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CONTENTS.

EULOGY.

Mr. President,
and Gentlemen of the American Academy,

The occasion, on which we are now assembled, is one of deep but melancholy interest. We meet to do honor to the memory of an eminent fellow-citizen and academic associate, who has recently closed a most useful life; which was filled up with faithfully discharging all the duties, even the most humble, that belonged to him as a member of the community immediately around him, while his leisure hours were employed in the highest department of science, in making those great acquisitions which have shed an unfading lustre on his country among distant nations.

It is painful to realize,—indeed, who among us can feel it to be a reality?—that, but a few weeks have gone by, since our illustrious President occupied that seat, as the head of our association, in the full exercise of those intellectual and moral powers, whose constant action, though not always observed, was yet felt through every circle of society in which he moved. How saddening is the reflection, that those rare endowments now lie prostrate and powerless! that the funeral rites, not long since conducted in that simple and unostentatious manner, which was in harmony with his whole life, have separated us from him for ever!

The death of this distinguished man has been felt by all his countrymen; and the event was no sooner known, than a spontaneous burst of sorrow throughout the nation proclaimed the sincerest homage to his great attainments in science and his unsullied private worth.

By the Members of this Academy, with whose interests he had been so long connected, the loss is severely felt; and your earnest desire to exhibit to the public, as distinctly as was known to yourselves, that part of his character particularly, which was not so obvious to general observers, — I mean his scientific attainments, — has led you to adopt this public mode of honoring the memory of our departed associate, and to assign to me the arduous, though honorable task of discharging this last sad office. If, however, I had been permitted to consult my own feelings, it would have been my wish, that you should have selected for this duty some member of our association whose studies and pursuits were more closely allied, than my own, to those of the eminent man, whose rare attainments are to form the principal subject of the present occasion.

I am well aware of the motives, which had an influence in directing your choice; but, if my long personal intimacy with our late colleague, and my residence for many years in his native town, have afforded me personally some peculiar advantages over most of the members of our association, yet these advantages, I fear, will be outweighed by others, to which I can make no pretensions in comparison with some whom I see now before me. But your decision has been made; and, whatever may be my own judgment and feelings in the case, I yield to your opinion, and will now proceed to the discharge of the duty which you have assigned to me.

The lives of great and good men, it has often been observed, should never cease to be held up as examples, especially to the young; whose minds, as the great philosophical statesman of England has justly said, should be formed "to that docility and modesty, which are the grace and charm of youth," and "to an admiration of famous examples."* And the public testimonials of gratitude with which we honor the memory of the dead, who have enlarged or adorned the edifice of human knowledge, are proper, in order to excite a useful emulation among the living who follow in their steps; while the glory of our country is also advanced by these very testimonials of its gratitude towards those of its children, who have shed lustre upon it.† In these respects the life of our departed associate is full of instruction, and is an example to be kept in remembrance.

The biographical details of his history have been already so fully and minutely exhibited to the public, that it is hardly necessary to ask your further attention to them.‡ Yet as this memorial of him, imperfect as it may be, would be still more incomplete without an allusion to some of them, you will expect me to advert to a few circumstances of his life, with which many of you may be already acquainted. Indeed, I cannot persuade myself, that you will in this instance feel any impatience in listening more than once to various particulars, which in most other cases you might think superfluous.

Dr. Bowditch was born at Salem, in Massachusetts, on the 26th day of March, 1773. That place had always been distinguished for its nautical enterprise; and his father and ancestors, in several generations, were by profession shipmasters.

It is now a subject of regret, that not many particulars of his earliest years have been preserved. The few surviving witnesses,

* Burke's Letter to a Member of the National Assembly.

† Notice historique sur la Vie et les Ouvrages de M. Visconti, par M. Dacier; Mém. de l' Acad. des Inscript., Tom. VIII.

‡ See the Rev. Mr. Young's Discourse on the Life and Character of the Hon. Nathaniel Bowditch, LL. D., F. R. S.; Hon. Judge White's Eulogy; and Obituary Notices in the public Journals.

however, who then knew him, concur in the general remark, that even in childhood he exhibited indications of a superior mind; that he was passionately fond of study, and had an uncommon power of intense application, with great rapidity in acquiring knowledge, particularly in his favorite science of mathematics, by which he first rose into public notice. In relation to this last point it has been stated to me by a friend as a fact, derived originally from Dr. Bowditch himself, that, while he was at school, his instructer gave him an arithmetical exercise of some difficulty for a boy of his tender years, and that he accomplished it so much sooner than was expected, that he was immediately accused of having obtained assistance in the performance of his task; and, when he denied having had any aid whatever, and resolutely persevered in asserting that he had done it wholly himself, the instructer would not believe he spoke the truth, but gave him a severe chastisement for attempting to deceive him, as he thought, by a falsehood, — an act of injustice, which was never forgotten. It is also related of him, that when he first heard of the science of Algebra, which was described to him by his brother, as a new method, practised by an instructer in the town, of solving questions by letters of the alphabet instead of the common figures, his curiosity became highly excited; and, when he had obtained the use of a book on that science belonging to the instructer, his mind became so intently fixed on the subject, — then wholly new to him, — that during the first night after the work was in his possession, as he said himself, he did not close his eyes.*

At a very early period of his life, too, that strong moral sense, which was conspicuous in his character, displayed itself, and was earnestly cherished by the affection and instructions of a fond mother, who, as he used himself to say, "idolized him."

* Rev. Mr. Young's Discourse, p. 60.

The early education of Dr. Bowditch was extremely limited; he had no other advantages of instruction, than such as could be found in the common schools, whether public or private, of that day; which were inadequate to the proper developement and discipline of the mind, and in which the inefficiency of the instructers was equalled only by the scarcely discernible acquisitions of the pupils.

After leaving school, which was at the very early age of ten years, he passed some time in the workshop of his father, who, at the close of the Revolutionary war, had been compelled by the circumstances of that trying period to resume his original occupation, which was that of a cooper. At the age of twelve or thirteen years, he was placed as an apprentice, or clerk, in a ship-chandler's shop in his native town. While in that situation, he used to devote his leisure moments to study, particularly in his favorite science of mathematics; and sometimes employed himself in little philosophical and mechanical experiments, which were interesting to himself and the boys of his acquaintance. It is also stated, that at the age of fifteen he made an almanac, complete in all its parts.*

He remained as an apprentice until he became of age; when it was decided that he should prepare himself for a nautical life; which he entered upon in his twenty-second year, in the capacity of captain's clerk, though nominally as second mate of the ship. He made five voyages (four of them to the East Indies), which occupied nine years of his life; and on some of them he went as master, though without pretending to be practically familiar with seamanship. During these voyages, numerous occasions occurred of making known, in foreign countries, his extraordinary mathematical powers; to the astonishment of all who were witnesses of the rapidity of his calculations and the accuracy of his results.

* Judge White's Eulogy, p. 16.

But a more important consequence of his mathematical knowledge, and of his example and personal influence, was, that he infused into the officers and mariners an ardent desire to make themselves masters of the principles as well as the practice of navigation; and, so intense was their thirst for this kind of knowledge, that on one of his voyages the twelve common seamen, who composed the whole crew, had acquired the method of calculating lunar observations,— at that day no small accomplishment even for the first and second officers of a ship, and one, to which a common mariner could hardly aspire.* This zeal for nautical knowledge was warmly cherished by Dr. Bowditch; he used to aid the studies of the seamen by his personal instruction and advice; and there can be no doubt, that a large portion of the nautical skill, for which his townsmen have been distinguished, may justly be traced, directly or indirectly, to him, as its original source.

At this period of his life he had acquired some knowledge of the French, Spanish, and Italian languages; and several years afterwards he added to these the study of the German, which at that time was very rare among the men of science in our country.

During one of his voyages he began his revision of the well-known work on the art of navigation, called "*The Practical Navigator*," which had then for a considerable time been in general use among persons of the nautical profession. This book, compiled originally by a British writer, John Hamilton Moore, was the most useful manual then extant on the subject. Dr. Bowditch was led to make an examination of the work, which he found to be over-

* For this fact, and the astonishment manifested in various foreign countries at his extraordinary powers of calculation, I am indebted to Captain Henry Prince of Salem, the intelligent commander with whom Dr. Bowditch made most of his voyages.

run with errors; and, at the instance of an enterprising bookseller, he began to revise it. Two revised editions were issued, but still under the name of the original compiler. In his subsequent revisions, however, Dr. Bowditch found it necessary to introduce so many improvements, and to give it so much the character of a new work, that he felt warranted in announcing it afterwards under his own name. As this was the first work published by him, and has been so extensively useful, — having in this country taken the place of every other work on navigation, — I may be allowed to mention some particulars connected with it.

The British work in its original state was a compilation, made up partly from Robertson's "Elements of Navigation," and partly from the well-known "Requisite Tables" of Dr. Maskelyne, formerly Astronomer Royal in the Observatory at Greenwich. It was constructed on a plan to contain such matter only as should be practically useful to navigators; and with that view Moore copied most of the rules of Robertson and the Tables of Maskelyne. This work, being of a moderate size and price, became popular in England and America; and in the former country had passed through thirteen editions at the time when Dr. Bowditch undertook his first revision of it; the publication of which was begun in the year 1798. In that edition none but the most material errors were the objects of revision; but various useful *additions* were made in different parts of the work.†

The popularity of the original work, as Dr. Bowditch observes, arose rather from the principle of its construction than from its execution, which was extremely faulty; for Moore, besides omitting to correct the errors of the works from which he made his compilation, added many blunders of his own; and, among them,

† Note A, at the end.

one that proved fatal to several vessels; in the Tables of the Sun's Declination, the year 1800 was set down by him as a *leap* year, which made an error of twenty-three miles in some of the numbers; and this was the cause of several vessels being wholly lost, and of others being brought into great danger. Dr. Bowditch justly characterizes this as "a very criminal inattention" in the compiler of a work, upon whose accuracy the lives and safety of thousands of navigators depended.*

In the year 1802 Dr. Bowditch published the "Practical Navigator" under his own name; this edition was originally to have been the *third* American one of Moore's work. But, as Dr. Bowditch observes in his Preface to it, on a careful examination, it was found so erroneous in the Tables, and so faulty in the arrangement, that he "concluded to take up the subject anew," and, without being confined to Moore's work, to have recourse to those authors, whose writings would afford the best materials for the purpose; to introduce additions and improvements, and to ensure accuracy in the Tables by *actually going through all the calculations* necessary to a complete examination of them.†

Notwithstanding the minute attention thus bestowed upon all the details of this work, Dr. Bowditch modestly says; "The author had once flattered himself that the Tables of this collection which did not depend on observations would be *absolutely correct;* but in the course of his calculations he has accidentally discovered several errors in two of the most correct works of the kind extant, viz. Taylor's and Hutton's Logarithms, notwithstanding the great care taken by those able mathematicians in examining and correcting them; he, therefore, does not absolutely assert, that these Tables are entirely correct, but feels conscious, that no pains have been spared to make them so."

* Preface to the Practical Navigator.

† Note B, at the end.

What a contrast does this language form with that of the original compiler; who, in the very edition which contained the egregious and "criminal" blunder before mentioned, as well as his other "eight thousand" errors, has the assurance to announce to all "mariners," that "he sells no *sea-books*, charts or instruments but such as *may be depended on;* consequently he excludes all those old, *inaccurate*, and erroneous publications, the depending upon which *has often proved fatal to shipping and seamen.*"

Notwithstanding this boasting language, however, as soon as Dr. Bowditch's revision was known, the usual orders, which had before annually gone from America to England for thousands of copies of Moore's Navigator, were stopped at once; the American work came into general use immediately in our own country, and was republished in London.*

Useful, however, as the "Practical Navigator" has been, it is not thus particularly noticed, as a work to which Dr. Bowditch himself attached any importance in respect to his scientific reputation, or in any other view than as a *practical manual;* the first excellence of which is, the greatest possible accuracy. From the period of its original publication, therefore, he spared no labor in making the most minute corrections and improvements. In the last edition, published in the autumn of 1837, the body of Tables has been increased, from thirty-three to fifty-six; some of them being entirely new, and others essentially improved or corrected. One or two of these improvements may be here referred to, as showing the extreme care used in the construction of the work. The tenth Table contains the distances at which any object is visible at sea, calculated by the rule given in Vince's Astronomy

* See Note C, at the end.

(§ 197), in which the *terrestrial* refraction is noticed, while this was neglected by Robertson, Moore, and others, and of course their tables are defective. His thirteenth Table contains the Dip of the horizon for various heights, calculated also by the rule in Vince's Astronomy (§ 197), in which the *terrestrial* refraction is likewise allowed for. In this Table all the numbers differ a little from those published by Dr. Maskelyne, who had made a different allowance for that refraction.*

I ought to add here, that Dr. Bowditch was enabled to give the greater accuracy to his work by means of a collection of Manuscript *Journals* of his seafaring townsmen, preserved in the valuable Museum of the East India Marine Society in Salem. By a regulation of that Society, which it is believed was proposed by Dr. Bowditch himself, each member, when going upon a voyage, is furnished with a blank book, uniformly ruled and prepared for the purpose of keeping a *journal* of nautical and other observations and remarkable occurrences; on the termination of the voyage each journal is deposited in the Museum of the Society; and the whole collection of them, now amounting to many volumes, forms a repository of innumerable facts, in nautical and geographical science, not to be found in any other sources.

In connexion with this subject I may here add, that he employed himself during three successive seasons, 1805, 1806, and 1807, with two intelligent assistants, in making a thorough hydrographical survey of the harbours of Salem and three neighbouring towns; of which he published a well-known chart, of surpassing beauty and accuracy. With such extraordinary precision was this laborious work accomplished, that the pilots of the port discovered, and were the first to observe to the author, that their established

* See Note D, at the end.

landmarks (which, however, Dr. Bowditch did not know to be such) were in fact laid down with such perfect accuracy in his survey, that the different ranges and bearings on the chart corresponded, with the utmost exactness, to those of the natural objects themselves.

At an early age the attention of Dr. Bowditch was directed to the *Principia* of his great master, Newton. But, as that work was published in the Latin language, which he had not then learned, he was obliged to begin the reading of it by asking the assistance of some college students of his acquaintance; who, during their vacations, used to render him such aid as they were able, in occasionally translating for him. He soon found, however, that the acquaintance, which those young persons had with the classical Latin of Cicero and Virgil, was of little comparative value in enabling them to comprehend the modern and technical Latin of Newton's work; and that his own knowledge of the subjects discussed by Newton, with the aid of the mathematical processes and diagrams on the pages of the Principia, would, with a little study of the language, qualify him to read that and other scientific works written in Latin, without the assistance of his youthful and inexperienced interpreters. He accordingly began to study that language himself, just before he entered upon the seventeenth year of his age. It is stated, that the first Latin book which he undertook to read was *Euclid's Geometry;* but the great subject of his studies in that language was the *Principia.**

In the earlier period of his mathematical studies, his pecuniary means were very limited, and he was unable to buy any books of science. But, by the liberality of a few individuals in his native town, who took a warm interest in the encouragement of his talents

* See Note E, at the end.

and pursuits, he had access to a small but valuable library (owned by an association of scientific and literary gentlemen), which contained a copy of the *Philosophical Transactions* of the Royal Society of London. This work was a treasure to him; and he began, in his eighteenth year, to make copious abstracts of all the mathematical papers in that immense repository of science. This labor was continued through many years; and the heavy folio volumes of those manuscript abstracts still remain in his library, the testimonials of his untiring zeal and industry.

In the year 1806, at the particular instance, as it is understood, of the late Chief Justice Parsons, (whose extraordinary attainments included a knowledge of some of the higher branches of mathematics,) Dr. Bowditch was elected Professor of Mathematics and Natural Philosophy in the University at Cambridge. He could not, however, be persuaded to accept that professorship; but preferred remaining in his native town, discharging the duties of the office which he then held (of President of a Marine Insurance Company), and pursuing his studies at such leisure hours as his official business would permit. Subsequently, however (in 1826), he became a member of the *Corporation* of the University, and remained in that body till his death.

Upon the establishment of that important institution, the Massachusetts Hospital Life Insurance Company, at Boston, in the year 1823, his peculiar talents were deemed indispensable to its organization and management; and he was accordingly invited to take charge of it under the title of its Actuary. The great exactness of calculation, and the order and precision, introduced by him, will long attest the comprehensiveness of his views, and his practical skill in conducting the affairs of that association.

On the occasion of leaving his native place, to enter upon this new office, his townsmen gave him a public dinner in testimony of their respect for his private character, as well as of the public services rendered by him to the cause of science.

He was elected a member of the American Academy in the year 1799; and from that period he communicated several papers, upon various questions of science, which are published in the different volumes of the Academy's Memoirs, and of which it is proper to give some account.

His first communication was "A new Method of working a Lunar Observation," published in the second volume of the Memoirs. This had been used by him for a long time before its publication, and previously to the appearance of the Transactions of the Royal Society for 1797, in which there is a method somewhat similar, by Mr. Mendoza y Rios. His object was, to simplify the modes of applying the *Corrections*, as they are called; which was always an embarrassing process to learners. By Dr. Bowditch's method there remained no difference of cases, and the Corrections were always to be applied in the same manner, whatever might be the distance and altitudes of the observed bodies. In an *Appendix* to this useful paper he proposes an improvement, to abridge materially the labor of making the necessary calculations for determining the longitude. This method was afterwards incorporated (with further improvements) into his Practical Navigator, where it has ever since retained its place. It may be here added, that the importance of this method, in a practical view, was so highly estimated abroad, that the eminent French astronomer, M. Delambre, thought it deserving of particular notice and commendation in the *Connoissance des Tems* (for 1808), published under his care, while a member of the French Board of Longitude.

The next paper communicated by Dr. Bowditch to the Academy was upon a question of a higher class, and is entitled "Observations of the Comet of 1807." Before any account of this comet had reached America, Dr. Bowditch had published, in one of our journals, a statement of the elements of it; and he came to the conclusion (which was afterwards found to be correct), that the comet in question was one which was before unknown to astronomers.* I allude to this circumstance, not by way of proving that he had displayed what he would himself have considered as evidence of mathematical powers, but as one, among numerous instances, to show, that results then obtained by him, as well as by eminent foreign astronomers, might be safely relied upon.

In the same volume of the Memoirs is his valuable paper containing "Observations on the remarkable Total Eclipse of the Sun, which happened on the 16th of June, 1806." This is the more interesting, as it contains, in the modest form of a *Note*, the first public mention made by him of an error in La Place's *Mécanique Céleste*, in the estimate of the oblateness of the earth. Dr. Bowditch, in determining the latitude of his place of observation, assumed the difference between the equatorial and polar diameters of the earth to be $\frac{1}{300}$th; which, he adds, is conformable to the Tables of La Lande; but La Place, from the observed length of pendulums, had calculated the ellipticity at $\frac{1}{336}$th; in which, Dr. Bowditch observes, a small mistake was made in one of the equations, which, if corrected, would make the result, that La Place should have given on his own principles, $\frac{1}{315}$th; which does not differ much from $\frac{1}{305}$th, the result deduced by La Place himself from the lunar theory.†

The next memoir by Dr. Bowditch was one of great practical value; an "Application of Napier's Rules for solving the Cases of Right-angled Spheric Trigonometry to several Cases of Oblique-angled Spheric Trigonometry"; in which, by a small alteration in the expression of those rules, they are made to include the solu-

* Mem. Amer. Acad. Vol. III. p. 1. † Ibid. p. 18.

tions of most of the cases of oblique-angled spheric trigonometry in a more simple manner than in their original form.

Another interesting communication by him is upon the extraordinary aërolite, or meteor, that exploded over the town of Weston in Connecticut, on the 14th of December, 1807; which excited greater attention throughout this country than any phenomenon of the kind had before done. The object of Dr. Bowditch was, to make an estimate, as nearly as practicable in such a case, of the height, direction, velocity, and magnitude of the body in question. He was induced to collect all the observations made, and to go into the calculations he has given, because, as he states, the methods of making these calculations are not fully explained in any treatise of trigonometry common in this country; and because one of his problems is not, to his knowledge, given in any treatise of spherics.

In this curious and interesting paper his friendship has led him to make acknowledgments to me personally, which I do not feel conscious of deserving, for some supposed assistance rendered him in collecting and combining the observations there detailed. The results obtained by him in the case will not be uninteresting.

The course of the meteor was in a direction parallel to the surface of the earth, and at the height of about *eighteen* miles. These points, he thinks, were ascertained with a considerable degree of accuracy. From satisfactory data the height must have exceeded *thirteen* miles. Its velocity probably exceeded *three miles* in a second, which is fourteen times as great as that of sound, and nearly as great as that of a satellite revolving about the earth at the same distance. The *magnitude* of the meteor was a subject of more difficulty; as the apparent diameter was not measured exactly by any observer. The least of all the limits of the diameter was 491 feet; which would give a cubic bulk of *six millions of tons.* But, as the whole mass which fell at Weston did not exceed half a ton, and would not make a spherical body that would have been easily visible at the distance of several of the places of observation, there seem to be some grounds for the opinion, that by far the greater part of the mass continued on its course without falling to the earth.

In the year 1811 a remarkable comet made its appearance, and was the subject of another able memoir by Dr. Bowditch; the result of which was, that this, like the comet observed by him in 1807, was one that had been before unknown to astronomers.* The calculations in this case were made with vast labor and perseverance, most of which would have been spared, as he himself used to observe, if the improved methods of the present day had then been known in this country.†

Another valuable paper of Dr. Bowditch was published in the same volume on that important subject, the Variation of the Magnetic Needle; containing an account of a series of observations made by himself in the years 1805, 1808, 1810, and 1811.

It had been asserted in some publications of that period, that the variation had ceased to decrease, and was then rapidly increasing. This was stated, particularly in New York, by persons, who, from their official situations as public surveyors, were supposed to be the most competent judges; and observations and facts were adduced to prove, that this change had taken place between the years 1804 and 1807. It was said, that the boundary lines of certain towns in that State, and the course of a particular turnpike road, had differed, in the space of four or five years, between 15′ and 45′ from the original surveys; and hence it was inferred, that a material change in the variation had actually taken place.

But Dr. Bowditch remarked, that the facts, as stated, by no means warranted the conclusion drawn from them; for, in the observations

* Mem. Amer. Acad. Vol. III. p. 313. † See Note F, at the end.

made, no notice was taken of the *daily* variation of the needle, which sometimes exceeds any of the changes that had been observed in New York; besides which, the variation found at the same place with different instruments will frequently vary half a degree; and by changing the place of an instrument, only a few feet, the same effect will sometimes be produced.

As this subject was of importance in a country like ours, where the boundary lines of towns and tracts of land are determined by the compass, and was of still greater consequence in our navigation, Dr. Bowditch instituted a course of observations in the four different years above mentioned. These observations were conducted with great care, and a minute attention to all those accidental causes, which might produce irregularities in the needle. And, to show the necessity of the utmost caution in such a case, it will be sufficient to state, that on one day, when he was observing with two excellent theodolites standing in the same place, the variation differed above *fifty* minutes; which was greater than any of the changes observed in New York, that had given rise to the discussions of the subject.

Dr. Bowditch came to the conclusion, that the differences noticed in New York arose in a great degree from the shortness of the needles used by the observers, and, perhaps, in part from the imperfection of their instruments. To obviate these difficulties, he procured a needle of twenty-four inches in length, suspended on an agate, and mounted with great care in every particular. This instrument was generally used in one of the rooms of his house; but, in order to ascertain whether the building affected the needle, he fixed a true meridian line on a table in the garden adjoining his house and at the distance of thirty feet from any building; and he found, that, even in so short a distance between the two places of observation, the variation in the garden was less by 3′ 25″ than in the house; and this correction he applied to all his observations.

I have given these particulars for the purpose of showing, with how much care he proceeded in his investigations, and how cautious we should always be, in admitting unqualified statements on questions of science which require delicate and accurate experiments, and thus hastily proceeding to account for a supposed phenomenon, before we have ascertained the fact of its existence.

But, in order to give a more complete view of the labor of conducting such a course of experiments, I ought also to state, that during those four years Dr. Bowditch made no less than five thousand one hundred and twenty-five observations; the result of all which was, that the needle had not then experienced any change of variation in this part of the country, but continued to approach the true meridian with nearly the same velocity as at the time of the earliest observations on record; that is, nearly about 1′ 19″ a year.*

This interesting and valuable paper was followed by one relating to a subject, which can hardly be made intelligible without a more minute explanation than can be given in this place, — *the Motion of a Pendulum suspended from two Points.* The experiment was first suggested and made by Professor Dean of Vermont, to illustrate the apparent motion of the earth as viewed from the moon. Dr. Bowditch was much interested in this experiment; and he undertook to examine the theory of the motions of a pendulum suspended in that manner. The singularly curious and interesting results of his investigation are contained in the paper here referred to.†

His next communication to the Academy was on an important mistake which existed for half a century in the Solar Tables of Mayer, La Lande, and Zach. And on this subject it should be

* Mem. Amer. Acad. Vol. III. p. 337. See Note G, at the end.

† Mem. Amer. Acad. Vol. III. p. 241.

observed, according to Dr. Bowditch, that in the Solar Tables of Delambre, published in 1806, the form of the Table is wholly altered; the method of entry by a double argument being used; and thus by taking a different path the error is avoided without noticing that it really does exist in the other works.*

This paper was followed by an elaborate one upon the oblateness of the earth; which was suggested by some errors contained in the article "Earth," published in "Rees's Cyclopædia." Dr. Bowditch was induced to notice the article in question, because that popular work had an extensive circulation in this country, and it was desirable that "currency should not be given to inaccurate ideas on the subject."†

His next paper is only a demonstration of the practical method (given in his Navigator) of correcting the apparent distance of the moon from the sun, or a star for the effects of parallax and refraction. The advantage of his rule is, that all the corrections are *additive*, which renders it peculiarly adapted to the daily use of mariners.

This was followed by a communication upon an improved formula, by himself, for computing the Dip of the Magnetic Needle in different latitudes, according to the theory of the French mathematician, Biot.

His next communication was on the methods of correcting the elements of the orbit of a Comet, in Newton's Principia and La Place's Mécanique Céleste. This was first published in the fourth volume of the Academy's Memoirs; but the substance of it had been communicated several years before to the late Rev. Dr. Willard, then president of the University, and one of the best practical astronomers of that period. Some importance is justly attached to this paper, as it relates to methods originally adopted by Newton

* Mem. Amer. Acad. Vol. IV. p. 28.

† Ibid. p. 30.

himself (though now not much used), and sanctioned by his commentators.

The immediate occasion of examining this subject, was an attempt made by a celebrated English mathematician, the late Mr. Emerson (in the notes to a new edition of La Motte's Translation of the Principia), to prove the accuracy of two equations used in the case; this had also been before attempted by other commentators on the Principia, as Gregory, Le Seur, and Jacquier; "and in none of the editions (that Dr. Bowditch had seen), not even that published by Bishop Horsley, is any doubt of their accuracy expressed or even insinuated." Yet, the method sanctioned by these high authorities, would, as Dr. Bowditch states, always make the corrections in question "double of what they ought to be." The method of La Place, which is also examined by Dr. Bowditch, though simple and elegant when used with *a small* number of observations, becomes objectionable and inconvenient when the number of observations is large.*

In the same volume we have a concise but interesting paper on the great question of the permanency of the Solar System, which I shall notice more particularly hereafter.

This was followed by an important paper on Doctor Matthew Stewart's formula for computing the motion of the Moon's apsides. It presents a curious case, in astronomical science, where a formula, apparently *general*, happened to be true only in the *particular* instance in which it was accidentally first used by its author.

In the year 1763 Dr. Matthew Stewart, of Edinburgh, published his computation of the Sun's distance from the earth by means of the motion of the Moon's apsides; and four years afterwards Bishop Horsley made a communication to the Royal Society of London in

* Mem. Amer. Acad. Vol. IV. p. 62.

support of the accuracy of that calculation. Some time after that, however, two British mathematicians, Mr. Dawson and Mr. Landen, took the opposite side; the latter of those writers showing, that "several small quantities neglected by Dr. Stewart, in order to simplify the *geometrical* investigation, would produce a very great effect on his estimate of the Sun's distance." Mr. Landen also expressed some *doubts* of the accuracy of Dr. Stewart's principles; but he made no calculation to ascertain, whether the neglected force did in fact produce any effect in the result.

This subject was again brought forward in the interesting biography of Dr. Stewart by Professor Playfair;* who, indeed, notices the objections of Mr. Landen, but concludes, notwithstanding, that Stewart's method, "instead of being liable to objection, is deserving of the highest praise, since it resolves, by *geometry alone*, a problem which had eluded the efforts of some of the greatest mathematicians, even when they availed themselves of the utmost resources of the integral calculus."

It is a remarkable fact in the history of astronomical science, that the accuracy of Stewart's method should also have been maintained by Dr. Hutton, by La Lande, and, still more recently, by Professor Playfair, in his elegant article on Physical Astronomy, re-published so lately as the year 1824, in the Supplement to the Encyclopædia Britannica, (in which Dr. Stewart is said to have *demonstrated* this remarkable theorem,) and again by the same writer, in an able article of a celebrated Review, in which he says, that Dr. Stewart had treated this subject "with singular skill and success."†

* Transactions of the Royal Society of Edinburgh, Vol. I. p. 69, of the Historical part.

† Edinburgh Review, Vol. XI. p. 280.

After noticing these historical facts in regard to the question, Dr. Bowditch remarks, that these late opinions of eminent mathematicians do not remove the objections which had been raised; that is, that the neglect of the tangential force and other peculiarities of the method might possibly affect the result; and he then proceeds to the examination of the question, whether this fundamental theorem expresses, in an approximative form, the mean motion of the apsides, supposing, with the author, the eccentricity to be very small, or the orbit nearly circular. He observes, at once, in his communication, which was written twenty years ago, that there is now no difficulty in settling this point by means of the analytical expression of the motion of the apsides given by La Place; and, upon applying that method, he found that Dr. Stewart's formula was far from being so correct as had been supposed by the able writers above referred to, but, on the contrary, that it was essentially defective. The first and most important term of the series is *double* its true value; and the whole formula will not give an accurate numerical result, except when the primary planet and satellite have a certain proportion to each other; and this, by a remarkable coincidence, happens to be the case nearly with the earth and Moon, the example taken by Dr. Stewart; but the same formula would not answer, if the Moon's distance from the earth were much greater or much less than it now is; and it would require but a very small decrease of the Moon's mean distance from the earth, to render the Sun's distance infinite when computed according to Doctor Stewart's directions; so that this method would have failed, if it had been applied to other cases, as, for instance, Jupiter's satellites; and he then demonstrates, that such would be the result.

Dr. Bowditch concludes, that the defect in the most important theorem of Dr. Stewart makes *his method wholly fail.* He attributes the mistake in this case entirely to the use of the *geomet-*

rical method of investigation; he observes, that the failure of so distinguished a mathematician shows, how extremely difficult it is to apply this method with success to complicated problems requiring great accuracy; and that there are few questions in the higher branches of Physical Astronomy, where the ancient geometry can be used with much advantage.*

I find but three other communications of Dr. Bowditch to the Academy, — the first, on the meteor which passed over Wilmington in the State of Delaware, November 21st, 1819;† the second, upon a mistake found in the calculation of M. Poisson relative to the distribution of the electrical matter upon the surfaces of two globes;‡ and the third, upon the elements of the Comet of 1819.§

Such is a brief account of the occasional labors of Dr. Bowditch in the cause of science during those leisure hours only, which an active life afforded him. Of themselves they would be deemed not inconsiderable for any individual, who was so circumstanced as not to be able to make the objects of science his exclusive pursuit; and, if we would justly estimate the labors of our countrymen, in comparing them with those of the favored individuals in the various states of Europe, who are enabled, either by the patronage of their governments or otherwise, to devote their whole lives to science, this difference of circumstances should ever be kept in view.

As to the patronage of government, which, indeed, among few nations has stimulated genius to such intense exertions as we find in the history of human knowledge, — alas! in our own country, a country of which we have just cause to be proud in numberless respects, — how little has it hitherto been able to effect for science. If our lamented President had been compelled by his pecuniary

* Mem. Amer. Acad. Vol. IV. p. 110.

† Ibid. p. 295.

‡ Ibid. p. 307.

§ Ibid. p. 317.

circumstances, or could have been induced by any motive, to depend upon the patronage of government, how long a period would have elapsed before we should have seen the publication of his great work, which has conferred such lasting honor upon his native land!

Fortunately for himself, and for the cause of science in this country, Dr. Bowditch was able (though with no small sacrifice of that property which he had desired to leave undiminished for his children,) to publish the work at his own expense. He might, indeed, have effected this by the aid of numerous friends, as well as of the American Academy; who would cheerfully have defrayed the expense, and actually offered to do it. But his high sense of personal independence could not be brought to submit to what he considered, in any degree, as a pecuniary obligation to private friends in such a case; he was willing to delay his work, and, if found necessary, even to retrench his daily expenses, moderate as they were, rather than to accept the aid offered him. In this determination he was encouraged by the noble-spirited matron, to whom he had been united in marriage for many years, and who declared herself ready to submit to any sacrifice that might be the consequence of his decision; an example worthy to be placed by the side of that, which the history of literature has recorded of the illustrious German scholar, Reiske, who would have refunded to his *six* subscribers the price of their copies, and then have abandoned in despair the publication of his great work (the Greek Orators), had not his affectionate and resolute consort, in a determined tone, said to him, "Trust in God; sell my jewels to defray the expense; what are a few shining baubles to my happiness."

Besides the publications already mentioned, Dr. Bowditch was the author of a few reviews, and other occasional articles, in some of the periodical works of this country.*

* See Note H, at the end.

But the great work, upon which his fame as a man of science will ultimately rest, is his copious and profound *Commentary* upon the *Mécanique Céleste* of La Place, of which he made the first entire translation, and which he has elucidated in a manner that commands the admiration of men of science in all countries.

To do justice to this invaluable work, would require much more time than can be allotted to it on the present occasion, even if I were qualified to perform that task in a manner worthy of the subject. The labors of Dr. Bowditch lie so far out of the range of readers, who do not make works of that kind a subject of their particular attention, that, amidst the universal and just commendation of the work, a very imperfect knowledge of its real value still exists, even among many well-informed persons. Difficult, however, as it may be for me to do justice to this part of my subject, yet the honored name of our President has been so long connected with this work of La Place, that it is necessary for me to occupy a part of your time with a few particulars in relation to the *Commentary* and the original work, — a work, which, like Newton's, in the preceding century, may justly be called the *Principia* of the age; and the author of which, by the common consent of men of science both in Great Britain and elsewhere, is placed in the next rank to his great predecessor, Newton.

We often hear the names of the original *Mécanique Céleste* and of the *Translation and Commentary* of our late president; and always accompanied with vague praises, which leave no distinct impression of the one or the other. Yet, if we would form a just estimate of the labors of Dr. Bowditch, I need not say, that it is indispensable to have a clear conception of the design and execution of both the works.

On the present occasion, if the remarks I am about to make were to be addressed to an association exclusively devoted to physical and mathematical science, I should neither think it proper, nor should I be presumptuous enough, to enter upon a lengthened examination of works, with which persons devoted to those pursuits are already more familiar than I can myself pretend to be.

But addressing myself, as I do, to a society composed of individuals, the greater part of whom have given more of their leisure to researches in literature and general science, than to physical astronomy or other branches of mathematical investigation, I shall be pardoned for some details which might otherwise have been spared, but which, unless I greatly deceive myself, will not be destitute of interest to all who hear me.

Now, at the very commencement, and as an introduction to those details, in order that we may justly estimate the high importance of the original work of La Place, (independently of the Translation and Commentary of Dr. Bowditch,) it is necessary to go back, in the history of physical astronomy, beyond the age of the illustrious author, and for a moment direct our attention to that glorious epoch, when a flood of intellectual light burst forth from the mighty mind of Newton, and, with the splendor of the sun in the firmament, revealed to his wondering fellow-mortals the master principle of the structure and laws of the visible universe.

"Astronomy," says La Place, "is a science which above all others presents us with the longest connected series of discoveries. The distance is immense between the first transient glance of the heavens, and that extended and general view by which, at this day, we are able to embrace the past and future condition of the system of the world. In order to arrive at the latter, it was necessary to observe the heavenly bodies for many centuries; to recognise in their apparent courses the real motion of the earth; to ascend to the laws of the planetary movements, and from those laws to the principle of universal gravitation; and finally, to descend again from that principle to a complete explanation of all the celestial phenomena, even in their most minute details. And this is what the human intellect has accomplished in Astronomy,"* that science, which, in another part of his work, he justly characterizes as "the most sublime of all the natural sciences," and whose objects cannot fail to draw around it a degree of their own splendor and magnificence; while the immense masses of those objects, their boundless distances, and the inconceivable velocity, yet steadiness and regularity of their movements, while they present the highest exercise to the human mind, deeply affect the imagination and impress the beholder with some conception of that mighty energy, which sustains them in their motions with a permanency to which we can see no limit.

"It was reserved for Newton," says La Place again, "to make us acquainted with the general principle of the heavenly motions. Nature, while she endowed him with a profound genius, took care also to give him to the world at the most favorable moment. Descartes had changed the face of the mathematical sciences; Fermat had laid the foundation of the geometry of infinites; Wallis, Wren, and Huygens had just discovered the laws of motion; the discoveries of Galileo on the fall of heavy bodies, and those of Huygens on the doctrine of evolutes and centrifugal forces, led to the theory of motions in curves; Kepler had determined those which the planets describe, and had a glimpse of universal gravitation; and finally, Hook had justly perceived, that their motions were the result of an original projectile force combined with the attraction of the sun. The mechanism of the heavens, therefore, seemed only to be waiting for some man of

* Exposition du Système du Monde, p. 1.

genius, who should generalize these discoveries, and be enabled to extract from them the law of gravitation. This was what Newton accomplished, in his immortal work on the Mathematical Principles of Natural Philosophy." *

As soon as Newton had arrived at this great principle, (continues La Place,) he perceived, that the important phenomena of the system of the world flowed from it. He found, among others, the following results; that the attractive force of a solid or a hollow sphere, upon a particle of matter placed without its surface, is the same as if the whole mass were collected in its centre; he proved that the rotation of the earth must flatten it at the poles; and he determined the laws of the variation in the degrees of the meridians and of gravity, upon the hypothesis, that the earth was homogeneous; he perceived, that the action of the sun and moon upon the earth, as a spheroid, must produce an angular motion on its axis of rotation, must cause a retrogradation of the equinoxes, raise the waters of the ocean, and keep up, in that immense fluid mass, those oscillations, which we observe in it, called the ebb and flow of the tide. In fine, he satisfied himself, that the inequalities in the moon's motion were owing to the united action of the sun and earth. "But, with the exception of what relates to the elliptical movements of the planets and comets, the attraction of spherical bodies, and the intensity of the attractive force of the sun, and of planets accompanied by satellites, all these discoveries were merely sketched out, or exhibited in their first draught. His theory of the planets is limited by the supposition that they are homogeneous; his solution of the precession of the equinoxes, notwithstanding its ingenuity and the apparent agreement of its results with observations, is yet defective in many respects. Among the

* Exposition du Système du Monde, p. 414.

numerous perturbations of the motions of the heavenly bodies, he has considered only those of the motions of the moon; and the most considerable of these, the evection, escaped his investigation. He thoroughly established the existence of the principle which he had discovered; but the developement of its consequences and its advantages was the work of the successors of this great geometer. The imperfections of the calculus of infinites, in its origin, did not permit him completely to resolve the difficult problems presented by the theory of the system of the world. He was often obliged to give mere sketches, or estimates, always uncertain, till they have been verified by a rigorous analysis. Notwithstanding these unavoidable defects, however, the importance and general form of the discoveries, with numerous profound and original views, which were the germ of the most brilliant theories of the geometers of the last century, — all of which he exhibited with great elegance, — ensure to the work on the Mathematical Principles of Natural Philosophy, the preëminence over all other productions of the human intellect."*

Such was the state in which the discoveries of Newton had left the science of physical astronomy, when the great work of La Place appeared, — undoubtedly the most important one that has distinguished the present age; and conducted by an analysis so far gradually perfected beyond that of any former period, that it has been said by an able writer, that if Newton or Leibnitz should have returned to the world at any time since the middle of the last century, they would have been unable, without great study, to follow the discoveries which their disciples had made, by proceeding in the line which they themselves had pointed out.† The grand

* Exposition du Système du Monde, p. 418, &c.

† Edinburgh Review, Vol. II. p. 252; in an article by Professor Playfair.

result of the efforts of those disciples was, that, at the close of the last century, there was not one of the phenomena, which had perplexed astronomers in the motions of the heavenly bodies, that could not be explained on the principle of gravitation; and the conclusions of *theory* were reconciled with the observations, except so far as imperfections in practice will ever occasion slight deviations from theory.

The time, then, seemed to have come, as La Place himself had said of Newton, for some man of genius to reduce into one work the whole theory of astronomy, with all the discoveries in the science since the age of the great English geometer; and La Place was the man, in all Europe, whom the scientific world would have selected for so great an undertaking.*

This vast labor La Place undertook in his *Mécanique Céleste.* He says, in his brief but comprehensive Preface, "The whole of the results of gravitation, upon the equilibrium and motions of the fluid and solid bodies which compose the solar system and the similar systems existing in the immensity of space, constitute the object of *Celestial Mechanics,* or the application of the principles of mechanics to the motions and figures of the heavenly bodies. Astronomy, considered in the most general manner, is *a great problem of mechanics,* in which the elements of the motions are the arbitrary constant quantities. The solution of this problem depends, at the same time, upon the accuracy of the observations and the perfection of the analysis. It is very important to reject every empirical process, and to complete the analysis, so that it shall not be necessary to derive from observations any but indispensable data. The intention of this work is to obtain, as far as may be in my power, this interesting result."

* Edinburgh Review, Vol. II. p. 253.

All this, says Dr. Bowditch, "he has accomplished, in a manner deserving the highest praise for its symmetry and completeness; but, from the abridged manner in which the analytical calculations have been made, it has been found difficult to be understood by many persons, — who have a strong and decided taste for mathematical studies, — on account of the time and labor required to insert the intermediate steps and demonstrations, necessary to enable them easily to follow the author in his reasoning." Dr. Bowditch then adds: "To remedy, in some measure, this defect, has been the chief object of the translator in the *Notes*. It is hoped, that the facility arising from having the work in our own language, with the aid of these explanatory Notes, will render it more accessible to persons who have been unable to prepare themselves for this study, by a previous course of reading in those modern publications, which contain many important discoveries in analysis, made since the time of Newton.

"The notes were written at the time of reading the volumes, as they were successively published. The translation was made between the years 1815 and 1817, at which time the four first volumes, with the several appendices and notes, were ready for publication." *

I must now ask you to follow me a little longer, while I lay before you a few particulars in relation to the original work and the Commentary; and I persuade myself, that you will find in them a degree of interest, which many persons would not expect in works lying so far out of the range of general readers, but yet involving discussions of the highest questions on which the human mind can employ itself.

I shall first ask your attention to as short a statement as possible of the leading subjects in the original work, and then to our late President's Commentary upon it.

* Bowditch's La Place, Vol. I. Preface.

In the very commencement, you cannot fail to be struck with the broad and general views, which the author has taken of his vast subject, as a whole; and the regular and beautiful order in which he gradually proceeds to every necessary detail, till the entire subject is exhausted; thus justifying the remark made by an able writer, before quoted; who says, "Such is the work of La Place, affording an example, which is yet solitary in the history of human knowledge, *of a theory entirely complete*; one that has not only accounted for all the phenomena that were known, but that has discovered many before unknown, which *observation* has since recognised. In this theory, not only the elliptic motion of the planets, relatively to the sun, but the irregularities produced by their mutual action, whether of the primary on the primary, of the primary on the secondary, or of the secondary on one another, are all deduced from the principle of gravitation; that mysterious power, which unites the most distant regions of space, and the most remote periods of duration. To this, we must add the great truths, — brought in view and fully demonstrated, by tracing the action of the same power through all its mazes, — that all the inequalities in our system are periodical; that, by a fixed appointment in nature, they are each destined to revolve in the same order, and between the same limits; that the mean distances of the planets from the sun, and the time of their revolutions round that body, are susceptible of no change whatsoever; that our system is thus secured against natural decay; order and regularity preserved in the midst of so many disturbing causes; and anarchy and misrule eternally proscribed." *

The first principal division of the *Mécanique Céleste* treats of the "Laws of Equilibrium and Motion"; and, under that general

* Professor Playfair, in the Edinburgh Review, Vol. II. p. 277.

head, La Place considers the Equilibrium and Composition of Forces which act on a Material Point; the Motion of a Material Point; the Equilibrium of a System of Bodies; the Equilibrium of Fluids; the General Principles of the Motion of a System of Bodies; the Laws of Motion of a System of Bodies, in all the relations mathematically possible between the Force and Velocity; the Motions of a Solid Body of any Figure whatever; and the Motion of Fluids.

The investigation of these great problems, in this very general form, it will be perceived, prepares the way for the consideration of the systems of bodies, and the individual bodies composing those systems, both solid and fluid, which are the constituent parts of the universe.

La Place then proceeds to the second principal division of his work; which is, the Law of Universal Gravitation, and the Motions of the Centres of Gravity of the Heavenly Bodies; and, under this part of his subject, he considers the Law of Universal Gravity, deduced from observation; the Differential Equations of the Motion of a System of Bodies, subjected to their Mutual Attractions; the First Approximation of the Motions of the Heavenly Bodies, or Theory of the Elliptical Motion; the Determination of the Elements of the Elliptical Motion; the General Methods of finding the Motions of the Heavenly Bodies by successive Approximations; the Second Approximation of the Celestial Motions, or Theory of their Perturbations; the Secular Inequalities of the Motions of the Heavenly Bodies; and the Second Method of Approximation to the Motions of the Heavenly Bodies, which is founded on the Variations, which the Elements of the Motion, supposed to be Elliptical, suffer by means of the *periodical* and *secular* inequalities. All these profound and complicated questions, particularly the *secular* inequalities, — whose progress and effects are so extremely slow, as to have eluded the calculation of all La Place's predecessors, —

are developed by him in so exact and satisfactory a manner, as hardly to leave any thing further to be expected from the most intense application of the human mind, with the aid of the most perfect instruments of analysis.

The two divisions, or books, above mentioned, form the first volume of the entire work.

The third book, with which the next volume opens, treats of the Figures of the heavenly bodies, deduced theoretically, in the most generalized form, from the attraction of homogeneous spheroids terminated by surfaces of the second order; the developement of the attraction of any spheroid in a series; the figure of a homogeneous fluid mass in equilibrium, and having a rotatory motion; and, lastly, the figure of a spheroid, differing but little from a perfect sphere, and covered by a fluid stratum in equilibrium.

These theoretical results are then compared with actual observations made of the figures of the Earth and the planet Jupiter; of which last the very perceptible oblateness, as the author observes, has been determined with great accuracy.* This third book ends with an investigation of the Figure of the Atmosphere of the heavenly bodies.

La Place next considers the Oscillations of the Sea and the Atmosphere; discussing, in their order, the theory of the ebb and flow of the sea, the stability of the equilibrium of the sea, the manner of noticing in the theory of the ebb and flow the various circumstances, which, in a harbour, have an influence on the tides; and, lastly, making a comparison of the theory with observation, and arriving at the conclusion, that the principal phenomena of the tides are in accordance with the theory of universal gravity.

The subject of his fifth book, which completes the *First Part* of

* Bowditch's La Place, Vol. II. p. 486.

the entire work, is, the Motions of the heavenly bodies about their own centres of gravity; under which head the author considers, in detail, the motions of the Earth, the Moon, and Saturn's Rings, about their respective centres.

In the *Second Part* of the work (which begins with the third volume, containing the sixth and seventh books), the author discusses the theory of the Planetary Motions, and their inequalities and perturbations, arising from all the known causes; beginning with the planet Mercury, and proceeding, in order, to the outer boundary of our system; excepting, however, the four newly discovered planets, Ceres, Pallas, Vesta, and Juno; the inequalities of which, as Dr. Bowditch observes, will not probably be completely ascertained for a long time.* In connexion with this part of his subject, La Place also considers the *masses* of the planets and of the moon; the determination of which, as he observes, is one of the most important objects in their theory.† This portion of the work concludes with important considerations on the formation of astronomical tables, and on the invariable plane of the planetary system and the action of the fixed stars upon the system; the great distance of which last, as the author observes, renders that action insensible.‡

After the theories of the planets themselves, the author gives that of their respective Satellites; beginning with the Moon, which occupies a large space (about half of the third volume), and which, as he remarks, has difficulties peculiar to itself, arising from the magnitude of its numerous inequalities, and from the slow convergency of the series by which they are determined. These inequalities, which arise partly from the oblateness of the Earth and Moon, and

* Bowditch's La Place, Vol. III. p. 187, note.

† Ibid, p. 333.

‡ Ibid, p. 343.

in part depend upon the action of the planets, are then discussed in order, and a comparison made of the theory with observation; to which the author adds the very interesting and delicate investigation of the secular variations, in the motions of the Moon and Earth, which may be produced by the resistance of an *ethereal fluid* surrounding the Sun; the existence of such a fluid being assumed by La Place as *possible.* Dr. Bowditch adds, in a note, that the existence of such a resisting medium is now considered highly *probable,* in consequence of the observed decrease of the times of revolution of Encke's comet, in its successive appearances between the years 1786 and 1829; and he further observes, that the extreme rarity of the mass of this comet, makes it peculiarly well adapted to the discovery of the effect of such a resisting ethereal fluid, which cannot, however, produce any sensible effect on the large and dense bodies of the planets and satellites.*

In the eighth book, with which the fourth volume opens, La Place considers the perturbations of the *Satellites* of Jupiter, Saturn, and Uranus; the masses of the satellites, the oblateness of the planet Jupiter, and the eccentricities and inclinations of the orbits of the satellites. The phenomena of the Satellites are of great importance; for, as La Place observes, although they have been discovered only two centuries, and their eclipses have been observed but a century and a half, yet, during "this short interval, these bodies have presented to our view, by the rapidity of their revolutions, all those great changes which time produces with extreme slowness in the *planetary* orbits; the system of the satellites *being an image of that of the planets.*" †

He next gives the theory of Comets; their perturbations at a

* Bowditch's La Place, Vol. III. p. 678.

† Mécanique Céleste, Vol. IV. Preface.

small or great distance from the Sun, and when approaching so near to a planet as to have their orbits wholly changed; and, lastly, their masses, which, from the circumstance of their action upon the planets being insensible, must be "excessively small." In the case of one of them, the first comet of 1770, La Place observes, we are sure, that the mass is not "one *five-thousandth* part of that of the earth." He adds, as a result of his calculations, that this comet passed directly through the space where Jupiter and his satellites were then situated; and yet it does not appear, that the comet produced the slightest alteration in the motions of those bodies; and, he concludes, generally, that, if in the immensity of past ages some of the comets have encountered the planets and their satellites, which is very probable, it does not seem that the shock can have had much influence on their motions. But he remarks further, that, if a comet, with a mass equal to that of the Moon, should encounter the Moon or a satellite of Jupiter, there is not the least doubt, that it would render the orbit very eccentric.*

After thus investigating the phenomena of the different bodies composing our system, and other parts of the universe, La Place proceeds to a subject intimately connected with all of them, — the subject of Light, and the theory of Astronomical Refractions, which will be further noticed hereafter.

In a supplement to this tenth book, La Place, after referring to a preceding part of his work (where he had considered the phenomena arising from the refractive power exerted by bodies upon light) and stating that this force is the result of the attraction of their *particles*, remarks, that the *law* of this attraction cannot be determined by the phenomena, because the only condition required, is, that it must become insensible at sensible distances; and this is the only case

* Bowditch's La Place, Vol. IV. pp. 435 – 437.

in which *corpuscular attraction* has been submitted to an accurate analysis. He then adds, that he shall now lay before mathematicians another case, which is still more remarkable, from the variety and singularity of the phenomena depending upon it, and from its being susceptible of an equally accurate analysis; the case of *capillary attraction*, a singularly curious and interesting subject, the theory of which he first published in the year 1806. The effects of the *refractive* power, he observes, correspond to dynamics and the theory of projectiles; those of *capillary attraction* correspond to hydrostatics and the equilibrium of fluids, which are elevated or depressed, according to certain laws. A minute and profound investigation of these laws, concludes this second part of the work; which completes the author's system.

It will not be uninteresting to pause here a moment, and in imagination place ourselves at a height, from which the vast subject of La Place's labors ought to be surveyed. If, then, we concentrate our attention upon it, as an entire object, we perceive the powerful intellect of the author, grasping the general phenomena of the matter of the universe, from the whole mass down to the minute and invisible particles, which are the ultimate component parts of that mass; beginning with the laws of equilibrium and motion, generally, as applicable to all matter, solid and fluid; then proceeding, step by step, to the subdivisions, or parts of the whole, considered as systems of bodies; and, next, to the individual bodies that are members of those systems; then, considering the laws of gravitation, and the mutual attraction and perturbations of the heavenly bodies; next, our own solar system, its planets, satellites, and comets; and, from the consideration of these, the author is led to the attraction of bodies of a particular character, that is, those which are homogeneous and of a spheroidal form, of which the Earth is an example, and is particularly discussed; and, connected with which, is the figure of a fluid mass in equilibrium and having a rotatory motion, as the ocean of our Earth; and, finally, after considering the attraction between *masses* of matter, the author proceeds to that which takes place between their *particles.*

In this manner does the author bring into one grand and magnificent review, the wonderful phenomena of all matter, the entire mass of the material world, through the various portions into which it may be divided, till he arrives at those inconceivably minute particles, whose law of attraction cannot be certainly determined by the phenomena, because they elude the power of human observation.

Such is the outline of this extraordinary work; a work, which, an able writer observes, "does honor, not to the author only, but to the human race; and marks, undoubtedly, the highest point to which man has yet ascended, in the scale of intellectual attainment." *

The Translation and Commentary of Dr. Bowditch extend to the first *four* volumes of the original work; which, in fact, contain the whole of the author's plan and views of the Mechanism of the Heavens. La Place had, however, shortly before his death, added a fifth volume, which it is only necessary to mention very briefly at this time. It was published at an interval of twenty years after the former volumes, and contains historical notices of the labors of other geometers on the same subjects, together with such further researches, as the author himself had subsequently made. This volume has not been translated by Dr. Bowditch; but this was the less necessary, as he has incorporated into the notes of his four volumes, and under the proper heads, all the important scientific matter contained in this additional volume, except upon the subject of the Earth's temperature and the velocity of sound; so that the Translation

* Professor Playfair, in the Edinburgh Review, Vol. XI. p. 278.

and Commentary now furnish us, in English, with a complete body of astronomy, such as is not to be found in any other language.

The original work was the fruit of incessant meditation, upon the great subjects of it, for more than sixty years,* and under circumstances the most favorable, that could fall to the lot of man; the author having the entire command of his time, and being surrounded by all the scientific men of France, who could render him any aid in their respective departments. If an observation in astronomy was required, — if any experiment became necessary in meteorology, in chemistry, in mechanics, — if laborious calculations were wanted in mathematics, — in order to verify his theories, — the most eminent men of France, at the most advanced period of human knowledge, may be truly said to have been at his command; some of them, indeed, literally so, by orders of the government; and others, from that common zeal in the cause of science, which is always glowing in such a community.

And here, I cannot but ask you, for a moment, to compare with these highly favorable circumstances, the disadvantages, under which our lamented President intrepidly undertook the difficult and laborious task, which he has so successfully accomplished, and which has secured to him so honorable and enviable a rank among his eminent contemporaries of the scientific world. La Place, it is true, like him, in the earlier part of his life, had no family influence, or rank, to promote his advancement; he was the son of a farmer in Normandy. But here all resemblance in the circumstances of the two cases ends. For when La Place quitted his native province, and determined to make his own fortune, upon his arrival at Paris he presented himself to the celebrated D'Alembert, who was then at the height of his fame and influence in that capital. He addressed

* Fourier, Éloge de La Place, Mém. de l'Institut, Tom. X.

a letter to that eminent mathematician, upon the general principles of mechanics; the profound views developed in that communication could not fail to make a deep impression on so great a geometer; and what was the result? A few days afterwards, La Place was appointed professor of mathematics in the Military School at Paris. From that moment, says his distinguished eulogist, he was enabled to bestow his undivided attention on the science which he had chosen; and he gave to all his labors a fixed direction, from which he never deviated. This immovable and determined constancy in his views was always the principal characteristic of his genius; and he passed the whole of a long life (of seventy-eight years) in accomplishing his great design, with a perseverance of which the history of science does not, perhaps, offer another example.*

Contrast with this good fortune the situation, in which our President was placed from the earliest period of his life. Compelled, by his father's humble circumstances, when only ten years of age, to forego even the slender advantages of a common school, that he might by his personal services contribute to the support of the family; then placed as an apprentice in a ship-chandler's shop; and, at length, in order to gain a livelihood for himself, obliged to become a seaman, in his twenty-first year, and to continue in that occupation for a considerable period of his life, — what an example does his history present of the extraordinary results that may be obtained by talents and industry, under the most unpropitious circumstances! When he first started into manhood, the state of mathematical science in this country was extremely low; he found no competent judge to appreciate his attainments; no powerful patron, who could place him in a situation where, like La Place, he

* Éloge, par M. le Baron Fourier.

could give his undivided attention to his favorite science; nor was he, like that distinguished man, at once placed in comparatively affluent circumstances, and relieved from all solicitude for those necessary means of living, for which the student as well as the man of business must provide; but, on the contrary, obliged to maintain a constant struggle against the formidable obstacles I have mentioned, and with a slender physical constitution, that demanded incessant vigilance, lest its powers should be prostrated by the exertions of his ever active intellect; how much did he achieve within the term of a life, shorter by thirteen years than that of his great exemplar, and during which he could pursue the study of his favorite science only at those intervals of leisure, which the daily avocations of business allowed him.

It is under such circumstances, that we should compare the scientific labors of our President with those of the eminent men of other countries; and, especially, with those of the illustrious author, whose great work is the subject of the profound and lucid *Commentary*, of which I am now to give a brief account.

Here I may, in the first place, remark, that the mere mechanical bulk of Dr. Bowditch's work exhibits an amount of actual labor that astonishes us. The four volumes now completed contain nearly a thousand pages each; and Dr. Bowditch has given *three* pages of commentary for every *two* of the original; the text of which he has followed, volume by volume, to the end of the fourth, of which he had just strength enough remaining to revise the *thousandth* page a few days before his death.

The scientific men of Great Britain were astonished at his attempting what they justly called a "gigantic task," — the task of translating into our common language, and elucidating with a copious and able commentary, a work, which they acknowledge to be so profound, that there were hardly twelve persons in that kingdom, who could even read it with any tolerable facility,* and not one who had then attempted to translate and explain it. Subsequently, indeed, to Dr. Bowditch's Translation being prepared for publication, there were printed in England two translations of the *first book* only, or about one third of the first volume, with notes, by Mr. Toplis, and by Dr. Young; but the latter extraordinary man, whom some of his countrymen place at the head both of "the letters and the science of England," left the eighth chapter of his translation, (upon the *Motion of Fluids,*) without any annotations, though it is the most difficult, and is one which Dr. Bowditch advises young students to pass over on their first reading of the work. Another translation, by Mr. Harte, was also begun about the same time; but no copy of it had been received in this part of our country, when Dr. Bowditch published his first volume.

An able English writer observes, that at the period of these publications there was a very meagre supply of works, in our language, illustrative of the celestial mechanism, "whether in the nature of express commentary and avowed illustration of the immortal work of La Place, or in the form of independent treatises, calculated to bring the whole subject before the reader in a more compendious and explanatory manner than was compatible with La Place's object."

The same writer, however, farther remarks, that these "desiderata" are now supplied; and "in a manner that leaves little to wish for"; and he adds, that, "if any thing were wanting to put our geometers effectually upon their mettle," it would be found in the extraordinary coincidence, that one of the works to supply the

* Quarterly Review, for July, 1832, Vol. XLVII. p. 558; and Edinburgh Review for January, 1808, Vol. XI. p. 281, in an article written by Professor Playfair.

want complained of is the production of "a *lady*, our own countrywoman," and the other, of an "*American*, by birth and residence." The writer then notices, in terms of high commendation, the first volume of Dr. Bowditch's La Place, and the "Mechanism of the Heavens," by the highly gifted female alluded to; * who, in that extraordinary work, has communicated the results of La Place's discoveries to the English nation, in their own language; and has thus repaid the obligation, which a century before had been conferred upon British science by a celebrated female mathematician of France; who, by her Translation of the *Principia* and her *Commentary* upon it, first made known to the French nation, in their native language, the great discoveries of Newton. †

Dr. Bowditch, having constantly in view *practical utility*, has in his first volume brought together various formulas which are of frequent use in the work and notes, and placed them at the end of his Introduction, for the convenience of reference. Of these he has given demonstrations at the end of the volume.

Another improvement, as it has heretofore been generally considered, is the introduction of *diagrams;* which students of this science find extremely convenient, though they have been discarded by mathematicians of great eminence. The use of them, to the extent allowed by Dr. Bowditch, is commended by a distinguished French mathematician, from whom Dr. Bowditch had received several letters respecting his work. ‡ Whether the practice has a tendency ultimately to retard or to facilitate the progress of the student, is not a question to be discussed on the present occasion.

In the Notes upon the Second Chapter of the First Book, which treats of the *Motion of a Pendulum*, Dr. Bowditch has done justice

* Mrs. Somerville. † See Note I, at the end.

‡ Letter from M. Lacroix to Dr. Bowditch, April 5th, 1830.

(as in numerous other instances) to that great French geometer, Le Gendre, by introducing the method of obtaining certain values by means of the Tables of Elliptical Integrals, computed by him. It has been a subject of regret, that, from any motives whatever, La Place should have omitted to do that justice himself to this distinguished mathematician.

On the other hand, the same spirit of justice, which influenced Dr. Bowditch in the case just mentioned, has led him in another part of the work (Book I. ch. 5) to vindicate the accuracy of La Place against the strictures of a writer in a celebrated European Journal, upon certain equations relating to the preservation of living forces and areas.

In another place, however, he finds La Place to have drawn too general a conclusion (ch. 7, on rotary motion), where he gives an equation which he says is integrable only in the three cases there specified by him; whereas Dr. Bowditch demonstrates, that there are three other cases not mentioned by La Place, in which this integration is possible by the same methods; and he then states them in detail.

In an elaborate Note on the First Chapter of the Second Book, Dr. Bowditch gives a very complete, though extremely condensed view of the subject of Conic Sections, and in so generalized a form as to comprehend them all within the compass of two pages.

The Fourth Chapter of the Second Book is upon the Computation of the Orbit of a Comet; and Dr. Bowditch, in his commentary upon it, when noticing Newton's Principia, remarks upon a fallacy which had run through all the editions he had seen of that work, and had even been defended by Newton's commentators as correct. This fallacy was noticed, many years ago, by Dr. Bowditch, in the Memoirs of the Academy, as I have before mentioned. *

* Bowditch's La Place, Vol. I. p. 460, note ; Mem. Amer. Acad. Vol. IV. p. 62.

In the same chapter, he notices the method adopted by La Place, of combining the observations, with a view to the greatest accuracy in the theory of a comet; and he considers the method to be liable to some objections. He then, in a subsequent note, proposes a valuable improvement in the mode of correcting the elements by a method of his own. *

We have, in the same Book (ch. 6, § 49), an example of his own skill in finding the last terms of the series there in question, by an original method, which he had discovered and used before he had ever seen the work of La Place, where the same method is adopted.

In the subsequent chapter of the same Book, he considers the great and interesting question of the permanency of the Solar System, which La Place believed he had there fully established. Dr. Bowditch, however, found it necessary to make a very important limitation in La Place's celebrated equations of condition, from which that author had inferred, that the orbits of the planets will for ever remain nearly circular and in the same plane; and he then shows, that however just the inference may be, that the orbits of the three exterior planets, Jupiter, Saturn, and Uranus, can never be very eccentrical or deviate much from the same plane, yet it does not follow, from the same equations, that the orbits of the *smaller* planets will always be nearly circular and in the plane of the ecliptic; for the orbits of these might be very eccentric, and even parabolic, and the planes of them be perpendicular to each other, and yet the equation be satisfied. Dr. Bowditch had discussed this point many years before, and published a paper upon it in the Memoirs of the American Academy, which I have already mentioned. †

* Bowditch's La Place, Vol. I. pp. 463, 470.

† Mem. Amer. Acad. Vol. IV. p. 74.

The first volume of Dr. Bowditch's Commentary is concluded with a valuable summary of Spherical Trigonometry.

After this particular account of the first volume of this great work, I shall notice very briefly only a few of the more important additions of Dr. Bowditch to the succeeding volumes.

In a note on the Third Book (Chap. 1, § 3) he mentions, in passing, an important improvement he had made in a particular notation, and which he had adopted, in his Commentary on La Place, many years previously to the publication of a method used by an eminent French mathematician*, which is substantially like that of Dr. Bowditch, and is now in general use.

He next notices (in Book III. ch. 2, § 8) La Place's remarkable omission of an important term in one of his formulas, as originally published; and, what will appear most surprising is, that this defect appears to have remained unnoticed by mathematicians for nearly half a century. A similar omission occurs afterwards (chap. 5, § 38), and both of these Dr. Bowditch has supplied in the text, as being essential to the formula. In his Note on the last-mentioned case, he has also given a method of his own for ascertaining the value of the radius vector of an ellipsoid, being more general than that of La Place, and the same which he had many years before published in the Academy's Memoirs.†

Dr. Bowditch had peculiar skill in bringing any proposed formula to the test by means of extremely neat and simple cases. Of this there is a striking example in this second volume; ‡ in which he shows by this test, that a rule proposed by an eminent English mathematician § is defective. I have understood, that Dr. Bowditch sometimes, among his intimate friends, alluded to this case as one of

* Baron Fourier, Secretary of the Institute of France.

† Vol. IV. p. 45. ‡ P. 207. § Mr. Ivory.

his most successful instances of this description. It arose from the following circumstance.

In the Philosophical Transactions of the Royal Society of London, for the year 1824, the able mathematician just mentioned published a paper, in which the principles used by La Place (Book III. ch. 3, § 18) in finding the equilibrium of a fluid mass were objected to as incomplete. Dr. Bowditch, in order to enable his readers "to judge of the difficulties of the subject, and of the sufficiency of the commonly received laws of equilibrium," gives a concise historical account of the different methods used from the time of Newton to the present day. After stating in his lucid manner the principles in question, he adds, that they "seem plain and satisfactory, and they were used by mathematicians during nearly a century, without any objection being made to them; and there was no doubt, in the mind of any one, that they comprised all the conditions necessary to the equilibrium of a fluid."

But in the paper abovementioned Mr. Ivory proposes another condition; which need not, however, be here stated.

This led to a reëxamination of the subject; and among the numerous opponents of Mr. Ivory's opinion was the celebrated French mathematician, M. Poisson; who, as Dr. Bowditch observes, points out several examples, in which Mr. Ivory's new principle, carried to its full extent, would lead to an erroneous result. To these examples Dr. Bowditch adds only one of his own (above alluded to), which he calls "an extremely simple case"; but that simple case decides the fate of the proposed rule.

In a subsequent part of this second volume (Book III. ch. 5, § 42) Dr. Bowditch notices an error in the computation of the figure of the earth, as deduced from the observed lengths of a pendulum in different latitudes; and he points out here, as he had done many years before in the Academy's Memoirs, the probable source of the error committed by La Place in this instance; as he also does, a few pages afterwards, another error "of considerable importance," (to use his own words,) in a subsequent part of that author's calculation.

Now, in order to make this subject intelligible at least, if not interesting, I may be allowed to remind you, that there are four methods in general use for computing the oblateness of the earth, supposing it to be an ellipsoid of revolution; 1. By comparing the observed lengths of two consecutive degrees of the meridian. 2. By comparing the lengths of two degrees of the meridian measured in different latitudes. 3d. By means of the observed variations in the lengths of pendulums vibrating in a second of time in different latitudes. 4. By means of two equations in the moon's motion (the one in longitude, the other in latitude), depending on the oblateness of the earth.

The two former of these methods, though they would at first view seem to be the most natural and accurate, as being the application of actual admeasurement, are from various causes the most uncertain; the *fourth*, which results from the moon's motion, is almost wholly independent of any error arising from the inequalities of the earth's surface, and is the most satisfactory; and next to this is the third, founded on the observed length of the pendulum.

On this last method, Dr. Bowditch gives, in his Notes to this volume, a most useful investigation of the Earth's figure, from "the latest and best observations" of the pendulum in different parts of the globe. La Place, in his computation of the oblateness of the earth as deduced from the length of the pendulum, was obliged to use the ancient observations; and his results were, many years ago, shown by Dr. Bowditch to be incorrect. Since that time, numerous observations have been made, and with more accuracy, from the equator to Spitzbergen, within eleven degrees of the north pole;

and these have been brought together, and analyzed with vast labor, by Dr. Bowditch, from the Transactions of learned Societies, the works of individual authors, scientific journals, and every other accessible source of information within the range of modern science.

The result of this laborious investigation, however, is not absolutely decisive of the question. Dr. Bowditch remarks, that the observations, though made with the greatest care, differ so much from each other, that we cannot place great confidence in the result of any combination of them, unless the number of observations is very great; and it is, therefore, desirable to obtain many more than we now have, particularly near the equator, where the most remarkable variations have been found. But another remark made by him, on the result of the observations which we already possess, is singularly striking and interesting, as a proof of the minute exactness of modern science. He observes, that, instead of being dissatisfied with this result, we ought to feel some degree of surprise, that by means of the very small excess of the polar over the equatorial pendulum, which may be considered *as a base line of less than a quarter of an inch in length,* we can determine *within a fraction of a mile,* the difference between the polar and the equatorial radius of the earth. Dr. Bowditch adopts, as being very near to the true value, the ratio $\frac{1}{300}$, which he has always used, and which was proposed by La Lande, in his Astronomy, forty years ago.

This subject had been discussed by Dr. Bowditch more than twenty years previously, in a Memoir communicated to the Academy, to which I have already referred. The examination of the subject at that time was suggested by the republication of Rees's Cyclopædia in this country. In the thirteenth volume of that work, containing the article *Earth,* he found that the editor had published the "elegant method" of computing the oblateness of the earth by the observed lengths of pendulums in different latitudes, as it was given by La Place in his *Mécanique Céleste*, but had allowed the application of the formulas to numbers to remain nearly as in the original work, — in which there was a material error, — and that additional mistakes had been committed by the author of the article itself. Dr. Bowditch justly observed, that as the Cyclopædia had an extensive circulation in this country, he thought it proper to notice these errors, in order that "currency might not be given to incorrect ideas on the subject"; and, as an additional reason, that by making the correction in question, we obtain from the observations of the pendulum a result much more conformable to those deduced from other methods. He then, in the same paper, points out the errors in the results, and their sources; to which I have already directed your attention.

The third volume of La Place's work contains, as before stated, the particular theories of the motions of the heavenly bodies; first giving the theory of the primary planets, and then that of their respective satellites; beginning with our own, the Moon, which occupies a large space. Dr. Bowditch's annotations on this volume are of the same important and useful character with those on the preceding parts of the work; but time will not permit me to refer to the different topics discussed by him. I may, however, be allowed to mention, that one interesting and important subject, which had previously come under his notice, is here more particularly considered; I mean, the effect produced upon the motions of the planets and their satellites by the resistance of an extremely rare ethereal fluid; to which I have before directed your attention, when noticing this part of the original work. Dr. Bowditch has also made a most valuable addition to this volume, — an Appendix containing a full view of the different modern improvements made in the modes of computing the orbit of a planet, or comet, moving in an ellipsis, parabola, or hyperbola; with the methods of computing the place of the moving body at any time. This Appendix, as he observes in his advertisement to the volume, contains many important formulas and tables, which are useful to astronomers in making the computations just mentioned. Some of the Tables are new, and the others have been varied in their forms, to render them more simple in their uses and applications; none of them, he adds, have heretofore been published in this country; and several of the formulas have been introduced into the calculations of modern astronomy since the commencement of the first part of the original work. The Tables, as here given by Dr. Bowditch, are highly valued by astronomers for their convenience, beauty, and exactness.

The theory of *Comets* concludes the inquiries of La Place relative to the matter and form, and the motions, of the various masses or bodies, which constitute the system of the world. There remains, however, another subject, intimately and essentially connected with those inquiries, — the subject of *Light* and the Theory of astronomical Refractions, — which the author then proceeds to examine.

The motion of light in the mediums through which it passes, particularly in the atmosphere, is, as he observes, one of the most important objects of astronomy; whether we consider it in relation to theory, or to its effect upon every astronomical observation. We view the heavenly bodies through a transparent medium, which by inflecting their rays changes their apparent position, and makes them appear in different places from those which they really occupy; it is, therefore, important to determine the law of this inflection, so as to obtain the real situations of those bodies. * This investigation is accordingly pursued in the Tenth Book. The author adopts the Newtonian hypothesis of the *emission* of light; which, however, has been much shaken by more recent observations tending to confirm the undulatory or wave theory.

* Bowditch's La Place. Vol. IV. p. 438.

On either hypothesis it becomes essential to ascertain the laws of light. La Place, as before observed, pursues his investigation of the laws of reflection and refraction upon the *Newtonian* theory; and Dr. Bowditch, in an able and copious Note, shows how the same results may be obtained according to the wave theory.

But of the numberless topics of interest and importance discussed in this great work, none is more singularly curious than one, whose name will hardly convey a just idea of the subject itself, — I mean that of *Capillary Attraction*, which La Place himself pronounces to be "one of the most curious objects of Physics." * This is a part of the work, on which our late President has concentrated his powers of analysis with as much force and skill, as upon any of the numerous subjects which he has examined in his Commentary.

In order that the importance of this subject may be understood, and that a just view may be taken of the extent of it in its various relations, we must reflect for a moment upon some of the numerous modes, in which this species of attraction exhibits itself.

The most usual form, in which it has been the subject of observation and experiment, is, in the ascent of water, or any other fluid, in *capillary* tubes, or between two plates of glass placed near each other in a vessel containing the fluid. The same principle, however, governs the movements of fluids in numberless other cases; some of which are so familiar to us, that they cease to attract our notice. For example; when we fill a glass or other vessel with water, if the vessel is already wet, the water will be drawn upwards round the sides of the vessel, and present a *concave* surface; but if, on the contrary, the vessel is entirely dry, the water will rise in it with a *convex* surface, and may, in popular language, be heaped up even above the brim of the vessel. From the same cause, a light body

* Bowditch's La Place, Vol. IV. p. 694.

floating on the water near the side of the vessel, will suddenly be drawn into contact with it; and two bodies lying on the surface, upon being brought towards each other, will suddenly rush together. In the same way, too, we see the rain forming itself into pellucid drops, and hanging from the under surfaces of bodies, or standing in imperfect globules on their upper surfaces; and the same principle manifests itself in the form of

> "the dew-drops, which the sun
> Impearls on every leaf and every flower;

and in

> "the gentle tear let fall
> From crystal sluce."*

In short, the phenomena of capillary attraction are so constantly manifesting themselves, and under such various circumstances, that they present to the philosophical observer questions of singular interest and extraordinary difficulty. These questions are most elaborately and profoundly investigated by La Place and his commentator.

Among other investigations of Dr. Bowditch in relation to this subject, I ought not to omit the fact, that he has most thoroughly examined and analyzed the very celebrated work of the present day called the *New Theory of Capillary Attraction*, by the eminent French mathematician, M. Poisson; and has shown, by numerous examples from M. Poisson's work, that, profound and acute as that author is, he has, under a different form of notation and with vast labor, only arrived at results which are either identical with those before obtained by La Place under his own form of notation, or which may be easily obtained from them; and that the supposed

* Milton, Parad. Lost.

discoveries announced in the *New Theory* have not in reality advanced this branch of science. This portion of Dr. Bowditch's work, when published, will, in the opinion of our mathematicians, attract the notice of men of science in Europe as strongly, perhaps, as any part of his labors.

When I briefly ask your attention to one or two results of this investigation, and their connexion, — not obvious at first view, — with other branches of science, it will not cause any emotion of surprise, that this curious subject should have so deeply engaged the attention of the author and his commentator.

From these investigations, says La Place, "we perceive the agreement which is found between the *capillary* phenomena and the results of the law of attraction of the *particles* of bodies, decreasing with extreme rapidity so as to become insensible at the least distances that are perceptible to our senses. This law of nature is the source of *chemical affinities;* like gravity, it is not arrested at the surfaces of bodies, but penetrates them, *acting beyond the point of contact, but at imperceptible distances.* Upon this depends the influence of *masses* in chemical phenomena, or the capacity for saturation, whose effects have been so beautifully developed by M. Berthollet. Thus two acids, acting upon the same base, are divided in proportion to their affinities with it; which would not take place if this affinity acted only when in contact; for then the most powerful acid would retain the whole base. The figure of the elementary particles, the heat, and other causes, being combined with this law, modify the effects of it. The discussion of these causes, and of the circumstances which develope them, is the most delicate part of Chemistry, and constitutes the philosophy of that science, making known to us as much as possible the intimate nature of the bodies, the law of the attractions of their particles, and that of the foreign attractions which operate upon them." La Place adds afterwards, that, "at the surface of a fluid, the attraction of the particles, modified by the curvature of the surface and of the sides of the vessel which contains it, produces the capillary attraction; therefore these phenomena, and *all those which Chemistry* presents, correspond to one and the same law, of which now there can be no doubt.* The effects of the capillary action, then, being reduced to a mathematical theory, as the author further observes, "there is only wanting in this interesting branch of physical science a series of very accurate experiments, by means of which we may compare the results of the theory with nature." †

But I must desist from further noticing the subjects of this great work in detail, and confine myself to a few general remarks upon the invaluable labors of Dr. Bowditch; who, by his Translation, first made the work accessible to all who speak the English language, in every quarter of the globe, and has accompanied it with a *Commentary*, which will still farther disseminate the important discoveries and speculations contained in it, by rendering them intelligible and familiar to great numbers of zealous students, whose comparatively slight attainments would, without such aid, have for ever debarred them from all use of the work.

One of the first remarks suggested by an examination of the work of Dr. Bowditch is, that, although his able and copious Commentary takes the name and place of *Notes* upon the original work, yet it not only contains elucidations of his author's text, but includes a history of the progress of mathematical science, from the time of La Place's original publication, more than thirty years ago, to the present day.

Another valuable service rendered by Dr. Bowditch is the

* Bowditch's La Place, Vol. IV. p. 1006 – 1009.

† Ibid., Vol. IV. p. 1015.

awarding of justice to different writers, whose labors had been made to contribute to the perfecting of the *Mécanique Céleste*, but who are not referred to in that work; so that La Place appears himself to be the author of discoveries, which belong to others. His contemporaries in France complained, that he was not willing to be just either to them, or to his predecessors; that his great fault was, his not citing the authors to whom he was indebted; and that he permitted the discoveries of others to appear to the world as his own.

It is not for us to determine how far these complaints of his countrymen were well-founded; in such cases the motive, of which we have not here the means of judging, is essential in estimating the justness of the charge. In point of fact, however, Dr. Bowditch has, in his Commentary, traced to their proper authors various processes and formulas, which, in the text, are not referred to their original sources.

Among the many eminent men, whose claims Dr. Bowditch has been careful to bring distinctly into view, the most conspicuous is the illustrious Lagrange; who, from his extraordinary mathematical powers, was at sixteen years of age made professor of mathematics in the Royal School of Artillery at Turin, in which every one of his pupils was older than himself.* This great man's talents and character, on the whole, appear to have commanded more of Dr. Bowditch's profound respect and admiration, than those of any other individual, whose works were the subject of his studies. Of his eminent talents he remarks, that, "upon the death of Euler, *Lagrange* remained, undisputedly, the greatest mathematician then

* Delambre, Notice sur la Vie et les Ouvrages de M. Lagrange; Mém. de l'Institut, Tom. XIII. 2e Série, p. xxxiv.

living";* and among those traits of his character, which called forth Dr. Bowditch's warmest admiration, was his inflexible sense of justice towards other men of science; for, as his eloquent eulogist says of him, "throughout his writings, whenever he adduces an important theorem, he gives due credit to the original author of it; and when he corrects the ideas of his predecessors or contemporaries, it is always done with that deference which is due to genius."†

Immediately upon the publication of the first volume of Dr. Bowditch's Translation and Commentary he received, from distinguished mathematicians and astronomers of England, France, Germany, and Italy, the most gratifying testimonials of the great service he had rendered to science, and of the ability which he had displayed throughout the work; and, if time would permit us to indulge ourselves in this honorable pride, it would be interesting to you to listen to them, as it has been gratifying to my own feelings to review them in the numerous letters on the files of his correspondence;‡ but I must forbear asking your attention to any farther details on this occasion.

Such is the noble work accomplished by Dr. Bowditch, and on which his fame, as a man of science, is ultimately to rest; and, assuredly, the most lofty ambition could not desire a more solid and lasting monument; a monument, which will endure as long as there shall be left a remnant of the human race to contemplate the mighty fabric of those heavenly systems, whose structure and laws are inscribed upon it.

The scientific reputation of Dr. Bowditch had been so long

* North American Review, Vol. XX. p. 363.

† Delambre, Notice, etc., p. lxxxviii.

‡ See Note J, at the end.

established, that he had, for many years before his death, been a member of various foreign Academies of Sciences; and, but for his death, would, doubtless, have soon been admitted into the Royal Institute of France.*

I have thus endeavoured to give you a brief, but, I fear, a very imperfect sketch of the scientific character and works of our lamented President. The particulars of his private life have already been fully exhibited in the interesting publications before referred to, and it is only necessary on the present occasion to add a few general remarks upon that subject.

In social life Dr. Bowditch was distinguished for great integrity, extraordinary energy of character, and unremitting zeal and perseverance in whatever he undertook to accomplish. His manner was ardent, and indicative of that warm heart, which has now ceased to throb for those friends who enjoyed the happiness of his society. His deportment was, to an extraordinary degree, unaffected and simple; and, in the expression of his opinions, he had an unmeasured frankness, which a heartless age of artificial civility would hardly consent to rank among the virtues. His reverence for truth, and for probity of character, was as deep-rooted, as his indignation was inexorable on the discovery of fraud or duplicity.

With a strong intellect, which was never unemployed, and a sensitive moral principle always in full exercise in the community around him, he may be justly said to have had a long life, though he did not attain to what we usually call old age, having hardly reached the close of his sixty-fifth year; which, however, as we are informed, was a greater age than had fallen to the lot of any of his lineal ancestors for several generations.

The fatal termination of his last illness was not anticipated by

* See Note K, at the end.

the public, till a short time before his death. When apprized himself of the apprehensions of his friends, in the first instance, and, afterwards, of the opinion of his eminent medical attendant,* that his malady must soon terminate fatally, he received the notice without dismay. He expressed a wish, — and what parent could feel otherwise! — that he could have lived to see his younger children grown up and established in life; but at the same time, with a heart full of gratitude to a kind Providence that had crowned him with innumerable blessings in this life, he declared his entire resignation and his readiness to depart.

The short interval remaining was employed, while his strength permitted, in arranging his official and private affairs, and in receiving the last sad visits of his near friends and other persons, who had peculiar claims upon him; during all which, his usual cheerfulness did not forsake him. One of those interviews, of a most affecting character, was given by him to the present distinguished Head of the University, with whom he had been associated for many years as a member of the corporate body of that Institution; and one of no less interest took place only a few days before his death with our distinguished associate, the chief magistrate of this State; the particulars of which are already known to you.

During his illness, among other occupations, he continued to employ himself in correcting the sheets of the last volume of his great work; but the progress of his disease was so unremitting, that, — as had happened to one of his illustrious predecessors, Lagrange, in whose life Dr. Bowditch had himself not long before regretted the unfortunate occurrence, — he had not sufficient strength remaining to enable him to complete the final revision of the whole volume. When he had reached the *thousandth* page, on which

* Dr. James Jackson.

his feeble hand had just traced a few intelligible signs, the iron grasp of disease snatched his last occupation from him for ever. His strength gradually failed; his physical powers refused their office; but his living intellect still shone bright and unclouded; and, like the sun in the firmament, whose radiant orb he had so often watched in mid-ocean, from the splendor of its meridian beams to the softened lustre of its evening decline upon the waters of the fathomless deep, his serene and tranquil spirit gently sunk to repose, in cloudless majesty, upon the bosom of the ocean of eternity.

NOTES.

NOTE A. p. vii.

The remark made at that period by the American publisher, in recommendation of his work, will not be uninteresting at this day in relation to Dr. Bowditch, who was then about twenty-four years of age. He says : —

" For several new Tables and Additions to this work, the Editor takes this public opportunity of returning his thanks to Mr. *Nathaniel Bowditch*, of Salem, Fellow of the American Academy of Arts and Sciences, whose acknowledged talents, both as a theoretical and practical navigator, reflect high honor on the nautical character of his country."

The publisher adds, that one of the *Notes* (on Table XIV. of that edition) " was furnished by Mr. *William Bowditch*," who was a brother of Dr. Bowditch, and distinguished also for his mathematical knowledge.

NOTE B. p. viii.

In going through this examination Dr. Bowditch made the last figure exact to the nearest unit ; and no less than *eight thousand* errors were discovered and corrected in the work of Moore, and above *two thousand* in the Requisite Tables ; though of the latter Dr. Bowditch justly remarks, that most of the errors were in the last decimal place, and in many instances would but little affect the result of any *nautical* calculation. But, he adds, when it is considered, that most of the Tables are useful on other occasions where great accuracy is required, it will not be deemed a useless improvement to have corrected so great a number of small errors. — *Preface to Practical Navigator*, p. vi. edit. 1802.

NOTE C. p. ix.

The following extract of a letter addressed to me, June 4th, 1838, by Mr. George W. Blunt, of New York (a son of the original publisher of Dr. Bowditch's Navigator), of whom I had made some inquiries respecting the history of the work, will be interesting to the American reader.

"The first edition of the American Practical Navigator was printed but not published in 1801. As soon as Mr. Blunt had printed the corrections and additions of Dr. Bowditch he discharged all his hands, took the work, as far as printed, and a copy of *Hamilton Moore*, with all the errors marked, amounting to several thousand, and went to England. On his arrival there, he called on the publishers of Hamilton Moore, John and James Hardy, and Steele; was introduced, and, after some conversation, one of the Messrs. Hardy observed, — 'You have done us up in America with one of our best books.' On being asked what he meant, he replied, *Hamilton Moore.* Mr. Blunt then said, that was his business in England; showed them the copy of *Moore*, with the errors in it, and finally sold the printed copy of *Bowditch* on condition, that the *American* edition should not be sold until June 1802, to give them an opportunity to get theirs into the English market at the same time."

The *London* edition was announced (on its title-page) as "originally written and calculated by *Nathaniel Bowditch*, Fellow of the American Academy of Arts and Sciences; revised, re-calculated, and newly arranged, by *Thomas Kirby*, Teacher of the Mathematics and Nautical Astronomy." In the prefatory Address of the English publishers, who recommended their edition as an "Improvement" of Dr. Bowditch's work, they speak of having made an arrangement with Mr. Blunt, the American publisher; which they were induced to do, "not only by Mr. Bowditch's high reputation, but by reflecting upon the low state to which the existing Works on Practical Navigation had fallen in the opinion of men of discernment;" and add, that they had "spared no expense in securing to the British nation the benefits of American science and diligence."

Unfortunately, either the English editor, Mr. Kirby, or his printers, performed their duty in so careless a manner, that many errors were found in the *London* edition of Dr. Bowditch's work. This gave occasion to a British writer (Andrew Mackay, LL.D.) who published a rival work on

Navigation, to make Dr. Bowditch's supposed inaccuracies a particular object of attack. In criticizing his revision of Moore's work, Dr. Mackay says: — "In this last book, which is pretended to be very correct, are many errors and contradictions," and, "it would be a tedious task to enumerate the errors" contained in it. — *Pref.* p. xiv. 1st edit.

This charge was promptly and emphatically repelled by Dr. Bowditch in his next edition (1807), in which he says: — "A number of mistakes have been made in printing the Tables of Mr. Kirby's first (London) edition, some of which have been taken notice of by Dr. *Mackay*, in the preface to his Complete Navigator; and, as the manner in which those mistakes are mentioned might lead the reader to suppose, that the same errors existed in the *American* Tables, it is thought proper explicitly to state, that *not one* of the 'many errors and contradictions' Dr. Mackay has mentioned is to be found therein."

Dr. Bowditch then adds, in a spirit of candor which his rivals and adversaries would have done well to imitate: — "It is so difficult to obtain perfect accuracy in a table depending solely on observations, that no one ever published was perhaps entirely free from error. As a proof of this assertion, we may refer to the Table published in London, in 1802, by order of the Commissioners of Longitude, in the third edition of the *Requisite Tables;* which Table is esteemed as accurate as any published; for in it the latitude of Sandy Hook is nearly four degrees too much, and that of Barbuda nearly fifteen miles too much, the last error being common to almost all books and charts. . . . . . If farther proof of the justness of the remark, — that errors exist in all tables of latitudes and longitudes, — were wanting, it might be obtained by inspecting the Table published at London, in 1804, in *The Complete Navigator* by Dr. Mackay, in which are many similar errors; three of which only will be mentioned, viz. Cape Ann Lights are laid down eleven miles too far to the northward, and are placed several miles to the westward of Salem instead of the eastward; Barbuda is placed fifteen miles too far to the northward, and Atwood's Keys nearly a hundred miles too far south; so that the remark made by Dr. Mackay, in the preface to his work, 'that the case of the seaman who has to trust to such tables is truly lamentable,' might in many instances apply with equal justice to his own table. The object in view, in pointing out these errors, is, to impress on the mind of the reader the utter impossibility of obtaining a perfectly accurate table, and to induce him to exercise a spirit of candor in judging of errors that may possibly exist in this part of the work."

After this full denial of the charges brought against the accuracy of the *American* Practical Navigator, it was to have been expected, that Dr. Mackay would have the candor to make some acknowledgment on the subject. He, however, suffered his remarks to be repeated, in the second edition of his work, which was not published till three years after Dr. Bowditch denied the truth of his charges.

I may here add, upon the authority of the publisher of Dr. Bowditch's Navigator, that American shipmasters are continually applied to, in foreign countries, to sell their copies of the work, and that "foreign mariners arriving in the United States, of every nation, whether speaking the language or not, always want *Bowditch*, as it is commonly called; and wherever it has been used, it has always been preferred;" and no other works on Navigation "are equal to Bowditch in extent of utility, accuracy, and simplicity." A late English Journal, of established reputation, states, that Bowditch's Practical Navigator "goes, both in American and British craft, over every sea of the globe, and is probably the best work of the sort ever published."—*London Athenæum*, of April 28th, 1838.

NOTE D. p. x.

Of the minor improvements one may be here mentioned, which, though apparently trifling, is practically of considerable value to those who are in the daily habit of using the Tables, and whose calculations, at sea, must sometimes be prompt as well as accurate; and I mention this, not so much for its own importance, independently of other considerations, as to show the unwearied pains taken by Dr. Bowditch to render every possible facility in matters of practical use. The little improvement I allude to is, that, instead of the English and American numerals of the present fashion, (in which the figures are all of the same length, and do not rise above or fall below the line in any instance,) he adopted figures of the older model, which is still followed by the French, and in which the eye is enabled to distinguish, at a glance, those figures that bear some resemblance to each other and are apt to be confounded, in the haste of taking them from the modern Tables.

NOTE E. pp. xi and xii.

The circumstances under which Dr. Bowditch was first enabled to obtain a copy of Newton's Principia (at that time an extremely rare book in this country) will not be uninteresting, as connected with his life and studies.

Since the decease of Dr. Bowditch, I have been informed by my respected friend, Col. Benjamin Pickman, of Boston, (formerly of Salem,) that this copy of the *Principia* originally belonged to him; and that he presented it to Dr. Bowditch, as he believes, through the late Rev. Dr. Bentley, of Salem, from whom he had himself received it as a token of friendship, while a student at Harvard University, in which institution Dr. Bentley was then an instructer.

So far as important consequences may justly be said to flow from small causes, how important have been those arising from the preservation of this single volume in the library of an enlightened individual, whose own pursuits, however, lying in another direction, rendered it of little value, comparatively speaking, to himself, but gave him an opportunity, most gratifying to his well-known feelings, of placing it in the hands of Dr. Bowditch, who, above all men in the country, at that time, was the best qualified to make the study of it beneficial to the public. Dr. Bowditch sometimes alluded to this occurrence; and, on the occasion of presenting a copy of his Translation of La Place's work to a friend, who declined accepting it, because, from his slight acquaintance with the higher mathematics, it would be of no use to him personally, Dr. Bowditch delicately insisted upon his taking it; and, in the last resort, reminded his friend, that, if it should not be of any use to him, personally, it might, perhaps, be placed in the hands of some one, to whom it might prove valuable, as the copy of the *Principia* had been to himself.

In connexion with Dr. Bowditch's early studies, the origin of the Library to which I have referred (p. xii.), and which had so important an influence upon his scientific acquirements, will, in many respects, be interesting; and I therefore subjoin the following account of it from Dr. Bowditch's last will, as published in Judge White's Eulogy:

"*Item.* It is well known, that the valuable scientific library of the celebrated Dr. Richard Kirwan was, during the Revolutionary war, captured in the British Channel, on its way to Ireland, by a Beverly privateer; and, that by the liberal and enlightened views of the owners of the vessels, the library thus captured was sold at a very low rate; and in this manner was laid the foundation upon which have since been successively established the *Philosophical Library,* so called, and the present *Salem Athenæum.* Thus in early life I found near me a better collection of philosophical and scientific works than could be found in any other part of the United States nearer than Philadelphia. This inestimable advantage has made me deeply a debtor to the Salem Athenæum ; and I do therefore give to that Institution the sum of one thousand dollars, the income thereof to be for ever applied to the promotion of its objects and the extension of its usefulness."

Judge White adds : — "I am happy to have it in my power to add, on the authority of the late venerable Dr. Prince, that the gentlemen into whose hands this collection of philosophical and scientific works had thus fallen (of whom he was one, and for many years after their librarian,) made an offer of remuneration to Dr. Kirwan, who respectfully declined it, expressing his satisfaction, that his valuable library had found so useful a destination."

NOTE F. p. xvi.

In order to give some idea of the labor expended on his calculations in this instance, it may be here mentioned, that the original *manuscript* volume upon this comet consists of 144 folio pages of figures, in his minute and close handwriting ; while all that the public are acquainted with is the *results,* which he has compressed into *twelve* quarto pages of the printed Memoirs of the Academy. The following extract of a letter from him to the German astronomer, Baron Zach, in relation to this subject, will be interesting to the American reader. The letter is dated at Salem, the 22d of November, 1822, and is published in Baron Zach's *Correspondance Astronomique,* Vol. x. p. 223.

"In calculating the orbits of the comets of 1807 and 1815 [1811 ?], I made many unnecessary calculations, as you will see in my memoir ; but it was an amusement to me, to see how near I could come to the true elements of those orbits by means of observations made only with a Reflecting Circle of Borda ; and I had the satisfaction to find some of them agree perfectly with those which the best astronomers of Europe had ascertained."

Baron Zach, in a note, inserts the elements here mentioned, with the following remark : — "As the literary productions of America reach us very late, and sometimes not at all, we here give the elements of the orbits of the comets, calculated by Mr. Bowditch, upon observations *entirely American*, made at Salem by Mr. Bowditch, at Nantucket by Mr. Folger, junior, at Cambridge by Mr. Farrar, at Falmouth by Mr. Nichols, and at New Haven by Mr. Fisher."

The learned editor also takes occasion to notice particularly Dr. Bowditch's constant attention to what would be *practically useful* in his researches ; and refers with warm commendation to the sentiment expressed in the following passage of the letter just cited : — "You will see that I have studiously avoided all scientific parade, and have published the work [the Practical Navigator] according to the method of instruction used in our country, where we prefer, in these matters, *practice* to theory."

The difficulty of obtaining public patronage for any other works, than those which are obviously of *practical* value, especially for profound works of science, has been experienced in all countries. The following anecdote respecting the publication of Lagrange's immortal work, the *Mécanique Analytique*, affords an instance of this disheartening fact, even in Paris, the very centre of mathematical science. I am indebted for it, to an able article written by Dr. Bowditch for the North American Review.

"This work," says Dr. Bowditch, "was written at Berlin, but Lagrange wished to have it printed at *Paris*, where it could be executed in a better style. A copy was made and forwarded to the care of the Abbé Marie ; and it would now hardly be believed, that he could not, in 1788, get a printer to undertake the publication of that single quarto volume, *without a guarantee to pay the expenses*, in case the sale of the work should not be sufficient. The Abbé agreed to this condition, and did even more ; for, at his own expense, he procured the assistance of one of the first mathematicians of Paris, Legendre, to overlook the publication, and see that it was printed correctly. The second edition of this immortal work was published in 1811, with many additions and improvements, showing the vigor of his mind though in extreme old age. Unfortunately for science, he did not live to complete the whole of the second volume, and a few of the last chapters are given exactly as in the first edition." Dr. Bowditch adds, that "this work ought to be studied frequently by every one who wishes to learn the most approved methods of treating the science of Physical Astronomy. It is much easier to read than La Place's *Mécanique Céleste*, as it does not go into the detail and numerical calculations, which are necessary in the application of the formulas." — *N. A. Review*, Vol. xx. p. 364. See also *Éloge de M. Lagrange,* in Mém. de l'Institut, Tom. xiii. p. lx. 1e Série.

NOTE G. p. xviii.

It will be perceived, that the observations of Dr. Bowditch upon the Variation of the Magnetic Needle were made thirty years ago; since which time far more extensive researches, than were then practicable, have been made in different parts of the United States, as well as in Europe, on this important subject. A highly valuable Table of Observations, made on the Variation and Dip of the Magnetic Needle in different parts of the United States, for more than a century past, has been lately published by Professor Loomis (of the Western Reserve College, State of Ohio), in the *American Journal of Science.* Professor Loomis urges upon men of science the great importance of observations of this kind "to a much greater extent than has been hitherto done;" and he states his conclusions, from the present data, as follows: —

"From an attentive examination of the preceding Table it will be seen, that, from the time of the earliest observations down to the commencement of the present century, the *westerly* variation was *decreasing*, and the easterly increasing in every part of the United States; that more recently, the reverse has taken place, that is, that a retrograde movement of the needle has commenced. The precise year when this change took place cannot be certainly known. To determine this, we need more numerous and more accurate observations. All the observations, however, agree in this, that the change began as early as 1819, while the Philadelphia observations would make it as early as 1793, and those at Newbern (North Carolina) not far from the same year. The annual motion is much greater in the eastern states than in the south and west. I have carefully compared all the observations contained in the preceding table, and, without giving the particulars of this discussion, will state at once the conclusion at which I have arrived, viz. that the *westerly variation is at present increasing and the easterly diminishing in every part of the United States;* that this change commenced between the years 1793 and 1819, probably not everywhere simultaneously; and that the present annual change of variation is about 2′ in the Southern and Western States, from 3′ to 4′ in the Middle States, and from 5′ to 7′ in the New England States."

This interesting paper is accompanied with a valuable *Magnetic Chart of the United States*, constructed by Professor Loomis, which "is intended to represent all the observations contained in the preceding Table reduced to the present time." *

In *Europe* the great importance of this subject has lately induced the Government of Russia, "the classic soil of terrestrial magnetism," as its Academicians call it, to order Magnetic Observations to be made, in connexion with a general system of Meteorological Observations, throughout the Empire. Numerous little observatories have been established in various places, for the purpose of beginning a course of these observations. At St. Petersburgh a *pattern* observatory is established, in which a number of officers are qualified, by the necessary practical instruction for one and two years, to become observers in the small establishments of the interior. Each of these observers has two aids, who lodge in the observatory; a rigorous and uniform system is followed, in the distribution of the hours, the selection of instruments, and the methods of observing. Meteorological observations are made eight times a day, and, in certain designated places, the Variation and Dip of the magnetic needle are also noted at the same times; the Variation is further observed, at certain periods of the year, simultaneously with the observations made in other parts of Europe.

The first part of these official observations has been lately published, by the Russian Government, under the title of "Observations Météorologiques et Magnétiques, faites dans l'Empire de Russie, redigées et publiées aux Frais du Gouvernement, par A. T. Kupffer, Membre de l'Académie des Sciences de St. Petersbourg." 4to. pp. 90.

NOTE H. p. xxiv.

The following are all the reviews and smaller published works of Dr. Bowditch, that have come to my knowledge:

1. Notice of the Comet of 1807; published in the Monthly Anthology, Vol. iv. p. 653.

* Silliman's Journal of Science, Vol. xxxiv. p. 290; for July, 1838.

2. Review of a "Report of the Committee [of Congress] to whom was referred, on the 25th of January, 1810, the Memorial of William Lambert, accompanied with sundry Papers relating to the Establishment of a First Meridian for the United States, at the permanent Seat of their Government." Published in the Monthly Anthology, Vol. ix. p. 245.
3. Defence of the Review of Mr. Lambert's Memorial. Monthly Anthology, Vol. x. p. 40.
4. Review of Olbers's Treatise on the most easy and convenient Method of Computing the Path of a Comet; and Gauss's Theoria Motus Corporum Cœlestium in Sectionibus Conicis Solem ambientium, etc. (containing a brief account of the progress of astronomy in Germany. Published in the North American Review, Vol. x. p. 260.)
5. Letter to Baron Zach; published in his *Correspondance Astronomique*, Vol. x. p. 223, for the year 1824.
6. Review of particular Works of Bessel, Burckhardt, Bouvard, Delambre, Lindenau, and La Place, (comprising a view of Modern Astronomy, and an account of the most distinguished writers on the subject. Published in the North American Review, Vol. xx. p. 309.)

To these Reviews may be added a great number of articles published in the *Mathematical Diary*, a quarterly journal. I am informed, that he solved every question that was proposed in that journal; and his solutions, part of which only were published, were, as we should expect, distinguished for their elegance, simplicity, and precision.

☞ To the *Memoirs* by Dr. Bowditch, mentioned in the text, should be added the following, which were accidentally omitted:

On the Eclipse of the Sun of September 17th, 1811; with the Longitudes of several Places in this Country, deduced from Eclipses and Transits published in the Transactions of different learned Societies. (*Mem. Amer. Acad.* Vol. iii. p. 255.)

Estimate of the Height of the White Hills, in New Hampshire. (*Mem. Amer. Acad.* Vol. iii. p. 326.)

On the Occultation of *Spica* by the Moon, observed at Salem, February 5th, 1820. (*Mem. Amer. Acad.* Vol. iv. p. 306.)

NOTE I. p. xliv.

The writer of the article in the Quarterly Review, here quoted, speaks of Mrs. Somerville as an *English lady*. In a subsequent volume of that journal, the reviewer says ; "The latter (Mrs. Somerville) we are obliged to confess, is *Scotch* by her birth, though we are very happy to claim her as one of the brightest ornaments of England." — *Quarterly Review*, Vol. li. p. 68.

NOTE J. p. lviii.

The following extracts from a few of the letters received by Dr. Bowditch, on the publication of the first and other volumes of his *La Place*, will be read with interest.

From Sir John Herschel, March 8th, 1830.

"It is very gratifying to me to commence a scientific intercourse, which I have long desired, with the congratulations which the accomplishment of so great a work naturally calls for ; and I trust, that its reception by the public will be such (of which indeed there can be little doubt) as to encourage you to proceed to the publication of the succeeding volumes, and that you will be favored with health, strength, and leisure to enable you to complete the whole of this gigantic task in the masterly manner in which you have commenced it. It is a work, indeed, of which your nation may well be proud, as demonstrating, that the spirit of energy and enterprise which forms the distinguishing feature of its character, is carried into the regions of science ; and every expectation of future success may be justified from such beginnings."

From Charles Babbage, Esq., Aug. 5th, 1832.

"It is a proud circumstance for America, that she has preceded her parent country in such an undertaking ; and we in England must be content, that our language is made the vehicle of the sublimest portion of human knowledge, and be grateful to you for rendering it more accessible."

Dr. Bowditch also received letters from Professor Airy, Francis Baily, Esq., the Bishop of Cloyne, (Brinkley,) and other persons of scientific eminence in various parts of Great Britain, testifying, in the warmest terms, their great satisfaction at the masterly manner in which the work was executed, and their high sense of the valuable service rendered by Dr. Bowditch, in giving to England and America his Translation and Commentary in the common language of the two countries.

From *France,* he received many letters of the same character; of which I can notice but a few, containing particular remarks upon it.

Letter from M. Lacroix, Paris, April 5th, 1830.

"Your work, in the first place, is a good book on account of the numerous aids it affords for surmounting the difficulties that must be encountered in reading the original, in which La Place has passed over many of the intermediate and almost indispensable steps. Besides doing honor to the able, patient, and conscientious geometer, who has undertaken this great labor, your work, by the beauty of its typographical execution, does honor to the country where it is published. It is, perhaps, the most beautiful book that has appeared upon mathematics. The calculations in it possess the greatest neatness; and the figures, which you have inserted in the body of the work itself, unite the greatest elegance with convenience. An undertaking so remarkable entitles you to the gratitude of those who are desirous of studying, to the bottom, the theory of the system of the world which rests upon transcendental mechanics; and it makes us wish for the speedy publication of the remaining volumes."

In another letter, (July 1st, 1835,) M. Lacroix says: — "I am more and more astonished at your continued perseverance in a task so laborious and extensive. I perceive, that you do not confine yourself to the mere text of your author and to the elucidations which it requires; but you subjoin the parallel passages and subsequent remarks of those geometers who have treated of the same subjects; so that your work will embrace the actual state of science at the time of its publication." And in a previous letter, (January 18th, 1833,) the same distinguished mathematician says: — "I have already had occasion to recommend it to a young professor at Lausanne, who requested of me some explanations of the work of La Place."

Letter from M. Legendre, Paris, July 2d, 1832.

"Your work is not merely a *Translation with a Commentary;* I regard it as a new edition, augmented and improved, and such an one as might have come from the hands of the author himself, if he had consulted his true interest, that is, if he had been solicitously studious of being clear," &c.

Letter from M. Puissant to D. B. Warden, Esq. (by whom Dr. Bowditch's work was transmitted), dated May 31st, 1835.

"I have received through you the third volume of the beautiful and valuable Translation of the Mécanique Céleste of La Place, with which your scientific countryman, Mr. Bowditch, has honored me. The numerous additions which accompany the text, and which, in their turn, deserve to be translated into French, are the more important, as they clear away the difficulties which the subject frequently presents, and moreover include whatever Mr. Bowditch and other geometers have added to the theory of the motions of the heavenly bodies."

His scientific correspondents in *Germany* were equally strong in their commendations of his work.

Mr. *Bessel*, at Königsberg, in a letter of February 18th, 1836, observes : — "Through your labors, on the *Mechanism of the Heavens*, La Place's work is brought down to our own time, as you add to it the result of the studies of geometricians since its first appearance. You yourself enrich this science by your own additions, for which special obligations are due to you."

Mr. *Encke*, at Berlin, in a letter of May 5th, 1836, characterizes the Translation as a work, "which, by the depth of the researches with which it is accompanied, will insure to you a distinguished place among the astronomers who have employed themselves on the difficult branch of Physical Astronomy."

The reception of the work by the practical astronomers of *Italy* has been not less gratifying. I will only add an extract or two from letters of Mr. *Niccolò Cacciatore*, Director of the Royal Observatory at Palermo.

In a letter of May 1st, 1836, he informs Dr. Bowditch, that he had been charged by the Royal Academy with the duty of making a report upon his work, which "had excited the enthusiasm of all who took an interest in the subject of it." And in a letter of the same date, addressed to one of his correspondents in the United States, he expresses himself in the following strong language : — "The work of Bowditch is great, very great. After having made my Report upon it to the Academy, which was very brief, because I was obliged to confine myself to narrow limits, I placed it on my study table, and now make the reading of it my pleasant employment. I find in it much to reflect upon, and much to learn. Bowditch has filled up, and in a superior manner, the design of the Mécanique Céleste, and has, moreover, corrected certain blemishes which have been noted in that work. Those comments and those notes, in my opinion, place Bowditch at the head of living mathematicians." In another letter to the same correspondent, of a later date, (September 21st, 1837,) Mr. Cacciatore says : — "In the enthusiasm of my admiration I have briefly mentioned it [Bowditch's La Place] in my work on Goniometry, p. 56, as you will see. The three volumes, with which the distinguished author has complimented the Academy, make them ardently desirous of seeing the fourth volume, as well as the other works of the same author."

The passage of Mr. Cacciatore's work, here referred to by him respecting Dr. Bowditch, is as follows: —

"The profoundness and clearness, which are conspicuous in that work, demonstrate, that it was only by the aid of such powers of analysis, that a commentary could be written upon the immortal work of La Place, and that La Place cannot be read with advantage, unless it is accompanied with the Notes of Bowditch. Italy must have a translation of it." — *Esercizio di Goniometria, ecc., dal Cav. Niccolò Cacciatore, Direttore del Reale Osservatorio.* 8vo. Palermo, 1837.

NOTE K. p. lix.

Dr. Bowditch was a member of the following Scientific Societies; which are here placed in the order of the dates of his diplomas: — The Edinburgh Royal Society, January 26th, 1818; Royal Society of London, March 12th, 1818; Royal Irish Academy, March 16th, 1819; Royal Astronomical Society, London, April 13th, 1832; Royal Academy of Palermo, March 12th, 1835; British Association, June 29th, 1835; Royal Academy of Berlin, March . . . , 1836.

I have stated, that he would soon have been elected a member of the Royal Institute of France. An American gentleman who was in Paris, when the news of Dr. Bowditch's death arrived there, wrote to a friend in this country, under date of May 30th, 1838, as follows: — "Had he (Dr. Bowditch) lived a little time longer, he would have been a member of the Institute of France. His works had been referred to a committee; and, that committee having asked Mr. Warden to furnish such information as he possessed as to his various works, I was applied to, as likely to know much more than any one in Paris about them. I immediately sent to the committee a hasty sketch, containing such anecdotes as I had heard, and such facts as I knew; and was shortly after informed, that there was no doubt of his nomination and appointment. But within three weeks afterwards came the sad news of his death. . . . . . I wish the Institute had moved a little earlier; for it would have been an honor to the country, and gratifying to him."

MEMOIRS

OF THE

AMERICAN ACADEMY.

I.

An account of the Magnetic Observations made at the Observatory of Harvard University, Cambridge.

BY JOSEPH LOVERING,

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AND

W. CRANCH BOND,

ASTRONOMICAL OBSERVER TO THE COLLEGE.*

Communicated by Joseph Lovering, A. M.

THE object of this communication is to give some information in regard to the nature and progress of the series of magnetic observations which has been instituted at the Observatory of Harvard University in coöperation with the plan of the Royal Society, as

* The authors of this paper desire it to be understood that Professor Benjamin Peirce has rendered great assistance in conducting the observations on Term and other days, and in devising simple methods of reduction. The empirical curves which are mentioned in this paper and which were calculated at a great cost of time and labor are the voluntary contribution of this gentleman to the objects of the Observatory.

detailed in their Reports.* Regular magnetic observations were undertaken at Cambridge in March, 1840, being confined at first to the monthly Term-days of the English scheme. The meteorological observations recommended in the same Reports were also begun in a modified form, adapted to the resources of the Observatory, at that time; but it is not proposed to speak of them except so far as they may be connected with the remarks on Terrestrial Magnetism. The necessity of conforming, as near as possible, to the general plan and acting in concert is apparent, as the observations are intended rather for comparison than for independent use. But in the execution of this charge, as far as it has yet progressed, questions of curiosity or of higher interest have been constantly occurring which suggested the expediency of observations additional to, but not interfering with, the chief work. In some cases, these inquiries could be answered or the approximate data for a solution be derived from the means at our command; but often, they depended upon comparisons between elements simultaneously observed at different places. In the latter instances, we have had valuable assistance in the prompt coöperation of Lieutenant C. J. B. Riddell at the Magnetic Observatory in Toronto, U. C. The results of these extraordinary observations will be exhibited in their proper place. That an opportunity may be afforded of judging of the degree of accuracy of the observations we shall first give a description of the plan of the Observatory, the nature, position and adjustment of the instruments, and the method of making the observations.

Plate I. is a ground plan of the University Observatory. The

* Royal Society. Report of the Committee of Physics, including Meteorology, on the Objects of Scientific inquiry in those sciences. London, 1840.

Report upon a letter addressed by M. Le Baron de Humboldt to his Royal Highness the President of the Royal Society, and communicated by his Royal Highness to the Council 9th June, 1836.

projections are given of only those parts of the building which are devoted to the purposes of an observatory; they were built expressly for this object and are attached to the northwest and southwest corners of the house in which the observers reside; one room of this house which is used for an observer's room is represented in the plate by *K.* *A* is the projection of the dome erected on the top of the house, and the rectangle is the opening through the floor by which it is entered. This dome has a revolving roof of panel work and plate glass with a vertical section which can be brought into any azimuth required by the observation. *E* is the place of the astronomical clock.* It has been thought inexpedient to carry the clock into the transit room where it would be exposed to great changes of temperature. For this and other reasons it is kept in a fixed position in a room where the temperature is nearly uniform throughout the day and night, and at all seasons. The observations are made directly with a chronometer which is compared with the clock as often as is necessary. This practice has recommended itself from long trial as convenient and safe. *G* represents the place of the barometers. The observatory is liberally furnished in this respect, having one standard barometer by Cary and two barometers by W. & S. Jones. Besides these, a beautiful standard barometer made by I. Newman has just been received and has been placed between the windows on the south side of the same room. As this barometer is after the model of those used at the other magnetic stations and has been compared directly with the standard barometer of the Royal Society which was made by the same artist on the same principle, it may be regarded as the best standard in this country. The following are the results of the comparison:

Royal Society Standard	29.506 in.	Royal Society Standard	28.604 in.
Cambridge Standard	29.504	Cambridge Standard	28.600

* This clock was made by Parkinson and Frodsham.

Newman's barometers are superior in several respects to all others. The graduated scale which measures the height of the mercury is made of brass, and slides by means of a tangent screw so that its end, which is of ivory, can be made to touch the upper surface of the mercury in the cistern. This is known to be the case when the reflected and actual point are in contact. The tube which holds the mercury is 0.512 of an inch in diameter; therefore the effect of capillary attraction is inappreciable.* The Royal Society have published in their Report a table of corrections for temperature, calculated by Professor Schumacher and applicable to this kind of barometers, by which an allowance is made for the unequal expansion of the scale and the mercury corresponding to every degree from 32° of Fahrenheit and for every half inch of the barometer. The vernier of Newman's standard barometer reads off to $\frac{1}{500}$ of an inch.

The piers which support the transit instrument are situated at *B*, and may be better understood from *m n o* in another part of the plate. The piers are 9½ feet long, with a tripod base; *m* is the east and west view, and *n* the north and south view; *o* is a granite pedestal, 6 feet long, 5½ feet wide, 2 feet 10 inches deep, firmly resting upon a gravel foundation. The lower side of this block of granite is 7⅓ feet below the floor. The sides of the transit room are supported on independent walls, separated from the base of the transit by a trench 3 feet wide which has been filled up with tan to preserve the stones from being deranged by frost. Care has been taken not to allow the floor to press upon the piers where they enter it. By these precautions the instrument is protected from the jar of footsteps in the observatory and the disturbances of carriages. An excellent Transit-instrument, made by Troughton and Simms, 4 feet long, was placed in adjustment in January, 1840, and a series of meridian observations, including moon-culminating stars, has been

* This correction for a tube whose diameter is 0.5 inch is only 0.003 inch.

continued from that time, which by their comparison afford satisfactory evidence of the stability of the pillars on which the instrument rests. *F F* is the direction of the astronomical meridian and intersects Blue Hill, in Milton, west of its summit. A firm and substantial meridian mark has been erected on that hill, consisting of a tower of round and substantial masonry, thirteen feet in diameter at the base, seventeen feet high above the ground and nine feet in diameter at the top. On this is placed a mark seven feet high, of the shape of the rhomb, with its larger axis perpendicular to the horizon. By this means the central vertical wire of the Transit instrument is put in the meridian. It appears from Mr. Borden's State Survey that the distance between the mark and the instrument is 58,520.5 feet. A brick house on the meridian line, about a mile from the Transit-instrument, affords a convenient though less accurate reference, when the state of the atmosphere does not allow the distant mark to be distinctly seen.

A short abstract from the astronomical records of the Observatory is annexed, to show the state of the Transit-instrument and the confidence that may be reposed in the accuracy of the time used in the magnetic observations. The equatorial intervals of the wires of the Transit-instrument, as deduced from a large number of observations, are thus:

	s.
From 1st wire to the mid-wire .	33.96
From mid-wire to 5th . . .	33.94
From 2d to mid-wire . . .	16.88
From mid-wire to 4th . . .	16.86

The following extract from the Transit-book includes all the standard stars whose transits were observed from July 10th to July 25th, 1840. In a few cases, an observation has been rejected because one of the five wires was accidentally missed. The introduction of such stars would vitiate the general comparison.

No.	Date. 1840.	Name of Star.	Declination of Star.	Obs'd time of transit by the sidereal clock.	Right Ascension of Star.	Clock slow of sidereal time.	Difference of obs'd times—Diff. of AR.*
	July.		° ′	h. m. s.	h. m. s.	m. s.	s.
1	10	Polaris S. P.	+88 27	13 00 57.3			
2	"	α Virginis	−10 20	13 15 38.84	48.56	— 1 9.72	
3	"	ε Bootis	+27 45	14 36 53.14	2.64	— 1 9.50	+ 0.29
4	"	α² Libræ	−15 23	14 40 55.50	5.10	— 1 9.60	— 0.10
5	"	β Libræ	— 8 48	15 7 17.60	27.19	— 1 9.59	+ 0.03
6	"	α Cor. Bor.	+27 15	15 26 48.02	57.68	— 1 9.66	— 0.05
7	"	α Serpentis	+ 6 56	15 35 16.81	26.37	— 1 9.53	+ 0.14
8	"	β¹ Scorpii	−19 22	15 55 02.48	11.90	— 1 9.42	+ 0.13
9	"	δ Ophiuchi	— 3 17	16 3 51.52	61.19	— 1 9.67	— 0.25
10	"	Antares	−26 4	16 18 30.42	40.10	— 1 9.68	— 0.00
11	"	τ Scorpii	−27 52	16 24 49.92	59.72	— 1 9.80	— 0.11
12	"	α Herculis	+14 35	17 6 14.86	24.47	— 1 9.61	+ .22
13	"	γ Draconis	+51 31	17 51 46.94	56.63	— 1 9.69	— 0.05
14	"	Polaris	+88 27	1 0 59 80			
15	11	α² Libræ	−15 23	14 40 53.87	5.09	— 1 11 22	
16	"	β Ursæ Minoris	+74 48	14 50 06.59	18.27	— 1 11.68	— 0 46
17	"	β Libræ	— 8 48	15 7 16.05	27.18	— 1 11.13	+ 0.56
18	"	α Serpentis	+ 6 56	15 35 15.03	26.36	— 1 11.33	— 0.18
19	"	β¹ Scorpii	−19 22	15 55 0.59	11.90	— 1 11.31	+ 0.03
20	"	δ Ophiuchi	— 3 17	16 4 49.95	61.18	— 1 11.23	+ 0.08
21	"	Antares	−26 4	16 18 28.67	40.10	— 1 11.43	— 0.19
22	"	τ Scorpii	+14 35	16 24 48.41	59.72	— 1 11.31	+ 0 12
23	"	α Herculis	+12 41	17 7 13.09	24.46	— 1 11.37	— 0.03
24	..	α Ophiuchi	−27 52	17 25 22.45	33.80	— 1 11.35	+ 0.03
25	"	γ Draconis	+51 31	17 51 45.11	56.62	— 1 11.51	— 0.14
26	12	β L' ræ	— 8 48	15 7 14.90	27.18	— 1 12.28	
27	"	ε Serpentis	+ 6 56	15 35 14 06	26.36	— 1 12.30	— 0 00
28	"	β¹ Scorpii	−19 22	15 54 59 52	11.89	— 1 12 37	— 0 06
29	"	δ Ophiuchi	— 3 17	16 4 48 98	61.18	— 1 12.20	+ 0 18
30	"	Antares	−26 4	16 18 27.88	40.09	— 1 12.21	— 0.00
31	"	α Hercules	+14 35	17 6 12 02	24.46	— 1 12.44	— 0.20
32	"	Sagittarii	—30 14	17 47 40.84	53.07	— 1 12.23	+ 0.24
33	"	Vega	+38 38	18 30 22.04	34 37	— 1 12.33	— 0.06
34	"	φ Sagittarii	−27 09	18 34 31.52	43.76	— 1 12.24	+ 0.09
35	14	α Herculis	+14 35	17 6 10.16	24.45	— 1 14.29	
36	"	α Ophiuchi	+12 41	17 26 19 76	33.79	— 1 14.03	+ 0.27
37	"	μ Sagittarii	−21 6	18 3 01.46	15.67	— 1 14 21	— 0 16
38	"	α Lyræ	+38 38	18 30 20.12	31.37	— 1 14.25	— 0.02
39	"	β Lyræ	+33 11	18 43 59 16	13 55	— 1 14.39	— 0.13
40	"	ζ Aquilæ	+13 38	18 56 52.48	6.72	— 1 14.24	+ 0.16
41	"	δ Aquilæ	+ 2 48	19 16 14.08	29.30	— 1 14.22	+ 0.04
42	"	α Aquilæ	+ 8 27	19 41 47.82	61.98	— 1 14.16	+ 0.07
43	"	β Aquilæ	+ 6 01	19 46 16.58	30.66	— 1 14 08	+ 0.08
44	"	α² Capricorni	−13 2	20 7 59.79	14.11	— 1 14.32	— 0.23
45	"	α Cygni	+44 43	20 34 47.44	61.75	— 1 14.31	+ 0 03
46	"	61 Cygni	+37 58	20 58 32.94	47.03	— 1 14.09	+ 0.24
47	"	ζ Cygni	+29 35	21 4 56.42	10 86	— 1 14.44	— 0.35
48	"	α Cephei	+61 55	21 13 34.03	48.06	— 1 14.03	+ 0 42
49	"	β Aquarii	— 6 16	21 21 56.99	11.42	— 1 14.43	— 0.39
	"	Polaris 1st wire		0 40 3.80			
	"	" 2d "		0 50 36 20			
	"	" mid "	+88 27	1 00 59.50			
	"	" 4th "		1 11 22.70			
	"	" 5th "		1 21 55.40			
50	"	Mean		1 0 50.50			
51	15	Polaris S. P.	+88 27	13 0 58.40			
52	"	Arcturus	+20 01	14 7 9.06	24.37	— 1 15.31	
53	"	β Libræ	— 8 48	15 07 11.74	27.15	— 1 15 41	— 0.05
54	"	α Cor. Bor.	+27 15	15 26 42.52	57 62	— 1 15.10	+ 0.32
55	"	α Serpentis	+ 6 56	15 35 11.06	26.33	— 1 15 27	— 0.16
56	"	β1 Scorpii	−19 22	15 54 56.48	11.87	— 1 15 39	— 0.11
57	"	η Draconis	+61 53	16 20 37.80	53.08	— 1 15 28	+ 0.13
58	"	α Herculis	+14 35	17 6 9.54	24.75	— 1 15 21	+ 0.11
59	"	olaris	+88 27	1 0 56.49			
					The mid-wire bisecting the mark on the Bluehill.		
60	25	Polaris S. P .	+88 27	13 0 47.50			
61	"	Arcturus	+20 01	14 6 54.82	24.25	— 1 29.43	
62	"	α Cor. Bor.	+27 15	15 26 28.06	57.50	— 1 29.44	— 0.00
63	"	α Serpentis	+ 6 56	15 34 56.60	26.14	— 1 29.54	— 0.09

* This difference has been corrected for the error of the clock. This error is found from the 7th column of the Table and may be seen on page 7.

Abundant materials are furnished by the preceding catalogue of transits for deducing the state of the instrument, the direction of the meridian and the true sidereal time. By means of these observations the rate of the clock is found to be

	s.		s.
From the 10th to 15th July	—1.16	From 15th to 25th July	—1.41
	—1.09		—1.43
	—1.15		—1.43
	—1.17		
	—1.12		—4.27
	—5.69	Mean	—1.42
Mean	—1.14		
	—1.42		
	—2.56		
	—1.23	Mean from 10th to 25th July.	

There are three methods in common use for determining the azimuth of the Transit instrument. One of them employs the successive intervals between the upper and lower passage of Polaris; another compares the transits of two circumpolar stars whose right ascensions vary about 12 hours; while the last depends upon the transits of high and low stars, including north and south stars. When the latter method is adopted, it is advisable to select stars whose difference of declination is at least equal to 40°. There are defects in all these methods. The first supposes the rate of the clock to be uniform during the 24 hours; this may not always be the case; but on account of the slow motion of the star a considerable error in time would make but a small difference in the azimuth of the instrument. The second process depends upon the clock for a much shorter time; but it requires four observations and the accidental error of these may exceed that produced in the first case by the clock. Lastly, the third mode requires only two observations and depends on the clock only for a short time; but it supposes the Tabular place of the star to be accurately known. A careful determination of the meridian must be based upon a combination of the three methods; when this is done, the instrument is adjusted with great exactness. This reduction has been made out of the transits in the table, and the azimuth of the instrument when on the meridian mark, calculated from 18 different sets of stars selected according to the known conditions of the problem, gives as a mean result

0″.072 west of south, being the azimuth of the south end of the Transit instrument.

The three successive transits of Polaris observed on the 14th and 15th July give

0″.11 west of south.

The final mean is 0″.091 west of south.

The octagon apartments to the west of the Transit-instrument contain a Gauss Magnetometer by which changes of magnetic declination are observed. They are built of wood, with copper and zinc nails; the walls rest on wooden posts; iron, stone and all other substances known or suspected to exert magnetic influence having been carefully excluded from every part of the building. $F D$ is the direction of the astronomical meridian and $D C$ of the mean magnetic meridian. The three circles at D are the projections of so many wooden posts which are bound firmly together at the top and support the marble table on which a Variation-transit is placed. This instrument was made by Troughton and Simms, and is used in the magnetic observations. The larger interior circle represents the table; the chord at right angles to the magnetic meridian is the projection of the scale which is read in the observations; C is a Gauss Magnetometer which is fitted up after the style of those at the Gottingen Observatory. The three circles at C are the feet of three posts, ten feet long, which unite at the top eight feet above the floor and give a stable point of suspension to the needle. The rectangle, enclosed within the feet, is the box which surrounds the magnet and protects it from currents of air. Within the box may be seen this magnetized bar in the magnetic meridian, with a mirror firmly fixed to its south end to reflect the scale at D into the tube of the Variation-Transit. The bar is suspended by a copper wire silvered, 0.011 of an inch in diameter, 5 feet 6 inches long, and with its fixtures weighs about 3 pounds.

From this arrangement it follows, that as the bar varies in its position it must carry the mirror with it. The place of the mirror determines the mark on the scale which is reflected into the centre of the telescope; so that as the reflecting surface moves the marks of the scale that are successively seen are read off and employed to ascertain the motions of the bar. The scale at Cambridge is so divided that the angular motion of the needle is read directly from it without any reduction. This novel mode of observing changes of magnetic Declination is a great refinement upon the old methods, and has given an accuracy to the determination of this magnetic element which has hitherto been considered attainable only in astronomy. For a more minute description of the Gauss instruments and the directions to be obeyed in observing with them, the reader is referred to Taylor's Scientific Memoirs, Parts V. and VI. It is necessary to omit in this place any further details except such as are required in order to understand the remarks which follow. As all the observations embraced in this paper were made with the Gauss Magnetometer, I shall pass at once to them and leave the description of the rest of the buildings and the instruments placed in them for the close.

The plan of magnetic observations, recommended by the Royal Society and generally adopted at the magnetic Observatories, prescribes that the Declination Magnetometer, and the Horizontal and Vertical Force instruments, shall each be observed once every two hours during the 24 hours on every day of the year; that is to say, one of them is read $2^m\ 30^s$ before each even hour; one at the even hour, and the third $2^m\ 30^s$ after the even hour. One day in each month has been set apart for observations of the three instruments *at shorter intervals.* On these days, which are called Term-days, the Declination Magnetometer is observed every five minutes, and the other instruments every 10 minutes, making four separate observations every 10 minutes, or 576 in the day. A short description of the instruments by which these observations are made is promised at the end of the paper. They have but recently been received and adjusted, and regular observations were made for the first time with them on the Term-day of March, 1841.

The observations with the Gauss Magnetometer, which make the subject of this article, have been coincident in time with those taken with the Declination Magnetometer at the British stations and are therefore comparable with them. The Report of the Royal Society on this great Magnetic Adventure provides that the observations shall be made as closely as the nature of the instruments, with all the recent refinements of mechanical skill added to the ingenious artifices of the observer, will permit; and the time is to be carefully noted after having been determined by the assistance of astronomical instruments, so as to make the observations at the different stations in a practical sense simultaneous. Observations, according to this rigid system, were originally expected to extend over three years. When the materials thus patiently gathered from so many remote sources shall be collected, they will pass into the hands of competent persons to furnish the elements for a complete Theory of the earth's Magnetism; and any attempt to pronounce at this time positively on this great subject would justly be regarded as premature. But it is equally certain that there are secondary questions, of considerable intrinsic importance, which may be discussed now as well as at any time; the settlement of which will be facilitated by an occasional publication of portions of the regular magnetic observations. Much light may be thrown upon the general subject by a comparison of partial results; and parts of a well-concerted plan to which no present objection appears may prove useless in fact, and be either remodelled or superseded by other observations which experience has shown will serve a better purpose. Moreover, the subject of Terrestrial Magnetism deeply engages the attention of the scientific world, and many not actively engaged in the research will be anxious to understand the progress of a scheme which promises to shed light upon this complex problem. In this great country it is highly important that something should be done to awaken the attention of individuals and of the American nation; and to bespeak their bounty in favor of a scientific enterprise which has received the highest patronage of European and other governments. The commercial prosperity no less than the interests of pure science will be affected by the spirit and liberality with which this bold project is sustained and conducted. It is hoped that the present publication may not prove useless for some of these purposes. A writer in the "London Quarterly Review," after speaking of the materials that will be collected at head-quarters, by three years' contribution, proceeds thus: "Voluminous beyond all former precedent as the mass of data thus accumulated must of necessity be, we trust the whole will be printed (each nation and each department of course providing for the publication of its own). No consideration of economy should be allowed to interfere with the performance of this necessary duty, without which we look upon all that shall be done as virtually thrown away. Highly as we respect the illustrious body above mentioned, and applaud their selection of the individual into whose hands the results will in the first instance pass; yet their full, fair, and effectual discussion can be secured by no other means than by inviting to it the collective reason of the age, and of all succeeding ones, and affording every one who may think proper to engage in the task, now or hereafter, ample opportunity to do so."*

It should be stated, for the information of those who have not watched the progress of the recent investigation into the laws of the earth's Magnetism, that it originated with Baron Humboldt and Professor Gauss of Gottingen. In 1828, Baron Humboldt laid the foundation of the German Magnetic Association, by erecting a magnetic Observatory at Berlin, which was imitated in various parts of Germany and Russia. In 1833, the attention of Gauss was called to the theoretical consideration of the earth's Magnetism, but he found himself soon arrested by the want of accurate and extensive data. He instituted accordingly a magnetic Observatory at Gottingen, and having furnished it with new instruments began observing in March, 1834. Coöperation was sought and obtained in various parts of the continent; a more intimate alliance was formed between the several points of observation; and after various modifications in the time and mode of observing, the amount of which was to make the observations more minute and the number of Terms smaller, one day in the months of February, May, August and No-

* *London Quarterly Review*, No. cxxxi, page 303.

vember was selected, in which observations were to be made at every five minutes during the 24 hours. These are the present German Magnetic Term-days. In this advanced stage of the research, Humboldt addressed a letter to the President and Council of the Royal Society, soliciting the countenance and support of the British nation; and this appeal, after having been met in the most prompt and generous manner at home, was sent abroad to various Academies and men of science in this country. The extent and important magnetic position of America were insisted upon in the appeal sent out to it, and it is to be wished that the example set by the magnetic Observatory in Philadelphia, under the care of Professor Bache, and by the American Academy of Arts and Sciences in Boston who have supplied the Cambridge Observatory with the requisite instruments, will be a motive to our government and to individuals to take measures in this matter worthy of their wealth and energy, as well as the eminent local advantages which they enjoy in regard to this scientific investigation.

The following table, from page 38 of the Report of the Royal Society, is published here for the information of those who have not seen the original.

Days of Commencement of the Terms of simultaneous observation, during the years 1840, 1841, *and* 1842.

Month.	1840.		1841.		1842.	
January . . .	Wednesday	22	Wednesday	20	Wednesday	19
February . .	Friday	28	Friday	26	Friday	25
March	Wednesday	18	Wednesday	24	Wednesday	23
April	Wednesday	22	Wednesday	21	Wednesday	20
May	Friday	29	Friday	28	Friday	27
June	Wednesday	24	Wednesday	23	Wednesday	22
July	Wednesday	22	Wednesday	21	Wednesday	20
August . . .	Friday	28	Friday	27	Friday	26
September . .	Wednesday	23	Wednesday	22	Wednesday	21
October . . .	Wednesday	21	Wednesday	20	Wednesday	19
November . . .	Friday	27	Friday	26	Friday	25
December . .	Wednesday	23	Wednesday	22	Wednesday	21

The observations on the Term-days with the Gauss Magnetometer were begun at the Cambridge Observatory in March, 1840, and no one has been omitted since that time.* The curves for only two of these days, the 29th of May and the 21st of October, are published; but the numbers which express the mean results for every five minutes during the 24 hours on all the Term-days are placed in Table I, at the end of the Paper. This mode is preferable in some respects to publishing the curves, as it enables any one who intends to make a comparison, to draw a curve for Cambridge on the scale used in observations made at other places. In our observations, the time was obtained accurately from the Transit-instrument and astronomical clock; and the scale which was reflected from the mirror at the southern extremity of the bar, and read off by the Variation-Transit, easily allowed of being marked to $\frac{1}{8}$ of a minute. The experience of the observers has satisfied them that dependence may be placed upon each separate reading within that limit of error. But other considerations make it necessary to determine the position of the Magnetometer for any assigned time by more than a single reading. As the bar in passing from one angle of declination to another is maintained always in a vibratory state, it is necessary to eliminate what is due to the oscillation from what belongs to an absolute change of declination. If the arc of vibration were constant, it would be eliminated by observing the limits of excursion of the magnetized bar and taking the mean between them. But the natural tendency of the

* As the Report of the Royal Society containing the details of their plan had not been received when the observations commenced, two of the Term-days were incorrectly taken, and the observations in April, besides being undertaken on the wrong day, were so imperfect that they have been left out of the account entirely. Instead of March 18, March 27, and instead of July 22, July 24 were observed at Cambridge. This must be considered in the comparison of these days with observations made elsewhere.

arc of vibration is to become shorter for every new excursion, and if the arc be of considerable length this circumstance must be taken into account. As the decrease of arc must be nearly uniform for a few vibrations, this is done by noting the limits of three successive excursions, and the mean of two means thus obtained is the true position of the bar for the middle time. Thus, if *a*, *b*, *c* are the readings, $\frac{1}{2}$ ($\frac{1}{2}$ (a+b)+$\frac{1}{2}$ (b+c)) or $\frac{1}{4}$ (a+2b+c) gives the place of the magnetic meridian for the time when *b* was observed. If the arc of vibration is very small, this correction will be inappreciable and the mean of two observations will suffice. But the declination itself meanwhile may vary by sudden and irregular movements, and then the process of observation and reduction becomes more intricate. Facts assure us that the magnetic meridian is subject to abrupt and lawless fluctuations as well as uniform and progressive variations. The practical mischief of these disturbed motions is diminished by the fact that they will most probably occur during periods of unusual perturbation; and although they must be kept in view when studying the laws of remarkable derangements of magnetic influence, their effect will be insensible in the regular and periodic changes.

A greater difficulty that affects particularly simultaneous observations is this. The precise moment of time to which the mean result corresponds may not be that for which the declination is sought; and the interpolation of the required times between the observed times is a matter of troublesome and uncertain calculation. This labor is prevented by an ingenious device of Gauss, in the way of observing. If two observations of a bar are made at an interval equal to the time of one vibration, the mean is the place for the intermediate moment. This is a proposition mathematically exact, if the change of declination can be regarded as uniform and the arc of vibration constant. It will, therefore, be practically true whenever no remarkable disturbances are apprehended and the arc of vibration is small; or within the same limitations as the other methods. If now the position of the magnetic meridian is desired for any definite moment, the first observation is made to precede this period by half the time of the bar's vibration, and the second to follow the period at the same distance. Thus, if t be the time of vibration, and T the time of mean observation, the actual observation must be made at $T-\frac{1}{2}t$ and $T+\frac{1}{2}t$. For greater accuracy, the final result is made to depend on several partial results as will be seen by an illustration. The time of vibration of the Gauss Magnetometer used at Cambridge is about 54″. This is divided into as many parts as separate observations can be conveniently taken during that time. It has, therefore, been divided into 6 intervals of 9″ each, and a separate observation is made at each interval. This is done during two vibrations of the needle, or 1′ 48″. By taking the mean of every two observations which have an interval of 54″ we have a partial result for the middle time, and these partial results are combined so as to give a final result for any time when the declination is required. If this time is $2^h\ 5'$ the first observation is made at $2^h\ 4'\ 6''$, and repeated at intervals of 9″ till $2^h\ 5'\ 54''$. An example is given from the observations made June 26, at 0^h of Gottingen mean time.

H.	M.	S.	Readings of the Scale.	Partial Results.	Times corresponding to partial Results.	
23	59	6	108.750			
		15	9.000			
		24	9.500			
		33	110.000	109.312	$23^h\ 59'\ 33''$	
		42	10.125	9.062	42	The Final Mean of the 7 partial results gives 109.294.
		51	10.000	9.250	51	
		0	9.875	9.375	00 0	
		9	9.125	9.312	9	
		18	9.000	9.375	18	
		27	8.750	9.375	27	
		36	8.500			
		45	8.750			
		54	108.875			
				Mean 109.294	0 0	

Thus it appears that each position of the needle is determined from 13 separate observations; and as each reading is to $\frac{1}{8}$ of a minute the mean of all may be considered as within a smaller error of observation, and only subject to the exception that the law of reduction is not rigorously exact when the change of declination during 1′ 48″ is not uniform. If the arc of vibration be so large as to have a sensible decrease the effect is cancelled when the readings extend through twice the time of vibration. On Term-days this process is repeated every 5′ during the 24 hours, so that 3,744 observations are made which give 288 mean positions. This was the rule of the Observatory till June 26th, 1840, when a slight modification was introduced which diminished the labor of observation and reduction without compromising the accuracy of the result. Thus the observation of June 26th, 3^h 40′, P. M.* which was the first one made in this way, stands thus; it should be remembered that the column of figures to the right of the point are not tenths but eighths.

H.	M.	S.	Readings of the Scale.	Partial Results.	Times corresponding to Partial Results	
3	39	10	106.3			
		19	105.7			
		28	105.3			
		37	105.2	106.	39′ 37″	
		46	105.1	105.937	46	
		55	105.2	105.812	55	
		4	105.5	105.875	40 4	The Final Mean gives 105.854 as the number on the scale corresponding to the magnetic meridian at 3^h 39′ 59″.5.
		13	106.0	105.750	13	
		22	106.2	105.750	22	
		31	106.4			
		40	106.3			
		49	106.2			
Means.			105.854	105.854	39′ 59″.5	

By this method, which is the same in principle as the other, only 12 observations are made, and the mean of them is the same as the

* Gottingen Mean Time is to be understood wherever it is not otherwise stated.

mean of the partial results, so that the latter column in the table is unnecessary and a great part of the labor of reduction is saved. The number 12 is a convenient divisor, and after the whole minutes are found the decimals are taken out of a Table calculated for this purpose and embracing every case that can occur. Look in the vertical column at the right or left for the whole numbers of the remainder, after dividing by 12, and in the top or bottom line for the eights, and in the corresponding square is the decimal value of the remainder.

	0	1	2	3	4	5	6	7	
0	000	010	021	031	042	052	062	073	0
1	083	094	104	115	125	135	146	156	1
2	167	177	187	198	208	209	229	240	2
3	250	260	271	281	292	302	312	323	3
4	333	344	354	365	375	385	396	406	4
5	417	427	437	448	458	469	479	490	5
6	500	510	521	531	542	552	562	573	6
7	583	594	604	615	625	635	646	656	7
8	667	677	687	698	708	719	729	740	8
9	750	760	771	781	792	802	812	823	9
10	833	844	854	865	875	885	896	906	10
11	917	927	837	948	758	969	979	990	11
	0	1	2	3	4	5	6	7	

It must be observed that the mean result obtained above corresponds to 3^h $39''$ $59''.5$, and not 3^h $40'$. But the difference of half a second comes within the limits of unavoidable errors of observation and is of no weight in deciding on the comparative merits of the two methods each of which depends on a knowledge of the time of vibration of the bar. But this time changes slightly from one period to another, and although always assumed to be $54''$ it is strictly $53''.4$ on the average, and oscillates about this mean value.* Whenever observations have been made with the Gauss Magnetometer since June 26th, 1840, it has been the rule of the Observatory, recommended by its superior simplicity and freedom from all practical objections, to take 12 readings at intervals of 9″, commencing 50″ before the real time, and to consider the mean of them as the final determination of position for that moment. Neither the Gauss method nor that of Cambridge which is based on it is practicable when the bar is agitated by unusual magnetic influences, as in seasons of violent disturbance, in consequence of the great extent of its motion. In such emergencies, the extreme of every excursion is recorded so long as this perturbation continues and an approximate time is obtained as exact as circumstances allow. The reduction is then made by this Formula $\frac{1}{4}(a+2b+c)$ which has been already explained. After the mean results for every five minutes during the 24 hours of a day are obtained by any of these processes, they are used as the data for projecting a diurnal curve of magnetic declination. Two lines are drawn upon a sheet of paper at right angles to each other and assumed as the axes of rectangular coördinates. One of them is divided into 24 equal intervals each of which is subdivided into smaller parts according to the scale of the chart. The other line is also divided in portions corresponding to degrees and minutes of arc. Any point that is most convenient may be selected as the origin of the coördinates, and by considering the time as ordinate and the result of observation annexed to it as abscissa we obtain as many points of a daily curve as there are mean results of observation. In ordinary Term-days the number is 288. When so many points are fixed upon the sheet they are connected by

* The mean of 28 vibrations in April was 53″.05 ; of 21 in July 53″.38 ; of 22 in September 53″.45 ; of 12 in October 53.65.

straight lines or curves of the simplest curvature. From the details published in regard to the principle of observing it may be inferred how closely these curves will represent the actual magnetic changes for the day. It cannot be denied that disturbances may happen, of less amount than the minimum quantity of observation or at less periods than 5′, which will elude the vigilance and refinements of the present state of Magnetic science. It has been noticed on more than one occasion that the bar has been instantaneously checked in the midst of a vibration and forced to retrace its steps by a long sweep in the opposite direction. The lines which are now drawn straight or in the most natural curve from one fixed point to another on the sheet might, if they were sensible of the shorter and more rapid magnetic impulses, change their curvature several times during the passage.

Plates II. III. IV. and V. represent the diurnal curves of magnetic declination for the days given on the plates; and we are first to consider from an attention to them as well as to the figures which describe the other days at the end of the communication whether the fact of a regular cycle of variations in the declination during the 24 hours is confirmed by these observations. The theory appears now to be well established, that the Elements of Terrestrial Magnetism are subject to daily, monthly, yearly, and secular perturbations similar to the periodical and secular variations which are known in astronomy. But in the astronomical problem, no derangement occurs whose cause is not looked for and generally found in the uniform operation of the simple law of gravity in its direct or reflected action upon the various members of the solar system. The singular fact of Encke's comet, which experiences a delay which has been attributed to a resisting medium, may be regarded as a solitary exception to the general truth. The laws of motion among the heavenly bodies are so few and clear that the character of the disturbance will generally indicate something in regard to the cause which produces it. But the Elements of the Earth's Magnetism are exposed to abrupt and violent fluctuations, which, so far as the circumstances are known, acknowledge no periods and, although perhaps capable of being explained by many conceivable causes which are in constant operation and therefore at the disposal of the philosopher, they cannot be distinctly brought home to any single one and are at present regarded as inexplicable. These magnetic hurricanes, as they have been fancifully called, are often exhibited during Auroral appearances, but many of them, so far as has been observed, are not coincident in time with this or any other class of natural phenomena. Now, every observed position of the needle for a given moment is beset with all these regular and irregular variations; which must be carefully eliminated by multiplying the number and shifting the exposure of the observations before we can be assured what is the exact and absolute value of the element for that time. And when we are seeking the amount of any particular order of perturbations, we must proceed as in the astronomical case by selecting as far as may be times for observation when the disturbance in question is a maximum and all others are of minimum value. The practice of the observer will supply many artifices of this sort for eluding or grappling with difficulties which appear at first sight insurmountable. It is obvious, that when the object is to ascertain the steady and periodical variations of the meridian we should exclude from the comparison those days whose serenity is affected by what Humboldt has denominated magnetic storms; just as we should pass over days of violent winds and tempests in deducing the gradual rise and fall of temperature during the 24 hours. No attempt should be made to frame an hypothesis or even to hazard a conjecture in regard even to the variations of the shortest period from one year's observations, however unremitted they may have been; but these observations may be of use in confirming a theory long entertained and well established by facts noticed in other places.

The observations of Graham, in 1772, which resulted in the detection of the diurnal variation of the magnetic meridian at London, have been repeated since in various parts of the world with increased delicacy and skill and with the same general result which is briefly described. The magnetized bar, free to place itself in the magnetic meridian, does not remain in one fixed position during the day but sometime in the morning, between six and eight o'clock as the average statement, it starts in a westerly direction and moves that way till between one and three in the afternoon; then it begins to retrace its steps back to the east again. These points of maximum and minimum declination are formed in every diurnal curve and at nearly the same hour. We shall hereafter see what the limits of the time are. There are two ways in which the bar regains its first position. In some places, as Paris for example, it arrives at its greatest eastern elongation again between eight and eleven o'clock in the evening and then remains stationary till the time of morning excursion has come round once more. In other places, as at Cambridge, it travels eastward till evening and then goes back to form a secondary point of maximum westerly deviation about three o'clock, A. M.; after which it passes eastward and recovers at eight o'clock the place it occupied 24 hours before. In certain cases, especially in northern latitudes, even when the secondary maximum and minimum are not formed, the bar does not remain stationary during the night but occupies nearly all the time from three P. M. to eight A. M. in returning through the space it has just passed over in seven hours. Again, the arc traversed by the bar in its daily excursions varies perceptibly from one day to another; but the approximate law is, that in the six months from the vernal to the autumnal equinox, its value is between 13′ and 15′; and in the remaining six months the mean of the daily arc is between 8′ and 10′. But there may be single days when it amounts to 25′ and others when it is as small as 6′.

Gauss thinks that eight A. M. and one P. M. of mean solar time are never far from the periods of daily minimum and maximum declination in Gottingen and that part of the globe. It appears from a Report in regard to the magnetic state of the Russian empire for 1837 * that, at St. Petersburg, the greatest westerly position of the north end of the magnetic meridian is near two o'clock, P. M. and the opposite position is at eight in the morning with the exception of November, December, and January, when it occurs later. This is easily explained by the high latitude of the place when we come to consider the dependence of this daily motion on the sun. Since the declination is easterly in some parts of Russia, it follows that the maximum declination there is in the morning and the minimum in the afternoon. As the Report in question has been published with great care we extract a Table of the Monthly Means of the arc of daily excursion to show how near they correspond to the more extended means which we have mentioned above.

* Annuaire Magnetique et Météorologique du Corps des Ingénieurs des Mines de Russie. Année 1837. St, Petersburg. 1839.

St. Petersburg, 1837.

April	16.2′	October	6.7′
May	15.1	November	3.7
June	16.5	December	1.9
July	13.6	January	3.2
August	11.9	February	5.8
September	9.9	March	11.0
	83.2		32.3
	13.86		5.4

We have no occasion in this place to remark on the cause of this great inequality of arc in the different months, or on the times when the maximum and minimum occur. We only wish it to be observed that the daily curve, so perceptible in other places, and so marked by its general uniformity of appearance, is clearly seen in the Cambridge observations. We have here referred to the Plates which represent some of these diurnal curves, but Table II. at the end will display in a condensed form, the results of 12 months' observation on this point. As the values for some of the months were deduced from scanty observations they cannot be brought into a fair comparison with more comprehensive means. If it shall appear that the times of maximum and minimum declination are embraced within the limits of a few hours, it is extremely important that observations should be made during those periods every day in the year to determine the precise moment when they occur each day and the arc of excursion. Means drawn from such abundant data might lead to a satisfactory solution of the daily changes and not leave them, as at present, to probable conjecture.

It appears from observations on various parts of our planet that periodical changes of days, months, years, and longer duration are affecting its magnetic equilibrium; all of which come, with few exceptions, under the same general expressions so much so as to leave no doubt that they have a common origin. Hence it might be expected that if the corresponding curves of magnetic Declination were drawn for the same solar time in different places they would conform to each other and exhibit a kind of parallelism. But in addition to the orderly variations there are other perturbations of a sudden and irregular nature; and it becomes an object of extreme interest to inquire how far these are local and accidental and to what extent they must be regarded as general and proceeding from some grand central force. Such an examination was contemplated as among the good results of the simultaneous observations made in Germany, Russia, Italy, &c., an account of which may be found in Taylor's "Scientific Memoirs" and "The Russian Magnetic Annual" to which I have already referred; and a possible answer to an intricate question was held out as an inducement to engage in the magnetic crusade. The expected comparison exhibits surprising coincidences in most of the irregular movements of the Magnetometer as if the cause were coextensive with the range of magnetic posts. Hitherto our country and indeed this whole Western Continent has not been represented in this Congress of Nations for a scientific object; having been destitute of the means of contributing its portion to the general levy which has been made upon them. But the Term-day observations at Toronto, U. C., Philadelphia, and Cambridge will furnish materials for doing this now. Plate III. exhibits the diurnal curves of the October Term-day for the magnetic Observatories of Toronto and Cambridge. The declination of the meridian was very considerably deranged by perturbations during the first 12 hours of the Magnetic day (which always begins at 10 P. M. of Gott. M. T.) and affords, therefore, a favorable opportunity of discovering the extent of extraordinary disturbances. Now a glance at the Plate betrays wonderful concert in the motions of the two remote bars; almost every digression of the bar at Cambridge and every change of curvature in the magnetic curve of that place has something corresponding to it in the curve of Toronto. There are a few singular exceptions; and, in a word, the bar at Toronto seems to have been more agitated and to have made greater excursions. But these discrepances throw no doubt on the subject; for they are just such as must be expected to occur in results which depend upon complex and multiform agents. A general and not a mathematical agreement is all that can be expected. The times which mark the limits of the eastern and western excursions in this fluctuating motion of the bars agree with great precision, except in two or three instances where the Cambridge curve lags behind five minutes or less. The parallelism appears at once from considering that the two curves, starting from points 12 minutes apart and making several digressions the same way of greater amount than the original arc of separation, do not cross each other except once; and this solitary instance will hardly be regarded as a transgression of the rule, since it arose simply from one bar being more affected by a particular wave of the magnetic tide than the other bar. On Plate II. is described the diurnal curve for the May Term-day. This too is singularly disturbed from 11 P. M., Gott. M. T. till 10 o'clock of the next morning. We have had an opportunity of comparing this with the similar curve observed by Professor Bache at the Girard College, in Philadelphia, and here again the instances of agreement make a stronger impression than the rare cases of discrepance. The correspondences are frequent and imposing; while the points which exhibit no such coincidence are few and of less importance. The agreement as to time is in almost every place precise; the disagreement is confined chiefly to the extent or the existence of the motion. At $12\frac{1}{2}$, $7\frac{1}{4}$, $9\frac{1}{2}$ o'clock Gott. M. T. some excursions appear in the Philadelphia curve which have little or no counterpart in the Cambridge curve. They are deserving of notice because they are more considerable than any others of a local character which have been noticed and yet they do not, any of them, exceed 5′ of arc. But the remarkable excursions in Plate II. at *a*, *b*, *c*, *d*, *e*, *f*, are all faithfully represented on the Philadelphia curve. Only the upper branches which belong to the easterly motion are exceeded by the corresponding simultaneous movement at Philadelphia, while the grand excursions at the bottom of the Plate, which are due to the westerly motion or increase of declination, go beyond their parallel passages in the Philadelphia curve. For instance, the branches *b*, *c*, *d*, *e*, *f*, extend respectively 10′, 12′, 11′, 5′, 6′, farther in the Philadelphia than the Cambridge curve. The reverse happens at *g*, *h*, *i*, where the Cambridge branches go 13′, 30′, $14\frac{1}{2}$′, farther west than the analogous ones at Philadelphia. The close coincidence of the times when the direction of any great motion changes, observed at Toronto, Philadelphia and Cambridge, makes it probable that the longitudes of the three places are known to a close approximation, or, at least, that the differences of longitude between these places are not much in fault; for, if they were, it would by its effect upon the regulation of the clocks prevent a coincidence of magnetic disturbances which actually existed and make the appearances different from what we observe; unless we can suppose what seems extremely improbable, that the constant error of the time should by chance balance precisely the actual want of coincidence in the arrival of the magnetic impulse at each place so as to deceive us in the final result. This, however, is a subject which requires to be pursued longer. The observations contemplated in coming years will, it is believed, furnish the materials for a comprehensive study of this problem and enable us to determine with more confidence than can be reposed in the comparison of places not widely removed from each other the extent and the laws of what are now classed among the irregular perturbations of the magnetic equilibrium. All attempts at induction now must be considered as subordinate to the final discussion; but they have their purpose in indicating from time to time the direction to which the attention of observers should be particularly turned. To this end, an arrangement supplementary to the large plan was completed with Lieutenant Riddell for making simultaneous observations on the declination Magnetometer at Toronto and Cambridge, at intervals of *two minutes* from $0^h\ 45'$ to $1^h\ 45'$ P. M. Gott. M. T. Such observations were accordingly taken at Toronto for the assigned hour every day (Sundays excepted) from October 23d to November 19th inclusive. Similar observations were made in Cambridge at the same time. Professor Bache would gladly have been a partner to this project but an accident prevented him from being informed of it in season. Another agreement was formed to observe *every vibration* of the bar during one hour from 9 to 10 P. M. Gott. M. T. for one week commencing with the 4th of January, 1841. Fig. 2d of Plate III. exhibits the hourly curve for the 28th of October; the upper one being the Cambridge curve and the lower one the Toronto curve. Here it will be noticed that the changes of flexure in the two curves are generally coincident in time and when they vary the maximum difference does not exceed the interval between two successive observations.* The hour selected for the January obser-

* While this Paper was passing through the press we received an account of the proceedings of the Irish Academy at a recent meeting, containing some remarks by Professor Lloyd on contemporaneous observations at short inter-

vations appears, on the whole, unfavorable for drawing conclusions in regard to the concurrence of abrupt changes of the magnetic state of the earth as it is the period when the bar is most quiet. It is of advantage, however, to know that the periods of repose are independent of longitude and the same absolutely for different places; an inference which the observations certainly authorize us to make. We shall have occasion hereafter to remark on the degree to which observations made with the Gauss Magnetometer and Lloyd's Declination instrument are comparable.

Whatever interpretation may be given to the anomalous changes to which the declination of the magnetic meridian is subject, there can be little hesitation in admitting that the regular and periodical ones having their expression in functions of solar time are dependent upon the sun's influence as an exciting and sustaining cause. The theory which we may adopt as to the nature of the earth's magnetism does not essentially affect this statement. If magnetism, as an independent property, exist in particles of the earth's mass, it may have its equilibrium disturbed by temperature as heat is known to affect the state of ordinary steel magnets; and as in the passage of the sun through his daily and yearly path parts of the earth's surface are heated to unequal degrees, that change of the magnetic fluid may be induced which shall result in periodical alterations of the magnetic meridian. But a strong body of evidence can now be summoned to prove that magnetism has no existence as an independent fluid or property of matter; but that

vals by himself and Professor Bache on the small variations of magnetic declination. The result of the comparison has convinced him that such changes do not occur simultaneously at places so far removed from each other as Dublin and Philadelphia. Therefore they will not, as was suggested, furnish a safe method of deducing differences of longitude.

polarity is one of the phases of the electrical fluid. The magnetic character of currents and the facility with which they are excited by motion and differences of temperature are now well approved facts. The earth's rotation; the sun's heat; volcanos; and the great eastern and western metallic ranges furnish all the materials and machinery that are needed for making the planet a grand electro-magnet. Aside from the magnetic phenomena, the existence of the earth's currents is thought to have been shown by direct experiment. If we do not admit them as the prime source of Terrestrial Magnetism they offer themselves as sufficient and satisfactory causes of the observed fluctuations about the average state. The belief in the earth's currents seems unavoidable; and if any proportion subsists between their magnetic energy and those of artificial electro-magnets the fund of magnetism which they supply must be ample to explain all the chief facts of the earth's magnetism. But if we adopt Gauss's estimate that the whole magnetic power of the earth is equivalent, on the average, to 7,8 steel magnets of 1 pound weight magnetized to saturation for every cubic metre, there may be some difficulty in conceiving of sufficient iron ore in the earth to furnish the depositary of such a magnetic force according to the common motion of steel magnets. Besides, there may be a question whether it is philosophical to look round for any such new principle when it is not needed to explain the facts. If currents are finally adopted not as the auxiliary but the main and standing cause of Terrestrial Magnetism, the unavoidable fluctuations and occasional overflowings with the daily ebb and flow to which from their nature and remote source they must be subject afford a liberal explanation of the regular and irregular perturbations in the declination of the meridian.

In so complex a subject, no attempt could be made at present to explain the *modus operandi* by which the sun's rays affect the position of a magnetized bar. It is much to have the dependence of these changes upon solar time clearly established. The moments at which the maximum and minimum points of the diurnal curves occur oscillate between certain limits; it is important, therefore, to have the diurnal curves for places removed many hours from each other in longitude, in order that a difference of time depending upon the constant difference of longitude may not be masked under the variation to which the time is subject at the same place. Now the Observatories of Gottingen and Cambridge differ in longitude $5^h\ 24'\ 16''$; it is plain, then, that if there be such a relation to the solar time of each place it must appear even in the curves of a single day. And so it is found by an examination of the Cambridge times and those published by Gauss for Gottingen and contiguous places that a difference equal to the difference of longitude exists in the mean times of the greatest eastern and western declination of the magnetic meridian. The extremes occur at nearly the same solar hours at each place, so that when we are observing our minimum in the morning the observer in those eastern longitudes is taking note of the western excursion of his bar; for at both places the interval from minimum to maximum is between five and six hours. The rest of the 24 hours is expended in the return of the bar back towards the morning position except in those cases where a secondary maximum and minimum occur; and if this unequal time of passage over the same arc cannot be explained it is analogous to what is known to be true of the rise and fall of the temperature on the earth. The heating requires a shorter time than the cooling process; and whatever depends on the heating and cooling process will of course be subject to the same inequality. And in regard to all the magnetic changes which are attributed to the solar influence it is to be observed that no more exact uniformity is to be expected in them than in the legitimate and acknowledged influences of the sun; that is to say, the earth's temperature.

Yet farther supplementary to the plan recommended by the Royal Society, a series of observations has been undertaken at Cambridge with the express object of throwing additional light on this interesting inquiry. As early as May, 1840, the observations took a wider range so as to furnish a diurnal curve not only for the Term-day but also for several other days in the same part of the month. The following Table shows the days over which the observations were extended, including the prescribed Term-days.

		Term-day.	Extra Days.
1840.	May	May 29	May 21, 22, 23.
	June	June 24	June 21, 22, 23, 25, 26, 27, 28, 29, 30. July 1.
	July		July 24.
	August	August 28	August 29, 30, 31. September 1.
	September	September 23	September 21, 22, 24, 25.
	October	October 21	October 20, 22, 23, 24.
	November	November 27	November 23, 24.
	December	December 23	December 21, 29.
1841.	January	January 20	January 22, 25.
	February	February 26	February 24. March 1.

On all the preceding days observations were made during the 24 hours so as to furnish materials for drawing as many diurnal curves. The intervals between the observations were not always five minutes as on the Term-days. Thus in May the interval was 15 minutes and in June and July 20 minutes. Again, in August the interval was only four minutes. In August, reasons appeared for recording the Thermometer at intervals of 20 minutes on all the days when the Magnetometer was observed. This was sufficient to give all the regular daily thermometric changes. In October, the Barometer was observed every 20 minutes during the five days. The observations on the Barometer have not been repeated as they did not promise to facilitate the inquiry upon which we were engaged; but the Thermometer has been observed regularly since the first trial every 20 minutes whenever magnetic observations are made. The magnetic observations were conducted on all these days with the same strictness as on the Term-days at intervals such as have been denoted; 12 or 13 readings determining the place of the magnetic meridian for every required period. There may be times during every time of observation when the arc of vibration is too large to allow of this process and then the 12 readings are suspended and the extreme limit of every oscillation is recorded. The expense of the Plates has precluded the idea of publishing all the diurnal curves which have been thus obtained. A specimen has been selected which will give an impartial view of the whole investigation. On Plate VI. the thermometric curves corresponding to the five October days may be studied by attending to the directions given on the face of it. The remarkable points are arranged in the following Table.

Abstract of the October Thermometric Curves.

Date. Civil Time.	Time of Minimum Heat. Cambridge M. T.	Thermometer.	Time of Maximum Heat. Cambridge M. T.	Thermometer.	Daily range of Thermometer.
Oct. 21	6h 10′ A. M.	50° 20′	1h P. M.	54°	3° 40′
" 22	1 "	46	2 "	51 30′	5 30
" 23	3 50 "	34	2 "	62	28
" 24	6 50 "	40 40	2 40′ "	53	12 20
" 25	1 30 "	37	11 A. M.	47 20	10 20
Means.	3 52 "	41 36	1 20 P. M.	53 34	11 58
Mean curve	6 10 "	43	2 "	52 15	9 15

The absolute changes of temperature from day to day cause the difference between the means of the numbers attached to the five days and the mean curve, as in the two last lines of the Table. The mean curve is drawn by adding together the figures observed at the same time on the several days and dividing by 5. The result is the mean temperature for that period of the day. Then the times of maximum and minimum of the mean curve are found from the greatest and least values of these mean results. The absolute variations of temperature from one day to another vitiate to a certain extent this process. The same method is pursued for laying down the mean diurnal magnetic curves; the absolute changes of magnetic declination from one day to another are too inconsiderable to produce any great error in the result. But the mean of the daily magnetic curves is materially injured by the *irregular* perturbations of the magnetic meridian. Hence it is supposed that the mean thermometric curves have a fair comparison with the mean magnetic curves. For the sake of facilitating this comparison, the following abstract is given of the single and mean diurnal magnetic curves which are drawn at length on Plate IV.

Date. Civil Time.	Time of Minimum Declination. Cambridge M. T.	Readings of the Scale.	Time of Maximum Declination. Cambridge M. T.	Readings of the Scale.	Daily Range.
October 21	8^h 6′ A. M.	102.562	0^h 28′ P. M.	92.354	10.208
" 22	8 36 "	104.333	11 46 A. M.	93.364	10.969
" 23	9 11 "	103.375	2 51 P. M.	96.031	7.344
" 24	8 16 "	103.208	2 31 "	95.396	7.812
" 25	5 11 "	101.740	1 41 "	92.302	9.438
Means	7 52 "	103.044	1 27 "	93.889	9.154
Mean curve	8 36 "	102.250	3 1 "	94.368	7.882

We have now the following results of comparison:

Times of maximum temperature range from 11^h A. M. to 2^h 40′ P. M. = 3^h 40′.
" " declination " " 11 46′ " to 2 51 " = 3 5.
" of minimum temperature " " 1 " to 6 50 A. M. = 5 50.
" " declination " " 5 11 " to 9 11 " = 4 hours.

It appears, then, that the times of maximum and minimum magnetic declination are comprised within narrower limits than those of the greatest and least temperature; and yet the last phenomena, as every one believes, depend on the apparent daily motion of the sun. It is to be observed that these days were selected and the curves published before the comparison was made. They are to be regarded as a fair index of the whole series of observations of a similar character taken in each month since August, 1840, inclusive when the thermometric and magnetic changes were first observed in connexion. As far as any dependence can be placed upon them, they authorize us in stating that the diurnal magnetic curve is a more exact and definite function of solar time than the regular daily change of temperature. In whatever particular the comparison is made the preference attaches to the magnetic curves. We have seen how it is in regard to the *limits* of the time of maximum and minimum. The greatest variation of any daily range of the thermometer from the mean of the ranges is more than $\frac{17}{12}$ of the mean range. The greatest variation of any magnetic range from the mean of the magnetic ranges is less than $\frac{1}{5}$ of the mean of the magnetic ranges. The most observable deviations from mean results in the magnetic observations pertain to the times of maximum declination of October 21 – 2 and 22 – 3 and the times of minimum declination of October 25 – 6. If they were excluded, the limits of the times of maximum declination would be reduced from 3 hours to 1 hour and 10 minutes and of minimum declination from 4 hours to $1^h\ 5'$. In regard to the first of these days, an unusual and irregular derangement of the magnetic equilibrium occurs between 1^h and 3^h P. M. Cambridge M. T.; and there is reason to think that the maximum declination, if the extraordinary influence could be eliminated, would fall between these disturbed hours. There is even a doubt whether now the western excursion at 3 P. M. ought not to be taken as the western limit of that day. The irregular perturbations which do not generally begin before 7 or 8 o'clock in the evening commenced their operations on this day earlier than usual by many hours. We are confirmed in this opinion by examining the curve of the next day from 10 o'clock Gott. M. T.* This curve is a continuation of the first from the place where it ends at the right hand of the Plate; and we see from it that the perturbations continue during the whole night and morning till nearly the time of the next minimum; one digression of the Magnetometer within 30 minutes about an hour before midnight of October 21st amounting to 20′. These agitations are felt at intervals till the following midnight and may be allowed any influence that is thought justly attributable to them in hastening the time of maximum of the second day. It is admitted that this maximum appears satisfactorily formed on the curve so as to leave no doubt that the time selected for it, 11^h 46′ A. M. Cambridge M. T., is correct. And further, in regard to the minimum of the last of the five days, there may be a question what precise moment between 5 and 7 o'clock A. M. Cambridge M. T. should be chosen. It seems probable that the minimum should be formed earlier than usual on this day as the maximum occurs later than the average time; so that the whole curve from the point of minimum to that of maximum takes a wider sweep of time than usual; a glance at the Plate makes this clear. These explanatory suggestions as to the extreme cases, if valid, will give still greater preëminence to the diurnal magnetic curves over the cotemporaneous thermometric curves so far as relates to the present comparison. But it is not at all necessary for our purpose to press this apology. No abatement for similar reasons is required in regard to the thermometric curves. Although

* The commencement of the Magnetic day is in all cases at 10 o'clock P. M. of mean Gottingen Time.

occasional tempests of heat and cold occur they cannot compete with the irregular disturbances of the magnetic force, where a change of 20′ occurs in half an hour while the greatest range from minimum to maximum on any of these days is only 11′. There is safety then in affirming that the changes in the declination of a magnetized bar would be a better index of solar time than a standard thermometer; or again, that starting from a known hour of the day with a given declination we might venture a closer prediction, founded on calculation, as to the position of the same bar 6 hours afterwards than would be safe with a thermometer under like conditions; care being taken of course to select that portion of the day which is most free from *extraordinary* magnetic and thermometric changes.

Let us now see how this conclusion is sustained by more extensive observations. To this end Tables are presented of the Monthly Means, comprising the mean periods of magnetic and thermometric minima and maxima since this kind of observation was instituted at the Cambridge Observatory.

Thermometric Table.

Months.	Number of days observed.	Time of the Mean Minimum Cambridge M. T.	Value of the Mean Minimum.	Time of the Mean Maximum. Cambridge M. T.	Value of the Mean Maximum.	Mean Daily Range.
August	5	4h 56′ A. M.	58° 36′	2h 36′ P. M.	77° 48′	19° 12′
September	5	5 56 "	41	2 16 "	63 48	22 48
October	5	6 16 "	43	2 06 "	52 06	9 06
November	3	5 36 "	25 48	2 56 "	35 20	9 32
December*	3		16 40	0 36 "	29 50	13 10
January	3	6 36 "	24 20	2 36 "	33 30	9 10
February	3	5 56 "	20 20	2 16 "	39 20	19 00
Means		5 53 "	32 49	2 12 "	47 23	14 34

* Time of minimum for this month is 6h 26′ P. M. Cambridge M. T. From this time the thermometer rises during 18 hours till the period of maximum.

Magnetic Table.

Months.	Number of days observed.	Time of Mean Minimum Declination. Cambridge M. T.	Reading of the Scale for Mean Minimum.	Time of Mean Maximum Declination. Cambridge M. T.	Reading of the Scale for Mean Maximum.	Mean Daily Range.
May	3	6h 26′ A. M.	114.523	1h 06′ P. M.	100.208	14.315
June	10	6 56 "	110 528	1 56 "	100.875	9.653
August	5	6 16 "	126.564	1 44 "	115.135	11.429
September*	5		111.925	11 36 A. M.	96.452	15.473
October	5	8 56 "	102.250	3 1 P. M.	94.368	7.882
November	3	8 51 "	111.958	1 16 "	95.927	16 031
December	3	8 06 "	100.767	3 16 "	92.226	8.541
January	3	9 16 "	98.871	3 26 "	90.062	8.809
February	3	8 16 "	99.816	3 16 "	91.090	8.726
Means		7 53 "	108.578	2 04 "	97.371	11.206

The times of the monthly mean minima of temperature for the seven months from August inclusive, December being rejected as anomalous, range between $4^h\ 56'$ and $6^h\ 36'$ A. M. so as to be all comprised in the space of $1^h\ 40'$. Similar times for the maxima points are included within $2^h\ 20'$ from $0^h\ 36'$ to $2^h\ 56'$ P. M. It also appears that the times of the monthly means of minimum declination for the same months together with May and June, if we leave out September, come between the limits of $6^h\ 16'$ and $9^h\ 16'$ or an interval of 3 hours, while the times of mean maximum declination, if we exclude September, are confined within the limits of $1^h\ 06'$ and $3^h\ 26'$ or $2^h\ 20'$. All circumstances being considered, these results are favorable to the theory which assigns to the daily changes of magnetic declination as precise a dependence on solar time as can be claimed for the corresponding variations of temperature. As far as coincidence of time between two phenomena proves one to be the cause and the other the effect, the daily oscillations of the magnetic meridian are as clearly referrible to the sun's agency as the familiar rise and fall of local temperature during the same period. It should

* The time of mean minimum for September is by the observations $8^h\ 31'$ P. M. Cambridge M. T. From this time the western deviation increases till $11^h\ 36'$ A. M., the time of maximum declination.

be considered that in the instance of magnetism the limits are estimated for nine months while those of the thermometer extend over only seven months. The longer period affords of course a wider field for the display of extreme cases. The disadvantage to magnetism is increased by the influence which the remarkable fluctuations of magnetic influence exert upon the regular periodic phases. As observations on temperature are hereafter to be made parallel with those of magnetic declination we shall be able, at some future time, to present the results of a larger and more satisfactory comparison of the two sets of changes than our present materials can afford. The limits for the times of maximum declination and temperature are the same; the limits of minimum declination are greater than those of minimum temperature. The considerations which have led to the exclusion of some of the observations must now be stated. First, we consider the mean thermometric curve for December. The maximum which falls 36 minutes after noon is earlier than usual; while the minimum is 12 hours from the average time of greatest cold and would come at $6^h\ 26'$ P. M. instead of the morning. We suppose therefore the true time of maximum for this month to be merged under irregular changes so as to escape notice even in the mean result. This mean was derived from three days' observations. The minimum for one of the days happened at $5^h\ 56'$ A. M.; for another at $2^h\ 14'$ while on the third day the changes of temperature were so frequent and disorderly from alterations in the wind and sudden variations from a clear to an overcast sky that the lowest temperature is at $6^h\ 14'$ P. M. and the highest at $6^h\ 56'$ A. M. The eccentricities of this day are sufficient to vitiate the whole result and prevent the real time of minimum from appearing even in the mean of several days. To guard against this source of error it is important that the monthly means should be deduced from as large a number of days as can be conveniently observed; every day in the month would not be superfluous. This could easily be done at Cambridge if provision were made for conducting the two hourly observations on every day according to the English plan. But these daily observations of the Magnetometer have not been attempted and would be impossible with the present resources of the Observatory.* It is not surprising that what occurred once in six months' observations on the temperature should have exhibited itself also in the diurnal curves of the Declination Magnetometer. This brings up the case of the September magnetic curve which we have excluded from any part in determining the mean quantities because it was calculated to injure the just average values which we are endeavouring to reach. The curve in question may be traced out on Plate V. by following the directions there given and a single glance will show how the times of its extreme elongations differ from those of the other three mean curves which are on the same Plate. The general appearance of these three curves indicates a law to which the fourth curve must be a palpable exception and transgression. An attention to the separate diurnal curves for the five days in September from which the mean curve is reduced will afford an explanation of this violation of what we may regard a principle of the earth's magnetism. On September 20–1, (Magnetic day, commencing as in all cases at 10 P. M. Gott. M. T.) we have these three maxima:

					Readings of the Scale.
1st at 11^h 36′ P. M. Cambridge M. T.,	September	20	=	82′.5.
2d " 4 56 A. M. " "	"	21	=	79 .5.
3d " 11 56 A. M. " "	"	21	=	83 .5.

* A Director with three Assistants all of whose time should be devoted to the work have been considered elsewhere as the full *personnel* of such an establishment.

and these eight minima:

				Readings of the Scale.
1st at 3^h 14′ P. M. of September 20			=	112.
2d " 5 46	"	" "	=	116.
3d " 7 56	"	" "	=	123.
				Reading at 8^h 16′ P. M. 109.
4th " 8 26	"	" "	=	125.
5th " 0 46 A. M.		" 21	=	116.
				Reading at 1^h 06′ A. M. 98.5.
6th " 1 54	"	" "	=	117.
7th " 6 06	"	" "	=	115.5.
8th " 2 31 P. M.		" "	=	108.

The whole range of the Magnetometer during this day is 45′.5. The smallest elongation from the meridian is at 8^h 26′ P. M. and the greatest at 4^h 56′ A. M., as the lowest number of the scale indicates greatest declination. But these like the rest of the maxima and minima for this day are mere lawless excursions caused by sudden derangements and have no connexion with the regular diurnal magnetic curve. Between the 3d and 4th minima the bar moves to 109′ or 14′ in arc in the space of 20 minutes and then falls back eastward again. So between the 5th and 6th minima the bar moves to 98′.5 of the scale or 18′ forward and back again in 1^h 8′. The time occupied in going from the 2d or greatest maximum to the 7th minimum is only 1^h 10′ although the space is 36′ or three times the ordinary daily range of the magnetic meridian for this month. If these perturbations were less frequent and not spread over the whole 24 hours means might be devised of shutting out their influence and interpolating the true daily curve in the gap left by their removal. But on this day no safe way of making the reduction presents itself and the times of maximum and minimum are both left indeterminate.

On September 22 – 3, the Magnetometer was more quiet; occasional oscillations of considerable extent occur but the maximum point is very regularly formed at 11^h 36′ A. M. and the minimum though less definite is placed at 6^h 06′ A. M. On September 24th westerly disturbances take place between 4^h 36′ and 7^h 36′ A. M., the time when the minimum generally shows itself; the effect is to bring the mean curve at this period too far to the west or to make the apparent mean time of maximum earlier than it is in fact or would appear if the observations were free from irregular variations. These derangements do not cease till nearly the close of the third magnetic day so as to throw uncertainty on the time of maximum of this day also.

September 24 – 5, (Magnetic day.) Disturbances break out again in strange forms. This day was affected by wholly unprecedented motions distinguished not so much for their extent as for their number and the rapidity with which they succeeded one another. A faint idea of them is conveyed by looking at those which occurred between 7^h 20′ A. M. and 7^h 40′ A. M. Gott. M. T. of October 22d, represented on Plate IV. The direction of the motion changed 60 times or more from east to west and back between 1^h and 2^h P. M. Gott. M. T. The whole sweep of the needle for this day is only 26′, an area much less than is often traversed in the diurnal motion; but the number and frequency of the oscillations is unparalleled. The greatest declination occurs at 3^h 06′ A. M. Cambridge M. T. and the least at 3^h 36′ P. M.; but another minimum more nearly resembling the regular daily minimum appears at 5^h 36′, A. M.

September 25 – 6, (Magnetic day.) The magnetic storm has subsided. The curve for this day is as quiet as that of the 4th day on Plate IV. The eye readily perceives that now we have only regular diurnal changes and that the times of greatest and least elongation from the astronomical meridian can be trusted. The mimimum is at 6^h 26′ A. M. and the maximum at 0^h 16′ P. M. Cambridge M. T.

We have here ample and abundant explanation of that singular figure assumed by the mean daily curve for September. We look for the time when some method shall be devised for evading the errors which such extraordinary changes of the magnetic declination entail on the mean values of the regular variations. If hereafter the dependence of the magnetic declination upon the hour of the solar day shall be so accurately discovered as to be reduced to a Formula we may be able, by the help of that portion of the curve which is undisturbed, to calculate the remainder. At present this Formula must be an empirical one, derived from the faulty observations themselves and in its defective state is available only in a partial degree for purifying these observations. Our chief resource now lies in levelling, as far as possible, the excessive excursions by the influence of undisturbed days with which they are combined; though this can be done only by sacrificing in part the more perfect observations. The case in hand teaches us that this method will not always be effectual in bringing out approximate results. The irregularities may be so great as to overrule the regular law. This is less likely to happen in proportion to the number of days that can be observed in each month and hence again the necessity of deducing our means from as numerous observations as can be obtained.

The dependence of the diurnal magnetic changes on solar time rests upon the evidence of a large number of observations collected from remote sources. But there is a difficulty in conceiving of the exact manner in which this connexion is sustained. Perhaps it will always be a hopeless task to attempt to trace the intricate path by which the heat deposited at one moment in the centre of our system arrives at its final result of causing a deviation in the direction of the magnetic meridian. And while this is the case, it will be impossible to enter upon the mathematical analysis of the problem and deduce formulæ which can be used for detecting the errors of theory or correcting or supplying the deficiencies of observation according to the well-known relation subsisting between these different methods of investigation. But the artifices of analysis will frequently take hold of cases which cannot be approached by any direct process. The observations allow us to proceed upon the ground that the declination or the ordinate of the diurnal curve of declination is a function of the solar day. It may, then, like any other periodic function be supposed to be expressed in a series of terms arranged according to the sines and cosines of the time and its integral multiples.* Thus if

$t =$ the time expressed in parts of a day as its unit,
$d =$ the ordinate of the diurnal curve for the time t,
$\pi =$ the ratio of the circumference to the diameter,
$n =$ any integer whatever ;

and if S denote the sum of the terms which correspond to the different values of n, we have for the general form ;

$$D = A + S.C_n \sin. 2 \pi n (t + c_n).$$

The values of A, C_n and c_n are readily determined by the following formulæ. Let observations be taken at equal intervals for several whole days and let

$h =$ time of observation counted from the beginning of each Magnetic day in parts of a day as unity :

* It was according to this mathematical developement that Professor Peirce calculated the empirical curves.

D_h = the mean of the observations taken at the time h of each day.

Then if S' denote the sum of all the terms which correspond to the different values of h, we have

1. $m\, A = S'\, D_h$

m representing the number of intervals on each day.

2. $m\, C_n \cos.\, 2\, \pi\, n\, c_n = 2\, S'\, D_h \sin.\, 2\, \pi\, n\, h.$

3. $m\, C_n \sin.\, 2\, \pi\, n\, c_n = 2\, S'\, D_h \cos.\, 2\, \pi\, n\, h.$

There is no known periodic function which does not admit of developement according to the sines and cosines of the time and its integral multiples and in the absence of positive evidence the same thing may be assumed in regard to that under present consideration. The constant A, being equal to $\frac{SD_h}{m}$, is the mean of all the partial results obtained from observation for the several intervals into which the day is distributed for this purpose. By substituting different values for n we obtain an indefinite number of terms out of the general one $C_n \sin.\, 2\, \pi\, n\, (t + c_n)$. It appears, however, from the calculation that the series rapidly converges so that the first four or five terms are sufficient to give the declination within a degree of exactness corresponding to the accuracy of the observations themselves. Dividing the 2d equation by the 3d, we have the value of the tang. $2\, \pi\, n\, c_n$; and multiplying equation 2d by cos. $2\, \pi\, n\, c_n$, and equation 3d by sin. $2\, \pi\, n\, c_n$, and adding them together we readily find the value of C_n. Thus, if the numbers 1, 2, 3, be successively taken for n, we shall have the following equation for finding the approximate declination, or the empirical magnetic curve:

$$D = A + C_1 \sin.\, 2\, \pi\, (t + c_1) + C_2 \sin.\, 4\, \pi\, (t + c_2) + C_3 \sin.\, 6\, \pi\, (t + c_3).$$

The empirical thermometric curve is calculated on the same principle by this formula:

$$T = B + D_1 \sin.\, 2\, \pi\, (t + d_1) + D_2 \sin.\, 4\, \pi\, (t + d_2) + D_3 \sin.\, 6\, \pi\, (t + d_3).$$

Plates IV. and VI. will show how rapidly the series of both formulæ converge and the limit of error incurred by dropping all the terms after the 5th. In the formulæ for October the 5th term of the declination cannot exceed ,034 of a minute and the 5th term in the value of the temperature cannot be greater than ,4 of a degree of Fahrenheit. From the nature of an empirical curve our confidence in it must bear some proportion to the accuracy of the observations. If these observations are exposed to errors from any cause, as we have seen that they are, the empirical curve will suffer, though in a less degree, on their account. The error which in a single diurnal curve is left in its naked state is of course diminished in the mean curve of several days by the levelling influence which all the days exercise upon any single one. But this process reduces, it does not extinguish the error. The passage from the mean of the observed curves to the empirical curve carries us one step further towards the true expression of the actual phenomena of magnetism. For a considerable mean error arising from irregular disturbances, which in the first is concentrated upon a single moment, will be in the second curve distributed over the whole day and may therefore disfigure the general character of the day though it does not distort extremely any particular part. Moreover, it is easy in calculating the values of the constants in the empirical formula to omit observations of an extraordinary character and which are notoriously burdened with strange anomalies. This we see on Plate V. in the instance of the September days and to a less extent in October. The whole character of the curve for the former is changed from what we have reason to believe is the real diurnal curve; although it has escaped those large and prominent excursions which appear three or four times in the mean of the observed curves. In seasons of great disturbance it would be more safe to rely on the empirical curve than the observed curve; but in quiet times, as the empirical curve borrows all its truth and expression from these observations, the latter have more claim to consideration than the calculated places. It is obvious from the principle on which the empirical curve rests and the manner in which the constants are deduced that they will answer only for one curve and must be calculated separately for every new curve that is required. As the form of these equations and the time, which is the only variable, are the same for each curve, whatever changes exist in the diurnal curve from one month to another in the year must be indicated by a corresponding change in the independent constants. And moreover if there be, as the comparison of recent and old observations lead us to believe, secular periods for the magnetic declination, they will betray themselves by slow variations in the mean yearly values of these same constants. It becomes then an object of curious inquiry to ascertain what are the values of A, C_1, C_2, C_3; c_1, c_2, c_3, &c. for every month in the year; and after this their mean values from one year to another. It is possible that the laws of the secular changes may be better studied from the variations of these constants than from immediate observations. Four of these formulæ are here given with the names of the months to which they belong, and the number of days employed in calculating them; $t =$ the time from 0^h Gott. M. T.

June, 10 days. Declination*

$= 9°17',3 - 3',853 \sin(t - 16^h 21^m 24^s) - 1',537 \sin 2(t - 9^h 31^m 24^s) - 0',948 \sin 3(t + 0^h 27_m 9_s) - 0'644 \sin 4(t - 4^h 22^m 9^s).$

August, 4 days. Declination

$= 9°13',9 - 3',907 \sin (t - 15^h 12^m 47^s) - 2'009 \sin 2 (t - 9^h 46^m 58^s) - 0',878 \sin 3 (t + 0^h 51_m 15_s).$

September, 5 days. Declination

$= 9°21',9 - 2',932 \sin(t - 9^h 34^m 18^s) - 1',530 \sin 2(t - 8^h 12^m 8^s) - 0',494 \sin 3(t + 1^h 32^m 29^s) - 1',090 \sin 4(t - 0^h 29_m 58_s).$

October, 5 Days. Declination

$= 9°18',7 - 1',575 \sin(t - 13^h 0^m 42^s) - 2',379 \sin 2(t - 10^h 40^m 58^s) 0',508 \sin 3(t - 0^h 4_m 58_s) - 0',034 \sin 4(t + 0^h 12_m 32_s).$

* The first term in the value of the declination is obtained directly in parts of the scale and is afterwards reduced to absolute numbers in the usual way of deriving the real declination from the reading of the scale. This process will be soon explained.

Here we close our investigation of the diurnal magnetic curve. The existence of such a curve regularly formed every day cannot be doubted; its general uniformity is also very observable. The limits of the times of maximum and minimum declination in different longitudes show conclusively that it is in some way connected with local solar time. Developing the declination according to the most general form of periodic functions we have obtained the preceding formulæ from which the empirical curves drawn on Plate V. were calculated. These calculated curves stand there side by side with the mean observed curves by which the constants of the formulæ were determined. The calculated curve, as we might expect, is less broken than the mean curve; still, the two agree in a striking manner and the greatest deviations are in those months which suffered most from magnetic perturbations. In June and August the empirical curve and the mean curve keep close together and these were periods of unusual magnetic repose; for in the mean of the latter month the disturbed Term-day was omitted. June was most quiet of the two, and shows it by a superior agreement between its mean and empirical curve. If there were no permanent change of declination but only the daily oscillation uninterrupted by disorderly fluctuations, the meridian would swing day after day through the same arc; and a few observations would be sufficient to establish a rigorous formula which would evolve an empirical curve strictly coincident with the observed curve. The want of this uniformity is felt in the variation of the constants of the formulæ already given. This simplicity does not exist in the motions of the heavenly bodies any more than in the magnetic movements. But the analysis is different. In astronomy we know the cause of the disturbance and allow for it at once without deranging the general analytical expression. In the other case we have no theory, no hypothesis; and the mathematical form must vary with the observations. Hence the difference between the constants in the formulæ for the four months. They are no greater than might be expected from the known change of absolute declination from day to day, the limits of the times of maxima and minima and the longer and more irregular derangements which beset the diurnal movement. The mean curves of many months, drawn from the most abundant materials, are requisite for investigating the law by which these constants vary and rendering them available for calculating the secular periods of the earth's magnetism. We think it is apparent from all that has been adduced, that the diurnal magnetic curve is as clearly a function of solar time as the daily thermometric curve. We are not to expect any greater uniformity in the effect than in the cause. If the thermometric curve is sometimes imperfectly formed, the same thing may happen to the magnetic curve without destroying our belief in its connexion with the sun. The change of constants in one class of formulæ appears likewise in the other, as the three following thermometric formulæ make manifest:

August, 5 days. Temperature

$$= 67°,6 + 8°.8 \sin (t - 15^h\, 57^m\, 28^s) + 0°.9 \sin 2(t - 5^h\, 34^m\, 56^s) + 1°.1 \sin 3(t + 0^h\, 44^m\, 56^s).$$

September, 5 days. Temperature

$$= 50°,2 - 10°.0 \sin(t - 13^h 38^m 54^s) - 3°,2 \sin 2(t - 9^h 31^m 4^s) - 0°,3 \sin 3(t - 2^h) - 0°,8 \sin 4(t - 4^h 39^m 48^s).$$

October, 5 days. Temperature

$$= 47°,7 - 3°,8 \sin(t - 14^h 21^m 44^s) - 0°,8 \sin 2(t - 9^h 17^m 36^s) - 0°,4 \sin 3(t - 6^h 35^m 25^s) - 0°,4 \sin 4(t - 0^h 38^m 12^s).$$

It still remains to discuss briefly those disturbances of the magnetic meridian which have no apparent law. We have occasionally alluded to them as irregular perturbations which produce perplexity in ascertaining the true diurnal curve. We are to inquire whether even they must be regarded as wholly inexplicable or whether they cannot be connected in coincidence of time at least with other well known phenomena of nature. There are few days in the year when strange fluctuations of greater or less amount are not exhibited; but there are some periods distinguished above all others by their remarkable frequency and magnitude. We annex a brief history of each month in this respect.

1840.

March 27–8. No perturbations of importance; only two unusual excursions, one at 2^h 45′, A. M. Gott. M. T. (March 28) and the other at 4^h 15′, A. M.

April. The observations of this month are very defective.

May 29–30. Term-day. Irregular disturbances of large amount, from 11 o'clock, P. M. Gott. M. T.(May 29) to 12^h of May 30. The whole sweep of the instrument through the day is 57′,2; and once, between 3^h 50′ A. M. and 4^h 10′ the declination changes 47′, 2 in 11^m or 4 times the average daily swing from maximum to minimum. The other days observed in May were not distinguished above the average by perturbations.

June. The ten days observed in this month were all unusually quiet.

July 24–5. Between 6 and 8 o'clock, P. M. Gott. M. T. (July 25) the arc of vibration of the Magnetometer amounted to 20′ so as to require the substitution of its extreme limits instead of the 12 readings at intervals of 10 seconds. But this large movement was not accompanied by any considerable change of absolute declination and the whole magnetic day was undisturbed.

August. The Term-day of Aug 28–9 was greatly deranged from 10^h 40′ P. M. Gott. M. T. to 8^h A. M., and small perturbations were experienced for 4 or 5 hours after this time. The whole range of the magnetic declination amounted to 61′. Once between 6^h 40′ and 7^h 20′ A. M. the change of declination exceeded 43′ in 27 minutes. The other days observed in August were still.

September 21–2. The sweep during this day was 45′.5. The disturbances on the days observed in this month have been already discussed at length. They were distinguished more by number than extent of arc.

October. The October curves were not entirely free from disturbances though they are all comprehended, in their widest excursions, in a zone of 22′ in breadth.

November. The three days of this month have some perturbations, but none deserving especial notice.

December. Two of the curves observed in this month were disturbed considerably; yet, the whole range does not surpass 28′.5.

1841.

January. The curves observed in this month were generally regular. On the 26th of January, between 4^h and 5^h A. M. Gott. M. T., a small disturbance was felt amounting to 17′.

February. General perturbations spread over the three days of this month, particularly observed at night. Those of greatest extent occurred on the Term-day, February 26–7, amounting in one case to 16′ of arc in 15 minutes of time. In addition to these extracts from the records of the different months, Table II. contains a column showing the extremes of the Magnetometer every day when complete observations were made.

The theory of the Aurora Borealis which has of late years found most favor with men of science supposes it to have some connexion with Electricity and Magnetism. It is important to investigate this subject further and see whether there be any and what relation between this brilliant appearance of the heavens and the derangements of the magnetic declination. For this purpose a careful record has been kept of all the Auroral appearances that have been noticed at the Cambridge Observatory; some of the most remarkable presented themselves at times when the regular observations on the Declination Magnetometer were in progress; and pains have been taken whenever it was practicable to watch the instrument on all other occasions when the heavens gave signs of preparation for such an exhibition. Annexed is a list of those which were displayed on a grand scale.

April 24–5. Slight Aurora.

May 28–9. Remarkable Aurora. An arch was formed, at $2^h\ 39'$, A. M. Gott. M. T., running as nearly as could be ascertained at right angles to the magnetic meridian. A crown began to form at $4^h\ 24'$. Its position was referred to α Cor. Borealis which was then on the meridian. As it was nearly at the same altitude of $74°\ 52'$ and to the west of the meridian, it could not have been far from the magnetic Pole. Shortly after this the arch was broken up and the northern sky covered with pulsations of light.

May 29–30. Brilliant Aurora. The auroral arch was first seen at $2^h\ 32'$ A. M. Gott. M. T., extending from a point nearly east to within a few degrees of the western horizon. The light was intense. The apex of the arch was situated 20° at first, and at $2^h\ 42'$, 30° south of the zenith. After this time, the light became broken and scattered, flying from east to west. This arch was entirely detached from the main body of the Aurora and resembled a streamer. In the north there was a diffused light but very bright; and swift flashes towards the zenith. At $3^h\ 59'$ a large meteor was seen in the north, 20° high, descending towards the northwest.

June 26–7. About $2^h\ 36'$ A. M. Gott. M. T., an Aurora was seen at the North, of a white diffused light. At $6^h\ 20'$, the Aurora assumed a dull appearance, with dark wane intermixed. At 7^h A. M., the Aurora became more active, and some streamers were seen. The needle was slightly affected at this time.

July 4–5. Between 5^h 28′ and 5^h 34′ Gott. M. T., bright diffused Northern Lights; occasionally long streamers; wane clouds near the northern horizon; Magnetometer quiet.

July 29–30. At 2^h 45′ A. M. Gott. M. T. (July 30) an auroral arch was formed 7° above the horizon and very still. At 9^h 40′ it began its motion up towards the zenith; rose to the altitude of 30°. At 3^h 54′, the Aurora had ceased. The light was dull during the whole time.

August 19–20. A steady auroral arch was observed. It was double and the altitude of its apex at 3^h 54′ A. M. Gott. M. T. (August 20) was 7° or 8°; its color was dull white. This Aurora continued till 4^h, and at 4^h 11′ the Northern Lights had entirely disappeared.

August 28–9. An auroral arch appeared running from east to west, of intense brightness and diffused, but without streamers. Apex nearly on the meridian and altitude 45° at 2^h 30′ A. M. Gott. M. T. At 3^h 20′ streamers shot up 60° from the horizon; the altitude of its highest part was about 76° 43′, as found from its place among the stars.

October 22–3. Between 1^h and 2^h A. M. Gott. M. T. an Aurora of a steady blue light was first perceived; it afterwards became brighter and whiter, the altitude was 3°; wane clouds below. At 5^h 20′, the Aurora was low.

November 30. At 3^h 24′ A. M. Gott. M. T., an Aurora was seen of white diffused light. No regular arch was formed. The Magnetometer was quiet.

It appears from this abstract of the records that the days most distinguished for auroral appearances are just those on which the declination of the magnetic meridian experienced the most extraordinary derangements. This was the case on May 29–30 and August

28–9. Unfortunately the Magnetometer was not watched on the night of May 28–9. By referring to Plate IV. it will be seen that the Declination instrument was subject to more than ordinary influences on the 22d of October between 0^h M. and 6^h A. M. Gott. M. T. The observers on the remarkable days of May and August describe the motions of the Magnetometer as peculiar in the highest degree. It was often checked in the midst of its vibration and suddenly forced back in the opposite direction; and this took place with such frequency at certain seasons as to give to the motion the appearance of jerks or sharp twitches. No correspondence was noticed between the time of maximum magnetic disturbance and the formation of the auroral crown. But it was sometimes supposed from successful comparisons in the phases of the different phenomena that the instrument gave intimation by some strange motion of the most signal changes in the Aurora. The display of May and August was as fine as any that has been witnessed for several years and we should not omit to state that on these occasions the Declination Magnetometer at Cambridge made the boldest sweep of the scale. As both these days happened to be Term-days the opportunity was improved at other magnetic Observatories of watching the coincidence between the auroral appearances and the perturbations, and the report is generally uniform from all. Plate II. which represents the May-term diurnal curve of declination offers a specimen of the extraordinary disturbances to which we refer and the time of them may be compared with the phases of the Aurora which are contained in the record for that day. The excursion at *g* was so great that it was found necessary to curtail it on the Plate; but the extent will be readily seen from remarking that it reached to 71.4 on the scale, 47′.2 of which were traversed in 11 minutes of time. An Aurora was seen on the same night at

Philadelphia, New Haven and at Toronto, U. C. A description of its appearance at New Haven may be seen in Silliman's Journal, No. I. Vol. XXXIX.* Where facilities existed for making the observations it was discovered to be accompanied with similar effects upon the magnetic declination as were felt at Cambridge. The Magnetometer at Philadelphia experienced great derangements, although the limits were less, not exceeding 55′.8. The influence which an Aurora exerts upon the earth's magnetism reaches as far and wide as the appearance itself; and probably the intensity of the effect is proportional to the brilliancy of the display. The greatest disturbance of the Magnetometer at Philadelphia was, as at Cambridge, between 4^h and 5^h A. M. Gott. M. T. The deflection of the instrument at Cambridge amounted to about 57 minutes, and the extremes were separated by little more than 2 hours. Lieutenant Riddell informs us that at Toronto the arc traversed was 1° 59′, which was never equalled, and approached but once on a similar occasion. We also learn from him that an Aurora was noticed at Greenwich, Great Britain, on the same day; but he adds, that the disturbances there and at Toronto were very different.

Such full information is not possessed in regard to the Aurora of August 28–9. It is evident from the observations that the Magnetometer at Cambridge was more affected on that day than ever before, the whole change of declination amounting to 61′. At Toronto, where the Aurora was also seen, the disturbances were equally surprising and produced an oscillation of 1° 33′ in declination. The greatest amount of derangement at Cambridge was as follows:

* See also the Journal of the Franklin Institute for June, 1840, which contains some observations made upon it at Southwick, Mass.

At $1^h\ 25'$ A. M., Gott. M. T., the reading of the scale was 111.9
Range of $52'.4$ East in $1^h\ 10'$.
" $2^h\ 35'$ " " " " " 164.3
Range of $52'.9$ West in 1 hour.
" $3^h\ 35'$ " " " " " 111.4

Again, at $5^h\ 20'$ A. M., Gott. M. T., the reading of the scale was 103.5
Range of $47'.6$ East in 25 minutes.
" $5^h\ 45'$ " " " " " 156.1
Range of $52'.4$ West in 1 hour.
" $6^h\ 45'$ " " " " " 103.7

During the first of these periods, the Aurora reached its culmination of splendor; between 5^h and 7^h it was faint and near the horizon. It does not appear from an examination of the May or August Term-day that the maximum agitation of the Magnetometer coincides in time with the greatest brilliancy of the heavens. In May, it had not accumulated its action when the Aurora began to decline; and in August, although it accompanied the display it continued with undiminished energy one or two hours after that had passed away. The most rapid motion of the bar was from 5^h $20'$ to $5^h\ 45'$, being equal to $47'6.$ in 25 minutes. This is nothing strange; but might be expected from the time which all the forces of nature consume in communicating themselves to bodies and penetrating large masses so as to overcome their inertia. More exact and frequent observations will doubtless conduct to a better knowledge of a connexion which is now so undeniable and yet so imperfectly understood. If observers are careful to note the times at which the chief phases of the Aurora are witnessed and its position among the stars and, where they have the opportunity, the simultaneous variations of the Magnetometer we may not despair of elucidating these two classes of intricate and interlaced facts; the

Aurora and the irregular perturbations of the magnetic meridian. It must not be inferred that other causes do not exist, in coöperation with the auroral phenomena, to derange violently the earth's magnetism. According to Ampere's theory of currents a large fund of such derangements must be deposited under the crust of the earth. The equilibrium although permanently stable must be subject to constant fluctuations. Theory supplies the reason and observation asserts the fact. Many of the small daily derangements have no apparent relation to the Aurora; and in regard to the magnificent strides of the Magnetometer it cannot be told which is cause and which is effect. If further search shall prove that an Aurora never fails to attend a great disturbance we may conclude that the Aurora itself is seldom displayed in the daytime. For the remarkable changes of declination almost always begin during the night and seldom continue into the next day. If, however, an unseasonable Aurora should occasionally arise we may be able to perceive indications of its presence from the magnetic perturbations, although its light were eclipsed by the brightness of the sun.

So far we have attended to relative only and not to absolute declinations. The former are sufficient when the object is to find the times of maxima and minima, the daily range and the diurnal curve. But it sometimes becomes necessary to know the absolute declination, so that the process will now be described of referring any reading of the scale to its absolute value. It is clear that if the absolute value of one reading can be ascertained that of all the rest is known at once. It is convenient to have the absolute declination always referred to the same number of the scale; we will suppose this number to be, therefore, 100. To find then the absolute declination corresponding to 100 of the scale we proceed thus: the Variation-transit with which the Gauss Magnetometer is observed is placed firmly on the table and then the line of collimation is adjusted in the meridian by means of Polaris and the large Transit-instrument; a section having been made in the roof for this purpose. The azimuthal circle is then read off. The circle is now turned until the line of collimation coincides with the direction of the magnetic meridian, as indicated by the needle that accompanies the *Variation-transit.* At the same moment the circle is read off again and the scale is noted through the telescope. The difference of readings from the azimuthal circle will indicate the angle which the magnet makes at that time with the astronomical meridian, and the reading from the scale shows to what number on it this absolute variation corresponds. Now since according to their arrangement on the scale at Cambridge an increase of numbers implies a decrease of declination, we readily find the absolute declination of 100 of the scale by adding or subtracting as the case requires the difference between 100 and the reading at the time. This will be easily understood from the following example:

The azimuthal reading by Polaris, June 21, at 8 P. M. Gott. M. T. - - - - - -	= 310° 34′ 40″.
The azimuthal reading at the Coincidence of the Needle - - - - - -	= 301° 15′ 30″.
When the reading of the scale through the telescope was 100,835, the absolute declination -	= 9° 19′ 10″.
The absolute declination at 100 of the scale -	= 9° 20′ 00″.

As it may not always be possible to take an astronomical observation on account of the state of the atmosphere, the azimuthal angle between some fixed mark and the true meridian is read off and the position of the magnetic meridian determined by reference to this. Thus it appears, June 25th, that a certain mark on Gore Hall, which has been previously found to be 38° 11′ west of the north, reads on the circle

		272° 23′ 30″
Adding its azimuth or . .		38 11
The azimuthal reading of the true meridian	=	310° 34′ 30
The azimuthal reading at the Coincidence of Needle . . .	=	301° 14′ 50
Absolute variation for 102.966 of the scale	=	9° 19′ 40
" " for 100. .	=	9 22 38

The absolute variation corresponding to 100 of the scale being known, the real values of all the lower numbers are found from it by adding and of all the higher numbers by subtracting the difference between them and 100. Here we suppose of course that all the readings on the scale are made in the same position of the telescope as the one by which the original absolute variation was determined. To secure this condition, when the observations begin, the azimuthal circle must be firmly clamped at some place which is considered the fixed reading for this period; and the vernier should be occasionally examined to see that the instrument has not been deranged. The absolute declination thus obtained cannot be relied on within so small a limit of error as that to which the changes of declination are subject. The chief uncertainty attaches to the coincidence of the needle with the line of collimation. Several readings repeated in succession are likely to vary three or four minutes so that their mean is only an approximation to the truth. Hence the difficulty of ascertaining the yearly change of declination which is so small as to be partially masked under accidental errors. If the feet of the Variation-transit were firmly secured to some durable foundation, the yearly variation might be found at once from the scale as we now find the daily ones. In this case the fixed reading should not be altered from one set of observations to another. Hereafter, as the observations will be made with Lloyd's Declination Magnetometer and a fixed telescope, we shall not be subjected to this inconvenience.

For greater accuracy, the absolute variation assigned to 100 of the scale for any period should not depend upon a single set of readings. But the process which has been described for finding the real value of any part of the scale should be repeated as often as possible during the days of regular observations. Thus we have:

June 21 at 8^h 0′ P. M. Gott. M. T., the absolute variation .		= 9° 20′ 00″ at 100 of the scale.		
June 22 at 11^h 15′ A. M.	" "	= 9 21 14	"	"
" 25 " 12 22 P. M.	" "	= 9 22 34	"	"
" 28 " 9 35 "	" "	= 9 24 25	"	"
" 29 " 3 26 "	" "	= 9 21 44	"	"
" " " 12 00 M.	" "	= 9 20 53	"	"
" 30 " 11 25 P. M.	" "	= 9 18 29	"	"
July 1 " 0 45 "	" "	= 9 18 57	"	"
" " " 11 25 "	" "	= 9 20 36	"	"
Mean for June		= 9 20 59	"	"
October 20 at 7^h 30′ P. M. "	"	= 9 18 15	"	"
" 21 " 9 40 " "	"	= 9 18 29	"	"
" 22 " 10 5 " "	"	= 9 16 40	"	"
" 23 " 8 15 " "	"	= 9 19 11	"	"
" 24 " 2 10 " "	"	= 9 16 58	"	"
" 24 " 10 10 " "	"	= 9 16 54	"	"
" 25 " 2 45 " "	"	= 9 15 56	"	"
Mean for October . . .		= 9 17 29	"	"

We now pass from the absolute value in declination of 100 of the scale to the absolute declination in this way. If the absolute variation for any single moment were desired, we should readily find it by adding or subtracting as the case required the difference between the reading on the scale and 100 to the absolute value of 100. But when speaking of the absolute variation we generally intend some mean value which is the representative of that element for a whole day or month or perhaps a longer period. We should certainly miss of this mean variation if we adopted the regular maximum or minimum reading of the scale or that of any extraordinary stride which may have been observed during the period. No single mark on the scale can lead to any thing more than a momentary expression of this element. The mean of the daily maximum and minimum limits of the scale or more accurately the mean of all the observations furnishes a mark from which some durable value of absolute declination may be derived. Now the mean of all the observations belonging to the 10 days of June is 103′.603 of the scale:

Hence the variation sought is . . . . . . 9° 20′ 59″ — 3′ 36″
or 9° 17′ 23″.

Again, the mean of the observations made during the 5 days of October is 98′.838; hence the variation is 9° 17′ 29″ + 1′ 10″
or 9° 18′ 39″.

The mean absolute Declination from June to November, 1840, may be considered . . . . = 9° 18′ 01″.

The following Table shows the variation of the needle at Cambridge and in the vicinity from the period of the earliest observations:

Cambridge	1708	9°	0′	W.	Cambridge	1788	6°	38′	W.
"	1742	8	0	"	Boston	1793	6	30	"
"	1757	7	20	"	Salem	1805	5	57	"
"	1761	7	14	"	"	1808	5	20	"
"	1763	7	0	"	"	1810	6	22	"
"	1780	7	2	"	Cambridge	1810	7	30	"
Beverly	1781	7	2	"	"	1835	8	51	"
Cambridge	1782	6	46	"	"	1840	9	18	"
"	1783	6	52	"					

As there can be no great difference between the variation for Boston and Cambridge* we infer from the Table that from 1708 to 1793 the declination diminished at the mean annual rate of 1′.8; and that from 1810 to 1840 it increased at the mean annual rate of 3′.6. It is probable that the change in direction took place between 1793 and 1810 at Cambridge; whatever was the cause it does not appear to have affected instantaneously remote places. Dr. Bowditch who made the observations at Salem in 1805, 1808 and 1810 supposed that the first two were smaller than they ought to be on account of instrumental errors. But I think that this was not the whole cause. The change in direction, if it had not already happened in 1810, came soon after. Now, on the assumption that it was after 1810, the mean annual rate of decrease at Salem (considering the observations at Beverly as comparable with those made at Salem) would be only 1′.3. This is smaller than the decrease appears to have been on the average. I incline to think, therefore, that the minimum declination really occurred during the period of Dr. Bowditch's observations, and that the differences which he attributed wholly to defects in the instruments were partly caused by this very circumstance. The value of the variation at Beverly in 1781 was obtained from the mean of 7 partial means which did not differ more than 6 minutes from each other. The variation at Salem in 1810 was the mean of 5125 observations. Confidence may accordingly be placed in both of these values; and consequently in the mean annual decrease of 1′.3 that results from them. Again,

* The following values of the latitude and longitude are taken from the American Almanac for 1840.

	Latitude.	Longitude.
Boston	42° 21′	71° 4′
Cambridge	42 22	71 8
Salem	42 31	70 53

the variation at Boston in 1793 is the mean of 1644 observations. The variation at Cambridge in 1782 is deduced from frequent observations at different hours on 127 days of that year. Allowing a reasonable error to beset the value at 1708, we may suppose that the number of years from which the rate of annual decrease is derived secures it from any large error. The same reliance may reasonably be placed in the determination of the rate of increase. The fact then is very remarkable that since the passage from a direct to a retrograde motion the rate of the annual change of variation has so materially altered. Assuming that the mean annual rate of decrease was $1'.8$,* the time of the change interpolated into the observations would be 1807; and this in the absence of better authority may be regarded as its date for Cambridge.

Another element of the Earth's Magnetism on which some attention has been bestowed at Cambridge is the Dip. All the methods of observing the Dip are extremely defective and do not admit of so great a degree of accuracy as the Declination instruments. The Dipping-needles of Gambey and Troughton and Simms are preferable to any other direct method of measuring absolute Dip. But two of the best Dipping-needles may vary $15'$ and more in the determination of this element for the same time. This difficulty suggested to Gauss the idea of expressing the Dip as a function of the horizontal and vertical components of the magnetic intensity. This led to the invention of his Bifilar Magnetometer and the Horizontal Force Magnetometer of Lloyd. Professor Lloyd has added to

* In most cases of this kind, the rate varies about the times of maximum and minimum as the time, reckoned from these points respectively; so that the value of the element is in proportion to the square of this time. But in the present instance, the simple supposition we have made in the text conforms best to the observations.

these another extremely delicate instrument by which *variations* of the Vertical Force may be observed. Consequently, with his two instruments the *changes* of Dip may be calculated to a close approximation, though the absolute Dip remains unaffected by all the improvements. In addition to the usual corrections applied to observations made with the dipping-needle the precaution should be taken of observing the inclination in different azimuths and deducing the true dip from every set at right angles to each other. Mr. Fox has invented a dipping-needle Deflector which gives the dip and intensity by a statical principle and Mr. Lloyd has applied the same principle to the simultaneous determination of the dip and intensity. Observations with the Vertical Force Magnetometer commenced with us on the Term-day of March, 1841; but they do not enter into the plan of the present paper and any further notice of them or of the instruments is deferred till we come to the description of the new Magnetic Observatory. The Dip has been observed directly at Cambridge and the vicinity during the last four years at irregular intervals. The Dipping-needles used were of the best construction, one of them made by Gambey, and the other, now in the possession of Major Graham, obtained from Troughton & Simms. The following Table gives the results with some old observations on the same element:

Place.	Date.	Dip.
Cambridge	1780	69°51′
"	1782	69 41
"	1783	69 41
Mean for	1782	69 44
	Lat.	Long.
Cambridge	42°22	71°8
Dorchester	42 19	71 4

		Gambey two needles.	Troughton and Simms one needle.	Means.
Dorchester	June 8	74° 20.3	74° 25.6	74° 23′
Cambridge	" 10	74 17.1		74 17.1
" *	"	74 20.1		74 20.1
"	June 22	74 24.7		74 24.7
"	"	74 14.1		74 14.1
"	Sept^r. 6	74 22.5	74 11.5	74 17
	1841			
"	May 9	74 35.5		74 35.1
Mean for	1840			74 21.6

* This observation was made by Professor Loomis.

Supposing that the inclination has been on the increase since 1782, its mean annual rate would be equal to 4.′5. It is thought that the inclination is decreasing at present in the United States as it has long been in Great Britain and on the continent. Professor Loomis assigns the rate for this country at 1.′8 yearly. If this be so, we observe the same great difference in the rate of increase and decrease of the inclination as of the declination. In either case it is equally inexplicable. The want is now felt of systematic observations of the dip in order to eliminate regular and irregular changes of this element and obtain a true mean for a given period. The general scheme of magnetic observations has not failed to provide for this, as we shall see further on. So far as the subject has been investigated, the dip does not appear to pass through such a uniform succession of positions daily as the declination. Its value often changes suddenly and to the amount of a degree and a half although according to Kupffer the regular daily range does not exceed five minutes. As the various observations on the Dip at Cambridge and Dorchester were made with the same needles, the range of 21′ in the values cannot be charged to the needles, and it is too great to come under the *daily* or *annual* variation. Observations made elsewhere show that such irregular disturbances occasionally derange the dip. Moreover the mean value, derived from frequent partial results obtained on different days and different hours of the same day, is still exposed to what may be called a constant error of the needle and which is not eluded by any of the different reversals. Thus out of 8 needles used by Captain James Ross in London, 2 differed 41′ in the values which they gave for the dip; although from 640 to 1000 readings were made with each. We subjoin the following Table drawn up by Quetelet,* which contains the value of the annual diminution of the magnetic inclination at various places:

* Nouveaux Mémoires de l'Académie Royale des Sciences et Belles-Lettres de Bruxelles. Tome XII. 1839.

Paris	3.'7	Stockholm	3.'13
Brussells	3. 4	London	2. 4
Berlin	3. 7	Dublin	2. 3
Turin	3. 5	Christiana	3. 56
Florence	3. 3	Gottingen	3. 05
Milan	3. 87	St. Petersburg	3. 8
Upsal	3. 27		

In 1837, Gauss published his "*Allgemeine Theorie des Erdmagnetismus.*" This was the first attempt to subject the Problem of the Earth's Magnetism to strict mathematical analysis. The solution was embarrassed and complicated, being of the nature of those which had already been performed in determining the Figure of the Earth and the Tides. It required the use of Laplace's celebrated coefficients, a powerful instrument but difficult of management. Besides, it labored under the peculiar disadvantage of not being supplied with sufficient data derived from observation for calculating with precision the value of the constants. The whole developement may be found in the original or translated Memoirs of Gauss and a general idea of the analysis can be obtained from the able Article on Terrestrial Magnetism in the London "Quarterly Review" to which reference has already been made. What is here called a theory makes none or the most general assumptions as to the nature and distribution of magnetism in our planet. The investigation, which is mathematical throughout, depends at last on ascertaining the values of certain constants from observed data. Here the want was felt of a complete series of such as were nearly accurate and strictly comparable. It cannot be entirely relieved until the accomplishment of the present magnetic enterprise. With insufficient data, but the best that the state of science afforded, many of which were obtained through the assistance of the German and Russian Magnetic Associations, Gauss calculates on the principle of least squares, which allows more places on the earth to be represented than there are unknown quantities, the values of his coefficients. After passing the formulæ through several new forms, the chief object of which was to make them more simple and to facilitate the application, he brings the three components of the function into the following shape.

X, Y and Z are the three coördinates of the magnetic force exerted upon a given point of the earth whose longitude is reckoned east from Greenwich. The auxiliary angles A^{i}, A^{ii}, &c. B^{i}, B^{ii}, &c. C^{i}, C^{ii}, &c. depend upon the latitude.

$$X = a^{\circ} + a^{\text{i}} \cos.(\lambda + A^{\text{i}}) + a^{\text{ii}} \cos.(2\lambda + A^{\text{ii}}) + a^{\text{iii}} \cos.(3\lambda + A^{\text{iii}}) + a^{\text{iv}} \cos.(4\lambda + A^{\text{iv}}) \ldots$$
$$Y = b^{\text{i}} \cos.(\lambda + B^{\text{i}}) + b^{\text{ii}} \cos.(2\lambda + B^{\text{ii}}) + b^{\text{iii}} \cos.(3\lambda + B^{\text{iii}}) + b^{\text{iv}} \cos.(4\lambda + B^{\text{iv}}) \ldots$$
$$Z = c^{\circ} + c^{\text{i}} \cos.(\lambda + C^{\text{i}}) + c^{\text{ii}} \cos.(2\lambda + C^{\text{ii}}) + c^{\text{iii}} \cos.(3\lambda + C^{\text{iii}}) + c^{\text{iv}} \cos.(4\lambda + C^{\text{iv}}) \ldots$$

Professor Peirce has calculated the value of X, Y and Z by these formulæ for the Cambridge Observatory, whose longitude is 71° 7′.5 W. and whose latitude is 42° 22′ N. Here $\lambda = 288° 52'.5$. The equations give these values for the coefficients and auxiliary angles.

$a^{\circ} = +645.9$	$b^{\circ} = 0$	$c^{\circ} = +1300$
log. $a^{\text{i}} = 2.29185$	log. $b^{\text{i}} = 2.23230$	log. $c^{\text{i}} = 2.36763$
log. $a^{\text{ii}} = 1.74467$	log. $b^{\text{ii}} = 2.04629$	log. $c^{\text{ii}} = 2.19893$
log. $a^{\text{iii}} = 1.36560$	log. $b^{\text{iii}} = 1.59317$	log. $c^{\text{iii}} = 1.62487$
log. $a^{\text{iv}} = 0.75277$	log. $b^{\text{iv}} = 0.92425$	log. $c^{\text{iv}} = 0.88968$
$A^{\text{i}} = 245° 55'$	$B^{\text{i}} = 353° 17'$	$C^{\text{i}} = 90° 34'$
$A^{\text{ii}} = 278$ 42	$B^{\text{ii}} = 56$ 55	$C^{\text{ii}} = 157$ 13
$A^{\text{iii}} = 243$ 31	$B^{\text{iii}} = 322$ 2.5	$C^{\text{iii}} = 46$ 19
$A^{\text{iv}} = 142$ 26	$B^{\text{iv}} = 232$ 26	$C^{\text{iv}} = 322$ 26

then we have:

$\lambda + A^{\text{i}} = 534° 47'.5$	$\lambda + B^{\text{i}} = 642° 9'.5$	$\lambda + C^{\text{i}} = 379° 26'.5$
$2\lambda + A^{\text{ii}} = 856$ 27	$2\lambda + B^{\text{ii}} = 634$ 30	$2\lambda + C^{\text{ii}} = 734$ 58
$3\lambda + A^{\text{iii}} = 1110$ 8.5	$3\lambda + B^{\text{iii}} = 1188$ 40	$3\lambda + C^{\text{iii}} = 912$ 56.5
$4\lambda + A^{\text{iv}} = 1297$ 56	$4\lambda + B^{\text{iv}} = 1387$ 56	$4\lambda + C^{\text{iv}} = 1477$ 56

and consequently:

$$+645.9 = a^{\circ}$$
$$\text{log. } a^{\text{i}} + \text{log. cos. } (\lambda + A^{\text{i}}) = 2.29006 = -195.01 = a^{\text{i}} \cos. (\lambda + A^{\text{i}})$$
$$\text{log. } a^{\text{ii}} + \text{log. cos. } (2\lambda + A^{\text{ii}}) = 1.60487 = -40.26 = a^{\text{ii}} \cos. (2\lambda + A^{\text{ii}})$$
$$\text{log. } a^{\text{iii}} + \text{log. cos. } (3\lambda + A^{\text{iii}}) = 1.30251 = +20.07 = a^{\text{iii}} \cos. (3\lambda + A^{\text{iii}})$$
$$\text{log. } a^{\text{iv}} + \text{log. cos. } (4\lambda + A^{\text{iv}}) = .64970 = -4.46 = a^{\text{iv}} \cos. (4\lambda + A^{\text{iv}})$$
$$X = 426.20$$

$$\log. b^{i} + \log. \cos. (\lambda + B^{i}) = 1.55579 = + \ 35.96 = b^{i} \cos. (\lambda + B^{i})$$
$$\log. b^{ii} + \log. \cos. (2\lambda + B^{ii}) = .95669 = + \ 9.05 = b^{ii} \cos. (2\lambda + B^{ii})$$
$$\log. b^{iii} + \log. \cos. (3\lambda + B^{iii}) = 1.09840 = - \ 12.54 = b^{iii} \cos. (3\lambda + B^{iii})$$
$$\log. b^{iv} + \log. \cos. (4\lambda + B^{iv}) = .71294 = + \ 5.16 = b^{iv} \cos. (4\lambda + B^{iv})$$
$$Y = \ 37.6$$
$$+ 300.00 = c^{o}$$
$$\log. c^{i} + \log. \cos. (\lambda + C^{i}) = 2.34214 = + 219.85 = c^{i} \cos. (\lambda + C^{i})$$
$$\log. c^{ii} + \log. \cos. (2\lambda + C^{ii}) = 2.18394 = + 152.74 = c^{ii} \cos. (2\lambda + C^{ii})$$
$$\log. c^{iii} + \log. \cos. (3\lambda + C^{iii}) = 1.61370 = - \ 41.09 = c^{iii} \cos. (3\lambda + C^{iii})$$
$$\log. c^{iv} + \log. \cos. (4\lambda + C^{iv}) = .78661 = + \ 6.12 = c^{iv} \cos. (4\lambda + C^{iv})$$
$$Z = \ 1637.6$$

X, *Y* and *Z* being thus determined, if we represent the declination by δ, the inclination by i, the total intensity by ψ and the horizontal intensity by w, we have these two formulæ to find δ and w:

$$X = w \cos. \delta, \quad Y = w \sin. \delta.$$

Again;

$$w = \psi \cos. i, \quad Z = \psi \sin. i.$$

from which i and ψ are deduced.

$$\log. Y = 1.57519$$
$$\log. X = 2.62961 \quad \log. X = 2.62961$$
$$\frac{Y}{X} = \text{tang. } \delta = 8.94558 \quad \text{sec. } \delta = 0.00170$$
$$\delta = 5^{\circ}\,4. \qquad 2.63131 = X \text{ sec. } \delta = w = 427.9$$
$$\log. Z = 3.21421 \qquad \log. Z = 3.21421$$
$$\log. \text{cosec. } i = 0.01433 \qquad \text{tang. } i = 0.58290 = \frac{Z}{w}$$
$$\psi = 1692.5 = 3.22854 = Z \text{ cosec. } i \qquad i = 75^{\circ}\,22'$$

After dividing the numbers which represent the Horizontal and Total Intensity by 1000 to reduce them to the arbitrary unit in common use, we have the following values of the elements for 1837, calculated according to Gauss' formulæ.

	Computed.	Observed.	Difference.
The Declination	= 5° 4′	9° 9′	4° 5′
The Dip	= 75 22	74 22	1 00
The Horizontal Intensity	= 0.4279		
The Total Intensity	= 1.6925		

We are now able to add one more to the list of 99 places for which Gauss has compared the computed and observed values of the elements. The difference which appears in all cases between the two is produced by several causes. The observations are not cotemporaneous: and they are vitiated by accidental errors and the strange anomalies of the magnetic force. The coefficients which depend upon the grouping of the observed values must suffer from the same influences; and hence the computed places by no fault of the theory are involved in uncertainty. In some cases the two errors may balance each other; at other times they will conspire to produce a great difference. Thus we explain those considerable discrepancies which occasionally appear between the results of observation and calculation. So far as declination is concerned, Cambridge suffers particularly from these causes; there are only 3 out of the 97 places for which Gauss has made the computation where the difference is so great between the computed and observed element. In these instances, it amounts respectively to 5° 45′, 4° 42′ and 5° 15′. In regard to inclination the case is more favorable, as there are 40 places in Gauss' catalogue where the difference is greater than at Cambridge; the maximum difference being 4° 38′, or 5 times that of the latter place. Out of the 98 places for which the declination has now been calculated the difference is plus in 52 instances and minus in 46; and out of 100 for which the inclination has been computed the difference is plus 66 times and minus 34 times. This is satisfactory proof that the error proceeds from the observations and not from the theory. Before sentence can be fairly pronounced upon the latter, better observations must be possessed for comparison and the determination of the arbitrary coefficients. It is especially to be desired that cotemporaneous observations of great accuracy should be made in every quarter of the globe, that the calculated values of the coefficients may be general and impartial. Until this is done we cannot expect that the theory, however complete in itself, will give correct expressions of the elements for all parts of the earth. Thus we explain the large difference between the calculated and observed declination for Cambridge and a few other places. We must however never lose sight of the fact that remarkable local disturbances may sometimes derange the observed value of the element so as to leave still a few cases of unusual discrepance. Part VII. of the "Scientific Memoirs," contains maps of the lines of declination and inclination on the globe for 1838, drawn by Gauss according to his theory. In Silliman's American Journal, No. 2 of 1838, is a Chart of Professor Loomis which presents both these classes of lines as they crossed the United States in 1840; they were projected from a collection of all the observations that had been made in the country, after they were reduced to the same time. A comparison of the observed and empirical lines exhibits sufficient agreement to satisfy us of the general correctness of Gauss' theory in its application to this Western Continent. Mr. Loomis remarks, in a paper published in the Philosophical Transactions of Philadelphia,* that the same dip is found in a higher latitude in the western than in the eastern states. By recurring to Gauss' Map of the lines of inclination we notice the same singularity in the empirical lines. So also on Gauss' Map of declination, the lines which are far apart in Europe are convergent in the northern states as they approach the Magnetic Pole. We can readily conceive therefore that an error in the value of the coefficients, which should hardly be felt in one place, may be magnified into great importance at the other. We dismiss this interesting discussion with the confident hope that the simultaneous and extensive

* Transactions of the American Philosophical Society. Vol. VII, New Series. Part I. Philadelphia. 1840.

observations of the magnetic elements which are now in progress will soon relieve the author of the theory from the embarrassments to which the want of accurate data subjected him; and enable him to predict with certainty concerning the magnetic state of any part of the globe, though it has never been approached by man.

We shall close this communication with a brief description of the new Magnetic Observatory at Cambridge. The buildings which have been erected for this purpose are represented on the right hand of Plate I. They connect with the observer's house at the northwest corner through a covered passage. Their shape as seen on the ground plan was determined by the positions required for instruments which they were to contain. The impossibility of ascertaining the dip with accuracy has caused it to be dropped as one of the primitive Elements of Terrestrial Magnetism and the horizontal and vertical forces have been substituted in its place. The three instruments in use at the Magnetic Observatories established by the Royal Society, and recommended to all the allies, are the Declination Magnetometer, and the Horizontal and Vertical Force Magnetometers. The first two are inventions of Professor Lloyd, and correspond in their objects and part of their construction to the Gauss Declination Magnetometer and his Bifilar Magetometer. Instead of the mirror, and the scale to be reflected from it, these bars are furnished with two sliding pieces, one at each end. That farthest from the observer contains a finely divided scale of glass; the other, an achromatic lens. The distances of the two are so arranged that the scale shall be in the focus of the lens. It is evident that the apparatus thus adjusted forms a moving collimator. The scale is carried by the bar in all its changes of position and, being read off by a fixed telescope at a suitable distance, records the variations of magnetic declination. It is extremely easy to pass from the readings of the scale to absolute values. It is only necessary to find the azimuth of the line of collimation of the telescope by a Variation-transit, and then adding or subtracting the difference between the former and a fixed point of the scale, determined by observation, we readily convert every observation into absolute declination. In this respect the instrument of Lloyd is preferable to the Gauss Magnetometer, where the passage from marks on the scale to their corresponding absolute values is difficult and uncertain. A more minute description of Lloyd's apparatus may be found in the Report of the Royal Society to which we have made frequent reference. It was first proposed that the place of the bar should be marked at three successive excursions and the position determined by the familiar formula $\frac{1}{4}(a + 2b + c)$; where a, b and c express the three readings. But a circular was issued to the Magnetic Observatories, under date of January 15, 1841, and signed by Professor Lloyd, recommending that the method of observing the Declination and Horizontal Intensity Magnetometers be so far modified as that, instead of the three successive readings just mentioned, they should be taken at the times $T—t$, T, and $T+t$, of which T is the appointed epoch of observation and t the mean time of vibration of the magnet. This is returning essentially to the principle of Gauss, which gives the position of the bar for the precise moment required, and which we should think to be generally superior, whenever the length of the arc of vibration admits of it, to the method of observing three successive excursions. To recur now to the Plate; b is the place of the Declination Magnetometer, g and g windows to allow the light to pass in so as to be reflected strongly on the scale; e is the place of the fixed telescope; a is a pillar which supports the Variation-transit. This instrument can be adjusted in the meridian by independent observations of the stars, through a section in the roof at *h*, or more easily by inverting the Transit at *B* and using it as a collimator. If the Variation-transit be directed to the mid-wire of the large Transit, so that while its line of collimation falls behind the latter it also intersects the mark on Blue Hill, then we know that it is in the same meridian line as the Transit, and by turning it over to the North and reading off the azimuth of the line *a e* we find the variation of the fixed telescope and, consequently, the absolute value of every reading that is made with it. We pass now to the Horizontal Force Magnetometer which differs from the Bifilar Magnetometer of Gauss only in employing a movable collimator instead of the mirror. The principle of either instrument is easily explained. A magnetized bar is suspended by a double wire, attached to two points near its centre at a definite distance apart, which remains the same through their whole length. The cap at the top from which the suspension is made is then turned until the torsion suffices to bring the bar round at right angles to the magnetic meridian. The horizontal component of the magnetic force of course tends to bring it back to the magnetic meridian, and therefore its mean value is measured by the mean torsion. But as the torsion remains nearly constant at the same angle, any change in the horizontal force is indicated by the motion of the bar to the one side or the other of the perpendicular direction. This small variation from a mean position is observed in the same way precisely as the variations of declination in the first instrument; the change of horizontal intensity is a simple function of this small arc and very easily determined. When the absolute horizontal intensity is required, it is found by the method which Gauss employs with his Bifilar Magnetometer. *c* is the place of the Horizontal Force instrument. *f* is the place of the fixed telescope whose position at right angles to the magnetic meridian is readily adjusted by the Variation-transit at *a*.

Hence, all the readings of this instrument can be readily converted into absolute determinations by applying the variation with the proper sign as a correction to the mean absolute value. Again, *d* represents the position of the Vertical Force Magnetometer. It consists of a magnetized bar resting by knife-edges on agate planes and loaded so as to be horizontal at the average value of the Vertical Force. It is evident that any change in the amount of this force will be indicated by a motion of the arms of the lever one way or another. Any motion of this sort is observed by fixed microscopes with micrometer wires in front of each end of the bar, the double reading securing greater accuracy. Two cross wires in a hollow circle on each extremity of the bar determine for the eye its axis; and the changes of the Vertical Force are a function of the variations of this axis from its mean horizontal position. Both the Horizontal and Vertical Force instruments are furnished with thermometers, and corrections for temperature are applied in the reduction of the observations to a definite unit. Thus we have the means of observing the three approved elements of the earth's magnetism. In regard to the Vertical Force, however, no way that is not open to practical objections has been devised of obtaining its absolute value. It is recommended, therefore, to obtain it indirectly from the formula $V = H$ tang. i where H represents the horizontal intensity and i the inclination. Thus, we are still subject to the inconvenience of observing the dip of the needle with the common dipping apparatus for absolute determinations of itself and the Vertical Force. The last Circular to the Magnetic Observatories advises that observations be made on the dip *Tuesdays in the forenoon and Fridays in the afternoon.* Various modes of observing this instrument are in use, and the best result is probably obtained by a combination of all of them.

The buildings which contain these instruments are made of wood with copper nails. Iron has been carefully excluded from every part. In order that the corrections for temperature may be small they are furnished with a soapstone stove, having a copper funnel.* The instruments rest upon blocks of red sandstone, which are firmly set on the ground, insulated from the vibrations of the floor, and known to be free from magnetic influence. It is of the first importance to secure the several Magnetometers from mutual interference. They are all too distant from the Gauss Magnetometer at *C* to give or receive any disturbance in that quarter. The mutual action of two magnets diminishes as the cube of the distance, and greater security has been placed in this mode of reducing it than more complex ones. Thus the distance from *b* to *c* is 36 feet 9 inches; from *b* to *d* is 36 feet 2 inches; from *c* to *d* 40 feet 6 inches. The distances of the fixed telescopes *e* and *f* from *b* and *c* respectively are 7 feet; from *a* to *b* it is 30 feet, and the width of the building is 6 feet. Biot, Gauss and Lloyd have investigated the problem of the mutual action of a system of magnets; and positions have been found for a limited number of bars in which the disturbance should be nothing or constant; in the latter case, a simple correction applied to all the observations or which might be made at once in the construction of the scale, if the arrangement were previously known, is all that is necessary. Out of several combinations of this kind for three magnets, which the general theory discloses, we have selected the one recommended by Weber. The line *a b* of course is the direction of the magnetic meridian; *a c* is perpendicular to it; then the point *c* is so selected that the an-

* In the magnetic Observatory at Munich, the instruments are placed in a room, 13 feet below the surface of the ground, where the temperature varies but little through the year.

gle which the line *b c* makes with the magnetic meridian at *b* may be equal to 35° (theoretically it should be 35° 15′ 52″.) Now, we are sure that the mean place of the declination instrument is not affected by the disturbance of *c* upon *b*, since it acts in the direction of the magnetic meridian. But the deviations from it will be affected by a constant error for which a correction must be applied. Again, the Horizontal Force instrument is practically affected only in regard to the divisions of the scale. The tangential part of the disturbance tends to move the needle from its transverse position but this is prevented by the suspension and enters unperceived into the calculation of the absolute value of the element. Again the angle which the line *b d* makes with the magnetic meridian is also 35°; so that *b* is affected by *d* in the same manner as by *c*. The action which *b* would exert upon *d*, being in a horizontal direction, can have no influence in deranging *d*, which admits only of motion in a vertical direction.

These three instruments have been in adjustment two months, and regular observations were made with them on the Term-days of March and April, 1841; and will hereafter be continued. The same observer, by constant attention, is able to tend the three instruments at once. Thus, if the time were 10 P. M. Gott. M. T., *b* would first be observed at 0^m; then *c* at $2^m\ 30^s$, then *b* again at 5^m, then *d* at $7^m\ 30^s$, then *b* a third time at 10^m, and *c* a second time at $12^m\ 30^s$, *b* a fourth time at 15^m, and *d* a second time at $17^m\ 30^s$. In this way, which is continued during the whole period of observation, we have one observation of the declination every 5 minutes, and one of the Horizontal and Vertical forces every 10 minutes. On the March Term-day, which was the time when the transition was made from the Gauss to Lloyd's Magnetometer, both declination instruments were observed in order to see how far they were comparable. At first sight the two curves with a general agreement exhibited some alarming discrepancies; but these have been referred to the stretching of the suspension threads of the new instrument, and are not likely to recur again. Another opportunity will be taken of comparing the two instruments together after that of Lloyd has attained its proper bearings. Fig. 2 of Plate II. represents one hour's observation with these Declination Magnetometers. As the apparatus for all the Magnetic Observatories is from the hands of the same artist the observations will be eminently comparable. A few years of such observations conducted on a systematic and uniform plan will avail more in solving the intricate problem of Terrestrial Magnetism and reducing it to a theory, than the whole mass of scattered and disorderly data that have accumulated since the days of Gilbert.

TABLE I.

Gottingen Time, reckoned from Mean Noon.	1840. March. 27/23	May. 29/30	June. 24/25	July. 24/25	Aug. 28/29	Sept. 23/24	Oct. 21/22	Nov. 27/28	Dec. 23/24	1841. Jan. 20/21	Feb. 26/27	March. 24/25
X— 0	106.9	109.3	104.1	100.3	116.5	111.0	96.0	96.7	91.1	91.0	93.1	92.7
5	107.1	109.4		100.2	116.5	111.4	96.0	96.8	90.3	90.6	92.7	95.1
10	107.3	107.1		100.1	116.2	111.4	96.2	96.5	90.1	91.3	92.0	94.1
15	107.5	106.8		99.9	115.0	110.8	96.4	96.2	89.8	92.9	91.2	92.3
20	107.9	108.9	103.8	100.1	116.4	111.8	96.4	95.8	88.9	94.9	91.1	91.4
25	108.3	108.9		100.2	117.3	112.5	95.9	95.7	89.1	95.2	92.0	92.4
30	108.9	111.6		100.1	122.4	114.6	96.1	95.9	89.2	91.5	91.3	91.6
35	109.6	106.5		100.2	126.9	116.3	98.8	96.4	89.7	94.3	92.0	90.8
40	110.2	109.2	103.7	100.3	134.1	117.9	101.7	96.2	90.0	94.1	92.3	91.5
45	110.4	111.7		100.5	134.9	117.5	104.5	96.0	90.5	93.6	93.3	92.2
50	110.7	112.0		100.6	131.7	114.7	102.1	97.1	90.1	93.2	93.3	94.2
55	110.7	113.5		100.7	129.7	112.4	100.5	97.2	90.3	93.2	92.8	94.0
XI— 0	110.5	111.6	103.2	100.7	127.4	110.6	99.0	98.3	91.1	93.3	91.8	93.3
5	110.3	106.0		100.7	125.1	109.0	97.1	98.8	91.9	93.4	90.2	92.4
10	110.6	110.1		100.8	123.4	106.1	98.5	99.6	93.6	93.4	89.8	94.3
15	111.0	111.3		100.4	122.4	104.8	99.7	99.4	95.0	93.7	90.0	93.7
20	110.9	106.0	103.8	100.2	119.7	103.9	100.7	99.2	94.7	93.6	90.2	91.9
25	110.9	123.4		99.9	117.0	103.2	99.7	99.3	94.7	93.3	89.5	91.7
30	110.9	101.3		99.8	114.9	102.5	99.1	99.4	91.8	93.5	89.4	92.7
35	111.1	117.5		100.2	114.9	100.8	99.6	100.4	92.1	93.3	89.4	93.1
40	111.1	116.7	103.9	100.8	116.0	99.3	99.2	101.2	93.2	93.5	89.4	92.1
45	110.7	109.4		100.9	117.5	98.6	99.1	101.5	95.2	93.7	90.4	94.2
50	110.8	107.7		101.0	120.2	98.4	97.7	101.6	94.0	93.9	91.3	96.3
55	110.9	112.1		101.0	118.1	98.1	97.9	101.3	93.3	94.0	91.7	96.7
XII— 0	111.4	113.3	103.4	100.8	116.9	98.4	98.2	100.1	92.0	94.1	91.8	98.1
5	111.7	117.1		100.6	115.7	98.5	99.7	99.8	92.6	94.3	91.3	97.6
10	111.6	116.5		101.0	114.5	99.1	99.7	99.7	93.4	94.7	90.6	94.9
15	111.2	113.5		100.8	112.6	98.7	100.5	99.7	93.5	94.9	90.7	92.5
20	111.1	109.6	103.7	100.8	110.5	98.7	101.5	99.7	94.0	95.1	91.7	91.7
25	111.0	106.7		100.7	110.3	98.7	101.9	100.4	94.7	95.2	92.5	92.6
30	111.0	105.6		100.5	111.1	99.4	101.7	101.0	93.5	95.3	92.0	98.6
35	111.1	108.1		100.4	112.2	98.9	101.9	101.3	92.9	95.2	91.2	107.5
40	111.2	110.3	103.7	105.3	112.9	98.8	104.2	101.6	93.0	95.1	89.3	107.4
45	111.5	110.7		101.7	113.6	98.8	107.3	100.8	93.6	95.0	91.6	108.0
50	111.8	110.6		102.4	114.1	98.7	108.4	101.6	94.4	94.8	95.3	105.9
55	112.1	111.1		103.4	113.5	98.8	108.5	100.9	96.6	94.7	104.8	102.8
XIII— 0	112.4	113.1	103.2	103.3	114.5	99.5	106.6	101.5	102.3	94.8	103.6	104.8
5	112.6	113.5		102.4	114.1	99.1	106.1	101.6	103.4	95.0	104.1	104.6
10	112.7	113.4		101.2	114.2	100.6	106.4	101.7	103.9	95.4	104.5	103.5
15	112.9	116.5		99.9	115.1	102.2	105.4	101.8	102.5	95.7	105.6	101.1
20	112.8	115.7	103.5	99.2	113.8	103.5	105.5	102.2	101.5	95.9	104.1	101.4
25	112.5	122.3		99.0	111.9	105.3	105.2	97.2	99.9	96.5	103.2	101.2
30	112.4	122.6		98.6	113.3	104.9	104.4	101.8	102.3	96.7	101.3	102.0
35	113.0	122.7		98.7	115.6	105.5	104.0	102.2	103.9	96.8	98.8	101.8
40	113.5	124.3	104.0	98.9	117.0	109.6	103.3	101.2	102.3	96.9	96.1	101.4
45	113.8	123.1		98.7	116.8	109.6	102.9	101.1	99.5	97.2	96.3	100.5
50	113.6	118.4		98.7	116.7	109.3	102.7	100.2	100.2	97.2	96.4	99.5
55	112.8	121.8		98.3	117.1	107.1	101.7	100.6	100.9	96.9	97.6	99.7
XIV— 0	112.5	122.1	103.2	98.8	118.5	105.2	100.9	100.7	97.5	95.8	97.8	100.0
5		123.2		99.1	121.0	105.2	101.1	101.8	93.2	95.6	97.7	101.5
10	113.0	123.9		99.2	123.5	106.0	101.6	100.7	92.5	95.9	97.6	102.7
15	112.9	124.1		99.3	129.8	105.0	101.8	100.9	90.1	96.0	97.4	103.0
20	112.5	122.8	102.1	99.1	143.1	104.1	101.1	100.7	94.0	96.1	98.3	102.6
25	112.6	118.4		99.5	153.7	105.3	100.6	101.2	95.7	95.9	98.3	101.0
30	113.3	113.5		99.6	162.3	105.7	100.9	101.0	95.4	95.9	98.0	100.5
35	114.2	113.9		99.7	164.4	104.2	101.7	100.9	94.5	96.1	98.1	100.3
40	114.9	116.7	101.0	99.6	164.0	103.4	102.3	100.7	96.8	96.4	97.9	100.0
45	115.7	114.6		99.6	153.9	103.0	103.2	100.5	98.7	96.4	98.5	99.5
50	116.3	111.5		99.8	145.1	102.2	103.6	101.7	100.3	96.7	98.3	100.4
55	116.6			100.0	142.6	101.6	101.6	100.6	100.7	96.7	98.4	99.9

TABLE I.—CONTINUED.

Gottingen Time, reckoned from Mean Noon.	1840. March. 27/28	May. 29/30	June. 24/25	July. 24/25	Aug. 28/29	Sept. 23/24	Oct. 21/22	Nov. 27/28	Dec. 23/24	1841. Jan. 20/21	Feb. 26/27	March. 24/25
XV— 0	117.5	108.7	101.9	100.0	140.3	102.2	101.9	101 3	98 3	97.1	100.0	100.7
5	118.7	113.6		99.8	138.0	102.7	99 2	101.5	99.2	98.2	101.7	100.6
10	118.6	115.6			143.9	101.7	98.4	101.2	98 2	100 0	103.2	99.9
15	119.0	118.6			139.9	100.8	98.4	101.6	101.3	102 0	102.0	99.1
20	117.5	116.0	101.9		137.0	100.7	100.0	101.8	103.9	103.2	101.6	98.8
25	117.1	117.1		100.6	130.9	100.8	102.4	101.7	103.6	103 5	95.9	98.0
30	116.3	113.4			124.8	101 2	103 5	99.7	103 0	102.5	93.4	98.9
35	115.4	110.0			111.5	100.3	103 3	100.9	101 6	101.1	94.4	100.0
40	115.0	101.8	103.9	101.7	120.4	97.9	102 7	100.5	100.6	99.3	99.4	102.1
45	114.1	96.3			127.7	97.4	102 2	99.8	102.0	97.7	99.7	102.7
50	113.9	101.7			129.8	98.3	101.9	100.9	102 5	97.9	100.9	101.6
55	113.8	114.4			129.2	100.0	106.1	100.9	100.7	97.1	106.9	100.1
XVI— 0	113.7	96.7	105.1	102.0	125.8	101.5	107.3	100.5	100.0	97.5	106.7	97.4
5	113.0	71.2			127.1	103.6	105.3	99.9	99.3	97.1	105.9	97.1
10	112.4	70.2			127.8	102.2	103.4	99.9	98.6	96.8	101.7	96.9
15	113.1	75.9			113.8	100.5	99.9	100.5	97 8	95.7	100 3	97.3
20	112.7	77.6	105.2	101.8	110.9	100.2	92.6	101.4	98.0	95.2	99.7	99.1
25	112.0	90.7			116.9	101.0	88 2	100.3	98.5	94 9	100.5	98.7
30	111.7	95.9			120.9	101 4	88.0	100 8	97.8	94.8	102 1	98.7
35	111.7	100.4			115.4	100.5	93 9	100.9	97.4	94.9	98.7	98.3
40	111.9	95.4	108.1	102.4	113.8	100.1	96.4	99.7	97.3	95.0	96.7	95.5
45	112.3	80.8			115.7	100.2	98.4	100.1	97 1	95 2	96 0	94.3
50	112.3	98.1			119.4	101.1	98.1	100.4	97.1	95.3	97.5	94.9
55	112.2	103.9			124.7	101.4	99.0	99.7	97.4	95.2	96.7	95.2
XVII— 0	112.0	97.7	106.2	102.2	129.1	103.3	98.7	100.2	97.6	95.0	97.0	94.7
5	111.9	95.7	106.8		125.5	103.9	97.7	99.9	98.5	94.8	97.3	93.4
10	112.1	112.4	107.5		119.6	103.9	99.7	99 8	99.2	95.0	95 9	93.7
15	112.2	121.2	108.0		112 7	104 1	102.9	99.1	99 6	95.9	97.0	92.2
20	112.2	116.6	108.2	102.5	108.5	103 8	104.9	99 3	99 6	95.3	96.2	93.4
25	112.5	106.0	108.2		111.4	102 9	105.0	99.2	99.4	95 3	96.6	93.5
30	111.6	104.9	108.2		115.3	102.1	104.2	99.3	99 2	95.1	96.2	94.3
35	109.6	116.4	108.0		156.1	102.8	103.1	99.3	98 8	95.0	96.7	94.2
40	107.8	191.4	107.7	101.9	137.5	103 8	102.5	99.3	98 9	95.0	96.0	96.1
45	107.7	117.3	107.5		137.0	104.4	102.3	99.4	98.7	95.0	97 1	96.9
50	107.2	119.4	107.3		136.2	104.0	102.6	99.1	98 6	95.0	96 6	96.2
55	108.1	119.1	107.2		118.2	103.2	102.1	98.9	98.7	95.2	95.8	97.0
XVIII— 0	109.3	123.4	107.3	101.4	122.0	103.2	101.4	98.6	98.5	95.2	95 7	95.4
5	110.3	121.9			140.7	102.3	101.2	99.1	99.3	95.2	94.1	95.2
10	111.1	119.2			138.5	101 5	100.9	98.6	99 3	95.2	94.3	95.2
15	111.7	118 2			128.7	100.8	101.1	98.3	99.7	95.2	95.4	93.1
20	112.5	121.9	107.5	102.0	121.0	101.2	101.0	99.4	99.5	95.4	96.1	91.3
25	112.3	118.2			122.5	101.9	100.9	99.4	97.3	95.4	95.6	89.7
30	111.6	114 9			128.6	102.7	100 9	99.8	93.7	95.2	95.7	91.1
35	111.1	111.3			126.2	101 6	101.6	98.9	92 7	95.2	95 9	91.7
40	110.4	105.9	107.4	101.3	108.0	99.6	101.6	99.7	91.7	95.3	96.0	92.6
45	111.6	101.0			103.7	99 5	100.3	99.5	89.7	95.2	96 6	93.2
50	111.3	96.0			108.0	100.1	101.2	98.9	89 3	95.0	95.7	92.3
55	111.4	94.4			114.0	101.4	101.8	99.0	90.7	95.4	95.1	92.1
XIX— 0	111.3	91.4	107.9	101.6	117.5	102.0	100.2	99.1	93.2	95.6	95.0	93.1
5	110.7	87.9			127.2	101.0	100.4	99 2	95.4	95.9	96.1	92.7
10	110.5	90.9			146.5	100.5	100.8	98.7	96.4	95.9	95.3	92.6
15	111.0	95.7			141.5	100.5	101.1	98 6	96.4	95.9	92.7	93.6
20	110.7	100.1	108.0	101.8	135.5	100.4	101.1	98.7	97.2	96.1	91.8	92.5
25	111.3	102.2			132.7	99.6	101.5	98.6	97.2	96.2	91.6	93.5
30	111.5	104.7			131 2	99.9	102.2	98.8	96 6	96.1	92.1	94.6
35	112.2	110.1			128.5	101.0	103.0	99.1	97.0	96.1	92.5	93.3
40	113.3	111.8	108.3	101.7	118.0	101 0	103 3	99.3	96.3	96.2	92.6	94.1
45	112.9	115.3			121 1	101 5	103.7	99.0	96.8	96.5	91.8	92 5
50	112.9	117.1			123 5	101.5	103 3	99.4	97.0	96.4	93 2	93.7
55	113 2	117.5			121.6	102.7	103 5	99.4	97.4	96.4	93.2	93 8

TABLE I.— CONTINUED.

Gottingen Time, reckoned from Mean Noon.	1840. March. 27/28	May. 29/30	June 24/25	July. 24/25	Aug. 28/29	Sept. 23/24	Oct. 21/22	Nov. 27/28	Dec. 23/24	1841. Jan. 20/21	Feb. 26/27	March. 24/25
XX— 0	113.4	117.4	108.3	101.8	117.1	103.5	103.2	98.9	97.3	96.4	94.5	93.9
5	113.4	117.1			117.9	103.7	101.3	99.7	97.5	96.1	94.7	92 8
10	113.9	116.7			122.5	103.5	100.9	99.6	97.1	96.3	94.5	97.3
15	113.8	116.1			123.0	104.5	100.5	99.0	96.6	96 3	95.2	92.3
20	113.5	118.5	108.5	102.2	123.0	104.9	98.2	100.7	97.0	96.6	94.9	93 5
25	113.6	118.6			123.6	105.2	97.1	99.5	97.8	96.5	95.1	93.1
30	113.5	121.9			123.7	105.3	95.8	99.6	97.6	96.6	94.6	92.5
35	113.2	120.9			126.4	105.1	95.7	99.4	97.1	96.6	95.2	92.2
40	113.1	118.8	108.6	101.7	126.9	105.1	94.9	98.8	97.3	96.6	95.0	94.3
45	113 0	118.8			127.9	105.4	94.3	98.9	98.3	96.1	95.2	94.3
50	113.1	117.7			129 6	106 1	93.3	99.1	97.8	96 0	95 3	93.8
55	113.0	116.1			128.5	105.9	92.4	99.1	97.3	95.8	95.7	94.3
XXI— 0	113.0	114.7	108.6	101.7	127.0	105.9	91.7	99.5	97.2	95 8	94.9	93.5
5	113.0	114.5			129.2	105.1	92.8	99.7	97.1	96.0	94.1	93.5
10	113.0	114 1			131.7	104.0	94.3	99.6	96.8	95 9	94.1	92.9
15	113 2	113.9			129.4	103 0	96.0	99.8	97.0	95.9	94.4	91.2
20	113.7	113 9	109.0	102.1	130.7	102.2	96.6	100.5	97.6	95.7	92 7	90.0
25	114.0	113.5			130.4	101.0	98.4	99.3	97.8	95.6	92.2	89.1
30	114.2	114 4			130.2	100.3	98.9	100.4	97.5	95 9	92 0	89.5
35	114.3	113.8			131.7	100.2	99.4	101.0	97.9	96.0	92.9	89.2
40	114.0	113.5	109.2	102.9	131.0	99.6	100.1	99.6	97.9	96.0	93 0	88.6
45	113.9	113.4			131.3	99 4	101.7	100.3	97.8	96.1	93 9	89.0
50	113.7	112.5			128.9	97.9	101.2	100 5	97.7	96.3	94.4	91.1
55	113.4	111.7			128.5	97.1	101.1	100.2	97.7	96.1	94.2	90.8
XXII— 0	113.2	111.3	109.0	102.8	129.5	97.9	100.9	100.6	97.5	96.3	95 1	93.6
5	112.9	112 6			130.6	98.1	100.7	101.0	97.7	96 3	95.6	91.4
10	113 1	107.8			130.1	97.9	100.5	100.6	98.3	96.2	95 2	91.5
15	113.5	113.2			129.3	97.2	100.8	100.2	99.1	96 3	95.8	93.6
20	113.8	114.2	109.2	103.5	131.8	96.4	100.9	102.2	100.1	96 2	96 2	92.9
25	114.1	115.0			130.6	95.0	101.1	100.2	99.5	96.1	96.8	94.1
30	114.3	112.0			129 0	94.0	101.2	101.9	98.7	96 2	96.9	94.7
35	114 5	115.0			127.5	92.9	101.1	102.6	96.9	96 3	96.8	94.4
40	114.5	114.5	109.7	103.6	128 2	91·1	101 0	101.2	95.9	96.2	96.3	94.2
45	114.3	113.6			128.2	89 5	101.0	101.9	96.1	96.3	96 8	95.0
50	114.3	113 4			127 6	87.2	101.3	101.4	96.5	96.3	97.3	94.8
55	114.2	111.5			127.0	87.0	101.3	102.2	96.8	96.4	97.8	95.6
XXIII— 0	114.0	112.7	110.2	103.7	128 2	88.4	101.3	100.7	96.5	96.3	97.3	95.4
5	114.5	111.8			130.0	91.2	101.2	98.6	96 9	96.3	97.6	95 7
10	114.8	110.9			129.2	93.0	101.4	100.1	96 5	96.2	97 6	95.2
15	114.8	110 5			130 9	95.6	101.3	99.6	95.4	96 1	97.6	95 7
20	115.0	110.4	110.3	104.3	132.0	95 2	101.4	99.0	94.9	96 2	97.6	96.2
25	114.7	111 0			133 8	95.7	101.7	98.8	94.9	96.4	97.5	97 0
30	115.0	110.8			132.2	96 8	101.6	101 7	95 7	96 2	98 0	97.6
35	115 1	111.1			131.1	96.2	101.7	101.7	96.1	96.5	98.7	98.1
40	114.7	111.2	110.6	105.5	130.5	95 8	101.6	101.2	95.6	96.2	98.2	98.5
45	114.7	112 1		105.4	132 0	95 0	101.8	100.1	95.4	96.4	97 9	98.4
50	114.6	112 7			133 8	95.1	101 9	102.0	95.1	96 6	98 0	98 4
55	114.8	112.8			132.9	93.6	102.2	100.7	95.4	96.1	97.9	98 2
XXIV— 0	114 6	110.8	110 5	105.5	133 3	94.5	102 3	101.0	95.7	96 2	97.8	98.5
5	114.6	111.8	110.5		134.4	94.5	101.3	101.1	95.6	96 2	97.8	98.3
10	115.0	112.3			134.2	95.1	101 9	101.1	96.7	96.4	98.0	98 5
15	115.2	110 2			134 8	94 8	102.4	100.9	98.2	96 4	97.9	98.5
20	115.2	111 4	110.5	105.0	134.6	92.9	102.4	102.5	98 1	96 4	97.5	98.0
25	115.6	111.0			135,2	91 7	102 4	99 5	97 7	96 5	97 8	98.3
30	115.6	112 5			135.2	90·9	102 6	100.9	96.9	96 5	97.9	98 6
35	115 3	113.1			135.8	89.8	102 5	102 0	96 6	96.6	97.9	98 6
40	115.2	113 0	110.3	105.0	136 0	90 5	102.8	103.1	96.6	96 6	97.7	98.9
45	115 2	113 4			135.5	90.9	102 9	102 0	97.6	96 7	97.9	99.0
50	115 5	114 6			135 5	91.2	102.8	102 4	98.4	97 0	98.4	99.2
55	116.1	113.9			135 9	91.7	103.1	102 2	99.0	97.0	98 2	99.3

TABLE I. — CONTINUED.

Gottingen Time, reckoned from Mean Noon.	1840. March. 27/28	May. 29/30	June. 24/25	July. 24/25	Aug. 28/29	Sept. 23/24	Oct. 21/22	Nov. 27/28	Dec. 23/24	1841. Jan. 20/21	Feb. 26/27	March. 24/25
I— 0	115.7	113.5	109.4	104.8	136.5	90.3	103.0	102.5	99.4	97.2	98.6	100.0
5	115.2	112.0			135.9	90.7	103.5	101.5	100.3	97.3	98.4	100.0
10	116.0	112.5			135.3	92.6	103.6	101.2	100.5	97.2	98.8	99.9
15	116.4	111.9			135.0	92.4	103.6	101.1	100.0	97.3	98.9	99.8
20	117.4	111.4	108.1	103.1	135.7	93.4	102.5	101.7	99.4	97.6	98.9	99.7
25	116.5	110.4			134.5	95.4	103.5	102.0	99.7	97.8	99.2	99.4
30	117.1	109.2			133.6	97.2	103.5	102·0	101.5	97.8	99.6	99.8
35	117.3	108.8			132.6	97.8	103.6	102.5	100.0	97.9	99.8	100.1
40	117.0	108.7	107.2	102.0	131.2	99.2	103.6	102.2	99.5	97.8	99.9	99.8
45	116.7	108.9			130.8	100.7	103.3	101.5	98.0	97.8	100.0	100.2
50	116.7	108.1			130.8	101.6	103.4	101·5	98.1	97.9	99.5	100.1
55	116.6	107.7			130.5	101.7	103.3	101·3	99.6	98.0	99.3	99.7
II— 0	117.0	107.0	107.4	101.3	129.9	101.6	104.3	101.7	99.2	97.5	99.5	100.6
5	116.7	105.6			128.2	99.6	102.9	102.6	98.8	98.1	98.9	99.9
10	116.6				129.0	99.7	103.8	103.7	99.9	98.3	98.7	99.9
15	116.2	107.5			128.6	98.0	103.3	103.9	99.8	97.9	98.5	99.3
20	115.9	108.5	107.0	101.6	128.0	99.8	103.3	103.5	100.9	97.9	98.2	98.7
25	115.6	107.1			127.1	99.7	103.3	103.3	100.6	98.2	97.9	99.5
30	115.6	105.4			126.1	101.5	104.1	102.3	99.3	98.7	98.5	99.2
35	114.9	103.6			125.3	101.1	104.0	101.8	98.0	98.6	98.7	99.7
40	114.8	104 2	106.5	102.7	125.7	100.4	103.4	102.1	98.0	98.4	98.4	99.6
45	114.5	103.9			124.2	99.4	102.7	101.3	97.6	98.3	98.4	99.4
50	114.5	102.9			125.0	99.3	102.6	101.5	98.6	98.4	98.4	98.9
55	114.7	103.4			123.5	97.2	102.2	101.2	100.3	98.1	98.6	98.7
III— 0	114.1	105.1	105.8	103.3	123.3	97.7	101.3	99.9	97.9	98 3	98.4	98.7
5	114.0	102.1			122.3	96.1	101.0	100.3	95.7	98.0	98.6	98.4
10	113.9	101.9			121.9	94.1	100.3	100.9	96.0	97.9	98.6	98.7
15	113.7	101.9			121.9	94.7	100.1	101.3	96.2	98.3	98.3	98 6
20	113.3	102.0	105.9	101.9	121.4	95.5	99.0	100.1	97.1	98.0	98.2	98.7
25	113.6	101.9			121.2	94.8	98.5	99.6	96.7	97.3	98.2	98.5
30	113.4	101.9			121.5	93.8	97.4	100.1	97.3	97.7	97.7	98.7
35	113.3	102.4			121.2	93.2	96.4	99.9	97.6	97.6	97.8	97.7
40	112.3		105.8	101.2	121.2	93.4	97.2	100.1	97.4	97.5	97.2	98.4
45	112.2				120 6	94.6	98.1	100.3	96.7	97.5	97.1	98.4
50	111.9				119.7	95.1	97.6	98.7	96.7	97.5	96.9	98.4
55	111.4				119.7	95.0	97.2	98.8	95.9	97.0	97.3	98.1
IV— 0	110.6	103.4	105.7	100.9	119.7	95.6	97.2	98.6	96.1	96.7	96.7	98.3
5	109.4	103.5			119.3	94.6	96.8	98.6	96.0	96.9	96.9	98.2
10	108.9				119.4	95.4	95.7	98.3	97.1	97.6	96.5	98.0
15	108.4	100.2			119.4	94.7	94.9	98.1	96.3	96.5	96.2	98.1
20	108.1		105.5	101.5	119.0	94.2	95.0	98.4	95.7	96.6	95.8	97.8
25	107.9				119.8	93.7	95.1	97.6	96.3	96.8	95.5	97.6
30	107.5	101.1			118.9	92.4	94.9	97.5	96.7	96.5	95.0	97.4
35	107.1				118.7	92.6	95.2	97.2	96.5	96·2	94.9	97.3
40	106.5		105.6	101.6	118.9	93.3	95.2	97.2	96.8	96.2	94.7	97.0
45	106.3	101.7			118.0	95.9	95.0	96.7	96.6	96.3	94.6	96 8
50	106.1				117.2	96.5	93.8	97.0	96.5	96.2	94.3	96.5
55	105.9				116.9	96.7	93.7	97.3	96.5	96.1	93.8	96.3
V— 0	105.8	102·0	105.4	101.4	116.7	96.3	93.6	97.6	96.0	96.1	93.6	96.0
5	105.8			101.5	116.9	96.9	93.5		95.9	96.1	93.7	95 8
10	105.9				117.0	97.8	93.4		96.4	95.8	93.7	95.6
15	105.9	101.0			115.8	98.4	93.4		96.2	95.9	93.1	95.4
20	106.0	102.0	105.0	101.0	115.4	98.3	93.6		96.0	96.4	92 6	95.1
25	105.8					97.8	93.6		95.7	95.9	93.1	95.1
30	105.8	102.0			115.0	98.0	93.9	97.9	85.7	95.7	93.1	95.0
35	105.9				115.1	98.1	94.1	97.5	95.3	95.5	92.8	94.6
40	105.8		104.1	101.4	114.8	98.2	94.0	97.5	95.4	95 2	93.2	94.5
45	105.7	102.2			114.8	98 6	94.6	97.3	94.6	94.9	92.8	94.2
50	105.8	101.7			114.8	98 8	95.0	97.4	95.0	94.4	92.5	93.6
55	105.8	102.0			114.5	98.8	95.1	97.6	94.6	94.2	92.5	93.6

TABLE I.—CONTINUED.

Gottingen Time, reckoned from Moan Noon.	1840. March. 27/28	May. 29/30	June. 24/25	July. 24/25	Aug. 28/29	Sept. 23/24	Oct. 21/22	Nov. 27/28	Dec. 23/24	1841. Jan. 20/21	Feb. 26/27	March. 24/25
VI— 0	105.9	101.8	104.0	100.7	114.4	98.1	94.8	97.3	94.1	93.8	92.3	93.6
5	105.9				114.2	98.1	94.0	97.0	94.3	93.4	91.8	93.5
10	105.7	101.6		95.0	114.4	98.5	94.3	97.2	94.0	93.2	91.8	93 5
15	106.1			99.4	115.0	98.4	94.6	97.6	94.1	92 5	92.2	93.1
20	106.0	101.9	103.5	99.0	114.9	98.5	94.9	97.8	93.9	92.1	91.9	92.8
25	105.8			98.4	115.2	98.5	94.8	97.5	93.3	91.9	91.7	92.5
30	106 4	102.0			114.8	98.8	94.9	96.1	93 2	91.5	91.5	92.5
35	106.2	102.5		98.9	115.1	98.8	96.3	95.4	93.3	91.6	91.6	92.2
40	106.2	102.7	103.0	99.6	115.3	98.6	96 4	94.7	93.3	91.5	91.3	92.4
45	105.0	103.0			115.3	98.1	96.5	95.0	93.6	91.6	91.4	92.2
50	104.9	103.0			115.4	97.5	96.3	94.6	93.2	91.6	91.2	92.2
55	105.0	103.1			115.6	97.8	95.7	95.0	93.0	91.8	91.2	92.3
VII— 0	104.2	103.2	102.1	99 5	115.5	97.9	95.9	95.1	93.1	91.1	91.3	92.3
5	104.1	103.4			115.8	97.7	96.1	95.2	93.7	89.9	91.3	92.2
10	104.1	103.6			115.9	98.1	96.2	95.4	93.6	91.1	91.0	92.1
15	104.2	103.7			115.9	98.1	96.6	95.2	94.3	91.2	91.1	92.1
20	104.3	104.0	101.9	101.0	116.3	98.2	96.6	95.0	94.1	91.7	91.3	92.1
25	104.3	104.1			116.6	98 5	96.3	94.8	93.7	90.8	91.2	92.0
30	104 2	104.0			116.4	98.4	96.1	94.9	93.4	90.3	90.6	92.0
35	104.5	104.0			116.5	98.1	96.2	94.8	93.0	91 4	90.0	91.7
40	104.1	104.3	101.3	99.5	116.6	98 4	95.8	94.8	92.8	91.3	90 0	91.4
45	104.4	104.2			116.3	98.5	95.8	94.8	92.7	91.2	89.6	91.3
50	104.4	104.5			116.2	99.0	95.6	95.1	92.4	91.3	89.6	91.1
55	104 3	105.0			116.3	98.9	95.2	95.4	92.0	90.8	89.7	90.9
VIII— 0	104.2	105.0	101.2	99.3	116 7	99.3	95.2	95.4	91.8	90.4	89.9	91.0
5	104.1	105.2			116.7	100.2	95.2	95.6	92 2	90.2	90.2	91.0
10	104.1	105.9			116.8	100.2	95.1	95.6	92.0	90.3	90.9	90.8
15	104.2	105.6			117.0	100.7	94.9	95.6	92.1	90.1	91.1	90.8
20	104.3	105.5	100.9	98.4	116.9	101.5	94.9	95.7	92.3	90.9	91.2	91.1
25	104·3	105.6			117.2	103.4	94.9	96.0	91.8	90.7	91.2	90.9
30	104.2	105.5			117 1	104.1	94.9	95.7	91.9	90.9	91.4	90.7
35	104·5	105.5			118.6	104.8	94.9	95.8	91.4	90.0	91 5	90.1
40	104 1	106.0	100.9	97.8	118.0	105.7	95.1	95.7	91.6	89.5	91.5	90.0
45	104.4	106.2			116.9	106.2	95.1	95.6	91.7	87.8	91.6	89.9
50	104.4	107.0			117 5	107.1	94.9	95.3	91.7	87.0	91.6	90.0
55	104.3	107.5			117.5	107.6	94.8	94.8	92.5	87.8	91.9	89.9
IX— 0	104.6	107.1	100.4	97.2	117.6	107.4	95.5	94.7	92 6	87.9	91.9	89.9
5	104.9	107.5			117.3	106.0	95.4	95.0	92 5	88.1	91.8	89.9
10	104.7	106.7			117.5	104.8	95.6	95.3	92.4	88.4	92.1	89.8
15	105.3	106.2			117.6	104.1	95.7	95.7	92.5	89.7	92.3	89.8
20	105.4		101.0	98.7	117.8	103.8	96.1	96.0	93.5	91.0	92.2	89.9
25	105 4	107.0			117.4	102.5	96.2	96.6	93.8	91.5	92.4	90.2
30	105.4	108.9			117.5	102.8	96.4	96.8	94.0	90.8	92.3	90.7
35	105.7	107.4			117.3	101.0	96.9	97.2	93.9	92.1	92.4	91.1
40	105.9	108.9	101.0	99.2	117.4	101.0	97.1	97.5	94.0	91.9	92.3	91.3
45	105.8	108.2			117 5	102.1	97.4	97.6	93.7	92.2	92.5	91.5
50	106.1	113.0			117 4	102.5	97.7	98.7	93.9	92.3	92.6	91.6
55	106 6	113.2			117.7	102.6	98.0	98.6	94.0	93.2	92.8	92 1

That part of Table II., which is referred to on page 24, may be found on page 38, where it is introduced for another purpose. The column, containing the greatest daily excursions, which was promised on page 51, has been omitted altogether, as it did not seem to be necessary for a complete view of the subject under discussion.

TABLE III.

	June.			August.			September.			October.		
	Computed.	Observed.	Difference.	Computed.	Observed.	Difference.	Computed.	Observed.	Difference.	Computed.	Observed.	Difference.
X— 0	102.57	102.67	— .10	118.00	118.01	— .01	103.95	105.52	—1.57	97.37	97 04	+ .33
20	102.93	103.01	— .08	118.27	118.45	— .18	104.05	107.54	—3.49	97.86	98.41	— .55
40	103.24	103.15	+ .09	118.51	118.95	— .44	104.16	107.16	—3.00	98.34	100.36	—2.02
XI— 0	103.42	103.35	+ .07	118.72	119.22	— .50	104.29	105.45	—1.16	98.80	100.18	—1.38
20	103.65	103 54	+ .11	118.92	119.43	— .51	104.46	106.36	—1.90	99.23	99 29	— .06
40	103.73	103 72	+ .01	119.11	119.47	— .36	104.66	103.81	+ .85	99.63	99.78	— .15
XII— 0	103.72	103 61	+ .11	119.30	119.09	+ .21	104.89	101.39	+3.50	99.98	98 94	+1.04
20	103.63	103.85	— .22	119.49	119.46	+ .03	105.14	100.59	+4.55	100.36	98.72	+1.64
40	103.49	103.71	— .22	119.69	119.23	+ .46	105.38	101.28	+4.10	100.55	101.87	—1.32
XIII— 0	103.26	103 34	— .08	119.90	119.18	+ .72	105.59	104 16	+1.43	100.76	100 62	+ .14
20	103.16	103.45	— .29	120.13	119.35	+ .78	105.74	106.31	— .57	100.92	101.23	— .31
40	103.03	103.12	— .09	120.37	120.15	+ .22	105.83	107.54	—1.71	99.04	101.36	—2.32
XIV— 0	102.97	102 90	+ .07	120.62	120.27	+ .35	105 83	111.59	—5.76	101.11	100.11	+1 00
20	102.99	102 58	+ .41	120.88	119.98	+ .90	105 75	108.57	—2.82	101.13	100 15	+0.98
40	103.12	102.31	+ .81	121.14	121.48	— .34	105.57	106.07	— .50	101.12	101.57	— .45
XV— 0	103.36	103.27	+ .09	121.40	122.24	— .84	105.33	104.98	+ .35	101.06	101.27	— .21
20	103.72	104 28	— .56	121.64	12[illegible]59	+ .05	105 02	104.23	+ .79	100.98	100.85	+ .13
40	104.11	104.72	— .61	121.85	122.24	— .39	104.69	102 99	+1 70	100.86	101 76	— .90
XVI— 0	104.58	104.78	— .20	122.08	123 18	—1.15	104.35	103.68	+ .67	100 72	103.37	—2.65
20	105.07	105 46	— .39	122.18	123.29	—1.11	104.04	104 13	— .09	100.54	98 23	+2.31
40	105.55	105.94	— .39	122.29	122.94	— .65	103.77	103.78	— .01	100.34	98.82	+1.52
XVII— 0	105.97	105.76	+ .21	122.35	122.69	— .34	103.56	99.78	+3 78	100.12	100.80	— .68
20	106.31	106 21	+ .10	122.38	122 67	— .29	103.42	104.46	—1.04	99.87	100.89	—1.02
40	106.55	106.20	+ .35	122.39	121.90	+ .49	103 35	102.52	+ .83	99.62	100.24	— .62
XVIII— 0	106 69	106 28	+ .41	122.36	121.25	+1.11	103 35	103.96	— .61	99.36	98.05	+1.31
20	106.72	106 49	+ .23	122.33	120.95	+1.38	103 40	105.33	—1.93	99.10	98.53	+ .57
40	106.66	106.27	+ .39	122·30	121.74	+ .56	103 48	102.52	+ .96	98 84	99.23	— .39
XIX— 0	106.55	106.48	+ .07	122 29	121.90	+ .39	103 57	105.22	—1.65	98 60	98.51	+ .09
20	106.38	106.45	— .07	122 30	122.62	— .32	103 65	104.16	— .51	98.38	98.93	— .55
40	106.24	106 34	— .10	122.36	121.50	+ .86	103.70	104.60	— .90	98.20	99.45	—1.25
XX— 0	106.05	106 95	— .90	122 46	122.35	+ .11	103 71	105 72	—2.01	98 07	98.81	— .74
20	106.15	106 78	— .63	122.63	123.61	— .98	103 67	104.39	— .72	97 99	97.78	+ .21
40	106.23	106 68	— .45	122.86	123.72	— .86	103 58	102.40	+1.18	97.98	97.51	+ .47
XXI— 0	106.46	107.03	— .57	123 14	123.86	— .72	103.45	101.92	+1.53	98 03	95.76	+2.27
20	106.79	106.84	— .05	123 48	123 78	— .30	103 28	104 65	—1.37	98.14	96.98	+1.16
40	107.24	107.20	+ .04	123.87	123.90	— .03	103.12	103 81	— .69	98.33	98.74	— .41
XXII— 0	107.77	107.16	+ .61	124.28	124.47	— .19	102.95	101.47	+1·48	98.58	99 54	— .96
20	108.46	107.68	+ .78	124.70	124.77	— .07	102 79	99 50	+3.29	98.89	99·74	— .85
40	109.06	108.32	+ .74	125.12	124 60	+ .52	102.66	100.80	+1.86	99.24	100.20	— .96
XXIII— 0	109.53	109.02	+ .51	125 50	124.61	+ .89	102.56	104.86	—2.30	99 62	100.53	— .91
20	110.20	109 55	+ .65	125·82	126.11	— .29	102 48	107.79	—5.31	100.00	100 50	— .50
40	110.37	109.86	+ .51	126.07	126.56	— .49	1012.4	103.32	— .91	100.39	99.42	+ .97
XXIV— 0	110.58	110 31	+ .27	126 22	126.18	+ .04	102 34	103.35	—1.01	100.74	99.71	+1.03
20	110.63	110.53	+ .10	126.25	126.08	+ .17	102 24	102.46	— .22	101.04	99.80	+1.24
40	110.50	110.19	+ .31	126.15	125.70	+ .45	102 10	100.72	+1.38	101.28	100 94	+ .34

TABLE III. — CONTINUED.

	June.			August.			September.			October.		
	Computed.	Observed.	Difference.	Computed.	Observed.	Difference.	Computed.	Observed.	Difference.	Computed.	Observed.	Difference.
I— 0	110.21	109.51	+ .70	125.92	126.22	— .30	101.90	99.74	+2.16	101.44	101.47	— .03
20	109.86	109.14	+ .72	125.56	125.18	+ .38	100.62	99 85	+ .77	101.50	101.41	+ .09
40	109.28	108.67	+ .61	125.06	124.95	+ .11	100 26	101.33	—1.07	101.46	101.69	— .23
II— 0	108.51	108.23	+ .28	124.44	124.42	+ .02	100.80	101.21	— .41	101.31	102.25	— .94
20	107.78	107.74	+ .04	123.71	123.79	— .08	100.29	100.16	+ .13	101.06	101.92	— .86
40	107.02	107.15	— .13	122.90	123 00	— .10	99.71	99.95	— .24	100.70	101.88	—1.18
III— 0	106.27	106.75	— .48	122.04	122.25	— .21	99.12	99.60	— .48	100.26	100.76	— .50
20	105.54	106.15	— .61	121.13	121.05	+ .08	98.54	98 47	+ .07	99.74	99.94	— .20
40	104.86	105.28	— .42	120.22	120.43	— .21	98.03	98.51	— .48	99.16	98.83	+ .33
IV— 0	104.34	104.28	+ .06	119.34	119.90	— .56	97.60	98.17	— .57	98.56	98.13	+ .43
20	103.69	103.69	.00	118.51	118 68	— .17	97.31	97.81	— .50	97 93	96.85	+1.08
40	103.19	103.07	+ .12	117.75	117.75	.00	97.19	96.94	+ .25	97.31	97.08	+ .23
V— 0	102.75	102.66	+ .09	117.09	117.20	— .11	97.20	96.52	+ .68	96.72	96.04	+ .68
20	102.35	102.25	+ .10	116.53	116.45	+ .08	97.41	97.81	— .40	96.17	95.93	+ .24
40	102.00	101.87	+ .13	116.09	116.03	+ .06	97.67	97.95	— .28	95.70	95.59	+ .11
VI— 0	101.60	101.64	— .04	115.78	115.85	— .07	98.28	98.06	+ .22	95.30	95.38	— .08
20	101.43	101.35	— .08	115.59	115.87	— .28	98.90	99.18	— .28	94.99	95.54	— .55
40	101.21	101.40	— .19	115.52	115.34	+ .18	99.60	100.17	— .57	94.79	95.58	— .79
VII— 0	101 04	100.98	+ .06	115 55	115.18	+ .37	100.31	100.63	— .32	94.68	95.22	— .54
20	100.93	100.87	+ .06	115.68	115.37	+ .31	101.03	100.00	+1.03	94.68	95 57	— .89
40	100.89	100.89	.00	115.88	115.69	+ .19	101.69	100.92	+ .77	94.74	95.53	— .79
VIII— 0	100.93	101.20	— .27	116.14	116.18	— .04	102.28	102.89	— .61	94.96	95.15	— .19
20	101.05	101.24	— .19	116.44	116.26	+ .18	102 78	102.26	+ .52	95.23	94.38	+ .85
40	101.26	101.34	— .08	116.76	116.35	+ .41	103.18	102.08	+1.10	95.57	94 84	+ .73
IX— 0	101.51	101.28	+ .23	117.09	116.84	+ .25	103.48	102.43	+1.05	95.97	94.96	+1.01
20	101.84	101.66	+ .18	117 41	117.47	— .06	103.69	101.63	+2.06	96.41	95.54	+ .87
40	102.19	102.30	— .11	117.72	118.18	— .46	103.84	102.38	+1.46	96.88	96.14	+ .74

This Table gives four monthly mean observed places of the Magnetometer for every 20 minutes during the day. A parallel column gives the corresponding place as calculated by the empirical curve. The column of differences shows to what extent the empirical and observed places agree, and the signs of these differences make it probable that they are accidental. The numbers in all these Tables are in minutes and decimal parts of a minute, according to the scale of the Gauss Magnetometer

MEMOIRS

OF THE

AMERICAN ACADEMY.

II.

An Account of the Magnetic Observations made at the Observatory of Harvard University, Cambridge.

COMMUNICATED

BY JOSEPH LOVERING,

HOLLIS PROFESSOR OF MATHEMATICS AND NATURAL PHILOSOPHY.

THE plan and occasion of the magnetic observations which have been made at Cambridge, under the auspices of the Academy, have been developed at length in a former communication. The observations which had been made previous to the date of that paper were then published. Since that time, a similar series, according to the same general system, has been sustained, at longer or shorter intervals, as circumstances permitted. The observations on the Term-days were made under the superintendence of Mr. W. Cranch Bond, the Astronomical Observer of the College. Those observations are not included in the present publication. They have already been presented in manuscript to the Academy, and will, I trust, be soon published, and distributed among all who are interested in these researches.

The observations which are here offered to the Academy, and through them to the brotherhood of magnetic observers, were taken during a period of a little more than a year, from the autumn of 1841 to the winter of 1842, as will be seen by reference to the printed records. It was not expected, at the commencement of the work, that observations would be made at Cambridge on any but the regular Term-days, since all the time that could be given to this object was only what the observers might be able to spare from their ordinary labors. At the suggestion of Professor Peirce, however, whose services to the Observatory have been invaluable, an Association was formed among members of the Senior, Junior, and Sophomore classes then in College, under the name of the Meteorological Society of Harvard University. By the help of this Association, observations were made on the Barometer, Thermometer, and the three Magnetic Elements, with the attached Thermometers, during the whole day and night, at intervals of two hours, one hour, or half an hour, as other duties rendered it convenient. The magnetic observations were made with the three instruments described at the close of my former communication, where the mode of observing is given. This Association was active for more than a year, and I am chiefly indebted to the zeal and diligence of its members for the materials of this paper. When we consider by whom the work was undertaken, — by students, who had little leisure to spare from their academic exercises, — by the young, who might be expected to seek more exciting relaxation than could be received from watching by night as well as day the vibrations of a steel bar, — and when we recall the care, accuracy, and spirit with which it was carried forward, we feel that the Academy, and that American science, are under great obligation to those young men who assumed voluntarily the toil of midnight observation, and sacrificed to the cause of severe science the natural tendencies of their youth. How excellently the work was done will appear by an examination of the published results.

A few words will be needed to render the Tables generally intelligible, but they are reserved for another place. I will take occasion, however, to remark now, that the Vertical-Force instrument has not satisfied any observer who has used it, here or elsewhere. This may be owing, in part, to thermometric disturbances, though Professor Lloyd, its inventor, ascribes it to mechanical difficulties in its construction. He seems disposed, therefore, to abandon the instrument altogether; and he has already contrived another, called the Inclinometer, for observing the same element. For the benefit of those who have not access to the "Proceedings of the Royal Irish Academy," I will transcribe the valuable remarks of this distinguished observer and expounder of Terrestrial Magnetism, in his own words;—

"In order to know all that relates to the earth's magnetic force, at a given place, observation must furnish the values of three elements. Those which naturally present themselves for immediate determination are, the *intensity* of the force itself, and the two angles (the *declination* and *inclination*) which determine its direction. We may substitute for these, however, any other system of elements which are connected with them by known relations. Thus, we have hitherto preferred to observe the *declination*, and the *two components* (horizontal and vertical) *of the intensity;* and, in general, the main considerations which should guide us in our choice are, the exactness of the observed results, and the facility of their determination.

"In this point of view, the *declination* and the *horizontal com-*

ponent of the intensity leave us nothing to desire, their determination being now reduced to a degree of precision, hardly (if at all) inferior to that of astronomical measurements. The same thing, however, cannot be said respecting the third element, as hitherto observed. In the Dublin Magnetical Observatory, and in the Observatories since established by order of the Government and of the East India Company upon the same plan, the third element chosen for observation has been the *vertical component of the intensity*, the instrument for the measurement of which has been already submitted to the notice of the Academy. The principle of this instrument, it will be remembered, is to balance the vertical component of the magnetic force by a fixed weight, and to observe the changes of the position of equilibrium, under the action of the changing force. Unexceptionable as this principle is in theory, the accuracy of the results has not been commensurate with that of the other two instruments. This inferiority is to be traced to the large influence which the unavoidable errors of workmanship must necessarily have on the position of equilibrium of a magnet supported on a fixed axle. It has been shown, that the effect of magnetizing a bar, under the most advantageous circumstances of form, and at the part of the globe where the vertical component of the magnetic force is greatest, is the same (as to its position of equilibrium) as if its centre of gravity had been transferred about the $\frac{1}{40}$th of an inch towards the north end; so that the moment of the force, exerted by the vertical component of the earth's magnetism, can never exceed this small quantity multiplied by the weight of the bar. Now, in order to render the results of this instrument comparable to those of the Horizontal-Force Magnetometer, it should enable us to measure changes of the vertical force, amounting to the $\frac{4}{100,000}$dth

MAGNETIC OBSERVATIONS AT CAMBRIDGE, UNITED STATES.

Gottingen Mean Time. 1841.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Oct. 26.							
h. m.							
1 58	−6·43	27°.5	145.2	140·0	26° 7		
2 0	6.00	29.1	144.2	141.0	27.3	30.024	33°.0
2 5	6 07	30.6	143.9	142 7	28 2		
2 30	5.04	32 5	144.1	147.0	32.9	30.055	35.8
3 0	2 22	37.5	142.5	150 1	44.0	29.929	34.0
3 30	0.19	41.5	145 0	151.7	44.1	29 927	60.2
4 0	+1.01	45.9	146.5	151.1	48.9	29.901	45.0
4 30			146.0	159.0	53.2	29.843	46.3
5 0			136.0	168.1	55.5	29.855	47.1
5 30			144·1	161.7	58.3	29.806	48 8
6 0	4.03	56.7	144.9	162 7	59 7	29.838	49.0
6 31	4.20	58 0	146.0	161.0	62.0	29.681	50.0
7 0	4.39	58.0	143.0	162.5	61.0	29.750	50.0
7 30	4.36	59.0	145.1	161.5	61.6	29.750	50.0
8 0	5.14	60.6	145.8	162.9	61.8	29.736	50.0
8 30	5.08	59.3	146.0	165.1	62 0	29 739	49.2
9 0	4.29	59.5	155.8	165.7	61.9	29.740	48.6
9 30	4.38	60.5	156.1	162.6	61.0	29.734	48.0
10 0	4.42	59.6	148.3	159 8	60 5	29.688	46.8
10 30	4.47	60.0	149.0	160.3	59.5	29.715	46.0
11 0	5.15	60.0	148.1	159.9	59.0	29.753	44.0
11 30	5.16	58.6	151.0	159.4	58.5	29.722	44.5
12 0	5.08	58.5	150.0	160.1	58.1	29.730	43.8
12 30	5.42	60.0	152 0	159.1	58.0	29.719	42.0
13 0	5.22	61.0	158.2	153.1	58 0	29.745	42.8
13 30	6.04	59.6	159.1	156.3	57.5	29.760	43.5
14 0	5 00	58 5	155.5	159.3	57.0	29.763	44.0
14 30	4.22	58.2	157 0	159 7	56.8	29.783	44.0
15 0	4 26	58.3	154.1	159.5	56.7	29.763	43.0
15 30	5.31	59.5	153.0	159.6	57.0	29.785	43.0
16 0	5.14	59.0	149.0	158.9	57.0	29.713	43.5
16 30	6.27	58.5	143.7	157.9	57.0	29 764	43 5
17 0	6.06	58.0	147.8	157.9	57.0	29.796	43.0
17 30	6.11	58.0	141.0	159 2	56.5	29.757	42.0
18 0	6.42	57 5	146.5	158 1	56.0	29.760	41.0
18 30	6.42	57.6	144.3	158 8	55.8	29.743	39.5
19 0	6.10	57.3	138 4	159 6	55.6	29.758	37.3
19 30	6 09	57.0	142 8	158.6	55.3	29.832	37.4
20 0	6.02	57 5	145 8	158 1	54.5	29.812	38.3
20 30	6.29	56.5	147.8	157.5	54.5	29 866	38 0
21 0	5.11	56.5	146 6	158 0	54.5	29.683	37.2
21 30	5 20	56.6	148.5	157 4	54.5	29.719	37.0
22 0	5.15	56 8	146 2	157 6	55.0	29.752	36.7
22 30	5.00	56 8	143 4	158.2	55.0	29 919	37.1
23 0	5.03	57.1	138 9	156.9	55 0	29.912	36.2
23 30	4.40	56.6	139.9	156.1	54.5	29.910	35.8
Oct. 27.							
24 0	4 48	56·0	143.5	155.4	54.5	29.936	35 8
0 30	4.32	55.7	145.5	155.9	55.0	29.948	36.0
1 0	4.06	65.3	143.4	158.4	54.5	29 951	38.6
1 30	4.02	55·2	140.4	158 5	54 2	29.953	42.0
⎧1 50	3.43	55.0	145.6	158.2	54.0		
⎨2 0	3.48	55.0	146 0	158.2	54.0	29.965	44.7
⎩2 10	4.01	55.0	145.3	158.6	54.0		
2 30	4.18	56.0	146.0	159.2	55.3	30.048	47.0
3 0	4.28	56.5	145.1	160.0	56 7	30.040	49.0
3 30	5.08	57.5	143.0	161.5	58.8	30.041	50.6
4 0	5.26	58.0	143.0	162.7	60.7	30.004	53.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
4 30	+5.40	59°.6	143.2	164 2	62°.6	30.012	52° 3
5 0	6.01	60.0	143.0	165.0	63.0	30.008	52.7
5 30	6 01	60.3	142.0	165.3	63.8	30.010	51.0
6 0	6.22	61.0	141.8	165.6	65 0	29 997	52.0
6 30	6 43	62.0	145.0	166.5	66 0	30.003	51.5
7 0	7.13	63.0	145 0	165 5	66.8	30.013	53.0
7 30	7.44	64.4	144.4	166.0	67.7	30.024	52.0
8 0	7.44	64.9	145.2	164.3	67.6	30.036	51.8
8 30	7.45	65.5	145.0	165.0	67.4	30.049	51.0
9 0	8.00	66.0	146 0	165.9	67.1	30.049	49.8
9 30	7.44	65.6	146.0	165.4	66 7	30.065	46.0
10 0	7.32	64.6	147.0	164.3	65.5	30.096	44.5
10 30	7.22	64.0	147.0	164 5	64.0	30.114	41.5
11 0	7.11	63 5	147.5	164.6	63.0	30.097	40.8
11 30	7.11	62.7	150.5	163 7	62.5	30.112	39.7
12 0	7 07	62.0	150.3	164 4	60.7	30.118	38 7
12 30	7.06	61.5	169.0	165 7	60.0	30.130	37.0
13 0	7.06	61.0	166.4	161.5	60.0	30.169	36.0
13 30	7.06	60.6	157.0	164.0	59.0	30.151	35.0
14 0	7.03	60.0	153.0	161.7	57.5	30 217	34.0
14 30	7.08	59.5	155 5	161.7	58.3	30.247	34.0
15 0	7.05	59.0	164.0	164.3	57.0	30 240	33.5
15 30	8 08	58 5	147.0	149.0	57.0	30 263	32.0
16 0	8.08	58.5	165.1	168.1	56.0	30.230	31.5
16 30	8·06	57.5	160.6	153.7	55.5	30.266	30 5
17 0	8 09	57.0	160.4	166.7	54.5	30 262	30.5
17 30	9.14	56.5	163.2	159.4	54.0	30.247	30.0
18 0	10.05	57.0	143 9	164.0	53.5	30.275	29.5
18 30	10.30	56.5	144.3	160.4	53 5	30 303	28.0
19 0	9.38	55.4	159.4	160.7	53.5	30.336	28.0
19 30	7.32	54 6	161.1	157.9	52.0	30.307	28.0
20 0	7.43	55.0	155.0	157.9	54 0	30.281	28.0
20 30	6.31	54.5	152.5	155.8	52.5	30 346	27.5
21 0	6.14	56.0	155.0	155.9	53.0	30.480	26.1
21 30	6 40	54 2	151.3	155.4	53.5	30 371	26.5
22 0	6.23	55.2	152.0	155.5	53 4	30.395	25.5
22 30	6.32	55 5	152.1	155.2	55.5	30.383	26.5
23 0	6.45	55.0	146.4	155.5	53.5	30.405	26.2
23 30	6.24	54 5	163.4	156.3	53.0	30.398	26.0
24 0	6.18	52.0	143.5	150.7	52 2	30.411	26.0
Oct. 28							
0 30	6 20	54.3	146.4	155.2	53.7	30.422	27.0
1 0	6.22	53 7	143 1	159.0	53 8	30.423	28.5
1 30	6.22	53 2	150 8	159.0	52 8	30.428	30.6
2 0	6.22	53.6	147.8	156.0	53.3	30.433	32.8
2 30	6.23	54.2	150.0	156.2	55.8	30 411	36.0
3 0	7 42	55.5	152 5	157 2	57 8	30.422	37.0
3 30	7.00	56.3	150.5	158.2	60.0	30.429	38.6
4 0	7.00	57 2	149.3	159.5	62 0	30.348	40.0
4 30	7 24	58 6	146.0	162.6	64.0	30.400	41.0
5 0	8.32	60 0	145.0	164 0	66.0	30.446	42.0
5 30	8.29	61.0	144 5	164 0	67.5	30.442	43.0
6 0	8.38	60.0	143 0	163 9	68.0	30.410	43.0
6 30	7.43	61 6	142.5	164.0	68.0	30.387	43.0
7 0	8.01	62 5	143 1	163.7	67.6	30.445	43.5
7 30	8.00	62 7	143.0	163.8	67 2	30 423	44.0
8 0	7.44	62 5	144 0	163.1	66 5	30.416	44.2
8 30	7.37	63.0	145.0	162.5	65.0	30 421	42.3
9 0	10 26	62 0	147.0	160.8	64 0	30 445	42.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.	Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.								h. m.							
9 30	+10.26	62.0	147.8	160.7	63.0	30.413	41.3	15 30	+9 33	60.5	149.2	159.0	59.5	30.144	44.0
10 0	10.11	61.0	148.8	161.5	61.5	30 397	40.0	16 0	9.28	60.5	150.0	158.5	59.5	30.143	44.5
10 30	9.48	61 0	147.1	160.9	60.5	30.414	37.8	16 30	9.32	60.5	150.5	158.1	59.5	30.146	47.0
11 0	10.08	62.0	148.0	159.2	60.6	30 474	35.7	17 0	10.43	6 .0	149.2	158.0	60.0	30.106	48.0
11 30	10.06	59.4	149.1	159.3	59.4	30.432	34.7	17 30	10.43	6 .0	144 0	152.0	60.0	30.110	47.5
12 0	10.01	58.5	151.6	157.2	58 5	30.430	33.0	18 0	10.43	60.5	145.0	158.0	60.0	30.107	49.0
12 30	10.45	57.5	153.0	157.2	57.5	30.428	31.7	18 30	10.40	60.0	145.0	158.0	60.0	30.139	49.0
13 0	10.48	57.0	152.5	156.4	56.5	30.419	31.0	19 0	10.35	60.0	150.0	15[illegible].1	60.0	30.124	49.0
13 30	10.01	56.1	152.5	155.3	56.0	30.499	30 8	19 30	10 42	60.0	150 7	157.8	60.0	30.107	48.0
14 0	10.17	56.5	153.0	154 4	55.8	30.369	30.3	20 0	10 38	60.5	15 0	157.5	60 0	30.107	48.0
14 30	10.12	56 6	152.9	154.1	55.4	30.418	30.2	20 30	10.47	60 5	151.0	156 6	60.0	30.145	48.0
15 0	10.05	56.6	151.9	153.7	5.1	30.487	29.6	21 0	10.49	60.5	153.2	158.0	60.0	30.102	48.0
15 30	10.06	55.3	151.2	153.9	54.5	30.282	29.0	21 30	10.48	61.0	152 6	158.4	60 6	30.120	48.5
16 0	10.48	55.5	151.2	154.2	54.4	30.274	28.2	22 0	10 08	61.7	153.0	158.0	61.0	30.129	48.2
16 30	9.22	55.0	150 6	153.8	54.0	30 307	28.0	22 30	10.08	62 0	152.0	159.0	61.7	30.034	48.0
17 0	9.26	54.0	151.1	154 4	53 3	30.296	27.9	23 0	10.08	62.5	148.2	159.1	62.0	30.094	48 0
17 30	10.45	53.5	151.1	154.0	53 0	30.475	27.0	23 30	10.37	63.0	150.6	159.9	63.0	30.133	47.6
18 0	10.34	53 5	150.5	153.2	52.5	30.366	26 0	Oct. 30.							
18 30	10.34	53.0	150.0	153 0	52.1	30.335	26 0	24 0	10.17	63.7	151.8	160.0	63 0	30 139	48.0
19 0	10.38	53.5	150.3	153.0	53 0	30.333	26.5	0 30	10.06	63.6	152 5	161 0	63.5	30.150	49.0
19 30	10.48	54 5	149.0	153 2	54 0	30.356	26.0	1 0	10.07	63.6	154.9	162.0	63.3	30.138	50.0
20 0	10.06	55.0	149.5	153.5	54.5	30 325	26 0	1 30	10.07	62.7	154.8	163 0	63.0	30.163	53.0
20 30	10.20	55.5	149.0	153.8	55.0	30.234	26.0	1 50	10.06	62.4	155.0	164.1	63.2		
21 0	10.15	55.5	149 2	154 0	55.2	30 221	27 2	2 0	10.06	62.4	155 0	164 1	63.1	30.161	55.2
21 30	10.14	55.9	150.0	154.0	55.6	30 323	28.0	2 10	10.06	62.4	155.0	164.5	63.4		
22 0	10.20	56.0	149.9	154 0	55.8	30.319	26.0	Nov. 1.							
22 30	10.20	56.0	150 5	154.2	56 0	30.327	28.0	0 30	7.05	56.0	152.6	158.8	55.4		
23 0	10.29	57.0	151.0	154.5	57.0	30.320	29.0	1 0	7.05	56 0	153.0	157.2	55.4		
23 30	10.33	57.0	151.0	155.0	57.0	30 315	30.5	1 30	7.05	56.8	152 8				
Oct. 29.								1 50	8.07	58.2	153.5				
24 0	11.44	57.5	152.0	155.8	58.0	30.343	32.0	2 0	8.19	58.5	153 5			30.115	60.0
0 30	11.44	58 0	152.0	156 1	58 0	30.323	34.5	2 10	8.32	59 0	153.4				
1 0	11.48	57.5	152.8	157.0	58 2	30.381	36 0	2 30	9.13	60.5	153.2	156.8	62.1	30.112	63.0
1 30	10.47	57.3	153.3	158.9	56.8	30.348	37.0	3 0	10.25	61.5	152.3	159.5	64.2	30.139	66.8
1 50	10.35	56.4	153 0	158.0	56.8			3 30	11.35	64 6	159.5	160.3	66.5	30.107	67.6
2 0	10.33	56 5	153 0	157.9	56.8	30.334	42.0	4 0	12 33	66.2	147.4	161.7	68.4	30.110	69.7
2 10	10.32	56 6	152.7	157.8	56 8			4 30	13.24	68.0	146.3	162.8	70.2	30.122	75.0
2 30	10.24	56.6	153 1	156 6	56.5	30 294	43.0	5 0	13.56	69.5	145.5	163.6	72 5	30.107	72.4
3 0	9.29	57.0	152.0	157 9	56.8	30.268	45 0	5 30	14.25	70 5	144.7	164.5	74.0	30.094	72.6
3 30	10 30	56.5	151.0	158 1	57.3	30.226	47.2	6 0	14 45	71.7	143.2	165.1	75.7	30.074	72.8
4 0	9.29	58.2	149.7	158.8	58.0	30.183	49.1	6 30	15.03	72.5	142.5	165 0	76.5	30 062	72 5
4 30	9.39	58 5	147.6	159.2	58.6	30.291		7 0	15.19	73.0	143.0	165.0	77.0	29.998	72.5
5 0	9.47	59.1	146.0	160 7	59.0	30 289		7 30	15.24	74.0	144 0	165.0	78.0	30.070	73.0
5 30	10.00	59.0	146.0	160.9	59.0	30.253	51.0	8 0	15.24	74.0	144.5	165.0	77.0	30.001	74.0
6 0	9.39	59.4	142 9	162.0	58.9	30 253	53 0	8 30	15 09	74.0	145.2	164.2	76.0	30.039	74.8
6 30	9.33	59 4	142 0	158.9	59.0	30.250	56 5	9 0	14.41	73.4	146 2	165.5	75.3	30.028	70.5
7 0	9 36	60.4	138 9	160.5	59.9	30.248	55.0	9 30	14.35	73 5	146.2	164.0	74.5	30.005	69.3
7 30	9.36	60.8	134 9	163.7	60 5	30.226	54.5	10 0	14.21	72 5	147 5	163 7	73 5	30.010	68.0
8 0	9 27	61.0	135.7	162.9	61 1	30 240	54 0	10 30	14.14	72 0	150.0	165.0	72 5	30.006	64.0
8 30	9.31	61.2	143.1	162 6	61.0	30 215	54.0	11 0	14.10	71.5	148.5	164 0	72.0	30.020	62.0
9 0	9.43	61.3	145.0	159.8	61 0	30.210	54.0	11 30	14 06	71 4	148.6	163.9	71.6	30 008	61.2
9 30	9.41	61.5	147.8	159 2	61 0	30 166	52.5	12 0	14.06	70 6	149.0	165 0	71.1	30 021	60.3
10 0	10.06	62.8	149 0	158.3	62.0	30.174	50.0	12 30	13.30	70.6	148 5	164.6	70 5	29 981	59 5
10 30	10.14	63.0	147.5	158 0	62.8	30.157	48 0	13 0	13 21	70.0	150.0	165 5	69.8	29.983	59.3
11 0	10.21	63.3	150.2	158.3	62 8	30.190	46.8	13 30	13.06	70.8	161 0	166.0	69.3	29.982	58.0
11 30	11.35	62 5	148 2	158.6	62.8	30 172	45 7	14 0	13.44	72.0	159.8	163.7	68 8	29 948	57.5
12 0	10.17	62.4	148.5	158.4	62.0	30.146	44 8	14 30	12 27	68.5	150 5	162.7	68.0	29.971	56 8
12 30	10.05	62.0	148.9	161.8	61.8	30.165	45.5	15 0	12.14	68 0	152 5	164.6	67.5	29.985	56.0
13 0	10.04	61.8	157.6	161.9	61.5	30.175	46 6	15 30	12.12	67.5	152.5	160.7	67.0	29.955	55.6
13 30	9.19	61.5	154.9	159.7	61.8	30.283	46 9	16 0	12.04	67.1	153 5	160.3	66.6	29.947	55.0
14 0	10 11	61.4	149 7	158 0	60.5	30.133	46.2	16 30	11.41	67 0	153.0	159.4	66.0	29.902	54.0
14 30	9.12	60.0	148.7	159.0	60.0	30.130	46.0	17 0	11.49	66.0	153.0	158.9	65.0	29 902	54.0
15 0	9.36	60.0	150.0	158 0	60.0	30 126	45 5	17 30	11.13	66 0	152 2	160 1	64.8	29 921	54.1

Gottingen Mean Time.	V. F.	Att Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.	Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.								h. m.							
18 0	+11.31	66.0	151.8	158.7	65 0	29.915	54 0	0 30	+9.26	61.5	155.0	155.2	60.0	29.733	42.0
18 30	11.:7	65 0	150.7	158.7	63.8	29.915	54.0	1 0	9.16	60.5	155 0	155.8	59.4	29.727	44.5
19 0	12.07	64.0	152.7	159.1	63.8	29.908	54.0	1 30	9.21	60.0	156.0	155.6	59.2	29.709	48.6
19 30	12.39	64.0	150.0	157.0	63 8	29.899	54.0	{ 1 50	9.26	59.8	155.6	156.1	59.5		
20 0	12.39	65 0	153.0	158 0	65.0	29.897	53.6	{ 2 0	9.29	60.0	155.6	156.1	59.7	29.719	58.6
20 30	12 10	65.0	150.5	158.0	65.5	29.815	53.5	{ 2 10	9.31	60.1	155.0	156.5	60.0		
21 0	11.47	65.0	152.0	157.5	65.0	29.818	53.5	2 27	10.39	60.1	154.9	157.0	60 6	29.706	48 0
21 30	12.29	65.0	158.0	158.0	64 5	29 821	53.0	2 57	10.40	59.9	154 0	158.1	60.9	29.706	50.8
22 0	12 29	64 0	157 0	158 0	64.5	29.811	53.0	3 27	10.48	62.0	157.1	159 1	62.6		54.0
22 30	12.29	64.0	157.0	158.0	64.5	29.821	52.0	3 57	10.11	62.5	158.6	160 0	65.0		56.0
23 0	11.31	65.0	152.:	158.0	64.8	29.847	52 0	4 30	10.26	63.0	147 1	161.2	66.0	29.693	57.8
23 30	11.20	64.0	152 :	158.0	64.5	29.798	53.5	4 57	11.41	64.0	145.4	161 5	67 5	29.693	59.8
Nov. 2.								5 30	11.33	65.0	144.0	163.0	69 0	29 663	61.5
24 0	11.01	67.5	154.0	157.7	64 0	29.847	54.0	6 0	12.05	66.0	143.3	162 3	70.3	29.65	61.9
0 30	11 07	64.0	155 0	157 5	63.6	29.858	56.0	6 30	12.26	67.1	143.0	163.6	71.3	29.632	61.4
1 0	10.31	63 5	155.4	158.5	63.5	29 830	57	7 0	13.00	68.0	143.6	163.9	72.0	29.632	60.0
1 30	10.33	63.3	155.5	159.0	63.2	29.801	60 3	7 30	13.00	68.4	142 2	163.8	72.0	29.61:	59.0
{ 2 0	10.35	63.5	154.9	159.0	64.0	29.789	63.5	8 0	13.00	68.4	144.6	163.0	71.9	29.590	56.5
{ 2 10	10.40	63 7	154.8	159 2	63.9			8 30	13.37	68.4	145·0	162 0	71.0	29.591	56.5
2 30	10.43	64.0	153 5	159 6	63 9	29.787	63.4	9 0	13.13	68.4	146.7	160.9	70.0	29.714	55.0
3 0	11.15	64.6	152 3	159 8	64.4	29.784	66 9	9 30			147.5	159.5	69.0	29.422	53.0
3 30	11.29	65.0	150.5	159.8	65.1	29.768	67.4	10 0			148.0	159.5	68.0	29.427	50.0
4 0	12.09	66.2	149.2	160.3	66 (	29.637	70.0	10 30							
5 0			145.0	161.9	67 4	29.720	66.0	11 0	11.25	64.5	149.5	160.5	65.0	29 570	46.0
5 30	12 37	67.3	143 9	161.2	67.5	29.698	66.0	11 30	11.49	64.0	150.0	157.7	65 0	29.561	45.0
6 0	12.35	67.3	142.9	161.3	67.4	29 691	65.3	12 0	11.39	62.7	150.6	158.4	63.0	29.564	44.0
6 30	12 20	67.3	141.5	160 4	67.2	29.681	64.1	12 30	10.16	61.6	149.7	159.0	62.2	29.587	43.8
7 0	12.01	67.0	141.0	159.4	67.0	29.690	60 3	13 0	9.40	60.7	151.1	157.6	61.3	29 606	43.7
7 30	11.36	66.6	141.5	160 1	66.7	29.682	61.0	13 30	9.09	60.0	152.7	154.7	60.2	29 567	43.5
8 0	11.16	66 3	141.6	159 3	66 2	29 671	60.9	14 0	9.02	60.0	151.8	152 9	59 5	29.611	42.5
8 30	11.08	65.5	141.7	158.7	65.9	29.683	60.6	14 30	9.02	58 3	150 6	149 3	58.2	29.522	41.8
9 0	11.08	66.4	145 3	160.2	65 5	29 699	61.0	15 0	8.07	57.0	152 5	150.6	57.5	29.549	41.0
9 30	11.08	66.0	147.2	159.4	65 0	29.680	60 5	15 30	8.48	56.3	152 6	149.8	56 8	29.530	40.3
10 0	11.08	65 0	146.2	158.6	64.0	29.640	58.0	16 0	8.45	55.9	149 8	149 :	56 2	29 524	39.8
10 30	11.16	65.0	145 5	158 4	64.2	29.693	54.2	16 30	8.05	56.0	152.9	148.8	56 4	29.548	39.3
11 0	11.27	65.0	153 0	157.4	63.5	29.711	52.0	17 0	8.16	56.4	154.9	153.0	56 8	29.515	38.5
11 30	11.40	65 4	149 6	157 1	63.6	29.706	52.3	17 30	8.16	56.8	154.2	154.0	57.2	29.558	38.0
12 0	12.45	64.6	150.3	157.3	63.0	29.725	52 2	18 0	13.42	57.5	149.3	150 9	57.3	29.534	37.0
12 30	12.21	64.0	150.7	157.0	62.6	29.726	52.0	18 30	18 30	57 0	155 6	159.7	57.2	29 558	36.2
13 0	11.07	63 5	150.2	157.7	62.0	29 736	51.2	19 0	18 37	57.0	149 4	163 4	57.5	29 525	36.4
13 30	10.36	62 0	153.1	159.1	61.5	29.731	50.5	19 30	12.49	57.0	166.3	158.3	57.0	29 562	34.7
14 0	10.41	62.5	160.1	155.0	61.0	29 749	49 6	20 0	10 26	56.5	157 9	155.8	56.8	29 565	35.5
14 30	10.41	62 5	151.9	154 6	61 0	29.732	50 0	20 30	8.48	56.2	158 0	152.0	56.1	29.544	34.3
15 0	10.48	63.0	152.2	157.0	61.5	29.752	49.0	21 0	7 00	55 7	158.2	152 6	56.0	29.528	33.6
15 30	10.42	63.3	150.0	156.6	61.2	29.741	48.8	21 30	8.08	56.0	160.1	151.8	55.8	29 530	33.3
16 0	10.48	63.4	150.8	156.3	61.5	29.749	48.8	22 0	8 41	56.0	165.0	151.5	55.8	29 510	33.8
16 30	10.24	63.5	150.9	156 3	62 0	29 729	46.0	22 30	8.23	55.5	159.7	153.7	55.2	29.531	32.6
17 0	10 16	63.0	150.9	156 7	60 5	29.762	45.9	23 0	9.45	55.0	135.0	153.5	55 0	29.558	32.0
17 30	10.45	63.0	151.0	156 5	61.5	29.749	45.0	23 30	14.28	54.8	140.4	151 3	54.7	29.542	31.0
18 0	10 41	63.0	151 2	157 0	61.5	29 728		Nov. 4.							
18 30	10.41	62.5	152 2	156 5	61.0	29.730	43 0	24 0	12.31	54.4	144.1	152.9	54 2	29 565	32.0
19 0	10.34	62.0	152 9	157 0	61.0	29.719	43 0	0 30	11.21	54.6	153 9	154 3	54 2	29.577	33.2
19 30	10 21	61.5	150.5	157 0	60.5	29.702	42.5	1 0	9.00	54.6	159.1	157 7	54.5	29.603	57.2
20 0	10 20	61.5	152 0	156 8	60.:	29.717	41.5	1 30	8.47	54.1	154.7	154.0	53.4	29.668	37.5
20 30	10.21	61.0	152.9	156 7	60.0	29.742	41.5	2 0	7.01	54 2	149.4	159.0	53 3	29.623	38.0
21 0	10.22	61.5	153 0	156.1	60.0	29.746	41.0	2 30	8.37	54.1	151.9	160.7	53 8	29.607	40.0
21 30	10 22	61.0	152.5	155.5	60.0	29.743	41 0	3 0	8.25	54.1	148 0	152 3	53 4	29.614	42.1
22 0	10.26	61.0	152.1	155.0	60.5	29.745	39.4	3 30	7.15	54.0	141.1	163.4	53.2	29 735	43.0
22 30	10.21	61.0	152.2	155.2	60.5	29.749	39.0	4 0	7.35	54.1	141.2	159.8	53.3	29.712	43.5
23 0	10 16	61.0	151.3	155.0	60 6	29 753	38.5	4 30	7.36	54.3	142 9	157.0	53 8	29 689	59.5
23 30	10.15	60.5	151.9	154.9	60.5	29.749	39.0	5 0	7.13	55.5	143.1	158 5	54.7	29 679	47.0
Nov. 3								5 30	8.25	56.5	143.5	157.5	56.0	29.734	50.0
24 0	9.38	60.5	153.9	155.1	60 5	29.753	42.0	6 0	8.57	58.0	142.(	157.9	57 5	29.577	50.5

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Att. Th.	Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Att. Th.
h. m.		°			°		°	h. m.		°			°		°
6 30	+9.40	59.0	143 0	158.0	59.0	29.639	51.0	12 30	+8.53	58.0	151.6	155.2	57.0	29.534	43.0
7 0	10.17	60.0	143 5	157.5	60.0	29.424	50.0	13 0	8.17	58.0	155.4	156.5	57.0	29.549	43.0
7 30	10 29	60.0	143.5	158.9	60.0	29 559	49 0	13 30	9 58	59.0	158.0	157.1	58.0	29 514	42.0
8 0	9.12	60.3	144 5	159.3	60 5	29 539	49.0	14 0	9.17	61.0	157 7	156.0	58.0	29.516	42 0
8 30	9 01	60.3	148.0	161.1	60.3	29.531	48.3	14 30	10.32	59.5	158 6	158.1	58.4	29.595	42.6
9 0	9.46	60 3	150.7	160.0	60.0	29 547	48.0	15 0	10.26	59.1	158 7	156.2	58.3	29.639	47.0
9 30	9.33	59 7	150.0	158.7	59.5	29 554	47.0	15 30	11.11	59 5	157.5	160.9	58.2	29.594	43.0
10 0	9.37	59.3	148 7	156.5	58.8	29.553	46.5	16 0	11.42	60.5	149.5	161.3	59.5	29.582	42.5
10 30	9 48	58 5	147.5	155.6	58.6	29.543	46.2	16 30	12.26	61.3	156.6	161.1	59.8	29.595	43.0
11 0	9.54	59.2	149.5	155.2	58.6	29.534	46 0	17 0	12.43	61.5	150.0	160 0	60.8	29.581	43.6
11 30	9.36	59 8	149.7	155.1	59.0	29.532	46.0	17 30	13.41	61.5	152.4	160.0	62.1	29.612	43.0
12 0	9.48	61.0	151 3	153.8	59.0	29.541	46.0	18 0	16.17	62.0	145.0	162 5	61.0	29.569	43.0
12 30	10.31	60.0	151.8	153.5	58 9	29.511	46.0	18 30	18.04	62.5	141 5	170.2	61.5	29.450	42.0
13 0	10.40	60.0	151.3	154.2	59.0	29.532	46.0	19 0	18.04	62.5	158.0	163.4	62 5	29.573	41.0
13 30	9.15	60.0	148.5	156 8	59.0	29 528	46.0	19 30	18.30	64 2	157.5	162·3	63.6	29.560	41.0
14 0	9.23	59.5	151 2	158.5	58 8	29.519	46 2	20 0	16.16	64 5	158.0	166.2	64.0	29 585	42.5
14 30	9.23	59.8	155.0	161.0	59 0	29.506	46 0	20 30	15.23	64.5	156 0	161.2	64.0	29.585	42.0
15 0	12.40	63.2	146 0	156.8	59.5	29.496	46.5	21 0	14.20	64.5	147.9	161.2	64.0	29.583	41.5
15 30	12.43	62.0	150.0	157.1	62.0	29.475	46.7	21 30	14.11	65.0	151 0	161.0	64.5	29.573	41.2
16 0	11 08	62 0	150.0	160.6	62.0	29 468	46.6	22 0	15 05	65 0	152.0	159 2	65.0	29.540	41.0
16 30	11.41	62 0	151.0	158.4	61.0	29.484	46.5	22 30	14.32	65.5	150 0	159.5	65.0	29 565	41.0
17 0	11.46	62.0	151.1	159.0	60 8	29.464	46 4	23 0	14.08	65.0	150 0	158.7	65 0	29 576	41.0
17 30	11.49	61.5	152.8	160.2	60.4	29 455	45 8	23 30	14.52	65.0	143.5	160 1	65.0	29.561	41.0
18 0	11.35	61 0	145 9	160.4	60.5	29.448	44.5	Nov. 6.							
18 30	11.42	61.0	145.5	159.6	60 0	29.426	43 7	24 0	14.36	65.5	124.0	166.5	65.0	29.585	40.5
19 0	12.49	60.5	154.1	160.5	60.0	29.418	42.0	0 30	12 45	65.0	129.8	164.3	64.9	29.621	40 5
19 30	12 09	61.0	153 8	163.2	59.9	29.421	41.6	1 0	12 40	65.0	134.5	163.5	63.8	29.628	40.5
20 0	13.04	64.0	146.0	161.0	60.5	29.357	42.0	1 30	11 39	61.7	140.2	162.6	62.7	29.631	41.8
20 30	13 22	63 7	141.8	159.8	60.7	29.364	42.0	{1 50	10.43	62.0	141.9				
21 0	13.48	61.5	152.0	159 7	60.7	29 352	42 0	{2 0	10.27	62.0	142 2	162.3	61.8	29.658	41.2
21 30	14.36	62.0	155.5	155.7	61.3	29.348	42.0	{2 10	10.27	61.7	142.1	163.4	61.5		
22 0	14.33	62 5	141.0	164.7	62.0	29 356	42.2	Nov. 8.							
22 30	14.30	62.7	138 1	164.5	62.4	29.373	42.5	{1 50	6.49	36.2	145.1	141.9	34.1		
23 0	14.31	66.5	149.1	154.5	62 9	29 313	43.0	{2 0	6.04	36 4	143.7	140.1	34.6	30.046	31.0
23 30	14.27	63.3	152 3	154.7	63.0	29.317	44.5	{2 10	6 04	36.6	144.7	144 4	34.8		
Nov. 5.								2 30	0.14	37.5	145 0	141.5	35.5	30.051	32.0
24 0	14.18	63 6	149 0	155.2	63.2	29.317	43.3	3 0	1.08	39.6	144.1	142.7	38.0	29.948	33.0
0 30	14.48	64.0	148.6	156.0	63 6	29.299	43.5	3 30	2.16	41.5	142 0	145.1	40.0	30.017	34.0
1 0			145 4	157.8	63 7	29.315	44.0	4 0	3.17	44.0	139.0	148 0	42.3	30.017	34.5
1 30	14.40	63.5	149 5	159.7	65.0	29.337	44.5	4 30	3.06	45.6	137 0	149 0	44.5	29.983	34 5
{1 50	13.17	63.3	148.5	161.4	64 0			5 0	4 21	47.5	135 6	149.7	46.0	29.961	36.0
{2 0	13 11	63.4	148.3	162.7	63.9	29.344	45.2	5 30	5.41	48.0	136.5	149.0	47.0	29.931	34.5
{2 10	13.02	63.2	149.4					6 0	5.03	49.0	134.4	149 1	48.0	29.855	34.5
2 30	12.28	62.9	151.4	161.4	62.9	29.357	45.5	6 30	6.42	50.0	133 5	148.6	48.0	29.863	35.0
3 0	12.28	62.2	155.5	161.5	62.0	29.358	45.6	7 0	6.40	51.5	134.2	150.7	50.0	29.850	35.1
3 30	11.04	61.3	149.4	166.2	61.4	29.394	46.0	7 30	6.40	52 2	138.0	151.1	51.3	29 638	35.5
4 0	11 28	60.8	146.0	168.6	60 3	29.398		8 0	5.41	52 4	136 4	150.0	52 0	29.767	36.1
4 30	10.17	60 5	149.0	165.5	60.0	29.408	46.0	8 30	6 00	52.6	138 0	150.6	52.0	29.772	36.2
5 0	9.31	60.5	148.5	162.8	59 0	29 410	49.0	9 0	6.11	52.9	139.1	149.3	52.3	29.771	36.8
5 30	9.59	60.0	145.2	161.2	59.5	29.409	50.0	9 30	6.12	53.0	140.3	148 8	52.3	29.760	36.9
6 0	10.29	60 0	143.2	160.2	59 5	29.430	49.0	10 0	6.19	53.0	140.8	148.5	52.4	29.760	36.5
6 30	9 08	60 0	142 8	158 8	59.5	29 432	47.8	10 30	6.37	53.7	141.6	148.4	52.9	29.769	36.2
7 0	9.30	60.0	143.5	160.3	59.2	29 319	46.7	11 0	7.48	54.0	142.0	150.2	53.5	29.770	34.0
7 30	9.28	60.0	142.7	161.7	59.0	29 320	56.0	11 30	7.08	54 7	143·3	151.1	53.9	29.804	33.8
8 0	7.46	59 1	143.1	164.0	58 6	29 480	45.0	12 0	6.39	53.5	143.2	152.1	54.4	29 801	33.1
8 30	7.12	58.0	141.9	164.1	57.7	29.479	45.8	12 30	7.01	54.0	148.7	152.4	52.8	29.793	33.1
9 0	6.14	58.0	141 2	165.5	57 2	29.500	45 3	13 0	7.01	54.0	144 0	153.7	53 0	29 805	32.7
9 30	5.52	63 5	149 0	165 1	61.5	29 463	44.6	13 30	6.42	54.2	144 0	151.1	53.0	29.815	32.8
10 0	4.25	62 0	148.2	166.5	61.0	29.436	44 0	14 0	7.00	54 3	144.0	154.6	53.2	29.846	32.5
10 30			146 2	163.0	55 4	29 522	44.0	14 30	7.40	54.5	146.1	152.0	53.4	29.845	33.2
11 0	1.29	57.0	160 0	162.2	54 5	29.516	45.0	15 0	7.38	54.6	146.4	150.9	53 8	29.865	32.5
11 30	6.07	57 5	147.5	153.7	56.0	29.540	43.5	15 30	7.43	54 8	145 0	151.3	54.0	29 886	33.5
12 0	6.48	57.7	154.0	157.0	56.9	29.545	43.0	16 0	7.43	54.6	142.9	152.0	54.0	29.917	34.8

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
16 30	+7.31	54.5	143.5	152.0	54.0	29.927	34.0
17 0	7.31	54.1	143.1	151.4	53.8	29.949	34.0
17 30	8.09	54.0	147.6	152.9	53.5	29.943	33.5
18 0	8.26	54.5	142.9	148.6	53.8	29.938	33.0
18 30	8.30	55.0	144.0	146.8	54 5	29.984	33.5
19 0	9.08	55.8	142.5	150.6	55.3	29.996	33.2
19 30	9.03	56.0	143 8	152.1	55.5	30.005	34.0
20 0	8.39	56.0	143.1	152.3	55.5	30.012	34.0
20 30	8.39	55.8	148.0	153.7	55.8	30.044	34.6
21 0	8.29	56.1	144.5	153.8	56.0	30.049	34.8
21 30	8.30	56.3	142.2	153.1	56.1	30.103	34.9
22 0	8.39	56.2	143.2	154.0	56.0	30.073	35.0
22 30	8.43	56.5	146.8	154.8	56.5	30.115	35.3
23 0	8.47	57.1	141.1	155.2	57.0	30.138	35.5
23 30	9.18	58.4	140.0	153.9	58.3	30.125	35.5
Nov. 9.							
24 0	10.10	59.7	144.8	152.2	59.5	30.149	35.7
0 30	10.27	60.5	146.1	151.9	60.0	30.239	35.5
1 0	10.09	60.0	147.6	153.6	60.0	30.240	35.5
1 30	10.31	58.0	147.6	154.0	58.0	30.307	34.0
{ 2 0	9.16	58.0	148.0	154.7	58 0	30.248	34.5
{ 2 10	9.07	58 0	147.0	156.5	58.0		
2 30	9.48	58.0	147.0	158.5	57.0	30.265	37.5
3 0	9.36	56 8	144.0	158.9	56.5	30.278	37.5
3 30	9.01	56.9	144.9	158.9	56.5	30.295	38.4
4 0	9.01	57.0	142.5	156.5	56.8	30.252	39.0
4 30	9.01	57.5		155.9	57.0	30.249	39.5
5 0	9.04	57.2	137.2	157.2	57.5	30.308	40.0
5 30	9.25	58.5	135.9	157.4	58.0	30.308	40.1
6 0	9.42	58.5	134.7	157 9	59.0	30.310	42.0
6 30	9.42	59.5	135.0	156.0	60.0	30.299	42.0
7 0	9.42	60.5	134.5	157.0	60.0	30.299	42.0
7 30	9.32	60.7	134.3	157.2	60.5	30.292	42.8
8 0	9.24	60.6	134.0	157.8	60.6	30.307	43.5
8 30	9.20	60.0	133.5	156.9	59.8	30.319	40.8
9 0	9.00	59.0	137.0	154.7	59.0	30.347	39.5
9 30	7.32	58.2	136.0	153.8	58.0	30.360	38.0
10 0	7.40	57.5	134.3	154 9	57.0	30.352	38.0
10 30	7.36	56.1	140.5	153.8	56.0	30.371	37.5
11 0	8.00	56.0	142.1	151.1	55.3	30.335	36 2
11 30	7.35	55.5	143.4	150.3	55.0	30.365	34.0
12 0	7.14	54.7	142.4	152.1	54.7	30.348	32.0
12 30	7.51	54.3	144.0	152.1	53 8	30.370	32.5
13 0	6.43	54.0	145.2	152.2	53.4	30.368	32.5
13 30	6.43	54.7	145.1	150.9	53.2	30.363	31.5
14 0	6.38	54.0	145.5	150.9	53.1	30.347	30.7
14 30	6.34	53.7	145 8	151.8	53.0	30.336	29.8
15 0	6.23	53.5	148.4	153.1	52.8	30.367	29.8
15 30	6.18	53.3	144.2	151.6	52.6	30.367	29.8
16 0	6.23	53.5	143.7	151.4	52.5	30.361	29.6
16 30	6.16	53.4	144.0	150.0	52.4	30.365	30.2
17 0	6.21	53.5	142.6	150.7	52.0	30.381	31.5
17 30	6.26	53.0	142.5	149.1	52.3	30.451	32.5
18 0	6.42	53.7	142.1	148.7	53.0	30.453	33.0
18 30	7.13	54.5	143.1	149.8	53.5	30.451	33 5
19 0	7.26	55.0	142.0	149.8	53.8	30.468	32.2
19 30	7.33	55.0	141.7	149.5	54.0	30.485	32.2
20 0	7.31	55.5	142.7	150.1	54.2	30.496	32.5
20 30	8.17	56.0	142.2	149.5	55.0	30.455	32.5
21 0	8 28	56.6	143.0	150.5	55.3	30.448	32.5
21 30	8.40	57.3	142.7	150.1	56.0	30.448	32.5
22 0	9.08	56.8	143.0	149.7	57.0	30.517	32.2
22 30	8.44	57.5	144.0	150.8	58.0	30.446	33.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
23 0	+9.07	58.5	143.5	151.7	58.8	30.578	33.0
23 30	10.30	60.5	143.0	152.8	60.0	30.406	33.0
Nov. 10.							
24 0	9.41	60.0	142.5	154.9	59.5	30.453	32.5
0 30	9.17	58.6	141.6	154.3	59.2	30.473	32.0
1 0	8.40	57.5	140.2	153.9	57.0	30.478	33.0
1 30	8.14	55.8	144.3	156.7	56.2	30.483	34.3
{ 1 50	8.00	55.3	147 1	154 5			
{ 2 0	8.00	55.2	147.7	154.3	55.6	30.487	34.9
{ 2 10	8.00	55.3	147.5	154.7	55.2		
2 30	8.14	55.0	145.6	154 2	55.0	30.495	34.5
3 0	7.24	55.0	144.2	153.5	54.0	30.451	34.5
3 30	8.20	55.5	143.0	153.2	55.0	30.500	34.5
4 0	8.25	56.5	141.4	153.1	55.0	30.490	34.7
4 30	8.29	55.7	139.8	153.6	55.0	30.496	34.6
5 0	8.22	55 7	138.9	154.5	55.0	30.492	34.7
5 30	8.09	55.3	138.0	153.8	54.7	30.465	35.3
6 0	8.33	54.8	137.3	153.4	54.3	30.468	35.0
6 30	7.16	54.3	137.3	152.8	53.7	30.400	35.0
7 0	7.10	54.0	138.3	151.5	53.5	30.455	35.0
7 30	7.18	54.2	139.0	152.0	54.0	30.431	36.0
8 0	8.37	55.0	139.7	150.6	54.5	30.422	34.5
8 30	8.46	56.0	137.9	150.7	55.5	30.423	34.4
9 0	8.57	56.5	138.5	150.1	56.2	30.429	34.7
9 30	8.13	56.5	139.7	152.0	56.2	30.425	32.9
10 0	8.54	56.2	139.2	151.1	56.0	30.430	31.3
10 30	8.45	55.6	141.9	150.6	55.8	30.431	29.5
11 0	8.45	55.5	140.9	150.2	55.2	30.431	28.6
11 30	7.04	55.3	140.0	149.8	54.8	30.424	28.3
12 0			140.0	150.0	54.9	30.403	28.0
12 30	6 31	54.5	139.9	152.2	53.5	30.419	27.5
13 0	6.23	53.7	142.9	153.5	52.8	30.425	27.2
13 30	6.23	53.5	143.9	151.6	52.2	30.422	26.5
14 0	6.34	53.6	144.1	149.0	52.5	30.419	26.0
14 30	6.20	54.1	139.8	151.2	53.0	30.414	25.6
15 0	6 39	54.5	142.0	150.1	53.2	30.419	25.1
15 30	7.05	55.0	144.0	150.2	53.6	30.395	25.1
16 0	7.41	55.8	144.2	150.5	54.8	30.376	25.1
16 30	7.44	56.2	142.0	150.0	55.1	30.380	24.9
17 0	7.48	56.3	140.0	150.8	55.2	30.372	24.8
17 30	8.02	55.8	142.0	152.0	55.0	30.381	24.7
18 0	7.23	55.2	142.0	151.8	54.3	30.389	24.2
18 30	7.27	54.5	139.6	151.6	53.8	30.379	24.0
19 0	7.33	54.2	143.0	151.4	53.0	30.372	23.8
19 30	7.33	54.0	143.0	150.5	53.2	30.367	23.6
20 0	7.44	54.7	144.8	150.6	53.5	30.356	23.6
20 30	8.07	55.0	145.5	151.6	53 8	30.357	23.5
21 0	8.13	55.0	145.5	151.0	54.0	30.345	22.7
21 30	8.07	54.7	146.8	149.8	53.9	30.339	22.7
22 0	8.00	55.2	145.9	150 2	53.9	30.341	22 9
22 30	8.02	55.3	144.8	149.8	53.9	30 367	22.8
23 0	8.00	55.3	145.7	149.3	53.6	30.310	22.3
23 30	7.44	55.0	145.8	148.5	53.4	30.291	22.3
Nov. 11.							
24 0	7.38	54.5	146.8	149.9	52.7	30.282	22.1
1 30	6.37	52.0	146.4	150.7	51.0	30.272	24.8
{ 1 50	6.37	51.7	147.8	150.5	51.7		
{ 2 0	6.37		145.5	150.5	51.8	30.169	28.0
{ 2 10	6 33	51.7	145.1	152.0	52.2		
2 30	7.11	51.6	143 4	156 5	54.6	30.255	30.5
3 0	7.28	52.0	143.4	156.2	59.0	30.259	33.2
3 30	8.00	53.0	140.9	159.0	65.0	30.242	36.5
4 0	8.02	54.0	141.1	159.0	66.5	30.224	39.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
4 30	+8 46	56 0	138 4	159.7	65.5	30.194	41.0
5 0	9.34	57.5	137.5	162.2	68 0	30.164	42.5
5 30	10.13	60.0	155.5	167.1	69 0	30.127	43.5
6 0	10.28	60.5	130.0	170.1	71.0	30.117	45 0
6 30	11.03	61.5	136.5	166.0	70.2	30.033	45.0
7 0	10.45	62 0	136.0	163.0	69.0	30.009	46.3
7 30	11.18	63.2	137.7	162.0	68.2	30.059	47.6
8 0	11.18	63.2	158.2	160.0	68.4	30 052	47.3
8 30	11.19	63.5	158 9	159.3	67.4	30.079	47.2
9 0	11.10	63.5	158.4	159.7	66 5	30.034	46 5
9 30	11 40	63.2	158.9	159 1	65 6	30.055	45.0
10 0	10.20	62.3	160.1	161.0	64.5	30.007	44 6
10 30	8 23	60.5	144.0	159.1	60.5	30.013	40.5
11 0	9.20	59.6	142.5	158 2	61.2	30.004	39 8
11 30	9.27	59.2	142 9	157.3	60.2	29.996	37.0
12 0	9.20	58.5	144 0	155.3	59.2	29 981	36 3
12 30	9.59	59 0	145.3	153.7	57.3	29.951	34.8
13 0	9.56	58 0	146.3	154.1	57.0	30.135	34.5
13 30	9.47	58.0	145.7	153 4	57 2	30.055	34.4
14 0	8.29	57.5	146.0	153.7	57.0	30.133	34 2
14 30	8.26	57.5	146.8	154.1	56.6	29.854	34.2
15 0	8.15	57 2	146.1	153.7	56 6	29 827	33.6
15 30	8.20	56.5	145.0	152.8	56.5	29.886	31.6
16 0	8.33	56.5	143.3	147.2	56.8	29.885	30.6
16 30	8.31	56.6	143.2	153.4	56.8	29 871	30.5
17 0	8.31	56.3	143.7	154.4	56.2	29.872	30.2
17 30	8.19	56.0	143 0	154.4	55.8	29.858	30.2
18 0	8.14	55.5	144.3	154.2	55.3	29.857	30.1
18 30	8.09	55.0	139.4	153.5	54.9	29 845	29.7
19 0	8.24	55.0	128.0	153.5	54.5	29.773	29.0
19 30	9.14	54.5	136.0	153.3	54 2	29.818	30.0
20 0	9.14	54.8	141.7	152.4	54.0	29.745	30 0
20 30	9.06	55.0	143.8	152.9	54.5	29.747	29.6
21 0	9.08	55.0	146.7	151.7	54.5	29.791	30 2
21 30	9.05	55.5	146 8	151.2	55.0	29.779	30.3
22 0	9.15	56.2	147.4	151.6	55.8	29.777	30 7
22 30	9.15	56.5	141.1	153.1	56.0	29.701	31.0
23 0	9.19	57.0	140.2	153.6	57.0	29.749	31.0
23 30	10.49	57.5	141.7	153.4	57.5	29.652	31.0
Nov.12.							
24 0	9.20	57.5	143 5	151.8	57.5	29.707	32.0
0 30	9.20	57.0	141.2	152 3	57.0	29.743	32.0
1 0	9.03	56.5	145.4	152.9	56.3	29.709	33.0
1 30	8.32	56.0	146.3	155.7	56.0	29.700	34.8
{ 1 50	8.32	57.0	147.0	153.6	56.0		
{ 2 0	8.32	57.0	147.7	154.2	56.0	29.669	36.0
{ 2 10	8.31	56.0	145.0	154.2	55.9		
2 30	8.40	56.0	146 5	154.3	56.0	29.518	37 0
3 0	8.47	56.6	148.0	155.0	56.5	29.642	39.0
3 30	9.13	57.4	145.1	156.5	57.2	29.632	39.2
4 0	9.15	57.8	141.2	158 4	57.8	29.597	38.7
4 30	9.16	57.9	143.9	158.3	58.0	29.534	38.5
5 0	9.11	57.3	142.1	156.1	57.5	29.556	37.5
5 30	9.09	57.3	141.2	155.5	57.2	29.529	36.5
6 0	9.19	57.7	140.1	154.8	57.0	29.514	35.7
6 30	9.18	58 0	139.0	155.5	57.5	29.545	36.3
7 0	9.18	58 5	138.0	156.2	58.0	29.463	35.0
7 30	9.24	58.5	139.5	155 7	58.0	29.430	35.5
8 30	8.32	58.0	140.0	156.0	57.0	29.456	37.0
9 0	9.33	57 5	139.5	155.0	57.0	29.326	38.0
9 30	8.13	57.0	138.3	154.5	56 5	29.328	36 8
10 0	8.39	56.5	139.0	155.0	56.0	29.324	36.0
10 30	8.40	56.0	140.0	155.0	55.3	29.364	37.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
11 0	+8.40	55.8	138.9	157.4	55.0	29.339	36.0
12 30	7 32	55.7	142.5	151.0	55.0	29.337	34.0
13 0	7.32	55.3	142.5	151 6	54.5	29.307	33.2
13 30	7.41	55.2	144.8	150.5	54.5	29.316	33.2
14 0	8.00	55.5	144 0	150.2	54.5	29.307	32.9
14 30	8.13	56.0	143.7	150.1	54 6	29.298	33.0
15 0	8.19	55.9	143 5	150.2	54.7	29.293	33.2
15 30	8.17	55.5	143.1	151 0	54.5	29.278	33 1
16 0	8.00	55.5	143.0	150.5	54.2	29.275	34.0
16 30	8.16	55.8	143.1	150.9	54.8	29.277	34.0
17 0	8.31	56 6	143.3	151.1	55.5	29.276	34.2
17 30	9.02	57.3	143 8	152 1	56.2	29 266	35.0
18 0	9.36	58.4	143.3	152.7	57.5	29 260	35.0
18 30	9.43	58.5	143.8	152.9	58.1	29.259	36.2
19 0	10.01	59 2	140.8	154 7	58.5	29 256	36.2
19 30	10.00	58 2	141.8	153.8	58.5	29.255	36.8
20 0	9.34	59.0	142.8	153.4	58.3	29.247	36.5
20 30	9.20	58.6	143.0	153 1	58.2	29 249	36.8
21 0	9.20	58.5	144.7	153.3	58.0	29 240	36.8
21 30	9.32	58.9	144.0	152.8	58.5	29.242	36.8
22 0	9.41	59.2	144.4	152.5	58 5	29.241	36.8
22 30	9.37	59.2	143.6	152 6	58.5	29.243	37.0
23 0	9.45	59.4	145.0	152.0	58.3	29.249	36.5
23 30	10.05	59.6	144.4	152.5	58.5	29.254	37.0
Nov.13.							
24 0	10.00	59.6	146.0	152.2	58.6	29 259	36.0
0 30	10.02	59.2	146.6	152.8	58.2	29.272	35.5
1 0	9.15	58.5	144.7	156 7	57.2	29.282	36.0
1 30	8.36	57.6	147.0	156.5	57.0	29.281	37.0
{ 1 50	8.27	56 7	147.1	156.0	56.6		
{ 2 0	8.27	56.7	147.0	155.1	56 6	29.289	38.0
{ 2 10	8.25	56.3	148.1	154.8	56.6		
Nov.15.							
2 0	2.62	43.1	144 9	143.8	42.0	29 255	38.9
2 30	3.35	44.0	144.7	143.6	42.5	29 245	39.9
3 5	4.33	46.0	142.8	144.1	44.9	29.244	39.2
3 30	5.20	48.1	141.3	145.1	47.3	29.236	41.6
4 0	6.15	49.9	140.2	146.1	51.0	29.225	42.2
4 30	7.00	51.5	139.0	148.9	54.0	29.222	43.0
5 0	7.28	53.0	138.1	151.0	57.0	29.216	45.0
5 30	8.15	54.5	137.7	152.0	59.0	29.162	45.0
6 0	8.28	55.5	137.3	152.2	59.0	29.162	44.8
6 30	8.33	56.0	138.1	147.2	58.5	29.200	45.5
7 0	8.25	56.0	139.2	131.8	57.9	29.182	44.8
7 30	8.33	56.2	140.5	150.9	57.5	29.176	44.1
8 0	8.44	57.7	146.3	150.4	57.7	29.172	44.5
8 30	9.22	57.6	141.8	150.5	58.4	29.170	43.8
9 0	9.36	58.4	142.0	150.6	58.9	29.188	42.4
9 30	9.36	58.5	141.5	151.4	59.0	29.186	41.6
10 0	9.36	59.0	142.1	151.7	59.0	29.175	41.8
10 30	9.27	58.2	141.6	152.1	59.0	29.185	39.8
11 0	9.27	58.0	141.6	153.5	58 3	29.201	38.8
11 30	9.27	58.0	142.3	153 0	58.1	29.193	38.0
12 0	9.27	57.5	141.5	152.5	57 8	29.185	38.6
12 30	9.14	57.5	141.2	152.7	57.5	29.189	38.0
13 0	9.23	57 5	145.0	154 1	57.0	29.193	38.0
13 30	9.17	57.7	149.9	156.9	57.0	29.197	38.5
14 0	9.48	57.3	145.5	154 8	56.9	29 212	38.0
14 30	9.02	57.5	142.1	154.0	56 6	29.161	37.7
15 0	9.05	57.2	141.0	153.2	56.4	29.205	37.9
15 30	9.13	56.8	144.3	148.1	56 3	29.205	37.3
16 0	9.12	56.7	140.1	151.9	56.0	29.207	36.6
16 30	9.03	56.5	145.7	153.5	55.5	29.202	36.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
17 0	+9.07	56.5	142.0	152.6	55.4	29.208	36.3
17 30	9.07	56.5	140.2	152.0	56 0	29.209	36 0
18 0	9.00	57.0	141.2	151.6	56.8	29.224	36.4
18 30	9 16	57.7	141.0	151.6	56.9	29.227	35.0
19 0	9.16	57.5	141.0	151.7	56.8	29.224	34.3
19 30	9.26	57.8	141.0	151.8	56.9	29 263	34.8
20 0	9.38	58 3	141 2	151.6	57.3	29.238	33.8
20 30	10.02	58.8	141.2	151.8	57.8	29.232	33.1
21 0	10.09	59.0	141.8	151 9	58.5	29.251	33.0
21 30	10.10	59.5	142.2	152.0	58.2	29.275	34.0
22 0	9.45	58.5	143 0	152 0	57.8	29.262	34 0
22 30	9.31	58.5	143.0	152.0	57.5	29.258	34.0
23 0	9.28	58.3	142.0	152.0	57.3	29.231	33.0
23 30	9.34	58.3	142.3	151.5	57.3	29.256	32.8
Nov.16.							
24 0	9.48	59.0	142.9	152.0	58.0	29.304	33.0
0 30	10.03	59.0	143.5	152.0	58.0	29.289	32.0
1 30	9.47	59 0	144 9	153.9	57.0	29.241	31.6
2 0	9.27	58.0	144.8	155 2	56.7	29.268	32.0
2 30	9.15	57.2	145.8	154 9	55.6	29 313	33.0
3 0	9.13	56.5	144 4	155.3	54.8	29.310	34.0
3 30	8.44	56.0	142.8	154.0	54 5	29.318	34.2
4 0	8 39	55 6	140.8	153.0	54 2	29.299	35.0
4 30	8 23	55.5	139 9	152.0	54.7	29.215	36 0
5 0	8 23	56.0	139.0	151.0	55.0	29.333	34.7
5 30	8.09	54 8	138.1	150 0	54.2	29.316	34.5
6 0	7.40	54.6	137.4	148.9	53.6	29.309	34.8
6 30	7.38	54.5	137.9	148.0	54.7	29.320	36.0
7 0	7.30	54.5	139.1	147.3	54.7	29 300	35.5
7 30	7.20	54.0	140.6	147.4	54.1	29.305	35.0
8 0	7.10	53.5	140.9	148.2	54 2	29.318	35.0
8 30	7.01	52.5	141.9	148.6	51.6	29.331	34.8
9 0	6.38	52.0	142.0	147.3	50.9	29.320	34.5
9 30	6.35	56.7	142.1	147.4	51.0	29 326	34.5
10 0	6 29	51.5	142.7	146.1	51.0	29.359	32.4
10 30	6.33	51.5	141 5	146.3	51.0	29.403	31.5
11 0	6.33	52.5	142.0	146.0	51.5	29.351	31.0
11 30	7.48	53.0	142.0	146.4	52.0	29.351	30.0
12 0	7.11	53.5	142 0	147.0	52.5	29.335	30.0
12 30	7.35	53.5	142.5	147.0	52.0	29.417	30.0
13 0	7.37	53 5	143 0	147.0	52.0	29.417	30.0
13 30	7.43	53.6	142.5	147.2	53.0	29.424	30.0
14 0	7.42	54.0	142.1	147.7	53 2	29.401	30.0
14 30	8.07	54.5	142.1	148.0	53.7	29.413	29.8
15 0	8.07	54.5	142.4	148.4	53.2	29.429	30.2
15 30	8 07	54.0	142.0	148.0	54 0	29.432	30.5
16 0	8.09	54.0	142.5	149.0	53.0	29.432	31.0
16 30	8.12	54.0	144.5	148.0	54.0	29.411	34.0
17 0	8.20	55 5	141.5	149.5	54.0	29.409	32.0
17 30	8.41	55.0	142.0	150.0	55.0	29.429	31.0
18 0	8.30	55.0	142.0	150.0	54.0	29.462	31.0
18 30	8.43	55.0	141 5	149.5	55.0	29.426	31.0
19 0	9.05	56.0	141.0	149.0	55.0	29.434	31.0
19 30	9.20	56.5	140.5	148.5	55.3	29.442	31.0
20 0	9.27	57.0	141.5	148.5	55.5	29.444	31 0
20 30	9.00	56.5	142.6	147.5	55.0	29.422	30.0
21 0		56.0	143.0	147.5	55.0	29.437	30 5
21 30	8.32	55.0	143.0	147.5	54.5	29.442	30.5
22 0	8.32	55.0	143.5	148.0	54.0	29.424	30.0
22 30	8.32	55.0	142.5	147.5	54.0	29.448	34.0
23 0	8.45	55.0	144.5	148.0	54.0	29.419	34.0
23 30	9.30	55.0	142.0	148.5	54.0	29.413	34.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Nov.17.							
h. m.							
24 0	+8.42	56.0	140.0	150.5	55.0	29.422	35.0
0 30	8.45	56.5	144 0	149.0	54.7	29.535	34.0
1 0	8.30	55.2	144.6	151.2	53.8	29.531	34.2
1 30	8.23	54.0	148.2	149.8	52.8	29.544	35.2
1 50	8.23	53.5	149.0	150.3	52.0		
2 0	8.24	53.5	148.2	150.2	52.0	29.543	37.0
2 10	8.25	53.5	146.2	150.9	52.0		
2 30	8.25	53 8	147.1	150.0	52.0	29.400	38.0
3 0	8.25	54.0	145.5	149.8	52.0	29.544	40.9
3 30	8.42	54.3	143.9	149.8	52.5	29.535	41.0
4 0	9.00	54.5	142.5	150.0	53.0	29 531	40.1
4 30	8.48	54 5	141.0	151.0	54.0	29.531	39.8
5 0	8.43	54.6	139.9	152.0	54.0	29.525	38.0
5 30	8.39	54.5	139 5	151.0	53.0	29.512	37.6
6 0	8.44	55.2	137.0	148.8	53.6	29.507	35.8
6 30	9.09	55.8	137.8	150.9	54.5	29.506	35.0
7 0	9.18	56.5	138.0	151 0	55.2	29.513	35.6
7 30	9.18	57.0	137.8	149.9	56.0	29.513	36.7
8 0	9 19	57.0	138.0	148 5	56.0	29.414	36.0
8 30	9.12	57.3	137.7	149.1	56 2	29.435	36.3
9 0	9.11	57.0	138.5	148.3	55.8	29.427	36.8
9 30	8.46	56.4	139.8	147.8	55.0	29.502	35 7
10 0	8.08	55.5	137.0	149.3	55.0	29.475	35.0
10 30	8.03	54.5	143.0	152.0	53.0	29.470	34.5
11 0	7.32	54.0	140.5	149.0	53.0	29.467	35.0
11 30	7.32	51.0	139.0	146.3	52.8	29.562	35.0
12 0	7.43	54.4	140.3	146.2	53.6	29.572	34.5
12 30	8.46	54.5	141.9	146 6	53.8	29.584	34.0
13 0	8.56	55 2	142.0	146.8	54.0	29.585	33.6
13 30	8.34	55 5	143 2	147.2	55 8	29.612	33.2
14 0	8.34	55.4	147.3	147.2	55.6	29·431	32.9
14 30	8.17	55.2	139.6	146.6	54.0	29.610	32.0
15 0	8.43	55.0	141.0	147.3	53.6	29.617	31.5
15 30	8.43	54.2	141.2	148.0	53.0	29.639	31.5
16 0	8.34	53.6	141 6	147.3	52.5	29.622	30.6
16 30	7.35	53 5	141.8	145.4	53.0	29.615	28.0
17 0	7.27	53.0	140.6	150.0	52.5	29.595	27.5
17 30	7.27	53 2	141 5	148.3	52.5	29.650	27.0
18 0	7.14	52 5	141.1	149.0	52.0	29.538	26.0
18 30	7.15	52 5	142.0	148.0	52.0	29.660	25.5
19 0	7.15	53.5	142.0	148.1	51.5	29.657	26.0
19 30	7.15	53 5	142.0	147.8	51.5	29.689	25.5
20 0	7.15	52.5	143.0	148.5	51.5	29.675	25.0
20 30	7.13	52.5	143.0	148 2	51.0	29.674	25.0
21 0	7.18	51.2	142.8	148.0	51.0	29.679	25.0
21 30	7.33	52.7	142.3	147.1	51.5	29.702	24.8
22 0	7.41	53.0	143.1	148.0	51.4	29.661	24.8
22 30	7.45	53.3	143.1	148.0	52.0	29.608	24.2
23 0	9.05	54.0	144.1	148.3	52.5	29 663	24.1
23 30	9.23	54.5	143.5	148.9	53.3	29.684	24.2
Nov.18.							
24 0	9.27	54.5	144.2	149.0	53.5	29.690	24.7
0 30	9.29	56.0	143 3	144.5	54.0	29.686	24.0
1 0	8.21	54.6	144.2	149.0	53.8	29.693	24.8
1 30	8.31	54.2	146.2	149.4	53.2	29.695	26.0
1 50	8.04	53.5	147.1	150.1	52.6		
2 0	8.01	53 5	148.2	150.7	52.6	29.710	28.0
2 10	8.02	53.4	148 1	150.9	52.6		
2 30	7.49	53.2	147.0	149.8	53.2	29.705	30.0
3 0	8.26	54.0	145.6	149 3	55.0	29.700	31.8
3 30	9.12	55.8	145.0	150.0	57.0	29.701	32.0
4 0	9.39	57.0	142.3	152.2	59.2	29.666	34.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Att. Th.
h. m.		°			°		°
4 30	+10.20	58.3	140.0	153.7	62.2	29.679	34.0
5 0	10.28	58.8	139.2	156.0	64.3	29.666	34.8
5 30	10 24	59.0	137.4	155.0	65.0	29.659	35.6
6 0	10.33	60.0	136.0	154 2	66.0	29.663	36.0
6 30	11 44	61.0	132.8	155.8	66.5	29.666	36.2
7 0	11.59	61.5	133.0	157.8	66.0	29.670	37.0
7 30	11.00	61.5	133.0	157.6	65.0	29.675	37.0
8 0	10.09	61.0	128.9	155.8	63.8	29.675	37.2
8 30	9.48	60.5	123.8	158.7	62.8	29.678	36 5
9 0	9.49	59.5	138.5	158.8	61.4	29.693	35.3
9 30	8.07	58.0	133.0	159.0	59.8	29.701	34.3
10 0	vibrating		131.7	158 9	58.2	29.719	33.0
10 30	5.22	56.5	126.0	156.7	57.0	29.732	31.5
11 0	5.18	56.0	125.0	159.2	56.5	29.752	31.0
11 30	9.32	55.5	168.2	158 0	56.0	29.753	30.0
12 0	—1.25	54.2	147.0	161.5	54.8	29.755	29.7
12 30	3.48	54 0	141.0	159.9	54.6	29.752	29.7
13 0	3.39	55.0	151.5	dist'rb'd		29.753	29.0
13 30	+8.15	56.0	120.0	167.5	55.0	29.745	29.0
14 0	0.00	54.0	137.0	166.4	55.0	29.631	28.5
14 30	0.32	55.5	142.6	168.0	54.5	29.786	28.5
15 0	—0.12	56.0	152.9	166.1	55.3	29.802	28.3
15 30	+3.25	56.5	150.5	174.6	56.0	29.805	28.0
16 0	vibrating		dist'rb'd	dist'rb'd		29.823	27 5
16 30	20.00	56.0				29.662	27.0
17 0	13.12	56.0				29.657	26.3
17 30	12.30	56.0	155.4	178.5	55.2	29.807	27.0
18 0	9.06	56.0	155.0	174.0	55.8	29.810	26.2
18 30	21.27	56.5				29.829	26.0
19 0	19.16	56.5	122.6	161.4	55.4	29.850	25.3
19 30	19.16	56 7	134.6	192.0	55.4	29.841	25.0
20 0	18.40	56 0	152.0	184.6	55.4	29 839	25.0
20 30	18.40	56.1	151.6	172.6	55.4	29.846	25.0
21 0	18.07	56.1	166.7	173.5	55.4	29.858	25.5
21 30	12.24	56.0	161.9	167.3	55.0	29.870	25.1
22 0	9.03	55.7	153.0	163.0	54.6	29.867	25.0
22 30	9.38	55.6	148.9	159.2	54.4	29.868	24.5
23 0	9.45	55 5	147.6	156.6	54.4	29.867	24.0
23 30	10.06	55.2	144.3	156.5	54.0	29.878	23.2
Nov.19.							
24 0	9.33	54.6	126.0	156.2	53.8	29.892	23.4
0 30	10.38	54.0	138.0	154.0	53.0	29.904	23.3
1 0	8.45	53.4	143.2	153.2	52.5	29.906	24.0
1 30	8.11	53.0	145.0	154.8	52.0	29.936	25.6
1 50	8.07	53.1	146.0	157.5	52.2		
2 0	7.49	53.3	143.7	154.2	52.2	29.936	27.4
2 10	7.49	53.6	144.0	154.8	53.0		
2 30	8.25	54.0	143.0	156.0	54.5	29.943	30.0
3 0	8.44	55.0	139.0	158.5	56.0	29.910	34.0
3 30	8.35	56.0	137.0	160.0	56.0	29.907	37.0
4 0	8.35	57.0	135.0	157.0	57.5	29.907	38.0
5 30	9.43	58.0	135.0	157.2	57.0	29.902	39.0
6 0	9.40	60.0	134.0	159.0	54.0	29 937	38.0
6 30	9.12	58.6	134.7	159.1	58.8	29.935	38.8
7 0	9.07	58.3	136.2	157.3	58.4	29.936	38.8
7 30	9.01	58.3	138.6	155.6	58.4	29.924	38.8
8 30	8.33	58.0	139.6	156.4	58.0	29.930	38.2
9 30	7.28	56.6	140.0	157.4	56.6	29.912	36.0
10 0	7.20	56.5	139.8	157.5	56.2	29.911	36.2
10 30	6.01	56.0	140.4	158.8	55.9	29.909	36.1
11 0	6.31	55.7	138.4	159.5	55.5	29.881	36.0
11 30	6.13	56.6	137.0	158.3	55.4	29.887	37.0
12 0	6.04	55.7	140.8	160.0	55.6	29.891	39.1

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Att. Th.
h. m.		°			°		°
12 30	+6.04	56.1	146.6	161.6	56.0	29.898	40.2
13 0	6.22	57.0	171.4	175.1	56.5	29.906	40.2
13 30	8.49	58.0	159.6	168.4	57.5	29.915	39.0
14 0	7.17	58.0	163.5	163.5	57.7	29.931	38.5
14 30	7.49	58.2	151.7	159.0	57.8	29.895	38.9
15 0	8.05	58.6	146.3	160.0	58.1	29.880	38.9
15 30	9.49	58.5	147.0	162.3	58.5	29.865	38.7
16 0	8 35	58.8	145.3	161.5	58.5	29.862	38.0
16 30	11.19	59.0	139.3	160.2	58.5	29.876	38.0
17 0	11.24	59.6	151.2	173.2	58.9	29.862	38.0
17 30	12.00	60.0	168.5	144.6	59.0	29.866	38.0
18 0	18.48	60.5	118.0	167.5	59.4	29.834	37.0
18 30	17.24	60.0	144.0	160.5	59.1	29.862	37.5
19 0	11.39	59.0	141.5	157.5	58.5	29.847	37.0
19 30	10.19	58.5	146.2	160.9	57.9	29.838	37.5
20 0	10.11	58.0	145.5	162.2	57.0	29.826	37.2
20 30	12.13	57.5	132.3	165.1	56.6	29.823	37.3
21 0	12.41	57.2	129.0	158.3	56.8	29.799	37.5
21 30	12.07	57.5	136.7	161.4	57.0	29.804	37.7
22 0	13.03	58.2	127.1	156.7	57.8	29.790	37.7
22 30	15.30	58.7	121.0	153.0	58.5	29.787	38 0
23 0	15.05	59.4	115.7	160.4	59.1	29.785	37.8
23 30	16.08	59.9	110.1	160.6	59.6	29.789	37.6
Nov.20.							
24 0	16.08	60.2	127.2	159.1	59.8	29.784	38.0
0 30	13.11	60.0	146.8	154.0	59.8	29.786	38.0
1 0	11.11	60.0	142.0	153.5	59.4	29.802	38.4
1 30	10.11	59.0	137.2	157.7	59.3	29.805	39.0
1 50	10.03	58.6	133.7	165.0	59.2		
2 0	10.10	58.6	132.4	165.8	59.0	29.801	39.0
2 10	10.11	58.6	129.7	168.9	59.0		
Nov.22.							
1 50	—0.42	35.5	143.9	Wires to the Horizontal Force Magnetometer accidentally broken.			
2 0	0.49	35.5	143.5			29.933	34.2
2 10	1.06	35.6	142.2				
2 30	1.12	36.0	139.5			29.905	36.5
3 0	0.33	37.0	136.0			29.900	38.0
3 30	0.13	38.5	133.0			29 885	39.0
4 0	+1.45	40.5	132.5			29.906	40.0
4 30	2.15	42.7	131.5			29 874	40.5
5 0	3.05	44 5	131 5			29 862	41.5
5 30	3.36	46.2	132.5			29.844	43.0
6 0	4.45	47.5	131.5			29.826	44.7
6 30	4 07	48.5	130.0			29.756	45.0
7 0	4.37	49.7	132.0			29.773	45.8
7 30	5.07	51.0	133.0			29.749	46.1
8 0	6.04	52.0	135.0			29.725	46.0
8 30	5.09	52 5	134.0			29.715	46.0
9 0	6.43	52.8	135.2			29.644	46 8
9 30	6.01	53.4	135.6			29.675	47.0
10 0	6.32	54.4	137.0			29.610	47.7
10 30	7.17	55.8	139.7			29.643	48.5
11 0	8.49	57.0	140.9			29.613	50.0
11 30	8.15	57.5	142.9			29.599	51.7
12 0	7.26	59.0	143.0			29.586	54.0
12 30	6.16	60.0	142.8			29.574	56.0
13 0	10.41	60.5	142.3			29.578	57.5
13 30	10 53	61.0	142.5			29.560	57.5
14 0	10.14	61.8	142.5			29.594	57.5
14 30	10.32	62.0	142.0			29.527	56.3
15 0	10.15	62.5	141.6			29.506	56.0
15 30	11.08	62.8	141.8			29.503	57.3
16 0	11.06	63.0	141.2			29.484	56.4

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
16 30	+11.37	63°.0	146.7			29.471	55°.7
17 0	11.44	62.5	145.8			29.459	55.5
17 30	10.49	62.5	143.0			29.458	55.3
18 0	10.11	62.4	145.1			29.484	55.5
18 30	10.11	61.0	139.7			29.415	56.0
19 0	10.19	62.0	140.5			29.414	56.0
19 30	10.19	62.0	143.0			29.434	57.0
20 0	10.14	62.5	145.2			29.445	56.6
20 30	10.14	62.7	143.2			29.459	56.0
21 0	10.27	63.0	141.5			29.447	52.0
21 30	10.17	63.0	142.0			29.468	51.0
22 0	10.17	63.4	143.2			29.489	52.0
22 30	10.29	63.2	144.0			29.501	52.0
23 0	10.32	63.0	142.7			29.505	51.0
23 30	10.10	63.0	140.0			29.494	49.5
Nov. 23.							
24 0	10.33	62.5	142.0			29.546	47.0
0 30	10.45	62.3	141.4			29.559	47.0
1 0	9.27	61.0	141.4			29.562	47.0
1 30	9.10	60 5	143.0			29.584	47.1
{ 1 50	9.04	60.0	145.1			29.617	47.0
{ 2 0	9.04	59.7	144.1			29.619	47.5
{ 2 10	9.00	59.6	143.7			29.629	47.5
2 30	9.49	59.5	142.6			29.635	47.7
3 0	9.41	59.5	142.4			29.639	48.0
3 30	9.39	59.2	140.0			29.651	49.0
4 0	9.00	60.0	139.2			29.640	50.0
4 30	9.39	61.5	138.0			29.628	50.5
5 0	11.23	63.0	136.2			29.608	50.5
5 30	11.02	64.5	135.0			29.641	51.5
6 0	11.01	65.3	134.2			29.611	51.0
6 30	11.03	66.0	133.8			29.644	50.5
7 0	11.08	66.7	138.2			29.630	50.0
7 30	11.27	67.0	137.0			29.671	49.5
8 0	11.27	67.0	137.0			29.666	48.5
8 30	11.34	66.5	137.0			29.675	47.8
9 0	11.45	65.5	136.7			29.669	47.0
9 30	11.28	65.0	137.7			29.662	45.8
10 0	10.38	63.5	138.7			29.692	44 2
10 30	10.22	63.2	141.2			29.700	41.5
11 0	10.17	61.0	143 5			29.689	41.2
11 30	10.46	60.6	143.8			29.689	41.6
12 0	10.39	60 5	144.3			29.704	39.6
12 30	10.39	61.5	143.9			29.730	39.5
13 0	9.13	60.0	144.1			29.731	39.0
13 30	9.13	60.0	144.0			29.732	39.0
14 0	9.13	60.0	143.5			29.727	39.5
14 30	9.13	60.0	143.2			29.738	39.6
15 0	9.13	60.0	142.3			29.742	39.5
15 30	9.18	60.0	142.2			29.730	38.5
16 0	10.32	60.0	142.6			29.737	39 5
16 30	10.42	61.0	142.0			29.731	38.0
17 0	10.37	60.5	141.7			29.755	36.5
17 30	10.49	59.4	141.7			29.755	36.2
18 0	10.27	60.5	141.1			29.748	34.8
18 30	10.33	60.2	142.3			29.748	34.0
19 0	10.27	59.5	143.0			29.747	33.0
19 30	9.15	57.6	143.0			29.755	32.5
20 0	9.39	58.5	143 0			29.768	33.0
20 30	9.48	57.5	142.2			29.766	33.0
21 0	9.40	58.0	143.5			29.752	33.0
21 30	9.37	59.0	143.0			29.751	33.0
22 0	9.41	57.5	144.5			29.768	33.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
22 30	+9.23	57°.0	138.5			29.790	32°.5
23 0	9.20	57.5	139.0			29.802	32.0
23 30	9.20	57.0	138.5			29.808	32.0
Nov. 24.							
24 0	9.05	57.0	144.0			29.821	31.0
0 30	9.29	56.5	145.0			29.824	31.5
1 0	9.29	55.5	144.4			29.831	32.3
1 30	8.48	54.0	140.0			29.863	33.0
{ 1 50	7.28	53.6	135.7			29.858	35.0
{ 2 0	7 28	53.5	136.2			29.860	35.8
{ 2 10	7.23	53.4	136.9			29.864	36.6
2 30	7.13	53.0	138.2			29.874	38.0
3 0	7.24	53.5	139.0			29.810	40.0
3 30	8.07	54.0	137.0			29.808	42.0
4 0	8.28	55.0	137.0			29.768	42.0
4 30	9.44	56.0	137.0			29.787	42.0
5 0	9.03	57.0	136.7			29.783	43.0
5 30	9.05	57.0	136.0			29.845	45.5
6 0	9.01	58.0	135.0			29.843	46.0
6 30	9.01	57.0	136.0			29.859	45.5
7 0	9.08	58.0	137.0			29.838	45.5
7 30	9.06	58.0	138.0			29.840	45.0
8 0	9.04	58.0	138.9			29.871	44.5
8 30	9.01	57.8	139.6			29.885	44.3
9 0	9.40	57.3	139.7			29.830	44.2
9 30	8.15	56.7	139.5			29.858	41.6
10 0	8.04	56.0	140.1			29.866	40.0
10 30	8.11	55.5	140.7			29.868	38.4
11 0	8.00	55.5	141.5			29.870	36.0
11 30	8 05	55.0	143.0			29.859	36.0
12 0	7.45	54.7	143.5			29.939	35.1
12 30	7.30	54.2	143.0			29.941	35.2
13 0	7.23	53.5	144.0			29.952	34.5
13 30	7.05	53.5	146.4			29.956	34.4
14 0	7.35	53.0	149.6			22.964	34.3
14 30	7.24	53.0	149.0			29.978	34.1
15 0	7.13	53.0	144.0			29.958	34.0
15 30	7.10	52.8	144.0			29.976	32.7
16 0	7.06	52.5	143.0			29.968	31.8
16 30	7.05	51.8	144.0			29.961	31.3
17 0	7.43	51.6	144.0			29.977	31.0
17 30	7.39	51.4	145.0			29.977	30.2
18 0	7.41	51.2	141.0			29.980	30.2
18 30	7.48	50.9	142 7			29.974	29.8
19 0	7.19	51.2	146.2			29.974	30.0
19 30	7.42	51.2	144 1			30.001	30.2
20 0	7.33	50.8	143 1			29.983	30.0
20 30	6.16	50.6	144.2			29.981	30.2
21 0	6.09	50.4	144.0			29.985	29 0
21 30	6 46	51 1	144.4			30.033	29.2
22 0	6.14	50.4	146.2			30.034	29.7
22 30	6.25	50.5	145.0			30.034	29.3
23 0	6.15	50.5	146.6			30 046	28.8
23 30	6.13	50.0	144.6			30.046	28.2
Nov. 25.							
24 0	6.46	49.4	146.7			30.030	29.1
0 30	5.30	48.9	145.0			30.063	30.1
1 0	5.05	47.8	144.1			30.050	31.0
1 30	5.18	48.0	145.0			30.046	32.1
{ 2 0	5.39	49.0	145.1				
{ 2 10	5.46	49.5	145.0			30.102	34.0
2 30	6.32	50.7	144.5			30.027	34.8
3 0	7.33	52.2	144.0			30.011	36.7

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.	Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°					°	h. m.		°			°		°
3 30	+8.04	53.4	144.0			30.037	38.8	10 0	+8.03	57.2	141.1			29.480	31.5
4 0	8.20	54.2	140.7			30.028	40.3		Term	day	omit	ted.			
4 30	8.28	54.8	139.8			30.005	41.4	Nov.29							
5 0	8.00	56 0	139.0			29 982	43.1	{ 2 0	−2.02	30.5	143 8	137.2	29 2		
5 30	9.37	57.5	137.0			29.954	44.4	{ 2 10	2.00	30.5	144.1	137 7	29.0	29.987	22.4
6 0	10.00	58.8	136.0			29.944	43.8	3 30	1.20	31.0	142.5	135.9	29.5	29.944	21.8
6 30	10.00	58.0	136.0			29.923	43 2	4 0	1.33		141.7	136 7	30.0	29.945	21.0
7 0	9.35	59 0	137.0			29.903	42.1	4 30	1.10	32.8	140.9	136.6	31 0	29.906	20.8
7 30	9.35	59.2	138.0			29.885	41.5	5 0	+0.07	34.7	140.0	137 5	34.5	29.893	21.0
8 0	9.43	58.7	138.0			29.894	40.5	5 30	1.05	36.7	139.7	138.3	36.5	29.880	21.2
8 30	10.02	60.0	139.3			29.889	40 0	6 0	1.32	38 5	139.2	138 1	38.5	29.867	21.4
9 0	9.38	59.6	140.3			29.876	40.2	6 30	2.32	40.8	139.2	139.2	41.0	29.895	21.0
9 30	9.40	59.0	141.2			29.871	39.5	7 0	2.46	43.0	139.0	140.6	43.0	29.841	22.8
10 0	9.32	59 2	143.0			29.885	39.2	7 30	4.32	44.5	140.0	142 0	44 8	29.785	23.0
10 30	9.28	58 5	143.0			29.876	38 5	8 0	5.11	46.0	140.5	142.8	46.0	29.787	23.0
11 0	9.19	59.0	143.0			29.808	37.7	8 30	5.22	47.0	140.2	143.1	46 5	29 803	23.0
11 30	9.29	59.0	147.0			29.806	36 3	9 0	5.19	47.0	140 5	143 8	47.0	29.818	22 8
12 0	9.34	60.0	144.0			29.841	34.2	9 30	5.04	46.3	141.3	144.5	46.0	29 800	22.2
12 30	9 09	58.7	142.6			29.798	33.0	10 0	4.42	46 3	143.0			29.791	22 0
13 0	9.02	58.2	142.9			29.798	33.0	10 30	5.05	46.6	142.8	143.8	46.0	29.802	21.8
13 30	8 40	58.0	143.0			29.861	33 0	11 0			142 8	143.8	46.0	29 789	20.5
14 0	8.42	58.0	142.8			29.850	33.0	11 30	5.42	47.3	142.9	143.7	46 3	29 789	21 8
14 30	8.36	57.6	143.0			29.844	32.5	12 0	5.29	47.0	143.0	144 0	47.0	29.785	22.0
15 0	8.37	57.7	143.0			29.792	32.8	12 30	5.29	47.0	143 0	144.0	47.0	29.777	22.0
15 30	9.06	57.7	142.7			29.768	32.2	13 0	5.05	46.8	142.7	144.5	47.0	29.801	21.0
16 0	9.06	57.6	143.0			29 810	32.5	13 30	5.04	46 5	142 0	144.0	47.0	29.778	21.0
16 30	8.49	57.5	142 5			29.748	32.5	14 0	4.45	46.0	142 7	144.5	47.0	29.773	22.0
17 0	9.16	57.7	142.6			29.732	31.8	16 30	3.29	43.5	143.0	144.8	42 0	29.858	24.0
17 30	9.16	60.0	142.9			29.736	33.2	17 0	3.09	43.0	143.1	143.0	41.3	29.854	23.8
18 0	9.35	59.1	142 5			29.730	33.6	17 30	3.18	43 2	142.2	143.2	41.4	29.858	23 2
18 30	9.25	60.0	142.9			29.688	34.0	18 0	4.39	44.0	142 2	142 8	43.5	29 854	23.1
19 0	8.23	57.4	142 9			29.622	34.1	18 30	4.21	45 0	141.9	142.9	44.0	29 868	23.0
19 30	8.44	57.7	142.4			29.632	34.8	19 0	5.12	46.5	141.2	143.6	45.8	29.878	22.8
20 0	8.45	58.0	142.5			29.623	35.6	19 30	5.34	47.5	142.2	144.4	46.7	29.906	22.2
20 30	8.48	58.0	143.0			28.603	34.5	20 0	5.36	48.0	141.1	145 0	47.5	29.897	22.0
21 0	8.32	58.5	143.0			29.582	34 0	20 30	6.01	49.0	142 0	144 9	48.0	29.930	22.0
21 30	8.08	58 0	143.0			29.554	33.1	21 0	6.31	49.5	143.0	145.7	49 0	29.932	22.1
22 0	8 08	56 9	143.0			29.607	34.6	21 30	6.49	50.5	143.3	146.6	49.5	29 939	21.6
22 30	8.08	56.9	143.0			29.621	34.5	22 0	7.11	51 0	142.3	146 3	50 5	29.956	21.1
23 0	8 21	56.5	143.0			29.570	33.5	22 30	7.17	51.5	142.8	146 7	51.0	29 966	21.0
23 30	8.41	58.0	143.7			29.526	34.0	23 0	7.31	51.5	143 0	147.1	51.0	29.987	20.0
Nov.26.								23 30	8.04	52.5	143.6	147.6	52.0	30.008	20.2
24 0	8.41	58.0	145.0			29.508	35.0	Nov.30.							
0 30	8.41	57.9	143.0			29.503	39.6	24 0	8.04	52.5	143.6	148.0	52.0	30.022	19.5
1 0	8.41	57.7	143.0			29.562	40.0	1 30	7.21	51.3	143.6			30.060	21.0
1 30	9.04	57.5	144.8			29.564	40 3	{ 1 50	6.46	50.7	144.2	149.5	49.3	30.083	20.8
{ 2 0	9.20	57.7	145.7			29.562	40.7	{ 2 0	6.37	50.4	144 3	149.7	49.0	30.082	20.9
{ 2 10	9.28	57.8	146.2			29.576		{ 2 10	6.32	50.0	144.7	149 7	48 5	30.085	
2 30	9.24	58 0	144.1			29.545	41.0	2 30	7.15	49.3	144.0	148.7	47.9	30.112	23.0
3 0	9.39	58.5	143.0			29.546	42.0	3 0	7 23	49.3	143.3	148.8	48.2	30.093	23.1
3 30	9.43	58.7	140.4			29.498	40.5	3 30	6.42	49.8	142.3	149.0	51.0	30.117	24 5
4 0	10.02	59.5	141.2			29.477	36.0	4 0	7.06	50.6	141.1	149.3	55.0	30.125	26.0
4 30	9.47	59.5	140.6			29.423	34 5	4 30	7.35	52.0	139.3	152 2	59.0	30.114	26.5
5 0	9.25	58.5	140.2			29.457	33 0	5 0	8 08	53.0	138.4	154.3	61.0	30 098	28.0
5 30	9.08	58 0	140.2			29.443	33.5	5 30	8.03	53.5	137.9	154 0	61.7	30 095	28 8
6 0	9.00	57.5	139.0			29.442	33.0	6 0	8.49	54.7	137.5	154.4	62.0	30.101	30.0
6 30	8.28	57 2	139.0			29.434	33.0	6 30	9.34	56.1	138.1	154.3	62.0	30.118	29.1
7 0	9.00	57.6	140.5			29.461	33.1	7 0	9 42	56.8	138 9	154 2	61.3	30.112	28 9
7 30	8.26	57.4	138.0			29.453	32.9	7 30	9.39	57.2	139 6	153.7	60.8	30.123	29.8
8 0	8.26	57.3	137.4			29.454	32.6	8 0	9.22	56.5	140.5	153 5	59 5	30.126	29.3
8 30	8 26	57.4	139.0			29.460	32.5	8 30	9.11	56.2	142.0	153.2	59.9	30.134	29.3
9 0	8 26	57.8	140.0			29.468	31.6	9 0	9.16	56.2	143.2	152.8	59.5	30.143	29.3
9 30	8.25	57.5	139.8			29.467	31.0	9 30	9.15	56.5	142.5	151.9	59.0	30.145	27.6

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
10 0	+9.21	56.5	142.5	152.4	59.5	30.151	27.0
10 30	9.21	56.5	142.5	152.4	59.0	30.149	26.3
11 0	9.29	56.5	142.8	152.7	59.5	30.155	25.0
11 30	9.29	57.0	142.4	152.6	58.5	30.155	23.4
12 0	9.29	56.5	142.2	153.1	57.5	30.163	23.2
12 30	9.25	56.5	142.9	153.1	57.0	30.169	20.9
13 0	9.25	56.5	142.9	152.5	57.0	30.142	20.2
13 30	9.32	56.5	142.9	152.1	57.0	30.141	20.6
14 0	9.26	56.5	142.9	152.6	56.5	30.141	19.8
14 30	9.16	56.0	142.9	152.7	56.0	30.204	19.0
15 0	9.16	56.0	142.5	152.1	56.0	30.184	19.0
15 30	9.05	55.5	142.5	152.7	55.3	30.186	18.2
16 0	9.00	55.4	142.9	151.6	55.1	30.184	18.1
16 30	9.08	55.5	142.3	150.8	55.5	30.183	17.5
17 0	9.16	55.6	142.2	151.0	55.6	30.185	17.0
17 30	9.19	55.6	142.4	151.0	55.2	30.198	16.0
18 0	8.47	55.0	142.3	151.1	54.6	30.197	16.5
18 30	8.46	54.8	142.2	150.3	54.6	30.197	17.0
19 0	9.08	55.0	142.2	149.8	54.2	30.184	17.0
19 30	9.09	55.0	142.5	149.3	54.2	30.187	16.2
20 0	9.09	55.0	142.0	149.1	54.4	30.207	16.0
20 30	9.16	55.0	142.2	149.1	54.4	30.214	17.0
21 0	9.14	55.0	142.5	149.0	54.5	30.192	18.0
21 30	9.23	55.0	144.7	149.0	55.0	30.184	20.0
22 0	9.17	54.5	145.0	149.0	55.0	30.187	20.0
22 30	9.11	55.0	145.0	149.2	55.0	30.189	
23 0	9.02	55.0	143.8	149.0	54.5	30.184	19.5
23 30	8.30	55.0	144.0	149.5	53.5	30.194	18.0
Dec. 1.							
24 0	8.00	53.5	143.0	149.8	53.5	30.187	17.0
0 30	7.48	53.5	143.9	148.8	53.5	30.230	19.0
1 0	7.38	51.0	142.5	143.2	50.5	30.242	19.8
1 30	6.10	49.5	143.0	148.9	48.0	30.250	19.5
1 50	6.38	48.7	144.7	147.7	47.0		21.0
2 0	6.31	48.4	145.3	147.6	46.5	30.258	22.2
2 10	6.28	48.3	145.1	148.5	46.5		
2 30	6.28	48.0	145.8	146.5	46.5	30.259	23.5
3 0	6.28	48.5	145.0	146.5	47.8	30.266	25.0
3 30	7.11	49.5	145.5	146.3	50.5	30.283	27.0
4 0	8.03	51.0	142.5	146.4	54.6	30.273	29.8
4 30	9.14	53.5	141.5	148.8	59.0	30.238	31.0
5 0	10.11	55.7	140.3	152.7	62.7	30.244	31.6
5 30	11.31	57.5	138.9	154.3	55.5	30.251	31.5
6 0	12.44	59.0	138.5	155.3	56.0	30.231	34.0
6 30	12.44	60.0	137.4	155.5	67.0	30.213	36.0
7 0			136.8	156.5	66.5	30.199	36.0
7 30	12.42	60.5	136.3	157.4	65.8	30.190	36.2
8 0	11.30	59.5	135.7	156.3	65.0	30.178	36.0
8 30	11.38	60.0	136.9	155.3	64.6	30.178	35.0
9 0	11.32	59.8	138.5	155.7	64.0	30.183	33.8
9 30	11.16	59.2	137.7	155.7	62.8	30.181	31.9
10 30	9.23	57.5	139.2	158.2	59.0	30.178	30.8
11 0	7.29	57.5	137.1	157.8	57.3	30.182	29.5
11 30	9.40	57.0	141.5	160.0	56.2	30.182	29.2
12 0	9.11	57.0	145.0	159.4	55.6	30.179	30.9
12 30	8.42	56.5	141.1	157.6	55.6	30.179	30.6
13 0	9.10	56.5	143.0	157.2	55.8	30.179	30.4
13 30	9.18	56.5	145.2	156.0	56.0	30.179	31.2
14 0	9.02	56.1	142.9	157.0	55.5	30.163	29.6
14 30	9.20	56.1	143.2	154.9	55.8	30.146	31.8
15 0	9.33	56.6	142.8	154.5	56.3	30.147	31.8
15 30	9.41	56.7	142.0	153.9	56.5	30.150	31.6
16 0	9.34	56.5	142.0	154.8	55.3	30.141	31.5

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
16 30	+9.34	56.5	142.0	154.9	55.2	30.130	31.3
17 0	9.34	56.0	140.2	154.1	54.8	30.148	30.8
17 30	9.40	56.3	141.4	154.2	55.0	30.142	30.6
18 0	10.03	56.3	144.0	155.1	55.0	30.153	31.2
18 30	11.33	56.0	138.8	152.0	55.0	30.159	31.0
19 0	12.32	57.0	136.7	151.3	55.3	30.169	30.8
19 30	12.02	57.0	140.7	152.4	55.0	30.172	31.2
20 0	12.23	56.3	143.8	153.8	54.7	30.174	31.3
21 30	11.15	55.3	144.0	153.3	54.7	30.254	31.3
22 0	10.42	55.0	144.4	152.7	53.0	30.147	31.9
22 30	9.07	55.0	143.4	151.9	53.0	30.046	32.5
23 0	9.47	53.5	144.5	151.8	54.0	30.058	32.5
23 30	9.34	54.0	143.8	151.7	54.5	30.064	32.5
Dec. 2							
24 0	10.04	54.6	141.6	151.2	54.7	30.096	32.7
0 30	10.25	55.5	141.5	150.8	55.0	30.130	33.0
1 0	10.03	55.5	142.0	151.2	55.0	30.153	34.0
1 30	9.46	56.6	143.4	152.0	60.3	30.164	35.0
1 50	9.33	55.6	144.5	152.7	54.8	30.188	36.0
2 0	9.30	55.5	145.0	152.7	54.8	30.192	35.5
2 10	9.26	55.2	144.7	153.5	54.6	30.197	35.5
2 30	9.19	55.0	145.0	153.4	54.3	30.201	36.0
3 0	9.20	54.5	145.2	153.2	55.2	30.200	39.0
3 30	10.06	57.0	141.9	154.0	58.0	30.199	41.0
4 0	11.12	58.0	140.0	156.7	62.0	30.224	41.0
4 30	12.01	60.3	141.1	158.2	66.3	30.217	41.8
5 0	12.31	61.6	138.0	160.6	69.0	30.203	41.7
5 30	13.02	62.8	135.8	160.6	71.0	30.228	41.5
6 0	13.34	64.0	134.5	161.8	72.0	30.219	42.0
6 30	13.44	64.8	135.0	162.3	72.1	30.199	41.8
7 0	13.42	65.0	135.8	163.2	71.4	30.197	42.0
7 30	13.38	65.2	137.0	162.3	71.0	30.189	42.6
8 0	13.16	65.0	137.9	160.9	69.0	30.177	42.0
8 30	13.10	60.0	138.3	161.6	68.5	30.157	41.8
9 0	12.32	63.5	140.0	161.1	67.0	30.137	41.3
9 30	12.12	61.5	141.0	159.9	65.5	30.183	37.5
10 30	11.00	58.5	142.8	158.4	61.0	30.239	34.0
11 0	10.35	58.0	143.7	157.8	59.0	30.219	33.3
11 30	10.16	56.7	144.0	157.6	57.3	30.208	32.0
12 0	9.45	56.0	142.5	157.6	56.0	30.246	31.2
12 30	9.29	55.5	142.5	157.7	55.0	30.227	30.2
13 0	9.15	55.3	144.7	164.3	55.0	30.251	29.5
13 30	9.00	55.7	146.2	163.8	55.8	30.234	30.0
14 0	9.12	56.0	141.0	159.0	56.7	30.246	29.5
14 30	9.31	57.0	147.1	156.9	56.7	30.198	29.5
15 0	9.18	56.5	147.9	158.8	56.2	30.251	27.2
15 30	9.03	55.7	142.7	158.8	55.8	30.265	26.2
16 0	9.03	55.7	145.2	157.8	55.6	30.229	26.0
16 30	8.46	55.3	144.9	156.4	55.3	30.246	26.0
17 0	9.11	55.0	141.1	155.0	55.0	30.253	26.5
17 30	10.20	55.6	142.3	154.4	56.9	30.250	26.0
18 0	11.35	56.9	145.0	155.0	59.5	30.262	24.5
18 30	12.00	57.3	135.2	155.2	58.4	30.226	26.1
19 0	11.35	57.8	139.5	153.8	58.2	30.253	24.5
19 30	11.42	57.7	140.7	154.4	58.0	30.306	26.1
20 0	11.47	58.5	144.0	155.1	58.7	30.265	27.8
20 30	13.01	59.3	150.0	156.5	59.4	30.255	27.5
21 0	13.04	59.5	143.5	156.1	59.3	30.248	27.5
21 30	12.35	59.3	140.6	156.9	59.0	30.242	26.8
22 0	14.49	59.5	138.2	153.0	59.0	30.234	28.0
22 30	15.48	60.0	127.1	159.0	60.0	30.238	29.0
23 0	16.18	60.5	130.5	150.3	60.5	30.223	28.5
23 30	16.48	60.5	142.2	149.1	60.0	30.214	27.5

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.	Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Dec. 3.								h. m.							
h. m.								7 0	+7.08	50°.5	136.5	150.2	55°.6	29.825	32°.8
24 0	+14.13	60°.0	144.0	150.4	59°.5	30.217	26°.2	7 30	8 31	51.6	136.4	151.0	56.5	29.832	33.1
0 30	13.29	60.0	144.9	153.1	59.8	30.223	26.8	8 0	8.22	53.0	139.0	150.6	57.2	29.850	33.2
1 0	13.08	58.0	141.5	151 8	60.0	30.214	27.0	8 30	8.33	53.4	139.8	150.6	57 2	29.855	33.1
1 30	12.20	59.0	141.0	157.0	60.0	30.219	29.5	9 0	8.33	53.5	140.2	151.0	56.8	29.862	32.2
{ 1 50			136.8	161.0	59.5	30.289	31.5	9 30	8.13	53.0	141.3	151.3	56.1	29.864	31.3
{ 2 0	11.40	59.2	136 3	163.2	59.5	30.204		10 0	8 48	52.5	142.1	150.0	55.0	29.879	30.0
{ 2 10	11.32	59.2	129.4	163.0	59.2	30.205	31.5	10 30	7.23	51.2	143.0	149.0	53.6	29.906	28.0
2 30	11.23	59.0	112.5	173.4	59.0	30.200	32.8	11 0	7.23	51.2	143.0	148.4	52.2	29.908	28.0
3 0	11.38	59.2	112.0	162.0	59.3	30.203	38.2	11 30	7.11	50.8	142.8	148.6	52.0	29.913	27.0
3 30	12.12	60 7	118.5	156.3	61.0	30.193	42.0	12 0	7.14	50.7	143.0	148.4	51.2	29.928	26.3
4 0	12.49	62.2	128 3	158.7	62 5	30.188	43.0	12 30	7.10	50.5	142.7	149.0	50 7	29.945	26.2
4 30	13.11	62.8	131.7	164.1	63.4	30.140	42.6	13 0	7.39	49.8	142.1	150.0	49.7	29.962	26.0
5 0	12.32	63.0	133.2	164.9	63.4	30.139	43.7	13 30	7.10	49.0	142.0	149.0	48.2	29.962	25.4
5 30	12.14	62.8	135.0	164.7	63.0	30.122	44.2	14 0	7.12	48.0	145.0	150.2	46.0	29.974	25.0
6 0	11.30	62.5	130.5	164.5	62.5	30.074	46.0	14 30	6.39	46.4	144.0	148.6	45.5	29.968	24.4
6 30	8.25	62.0	132.0	163.0	61.7	30.075	46.0	15 0	5.16	46.5	146.0	147.7	44.5	29.958	23.8
7 0	9.25	61.2	136 2	159.8	61.0	30.058	46.0	15 30	5.27	46.0	144.4	147.3	44 3	30.002	23.0
7 30	10.10	60 5	136.0	161.2	60.5	30.038	46.0	16 0	5.31	47.0	141.1	147.2	45.5	29.996	23.5
8 0	10.14	60.0	134.5	157.0	61.0	30.011	42.0	16 30	5.31	48.0	142.0	148.2	47.5	30.015	23.7
8 30	11.17	60.8	136.0	159.2	62.0	30.007	40.8	17 0	6.11	49.3	142.8	147.8	48.8	30.016	23.6
9 0	11.25	62.5	136.5	159.0	62.8	29.991	39.3	17 30	6.07	49.4	143.6	149.0	49.0	29.991	24.0
9 30	11.29	62.0	137.5	160.5	61.9	29.957	39.6	18 0	6.30	49.0	143.0	149.7	49.1	30.020	23.0
10 30	10.25	60.5	141.5	159.0	61.0	29.922	39.0	18 30	6.47	49.7	141.7	148.6	49.0	30.009	24.0
11 0	10.09	60.5	142.5	164.0	60.0	29.850	39.0	19 0	7.00	49.3	143.0	150.8	49.0	30.027	21.8
11 30	10.18	60.0	148.0	161.5	59.8	29.891	39.0	19 30	7.23	50.3	143.0	151.0	50.8	30.033	22.0
12 0	8.48	61.0	153.7	163.7	59.0	29.850	39.0	20 0	7.38	51.0	147.4	151.3	51.6	30.039	21.8
12 30	8.29	57.5	146.8	162.2	58.0	29.801	39 6	20 30	7.38	50.8	149.0	151.0	50.8	30.046	22.4
13 0	10.02	58 0	146.7	164.6	57.7	29.747	39.9	21 0	7.22	50.8	147.5	150.1	51.0	30.053	22.1
13 30	10.27	58.0	146.0	161.5	57.7	29.715	40.5	21 30	7.32	51.4	149.0	150.8	51.6	30.043	21.0
14 0	9.20	58.0	146.6	162.8	57.7	29.646	41 0	22 0	8.00	52.1	149.2	150.0	52.7	30.061	20.7
14 30	9 33	58.0	149.0	161.8	57.4	29.607	42.0	22 30	8.18	52.7	149.0	150.1	53 5	30.065	19.8
15 0	9.36	57.3	151.3	160 8	56.7	29.525	42.5	23 0	8.36	53.0	145.2	153.8	54.0	30.063	19.8
15 30	9.18	56.5	145.9	160.3	55.8	29.513	43.2	23 30	9.05	53.5	147.5	153.4	54.3	30.087	19.0
16 0			136.0	161.3	55.2	29.465	44.4	Dec. 8.							
16 30	11.37	56 5	133 9	158.9	54.5	29.438	44.5	24 0	9.37	53.7	151.0	151.1	56.0	30.096	20.7
17 0	10.03	55.5	140.6	156.9	54.1	29.394	45.0	1 0	9.34	55.4	141.6	151.4	56 4	30 042	21.2
17 30	9.22	55.3	144.8	156.5	53.6	29 370	44.7	1 30	10.38	55.3	143.5	153.1	56.2	30.048	23.6
18 0	9.06	55.0	144.9	154.9	53.2	29.284	45.9	{ 1 50	9.20	54.6	145.6	153.8	55 0	30.055	
Dec. 4.								{ 2 0	9.12	54.4	145.1	154.5	55.0	30.055	25.0
{ 1 50	8.18	51.5	143.7	150.3	49.9	29.167	46.2	{ 2 10	8.46	54.1	143.5	153.9	54.5	30.059	25.5
{ 2 0	8.18	51.5	144.4	149.8	49.8	29.167	47.0	2 30	8.18	53.5	142.5	155.3	53.6	30.082	26.7
{ 2 10	8.18	51.5	144.0	150.6	49.8	29.157	47.1	3 0	8.18	52.8	140.0	159.2	53.3	30.090	28.5
4 0						29.086	51.5	3 30	8.12	52.5	133.5	162.6	53.8	30.092	30.5
Dec. 6.								4 0	7.49	53 0	126.7	166.6	56.0	30.070	33.0
{ 1 50	2.44	39.7	144.9	140.7	39.0	29.297	35.2	4 30	7.47	54.5	129.1	165.3	58 8	30 050	34.5
{ 2 0	3.13	40.3	144.6	142.1	39.5	29.294	35.0	5 0	9.38	57.0	127.5	165 7	62.5	30.118	35.5
{ 2 10	3.27	41.0	145.6	142.5	40.2	29.302	35.5	5 30	9.26	58.5	127.5	168.5	64.5	30.080	36.0
Dec. 7.								6 0	9.26	58 5	127.7	167.4	65.8	30.043	38.0
1 0	1.20	29.0	143.2	136.0	26.5	29.619	24.7	6 30	9.19	58.0	127.0	166.0	65.0	30.000	37.0
1 30	—1.20	29.1	144.6	136.3	26.2	29.777	25.0	7 0	9.36	59.0	125.0	164.0	63.8	29.990	37.5
{ 1 50			145.5	135 0	27.0			7 30	9.36	59.0	129.0	162.0	62.7	29.990	39.0
{ 2 0	0.46	29.6	145.7	134.7	27.0	29.784	26.0	8 0	8.23	58.7	128.0	161.4	61.8	29.977	38.4
{ 2 10	0.42	30 0	146.1	134.1	27.7	29.785	26.0	8 30	8.18	58.1	126.5	159.1	60.5	29.964	37.2
2 30	+1.37	31.5	145.4	135.8	30.0	29.772	28.0	9 0	8.03	57.5	131.2	159.4	59.3	29.951	37.0
3 0	1.40	34.5	146.5	137.2	36.0	29.766	29.0	9 30	7.36	57.0	132.2	156.2	58.7	29.938	36.3
3 30	3.23	38.0	145.8	141.0	41.0	29 759	30.0	10 0	7.37	57.0	136.5	158.3	57.8	29.925	34.0
4 0	5.00	42.0	142.5	145.2	44.5	29.752	31.0	10 30	8.05	57.0	141.0	160.5	58.0	29.913	34.0
4 30	6.00	44.5	141.6	147.0	45.0	29.768	31.0	11 0	9.33	58.0	143.0	159.0	58.0	29.969	32.0
5 0	6.00	45.0	140.0	148.0	51.0	29.769	32.0	11 30	9.45	58.0	144.0	161.8	58.0	30.025	31.5
5 30	6.17	46.5	137.2	150.0	54.0	29.759	32.0	12 0	9.32	55.6	144.3	158.3	57.0	30 012	31.0
6 0	6.28	48.5	135.8	150.0	55 0	29.752	31.0	12 30	9.32	55.5	145.8	156.4	56.0	30.010	30.0
6 30	7.42	49.2	137.0	151.5	55.0	29.845	31.0	13 0	9.26	54.4	146 2	156.3	54.5	30 008	29.8

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
13 30	+8.22	54.8	146.0	155.5	54.2	29.996	29.7
14 0	9.36	55.0	145.2	155 5	54.6	29.983	30.4
14 30	9.08	55.4	144.5	155.9	55.2	29.973	30.5
15 0	9.14	55.7	144.0	155.0	55.5	29.960	32.3
15 30	9.28	56.3	143.0	155.4	56.5	29.945	33.0
16 0	10.46	57.1	142.5	155.6	57.4	29.945	34.0
16 30	10.46	57.4	142.2	156.0	57.5	29.951	35.9
17 0	10.35	57.1	141.8	156.0	57.3	29.937	36.6
18 0	9.36	56.5	141.0	155.9	56.5	29.922	36.8
18 30	9.15	56.5	141.0	155.5	56.8	29.904	37.0
19 0	9.15	57.0	141.9	155.7	56.2	29.904	37.0
19 30	9.15	57.0	141.0	155.5	56.6	29.887	37.4
20 0	9.15	57.5	143.0	155.5	56.6	29.890	38.4
20 30	9.37	57.5	141.0	154.9	56.6	25.859	39.0
21 0	10.09	58.5	141.7	154.8	57.5	29.871	40.0
21 30	10.01	60.0	143.5	155.3	58.7	29.855	39.6
22 0			142.7	155.9	60.0	29.845	40.0
22 30	10.31	60.0	143.0	156.1	59.5	29.843	40.0
23 0	10.31	60.0	143.2	156.5	59.5	29.810	40.4
23 30	10.36	60.0	142.2	156.0	60.5	29.826	40.1
Dec. 9.							
24 0	11.10	61.7	143.1	156.0	61.0	29.813	40.2
0 30	11.21	60.0	145.2	156.0	61.5	29.814	41.0
1 0	12 48	62 0	144.5	155 7	62.0	29.831	42.0
1 30	12.48	62.0	144.5	157.5	62.0	29.808	42.0
{ 1 50	11.34	60.2	144.3	158.1	61.5	29.760	42.2
{ 2 0	11.28	60.9	144.0	158.5	61.2	29.764	42.5
{ 2 10	11.17	60.5	144.0	159.1	61.0	29.769	42.5
2 30	12 05	60.5	145.0	158.7	60.5	29.768	42 5
3 0			143.4			29.732	
3 30			141.8			29.696	
4 0			140 2			29.660	
4 30	10.18	57.5	138.0	159.4	56.0	29.624	45.0
5 0	10.00	57.0	136.0	158 5	56.0	29.620	45.0
5 30	9.42	57.0	134.1	158.1	55.5	29.631	46.0
6 0	10.00	57.5	134.9	156.0	56.0	29.622	48.0
6 30	10.00	58.0	132 9	155 5	56.5	29.734	46.2
7 0	9 39	58.0	134.8	156.5	56.8	29.715	45.4
7 30	9.40	58.0	134.0	155.0	56.7	29.731	47.4
8 0	10.05	59.5	136.6	155.5	56.5	29.734	46.9
8 30	10.00	58 5	137.0	154.5	57.9	29.739	46.0
9 0	10.30	59.6	137.6	154 8	59.0	29.715	45.0
9 30	10.46	60.0	140.5	154.7	59.8	29.717	45.0
10 0	11.13	60.3	139.6	155.0	60.7	29.741	44.0
10 30	11.35	61.5	141.0	155.6	61.5	29.726	43.3
11 0	12.02	62.3	141.5	155.0	62 6	29.725	43.0
11 30	12.11	62.5	141.3	156.4	62 8	29.715	41.2
12 0	12.36	62.5	141.5	157.0	62.0	29.731	41.5
12 30	12.26	61.5	142.0	157.0	61.5	29.742	42.0
13 0	12.26	61.0	142.0	156 9	61.0	29.744	42.1
13 30	12.32	61.5	143.0	156.5	61 5	29.746	42 1
14 0	12.32	61.5	143.0	156.0	61.0	29.744	42.0
14 30	12.03	61.0	143.0	156.2	60.6	29.763	42.0
15 0	12 25	61.0	143.0	156.5	60.5	29.758	41.0
15 30	12.25	61.0	143.0	157 0	60.5	29.760	41.0
16 0	11.12	61.0	141.8	158.0	60.5	29.770	40.5
16 30	11.04	60.5	144.0	158.5	59.5	29.766	40.5
17 0	11.48	60.5	143.0	158 9	59.5	29.768	39.5
17 30	11.48	59.0	148.1	157.5	58.5	29.763	39.0
18 0	11.48	59.0	142 9	156.8	58 3	29.757	39 0
18 30	11.48	60.0	146.0	159.5	58.3	29.772	39.5
19 0	11.48	59.5	137.0	162.0	57.3	29.766	39.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
19 30	+12.41	60.0	131.2	155.0	59.0	29.759	39.3
20 0	13.28	61.2	137.7	155.7	60.8	29.752	39.4
20 30	13.46	62.2	143 3	157.0	62.0	29.745	38.0
21 0	13.45	62.4	144.8	158.0	62.0	29.738	37.0
21 30	10.17	62.3	139.6	159.0	62.0	29.734	37.0
22 0	12.02	62.0	141.0	158.7	61.6	29.730	37.0
22 30	12 44	61.7	143 0	156.3	61.3	29.727	36.0
23 0	12.16	62.0	144.9	155.3	61.3	29.730	36.0
23 30	12.06	61.7	144.0	157.5	61.3	29.733	35.0
Dec. 10							
24 0	11.19	60.4	145 5	156.0	60.0	29.737	34.0
0 30	12.36	60.5	145 9	155.8	60.5	29 832	33.5
1 0	12.11	61 0	146.0	157.4	61.0	29.829	33.5
1 30	11.44	61.0	138.1	161.9	60.6	29.832	33.6
{ 1 50	11.44	60.5	129.7	163.4	60.0		
{ 2 0	11.34	60.0	128 2	163.2	60.0	29.824	35.0
{ 2 10	11.28	59.8	127 9	161.9	59.5		
2 30	11.12	59.5	132.2	159 6	59 8	29.825	38.0
3 0	11.24	58.2	136.8	156.4	58.1	29.817	41 8
3 30	11.12	58 0	141.1	155.4	58.5	29.829	44.4
4 0	11.16	58.5	142.5	156.1	59.4	29.824	44.5
4 30	11.17	58.0	140.0	156 5	60.0	29.786	46.0
5 0	12.13	59.0	138.5	157.5	60.0	29.802	47 0
5 30	12.24	58.0	138.0	159 0	60.0	29.771	47.0
6 0	11 11	58.0	137.0	158.5	60.0	29.769	46.0
6 30	11.47	58.0	137.0	158.5	60.0	29.791	47.0
7 0	11.38	59.0	137.0	157.5	59.0	29.787	47.0
7 30	10.27	59.0	136 5	158.7	59.0	29 751	46.0
8 0	10.00	58.6	136.8			29.752	
8 30	10.14	58.5	137 1	156.2	58 5	29.759	43.5
9 0	10.00	58.2	137.0	157.1	58.1	29.746	42.5
9 30	10.21	58.2	137.0	158.0	57.0	29.731	41.0
10 0			139.3			29.723	
10 30	9.12	56.0	141 6	155.0	56.2	29.695	40.0
11 0	9.32	56.0	143.7	153.8	55.2	29 678	41.0
11 30	9.44	56.5	141.2	154.5	56.1	29.668	41.0
12 0	9.49	57.5	141.7	154.8	57.2	29.656	41.0
12 30	10.10	57.9	142.0	154.4	58.0	29.641	41.0
13 0	10.35	58.6	142 0	155.0	59.4	29.616	41.1
13 30	11.36	59.5	142.4	155.3	60.0	29.598	41.3
14 0	11.00	59.4	142.3	155.9	60.0	29.582	41.5
14 30	12.00	60.0	143.0	157.0	60.0	29.541	41.8
15 0	11.41	59.0	143.5	156.0	59.6	29.532	42.0
15 30	11.43	59.0	143 0	156.5	59.5	29.520	42.0
16 0	11.40	58.8	142.0	156.0	59.2	29.508	42.6
16 30	11.43	58.7	142.0	156.0	59.0	29.488	43.0
17 0	11.36	58.5	141 8	156.8	58.5	29.470	42.5
17 30	11.32	58.5	142.0	156.3	58.0	29.446	43.0
18 0	11 27	58.0	141.5	156.0	58.0	29 436	44.0
18 30	11.27	58.0	141.0	156.0	57.8	29.422	44.8
19 0	11.29	58.0	141.5	155.0	57.6	29.422	45 0
19 30	11 34	58.0	141.0	155.0	57.6	29.414	45.5
20 0	11.01	58.5	141.5	154.5	58.0	29.416	47 2
20 30	11.17	59.5	141.7	154.8	59.8	29.391	49 2
21 0	12 09	61.2	141.8	155.3	61 3	29 378	49 0
21 30	12.48	63 0	142.3	156.0	63.6	29.365	49.0
22 0	13.32	64.3	142.1	157.0	65.2	29.354	49.1
22 30	14.08	65.5	142.1	158.0	66.8	29.334	49.0
23 0	14.34	66 5	142.4	159.2	68.0	29.327	49 5
23 30	14.30	67.0	142.2	160.0	68.5	29.336	49.0
Dec. 11.							
24 0	14.27	67.0	142.3	160.6	68.0	29.329	48.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Dec. 13.							
h. m.							
1 50	+0.12	32.8	144.3	135.7	30.5	30.092	27.0
2 0	0.13	33.0	144.1	135.7	31.0	30.089	28.0
2 10	0.24	33 5	145.3	135.7	31.5	30.077	28.0
2 30	1.11	35.2	145.5	137.1	83 0	30.092	30.0
3 0	0.45	36 5	145.3	136.5	34 0	30.063	32.0
3 30	3.11	37.0	144.5	137.5	39.8	30.059	34.0
4 0	5.41	42.5	142.2	140.5	45.5	30.107	37.0
4 30	6.32	46.5	141.3	144.4	52.5	30.108	38.8
5 0	9.00	51.5	140.5	148.8	58.0	30.070	40.5
5 30	10.25	54.5	139.4	150.9	61.8	30.056	39.5
6 0	11.00	56 0	138.0	154.2	63 2	30.047	39.3
6 30	11.13	57.8	136.5	154.6	63.8	30.023	39.8
7 0	11.26	58.3	136.0	155.0	63.6	30.021	39.8
7 30	11.31	58 3	136.0	155.2	63.3	30.005	39.3
8 0	11.23	58 5	137.7	155.1	62.8	30.031	39.3
8 30	11.16	58.5	137.7	154.3	62 5	30.038	38.5
9 0	11.05	58.5	139.0	154.5	62.8	30.033	38.5
9 30	11.48	59.5	140.0	154 5	61.0	30.013	38.5
10 0	11.43	59 0	141.0	155.0	60.0	30.014	37.0
10 30	10.25	59.0	141.0	154.3	60.0	30.006	37.6
11 0	10.16	57.8	142.7	155.9	59.5	30.006	36 8
11 30	10.11	57.5	142 5	154.8	58 8	29.996	36.0
12 0	10.11	57.7	142.3	154.1	58.9	30.000	35.5
12 30	10.11	57.6	142.5	154.2	58.6	29.998	34.2
13 0	10.11	58.0	143.5	153.6	58.4	30.001	33.5
13 30	10.11	57.1	143.7	153.7	58.0	30.001	32.5
14 0	10.08	57.0	143 9	153.7	57.5	30.000	32.5
14 30	9.28	56.5	143.9	153.3	57.0	29.993	31.7
15 0	9.18	56 0	143.9	153.3	56 7	29.988	31.4
15 30	9.46	56.1	143.4	153.2	56 6	29.998	30.1
16 0	9.23	55.5	143.7	153.6	55.5	29.993	30.5
16 30	9.28	55 2	143.2	153.6	55.5	29.999	30.3
17 0	0.35	55.4	143.4	154.0	56.0	30.021	31.2
17 30	9.44	55.6	143.2	154.0	56.0	30.027	33.0
18 0	9.09	56.0	145.2	151.9	56 0	30.025	33.4
18 30	11.02	56.0	140.3	149.5	56.0	30.017	33.5
19 0	11 26	56.0	141.0	155.0	57.0	29.996	33.6
19 30	10.37	56.5	143.2	155.6	57.0	29.975	34.5
20 0	10.41	56.8	146 0	153.8	57.4	29.967	35.0
20 30	10.45	57.8	144.8	154.1	58.4	29.939	34.3
21 0	10.42	58.0	144.5	153.4	58.6	29.927	34.6
21 30	10.44	58.1	145.5	154.1	58.6	29.902	35.5
22 0	10.40	57.9	144.8	153.4	58.5	29.884	37.0
22 30	10.41	57.8	147.0	153.0	58 4	29.836	38.0
23 0	10.35	57.7	144.2	153.0	58.1	29.858	38.5
23 30	10.31	57.5	143.5	153.4	57.8	29.869	39.0
Dec. 14.							
24 0	10.36	57.7	144.3	153.1	58.0	29.850	39.5
0 30	10.35	57.7	144.5	152.8	58.0	29.828	39.5
1 0	11 00	58.0	145.4	153.0	58 0	29.837	39.2
1 30	11.34	58.0	147.0	155.0	58 0	29.842	40.5
1 50	10.34	57.5	145.8	155.2	58 0	29.846	41.5
2 0	10.31	57.5	145.5	155.3	58.0	29 837	41.5
2 10	10.31	57.5	145.4	155.3	58.0	29.830	41.8
4 0	11.05	59.8	142.6	152.9	59 0	29.770	43.5
6 0	11.24	60.0	137.3	155.3	60.0	29.641	45.0
10 0			140.4				46.2
12 0			141.6				46 8
13 50	9.42	58.7	143.0	160.2	58.3	29 623	47.5
14 0	10.15	58.7	147.3	162.4	58.1	29.626	46.5
14 10	10.20	58.7	149.3	162.9	57.9	29.629	45.5
16 0	10.30	56.8	140.0	158 6	55.8	29.615	42.0
h. m.							
18 0	+10.23		140 5	156.4	56.5	29.616	39.8
20 0	10.21	58.8	143.0	156 7	59.5	29.620	36.2
22 0	9.49	57.0	143.1	157.8	57.2	29.640	37.0
Dec. 15.							
24 0	11.04	59.5	141.9	156 4	60.8	29.646	41.0
1 50	10.48	59.5	145.4	159.2	60.0		
2 0	10.34	59.2	145.6	159 8	59.5	29.853	37.0
2 10	10.26	59.0	146.0	159.4	60.0		
4 0	9.30	56.5	144.0	160.0	59.5	29.828	41.8
6 0	11.20	61.1	138.5	162.8	67.5	29 856	45.3
8 0	13.06	64.5	139.5	162 7	69.0	29.860	47.0
10 0	11.41	61.7	141.3	161.2	63.7	29.864	41.2
12 0	10 42	58.3	144 7	159.6	57.9	29.898	39.0
13 50	9.37	55.5	144.4	156.0	54.8	29.889	39 0
14 0	9 37	55.5	144.4	155 6	55.0	29.890	39.0
14 10	9.34	55.8	144.4	154.8	55.0	29.891	38.9
16 0	10.20	58.0	141.5	155.5	58.0	29.909	40.0
18 0	11.32	60.5	141.8	157.7	61.1	29.892	40.3
20 0	11.30	60.7	141.8	159.3	61.3	29 899	40.0
22 0	12.36	62.3	144.6	159.4	63 3	29.872	39 0
Dec. 16.							
24 0	12.42	63.0	143 5	159.7	63.8	29.870	39.0
1 50	12.13	62 0	146.3	158.5	62.5		
2 0	12.16	62.0	145.6	158.1	62.5	29.881	39.0
2 10	12.12	62.0	144.0	158.7	62 5		
4 0	11.00	60.0	138 5	163.5	59.0	29.888	40.9
7 15			135.5	157.0	56.2	29.805	44.0
8 0	9.24	56.2	135.5	158.0	55.6	29.794	42.5
10 0	8.03	55.2	145.0	160.4	55.3	29.742	42.2
12 0	9.23	57.7	143 3	160.0	57.3	29.733	41.0
13 50	9.03	57.0	145.0	158.4	56.5	29.721	40.3
14 0	9.09	57.0	144.0	158.4	56.3	29.699	39.9
14 10	9.13	57.0	145.0	157.9	56.0	29.677	39.5
16 0	8.26	54.0	143.7	156.1	53.0	29.647	38.0
18 0	9.17	55.3	140.7	153.1	54.6	29.614	37.8
20 0	8.32	54.5	141.5	153.8	53.8	29.537	37.0
22 0	8.47	54.0	141.0	152.3	53.5	29.491	34.5
Dec. 17.							
24 0	8.12	52.5	144.5	151.1	52.0	29.439	32.0
1 50	7.13	50.3	144.0	152.2	49 0	29.444	32.0
2 0	7.13	50.0	139.9	153.5	50 0	29.434	32 0
2 10	7.18	50.0	140.0	152.5	50.0	29.432	32.0
6 0	5.40	47.3	136.1	152.5	46.8	29.261	32.2
8 0	5.04	47.2	136.5	151 0	47.0	29.252	32.2
10 0	4.44	44.7	140.5	149.6	44.3	29.213	32.2
12 0	4.10	45.5	149.9	151.5	44.3	29.261	34.5
13 50	5.17	47.5	143.7	150.5	47.2	29.265	36.3
14 0	5.29	47 5	149.0	151.0	47.5	29.255	
14 10	6.44	48.0	149.6	150.2	48.0	29.245	33.3
16 0	8.07	51.4	149.0	153.2	51.7	29.244	32.0
18 0	9.08	53.5	141.4	154.0	53.8	29.187	32.0
20 0	10.21	55.0	140.1	153.0	55.2	29.162	32 0
22 0	9.34	56.0	140.9	153.9	57.0	29.095	30.3
Dec. 18.							
24 0	9.17	55.5	142.5	153.2	56.0	29.129	28.5
2 0	7.12	51.0	145.6	153.0	51.0	29.137	27.0
2 10	7.00	50.5	145.6	153.1	51.0	29.137	
Dec. 20.							
1 50	8.21	24.5	130.5	136.3	22.0		
2 0	8.20	24.7	143.1	136.6	22.5	29.970	25.0
2 10	8.27	24.9	144 5	135.7	22.5		
3 30	6.45	29.5	145.3	137.5	28.0	29.978	27.5
4 0	6.31	31.5	141.1	140.7	30.5	29.974	29 0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
6 0	+4.30	42.0	135.5	148.2	48.0	29.952	32.3
8 0	6.45	48.5	136.5	150.9	50.6	29.956	31.8
10 0	6.36	47.8	141.0	150.5	48.0	29.953	28.8
12 0	6.23	47.2	144.5	150.8	47.1		28.9
13 50	6.14	48.0	145.5	146.8	46.5	29.961	27.0
14 0	6.30	48.0	145.0	146 8	47.5	29.942	27.0
14 10			145.0	147.0	47.0	29.923	27.0
16 0	8.42	51.0	143 0	151 8	50.0	30.024	23 0
18 0	9.49	52.6	142.0	153 0	52.3	29.982	25.0
20 0	8.42	53.0	141.0	154.6	52.8	30.023	24.7
22 0	9.18	53.5	139.6	153.5	53.5	30.033	20.8
Dec 21.							
24 0	9.31	55.5	142.0	154.9	56.0	30.066	18.5
1 50	9.01	53.5	144.6	155.0	54.0	30.116	17.0
2 0	8.44	53.2	144.8	155.2	53.5	30.115	17.5
2 10	8.42	53 0	145.2	155.2	53.5	30.121	17.7
3 30	8.39	52.0	145.0	154.9	51.2	30.142	19.0
6 0	5.23	46.1	137 8	154.6	45.4	30.118	18.7
8 0	5.49	44.7	139.0	151.7	43.9	30.142	18.0
10 0	4.14	42.4	142.2	146 7	42.2	30.209	17.9
13 50	4.21	42.1	144.5	147.0	41.4	30.327	12.5
14 0	4.19	42.5	143 9	146.9	41.5	30.324	
14 10	4.25	42.7	143.8	145.5	41.5	30.322	12 4
16 0	3.34	40.6	144.0	146.8	40.1	30 365	12.2
18 0	3.34	40.3	141.5	145.1	39.7	30.390	9.9
20 0	3.40	41.0	139.9	145.1	40.8	30.440	7.4
22 0	3.23	39.5	141.5	143.3	39.4	30.475	6.5
Dec. 22							
24 0	2.43	38.5	142.5	142.3	37.3	30.556	7.0
1 50	3.21	39.3	144.9	142.0	38.0	30.606	8.0
2 0	3.18	39.4	145.1	142 2	38.2	30.606	8.0
2 10	3.18	39.5	145 6	142 2	38.5	30 605	8.5
8 0	5.33	49.5	132.0	156.9	56.0	30.592	17.8
	Term	day	omit	ted.			
Dec. 23.							
12 0	5.39	48.5	138 8	149.5	47.5	30.417	24.3
16 0	7.00	49.5	143.0	149.8	48.0	30.192	33.2
18 0	9.05	52.3	140.7	148 8	51.0	30.080	35.2
20 0	10.18	54 6	140.8	152 3	54.1	29.921	37.8
22 0	9.36	55.3	140.5	152.5	54.5	29.750	40.0
Dec. 24.							
24 0	10.21	56.7	142.0	152 8	56.0	29.621	45 0
1 50	11.24	56.7	138.3	153.1	56.0	29.654	48.1
2 0	10.07	56.6	138.8	153 2	55.9	29.646	
2 10			138.2	154.3	55.8	29.638	48.3
4 0	10.00	55.8	141.0	155.5	55.0	29.612	49.6
6 0	9.26	56.9	135.7	165.5	64.5	29.645	45.8
8 0	8.39	51.0	140.3	158.1	58.2	29.778	38.0
10 0	7.48	52.8	140.3	156.3	53.2	29.833	33 2
12 0	6.28	50.2	154.7	152.4	50.0	29.885	30.7
13 50	6.35	50.0	142.8	153.6	48.9	29.880	29.7
14 0	6.35	50.0	144.5	151 3	48.9		
14 10	6.38	50.0	144 5	150.8	48 9	29.880	29.8
16 0	6.34	49.7	145.3	152.8	48.1	29.950	28.6
18 0	6.31	50.3	142.5	151.0	49.1	29.941	28.7
20 0	7.31	51.5	140.8	153.0	50.5	29.936	28.9
22 0	7.35	51.0	135.4	154.3	50.9	29.941	30.0
Dec. 25.							
24 0	7.20	51 0	142.0	151.6	50.8	29.963	29.2
1 50	7.29	51.2	144 3	152.2	51.2	29.967	30.0
2 0	7.17	51.3	145.0	152.6	51.3	29.970	
2 10			145.0	152.6	51.2	29.972	30.7

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Dec 27.							
h. m.							
1 50			144.5	135.8	19.0		
2 0	−5.03	20.6	144.8	134.1	19.5	30.140	18.0
2 10	5.08	21.0	144.3	135.1			
4 0	4.04	24 0	142 7	140 6	31.0	30.169	25.0
6 0	2.43	28 1	146.4	138.5	37.3	30.158	28.6
8 0	0.25	34.4	143 5	138.5	36.8	30.126	30.8
10 0	0.41	35.7	142.2	141.9	36.6	30.150	27.4
12 0	+5.45	48.5	143.0	145.0	44.3	30.143	26.9
13 50	5.41	44.2	142.8	147.8	44.5	30.157	24.3
14 0	5.38	44.0	142 8	147.9	44.5	30.182	24.2
14 10	5.34	43.8	143.0	148.1	44.2	30.208	24.1
16 0	3.33	42.0	142.5	148.0	41.0	30.129	25.5
18 0	4.35	43.0	142.6	147.0	42.1	30.126	26.1
20 0	6.48	48.2	142.1	149.2	48.1	30 146	28.0
22 0	9.07	53.5	142.0	152.8	51.7	30.120	27.7
Dec. 28.							
24 0	9.08	52.5	143 9	153 2	50.5	30.133	29.5
2 30	7.25	50 0	145.0	153.1	50.2	30.137	32.7
4 0	7.48	48.0	142.0	155.0	46.0	30.159	33.0
6 0	7.06	49.8	137.8	154.3	48.8	30.051	35.6
8 0	7.12	50.3	139.0	152.0	49.5	30 058	36.2
10 0	7.36	49.5	140.0	153.0	49.0	30.150	32.5
12 0	5.06	46.0	142.5	150.7	44.5	30.061	27.7
13 50	5.42	45.5	145.2	147.8	43.6	30.078	28.7
14 0	5.07	46.0	145.0	147.9	43.7	30.080	28.8
14 10	5.09	46.0	144.9	147.9	43.8	30.083	29.0
16 0	6.02	47.3	143.5	148.8	46.1	30.110	27.1
18 0	6.19	48.4	142.6	149.7	47.7	30.089	25.9
20 0	6 35	47.5	142.0	148 6	45.1	30.124	24.0
22 0	7.31	51.4	144 1	150.4	50.2	30.115	24.6
Dec. 29.							
24 0	7 29	50.5	145.0	149.8	49.5	30.170	26.4
1 50	6.37	51.5	145.0	150.7	50.9	30.169	27.0
2 0	6 41	51.5	145.1	150.4	50.9	30.155	27.0
2 10	6.41	51.3	145.8	156.0	50.9	30.142	27.0
4 0	8.33	52.0	140.1	156.2		30.182	30.5
6 0	8.23	53.0	138.3	157.9	57.1	30.172	37.9
8 0	9.16	54.5	139.2	155.0	56.0	30.165	37.8
10 0	8.31		142.0	153.0	58.9	30.233	35.0
12 0	10.47	56.8	143.6	148.8	56.6	30.240	33.1
13 30	9.33	50.5	144.2	155.3	55.2	30.310	31.0
16 0	7.30	49.7	146.2	151.7	48.4	30.287	27.8
18 0	7.35	46.3	143.7	148.4	45.0	30.320	24.0
20 0	6.12	47.5	144.8	147.1	45.3	30.337	25.2
22 0	7.14	49.2	142.9	147.1	48.4	30.317	25.0
Dec. 30.							
24 0	8.00	51.0	146.2	146.8	50.1	30.292	26.0
1 50	8.48	52.6	137.1	153.7	53.0		
2 0	8.41	52.6	134.1	156.0		30.257	29.5
2 10	8.48	52.6	132.3	156.8	53.0		
4 0	9.34	50.7	135.5	151.4	50.4	30.095	33.0
6 0	7.03	49.5	121.5	159.6	48.8	30.043	37.0
8 0	4.32	49.6	127.2	160.0	48.8	29.999	37.0
10 0	6.25	49.0	135.5	138.0	48.0	29.971	32.0
12 0	3.40	48.6	140.5	162.2	47.8	29.957	30.7
13 50	6.29	51.0	143.5	158.5	50.3	29.896	30.8
14 0	6.29		145.0	159.6	50.3	29.861	30.9
14 10	6.40	50.9		158.3	50.4	29.826	31.0
16 0	8.01	52.0	145.5	157.0	52.3	29.851	31.0
18 0	8.38	53.2	142 4	158.4	53.2	29.800	32.2
20 0	9.46	54.5	141.8	159.0	54.8	29.827	28.0
22 0	10.09	55.1	144.8	158.1	55.0	29.835	27.5

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Dec. 31.							
h. m.							
24 0	+8.39	53.0	139.0	156.3	53.0	29.854	24.0
1 50	7.44	51.5	141.5	157.1	50.6	29.864	25.2
2 0	7.36	51.5	142.2	156.9	50.6	29.860	26.2
2 10	6.28	51.5	143.0	156.5	50.6	29.857	27.2
4 0	9.18	55.0	143.2	161.3	59.0	29.825	35.5
6 0	10.24	58.2	139.2	171.1	68.4	29.715	39.7
8 0	11.07	58.6	139.6	163.8	62.0	29.688	38.0
10 0	8.42	55.9	144.8	163.5	57.3	29.666	36.5
12 0	8.23	53.2	143.9	155.6	53.4	29.664	33.7
13 50	9.38	54.4	144.0	157.0	54.0	29.642	32.4
14 0	9.43	54 5	144.0	156.6	54 0	29.652	32.5
14 10	9.46	54.5	143.5	156.7	54.0	29.662	33.0
16 0	8.22	52.0	144.0	155.3	51.5	29.761	32.5
18 0	7.05	54.0	143.5	155.5	51.0	29.761	27.0
20 0	8.42	53.0	143.5	155.5		29 750	21.0
22 0	9.40	50 0	144.8	155.0	52.0	29.742	17.0
Jan. 1,	1842.						
24 0	8.33	48.0	143.0	153.0	53.0	29.853	16.0
1 50	6.42	45.6	133.3	150.8	44.2		
2 0	6.41	45.5	132.9	150.7	44.2		
2 10	6.32	45.2	140.4	150.2	44.0	30.124	16.5
Jan. 3.							
1 50	—1.47	26.5	145.9	135.5	24.5	29.789	7.3
2 0			146.0	135.6	25.0	29.783	8.0
2 10			145.9	136.0	25.0	29.787	8.0
4 0			140.5	147.5	42.5	29.834	11.5
6 0	0.19	31.7	135.0	161.2	64.0	29.851	14.0
10 0	1.19	29.0	139.3	154.6	46.5	29.973	13.2
12 0	2,31	26.6	139.8	149.0	49.8	29.998	13.0
13 50	4.48	24.0	139.1	152.2	49.8	30.019	12.5
14 0	4.36	24 0	139.6	152.2	49.8	30.035	12.6
14 10	3.20	24.0	140.9	152.6	49.8	30.052	12.8
16 0	4.35	22.5	140.5	152.5	48.4	30.019	12.1
18 0	4.40	22.3	138.1	150 8	48.5	30.021	13.9
20 0	4.20	23.0	141.0	151.9	50.0	29.978	15.8
22 0	4.09	23.1	141.8	152.1	50.7	29.857	17.0
Jan. 4							
24 0	4.02	23.4	142 9	152.0	49 6	29.852	17.5
1 50	3.23	23.3	140.7	152.3	47.0	29.716	22.0
2 0	3.22	23.5	141.9	152.1	47.0	29.705	22.0
2 10	3.25	23 6	143.1	152.5	47.0	29.714	22.5
4 0	2.27	25.5	139.5	153.0	45.0	29.648	25.5
6 0	1.33	29.3	136.3	152.2	48.0	29.546	28 6
8 25	0.37	32.3	138 0	153.4	55.0	29.587	28.0
10 0	+0.27	32.3	140.4	152.6	54.0	29.651	23 4
12 0	1.21	30.5	142.1	152.0	50.5	29.663	18.1
13 50	1.32	29.2	143.2	153.0	48.5	29.710	18 0
14 0	1.38	29.2	143.1	152.8	48.5	29.711	18.0
14 10	1.42	29.5	142.8	152.6	48 5	29.712	18.0
16 0	—1.22	30.5	151.5	153.3	45 0	29.703	17.5
18 0	1.42	29.6	140.4	148 9	46.1	29.699	19.4
20 0	1.40	30.0	143.2	151.5	50.5	29.741	17.0
22 0	1.32	29.3	139.0	151.3	50 6	29.732	18.2
Jan. 5.							
24 0	1.32		143.4	154.1	54.5	29.817	24.0
2 0			147.2	154.1	50.0	30.090	20.0
4 0	1.09	28.5	139.2	160.1	59.6	30.124	24.0
6 0	0.42	31.7	135.8	167.0	70 6	30.120	23.7
8 0	+0.31	32.9	138.2	158.1	58.0	30.259	20.0
10 0	0.33	31.4	139.0	157.2	54.8	30.319	17.0
12 0	—2.04	29.2	161.6	158.9	51.5	30.386	12.9
14 0	2.45	27.1	144.0	151 8	49.9	30.459	12.3
h. m.							
16 0	—2.42	25.0	143.2	151.9	44 0	30.459	8.8
18 0	3.15	23.0	142.3	149.1	43.7	30.473	7.2
20 0	4.23	21.2	142.1	150.7	48.1	30.524	6.0
21 0	5.39	20.0	141.4	151.3	48.4	30.506	6.0
22 0	4.48	29.8	142.2	151.4	47.6	30.522	3.7
Jan. 6.							
24 0	6.06	18.0	143.0	150.6	46.3	30.541	2.8
1 50	6.25	17.0	145.5	151.4	46.0	30.556	4.2
2 0	6.37	17.0	145.2	152.4	46.0	30.556	5.0
2 10	6.37	17.0	146.1	152.2	46.0	30.545	5.2
4 0	5.37	18.0	141.8	156.3	51.6	30.538	14.9
6 0	4.09	22.9	135.7	159.1	54.7	30.405	21.7
8 0	2.17	25.8	135.3	153.6	50.2	30.351	25.4
10 0	2.18	26.6	138.7	150.6	51.9	30 334	25.0
12 0	2.20	27.0	138.5	153.2	52.0	30.220	26.0
16 0			147.2	149.0	46.8	29.871	32.6
18 0	0.27	29.8	144.5	151.3	49.0	29.764	34.3
20 0	+0.30	32.5	141.5	155.3	53.5	29.594	42.5
22 0	2.01	35.2	138.7	156.5	55.2	29.512	43.2
Jan. 7.							
24 0			144.4	157.0	57.5	29.455	44.3
1 50	2.41	39.0	143.0	159.7	57.0		
2 0	2.45	39.0	143.2	159.3	57.0	29.464	42.7
2 10	2.45	39.1	143.3	159.2	57.0	29.478	42.6
4 0	3.11	40.5	139.5	159.5	55 0	29.461	43.0
6 0	3.30	41.3	137.4	160.0	53.7	29.439	44.2
8 0	3.46	42.2	135.0	154.2	54.0	29.503	45.0
10 0	3.23	42.0	139.3	156.6	56.0	29 584	42.5
12 0	3.38	41 5	141.1	154.9	55.0	29.670	39.7
18 0			142.1	155.0	52.3	29.937	30.9
20 50	1.26		141.5	153.1	51.8	30.009	26.2
22 0	0.01	34.1	141.9	153.1	51.5	30.046	24.0
Jan. 8.							
0 20			143.2	153.2	51.1	30.132	20.8
0 45	—0.27	31.4	145.0	153.8	50 1	30.152	20.4
1 50	0.18	30.5	146.0	154.5	48.0	30.170	21.0
2 0	0.23	30 5	146.1	154.6	48.0	30.188	21.5
2 10	0.25	30.2	146.0	154.4	47.2	30.184	22.0
Jan. 10.							
1 50	0.48	34.0	144.3	141.7	32.2	30 188	
2 0	+1.00	34 0	144.7	141.5	32.2	30.182	33.0
2 10	1.02	34.2	144.8	141.6	32.2	30.180	33.0
4 0	1.20	34.5	139.5	142.7	32.8	30.192	35.0
6 0	1.36	35.8	134.0	141.4	34.2	30.132	38.2
8 0	2.02	36.5	138.0	140.3	41.8	30.129	35.0
10 0	2.09	37.3	141.0	145.6	49.6	30.130	34.7
12 0			140.0	149.6	49.9	30.170	32.7
13 50	3.24	40.1	141.9	151.9	53.5	30.154	31.4
14 0	3.20	40.0	141.4	152.0	53.8	30.149	
14 10	3.18	40.0	141.8	152.2	54.0	30.145	31.0
16 0	3.26	39.0	140.1	155 9	54.6	30.124	30.8
18 0	3.08	38.5	146.0	158.8	55.0	30.165	30.6
20 0	2.37	37.8	146.0	159.0	56.0	30.149	30.0
22 0	2.00	37.0	144.0	156.8	55.9	30.135	28.7
Jan. 11.							
24 0	2.21	36.5	142.4	155 6	56.0	30.122	27.5
2 0	1.29	35 2	148.4	153.4	54.2	30.141	27.0
4 0	1.31	35 5	139.7	159.0	50.5	30.077	30.0
6 0	2.05	36.2	134.9	155.2	51.6	30.000	34.0
Jan. 12							
1 50	0.05	31.4	143.0	143.6	29.5	29.641	27.0
2 0	0.08	31.3	143.5	143.4	29.8	29.637	
2 10	0.12	31.2	148.0	142.7	30.0	29.600	27.3

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
4 0	−0.26	32.5	139.5	148.2	42.8	29.586	34.0
6 0	+2.32	37.2	135.1	150 1	47.2	29.556	35.5
8 0	2.21	37.5	137.8	150.4	50.8	29.561	35.1
10 0	2.06	37 0	140.1	150.6	50.0	29.566	33.0
12 0	1.39	36.0	140.0	152 8	49.9	29 604	28.8
16 0			141.8	154.0	49.6	29.609	30.4
18 0	1.15	34 5	139 8	151.6	49.1	29.623	30.0
20 0	1.02	34.5	140.0	153 0	55.0	29.743	22 5
22 0	0.20	32.2	140.3	155.4	56.4	29.769	18.7
Jan. 13.							
24 0	−0.42	29.0	142.3	155.8	45.3	29.918	10.0
1 50	2.42	24 5	143.0	149.9	40.5	30.046	4.0
2 0	2.37	25 2	143 4	149.6	40.2	30.055	4.0
2 10	2.17	24.0	142.7	150.2	40.0	30.059	4.0
Jan. 14.							
1 50	6.00	14 0	144.0	135 3	20.0	29.986	14.8
2 0	5.47	14.1	143.9	135.8	19.9		
2 10	5.47	14.3	143.7	135 8	19 8	29.981	16.1
4 0	4 20	17.8	139 0	144.0	35.5	29.914	33 2
6 0	1.36	25.0	134.0	150.8	47.1	29.714	39 9
8 0	+0.41	30.5	137.8	150.3	51.0	29.603	42.0
10 0	2 23	34 5	140 0	149.8	49.6	29.564	41.7
12 0	3.06	36.5	141.4	152 2	51.0	29.538	40.5
13 50	3 46	38.5	142.7	151 5	50 8	29.525	39.6
14 0	4.02	38 5	143.9	152.0	51.0	29 524	39.4
14 10	4 35	38.8	145.6	152.1	51 2	29.524	39 3
16 0	4.05	38 8	141.8	153.3	55.0	29.525	38.3
18 0	4.11	38.7	140.4	156 1	58.0	29.537	36.9
20 0	3.44	38 5	140.1	156.3	58.[illegible]	29.562	34 0
22 0	3.21	37.4	141.6	156.4	55.9	29.565	32.5
Jan. 15							
24 0	3.02	36.3	142.8	154.6	56.1	29.570	31.0
Jan. 17.							
1 50	−4.10	18.2	146 0	135.0	17.0	29.965	17.0
2 0	3.49	18.3	147 5	135.6	17.0	29.967	
2 10	4.02	18.[illegible]	147 4	135.4	17.0	29.965	
4 0	2.47	21.1	142.9	144.1	36.7	29.980	33.9
6 0	+0.13	28.2	134 4	156.9	52.1	29.901	38.0
8 0	1.39	33 0	135.1	154.5	51 6	29.837	39.0
10 0	2.01	34.2	139.7	152.7	54.4	29.840	38.0
12 0	2.20	35 0	141 7	154.1	54.8	29.852	36 1
13 50	2.28	35 5	143.1	156.1	57.0	29.855	37.5
14 0	2.31	35 7	142.0	156 1	57.2	29.845	37.5
14 10	2.38	36.0	141.6	156.2	57.6	29.835	37.4
16 0	3 09	36.5	144.7	157.8	57.3	29.831	35 3
18 0	3 04	36.5	140.1	156.2	56.3	29.794	36 3
20 0	3.15	36.5	140.0	154.1	57.8	29.848	34.5
22 0	3.05	36.0	141.1	156.8	58.5	29.864	34.5
Jan. 18							
24 0	2.44	35 5	142.9	156.3	56.8	29.892	30.5
1 50	2 08	34.6	147.0	155.0	55 0	29.953	32.6
2 0	2.15	34.5	148.1	154.8	55.0	29.960	33.1
2 10	2.20	34.6	147.7	154.8	55.0	29.968	33.6
Jan. 19							
1 50	2.00	33.7	146.9	145.4	33.9	29.930	35.8
2 0	2.12	34.0	147.1	145 6	34.0	29.920	36.5
2 10	2 21	34.0	146 4	146 2	34.0	29.931	37.3
4 0	3.03	35 5	141.1	154.6	45.8	29.903	44.8
6 0	5.25	41.4	133 6	166 3	70 6	29.840	52 8
8 0	8.01	48 5	135.7	167.3	67.1	29.799	57.0
	Term	day	omit	ted.			
Jan. 20.							
12 0	10.46	56.0	141.7	165.7	64.0	29.685	45.1
h. m.		°			°		°
13 50	+10.14	53.0	144.4	163.8	61.0	29.678	43.0
14 0	10.18	53.0	144.4	163.4	60.1	29.676	43.0
14 10	10.13	53.0	144.6	163 8	60.1	29.674	43.1
16 0			142.[illegible]	160.0	57.6	29.608	44.4
18 0			141.6	158.8	57.5	29.560	45.4
20 0			142.3	159.1	57.5	29.496	46.4
22 0	8.25	48.5	143.1	158.8	57.0	29 395	50.9
Jan. 21.							
24 0	8 30	49 4	143 4	159.9	60.8	29.350	51.5
1 50	9.13	50 2	144.0	162.0	60 4	29.299	50.4
2 0	9.22	50.7	144.2	161.3	60.2	29.299	50.7
2 10	9.25	50.7	144.2	161.1	60.2	29.299	50.9
Jan. 22.							
1 50	0.48	31.5	143.9	144.2	30.1	29.619	28.0
2 0	1.07	31 5	143 8	144.8	30.1		
2 10	1.09	31.5	145.2	145.3	30.1	29.619	27.2
Jan. 24.							
1 50	−7.16	7.8	146.3	133.1	17 8	30.559	0.8
2 0	7.10	8.0	145 0	133 9	18.8	30 557	
2 10	7.10	8.1	144.5	134.8	20.0	30.567	1.8
4 0	5.19	10.8	139.0	157.7	49.0	30.551	8.2
6 0			135.6	154.8	47.3	30.493	13.7
8 0	0.00		137.3	157.2	53.5	30.455	17.8
10 0	+0.13	27.5	134.7	163.1	53.8	30.425	18.0
12 0	−1.26	25.5	135.7	158.8	51.2	30.390	
13 50	1.14	25 0	139.0	158.4	52.8	30.359	12.2
14 0	1.04	25.0	139 4	158.7	52 8	30.350	12.1
14 10	0.46	24.8	139.1	158.7	52 6	30.342	12.0
16 0	1.31	23 0	140.0	160.8	52.0	30.292	13.0
20 40	2 09	22.0	144.0	159.7	46.0	30.127	17.0
22 0	1.43	22.0	142.1	156.3	46.0	30.101	21.9
Jan. 25.							
24 0	0.44	23.5	144.0	157.9	50.5	30 051	24.0
2 0	0.40	24.7	145.0	159.1	52.1	30.047	26.3
2 10			145.2	159.7	52.0	30.033	27.1
Jan. 26.							
1 50	+1.12	28.4	142.7	146.6	32.0	29.715	27.1
2 0	1 13	28.5	143 0	146.7	32.6	29 706	28.2
2 10	1.15	28.6	143 4	146.8	33.2	29.698	28.4
4 0	2.09	30.8	140.7	161.8	57.0	29.761	40.0
6 0	5.42	36.8	138.0	173.6	71.2	29.680	47.5
8 0	8.45	42.0	137.0	173.0	69.0	29.607	43.8
10 0	8.40	47.5	139.6	169.1	67.0	29.608	42.9
12 0	8.15	46.5	140.1	168.5	63.0	29.579	37 8
13 50	7.16	44.1	140.2	166 8	61.0	29.533	33.7
14 0	7.15	44.0	140.3	166 8	61.0	29.536	33.2
14 10	7.04	44.0	140.3	167.0	60.8	29.540	32.7
16 0	6.40	41.5	140.2	166.0	58.5	29.479	31.3
18 0	5.44	39.5	140.2	164.0	58.6	29.386	28.8
20 0	5.18	38.5	140.3	163.8	58.8	29.325	32.0
22 0	5.09	38.1	140.6	164.2	60.2	29.266	32.8
Jan. 27							
24 0	5.05	37.5	143 0	165.5	58.0	29.249	29.2
1 50	4 32	36.3	146.6	162.9	54.2	29.274	32.4
2 0	4.29	36 4	147.1	163.1	54.0	29.284	32.4
2 10	4.31	36.5	146.9	163.3	53.8	29.294	32.4
Jan 28.							
1 50	−2.14	19.0	145.0	139.7	18.2	30.280	18.0
2 0	2.25	19.1	145 4	138.5	18.7	30.280	19.0
2 10	2 28	19.2	145.7	139.6	18.8	30.280	20.0
4 0	1.10	22.0	143.4	149.4	39.2	30.292	30.8
6 0	+2.19	30.7	138.3	159.7	52.5	30.212	36.0
8 0	4.43	36.5	136.0	163.0	56.0	30.118	36.3

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m							
10 0	+4.16	36.0	139 2	159.9	55.0	30.109	33.8
12 0	4.23	36.5	137.9	163 5	56.0	30.043	32.0
13 50	4.02	35.7	151.4	164.6	56.8	30.007	32.1
14 0	4.10	35.8	148 8	164.1	56.4	30.015	32.3
14 10	4.19	35.9	146.9	164 9	56.1	30.023	32.5
16 0	4.18	36.0	142.2	164.3	55.8	29.986	35.8
18 0	4.46	37.0	140.7	162 2	53.0	29.929	37.5
22 0	5.25	38.1	141.5	162.5	56.8	29.879	41.4
Jan. 29.							
24 0			138.8	161.4	58.0	29 802	41.0
1 50	5.43	39.5	144.3	160.1	56 0	29.771	45.7
2 0	6.00	39 6	145.0	160 4	56 0	29.773	45 8
2 10	6.09	39.8	145.6	160.9	55.8	29.775	46.0
Jan. 31.							
1 50	5.35	38.4	145.8	157.1	34.9	29.841	36.0
2 0			147.2	150.9	35.0		
2 10			146.4	150.0	35 0	29.844	37.0
4 0	6.16	38.7	141.3	157 4	45.8	29 794	46 9
6 0	6.22	41.5	136.1	165.4	58.5	29.657	51.1
8 0	6.45	43.2	136 9	164 4	61.2	29.523	51.5
10 0	7.36	44.3	140.7	165.5	61.3	29.496	49.7
12 0	8.10	45.0	142.2	165.0	62.2	29.447	51 6
13 50	8.22	46.0	141.3	166.4	62.3	29.422	52 8
14 0	8.19	46.0	141 6	166.4	62 3	29.425	52.5
14 10	8.10	46.5	142 0	166.7	62.2	29.429	52.3
16 0	8.09	46 5	144.1	168.4	62.0	29 491	46.0
18 0	9.06	45.7	146 3	169.1	60 7	29 543	42 5
20 0	8.16	45.2	137.9	165.0	60.0	29.598	37.3
22 0	7.16	44.0	135.9	166.0	59.8	29.684	34.0
Feb. 1.							
24 0	6.46	42.5	146.5	166.0	59.0	29.774	31.7
1 50	6.00	41.0	142 7	166.6	57.0	29.853	33.5
2 0	6.10	40.5	144 6	166.0	57.0		34 5
2 10	6.14	40.5	145.5	167.0	57.0	29.869	35.0
Feb. 2.							
1 50	3 04	33 0	146.1	151.9	31.0	30.304	25.2
2 0	3.02	33.0	145.8	148.2	31.2	30.298	26.3
2 10	2 49	33.0	145.4	148.3	31.3	30.292	27.4
4 0	3.40	35.0	139 4	158.2	43 6	30.304	39.6
6 0	4.26	38.3	134 3	166.5	56 3	30.149	43.9
8 0	5.15	41.0	134 4	167.7	59.6	30 134	42 2
10 0	5.22	41.2	140.5	163 5	57.2	30.096	41.6
12 0	5.32	41.4	140 5	162.7	55 7	30.058	38.0
13 50	5.11	40 5	140.3	163.7	55.6	30.042	40.6
14 0	5.18	40 5	140.7	163.9	55.3	30.040	40.8
14 10	5.28	40 6	141.1	163.8	55.3	30.039	41.0
16 0	5.49	41.0	142 5	163.8	56.4	30.009	43.2
18 0	6 03	41.5	141.3	167.1	60.7	29 956	43.8
20 0	6.15	41 6	139 8	169.2	62.8	29.917	44.7
22 0	6.32	42.6	143.0	168.4	63.4	29.866	49.0
Feb. 3.							
24 0	6.43	43.5	143.2	168.4	63.0	29.821	48.3
1 50	7.13	44 6	141.5	168 8	63.8	29.787	51 9
2 0			141.7	169.0	63.8	29.751	52.3
2 10			141.6	168.6	63.8	29.767	52.8
Feb. 4.							
1 50	12.03	55.8	145.1	168.9	60.4	29.462	60.2
2 0	12.02	55.8	145.2	169.0	60.4	29 470	60.1
2 10	12.02	55.8	145.3	168.6		29.459	60.0
4 0	12.15	51 0	140.0	169.9	61.3	29 576	53.0
6 0	12.45	55.7	133.4	171.8	63 5	29.579	57.2
8 0	11.31	55.7	136.5	169.5	62.0	29 563	52.5
10 0	11.07	55.0	138.3	167.0	64.0	29.541	48.9

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
12 0	+11.42	54.5	139.0	170.0	65.0	29.529	48.0
13 50	10.28	53.5	140.8	171.0	64.5	29.479	45.0
14 0	10.36	53.3	141 0	171.3	64.6	29.493	44 8
14 10	10.30	53.3	142.0	170.9	64.8	29.475	44.7
16 0	10.13	52.5	141.8	170.4	65.8	29 385	44.6
18 0	10.37	52 2	141.6	172.1	66.8	29.306	43.6
20 0	10.15	51.2	141.3	172 2	63.8	29.241	42.6
22 0	10.00	51.3	142.2	169.7	64.1	29.146	43.1
Feb. 5.							
24 0	9.45	50 6	141.2	169.7	65.0	29.106	42.4
1 50	9.47	50 0	145.6	170.8	62.3	29.067	43.2
2 0	10.01	50.0	145.4	170 5	62.2	29 072	43.6
2 10	9.31	50 0	145.4	170.5	62.0	29.077	44.0
Feb. 7.							
1 50	6 01	40.8	142 4	157.9	39 0	29.646	39.8
2 0	6.05	40.9	137.7	161.7	39.0	29.630	40.1
2 10	6 14	40.9	133.9	164.5	39.0	29.621	40.5
4 0	7.14	42.4	128.1	160.8	47.0	29 600	50.0
6 0	8.12	44.4	133 8	164.5	56 3	29.558	52.1
8 0	6.27	45 5	137.6	167.5	58.8	29 523	50.2
10 0	6.38	45.5	147.5	170.5	60.5	29.489	46.5
12 0	6.15	45.5	138 8	171.0	65.0	29.420	45.0
13 50	6.18	45 2	140.4	171.4	63.4	29.434	44.2
14 0	6.23	45.2	140.4	170.8	63.2	29.429	43.9
14 10	6.44	45.3	141.5	171.8	63 0	29 424	43.7
16 0	7.10	44.6	140.4	169.4	62.0	29 430	37.0
18 0	7.00	43.6	141.0	169.3	60.2	29.422	33.8
20 0	7.07	42.6	141.6	168.3	60.0	29.404	34.0
22 0	6.48	42.3	142.3	166 7	60.5	29 390	33.5
Feb. 8.							
24 0	6.22	46.5	141.9	166.5	59.5	29 409	32.0
1 50	5.45	41.0	145 6	166.4	57.0	29 405	32.0
2 0	5.46	41 0	146 1	166 2	57.0	29.407	32.0
2 10	5.48	41.0	145.6	166.9	56.7	29.410	32.0
Feb. 9.							
1 50	—1.19	23.2	147.9	144 1	15.0	30.011	4.9
2 0	1.14	23 1	147.8	141.0	15.1	30.013	5.6
2 10	1.17	23.1	148.3	138.7	15.2	30.016	6.3
4 0	1.15	23.3	145.3	146.5	31.1	30 072	11.3
6 0	0.09	26.6	139.8	159.9	48.4	30.070	17.1
8 0	+1.19	30.0	141.0	162 6	53 0	30.049	20.1
10 0	1.42	31.0	142.7	163.1	55.9	30 033	21.1
12 0	1.12	30.0	142.3	161.5	52.0	30.044	18 2
13 50				161.2	52.8	30 000	19.8
14 0			141.5	161.5	53.0	30 006	20.0
14 10			141.5	161.6	53.0	30.013	20.3
16 0	2 03	29.0	141.0	156.3	46.1	29.992	22.2
18 0	1.15	29.1	142.7	164.1	59.2	29.970	26.0
20 0			143.1	168.1	62 0	29.949	28.1
22 0	2.01	30.6	143.5	167.8	57.2	29.955	27.6
Feb. 10.							
24 0	2.09	30.7	143.6	163 9	56.5	29.941	27 6
1 50	2.24	31.4	145.5	165.8	59.8	29.997	31.0
2 0			146.0	165.6	59.8		
2 10			146.5	165.7	59.7	29 998	32.4
Feb. 11.							
1 50	1.04	29.0	139.8	150.3	29 0	30 195	24.0
2 0	1.08	29.2	144.1	150.9	30.0	30.194	25.0
2 10	1.24	29.2	143 7	147.9	30.2	30.192	26.0
4 0	2.29	31.0	143.5	154.9	46.0	30.171	38.0
6 0	4.23	36.0	134.6	171.4	66.5	30.130	48.2
8 0	6.13	41.0	131.0	173 1	69.0	30.073	50.2
10 0	5.44	43.0	127.1	175.5	67.2	30.052	47.4

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
12 0	+4.18	42.8°	138.4	179.3	64.3°	30.010	40.8°
13 50	4.00	42.0	144.0	181.0	65.5	29.986	39.8
14 0	4.00	42.0	143.7	180.9	66.0	29.978	39.3
14 10	4.04	42.0	145.1	180.9	66.0	29.969	39 0
16 0	5.22	42.0	149.3	182.0	65.5	29.913	39.5
18 0	8.13	42.3	149.8	187.4	67.1	29 848	42.8
20 0	8.13	42.5	142.4	185.0	66.0	29.755	42.5
22 0	8.23	42.5	135 2	178.4	63.5	29.698	42.2
Feb. 12.							
24 0	7.21	42.8	145.6	172.3	66.0	29.686	45.5
1 50	6.25	43.0	152.0	172 3	66.0	29.703	47.0
2 0	6.30	43.0	151.9	171.7	66.3	29.693	47.0
2 10	6.32	43.0	151.1	172.0	66 5	29.683	46.8
Feb. 14.							
1 50	5.08	38.5	145.1	149.7	37.4	29.380	39.7
2 0	5.12	38 5	144.8	149.8	37.6	29 383	40 0
2 10	5.22	38.7	145.3	149.9	37.9	29.386	40.2
4 0	6.31	40.5	145.5	155.9	49.7	29 381	46.7
6 0	7.35	43.5	139.6	166.9	63.8	29.333	48.2
8 0	8.35	46.0	132.2	171.7	67.0	29.294	48.3
10 0	8.01	47.5	134 5	171.8	62.7	29.340	42 3
12 0	7.10	44.7	140.1	169.4	58.2	29.452	31 4
13 50	6 21	42.1	143.4	166 1	55.6	29.505	27.1
14 0	6.25	41.8	143.6	165.9	55.3	29.517	26 5
14 10	6.16	41.5	143 9	167.3	55.1	29.518	26.0
16 0	5.20	39.4	143.9	165.1	53.9	29.572	23 0
18 0	4.33	37.1	142.7	164.3	52 6	29.656	19.2
20 0	3.38	29.5	144.7	163.7	52.0	29.754	12.0
22 0	3.08	33.6	143.1	161.3	49.4	29.835	8.1
Feb. 15.							
24 0	2.05	30.1	143.6	159.3	49.9	29.889	9.0
1 50	1.15	28.4	146.9	160.8	50 8	29.949	10.8
2 0	1.09	28.4	146.1	160.7	50 8	29.966	11.3
2 10	1.15	28.3	145.6	160.4	50.9	29.984	11.8
Feb. 16.							
1 50	−0.03	25.0	147.3	142.2	23.8	29.959	26.8
2 0	+0.01	25.2	147.2	143.9	23 9	29.924	27.5
2 10	0.10	25.4	147 9	144.4	24 0	29.889	28.2
4 0	1.02	27.4	145 1	151.5	39.0	29.802	39.5
6 0	2.30	30.5	138.9	162.0	51.3	29.666	38.0
8 0	2.37	32.0	137.2	161 3	60.0	29.465	39 0
10 0	3.18	33.7	135.2	163.1	57.1	29.266	38.3
12 0	4.25	35.3	141.3	162 0	57.0	29.053	40 0
13 50	2 08	36 9	138.9	176 8	58 3	28.801	42.0
14 0	1.18	37.0	144.5	179.8	58.0	28.861	42.0
14 10	1.05	37.2	143.8	180.1	58.0	28 746	43.2
16 0	2.30	39.0	143.6	173 0	66.2	28.497	47.0
18 0	3.32	40.0	144.0	174.1	60.7	28.373	41.6
20 0	4.10	39.0	145.6	169 0	53 0	28.521	32 0
22 0	3.25	34.5	144.8	160.6	42.6	28.682	24.4
Feb. 17.							
24 0	3.12	31.2	143.0	155.7	35.0	28.844	
1 50	4 06	29.2	134.6	147.1	30.3	28.952	21.0
2 0	3.43	29.2	135.7	146.0	30 0	28.967	20.0
2 10	3.42	29.1	137.5	146.0	30.0	28.982	20.8
Feb. 18							
1 50	−0.20	21.7	145.7	143.4	16.2	30.235	22 0
2 0	0.06	21 9	141.1	144.3	17.0	30.235	23 2
2 10	0.03	22 0	139.2	142.4	17.6	30.234	24.3
4 0	+1.14	24.7	136.9	149 4	37.1	30.259	30.1
6 0	1.18	28.2	135.4	164.6	49 6	30.197	32 4
8 0	1.33	30.8	134.5	165.5	54.3	30.166	36.7
10 0	0.39	32.5	131.9	167.1	56.7	30.157	35.7

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
12 0	+1.26	33.1°	156.2	167.3	54.2°	30.104	34.4°
13 50	2.00	33.1	139.2	166.0	54.1	30.065	34.5
14 0	2.01	33.1	138.3	165.9	53.2	30.055	38.2
14 10	2 09	33.3	139.0	165.8	53.2	30.045	37.0
16 0	3 31	34.5	141.2	166.8	59.1	29 979	39 8
18 0	4.14	35.6	142.2	168 3	58.4	29.910	42.7
20 0	5.10	37.0	141.0	170.7	64.5	29.815	45.0
22 0	6.17	38.5	130.6	174.2	64.6	29.759	44.6
Feb. 19.							
24 0	6 28	40.0	142.0	172.7	66.5	29.611	48.0
1 50	6.42	41.5	135.0	176.0	66.0	29.525	50.0
2 0	7 05	41.5	131.3	176.6	65.5	29.503	50.0
2 10	7.11	43.7	128 6	176 4	65.3	29.482	49.5
Feb. 21.							
1 50	1.05	25.8	144.5	145.0	24.5	30.069	21.2
2 0	0 35	25.8	144.5	145.2	25.0		21.6
2 10	0.39	25 9	144.9	145 4	25 3	30.069	22.1
4 0	2.10	29.1	143.9	159 6	53.2	30.046	27.7
6 0	4.24	33.9	140 [illegible]	167.8	63.9	30.018	31.1
8 0	5.24	37.6	138 9	168 1	64.6	30.001	32.9
10 0	5.45	39 2	137 9	171.0	64.0	30 010	31.4
12 0			139.4	170.0	57.8	30.034	26.7
13 50			140.5	164.4	55.0	30.046	23.8
14 0			140 9	164.0	55.0		
14 10			140.9	163 7	54 [illegible]	30.053	23 2
16 0	3.49	34.5	144.9	164.3	55.8	30.043	21.2
18 0	3.07	33.0	141.8	163.7	55.9	30.069	18.5
20 0	3.31	21.0	143.8	166.8	60.2	30.020	18.2
22 10			141.7	166.9	61.0	30.018	18.1
Feb. 22.							
24 0	2.21	29.8	144.2	168.0	57.0	29.991	17.5
1 50	2.27	30 6	144.3	163.2	51.5	30.013	20.4
2 0	2.38	30.6	143.9	163.9	51.0		
2 10	2 34	30.7	143.6	163.6		30.005	21.0
Feb. 23.							
1 50	1.34	28.0	144.7	147.7	24.9	30.054	21.1
2 0	1.31	28.1	144.6	147.9	24.9		
2 10	1 37	28.0	143.9	147.3	25.0	30.048	22.9
4 0	3.06	30 3	143.1	153.8	42.8	30.051	29.3
6 0	5.28	35.2	138.2	164.5	61 7	30.027	35.8
8 0	6.16	39.0	138.3	167.8	64.9	29.979	37.8
10 0	6.36	40.4	139.3	166.8	60.8	29.970	35.5
12 0	5 42	38.8	139.6	166.0	59 4	29.982	28.8
13 50	4.44	37 2	140 6	165.8	56.7	29.991	27.0
14 0	4.33	37.3	140.4	165.8	57.0		
14 10	4.40	37.1	140.7	165.9	57.1	30.000	26.6
16 0	5.15	36 1	145.1	167 5	55 5	30.005	28.2
18 0	4 27	35.6	143 0	163.8	55 1	30.007	30.1
20 0	4.28	35.7	146 0	[illegible]	58.2	29 991	30.3
22 0	4.26	35.6	147.5	164.9	59 7	30 003	29.5
Feb. 24							
24 0	7.07	35.7	149.4	166.8	60.6	30.013	30.2
1 50	6.23	36 3	148.3	163.9	58.9	30.038	33.2
2 0	6.26	36.5	148.8	162.7	59.4	30.040	37.3
2 10	6.36	36.5	147 4	163.5	60.0	30.041	34.4
Feb. 25.							
1 50	2.40	32 4	143.1	155.9	39.6	30.472	23.0
2 0	2.38	32.4	143.3	156.3	40.6	30,482	23.9
2 10	2.43	32.5	143.0	156 7	41.7	30.492	
4 0	3.34	33.9	142 2	166.4	57.6	30 505	26.2
6 0	4.16	35.3	139.5	168.8	66.2	30.490	26.4
8 0	4.43	36.5	137.8	168.6	62.2	30.489	27.0
	Term	day	omitted.				

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Feb. 28.							
h. m.							
1 50	+4.10	34.5°	145.5	152.9	42.5°	29.961	31.0°
2 0	4.16	34.6	145.0	153.4	42.5	29.949	
2 10	4.10	34.8	145.1	153.8	43.1	29.965	31.0
Apr. 1.							
24 0	3.28	30.8	146.0	170.8	32.2	30.226	18.3
1 0	3.01	30.8	147.9	173.1	53.2	30.208	20.4
1 50	3.47	31 5	149.5	181.3	52.0	30.214	20.8
2 0	3.42	31.5	147.2	179.3	52.0	30.228	
2 10	3.37	31.4	145.5	177.8	51.9	30.229	21.6
3 0	3.32	31.6	142.0	175.4	53 8	30.110	23.9
4 0	4.14	32 3	131.3	176.3	53.0	30.253	26.0
5 0	5.10	33.6	135.0	178.2	53.5	30.242	27.3
6 0	5.18	35.5	131.4	178.1	51.5	30.176	28.0
7 0	6.23	38.0	129 5	179.1	51.0	30.198	30.3
8 0	6.24	38.2	129 5	176 6	53.8	30.206	31.7
9 0	6.20	40.5	130.1	175.5		30.178	31.8
10 0	6.04	40.5	129.2	173.2	51.5	30.188	32.0
11 0	6.05	40.5	133.6	173.5	49.0	30.196	31.9
12 0	5.07	39.0	135.5	167.1	46.0	30.209	28.0
13 0	5.27	39.0	138.8	165.6	44.5	30.206	27.0
13 50	4.37	37.5	144.7	171.1	41.0	30.218	25.4
14 0	5.02		145 5	171.2	40.6	30.214	20.3
14 10	5.02	37.5	147.3	170.9	40.5	30.210	25.3
15 0	5.16	36.7	146.7	172.7	45.3	30.221	25.4
16 0	6 18	36.5	145.0	172.5	47.0	30.209	26.5
17 0	7.34	37.0	138.0	171.0	43 5	30.180	28.0
18 0	5.37	36.2	140.5	170.8	45.5	30.197	29.0
19 0	6.13	36.3	136.7	172.2	49 0	30.190	29.5
20 0	6.00	36 5	132 6	172 5	52 7	30.189	30.5
21 0	6.11	37.0	131.5	175.8	56.5	30.193	30.5
22 0	6.03	37.5	138.4	176.2	58.0	30.174	30.2
23 0	6.38	38.0	137.8	176.5	59.8	30.139	30.0
Apr. 2.							
24 0	6.41	39.3	138.5	177.0	59.6	30.105	31.0
1 0	6 39	37.7	141.2	177.4	58.0	30 030	33.0
1 50	5.31	37.7	141.7	177.4	56.8	30.013	36.0
2 0	5.34	38 0	141.4	177.0	56.8	29.998	36.9
2 10	5.34	38.3	141.2	176.8	56 5	29.983	36.3
Apr. 4							
1 50	9.11	45.0	141.4	171.4	42.6	30.202	37.2
2 0	9.06	45.0	141.2	171.5	42.6	30.197	
2 10	9.11	45.0	141.7	171.5	42 7	30.187	37.2
2 40	9.11	45.0	141.1	173.8	43.0	30.206	38.0
4 0	10.10	45.0	138.0	176.0	44.2	30.204	39.0
5 0			133.1	178.6	47 7	30.189	39.1
6 0	9.24	45.0	128.1	182.0	52.0	30.187	38.0
7 0	9 06	45.0	130.8	177.1	55.0	30.188	38.5
8 0	9.05	45.5	132.2	177.0	57.0	30.201	37.5
9 0	8 39	45 5	132.2	177.8	58.8	30.177	36.8
11 0	7.39	44.0	133.5	176.7	58.0	30.183	35.5
12 0			133 0	176.2	56.0	30.189	35.0
13 0	7.21	44.0	136.5	176.7	53.8	30 191	35.0
14 0	7.25	44 0	135.2	173.8	52.2	30.197	35.0
15 0	7 23	43 5	146.8	173.8	52.4	30.168	35.0
16 0	8.45	43.5	136.2	176.8	54 5	30.171	35.5
17 0	7.44	42.5	137.2	176.0	56.2	30.153	35.4
18 0	7.44	42.5	137.5	176.8	56.2	30.130	35.6
19 0	7 44	42.0	139.0	177.0	57.0	30.118	36.8
20 0	7.22	41.5	140.4	177.2	59.5	30 011	35.8
21 0	8 08	41.0	140.2	179.2	59 6	30.028	35.2
22 0	7.35	41.0	138.0	179.2	59.0	30.014	36.0
23 0	6.35	40 8	139.5	178.8	59.5	30.036	35.2

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Apr. 5.							
h. m.							
24 0	+6.42	41.0°	140.0	179.0	60.5°	30.054	33.5°
1 50	6.47	40.2	146.0	180 6	59.2	29.993	34.0
2 0	6.40	40.1	144 7	179.1	59.0	30.025	
2 10	6.44	40.1	144 5	179.4	58.8	30.011	34.0
4 0	7.02	40.2	138.5	179.5	54 5	29 986	35.8
5 0	8.12	40 4	133.0	178.3	53.0	29 990	35.0
6 0	7.10	40.5	129.7	174.5	50 0	29 995	35.0
8 0	7.17	41.5	129.3	171.1	50.0	29.973	36.3
9 0	6.34	41.3	127.9	172.8	49 5	29.966	36.0
10 0	6.12	41.5	131.4	171.2	48.5	29.964	35.4
11 0	7.00	42.0	135.0	176.6	48.0	29.972	35.0
12 0			136.5	170.5	48.0	29 994	35.0
14 0	7.33	42.1	138.0	171.8	48.0	30.007	34.4
16 0	7.46	41.3	140.4	171.5	46.0	30.014	34.0
17 0	7.38	41.4	140.3	175.3	45.2	30.002	34.2
18 0	7.46	41.3	140 2	176 8	50.0	30 003	34.3
19 0	8.01	41.3	140.3	178 2	54.0	30.001	34.3
20 0	8.08	41.2	140.7	178.9	55.0	30.001	34.4
21 0	8.05	41.1	141.3	179.8	55.5	30.035	34.6
22 0	8.05	41.0	141.9	178.8	57.0	30 063	34.7
23 0	7.16	41.2	141.3	179.2	58.8	30.073	34.8
Apr. 6.							
24 0	6.41	41.0	141.8	180.5	60.2	30.114	35.8
1 0	6.00	42.0	142.2	184.0	60.4	30.110	38.0
1 50	7.20	42.5	141.1	183.1	60.2	30.116	40 3
2 0	7.37	42 6	141.5	183 2	60.0	35.108	
2 10	7.44	43.0	141.1	182 6	60.1	35.126	42.2
3 0			140.0	183.9	61.7	30.134	49.7
4 0	10.21	47.0	139.0	186.7	63.5	30.117	51 8
5 0	11.34	50 8	135.0	187.6	64.0	30.094	55.4
6 0	12.04	52.5	132 0	187.2	66.8	30.033	54.8
7 0	13.31	56.0	131.0	185.4	68 0	30.050	57.2
8 0	13 39	57.2	132 0	183.9	69.5	30.027	60.3
9 0	14.19	58.5	134 5	184.5	70 5	30.013	61.0
10 0	15.03	60.4	136 1	184 9	71 3	29.991	61.5
11 0	14.36	60 5	137 2	183.6	68.0	30.002	58 2
12 0			138 0	180 6	65.0	30.000	50.0
13 0	14.15	57.5	138.7	181.2	61.9	29.979	48.0
14 0	14.10	56.6	139.5	179 6	60.0	29.971	47.0
15 0	14.44	56.0	139.0	177.5	58.0	29.967	45.0
Apr. 7.							
1 50	10.20	48.7	143.8	172.5	48.0	29.832	47.0
2 0	10.07	48 8	143.6	173 0	48.0	29.828	
2 10	10.14	49.0	143.6	172.7	48.0	29 824	47.0
3 0	10.30	49.3	141.1	176.2	48.9	29.821	47.6
4 0	11.10	49.8	136 5	178.8	49.5	29 822	47.0
5 0	11 20	50.2	131.4	178.3	50 0	29.824	46 6
6 0	11.20	50 5	128.0	177.8	50 5	29 802	47.5
8 0	10.38	50.5	130 0	173.8	51.0	29.766	45.2
9 0	10.22	50.5	132.1	173.1	50.0	29.727	41.2
10 0	10.23	49.8	135.0	169.8	50.2	29.734	42 5
11 0	10.15	49.0	135.3	170.6	49.2	29.734	41.6
12 0	10.09	48.5	137.5	170.0	48.0	29.742	40.9
13 0	10.09	49.0	137.0	172 8	49 8	29.727	40 5
14 0	10.09	48.5	136.0	167.4	52.0	29.730	40 0
15 0	10 44	48 5	137.3	175 1	55.0	29.717	40 2
16 0	10.35	48.0	136 5	176.0	56.2	29.692	40.0
17 0	10.02	48 0	137.0	170.7	58.0	29.714	40.0
18 0	10.03	48.0	140.0	170.5	58.0	29.735	40.0
19 0	11.00	47.5	140.0	170.7	58.0	29.762	39.5
20 0	10.06	47.5	140 0	170 6	58.5	29 774	39.0
21 0	10.07	47.0	140 2	170.7	58.5	29.775	39 0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
22 0	+10.05	42.5	140.2	170.6	59.0	29.725	39.0
23 0	10.11	46.5	140.4	170.8	60.0	29.739	39.0
Apr. 8.							
24 0	9.06	41.5	140.5	170.7	58.5	29.770	40.0
1 0	9.03	46.0	145.7	173.7	56.0	29.814	40.0
3 0	9.46	46.2	144.4	173.2	51.5	29.839	40.1
4 0	10.00	45.5	140.0	174.5	50.6	29.849	39.5
5 0	10.06	45.5	136.0	177.0	52.0	29.851	40.0
6 0	10.05	45.8	133 6	178.4	56.3	29.856	40.5
7 0	9.35	45.5	132.2	180.0	59.0	29.855	40.0
9 0	8.44	45.7	133.3	176.2	60.6	29.862	38.6
10 0	9.18	45.4	133.0	177.8	58.5	29.889	38.3
11 0	8.18	44.0	133.9	173.6	55.7	29.912	37.8
14 0	7.28	43.0	137.5	172.3	46.0	29.706	38.0
15 0	8.13	43.0	138.5	169.7	45.5	29.906	38.0
16 0	8.19	43.0	138.7	168.8	45.0	29.942	38.0
18 0	9.45	42.5	138.5	170.9	49.0	29.956	37.5
20 0	8.48	42.5	139.0	175.0	56.6	29.955	37.5
22 0	8.15	42.0	140.0	177.1	59.1	29.950	36.3
23 0	8.06	42.2	139.5	177.8	60.6	29.952	36.5
Apr. 9.							
24 0	7.38	42.0	142.0	170.5	61.8	29.973	38.5
1 0	7.01	42.5	144.2	175.3	57.5	29.973	38.0
1 50	7.22	42 5	146.2	174.0	54.4	29.978	38.0
2 0	7.27	42.5	146.4	173.8	54.6	29.976	
2 10	7.41	42.5	146.2	173 6	54.2	29.975	38.2
Apr. 11.							
1 0	8.34	42.7	148.0	176 8	41.0	29.716	46.5
1 50			147.4	177.0	43.5		
2 0	9.08	44.3	146.0	175.9	44.2	29.691	55.2
2 10	9.20	44.7	144.8	176.1		29.685	56.5
3 0	10.14	47.5	142.7	178.0	49.5	29.705	60.0
4 0	11.13	50.7	140.0	182.1	55.0	29.768	
5 0	12.43	53.5	136.9	184.5	59.0	29.652	64.6
6 0	13.33	56.0	132.6	185.5	61.0	29.666	62.0
7 0	14.22	57.5	131.5	183.7	63.0	29.652	62.0
8 0	15.32	59.5	132.0	181 5	64.0	29.641	62.0
9 0	15.49	60 5	135.0	179 8	64.0	29.678	61.0
12 0	12 07	59 0	141.0	187.0	60 5	29.695	54.0
13 0	12.43	57.5	139.0	180.9	59.0	29.768	50.5
13 50	12.45	56.6	136.2	178 6	56.2	29.779	47.5
14 0	11.32	56.5	136.4	177.4	56.0	29.786	47.2
14 10	11.39	56.3	137.6	177.1	55.8	29.794	47.0
15 0	12.20	54.5	147.0	174.7	54.2	29 810	45.0
16 0	11.46	53.5	148.8	178.5	53.0	29.815	42.0
17 0	11.47	52.5	143.6	179.0	54.9	29.801	44.4
18 0	13.48	51.7	148.9	189.3	58.0	29.829	42.0
19 0	8.13	51.5	144.1	183.0	59.0	29.697	41.0
20 0	9.14	51.3	144.8	181.0	57.3	29.690	39.0
21 0	9.12	49.5	140.2	180.3	56.0	29.688	38.0
22 0	9.30	47.0	140.1	179.3	58.2	29.660	36.0
23 0	9.14	47.5	142.0	180.2	57.5	29.749	35.0
Apr. 12.							
24 0	9.44	46.5	132.0	181.5	56.5	29.817	36.5
1 0	10.24	46.0	122.0	182 8	55.0	29.881	38.0
1 50	10.42	45.6	124.0	180 0	55.0	29.854	39.7
2 0	11.02	46.0	128.4	177.7	55.0	29.882	
2 10	11.04	46.2	131.3	177.5	55.1	29.876	41.2
3 0	11.30	47.3	141.0	182.3	56.7	29.840	44.0
4 0	11.22	48 8	139.6	187.1	58 0	29.860	47.0
5 0	11 32	50.1	132.0	188 0	59.7	29.834	49.0
6 0	12.07	52.0	130.5	186.6	61.8	29.825	50.2
7 0	12.12	53.6	128.6	182.3	63.1	29 792	52.2

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
8 0	+11.11	55.0	129.0	157.9	63.2	29.730	53.0
9 0	9.32	55.8	129.6	176.7	63.3	29.776	54.0
10 0	10.33	56.2	131.0	179.4	63.0	29.800	53.0
11 0	9.10	55.5	135.0	183.4	61.8	29.818	49.8
12 0	7.35	54.2	141.5	192.0	58.8	29.863	45.2
13 0	9.15	53.5	142.3	187.0	55.6	29.891	42.1
13 50	9.10	49.7	144.6	193.8	53.3	29.948	39.0
14 0	8.03	49.5	145.2	190.8	53.0		40.4
14 10	8.11	49.4	145.7	189.7	52.5	29.953	39.5
15 0	8.04	47.5	142.1	174.8	50.0	29.963	37.5
16 0	8.08	46.4	141.7	176.5	48.0	29.988	35.5
18 0	8.46	43.3	135.1	168.3	43.5	30.030	34.3
Apr. 13.							
1 0	10.33	39.0	134.5	180.2	36.7	30.101	36.0
1 50	10.31	39.9	128.8	185.3	38.6	30.097	40.5
2 0	10.15	40.1	130.0	185.0	39.0	30.096	42.0
2 10	9.42	40.4	132.4	184.5	39.5	30.104	43.2
5 0	9.05	46.0	146.0	177.0	51.5	30.079	46.0
6 0	10.44	47.0	137.0	178.0	54.0	30.074	47.0
7 0	9.12	48.0	132.5	180.8	56 5	30.042	45.0
8 0	8.29	49.0	135.0	175.2	57.0	30.008	45.0
9 0	7.43	49.5	134 8	171.8	56.5	30.005	43.2
10 0	7.38	49.5	131.0	171.5	56.0	29.988	42.8
11 0	7.26	48.5	128.0	177.3	54.0	29.980	40.0
12 0	6.47	46.0	135 2	174.0	50.4	29.972	37.3
13 0	7.00	41.0	131.0	177.2	49.0	29.982	38.4
13 50	8.04	46.0	134.0	178.2	50.0	29.975	37.5
14 0	8.10	46.0	134 5	178.0	50.5	29.961	37.5
14 10	8 07	46.0	134.7	178.2	51.0	29.945	37.5
15 0	8.32	47.0	135.1	178.1	52.0	29.924	38.0
16 0	8.36	46 0	136.0	179.3	56.0	29.908	39.0
17 0	8.36	46.0	136.0	180.0	57.0	29 880	38.2
18 0	8 36	45.5	136.3	180.0	57.0	29.876	38.0
19 0	9.21	45.0	137.0	179.0	56 0	29.855	
20 0	9.21	44.5	130.0	178.9	55.5	29.855	
21 0	8.38	44.5	130.2	179.3	54.5	29.851	
22 0	8.09	44.0	138.1	178.8	55.5	29.832	
23 0	8.40	44.0	140.0	179.2	55.2	29.811	
Apr. 14.							
24 0	8.29	43.5	136.5	180.8	56.0	29.748	37.6
1 0	8.09	43.5	141.4	177.3	55.0	29.661	38.0
1 50	8.11	44.0	143.2	179.1	55.0	29.695	39.0
2 0	8.07	44.0	144.5	179.9	55.0	29.699	
2 10	8.02	44.0	144.7	179.3	55.2	29.695	39.0
3 30	9.30	44.5	140.1	182.0	55.5	29 672	39.0
4 0	9.30	44.5	139.1	182.1	55.0	29.652	39.0
7 0	9.25	46.0	128.5	170.2	51.0	29.573	41.0
8 0	9.40	47.5	129.8	170.6	50.5	29.718	43.0
9 0	9.00	47.0	132.8	172.0	50.5	29.597	42.0
12 0	9.27	46.2	137.1	174.5	49.5	29.685	40.5
13 50	8.22	45.5	134.0	171.3	47.4	29.608	34.7
14 0	8.24	45.4	134.5	171.4	49.2	29.647	32.6
14 10	8.40	45.4	135.1	173.0	49.1	29.686	34.5
15 0	8.27	45.4	135.3	173.0	49·1	29.648	34.2
16 0	8.20	44.5	166.0	188.2	52.0	29.657	36.0
17 0	8.17	44.5	119.6	159.9	52.5	29.654	36.2
17 30			72.3	183.0			
18 0	27.00	49.0	86.0	249.8	54.9	29.718	36.3
19 0	off scale	45.2	69.5	off scale	57.0	29.837	35.5
20 0	23 40	45 5	112.0	215.1	58 2	29.843	41.5
21 0	15.26	46 0	147.2	205.5	60.0	29.849	36.7
22 0	16.05	45.5	168.0	197.5	61.5	29.839	33.5
23 0	21 03	46.0	131.7	216.7	62.5	29 849	32 5

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Apr. 15							
h. m.							
24 0	+11.42	49.2	139.7	190.4	62.8	29.870	37.4
1 0	10.12	44 8	149.5	190.5	61.8	29.882	40.9
1 50	9 39	45 6	144.6	191.3	60.8	29.863	45.0
2 0	9 39	45.6	149.4	189.7	60.8	29.876	46.2
2 10	9.39	46.2	148.5	190.0	60.8	29.872	48 3
3 0	10 08	47.7	142.2	199.0	62.3	29.841	52.2
4 0	11.25	49 5	124.1	204.8	64.0	29.872	55.1
5 0	11.29	52.0	127.0	200.0	66 0	29.857	57.3
6 0	12.1	53.5	127.4	193.2	67.6	29.861	58.2
7 0	8.11	57.5	142.8	175.0	68.2	29.814	59 3
10 0	10.34	57.6	136.0	185.0	66.8	29.793	57.5
11 0	11.00	57.0	135.0	182 5	65.0	29 800	54.7
18 0	26 16	49.0	155.2	208.6	51.2	29.949	38.2
19 0	27.04	49.0	127.3	203.2	52.8	29.924	38.0
20 0	24.02	49.0	164.2	220.5	58.2	29.915	39.0
21 0	19.28	48.0	163.7	201.6	59.0	29.943	38.2
22 0	10.17	48.6	154.9	184.5	58.2	29.979	36.2
23 0	9.38	47.0	148.4	183.0	58.8	29.989	35.6
Apr. 16.							
24 0	8.38	46.2	147.4	181.4	56.4	30.025	36.5
1 50	9.09	46.0	145.0	184.3	54.0	30.027	42.5
2 0	9.15	46.0	145.0	184.0	54.0		
2 10	9.25	46.2	145.0	184.4	54.3	30.032	45.3
Apr. 19.							
1 50	8 38	41.4				29.717	38.2
2 0	8.30	41.4	135.8	174.6	40.0		
2 10	8.22	41 5	137.0	176 6	40.0	29.733	43.0
3 0	8.15	41.8	135.9	174.3	41 2	29.730	38.9
4 0	8.27	42 3	135.2	178.2	46.0	29.695	39.5
5 0	8.22	43.0	134.8	182 6	52.0	29.670	40.0
6 0	8 42	44.0	131.1	180.5	58.0	29.632	41.2
7 0	8 26	44.2	133.0	181.9	59.4	29.627	40.7
8 0	8.20	44.5	132 0	183.2	59.5	29.584	41.0
9 0	8.05	44 5	134 2	179.7	58.3	29.572	40.2
10 0	8.03	44.5	135.0	184.0	60 2	29.542	40.2
11 0	8.10	44.3	138 4	180.5	60.2	29.548	40.2
12 0	8 04	44.3	137.9	181.2	59.8	29.537	40.0
13 0	8.34	44.5	153.3	179 4	58 0	29.530	40.0
13 50	9 05	44.5	140.0	183 6	58.6	29 528	40 0
14 0	9.09	44.5	140.0	181.8	58.7	29.529	40.0
14 10	9.06	44.5	138.3	183.0	59 0	29.529	40.0
16 0	9.14	44 5	138.0	181.8	58.5	29.499	40.0
17 0	10 16	45.5	132.8	176.2	56.2	29 494	40.0
18 0	10.06	46.0	138.0	179.0	57.5	29 491	40.4
20 0	9.24	46.0	139 0	181.0	61.0	29.466	40.5
21 0	9.24	46 0	139.8	181.4	62[illegible]	29.478	40.5
22 0	9.38	46 0	142 6	182.3	62.0	29.460	40.8
23 0	9.25	46.0	142.6	181.0	63.0	29.482	41.0
Apr. 20.							
24 0	9 30	46 0	144 0	182.0	63.0	29.597	42.0
1 50	10.14	46.8	137.8	179.0	59.0	29.524	44.0
2 0	10.31	46.8	137.5			29.526	
2 10	10.24	47.0	138.4	178.2	58.2	29.530	44.5
3 0	10.15	47.5	137.0	179.0	57.5	29.617	46.4
5 0	12.02	50 4	134.4	183.1	58 7	29.555	52 0
7 0	12 21	53 7	134.1	181.2	61.5	29 587	56 1
8 0	12 48	56.0	135.0	181.0	63.5	29.697	56.0
9 0	13 29	56 7	136 9	183.0	64.0	29.635	56.0
	Term	day	omit	ted.			
Apr. 21.							
11 0	16.08	63 0	140 0	179 0	67 0	29.918	58.0
12 0	15.10	62.0	137.7	182.0	65 6	29.904	54.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
16 0	+13.37	55.8	142.2	178.4	56.5	29 909	47.6
17 0	13.08	54.4	140.0	176 8	55.5	29.902	43.0
18 0	12.38	54.6	139.1	176 6	55.0	29.880	46.0
19 0	12.12	53.5	137.5	179.0		29.715	45.5
20 0	12.41	57.5	139.0	180.0	58.0	29.746	45.5
21 0	12.38	57.5	140.0	181.2	60.8	29.738	45.5
22 0	11.47	52 0	140.0	182.2	62.8	29.819	45.0
23 0	11.33	52.0	141.0	182.3	63.2	29.803	45.2
Apr. 22.							
1 0	13.23	54.2	142.9	183.0	61.9	29 786	54.0
1 50	13.21	54.6	142 5	184.2	63.0	29.766	63.5
2 0	13.38	55.0	142.3	184.6	63.2	29.772	
2 10	13.22	55.2	142.2	185.0	63.6		65.2
4 0	16.25	60.5	134 4	189.3	69.8	29.687	74.5
5 0	17.14	63.1	132.5	191.6	74 5	29.650	80.0
6 0	18.10	65.5	132.6	191.5	77.0	29.655	79.6
7 0	20.03	74.0	133.0	199.0	82.0	29.597	82.0
11 0	vibrating	77.7	135.0	202.0	82.0	29.480	77.0
13 0	22.40	74.5	136 4	174.5	75.0	29.477	68.0
13 50	22.40	73.5	138.3	192.0	75.0	29.457	62.5
14 0	21.26	73.0	138.5	194.5	74.6	29 461	62.5
14 10	21.30	72.6	137.7	193.7	74.5	29.475	65.5
15 0	19.20	72 0	138.0	173.4	72.0	29 466	63.5
16 0	18 47	71.0	139.6	193.2	71.6	29.473	62.0
17 0	19.03	70.0	142.5	189.8	70.1	29.475	60.9
18 0	19.17	68 8	139.3	189.2	69.0	29.478	60.2
19 0	18.23	67.9	141.5	192.9	67.9	29.471	61.2
20 0	18.25	67.5	140.1	191.6	67.1	29 480	64.0
21 0	18.11	66.7	140.8	191.1	66.3	29.540	63 4
22 7	17.11	66.4	141.2	189.7	65.3	29.613	60.0
23 0	16 21	64.0	142.2	188.9	64.8	29 658	56.0
Apr. 23.							
24 0	15.06	63.0	141 2	188.4	63.2	29.727	55.0
1 0	14.25	61.5	139.4	190.5	62.4	29.766	56 0
2 0			141.6	190.9	62.2	29.799	55.8
2 10	14.30	59.7	141.4	191.5	62.3	29 799	55.2
Apr. 25.							
2 0	8.45	47.6	142 4	181.4	46.2	29 876	
2 10	9.00	47.7	141.9	182.0	46.1	29.884	44 5
5 0	10.43	50.0	132.6	185.0	48.7	29 838	48.2
6 0	10.47	51.0	130.8	183.5	50.0	29.825	50.0
7 0	11.01	52.5	129.1	182 0	52 1	29.813	52.0
8 0	11.40	53.0	131.5	179 8	53.5	29 713	50.5
9 0	11.00	53.5	134.5	179 2	54 0	29.803	51.0
11 0	10 41	52 8	137.6	180.7	54 0	29.811	41.7
12 0	10.34	52.0		179.2	54.0	29.806	44.5
13 0	10.09	51.2	136 6	176 8	52.0	29.815	43.5
14 0	10.40	51.0	136.5	177.0	51.0	29.802	43 5
14 10	10.45	50.5	137.0	177.0	51.0	29.790	43 0
15 0	10.48	50.5	139.0	178.0	50 2	29 806	43.0
16 0	10.48	50 0	138 0	179.8	50.5	29.784	43.0
17 0	10.22	50.0	137.0	180.2	53.0	29 758	41.5
19 0	10.24	49.5	138 2	183.2	57.0	29.768	43.0
20 0	10.05	49.0	140.0	183.5	56 0	29.767	42.0
21 0	9.31	48.8	140.5	181.5	56.0	29.761	42.0
22 0	9.24	48 8	139.0	182 0	57.0	29.763	42.0
23 0	9.11	48.5	139.5	182.5	57.5	29.743	41.0
Apr. 26.							
24 0	9.12	48 5	146.0	183.0	58 0	29.741	41.5
1 0	8.36	48 0	146 3	185.1	58.5	29.757	41.5
1 50	8.33	48.0	142.9	186.5	57.3	29.732	41.5
2 0	8.41	48.1	142 7	186 6	57.[illegible]	29.730	
2 10	8.42	48.2	141.5	186 8	57.2	29.726	41.3

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
3 0	+9.03	48°.0	138.5	187.2	56°2	29.724	41°.5
4 0	9.03	48.5	134.2	186.0	55.5	29.660	41.8
7 0	9.48	48.5	132.1	183 9	55.8	29.583	43.3
8 0	9.46	48.8	130.9	180.3	55.3	29.539	43.0
9 0	9.46	49.0	133.0	178.0	54.5	29.511	43.0
10 0	9.37	48.7	134.9	179.5	53.5	29.536	43.0
11 0	8.48	48.4	137.0	177.0	52.4	29.475	43.2
12 0	8.25	48.5	139.0	180.0	51.5	29.462	43.2
13 0	8.35	48.0	143.0	180 6	51.0	29.451	43.0
14 0	9.40	48.0	140.0	178.9	50.2	29.431	43.6
15 0	8.24	47.6	137.5	179.1	50 8	29.422	43.0
16 0	9.17	49.0	138.5	181.0	53.3	29.412	42.5
17 0	9.08	48 6	138.2	181.4	55.5	29.394	42.5
18 0	9.04	48.2	140.0	183.4	57.8	29.348	42.5
19 0	9.00	48.5	141.0	185.0	58.3	29.247	41.4
20 0	8.36	48 5	141.7	184.4	60.3	29.218	41.7
21 0	9.24	49.8	142.8	184.7	61.5	29 238	42.0
22 0	9.28	49.0	143.5	186.5	62.9	29.246	41.9
23 0	9.03	48.7	142.8	187.0	62.5	29.212	42.0
Apr. 27.							
24 0	9.10	48.7	143 0	187.2	64.3	29.160	42.1
1 0	9.09	48 7	142.0	189.8	65 0	29.298	43 2
{ 1 50	9.27	49.5	140.8	190.4	63.3	29.236	47.5
{ 2 0	10.00	49.9	140.0	190.2	63.2	29 259	
{ 2 10	9.47	50.4	139.8	190.2	63.0	29.240	49.1
5 0	13.30	55.5	133.2	191.3	64.4	29.238	57.1
6 0	14.31	58.5	128.6	187.8	64.6	29.307	58.0
8 0	14.10	60.7	127.2	189.0	65.2	29 233	60.0
9 0	14.08	61.0	130.0	189.0	64.5	29 235	58.5
10 0	14.27	60.6	134.0	185.2	63.5	29.258	57.0
12 0	12.47	58.4	134.0	184.0	60.0	29.333	51.0
13 0	12.05	56.0	136.2	182.9	57.0	29.378	46.8
14 0	12 29	55.5	138 5	181.4	56.0	29.290	46.0
15 0	11.14	53.5	138.4	182 5	55.0	29.256	
16 0	10.41	52.5	138.0	183.2	56 0	29.247	43.0
17 0	10 23	51.8	138.2	184.3	56.0	29.330	41 5
18 0	10.20	52.0	138.5	183.2	56 0	29.343	41.0
19 0	10.28	49.5	139.0	182.2	56.0	29.368	39 5
20 0	9.32	48.5	138.9	183.3	56.5	29 425	38.6
21 0	9.28	49.5	138 9	184.0	56.3	29.354	37.0
22 0	10.12	50.5	139.9	183.8	56 5	29.428	38.0
23 0	8.05	51.5	142.0	184.0	58.4	29.525	38.0
Apr. 28.							
24 0	10.31	54.0	143 0	184.0	57.3	29.452	40.5
1 0	11.01	53.5	142.2	184.3	56 5	29.463	48 0
{ 1 50	11.40	53.6	142.2	186.0	56.8	29.456	49.3
{ 2 0	11.47	53.6	142.7	186.2	57.0	29.452	
{ 2 10	11.46	53.8	142.9	186.4	57.0	29.443	50.4
5 0	12 13	55.0	131.2	188.4	59 5	29.464	51.4
6 0	12.18	55.0	140 5	187.6	59.0	29 452	52.9
7 0	12 12	55.5	130.2	184 2	59.0	29 461	55.0
9 0	12.21	56.0	132.5	179.8	58.0	29.365	50 0
10 0	12.21	55.0	135.2	179.5	57 0	29.480	50.0
11 0	11.48	53 5	136.0	179.8	56.0	29.542	46.2
12 0	11.46	53.5	137.0	179.0	54 5	29.523	46.0
13 0	10 46	51.5	138.0	178.7	52.5	29.643	43.0
{ 13 50	10.22	51.0	138.7	179.4	51 0	29.582	43.0
{ 14 0	10.22	51.0	138.0	179.2	50.6	29.580	43.0
{ 14 10	10.24	50.6	138.9	179 9	50 5	29.590	42.6
15 0	10.11	50.4	139.8	177.6	49.8	29.602	41.3
16 0	9.30	49.5	139.2	179.9	48.9	29.617	40.0
17 0	9.23	47.8	138.0	182.6	51.0	29.611	39.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Apr. 29.							
h. m.							
1 0	+8.33	46°.0	144.0	178.2	46°.5	29.667	44°.5
{ 1 50	8.39	46.6	142.7	181.0	47.8	29.651	47.0
{ 2 0	9.09	46.9	142.5	181.6	48.0	29.657	
{ 2 10	9 16	47.1	144.7	182.5		29.653	47.2
3 0	10.31	48.3	143.2	184.8	51.0	29.683	50.0
3 30	11.38	52.0	137.5	187.5	55.5	29.644	56.0
4 0	12.31	53.5	131.1	187.3	59.6	29.511	54.1
8 0	12.31	57.8	129.4	185.8	62.0	29.606	52.0
9 0	12.04	58.0	126.0	185 4	61.0	29.594	55.0
10 0	12.18	57.5	127.8	185.8	60.0	29.656	55.0
11 0	11.12	56 4	131.2	187.3	58.8	29.632	54.3
12 0	12 22	56 5	134.0	185.0	58.0	29.645	52.5
13 0	12.00	55.0	135.0	181.0	56.5	29.657	47.0
14 0	11.18	54.6	137.6	182.9	54.0	29.625	43.0
15 0	11.03	54.0	138.4	182.8	53.2	29.649	41.6
17 0	10.02	50.6	137.1	183.5	55.2	29.667	36.0
18 0	10.02	49.5	138.0	183.0	56.0	29.765	34.0
19 0	10.15	49.0	138.0	182.5	55.5	29.765	34.0
20 0	10.12	49.0	139.0	184.0	55.0	29.735	35.0
21 0	9.33	47.0	136.0	183.0	56.0	29 695	32.0
22 0	8.36	46.0	132.0	184.0	56.0	29.695	32.0
23 0	7.03	47.0	132.0	184.0	57.0	29.495	34.0
Apr. 30.							
24 0	9.04	47.0	133.0	186.0	57.0	29.729	36.0
May 2.							
{ 1 50	11 35	52 8	144 2	178.1	51.0	29.415	52.5
{ 2 0	11.48	53.0	144.4	178.8	51.0	29.408	
{ 2 10	12.16	53 2	145 2	178.9	51.0	29.380	53.2
3 0	12 35	54.5	140.5	182.5	55 0	29.497	57.0
4 0	13.33	56.7	136.0	187.0	58.0	29.415	60.0
5 0	14 02	58.0	132.5	187.0	59 5	29.425	61.0
7 0	14.05	59.0	129.5	186.3	60.5	29.432	57.0
9 0	12.47	57.6	134.0	184.1	58.5	29.411	55.2
10 0	12 24	57.3	137.5	183.7	60.0	29.419	54.8
11 0	12.26	56.9	139.0	185.5	63.8	29.415	51.8
17 0	12.19	55.5	151.9	183.4	59.0	29.437	45.0
18 0	12.19	54.5	152.9	182.5	57.0	29.576	45.0
19 0	12.04	54.5	153.0	183.1	57.0	29.570	43.5
20 0	12.24	55 5	153.0	184 5	58 5	29.660	42.0
21 0	12.25	56.0	153.0	185.5	60 5	29.666	43.0
22 0	12.35	56.2	154.5	184.2	60.0	29.673	44.0
23 0	12 18	55.7	155.5	185.1	59.3	29.681	44.5
May 3							
{ 1 50	11.41	55.2	151.7	187.8	56.0	29.734	49.4
{ 2 0	11.40	55.0	152.1	187.5	56.0	29.740	49.4
{ 2 10	12.15	55 0	152.2	187.6	56.0	29.741	48.3
May 5.							
{ 1 50	9.35	47.8	159.0	180.5	45.2	30.111	50.3
{ 2 0	9.34	48 2	158.5	180.9	45.8	30.105	51.0
{ 2 10	9.42	48.5	157 7	181.4	46.1	30.103	
3 0	10.32	50.5	153.0	184 3	50.0	30.102	54.0
4 0	12 10	53.7	146.3	187 2	55.5	30.080	57.0
6 0	13 41	57 5	143 2	188.1	60.8	30.076	60.2
9 0	15.39	63.0	149 7	187 4	65 6	29.987	64.0
10 0	17.08	64.0	150.7	188.3	65 5	29.949	64.0
11 0	16.03	63.5	150 0	189.0	65.0	29.978	61.8
13 0	15.04	62 8	150.0	186 0	62.4	30.011	56.0
{ 13 50	13.43	59.0	152 1	156.1	58.1	29 964	50.0
{ 14 0	13.32	58 6	152.0	159 4	55 5	29 946	
{ 14 10	13.16	58.0	151.3	161.9	55 7	29.978	50.0
15 0	12.08	58.0	150 5	180.9	57 0	29.999	50 0
16 0	13.04	57.0	151.5	180.9	56.5	29.970	50.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.	'	°			°		°
17 0	+12.16	56.3	151.3	180.6	56.0	29.979	48.6
18 0	12.11	55.6	150.5	183.2	59.8	29.948	47.6
19 0	12.45	55.0	151.1	184.0	62.2	29.956	45.8
20 0	12.41	54.0	152.5	184.7	62.0	29.957	44.5
21 0	11.35	53.5	151.0	186.0	62.5	29.951	43.8
22 0	11.30	52.8	154.2	188.0	63.5	29.939	42.2
23 0	11.46	53.5	158.6	187.8	65.0	29.948	43.2
May 6.							
1 52	12.32	55.2	155.5	189.2	61.0	29.836	59.8
2 0	12.34	55.3	156.8	190.3	61.1	29.847	60.0
2 8	12.37		156.1	190 0	61.5	29.861	60.3
3 0	14.05	58.0	152.0	188.8	63.5	29.818	65 0
5 0	15.15	61.5	136 5	195.9	69.5	29.769	68.8
6 0	16.02	64.5	135.0	153.8	71.5	29.728	70.0
7 0	17.44	66.5	136.5	192.7	73.0	29.641	71.8
9 0	16.33	69 5	142.1	191.9	74.2	29 657	71.8
11 0	16.38	69 2	144.2	197.5	73.0	29.659	68.5
13 0	16.46	67.6	147.5	192.7	69.4	29.693	64.4
14 0	16.34	67.0	151.0	190.1	68.0	29.717	61.5
15 0	16.21	66.5	152.6	190.8	67.0	29.741	59.6
16 0	16.41	64.5	153.0	188.6	64.5	29.708	54.5
17 0	15.23	63.0	152.0	188.2	63.0	29.713	51.0
18 0	15.45	61.5	154.7	186.5	61.0	29.823	50.0
19 0	14.22	60.5	153.2	185.2	60.0	29.772	48.0
20 0	14.03	60.0	155.0	192.0	60.8	29.757	44 0
21 0	12.21	56.5	155.0	190.5	63.5	29.840	42.0
22 0	12.32	55.8	157.0	188.5	63.0	29.870	40.0
23 0	11.31	57.5	161.2	189.0	61.0	29.898	39.0
May 9.							
1 50	9.43	48.7	155.0	178.4	46.5		
2 0			154.6			29.598	44.0
2 10	9.38	48.5	154.5	178.9	46.5		
5 0	10.42	49.7	143.5	180.2	47.9	29.589	46.4
6 0	10.10	51.0	141.3	179.9	49.8	29.576	50.4
7 0	11.27	52.3	141.4	182.5	52.1	29.572	50.8
8 0	10.22	53.2	143.7	180.8	53.4	29.609	50.7
9 0	11.35	53 5	145.0	183.0	54.0	29.565	49.0
11 0	9.33	52.5	150.5	176.1	52.0	29.590	45.0
12 20	8.02	50.5	152.2	182.2	50.0	29.595	41.3
13 0	8.16	49.8	151.2	181.2	49.0	29.622	40.0
May 10.							
1 52	8.37	46.6	156.6	179.0	43.8	29.589	49.5
2 0	9.00	46.8	157.3	179.3	44.0	29.574	
2 8	8.43	46.8	157.1	178.6	44.2	29.575	50.0
9 0	8.33	49.0	145.0	175.5	48 0	29.439	49.2
10 0	8.10	49.5	147.0	175.5	49.5	29.430	49.5
11 0	7.36	49.5	151.0	180.0	52.2	29 552	48.5
12 0	8 27	49.5	150.0	184.5	57.5	29.546	47.5
13 0	10.15	52.5	148.5	186.5	60.0	29.560	45.0
13 52	10.13	52.0	149.0	187.0	61 0	29.560	45.0
14 0	10.13	51.8	149.6	187 0	61.0	29.576	45.8
14 8	10.06	51.8	150.0	187.0	61.0	29.547	44.6
15 0	10.26	51.5	156.0	184.0	60.5	29.552	45.5
16 0	11.18	51.5	157.5	190.5	62.0	29.565	45.0
17 0	11.30	51.0	150.6	193.0	64.0	29.549	45.0
18 0	11.25	50.5	142.0	191.0	64.0	29.566	45.5
19 0	11.12	51.0	154.6	192.0	66.0	29.561	44.8
20 0	11.15	51.0	151.0	193.5	67.4	29.539	43.8
21 0	10.20	50.8	153.4	192.5	66.0	29.544	42.0
22 0	10.16	51.0	153.0	192.0	64.5	29.552	42.0
23 0	9.40	51.2	153.3	191.6	62.8	29.566	43.5
23 40	9.22	51.0	153.1	192.0	62.0	29.582	46.0
May 11.							
h. m.	'	°			°		°
24 0	+10.40	51.0	156.0	191.5	61.6	29.581	48.0
1 0	10.26	51.8	157.0	190.5	61.0	29.591	53.5
1 52	11.08	53.1	155.1	192.7	62.2	29.600	56.6
2 0	11.24	53.4	155.1	193.0	62.1	29.595	
2 8	11.27	53.6	154.7	193.0	62.3	29.592	57.8
3 0	12.07	55.2	151.0	195.2	64.0	29.581	57.0
4 0	13.30	58.0	144.0	196.5	66.0	29.576	60.0
5 0	16.12	60.7	144.4	195.1	66.1	29.562	59.8
6 0	16.23	61.9	140.8	194.2	68.6	29.545	52 8
8 0	14.39	62.2	143.5	190.1	69.2	29.464	57.7
9 0	15.43	63.0	146.0	186 2	65.5	29.434	58 0
11 0	13.35	63.0	150.0	182.5	61.5	29.484	59.0
12 0	14.11	62.5	151.0	186.4	62.4	29.486	54 5
14 0	14.09	61.0	151.5	186.6	60 0	29.549	49.0
15 0	13.28	60.0	149.0	187.5	59.5	29.544	48.6
16 0	13.26	57.5	159.5	188.5	61.0	29.578	48.0
May 12.							
24 0	12.08	55.0	160.1	185.4	55.6	29.611	50.0
1 0	12.43	55.0	159.0	187.4	55.0	29.622	51.4
1 52	12.21	55.6	156.7	188 6	55.4	29 639	53.3
2 0	12.14	55.9	157.0	188.4	55 5	29.631	52.3
2 8	12.22	55.8	156.0	188.9	55.5	29.631	52.7
3 0	12.40	56.5	155.0	190.8	57.0	29.544	55.0
4 0	13.18	57.7	150.0	191.3	59.5	29.658	58.1
5 0	14.36	59.0	145.0	191.0	60.8	29.656	57.0
6 0	14.17	60.5	140.0	190.5	61.9	29.654	60.3
7 0	15.12	61.0	140.0	187.0	62.5	29.660	58.4
8 0	15.29	61.6	142.5	185.2	62.4	29 664	59.0
9 0	15.49	60.5	145.0	184.3	60.2	29.664	58.0
10 0	14.28	61.5	146.2	187.0	64.2	29 682	59.0
11 0	14.06	60.5	148.5	187.0	63.5	29.695	57.5
12 0	13.11	59.2	149.3	185.6	62.1	29.720	55.6
13 0	13.08	59.0	151.0	184.7	59.0	29.787	53.0
13 52	13.26	59.0	152.0	184.5	59.0	29.812	50.6
14 0	13.34	58.5	152.0	184.5	59.0	29.810	50.5
14 8	14.44	58.4	151.7	183.9	58.6	29.812	50.0
23 0	8.04	50 0	155.7	176.2	45.5	29.856	40.5
May 13.							
24 0	11.32	50 5	157.0	176.7	45 0	29.878	46.6
1 0	10.06	50.5	157.7	181.2	46.0	29.852	51.0
1 52	11.17	52.2	156.7	183.7	50.0	29.822	54.0
2 0	10.49	52 5	155.5	183.4	50.1	29.822	
2 8	11.21	52.8	155.3	184.1	50.5	29 810	54.7
3 0	12.20	55.0	151.0	187.0	54.4	29.796	58 0
5 0	14.37	59.5	144.0	188.5	61 5	29.743	61.6
7 0	16 04	64.5	141.5	189.0	66.0	29.677	65.5
8 0	16.23	65.5	143.0	188.8	66 1	29.649	65.6
13 0	14.44	61.5	150.5	186.0	59 5	29.588	55.0
14 0	15.42	61.5	150.6	186.0	59.2	29.618	54.2
15 0	15.34	61.6	149 5	184.2	58 6	29 606	55.0
16 0	14.32	60.6	150.2	186.6	59.0	29.646	55.0
May 14.							
24 0	12.42	56.2	154.5	182.9	55.5	29.841	48.0
1 0	12.19	56.0	156.4	184.5	56.8	29.857	47.8
1 52	12 40	57.5	155.0	187.2	60.0	29.859	51.0
2 0	12.47	58.0	154.2	187.7	60.4	29 851	50.8
2 8	13.04	58.2	154.0	188.4	60.6	29.853	50.9
May 16.							
1 0	17.01	52.0	134.5	198 9	48 3	29.811	52.0
1 52	17.24	53.6	141.5	195.0	50.0	29 805	58.0
2 0	17.08	53.7	144.8	195 9	50.2	29.773	57.2
2 8	17.01	54.0	146.6	196.5	50 8	29.782	56.9

Gottingen Mean Time. h. m.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
3 0	+16.07	55°.9	139.6	194.7	54°.6	29.821	59°.0
4 0	15.34	58.2	146.2	197.0	58.5	29.774	62.2
5 0	16 08	61.0	146.3	200.0	63.0	29.706	65.0
6 0	16.16	63 5	143.5	193.0	66.0	29.702	66 3
7 0	16.45	65.0	146.0	191 5	68.5	29 615	68.5
8 0	16.15	67.5	144.7	192 8	70.0	29.711	69.3
9 0	17.31	69.0	149 0	187.8	70.0	29.713	70.0
10 0	17.17	69 5	147.3	193.4	70 0	29.706	68.5
11 0	17.47	69.0	148.0	194 8	69.0	29.739	67 0
12 0	16.42	68 5	149 0	193.5	68.2	29 764	63 5
13 0	16.00	66.5	150.0	190 8	66 0	29.809	59.4
13 52	16.00	65 5	149.2	190.7	64.0	29.832	57 0
14 0	16.00	65.5	151.0	190.0	64.0	29.834	57.0
14 8	16.00	65.5	151.0	189.2	64.0	29.820	57.0
15 0	15.12	64.0	162 7	194.0	62 5	29.851	55.0
16 0	15.39	63.0	165.2	200.7	61.0	29.817	53.0
17 0	15.14	62 0	159 7	192.5	60.0	29.896	52.0
18 0	17.03	60.5	148.7	186.7	59.0	29.935	51.0
19 0			148 0	187.1	61.0	29.944	49.5
20 0			149 5	188.0	62.1	29.956	48.8
21 0			153.7	197.5	61.9	29.979	49.7
22 0	19.10	58.4	139 5	192 9	61.4	29.979	48.0
23 0	15.11	58.2	155.5	186 4	59.1	30.006	51.2
May 17.							
24 0	17.11	60.5	148.5	192.5	59 8	30.052	58.0
1 0	16.35	61.0	156.8	192 2	61.0	30.080	62.0
1 52	16.41	62.6	152 7	194.5	63.0	30 049	66 4
2 0			152.7	193.8	63.2	30.045	66.2
2 8	16.40	63.2	151 5	194.9	63 6	30.069	66.1
3 0	17.00	66.0	154.9	197 5	66.5	30.081	68.0
5 0	18.11	68.6	142 5	204 1	71.0	30.115	69.1
6 0	17.30	69 0	145.3	196.7	72.0	30.107	67.0
9 0	17.15	67.0	148.7	190 0	70 0	30.099	63.0
12 0	11.43	62.5	150.5	188.4	64.5	30.082	57.5
13 0	13.44	61.5	153.0	192 9	63.0	30.105	55.5
14 0	11.24	61.5	158.0	193.7	61.8	30.130	57.2
15 0	11.48	62.1	153.1	190.8	60.8	30.143	54.0
16 0	15.38	63.0	153.1	186.4	60.0	30.140	52.0
17 0	16.49	62 0	151.5	188 7	58 7	30.143	51.5
18 0	15.19	61.0	153 8	188 1	57.0	30.148	52.0
May 18.							
1 52	15.02	60.4	152.5	192.2	57.2	30.208	64.0
2 0	15.25	60.6	152.0	190.3	57.7	30.195	
2 8	15.30	60.8	151.7	190 3	58.1	30.185	64.5
4 0	16.44	65.2	146.0	195 9	66.0	30 165	71.0
5 0	17.38	67 0	146.0	196.2	69 4	30 156	73.2
6 0	18.26	69.0	145.5	195.5	72.0	30.133	75.0
9 0	20.37	73.5	146.5	193.0	74.5	30.003	74.0
10 0	19.41	74.0	147.5	196.3	74.5	30.047	72.0
11 0	19 36	73.5	146.5	193.0	73.2	30.009	69.0
12 0	18.27	71.5	150.0	193 2	70 5	30.001	65.3
13 0	17.33	69 0	149.5	192.3	67 5	30.022	59.8
14 0	18.00	67.8	151.6	190.4	65 4	30.056	55.2
15 0	17.37	66.0	155.2	186 4	64.0	30.050	54 0
16 0	17.18	65.0	153 4	188.5	62.8	30.063	52.0
17 0	16.17	64 0	151.8	188.0	61 0	30.045	49.2
18 0	15.07	62.0	151.3	184 2	59.0	30.054	50.0
21 0	14.40	60.0	153.4	183.0	57.0	29.971	53 0
22 0	14.26	60 0	153.7	183 9	57.0	29 963	52.7
23 0	14.26	60.5	153.7	185.0	57.0	29.970	55.7
May 19							
24 0	15 18	61.0	150.8	187.7	57.0	29.978	59.0
1 0	16.16	61.5	149.4	190.2	59.0	29.961	64.0
1 52	+17.01	62°.8	154.8	193.3	61°.2	29.924	69°.0
2 0	16.37	63.2	152.4	194.4	61.8	29.926	
2 8	16 40	63 5	151.0	194.6	62 0	29.923	69.0
3 0	18.39	66.0	147 0	195 5	66 8	29 904	73.0
4 0	19 07	68.5	147 9	196 2	70 7	29.873	75.0
5 0	20 00	72.4	145.0	198 8	74.0	29.848	77.3
6 0	20 00	75.0	143.0	197.0	75 0	29.815	77.0
7 0	20.05	76 0	144 0	196.0	75.0	29.867	76.0
8 0	21.03	73 0	146.0	197.0	74 0	29.870	76.0
9 0	21.43	75.0	147 5	196 6	76.0	29.755	76.0
12 0	17 49	69.5	149 0	189.4	68.2	29.958	56.3
13 0	15 45	66.5	151.0	189.7	65.5	30.120	52.5
14 0	17.42	66.0	155.7	189 1	64.2	30 055	52.8
15 0	16.38	63 5	150 5	188 1	62.7	30.088	51.2
16 0	14 46	61.7	151.7	188.2	60.7	30.119	50.0
18 0	14 39	59.0	152 3	186.0	57 5	30.172	45.0
19 0	13 05	57.0	154 0	184.0	56.0	30.134	43.0
20 0	13 43	56.0	151.8	184.0	55 0	30.054	42.0
21 0	12 48	55 0	151 9	185 4	57.0	30.039	43.0
22 0	11.18	54 0	152 0	186.5	58 0	30.043	42.0
23 0	11.05	53.0	157.0	184.0	58.0	30.094	41.0
May 20.							
24 0	10 20	52.0	153 0	183.7	58.0	30.106	38 0
1 52	10 21	50 5	151.6	183 2	55.9	30.275	36.2
2 0	10.08	50.0	150.5	182.7	55.3	30.279	
2 8	9.20	49 0	147.5	182.9	55.0	30.279	36.0
3 0	10.30	49.0	144.6	183.4	54.0	30.307	36.0
5 0	9.28	48.0	143.8	178 0	58.0	30.286	37.0
6 0	9 20	48.0	143.0	174 5	49 5	30 257	38 0
7 0	9.00	48.5	140.7	175.0	50.0	30.253	39.0
10 0	9.41	50 5	150 0	177.4	50.0	30 236	43 0
12 0	9.33	51.5	149.0	176 5	49.3	30 460	41.0
14 0	9.15	46.5	149.0	175 6	46.9	30.226	34.5
15 0	9.11	47.0	150.1	174.9	45.3	30 226	33.5
16 0	9.01	47.0	150 5	179 6	47.7	30.214	32 8
17 0	8.42	46.5	152.0	182.7	54.4	30.209	32.0
18 0	8.37	45.9	150.0	183.5	55.4	30.201	32.0
May 21.							
24 0	9.22	47.0	155.0	176.9	42.0	30 202	40.4
1 0	9.08	46 0	154.5	180 4	49.6	30.230	45.0
1 52	11.44	54.6	155.4	184.5	52.8	29 701	52.2
2 0	12.03	54.6	155.0	183.2	52 6	29.693	
2 8	12 01	54.7	155.1	184.9	52.8	29 689	52.9
7 0	13.22	57 3	140.5	178.0	56.5	29 752	57.3
9 0	13.37	58.4	144.8	178.7	57.8	29.706	57.5
11 0	14.03	59.8	149.0	184.0	58 5	29.790	54.5
12 0	14.15	59 5	150.5	184.0	58.5	29.831	52 0
13 0	14.45	59.6	150 0	182 0	57.5	29.853	49 5
13 52	12 24	56.5	148.2	182.0	54.0	29.891	44.5
14 0	12.20	56 5	149.4	178 8	54.0	29.719	
14 8	12.48	56 5	150.5	180.2	54.0	29.878	44.0
16 0	12.00	54.8	150 4	179.9	52 0	29.831	42.5
17 0	11.30	54.0	150.4	179.5	52 0	29.944	41.0
18 0	11.20	52.5	150 2	181.6	56.0	29.929	40.0
19 0	11.20	52.5	150.5	184.2	60.0	29.961	42.0
20 0	11.10		153.2	185 0	61 0	29.953	43.5
21 0	11.05	52.1	152.0	186.0	62.7	29.966	41.7
22 0	10.42	51.8	153 5	184.7	64.8	29.965	41.8
23 0	11.00	52 0	160.0	186.8	67.0	30.001	42.2
May 24.							
1 52	14.13	57 8	160 7	191.0	64.5	29.981	55.8
2 0	14.22	58.0	161.2	190.9	64.[illegible]	29.985	
2 8	14.14	58.0	160.5	190.6	64.2	29.985	57.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
3 0	+14 33	59°0	155.2	191 3	63°8	29.973	59°.0
4 0	14.33	59.0	149.4	193.0	63 8	29.962	57.5
5 0	14.42	59 5	141 0	192 5	64.5	29 952	59.4
6 0	14 30	60.0	140.0	190 0	64.4	29.885	58 8
7 0	14.38	59.5	140.5	186.4	65 0	29 942	59.5
8 0	14 32	60 5	142.4	184.7	64.4	29 891	61.4
9 0	15.10	62 0	145.0	182.2	63.0	29.874	60.7
10 0	15.18	62 5	146.0	181.5	62 5	29.854	60.5
11 0	14.31	61 0	147 0	181.6	61.0	29.848	58.0
12 0	14.41	61.0	148 5	182.7	60.0	29.866	56 0
13 0	14.17	59.5	150.1	183 5	58.7	29 870	53.5
14 0	14.39	59.0	150 6	182 0	58 5	29.874	53.5
16 0	14 15	59.5	151 8	181.0	58.5	29 852	51.0
17 0	14.29	59.5	154.0	181.2	59.5	29.848	50 2
18 0	14.40	58.8	155.8	184 6	61.4	29.805	50 0
19 0	14.05	58.6	151.0	185.8	54 5	29 769	49 8
20 0	14.48	57 6	151 6	186 3	64.5	29 785	50.2
21 0	13.33	57 5	153.0	189.7	66 5	29.756	50.5
22 0	13.24	57.3	154.0	189 2	67 5	29.772	50.5
23 0	13.25	57.3	156 7	189.4	69.0	29.757	51.0
May 25.							
24 0	13.03	55 7	160.0	190 4	70.5	29.740	52.5
1 52	12 05	57.3	156.9	193.9	69 5	29.733	54.8
2 0	12.21	57.3	155.9	194 3	69.5	29 735	
2 8	12 25	57.5	155.2	193.1	69 0	29 741	54 4
4 0	14.20	60.0	149 0	193.8	67 5	29 720	59 0
5 0	15.02	60.5	145.0	192.0	67.0	29 693	64 0
7 0	17.25	66.0	143.2	189 8	72 0	29.648	67 0
8 0	18.45	67 5	143 5	192.2	74.0	29 628	68 0
10 0	17.03	67.7	149.3	190 0	72.8	29.643	65.0
11 0	16.23	66.8	148.5	191.4	71.9	29 651	64.1
12 0	16:11	65.6	150.2	186.2	70 0	29 673	61.3
13 0	16 11	65.2	153.6	190.2	68.5	29.658	58 2
13 52	22.19	64.8	158 7	190.9	66 0	29 625	54.0
14 0	24.18	63.5	157 8	190.0	65.0	29.623	
14 8	31.14	63.0	157.7	189.5		29.631	53.0
15 0	31.15	62.0	153 5	188.5	62.0	29.754	53.0
16 0	15.05	59.0	153.5	186.1	61.0	29.750	50.0
17 0	14.26	59.0	152.7	184.9	60.0	29.753	47.0
18 0	15.16	59 0	152.0	183 1	57 6	29 761	47.0
19 0	14.16	59 0	150 7	181.9	56.5	29.760	47.0
20 0	14.45	58.0	151.0	184.2	58 0	29 745	47.5
21 0	13.27	57.0	148.0	187.6	62 0	29.721	46 0
22 0	13.11	57.0	146.1	186 4	62.5	29.737	46 0
23 0	11.19	59.0	160.0	185.0	61.0	29 752	51.0
May 26.							
24 0	16.26	62 5		184.0	60 3	29.785	56 6
1 0	15.37	61.0	158.0	186 9	60.8	29 715	58.5
1 52	15.43	62.4	154 8	187.7	61 8	29.775	61.3
2 0	16.15	62.6	155.2	188 0	61.9	29.775	
2 8	16.05	62.6	154.8	188 2	61 8	29.777	62 0
3 0	16 10	63.5	152 0	192.5	63 5	29.767	63.5
4 0	17.10	65.0	146 9	197.7	65.0	29.768	66.0
5 0	18.25	67 0	143.0	195.7	67.5	29.738	68.0
7 0	19.47	69.3	139.5	192 3	70.0	29 725	69.5
8 0	19.13	70 6	141 5	188 5	70.5	29.720	70.0
9 0	19.04	70 6	143.5	183 7	70 5	29.741	69 5
10 0	17.34	70.5	144.8	186 0	69.6	29.734	68 0
11 0	17.47	69.4	148 0	188 1	69.1	29.740	66.7
12 0	17.47	69 0	147 8	190.2	68.3	29.767	65.7
14 0	17.36	66.5	150.0	188 4	65.5	29 841	56.2
16 0	16.48	62 0	155.3	182.9	60.4	29.874	50.0
17 0	15.17	62 0	154.7	182.0	60.0	29.829	47.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
18 0	+15.29	61°.0	153.0	185 0	61°.0	29.845	47°.0
19 0	15 23	61 0	150 5	186.5	63 0	29.831	46.0
20 0	14 42	60.5	150.5	186 9	63.2	29.858	45.6
21 0	14.31	60 3	152.0	186 6	62.9	29.825	47.2
22 0	14.27	60 2	152 2	187.1	63.2	29.898	50.0
23 0	14.33	60.5	154.6	187.5	64.0	29.931	51.0
May 27.							
24 0	14.39	60.2	158 4	186 0	63.4	29.917	53.0
1 0	14 13	59.3	159.6	187.0	63 5	29.904	54.8
3 0	14.31	59.3	152 5	189.3	62.5	29.863	57.2
4 0	15 05	60 0	146.4	190.5	62.0	29.864	57.5
5 0	15.05	60.0	143.2	189.3	62.0	29 845	58.2
6 0	15.18	60.5	141.0	185.9	62.0	29.843	57.5
7 0	15 05	59 8	143.3	183.6	62.0	29.821	57.0
8 0	15 49	59.3	144.0	183.2	61.5	29.778	54.3
9 0	14 24	58 8	147.0	182.0	61.0	29.784	52.2
	Term	day	omit	ted.			
May 30.							
24 0	12 44	53.5	156.0	177.4	50.0	29.495	48.0
1 52	12.10	53.6	155.5	181.0	50 6	29.462	49.2
2 0	12.06	53.7	155.3	181 2	50.7		
2 8	11.48	53.5	154.7	181.1	51 5	29.442	49.0
3 0	12 19	5 5	152.7	183.0	51.5	29.490	49.5
4 0	12 38	54.0	149 5	181.3	52 0	29.446	49.6
5 0	13.31	54 4	145.4	181.4	52.6	29.452	50.4
6 0	12.42	55.5	144.1	182.2	53.8	29.440	52.5
7 0	13.03	55 5	143.6	183 6	54.5	29 423	52.3
8 0	13 03	56 2	146.0	181 5	55.0	29.423	54.0
9 0	12.30	56 5	146 0	181.0	55 0	29.397	53.2
11 0	12 24	56.3	149.0	180 0	54.5	29.402	52.0
12 8	12.32	56.4	150.0	182.0	54 0	29.439	53.5
13 0	13 05	56.0	149.0	181.5	54.5	29 442	52.5
14 0	11.02	57.0	148.0	182 0	55.0	29.465	53.0
15 0	13.02		149.0	182 0	55.0	29.487	52 0
16 0	13 46	56.0	149 5	182.7	55.0	29.470	52.0
17 0	13.30	56 0	149.3	183.7	56.7	29.470	51.6
18 0	13.01	56 0	149.6	184.0	59.0	29.482	50.0
19 0	13 02	55.7	149.5	186.7	63.0	29.495	49.0
20 0	12 38	55.5	150.2	188.8	66.0	29.505	47.0
21 0	12.43	55 2	150 1	188 1	65.0	29.501	46.3
22 0	13.14	54.6	151.7	186.5	63.1	29.534	45.1
23 0	12.28	55.3	154.5	186.3	63.5	29.547	49.3
May 31.							
24 0	13 44	57.4	158.5	186.0	63.0	29.561	53 3
1 52	14.43	59.0	155 9	186 9	63.5	29.559	70.3
2 0	15 03	59 2	157.3	187 6	63.5	29.574	68.1
2 8	14.45	59.5	157.4	187.6	63.4	29.583	67.3
4 0	16 41	63.5	149.7	191.5	67.0	29 598	61.0
6 0	17.40	66.5	145.0	191.8	68.0	29.607	64.0
7 0	18.00	67.0	144.0	190.5	68.5	29 584	65.0
8 0	18.00	68.0	145.0	190.5	69.0	29.567	66 2
9 0	18.06	69 0	146.6	189.6	69.0	29.569	66.0
10 0	18.26	69.0	149.5	188.0	69.0	29 579	65.8
11 0	18.19	69.0	151.5	189.0	68.5	29.610	64.0
12 0	17.39	67.5	151.2	187.5	66 8	29 634	61.0
13 0	17.34	66.0	151.2	185.0	65.0	29.689	55 9
14 0	16.28	64.0	151.5	185 7	62 6	29.704	52.0
15 0	15.38	61.5	152.2	184.3	60.0	29.730	49.2
16 0	15.16	61 0	152.5	184 2	59.5	29.742	48.0
17 0	14.42	60 0	151.4	183.7	57.5	29.759	46.5
18 0	14.10	57 5	152.0	184 3	58.4	29.797	44.4
19 0	13.38	56.5	152 4	184.0	58.5	29.809	44 2
20 0	14.11	55.5	151.4	185.0	55.0	29.831	47.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
21 0	+12.42	59.5°	151.8	185.6	55.8°	29.814	46.0°
22 0	12.15	54.5	152.8	185.5	61.3	29.837	45.0
23 0	11.31	55.0	156.5	184.7	60.8	29.883	49.5
Jun. 1.							
24 0	15.13	59.8	158.9	183.3	60.8	29.907	54.4
1 0	15.06	58.0	159.0	185.0	61.2	29.915	58.2
{1 52	15.16	59.2	157.0	187.3	62.7	29.915	61.5
{2 0	15.20	59.5	156.3	187.6	62.6	29.915	
{2 8	15.22	59.8	155.9	187.7	62.5	29.918	61.9
3 0	16.04	61.7	153.1	188.9	62.5	29.913	62.0
4 0	16.36	63.5	148.8	189.7	64.0	29.911	63.9
5 0	18.08	65.0	145.5	191.0	65.0	29.929	65.5
6 0	17.30	66.5	143.0	192.9	68.3	29.930	67.0
7 0	17.33	67.5	142.0	191.4	69.0	29.917	67.2
8 0	17.48	68.8	143.5	190.5	70.0	29.878	68.8
9 0	17.20	69.5	144.6	187.0	70.0	29.892	68.2
10 0	17.02	69.0	146.0	191.2	69.4	29.891	67.0
11 0	17.44	68.0	150.0	189.0	68.2	29.909	65.4
12 0	16.24	67.0	149.0	186.0	66.5	29.947	63.2
13 0	16.28	65.0	151.5	185.0	65.0	29.983	58.0
14 0	16.34	64.5	150.2	184.4	63.5	30.007	54.0
15 0	16.05	63.0	150.5	183.3	61.6	30.021	50.0
16 0	15.44	61.2	152.5	185.9	60.5	30.009	47.2
17 0	14.15	60.0	167.0	188.5	61.4	30.049	45.0
18 0	13.24	59.0	154.0	187.0	61.5	30.048	44.0
19 0	14.30	57.5	153.5	190.0	62.0	30.058	43.5
20 0	14.40	56.0	156.5	191.5	62.0	30.063	44.0
21 0	14.19	55.0	155.0	187.7	61.0	30.028	41.5
22 0	13.39	53.5	157.9	186.0	60.0	30.059	41.0
23 0	10.21	55.0	159.2	182.2	58.0	30.080	47.5
Jun. 2.							
24 0	15.18	60.0	160.5	182.7	57.3	30.123	52.3
1 0	15.16	58.0	157.0	186.0	58.0	30.126	58.0
{1 52	15.48	59.5	158.8	191.2	59.7	30.129	64.0
{2 0	16.09	60.0	158.0	192.0	60.0	30.129	
{2 8	16.16	60.2	157.8	191.3	60.2	30.136	65.1
3 0	17.24	63.2	144.5	190.3	63.6	30.122	68.4
4 0	16.45	65.5	145.0	188.0	67.2	30.125	70.0
7 0	19.01	70.0	139.5	192.6	73.0	30.017	69.7
8 0	20.36	70.3	139.6	192.0	72.7	30.070	69.3
9 0	20.23	71.0	143.0	190.0	72.5	30.019	69.1
11 0	19.11	70.5	149.7	190.2	69.8	30.005	67.0
12 0	18.38	69.0	151.5	188.0	68.0	30.020	62.0
13 0	17.48	67.0	152.5	185.5	66.5	30.069	58.5
14 0	19.03	65.5	160.8	187.3	65.4	30.080	54.2
15 0	18.30	64.5	163.9	185.0	64.0	30.084	52.0
16 0	17.18	63.5	157.1	189.0	65.5	30.089	50.5
17 0	17.03	63.5	150.0	190.0	66.1	30.090	48.8
18 0	17.03	63.5	148.0	192.0	68.0	30.094	47.0
19 0	17.03	62.5	151.0	191.0	68.0	30.094	45.5
20 0	16.11	62.4	152.2	190.7	68.5	30.060	44.4
21 0	15.18	59.6	153.2	190.9	68.0	30.066	42.5
22 0	14.07	57.8	156.8	185.7	65.5	30.073	41.2
23 0	11.06	57.8	160.0	184.0	63.0	30.082	46.6
Jun. 3.							
24 0	17.17	63.5	161.2	184.8	61.5	30.112	54.3
1 0	16.49	61.2	160.7	190.0	61.0	30.107	60.5
{1 52	17.13	62.7	157.9	192.2	62.3	30.107	65.4
{2 0	17.17	63.0	155.6	192.8	62.7	30.099	
{2 8	17.28	63.2	155.0	193.8	62.9	30.095	65.7
3 0	18.17	65.0	152.5	198.0	65.2	30.075	69.0
4 0	19.01	67.0	146.0	199.0	68.0	30.053	71.0
6 0	20.05	69.8	141.3	197.2	72.8	30.052	71.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
8 0	+20.03	71.8°	143.0	198.0	75.0°	29.999	71.0°
9 0	20.40	72.0	145.0	197.0	74.5	30.009	70.0
10 0	19.28	74.0	152.0	195.0	73.5	30.088	70.0
11 0	18.37	71.0	153.0	190.0	71.6	29.869	67.0
12 0	18.07	69.0	154.5	188.0	69.0	29.983	62.5
13 0	17.19	66.0	152.5	185.5	67.0	29.994	57.0
14 0	17.25	66.0	153.1	187.4	65.4	30.006	51.0
15 0	16.42	63.5	153.2	185.6	63.5	30.009	49.0
16 0	16.24	62.0	153.2	185.5	61.5	30.008	46.5
17 0	15.45	60.5	153.7	183.0	59.3	29.994	45.0
18 0	15.06	59.5	153.5	184.0	58.0	29.979	44.0
19 0	15.42	57.5	153.2	183.7	58.0	29.971	42.0
20 0	14.14	56.5	152.0	186.0	60.0	29.958	41.0
21 0	14.00	55.5	152.2	188.0	63.0	29.929	40.7
22 0	13.13	54.0	151.0	188.0	65.0	29.939	40.2
23 0	10.31	55.8	160.0	187.2	64.8	29.939	46.0
Jun. 4.							
24 0	15.30	61.0	162.0	187.2	64.0	29.948	54.5
1 0	15.28	59.0	162.8	187.0	63.8	29.964	59.0
{1 52	15.46	60.5	160.5	188.2	64.5	29.935	63.0
{2 0	15.46	61.0	160.0	189.0	64.9		63.2
{2 8	16.10	61.4	160.0	189.9	65.0	29.932	64.4
Jun. 6.							
{1 52	19.12	70.2	158.2	198.2	67.6	29.716	66.5
{2 0	19.08	70.5	158.0	198.2	67.8	29.704	
{2 8	19.15	70.4	158.0	198.5	67.9	29.697	68.2
Jun. 7.							
{1 52	13.03	55.4	156.2	183.9	48.6	30.212	55.1
{2 0	13.23	55.5	156.0	184.1	48.7	30.191	
{2 8	13.05	55.5	155.9	184.7	49.2	30.201	55.3
7 0	15.12	62.2	141.7	188.5	62.7	30.175	62.0
8 0	15.25	63.0	144.0	188.9	62.9	30.156	64.2
10 0	15.26	63.8	147.0	187.0	63.0	30.151	62.8
11 0	15.28	63.8	149.0	191.0	63.0	30.280	62.8
12 0	15.00	63.5	149.0	192.5	63.0	30.228	60.5
13 0	9.42	62.5	147.0	188.7	62.0	30.139	56.0
14 0	9.25	59.0	150.0	185.3	60.0	30.148	51.0
15 0	vibrating	55.0	151.0	185.5	58.0	30.339	47.2
16 0	12.20	55.8	152.0	184.9	56.8	30.360	46.0
17 0	13.06	55.5	154.0	188.5	57.2	30.372	45.0
18 0	14.46	54.8	154.0	186.5	57.7	30.352	43.5
20 0	12.37	53.0	150.0	191.8	61.0	30.365	40.8
21 0	12.37	53.5	148.7	189.2	60.0	30.361	40.1
22 0	12.09	53.0	145.0	189.0	60.0	30.382	39.3
23 0	8.32	56.0	154.1	190.5	62.5	30.417	47.0
Jun. 8.							
24 0	13.48	58.6	156.1	192.2	64.1	30.389	51.7
{1 52	14.45	58.6	157.4	194.8	65.2	30.447	62.0
{2 0	14.44	59.0	156.7	195.0	65.2	30.455	
{2 8	15.09	59.1	156.6	195.8	65.3	30.446	62.6
3 0	15.34	61.5	152.0	194.5	65.0	30.455	63.6
4 0	15.10	63.0	144.0	193.4		30.450	64.7
5 0	15.36	64.5	138.0	195.4	65.7	30.431	65.8
6 0	17.30	65.3	139.5	191.5	65.0	30.400	65.0
7 0	17.34	65.5	141.2	190.0	65.0	30.391	62.5
8 0	16.20	65.5	143.3	184.5	63.8	30.372	60.0
{13 52	14.14	59.0	150.4	186.3	57.0	30.359	52.8
{14 0	13.25	59.0	149.7	188.5	57.0	30.363	52.5
{14 8	13.44	59.0	149.9	188.2	57.0	30.370	52.3
15 0	13.40	58.7	152.3	187.7	57.0	30.373	51.0
16 0	14.25	58.0	156.0	183.7	56.5	30.349	50.8
17 0	13.47	57.5	155.7	186.0	56.0	30.332	50.2
18 0	13.25	57.5	154.9	186.2	55.0	30.294	51.5

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
19 0	+13.25	57.5°	151.6	188.0	56.0°	30.267	51.5°
20 0	13.26	57.5	154.7	187.1	57.0	30.264	50.0
21 0	12.25	57.0	153.7	182.0	58.0	30.226	50.3
23 0	13.25	57.0	146.5	187.0	59.0	30.163	52.0
Jun. 9							
24 0	12.00	56.5	146.7	187.2	59.0	30.137	53.0
1 0	13.38	56.5	150.5	185.0	55.0	30.112	
{ 1 52	13.04	56.7	164.1	193.7	58.4	30.068	55.0
{ 2 0	12.49	56.7	155.3	189.9	58.4	30.063	
{ 2 8	12.41	56.7	156.8	189.2	58.6	30.036	55.0
7 0	15.10	60.5	145.0	187.3	61.0	29.849	60.3
12 0	14.48	64.5	151.0	191.5	65.3	29.745	66.0
23 0	15.00	63.5	160.0	189.0	62.0	29.424	62.0
Jun. 10.							
24 0	15.36	63.5	162.0	185.3	62.0	29.596	64.6
2 0	16.41	65.0	165.7	187.5	64.2	29.588	67.0
4 0	18.00	67.2	159.0	196.4	67.0	29.590	68.0
6 0	18.40	68.0	145.5	195.0	68.0	29.543	69.5
8 0	19.44	71.6	141.2	195.0	72.6	29.492	74.9
12 0	13.08	56.5	161.5	183.5	55.0	29.655	47.0
13 0	13.15	57.0	159.5	182.0	54.0	29.649	45.0
Jun. 13.							
{ 1 52	15.02	59.4	155.7	193.2	55.0	30.001	65.7
{ 2 0	15.02	59.6	153.0	191.8	55.5	29.988	
{ 2 8	15.14	60.0	153.2	192.4	56.0	29.995	66.8
13 0	14.43	67.5		197.6	66.7	29.967	63.0
15 0	16.00	64.5	158.8	193.7	65.0	29.987	60.0
16 0	16.02	66.5	158.5	194.2	64.6	29.974	60.6
17 0	17.06	66.0	157.0	187.2	64.5	29.890	60.0
18 0	17.26	66.0	154.0	192.0	64.7	29.767	60.3
19 0	22.36	66.0	129.0	197.9	67.4	29.951	60.5
21 0	19.11	66.0	155.0	194.0	71.8	29.928	61.0
22 0	18.32	66.0	150.6	197.2	71.0	29.931	61.6
23 0	19.41	66.0	149.0	203.0	70.6	29.933	62.0
Jun. 14.							
1 0	18.41	66.0	147.5	201.7	69.5	29.995	64.8
{ 1 52	19.14	66.9	156.0	194.0	69.0	29.991	65.1
{ 2 0	19.20	66.8	156.2	194.3	68.9	29.997	
{ 2 8	18.47	66.9	156.6	195.0	68.8	29.993	65.4
3 0	13.32	68.5	158.0	198.0	69.0	30.007	68.0
4 0	19.15	69.0	153.5	201.6	70.0	30.020	69.5
5 0	19.33	70.8	150.8	204.1	72.2	30.018	73.0
6 0	19.41	72.0	145.0	205.0	73.8	30.026	74.5
7 5	20.01	73.8	149.0	196.5	74.2	30.029	76.2
9 0	20.44	75.0	144.0	200.6	75.0	30.001	72.5
10 0	18.10	75.0	155.0	199.5	74.5	29.969	69.5
11 0	18.16	71.7	149.3	194.8	73.3	29.999	68.0
12 0	18.33	72.0	150.0	195.8	72.6	30.021	71.0
13 0	19.11	71.8	150.8	196.0	72.3	30.017	68.3
{ 13 52			152.0	194.0	71.0	30.035	66.0
{ 14 0	19.05	71.5	152.0	194.0	71.0	30.021	64.0
{ 14 8	19.22	71.5	153.0	194.2	71.0	30.013	64.0
15 0	20.01	70.0	158.5	190.0	64.2	30.027	65.0
16 0	18.22	68.5	154.0	194.3	68.0	30.031	63.5
17 0	20.12	69.5	146.5	197.0	68.5	30.032	63.5
18 0	24.20	69.5	151.0	198.2	68.3	30.002	63.5
19 0	21.00	69.3	158.0	195.0	68.0	30.010	63.0
20 0	19.29	68.7	159.6	194.5	67.5	29.980	62.8
21 0	19.45	68.6	146.0	197.3	67.0	29.932	62.8
22 0	19.22	68.4	149.9	192.4	66.6	29.928	61.8
23 0	19.20	68.0	158.2	193.7	66.2	29.929	61.5
Jun. 15							
1 0	19.42	68.0	155.7	193.6	66.0	29.987	66.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
3 0	+19.15	69.5°	165.0	185.2	68.0°	29.986	69.0°
4 0	20.16	71.5	151.3	196.6	70.8	29.957	73.2
5 0	21.15	73.5	149.8	197.0	72.8	29.938	74.5
6 0	21.27	74.0	147.1	197.7	74.0	29.914	73.4
7 0	22.12	75.5	146.2	195.6	74.0	29.890	76.0
9 0	22.07	75.5	149.0	197.0	74.5	29.938	73.5
10 0	21.43	74.0	149.0	195.5	74.0	29.907	69.0
11 0	20.21	73.0	149.0	195.5	73.0	29.981	69.8
12 0	20.00	72.3	149.0	196.0	72.5	29.948	69.8
13 0	19.47	71.6	151.9	195.4	72.0	29.954	68.0
{ 13 52	20.02	71.5	155.0	193.1	71.0	29.954	68.0
{ 14 0	19.39	71.5	154.0	193.3	71.0		
{ 14 8	20.12	71.5	154.0	193.5	71.0	29.974	68.0
15 0	19.11	70.7	151.9	194.0	71.0	29.972	67.0
16 0	20.02	70.0	148.5	192.8	70.2	29.966	65.0
17 0	20.26	70.5	149.2	195.5	70.0	29.953	65.0
18 6	19.39	70.5	153.9	195.0	68.6	29.952	64.7
19 0	19.40	70.2	151.9	193.7	68.7	29.928	64.8
20 0	19.40	69.5	143.8	195.9	68.2	29.883	63.0
21 0	19.37	69.5	149.4	191.9	67.5	29.897	62.5
22 0	19.10	68.8	154.6	191.7	67.0	29.874	61.0
23 0	18.39	68.2	158.5	192.2	66.2	29.853	60.0
Jun. 16.							
1 0	18.26	67.0	158.4	194.0	65.2	29.765	65.2
3 0	18.43	67.6	153.5	195.6	66.8	29.767	67.8
4 15	19.20	69.0	148.5	196.0	68.0	29.748	69.2
5 0	19.31	69.5	148.0	195.8	68.6	29.756	69.3
6 0	19.44	70.0	148.8	194.3	70.0	29.724	70.2
7 0	20.19	71.2	150.4	191.7	71.3	29.719	73.0
8 0	21.45	72.5	151.8	191.8	73.0	29.718	75.0
9 0	21.09	74.0	153.7	192.9	74.6	29.708	75.2
10 0	21.09	74.6	153.3	195.3	74.5	29.710	75.2
11 0	21.25	75.0	151.9	197.1	74.9	29.732	74.7
12 0	21.25	74.6	151.0	198.2	75.6	29.726	73.0
13 0	21.13	74.5	151.2	198.1	75.0	29.740	71.8
16 0	18.08	69.0	151.2	191.5	69.0	29.743	63.5
17 0	19.43	69.5	151.9	193.5	68.5	29.776	63.2
18 0	18.36	69.0	152.8	193.0	68.0	29.794	63.0
19 0	18.43	69.0	153.5	193.0	68.0	29.764	62.5
20 0	18.30	68.5	154.5	191.9	67.5	29.778	62.5
21 0	18.20	68.0	155.4	193.0	67.0	29.783	61.8
22 0	18.48	68.0	155.0	192.3	66.5	29.696	62.4
23 0	18.03	67.5	157.0	192.5		29.767	64.0
Jun. 17.							
1 0	19.22	69.5		197.0	69.5	29.797	71.2
3 0	22.28	75.3	156.0	202.5	74.0	29.755	78.0
4 0	23.23	76.8	152.0	202.2	76.8	29.746	79.5
6 0	24.00	80.5	148.0	202.2	81.5	29.792	81.5
7 0	24.00	81.3	148.8	201.4	82.2	29.775	83.0
8 0	23.33	82.0	149.3	200.3	82.5	29.772	81.8
9 0	24.09	81.7	149.8	199.9	82.5	29.783	80.0
10 0	24.00	81.3	151.5	199.0	82.0	29.765	78.5
11 0	22.22	80.5	152.5	199.7	81.5	29.779	79.5
{ 13 52	20.46	76.0	152.5	197.2	77.0	29.819	70.5
{ 14 0	20.46	76.5	153.0	197.2	76.0		
{ 14 8	19.25	76.5	154.6	199.0	75.5	29.823	70.0
15 0	20.30	75.2	154.4	196.0	69.3	29.827	68.0
16 0	20.19	72.5	153.1	196.2	73.0	29.829	68.0
17 0	20.24	72.0	154.5	195.2	72.0	29.836	66.5
Jun. 21.							
2 0	15.20	66.0	159.8	191.5	61.0	29.935	67.1
3 0	17.08	67.5	157.5	195.0	64.0	29.931	70.0
4 0	vibrating	72.0	152.0	198.6	68.2	29.938	72.2

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
5 0	+19.25	70.5	147.1	198.0	71.1	29.963	73.0
6 0	17.05	70.3	146.0	197 0	77.0	30.287	79.2
8 0	17.25	76.0	147.0	197.0	78.5	30.184	78.0
9 0	20.35	77.0	149.0	198.0	79.0	29.852	77.0
10 0	21.03	77.0	150.0	197.0	78.0	29.397	76.0
11 0	21.35	77.0	151.0	199.0	77.5	29.171	
12 0	21.09	75.6	153.0	196.0	75.9	29.876	71.3
13 0	19.08	73.5	152.0	194.0	74.0	29.881	67.0
14 0	19.00	71.5	152.5	193.8	72.0	29.923	63.2
15 0	19.02	71.5	153.6	194.6	70.0	29.902	60.0
16 0	18.20	70.0	153.2	191.7	68.5	29.889	58.5
17 0	18.10	69.0	153.4	190.5	67.0	29.894	57.5
18 0	17.22	68.0	154.2	189.8	66.0	29.881	56.0
19 0			155.1			29.859	54.0
20 0			155.8			29.837	53.0
21 0	15.48	63 5	156.3	187.6	61.8	29.815	52.0
22 0	15.11	63.0	157.6	186.0	60.7	29.848	52.0
23 0	vibrating		158.6	185.2	59.2	29.821	58.2
Jun. 22.							
24 0	16.23	66.0	161.3	187.8	59.5	29.836	62.0
1 0	17.20	66.0	161.4	189.5	60.5	29.831	66.0
3 0	18.32	70.0	153.0	197.1	68.0	29.706	76.0
4 0	vibrating		149.0	203.5	73.5	29.762	78.2
5 0	22.07	74.8	147.0	204.1	75.6	29.787	80.5
7 0	22.04	77.0	144.0	198.3	81.0	29.681	81.0
8 0	24.08	79.7	143.5	198.7	82.2	29.652	81.3
	Term	day	omit	ted.			
Jun. 23.							
10 0	15.03	64.5	153.1	183.7	63.2	29.741	58.5
11 0	15.49	64.0	157.9	190.0	63.8	29.745	56.0
12 0	14.24	63.5	153.6	189.8	63.3	29.747	55.9
13 0	13.45	62.0	146.2	187.0	61.8	29.740	55.5
14 0	14.28	62.5	153.0	187.2	61.2	29.768	55.0
15 0	14.27	62.0	156.9	188.3	60.6	29.781	54.5
Jun. 24.							
24 0	16.48	60.2	152.2	190.1	56.6	29.807	58.3
1 0	16.19	61.0	156.2	191.4	57.8	29.798	63.0
3 0	16.27	65.8	157.5	194.9	64.0	29.797	67.0
4 0	17.03	67.5	149.0	199.5	67.0	29.759	68.0
8 0	10.34	72.8	148.3	196.4	74.7	29.718	71.9
10 0	19.13	73.5	146.0	195.0	75.0	29.724	70.5
11 0	18.17	73.4	151.5	192.5	74.0	29.730	70.2
12 0	17.30	72.0	152.0	195.0	73.2	29.724	69.0
14 0	15.22	68.5	154.0	192.0	70.0	29.765	60.0
16 0	vibrating		158.0	192.0	65.5	29.804	57.4
17 0	16.03	65.0	160.5	195.9	65.0	29.802	55.0
18 0	18.00	65.0	155.0	195.0	64.5	29.794	55.0
19 0	16.25	64.5	154.7	191.5	66.5	29.791	55.0
20 0	15.32	63.5	155.6	191.2	66.0	29.822	49.0
21 0	15.15	62.5	155.0	193.0	65.4	29.807	53.0
23 0	13.10	65.5	152.6	196.5	67.0	29.831	58.6
Jun. 25.							
24 0	18.20	72.0	157.5	192.2	66.5	29.881	63.5
Jun. 27.							
1 0	17.01	68.0	160.0	193.7	64.5	29.732	63.0
2 8	18.48	69.7	154.8	194.5	66.5	29.756	62.8
4 0	17.48	68.5	133.7	190.1	67.0	29.756	60.0
5 0	17.17	67.5	145.0	192.0	63.5	29.772	59.0
6 0	17.30	68.0	146.0	189.7	62.0	29.767	62.5
7 0	17.35	68.5	144.2	189.0	63.0	29.790	62.5
8 0	17.28	68.5	147.4	185.0	62.9	29.784	61.0
9 0	17.47	68.5	147.0	186.5	62.0	29.768	60.7
11 0	17.00	67.5	151.1	185.9	60.3	29.804	58.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
13 0	+15.34	65.0	155.5	185.8	60.0	29.805	54.7
14 0	12.02	62.0	163.5	187.0	57.0	29.803	59.0
Jun. 28.							
2 0	15.02	62.0	163.5	189.0	59.0	29.803	59.0
4 0	15.06	61.0	154.7	191.2	59.2	29.731	62.0
5 0	15.26	62.1	146.7	192.4	60.5	29.728	63.2
7 0	15.04	64.0	145.0	193.0	62.0	29.728	65.4
8 0	15.31	65.0	148.0	187.8	64.0	29.757	67.3
13 0	15.43	66.0	153.0	187.0	62.0	29.741	58.9
Jun. 29.							
1 0	16.40	66.0	161.5	188.0	63.0	29.749	71.0
5 0	19.45	74.5	145.0	200.0	76.0	29.731	79.0
6 0	22.35	77.0	143.0	200.0	80.0	29.809	80.5
8 0	21.32	77.8	145.8	197.0	80.0	29.745	78.1
11 0	21.12	77.0	149.7	198.3	79.0	29.797	74.5
13 0	20.27	76.0	153.5	193.6	76.0	29.877	67.8
14 0	21.43	72.5	143.4	188.4	74.0	29.894	61.0
15 0	21.25	71.5	143.9	193.0	70.0	29.996	60.0
16 0	20.05	71.0	144.0	191.5	69.0	29.988	59.5
17 0	20.32	70.5	144.3	190.1	67.0	30.002	57.0
Jun. 30.							
24 0	18.30	72.0	161.6	187.6	59.5	30.045	65.3
1 0	18.21	68.0	161.2	188.6	61.0	30.023	71.0
2 0	18.26	69.0	161.0	192.2	64.5	30.011	75.5
5 0	22.03	75.0	145.0	204.0	76.0	29.992	81.0
6 0	22.42	77.5	144.0	200.5	78.3	29.955	82.4
7 0	22.35	78.0	138.7	210.5	79.5	30.005	79.7
8 0	23.01	79.5	143.2	199.2	82.0	29.900	79.2
11 0	22.17	79.5	151.0	199.5	80.0	29.962	76.8
12 0	22.29	78.7	147.7	196.2	78.5	29.820	74.0
{ 13 52	22.24	75.5	154.2	192.0	75.0	29.906	69 5
{ 14 0	22.28	75.5	154.0	191.0	75.0	29.791	69.5
{ 14 8	22.32	75.5	154.0	192.0	75.0	29.918	69.5
15 0	23.46	75.0	170.0	196.0	74.5	29.923	68.0
16 0	22.37	74.5	162 5	205.0	74.0	29.911	68.0
17 0	21.20	74.0	160.2	201.0	73.0	29.921	69.0
18 0	21.29	73.5	164.0	200.0	73.0	29.909	69.0
19 0	20.18	73.1	163.0	199.0	73.0	29.901	68.0
20 0	18.20	72.0	161.5	198.0	72.0	29.902	69.0
21 0	15.22	72.0	158.2	198.0	71.0	29.899	70.0
22 0	12.13	72.5	157.0	197.2	72.0	29.853	70.0
23 0	10.21	72.5	159.0	199.0	71.5	29.863	70.0
July 1.							
24 0	9.49	73.0	158.5	200.8	72.0	29.889	72.0
1 0	17.46	73.0	162.6	198.2	72.5	29.886	74.0
2 0	23.44	79.5	140.0	205 5	82.0	29.879	84.5
July 5.							
3 0	17.21	73.5	158.5	212.6	73.8	29.852	74.5
4 0	18.33	75.0	156.3	212.3	75.0	29.852	77.0
5 0	19.11	76.5	153.1	212.8	76.2	29.848	78.2
9 0	19.34	78.8	149.0	205.9	78 5	29.805	77.2
10 0	19.08	78.0	149.3	203.9	76.5	29.792	76.3
11 0	18.26	77.3	150.6	202.6	76.2	29.746	74.0
12 0	18.04	75.5	150.5	202.5	75.5	29.786	72.3
13 0	17.31	74.0		203.5	74.5	29.807	70.5
{ 13 52	16.22	73.0	152.2	204.8	72 0	29.864	67.8
{ 14 0	16.22	73.0	153.0	205.2	73.9	29.869	
{ 14 8	16.18	73.0	153.8	204.9	73.6	29.865	
15 0	16.30	74.0	159.0		72.6	29.786	66.0
July 6.							
24 0	16.10	70.7	161.8	200.9	70.0	29.827	70.0
1 0	16.31	71.8	159.0	203.3	70.8	29.845	73.0
6 0	16.25	77.0	146.9	201.8	76.5	29.805	77.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
7 0	+18.37	76°.5	145.6	201.7	76°.0	29.798	75°.0
9 0	18.22	76.0	145.6	199.5	75.8	29.818	75.2
10 0	18.24	75.7	149.2	193.2	75.8	29.824	73.8
11 0	18.28	74.5	149.2	193.9	75.2	29.856	70.8
12 0	15.32	72.5	145.5	202.3	74.0	29.854	64.2
13 0	16.18	69.2	167.0	195.6	74.0	29.852	64.5
{ 13 52	18.35	69.2	159.0	212.0	72.5	29.875	64.5
{ 14 0	16.29	69.5	149.2	209.1	72.2	29.863	
{ 14 8	18.12	71.0	147.9	209.3	71.8	29.868	64.8
15 0	16.01	70.5	150.0	204.5	70.0	29.888	64.2
16 0	16.39	70.0	171.7	204.4	69.5	29.936	63.6
17 0	16.28	70.5	170.3	205.1	69.0	29.967	63.0
18 0	15.44	69.0	169.4	202.3	69.2	29.965	62.5
19 0	15.01	68.5	170.5	203.5	68.0	29.967	62 8
20 0	18.14	68.0	144.9	202.6	67.0	29.965	61.0
21 0	17.45	67.0	153.5	203.0	66.5	29.971	
July 7.							
24 0	15.45	71.0	159.4	196.9	63.5	30.086	61.0
3 0	16.35	69.0	153.2	207.3	67.0	30.134	68.5
4 0	18.00	71.0	147.0	210.0	69.7	30.128	70.0
5 0	18.00	71.5	148.3	208.1	71.5	30.112	70.0
9 0	16.46	71.8	146.6	202.9	71.7	30.031	67.7
10 0	16.49	72.0	148.7	201.2	71.2	30.051	67.4
11 0	16.19	71.4	150.5	200.8	70.6	30.058	66.0
12 15	15.37	70.0	151.7	197.0	69.0	30.082	63.5
13 0	14.16	69.0	146.5	200.0	68.0	30.038	63.0
{ 13 52	16.42	69.0	146.5	201.5	68.0	30.103	62.0
{ 14 0	15.35	69.0	147.0	201 5	67.5	30.107	61.5
{ 14 8	15.31	68.5	147.5	200.5	67.5	30.107	61.5
15 0	15.19	67.0	148.0	200.2	67.0	30.109	60.0
16 0	14.28	65.5	147.7	198.2	65.8	30.108	57.2
17 0	14.22	63.8	148.6	197.3	65.0	30.105	57.2
18 0	13.37	64.3	148.1	197.5	64.0	30.099	56.8
19 0	13.31	64.3	148.2	196.7	63.2	30.092	56.2
20 0	13.21	64.0	149.0	196.5	63.0	30.073	56.5
21 0	13.15	63.6	149.0	196 5	62.6	30.067	57.5
22 0	12.27	62.0	150.2	196.1	62.5	30.073	58.5
23 0	12.28	61.7	157.4	195.8	62.0	30.065	63.0
July 8.							
24 0	13.12	62.8	160.8	196.6	62.2	30.075	63.0
1 0	13.20	63.5	160.0	198.0	62.7	30.072	63.0
3 20	14.23	65.2	155.2	204.0	64.5	30.048	67.5
4 15	15.33	67.0	150.0	206.0	66.5	30.044	71.0
5 0	16.19	68.5	147.4	206.0	68.0	30 039	71.0
6 30	16.11	68.3	144.5	204.0	68.5	30.024	66.5
8 20	15.25	68.0	142.3	200.6	68.2	29.991	66.5
13 0	14.04	68.7	146.6	200.5	68.4	29.926	64.3
{ 13 50	14.20	69.5	171.8	203.4	67.6	29.931	63.7
{ 14 0	15.28	69.5	165.3	202 6	67.5		
{ 14 10	15.23	69.5	157.2	202.9	67.5	29.931	63.8
16 0	21.30	69.5	160.3	209.0	69.0	29.927	68.0
17 0	20.01	69.8	155.0	202.2	69.0	29.912	68.0
18 0	19.35	70.0	163.9	208.8	69.5	29.897	68.0
19 0	23.15	70.0	156.6	197.0	69.8	29.885	68.5
20 0	19.20	70.5	154.5	197.8	70.0	29.847	69.5
21 0	19.08	71.0	137.5	202.7	70.5	29.830	70.0
22 0	19.20	71.0	148 0	198.0	71.2	29.856	70.5
23 0	18.35	71.5	147.7	202.0	71.5	29.881	71.0
July 13.							
2 0	18.33	73.5	158.5	205.7	71.2	29.834	77.8
4 0	20.40	77.6	150.0	216.0	79.0	29.790	84.0
6 0	23.08	82.0	148.0	213.5	86.2	29.755	87.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
8 0	+23.28	86°.0	145.0	211.5	90°.5	29.728	89°.3
10 0	23.17	88.0	146.2	214.0	90.4	29.713	88.0
12 0	22.15	87.0	148.0	216.5	88.0	29.719	83.0
14 0	20.29	83.0	145.0	210.0	84.0	29.724	76.5
16 0	19.33	80.5	149.0	209.0	80.7	29.720	72.4
18 0	vibrating		149.7	207.0	77.0	29.593	71.5
20 0	"		150.2	204.7	74.8	29.722	69.1
22 0	"		152.0	204.8	73.0	29.762	68.0
July 14.							
24 0	19.07	79.0	156.1	204.0	72.5	29.719	74.0
2 0	19.06	78.5	157.8	209.5	76.0	29.791	79.0
4 0	20.44	82.0	149.6	206.8	82.0	29.761	83.2
6 0	23.06	85.5	142.6	218.0	87.0	29.718	87.2
8 0	23.12	88.0	141.3	214 8	89.4	29.715	89.0
10 0	23.12	88.0	145.0	212.0	87.8	29.681	85.3
12 0	21.20	85.0	148.0	209.6	84.0	29.707	78.0
14 0	21.05	82.0	145.2	210.2	81.0	29.747	74.0
16 0	21.05	81.0	147.5	211.4	79.2	29.778	70.8
18 0	21.18	79.0	141.5	211.7	76.0	29.759	70.0
20 0	19.32	74.0	150.1	204.4	76.0	29.787	67.4
22 0	18.06	74.0	143.3	204.6	73.5	29.799	67.5
July 15.							
2 0	19.27	77.0	158.7	211.9	76.3	29.799	80.5
4 0	22.42	81.6	150.0	217.8	82.0	29.808	84.0
6 0	20.20	80.5	143.0	215.0	82.0	29.824	74.0
8 0	18.25	77.0	143.0	205.5	78.8	29.847	72.4
10 0	19.04	77.5	147.5	208.5	78.0	29.843	72.8
12 0	19.02	77.0	148.0	208.6	78.0	29.855	73.0
14 0	18.17	76.0	150.5	204.5	76.0	29.875	70.0
16 0	18.15	75.0	155.0	203.9	75.0	29.882	67.5
18 0	17.33	73 0	157.1	206.6	73.0	29.844	66.2
20 0	17.00	71.8	150.0	203.0	71.4	29.845	66.0
22 0	16.23	71.0	156.0	205.0	71.0	29.849	67.0
July 16.							
2 0	16.38	70.0	157.0	207.0	70.0	29.884	69.5
July 18.							
4 0	20.40	79.0	153.0	207.2	79.0	29.770	86.0
6 0	24.39	84.0	144.5	212.0	86.0	29.731	88.0
8 0	23.42	87.0	147.2	211.0	88.6	29.675	89.0
10 0	23.36	78.0	151.1	209.0	87.0	29.726	84.0
12 0	22.05	84.0	150.2	206.0	83.6	29.729	78.0
14 0	20.29	80.0	154.0	204.5	79.0	29.781	71.0
16 0	20.10	76.5	155.7	209.2	75.7	29.813	68.5
18 0	vibrating		153.2	205.7	75.0	29.775	66.2
20 0	18.08	70.0	154.0	206.1	72.5	29.779	65.0
22 0	17.17	69.0	148.0	205.0	71.5	29.783	65.0
July 19.							
2 0	18.40	74.0	157.0	207.0	74.0	29.762	78.0
July 20.							
24 0	19.37	76.0	156.0	209.0	74.6	29.695	76.0
{ 1 50	20.25	76.8	158.0	200.0	74.2	29.688	78.0
{ 2 0	20.36	76.8	156.2	211.2	74.4	29.689	78.4
{ 2 10	20.33	77.0	155.6	209.5	74.6	29.689	78.6
4 0	20.23	76.0	153.0	208.0	74.0	29.707	74.0
{ 5 50	19.32	75.0	146.8	201.6	73.5	29.717	74.0
{ 6 0	19.36	75.0	146.9	201.0	73.7	29.715	74.3
{ 6 10	19.24	75.3	147.2	202.5	73.8	29.712	76 4
8 0	20.34	78.4	148.0	200.8	76.4	29.711	81.2
	Term	day	omit	ted.			
July 21.							
10 0	19.08	75.5	153.1	203.2	76.0	30.135	76.0
12 0	18.18	74.0	154.0	205.3	74.0	30.126	70.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
14 0	+17.12	70.0	138.5	201.3	70.0	30.153	61.5
15 50	15.43	66.5	140.7	199.2	68.0	30.144	57.0
16 0	16.26	66.5	144.1	197.9	68.0	30.145	57.0
16 10	16.28	67.0	144.5	199.5	68.2	30.145	57.0
18 0	16.12	66.5	139.1	197.3	66.0	30.145	55.2
20 0	14.42	64.5	135.0	197.7	63.8	30.153	54.0
22 0	14.30	64.4	141.2	196.9	62.6	30.149	52.3
July 22.							
23 50	15.17	66.5	151.0	196.1	61.4	30.147	59.0
24 0	15.27	66.0	148.3	195.7	61.4	30.156	60.0
0 10	15.24	65.4	149.5	195.6	61.4	30.168	61.0
2 0	16.05	66.5	159.0	206.0	65.0	30.132	71.0
July 25.							
1 50	13.24	66.0	160.0	201.7	62.2	30.095	61.8
2 0	15.14	64.7	163.0	200.9	62.0	30.074	62.0
2 10	15.19	66.0	161.5	202.0	62.5	30.084	62.5
4 0	15.39	66.7	155.3	206.4	66.0	30.068	65.3
5 50	16.21	68.6	146.3	206.8	69.8	30.051	68.2
6 0	16.23	68.7	146.3	207.6	70.2	30.057	68.3
6 10	16.31	69.0	145.1	207.4	70.5	30.055	69.0
8 0	17.35	71.5	145.0	203.5	73.2	30.023	71.6
9 50	18.09	73.0	151.0	201.3	74.0	30.006	71.8
10 0	18.22	73.0	151.2	201.5	74.0	30.027	71.5
10 10	18.11	73.0	151.4	201.2	73.9	30.003	71.4
12 0	17.18	71.5	152.5	201.0	72.5	29.991	67.5
13 50	17.40	70.5	153.0	201 0	70.0	30.017	63 7
14 0	17.49	70.4	152.0	202.6	70.0	30.021	64.0
14 10	18 04	70.5	154.0	201.7	69.8	30.011	64.0
16 0	17.15	69.5	156.6	202.1	68.5	30.027	62.0
17 50	17.20	68.0	153.8	200.2	67.5	30.017	61.0
18 0	17.31	68.1	153.9	200.7	67.4	30.029	61.0
18 10	17.42	68.3	153.6	200.0	67.4	30.018	62.5
20 0	17.03	66.7	153.0	200.9	66.2	29.985	61.0
21 50	16.06	66.6	155.0	199.0	65.7	29.957	60.6
22 0	16.05	66.2	155.7	199.4	65.6	29.954	60.6
22 10	16.07	66.2	156.0	199.4	65.8	29.969	60.6
July 26.							
24 0	15.26	65.5	159.0	198.9	64.8	30.000	61.7
1 50	16.17	65.6	161.0	201.3	65.2	29.975	65.5
2 0	16.30	66.2	161.5	201.8	65.2	29.951	69.0
2 10	17.00	66.6	161.5	200.5	65.6	29.961	70.5
July 27.							
1 50	21.13	75.5	163.5	206.2	75.0	29.804	79.0
2 0	21.19	76.0	163.5	207.0	75.5	29.778	79.6
2 10	21.27	76.5	162.5	207.6	75.8	29.761	80.0
4 0	24.00	81.6	149.7	211.0	82.6	29.738	85.8
5 50	25.21	85.8	143.5	215.6	87.9	29 693	88.4
6 0	25.27	86.0	143.0	216.0	88.0	29.724	88.8
6 10	25.32	86.4	143.0	216.6	88.5	29.747	89.0
8 0	24.27	86.5	142.2	212.9	89.0	29.733	80.0
9 50	22.32	82.5	147.0	204.6	84.0	29.726	79.8
10 0	22.28	82.5	147.0	205.4	84.0	29.737	80.0
10 10	22.23	82.4	148.2	205.0	83.8	29.744	79.2
12 0	22.28	81.5	152.0	206.0	82.5	29.803	77.0
13 50	21.35	79.0	149.0	205.0	79.5	29.848	71.2
14 0	21.30	78.5	149.3	204.4	79.0	29.851	70.6
14 10	21.28	78.5	149.5	204.3	79.0	29.849	70.2
16 0	20.40	76.2	149.7	203.2	76.5	29.881	68.2
17 50	19.05	72.5	150.4	202.1	74.0	29.877	67.0
18 0	19.00	72.6	150.9	201.7	73.4	29.873	66.0
18 10	19.26	72.8	151.4	201.2	73.3	29.887	67.0
20 0	18.30	71.2	151.5	198.5	70.0	29.922	62.4

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
21 50	+17.40	69.4	152.4	197.1	67.6	29.937	61 2
22 0	17.39	69.0	151.2	197.7	67.4	29.946	62.0
22 10	17.16	68.8	152.8	197.0	67.5	29.944	61.8
July 28.							
24 0	16.38	66.5	162.8	198.2	66.0	29.987	65.0
1 50	18.28	70.4	161.9	204.5	68.5	29.989	72.8
2 0	18.29	70.5	161.2	205.2	69.0	29.981	73.0
2 10	18.33	71.0	159.8	206.0	69.2	29.978	73.0
July 29.							
1 50	17.37	67.5	166.5	196.4	66.0	30.073	71.4
2 0	17.34	67.6	168.0	198.0	66.4	30.059	71.3
2 10	17.45	68.0	169.0	198.8	67.0	30.059	71.8
4 0	20.14	72.0	159.5	203.6	72.8	30.043	81.0
5 50	22.15	76.5	146.7	207.5	77.5	29.978	81.2
6 0	22.22	76.5	146.4	207.7	77.6	29.997	81.0
6 10	22 27	76.6	146.8	206.2	78.0	29.999	81.6
8 0	23.26	79.5	143.0	209.4	80.5	29.936	81.0
9 50	22.21	80.3	141.7	210.2	79.8	29.886	79.0
10 0	22.12	80.2	142.8	208.9	79.6	29.926	78.0
10 10	22.10	80.0	143.4	208.7	79.5	29.910	78.0
12 0	21.19	78.5	147.5	202.0	78.0	29.899	75.0
13 50	20.36	76.5	147.0	209.4	75.6	29.877	72.0
14 0	21.14	76.6	146.3	207.4	75.6	29.882	72.0
14 10	21.35	77.0	146.4	207.5	75.6	29.885	72.0
16 0	21.05	76.6	141.5	204.4	75.0	29.865	71.8
17 50	21.43	76.2	153.8	204.4	74.5	29.785	71.6
18 0	21.42	76.0	153.0	205.6	74.5	29.775	71.8
18 10	21.37	76.0	153.0	206.0	74.6	29.771	72.0
20 0	19.03	74.0	154.5	204.0	74.2	29.728	70.0
21 50	19.22	73.0	153.5	202 3	72.6	29.710	69.8
22 0	19.24	73.0	153.1	202.5	77.0	29.699	69.2
22 10	19.34	73.2	153.6	202.0	77.0	29.701	69.3
July 30.							
24 0	20.35	71.0	156.0	203.5	73.4	29.688	71.0
1 50	21.49	78.5	162.5	208.3	78.0	29.621	81.8
2 0	22.11	79.0	163.0	208.3	78.8	29.630	82.2
2 10	22.28	79.5	163.6	210.0	79.0	29.626	83.0
Aug. 1.							
1 50	13.41	61.0	159.4	200.0	58.4	29.889	60.2
2 0	13.46	61.1	159.2	200.0	58.8	29.882	60.2
2 10	13.40	61.4	160.8	201.4	59.0	29.877	60.2
4 0	14.25	63.7	152.2	201.2	63.3	29.885	64.1
5 50	16.02	66.5	145.7	199.2	67.6	29.880	65.5
6 0	16.16	66.7	145.3	200.1	68.0	29.886	66.0
6 10	16.19	66.9	145.0	199.5	68.1	29.876	65.0
8 0	16.25	69.5	144.7	198.2	70.1	29.854	68.2
9 50	16.31	69.4	148.6	200.2	70.0	29.864	66.7
10 0	16.24	69.3	149.8	198.4	70.0	29.863	66.5
10 10	16.09	69.2	150.2	198.5	69.8	29.869	66.3
12 0	15.28	67.6	148.2	196.3	67.7	29.894	63.0
13 50	15.02	66.3	146.2	198.6	65.6	29.954	56.6
14 0	15.04	66.2	146.5	197.4	65.3	29.938	56.4
14 10	15.11	66.0	147.2	197.7	65.1	29.955	56.0
16 0	14.37	64.4	151.7	200.7	63.2	29.972	52.5
17 50	14.03	62.3	149.9	195.9	61.5	29.981	50.2
18 0	14.13	62.2	151.6	196.3	61.0	29.983	50.2
18 10	13.44	62.0	152.5	196.2	61.0	29.981	50.4
20 0	12.30	59.3	153.1	195.4	58.8	29.990	47.2
21 50	12.19	58.0	154.6	196.2	57.0	30.026	46.0
22 0	12.14	58.0	155.6	191.2	57.2	30.026	46.0
22 10	12.02	58.0	155.4	191.4	57.0	30.020	46.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
Aug. 2.							
24 0	+14.03	58.3	159.8	190.0	55.1	30.056	53.5
1 50	12.32	60.0	159.0	197.6	58.2	30.052	59.0
2 0	12.38	60.2	158.8	198.5	58.6	30.055	59.8
2 10	12.48	60.5	157.4	199.5	57.2	30.055	60.8
Aug. 3.							
1 50	13.20	60.0	158.2	200.3	59.0	30.143	67.0
2 0	13.28	60.5	158.0	201.0	59.5	30.139	67.8
2 10	13.44	61.0	157.0	201.8	60.0	30.158	68.5
4 0	16.47	67.6	145.8	207.0	68.6	30.151	74.2
5 50	19.00	72.0	140.6	208.5	75.0	30.150	76.2
6 0	19.04	72.5	140.3	208.4	75.5	30.142	76.8
6 10	19.12	72.8	141.0	208.0	76.0	30.139	77.0
8 0	20.04	76.5	145.5	206.3	78.0	30.113	78.2
9 50	19.46	76.6	150.2	205.5	76.3	30.103	73.8
10 0	19.38	76.5	150.4	205.0	76.2	30.111	73.0
10 10	19.27	76.0	150.9	204.2	76.0	30.110	72.2
12 0	18.41	73.5	151.2	202.0	72.3	30.143	68.5
13 50	18.00	71.2	147.9	202.2	70.0	30.160	62.8
14 0	17.44	71.0	148.1	202.2	69.8	30.162	62.0
14 10	17.48	71.0	148.7	202.0	69.7	30.170	62.0
16 0	17.16	68.7	151.4	202.5	68.0	30.184	60.0
17 50	16.19	66.7	148.8	200.2	66.0	30.148	58.5
18 0	16.14	66.7	147.4	199.6	65.8	30.173	58.5
18 10	16.08	66.5	148.5	198.8	65.5	30.174	58.0
20 0	15.12	64.3	148.8	199.4	63.4	30.163	57.2
21 50	14.15	62.6	149.1	196.7	61.6	30.143	55.2
22 0	14.10	62.7	154.3	196.8	61.6	30.149	55.8
22 10	14.00	62.5	154.9	197.3	61.4	30.151	55.6
Aug. 4.							
24 0	13.46	62.3	155.0	194.7	61.0	30.156	60.0
1 50	14.27	63.5	156.6	203.0	62.2	30.169	60.2
2 0	14.34	63.5	155.8	203.5	62.5	30.175	60.8
2 10	14.42	64.0	154.8	205.0	63.0	30.158	61.4
Aug. 5.							
1 50	14.18	61.5	161.8	203.5	60.5	30.122	59.8
2 0	14.11	61.6	161.0	205.3	60.5	30.124	59.2
2 10	14.08	61.7	159.9	205.2	60.6	30.125	59.3
4 0	14.13	63.6	150.6	203.8	61.3	30.122	61.7
5 50	14.18	62.8	142.9	203.0	61.8	30.100	61.2
6 0	14.25	62.8	143.2	203.0	62.0	30.101	61.3
6 10	14.28	63.0	143.5	202.0	62.0	30.103	61.6
8 0	15.12	64.5	146.0	200.0	64.0	30.094	64.0
9 50	16.11	66.6	150.2	199.2	66.0	30.071	67.0
10 0	16.15	66.6	150.2	199.0	66.0	30.073	67.0
10 10	15.44	66.6	150.8	199.3	66.0	30.074	67.8
12 0	16.05	68.0	154.0	199.5	67.5	30.082	66.6
13 50	15.42	67.6	153.5	206.0	68.1	30.095	66.0
14 0	15.42	67.0	153.0	206.0	68.1	30.101	
14 10	15.42	67.6	152.8	205.2	68.1	30.105	65.8
16 0	20.19	67.5	157.4	213.4	68.2	30.114	65.9
17 50	21.28	67.6	164.0	218.0	68.0		65.2
18 0	21.02	68.0	169.1	214.0	68.0	30.123	66.2
18 10	21.25	68.5	166.7	211.5	68.1	30.123	65.8
20 0	23.00	67.8	156.0	200.5	67.8	30.120	63.8
21 50	20.15	67.1	158.1	213.5	66.8	30.131	63.3
22 0	20.05	67.0	158.5	213.0	66.8	30.135	63.2
22 10	19.40	66.9	158.4	211.0	66.7	30.133	63.3
Aug. 6.							
24 0	16.30	66.6	160.7	203.5	66.2	30.135	64.2
1 50	16.41	66.6	159.2	204.9	66.0	30.138	66.6
2 0	16.33	66.6	158.3	205.0	66.1		
2 10	16.34	66.8	156.0	205.8	66.1	30.142	66.3

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
Aug. 8.							
1 50	+16.06	68.3	155.2	210.0	67.1	29.867	67.3
2 0	16.14	68.5	155.4	210.4	67.4	29.885	67.6
2 10	16.35	68.6	155.1	210.0	67.5	29.857	68.0
4 0	17.36	70.6	148.7	208.8	69.8	29.853	71.6
5 50	17.29	71.3	143.0	204.8	70.6	29.864	71.2
6 0	17.26	71.3	143.0	204.6	70.4	29.854	71.2
6 10	17.24	71.4	143.1	204.2	70.7	29.854	71.6
8 0	17.20	72.2	146.2	200.8	71.6	29.844	71.6
9 50	17.15	72.5	153.1	198.6	71.8	29.836	71.7
10 0	17.08	72.6	153.4	198.2	71.9	29.832	71.3
10 10	17.03	72.7	153.6	198.4	71.8	29.829	71.3
14 0	17.00	71.0	145.9	209.5	70.6	29.884	66.8
16 0	17.19	72.0	143.6	206.7	70.2	29.881	66.2
18 0	17.15	69.5	143.1	205.6	68.9	29.903	60.2
20 0	17.09	68.8	136.2	204.5	67.5	29.926	65.5
21 50			147.9	203.3	67.4		
22 0	17.25	68.5	148.3	203.2	67.4	29.946	65.4
22 10	17.20	68.5	148.9	203.0	67.3	29.964	65.2
Aug. 9.							
24 0	16.07	68.0	161.7	203.2	66.8	29.982	67.2
1 50	16.47	69.0	161.8	208.4	68.0	29.999	70.8
2 0	16.45	69.2	161.5	207.8	68.1		
2 10	vibrating		160.7	207.3	68.4	30.004	71.8
Aug. 10.							
1 50	17.33	71.0	158.0	205.6	70.0	30.071	72.5
2 0	17.35	71.2	157.0	206.2	70.2	30.063	72.8
2 10	17.45	71.5	156.8	207.0	70.4	30.063	73.0
8 0	17.33	76.5	149.8	204.3	75.6	30.047	71.8
9 50	18.20	73.6	152.5	200.4	72.6	30.026	66.2
10 0	vibrating		152.0	202.4	72.4	30.020	66.2
10 10	"		152.0	202.0	72.3	30.034	66.2
12 0	17.03	70.5	155.2	203.7	70.6	30.009	66.0
13 50	16.06	69.0	151.8	203.0	69.0	30.048	65.0
14 0	16.44	69.0	151.5	202.7	69.0	30.040	65.0
14 10	16.17	69.2	151.0	203.2		30.046	65.0
16 0	16.20	69.0	151.9	204.0	68.3	30.052	65.0
17 50	18.05	69.0	158.0	203.0	68.0	30.072	64.7
18 0	17.38	69.0	156.5	204.3	68.0	30.070	64.8
18 10	17.32	69.0	156.1	205.8	68.0	30.052	64.8
20 0	16.28	67.5	157.0	203.0	67.0	30.049	64.0
21 50	15.20	66.5	158.0	200.0	66.0	30.047	64.0
22 0	15.18	66.2	157.7	200.0	66.0	30.049	64.0
22 10	15.14	66.4	158.0	200.0	66.0	30.049	64.0
Aug. 11.							
24 0	15.34	66.5	157.4	202.5	66.2	30.054	65.5
1 50	16.37	67.6	156.0	206.5	67.0	30.068	70.0
2 0	16.28	68.0	154.0	205.3	67.2	30.066	70.0
2 10	16.39	68.2	153.2	206.0	67.5	30.074	70.3
Aug. 12.							
1 50	17.30	68.5	156.0	203.5	67.9	30.068	73.0
2 0	17.13	69.0	156.2	204.5	68.0	30.071	73.4
2 10	17.25	69.0	156.0	205.5	68.5	30.068	74.0
4 0	18.40	72.5	145.6	209.7	73.8	30.061	75.0
5 50	18.10	72.9	144.5	209.5	73.8	30.053	75.0
6 0	18.08	72.8	144.1	208.5	73.6	30.054	69.7
6 10	17.48	72.5	144.8	208.0	73.2	30.057	67.0
8 0	16.36	71.0	147.0	204.6	71.0	30.051	68.6
10 0	16.48	71.4	150.5	203.0	71.3	30.069	68.5
12 0	16.39	70.7	151.5	201.3	70.3	30.077	66.0
13 50	15.38	68.3	146.5	200.5	68.0	30.099	65.2
14 0	16.11		147.5	201.0			
14 10	16.25	68.6	147.0	201.0	68.2	30.091	65.2

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
16 0	+17.13	69.6°	146.0	201.7	68.3°	30.083	65.0°
17 50	17.07	69.5	148 0	200.3	68.0	30.075	64.6
18 0	17.10		147.9	200 8			
18 10	17.11	69.5	148.0	200.6	68 0	30.073	64.6
20 0	17.09	69.2	141.6	201.6	67 6	30.064	63 8
21 50	16.46	68.3	148.9	200.0	67.0	30.075	61.1
22 0	16.39		150.0	200.2			
22 10	16.29	68.0	151.3	200.1	66.8	30.071	61.0
Aug.13.							
24 0			153 8	197.9	65.1	30.090	60.5
1 50	14.44	65.0	152 4	201.8	64.3	30.116	60 5
2 0	14.43	65.0	152.4	201.0			
2 10	14.47	65.0	152.0	201.8	64.1	30.098	60.7
Aug.15.							
1 50	14.43	65.5	154.5	206.2	65.0	29.879	64.6
2 0	14.44	65.6	151.8	206 6	65.1	29.881	65.8
2 10	15.06	66.0	151.7	206.4	65 5	29.881	66.9
4 0	16.32	70.6	142 2	208 2	70.5	29.874	72.8
5 50	17.11	71.5	140.0	206.4	72 1	29.863	70.6
6 0	17.16	72.0	143.6	207.6	72.5	29.863	71.5
6 10	17.08	72.3	143.0	207.2	72.6	29.864	71.7
8 0	17.27	73 5	149.0	202.7	73 6	29.888	72.3
9 50	17.30	73.5	155 9	203.1	73.6	29.851	72.0
10 0	17.32	73.5	155.9	204.9	73.2	29.850	71.9
10 10	17.39	73.4	156.0	202 9	73.4	29.853	72.0
12 0	17.17	71.9	146.6	203.2	71 8	29.881	69 3
13 50	18.10	72.5	149.6	205.1	71.4	29.896	65.6
14 0	18.07	72.4	149.7	205 1	71.4	29.902	65.6
14 10		72 5	149.6	205.4	71.4	29.907	65.1
16 0	17.42	71.4	157.5	204.0	70.2	29.886	64 2
17 50	17.36	70 2	160.4	202.7	69 0	29.885	64.1
18 0	17.39	70.1	158.9	202 8	69.0	29.887	64.1
18 10	17.41	70.1	158.3	203.1	69 1	29.889	64 2
20 0	17.00	69.6	152.6	204.9	68.2	29.873	64.3
21 50	16.20	69.0	155.7	203.4	68.9	29.882	63.8
22 0	16.12	69.0	157.4	203.7	67.8	29 882	63 8
22 10	16.37	68.7	158.2	203.1	67.4	29.880	63.8
Aug.16.							
24 0	14.46	66.3	163.3	203.8	67.0	29.890	63.2
1 50	16.00	67.5	161.0	208 5	67.5	29.889	68 0
2 0	15.49	67 5	161.0	208 7	67.5	29.897	68.8
2 10	16.02	67.6	160.0	208.6	67.8	29.907	68.9
Aug.17.							
1 50	16.12	67.5	164.0	210.0	66.7	29 913	71.0
2 0	16.17	68.0	163.3	209.2	67.0	29.927	72.0
2 10	16.29	68.2	163.0	209.5	67.3	29 923	73.0
4 0	18.16	71.6	152.8	211.7	71.6	29.893	75.7
5 50	19.14	75.0	144.0	211.8	76 0	29.893	78.0
6 0	19.13	75.2	143.8	212.0	76.2	29.887	77.0
6 10	19.12	75.5	143.6	211.0	76 5	29.889	77.6
8 0	18.32	75.6	149.0	208.2	76.7	29.862	74 0
9 50	18.38	76.4	154.3	206.8	76.8	29.861	76.5
10 0	18.44	76.4	154.5	206.8	76.8	29.863	76.7
10 10	18.43	76.5	154.3	207.0	76 8	29.855	77 0
12 0	18.34	76.0	155.0	207.0	76.0	29.885	72 2
13 50	17.28	73.0	156.7	205.1	74 0	29.913	68.0
14 0	17.42	73.0	156.6	204.7	73.8	29.920	67.0
14 10	17.45	73.0	157.0	203.6	73.2	29.919	67.0
16 0	17.18	70.0	155.4	204.2	72.0	29.926	65.0
17 50	18.30	70.0	167.4	209.7	70.0	29.923	65.4
18 0	18.33	69.0	167.5	210.0	70.0	29.921	65.2
18 10	18.32	69.0	167.5	210.0	70.0	29.919	65.0
20 0	18.15	68.8	165.5	207.7	69.0	29.903	63.2

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
21 50	+16 02	68.5°	156.5	202 8	68.0°	29.892	64.7°
22 0	16.00	68.5	156.5	203.0	68.0	29.894	64.3
22 10	16.04	68.5	156.5	203.0	68.0	29.896	63.7
Aug.18.							
24 0	15 34	68 0	163.7	204.6	67.5	29.901	66.3
1 50	16.32	69 5	161.0	207.5	69.8	29 887	72.0
2 0	16.38	70.0	160.5	207.8	69.8	29.893	71.6
2 10	16.34	70.0	160.0	208.2	69.8	29.882	71.0
Aug.19.							
1 50	19.08	73.0	161.8	222.2	72.3	29 853	75.8
2 0	19.10	73 1	156.5	222 1	72.4	29.855	75.8
2 10	19.13	73.2	150.0	222.4	72.5	29.851	76.4
4 0	19.19	75.4	143.0	219 0	75.0	29.848	77.1
5 50	20.39	79 5	137.0	213.2	81.0	29.804	82.0
6 0			139.3	211.8			
6 10	20.34	80.0	138.2	212 7	81.8	29.795	82.3
8 0	21.31	83.0	147.2	209.5	85.0	29.768	82.8
9 50			166 2	204.0	84.3	29.759	81.0
10 0	19.16	83.5	166.7	204.3	84.0		
10 10	19.26	83.3	166.6	203.1	84.0	29.759	80.8
12 0	19.27		161 3	204.0	79.0	29.777	75.0
13 50			157.2	204 3	78.5		
14 0	19.27	77.0	157.6	206 3	78.5	29.787	70.2
14 10	19.23	77.0	157.8	207 5	78.4	29.791	70.1
16 0			158 0	207.1	75.0	29.839	69.0
17 50	17.20	71.0	158.5	206.0	74.3	29.831	64.8
18 0	17.18		159 5	205.9	74.0		
18 10	17.22	71.0	160.3	205 7	74.0	29.838	64.8
20 0	16.27	69 5	155 5	206.5	71.0	29.844	62.5
22 0	15 35	67.2	158.8	205.5	68.6	29.867	61.6
Aug.20.							
24 0	15.12	66.6	165.1	202.5	68.0	29.875	64.8
1 50			160.8	210.0	69.8	29 887	71.4
2 0	16.10	68.7	160.2	210.1	70.0	29.889	70.2
2 10	16.19	69.0	160.2	210.0	70.2	29.892	70.4
Aug.22.							
1 50	13.39	61.4	165.2	205.0	63.1	30.245	64.5
2 0	14 03	62.1	165 2	205.8	63 7		
2 10	14.10	62.7		206.2	64.3	30.236	66.3
4 0	17.08	68.5	154.6	210 2	72.0	30.232	74 0
5 50	18.21	73.0	149 0	210.5	76.5	30.229	77.2
6 0	18.24	73 4	148 2	211.5	78.0		
6 10	18.32	73.8	148.2	210.8	78.1	30.222	79.0
8 0	19.26	77.0	150.1	209 3	80.8	30.206	77.8
10 10	19.20	78.0	153.1	208.2	79.6	30.204	76 8
12 0	18.00	74.8	153.8	205.3	75.4	30.213	68.7
13 50	16.30	71.2	146.4	207.6	72.0	30.231	63.0
14 0	16.49	71.2	151.5	206.6	72.0		
14 10	17.00	71.2	149 2	204.5	71.8	30.240	62.3
16 0	15.40	66.5	154.8	201.3	70.0	30.244	60.2
17 50	16.18	67.0	152 6	197.7	68.0	30.247	57.5
18 0	17.00	67.2	152.0	197 7	67.8		
18 10	16.37	67.1	151.9	198.0	67.5	30.260	57.7
20 0	15.02	65.6	149.8	201.5	66.0	30.229	56.8
22 10	15.22	63.5	158 3	198.5	64.0	30.257	55.2
Aug.23.							
24 0	15.22	62.8	165.9	198.4	62.3	30.298	59.4
2 0	16.30	67.0	158.7	206.0	68.0	30.298	70.0
Aug.24.							
1 50	15.10	61.0	159 4	203.2	62 0	30.231	64.6
2 0	15.37	61.3	159.9	203.7	62.1	30.245	68.0
2 10	14.17	61.5	156 1	203.0	63.0	30.250	65.6
4 0	16.37	67.0	147 9	204.2	70.7	30.246	72.8

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
6 0	+17.44	71.0	143.0	206.6	76.0	30.193	74.0
8 0	18.37	74.0	149 7	203.0	77.8	30.138	73.8
12 0	18.15	72.5	153.5	203.4	72.8	30 122	68.0
13 50	17.45	69 5	163 5	202.5	70 0	30.133	62.0
14 0	17.40	69.1	159.5	204.9	70.0		
14 10	17.25	69.0	159.6	206.5	69.8	30.133	61.4
16 0	15.49	65.5	156.5	203.7	67.8	30.119	58.5
22 0	12.49	58 5	159.5	200.9	61.4	30.063	54.2
Aug.25							
24 0	12.46	58.6	159.5	200.7	60.8	30.065	58.6
2 0			163.3	203.0	62.0	30.058	66.6
Aug.26							
1 50	18 38	70 5	161.0	209 2	70.3	29.937	70.8
2 0	18.26	70 5	160.0	210.0	70 5	29.935	71 0
2 10	18.22	70.5	160.0	209.6	70.8	29 950	71.2
4 0	19.29	73.0	147.5	210.5	74.5	29.928	75.6
5 50	21.04	75.6	144.6	205.8	77.2	29.907	74.2
6 0	20 46	75.6	144.3	205.5	77.0	29.901	73 5
6 10	20 40	75.4	145.0	203.6	77 0	29.908	73.4
8 0	20.10	75.3	146.6	205.6	76.8	29.879	75.0
	Term	day	omit	ted.			
Sept. 5							
1 50	15.33	61.8	164.0	208.0	62.5	29.741	67.4
2 0	16.00	64.0	163 7	208.2	62.8	29 747	68.3
2 10	16 01	64 0	162.5	209.0	63.0	29.764	68.6
6 0	16.34	68.0	141.5	209.0	68.5	29.724	69.0
8 10	16.46	71.0	148.7	202.3	71.2	29 716	71.4
10 0	18.15	72 5	157.0	201.7	73 0	29 705	71.8
12 0	16.32	72.0	156.0	215.5	72.0	29.721	69.0
14 0	17 22	71.0	154.0	205.0	71.0	29.738	67.0
16 0	16.17	67.5	154.0	202 6	68.0	29 817	61.8
22 0	14.14	60.0	153.6	198.4	61.6	29 935	55.0
Sept. 6.							
24 0	13.37	60.0	160.2	197.1	59.0	29.952	52.0
Sept. 7.							
1 50	13.15	57.5	161.9	201.4	57.0	29.930	60.0
2 0	13.25	57.5	161.9	201.6	57.0	29.923	60 0
2 10	13.39	59.0	161 4	202.3	57.0	29.913	60.5
4 0	14.30	61.5	151.5	207 2	61.5	29.893	66.5
6 30	16 24	66.0	144.0	204 3	67.0	29.853	73.0
8 0	17.16	68 5	148 6	202.0	70.8	29.805	72.3
10 0	18.12	70.5	155.8	203 0	72.0	29.762	71.0
Sept.12.							
24 0	15.25	63.5	162.0	197.7	63 2	29.530	69.0
2 0	18.09	68 7	149.0	210.5	71.8	29.569	74.1
3 0	13.31		153.0	212.0	75.6	29.564	77.0
4 0	21.20	74.6	145.7	209.0	78.2	29 545	78.5
5 0	18 44	76.0	149.0	214.0	78.0	29.533	82.0
7 0	22.44	79.5	146.0	204.0	81.2	29.522	83 5
8 0	10.02	81.0	149.2	205 2	83.0	29.361	84.0
11 0	12.16	82.3		216 0	82.8	29.504	80.8
12 0	16.24	82 0	144.8	210.0	82 0	29.402	79.0
13 0	18 10	80.0	146.4	211.0	79.0	29.513	71.2
14 0	20.04		146 0	212 4	75.9	29.503	67.0
15 0	20 39	75.3	156.0	211.2	75.0	29.504	66.3
16 0	18 47	74 7	155.7	204.5	73.0	29.460	66 0
17 0	18.46	73 6	147.7	215.4	72 0	29.403	65.1
18 0	18.36	73 1	149.0	206.6	71.7	29.403	64.2
19 0	18.35	72.2	143.0	208.5	70.9	29 385	62.8
20 0	18.41	71.5	146.0	205.2	70.0	29.374	63.0
21 0	18.35	72.0	147.5	205.0	69.5	29.363	65.0
22 0	18.22	72.0	145.0	202.0	68.0	29.375	61.3

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Sept.13.							
h. m.							
2 0	+18.46	69.0	140.0	206.4	67.9	29.411	69.6
3 0	18.41	69.5	140.0	206.0	68.6	29.420	69.6
4 0	18.33	69.7	136.0	211.0	69.5	29.432	70.0
5 0	18.31	70.3	133.2	209.2	70.0	29.415	69.1
6 0	18.07	72.4	133 5	210.0	72.8	29.432	72.5
7 0	15.28	67.0	134.6	201.5	68.9	29.473	61.4
8 0	15.00	67.0	136.0	205.0	67.9	29.520	62.8
11 0	13.20	64.3	162.0	212.3	64.0	29 723	59.0
12 0	10.42	64.0	160.0	209.0	64.0	29.526	57.0
13 0	9.35	64 0	155.2	206.0	64.0	29.538	58.0
14 0	14.36	64.9	159.1	206.0	63.6	29.796	58.5
15 0	14.42	65.0	159.0	201.3	63.3	29.738	58.3
16 0	20.41	64.0	156 0	212.1	63.0	29 654	58.5
17 0	16.31	63.5	156.0	202.5	62.0	29.689,	
18 0	14 32	63 5		200.5	61.5	29.723,	
19 0	14.32	63.0	155.5	200.0	61.0	29.755,	
22 0	14.18	62.5	152.7	199.7	61.0	29.857	60.9
23 0	14.02	60.5	153.0	201.1	61.0	29.867	55.5
Sept.14.							
4 0	14.41	63.5	142 2	207.0	66.0	29.938	62.0
11 0	15.43	67.3	153.0	199.3	65.0	29.968	57.8
14 0	12 37	57.5	148.0	197.6	55.8	30.008	56.0
15 0	13.03	53.0	148 0	200.0	52.7	29.998	58.6
17 0	13.04	53.0	148.0	204.7	55.0	30 002	57.6
18 0	13.00	53.0	147.0	204.0	55.0	29.891	56.9
Sept.15.							
11 0	10.22	55.0	155.3			29.953	50.7
12 0	11.12	55.5	154.0	196.8	55.8	29.980	51.0
15 0	12.41	56 5	150.0	197.0	56.5	29 850	54.0
16 0	12.42	57.5	151.0	199.5	58.0	29.940	52.0
17 0	13.08	59.0	152.5	200.5	60.5	29.936	54.0
18 0	14.32	60.0	157.5	201.0	62.5	29.962	53.0
18 50	15.34	60.0	145.0	198.0	60.0	29.911	56.5
19 0	15.30	60.0	145.0	200.0	60 0	29.900	
19 10	14.22	60.0	146.0	203.0	59.4	29.890	57.1
Sept.16.							
13 10	13.29	61.5	152.0	204.0	60.8	29.858	56.0
14 0	13.00	61.5	152.0	203.6	60.8	29 848	56.0
15 0	13.37	61.5	154.5	204.0	60 5	29.880	56.0
16 0	15.33	61.3	154.0	202.0	62.0	29.879	56.0
17 0	16.10	61.0	158.5	207.7	63.5	29.863	56.0
18 0	16.07	61.5	161.4	211.0	64.0	29.861	56.0
19 0	15.30	61.0	157.0	212 3	64.7	29.871	57.0
23 0	14.40	61.0	156 0	200.0	63.4	29.892	55.0
Sept.17.							
24 0	13.47	61.0	161 5	200.5	62.5	29 899	57.0
1 0	13.40	60 5	162.5	204.2	62.0	29.898	58.4
Sept.19.							
3 0	12.43	57.5	151.0	201.5	57.3	29.751	57.5
4 0	13.45	68.0	151.2	204.0	61.6	29.736	61.0
5 0	13.31	62.0	148 0	203.8	62.8	29.734	61.2
6 0	13.32	61.5	147.7	200.6	63.5	29.757	60.8
7 0	13 09	61.3	144.0	198.2	62 8	29.801	60 2
8 0	13.05	60 8	150.1	191.9	62.0	29.754	57.2
9 0	12 18	61.4	144 5	199.6	61.5	29.729	55.0
10 0	12.47	61.5	146.5	190.0	61.1	28.930	51.2
11 0	9.31	60.3	155.5	200.0	60.2	28.933	53.1
12 0	12.01	60.5	144.7	198.0	59.2	29.837	52.0
13 0	12.28	60.6	147.0	199.5	59.0	29.869	51.3
13 50	11.05	58.5	156 0	209 0	58.9	29.800	48.8
14 0	10.24	58.0	163.4	212.1	58.3	29.801	48.6
14 52	10.03	57.5	164.0	211.7	58.4	29.814	48.8

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
15 0	+12.21	58°.5	154.2	202 8	57°.8	29.886	48°.0
16 0	12 15	59.0	152.8	203.4	59.0	29.880	47.4
17 0	12.15	59.0	152.9	200.2	61.2	29.809	45.2
18 0	13.12	59.2	153.9	202.1	63.0	29.832	46.1
19 0	14.45	61.0	153.2	201.8	64.0	29.832	46 6
20 0	14.35	60.3	157.0	202.1	63.3	29.845	45.1
21 0	13.17	59.0	154 0	200.0	61.9	29 765	46.0
22 0	13.45	59.0	154.0	200.6	61.1	29.853	45.2
23 0	14.43	58.5	163.6	197.0	60.5	29.907	45.2
Sept.20.							
24 0	12 18	57.5	164.3	195 6	58.7	29 933	45.7
1 0	12.45	57.5	147.0	210 0	59.5	29.770	50.5
{ 1 50	12.11	60.0	160.3	200.3	62.0	29.943	53.0
{ 2 0	13.01	69.1	163.0	203.0	62.5	29.947	53 0
{ 2 10	12 27	59.2	162.5	204.5	62.9	29.948	52.3
3 0	12.45	59.0	151.7	206 0	62.8	29.949	54.5
4 0	12.26	58.5	151.0	208.0	64.3	29.954	57.0
5 0	13.23	60.0	149 0	206.0	65.5	29.931	59.0
6 0	12.24	61.0	146.0	205.0	66.0	29.905	61.0
7 0	14,12	64.0	147.5	202 0	65.0	28.935	61.5
8 0	13.18	63.5	148 2	209.0	66.0	29.894	62.5
9 0	13.42	66.0	150.0	203.7	66.5	29.899	63.4
10 0	13.38	64.7	149.0	201.5	65.0	29.880	58.9
11 0	13.35	64.4	150.1	197.0	64.0	29.934	57 5
12 0	12.35	63.0	139.0	201.0	62.5	29.843	52.0
13 0	14.30	60.6	191.9	211.0	60.0	29.930	49.3
{ 13 50	12.12	58.0	158.5	196.2	58.5	29.962	48.2
{ 14 0	13.19	58.2	162.5	195.2	58.3		47.0
{ 14 10	13 33	58.4	158 4	195.6	58.1	29.934	48.0
15 0	11.34	58.7	155.5	197 5	57.8	29.929	46 4
16 0	11.44	57.5	153.5	198 5	58.9	29.914	45.7
17 0	11.14	57.5	153.8	198.7	58.8	29.912	45 1
18 0	11.35	57 6	155 7	199.3	59.3	29.900	42.2
19 0	13.23	57.5	148.0	195.0	59.7	29.877	41.4
20 0	14.18	57.7	156.7	201.6	59.6	29.872	40.4
21 0	12 07	57.1	160.0	200.5	59 3	29.751	40.1
22 0	11.33	57.0	157.0	201.0	59.0	29.801	41.1
23 0	11.19	56.2	157.0	202.5	58.8	29.821	41.3
Sept.21.							
24 0	11.11	55.0	155.2	200 5	57.5	29.805	42 5
1 0	10.35	55.0	161.0	197.5	57.4	29.788	46.5
{ 1 50	11.48	55.7	160.0	198 5	58.0	29.719	51.0
{ 2 0	11.49	55.9	160 0	199.5	58.0		
{ 2 10	11.09	56.0	160.0	200.0	58.0	29.760	52.0
3 0	11.13	57.2	157.7	205.5	59.5	29.778	56.8
4 0	11.44	60.0	152.5	211.4	61.8	29.570	53.7
7 0	12.36	62.3	145.0	203 2	63.0	29.564	63.3
8 0	12 42	62 5	145.5	200.3	63.5	29.564	62.5
9 0	12 47	68.0	152.0	199.0	63.0	29.504	58.5
	Term	day	omit	ted.			
Sept.22.							
11 0	11.14	56.5	152.7	201.7	61.1	29.727	47.5
12 0	12.30	56 8	153.9	198.8	60.5	29.750	45.2
13 0	12 42	57 5	159.0	199 2	61.5	29.620	44.0
{ 13 50	13.09	58.2	162.0	197.0	61.8	29.849	43.8
{ 14 0	13.30	58.0	167 0	193.2	62.1		
{ 14 10	13.49	58 1	163.8	190.0	61 9	29.837	43.5
15 0	12.21	58.2	156.0	201.5	62.0	29.832	41.1
16 0	12.34	57.9	152.5	200.7	61.6	29.837	40.8
17 0	12 27	57.6	160 0	200.0	61.1	29.841	39.6
18 0	12 25	56.8	151.5	203.0	60 6	29.848	39 3
19 0	13.26	55.7	144.6	203.0	60.5	29.843	38.9
20 0	13.40	55.4	143.0	202.5	61.6	29.837	39.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
21 0	+12.10	53°.8	150.5	204.0	63°.5	29.803	38°.7
22 0	14.06	53.5	146.0	201.0	65.0	29.803	37.8
23 0	11.23	52.5	144.7	201.1	63.9	29.816	38.0
Sept.23.							
24 0	10.16	52.7	161.0	200.0	60.6	29.837	39.9
1 0	11.29	53.5	160 0	204.0	59.7	29.850	42.0
{ 1 50	10.17	54.3	161.0	207.1	61.0	29.764	43.8
{ 2 0	10.24	54.4	160.0	208.1	61.1	29.767	44.2
{ 2 10	10.24	54.4	159.0	208.6	61.3	29.765	44.8
3 0	10.13	55.5	154.0	208.5	62.5	29 724	46 4
4 0	11.14	57.0	147.5	209.2	66.0	29.862	49.5
5 0	11.04	59.0	143.5	207.6	67.8	29.719	51.8
6 0	12 01	60.0	145.5	238.0	69.5	28.911	53.5
7 0	12 27	62.0	147.3	231.5	67.0	28.995	53.0
8 0	12 06	61.0	145 0	198.0	64.5	29.672	53.8
9 0	12 37	62.0	153 0	193.0	62.5	29.848	54.1
10 0	10.37	61.5	152.7	193.3	60.5	29.859	52.0
11 0	11.06	60.0	151.9	194.1	57.3	29 888	47.7
12 0	12 05	59.3	155.0	196.2	56.5	29.405	43.2
13 0	12.45	57.5	155.4	195.0	56.0	29.932	41.6
{ 13 50	12.40	56 0	153.0	193.0	55.0	29.939	40.5
{ 14 0	12.12	57.0	157.0	192.7	55.0		
{ 14 10	12.20	57.0	157.5	192.9	55.0	29.924	40.0
15 0	12.45	55.7	155.2	195.4	55.5	29.917	37.5
16 0	12.21	54.0	148.2	191.5	55.0	29.964	36.0
17 0	10.40	52 0	157.5	196.0	55.0	29.950	35.5
18 0	10.40	54.0	157.0	196.0	56.0	29.958	34.0
19 0	9.15	50.5	154.5	194.0	55.3	29.957	34.0
20 0	10.12	49.0	159.0	197.2	57.0	29.949	33.0
21 0	9.43	48.0	158.5	197.5	58.0	29.932	32.0
22 0	9.20	47.0	154.2	198.0	58.7	29.935	31.0
23 0	7.43	46.5	156.0	198.0	58.0	29.917	31.0
Sept.24.							
24 0	6.25	45.0	150.0	198.0	56.8	29.991	32.5
1 0	6.29	44.8	161.0	197.0	56.1	30.009	35.5
{ 1 50	12.08	46.5	160.0	199.5	56.0	30.147	40.0
{ 2 0	13.10	46.7	160.0	199.5	56.0		
{ 2 10	13.12	47.1	160.0	199.8	56.0	30.041	42.1
Sept.26.							
{ 1 50	8.48	47.7	158.7	190.5	48.6	30.195	47.0
{ 2 0	9.09	47.9	158 5	190.3	48.8		
{ 2 10	9.12	48.1	158.7	190 8	49.5	30.188	49.8
3 0	9.29	51.0	158 0	193.1	54.0	30.182	54.1
4 0	11.29	53.4	156.5	196.0	58.5	30.063	60.8
5 0	12.18	57.5	154.4	200.0	65.0	30.164	62.0
6 0	14.31	60.2	152.0	202.0	68.0	30.121	63.8
7 0	15.00	64.0	150.0	202.0	69.5	30.109	65.2
8 0	15.35	66.0	150.0	201.6	70.2	30.086	67.0
9 0	15.30	67.5	150.0	202 0	70.8	30.100	
10 0	16 10	67.5	151.0	200.8	70.0	30.107	65.0
12 0	14.39	64.2	153.2	198.8	65.2	30.085	54.8
13 0	10.37	64.0	144.5	197.5	63.5	30 080	52.0
14 0	14.12	61.5	155.1	196.3	61.3	30.099	49.2
15 0	13.26	59.3	154.0	198.5	60.0	30.090	48.0
16 0	13 24	58.0	153.4	195.2	59.0	30.086	46.0
17 0	12.41	58.5	154 5	197.0	60.0	30.078	45.0
18 0	12.49	57.5	154.5	197.9	60.0	30 067	44.0
19 0	12.19	57.0	154.5	197.1	60.0	30.067	43.0
20 0	11.10	55.0	150.0	197.4	59.5	30.065	42.0
21 0	11.05	53.5	150.1	197.5	59.5	30.051	41.0
22 0	10 40	53 5	151.0	197.0	60.0	30.058	41.0
23 0	10.29	53.5	151.5	197.7	61.0	30.047	41.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Sept. 27. h. m.							
24 0	+11.27	55.2	155.4	198.3	61.0	30.066	41.0
1 0	9.00	54.0	160 8	198.0	61.5	30.015	45 0
1 50	11.21	53.5	158.6	199.3	62.8	30.083	44.4
2 0	11.22	53.5	158.5	200.0	63.0		
2 10	11.22	53.5	158.6	200.0	63.4	30.081	51.0
3 0	10.39	54.6	158.0	202.6	66.6	30.068	56 2
4 0	11.41	57.0	154.2	205.1	71.5	30.015	62.1
5 0	13.12	59.8	150.5	207.7	75.0	30.033	65.0
6 0	14.38	65.1	148 8	209.7	75.6	29 959	69.0
7 0	15.30	68.0	150.0	209.5	77.5	29.956	
8 0	18.04	70.8	150.1	208.8	78.2	29.907	71.8
9 0	18.00	71.2	151 0	208.9	77 2	29.914	70.0
10 0	18.00	71.0	151.5	208.5	75.2	29.903	69.0
11 0	17.07	70.3		208 2	74.2	29.919	65.3
12 0	16.09	67.6	145.4	204.0	71.8	29.866	60 2
13 0	15.07	66.0	147.0	204.0	69.5	29 897	58.0
13 50	14.38	65.1	147.2	200.8	68.1	29.858	57.0
14 0	14.42	64.2	147.1	200.9	68.0		
14 10	14.42	64.3	147.6	201.2	67.9	29.860	56 4
15 0	14.36	63.5	147 2	200 5	66.7	29.863	54.0
16 0	14.14	63.0	147.1	200.0	65.0	29.861	52.9
17 0	14.03	62.0	147.3	201.0	63 3	29.863	52.8
18 0	13.31	61.1	147.8	198.9	61.7		51.6
19 0	13.10	60.0	147.9	198.1	60.8	29.756	50.8
20 0		60.0	147 5	196.1	60.0	29.798	50.9
21 0	14.07	60.0	156.3	196 0	59 8	29.755	52.7
22 0	14.14	60 0	154 9	197.0	63.5	29.772	53.9
23 0	14.14	60.0	155.7	198.5	66.0	29.766	56.0
Sept. 28.							
24 0	13.04	58.0	149.1	199.5	66.0	29.756	54 0
1 0	11.00	59.0	157.0	199.0	66.0	29.754	58.0
1 50	14.10	60.3	158.0	201 4	66.0	29.760	63 0
2 0	14.19	60.5	158.5	201.0	66.0		
2 10	14.14	60.5	158.0	201.4	66 1	29.768	63.0
3 0			156.9	203.7	68 8	29.750	65.1
5 0	17.47	68.0	150.5	206.3	74.8	29.749	71.0
6 0	18.17	70 2	149 0	205.4	76.2	29.702	72.0
7 0	18.03	71.5	148.8	205 9	78.3	29.681	
8 0	19.10	73.5	146.4	208.5	78.0	29 732	72.5
10 0	18.31	73.0	150.0	204.8	76.0	29.730	70.5
12 0	17.31	71.2	150.0	204.9	73.0	29 771	64.1
13 0	17.35	71.0	145 5	205.0	71.0	29.805	60.5
15 0	16.28	66.5	145 6	201.7	67.2	29 819	57.2
16 0	10.42	65.5	145.3	202 0	66 4	29.813	56.0
17 0	10.29	64.5	150.5	205.3	64 5	29.825	57 5
18 0	10.04	63.7	155.1	201.0	64.5	29.840	55 4
19 0	10.18	63.0	148.9	198.2	62 5	29 823	54.2
20 0	10.05	62.4	147.8	198.3	61.8	29.817	53.6
21 0	10.28	61.5	149.3	197.7	60.0	29.816	53 5
22 0	10.12	60.0	148.2	198 5	60.5	29.742	53.5
23 0	9.42	60.4	132.5	204.5	60.5	29.762	49.5
Sept. 29.							
24 0	10.33	60.5	139.5	198 6	60.5	29.825	49.0
1 0	16.09	58 0	137.9	197.7	58.0	29.874	49.0
2 0	14.25	57.0	156.0	198.0	58 0	29.685	53.0
3 0			148 0	205 6	62 8	29.977	63.0
4 0	14.03	61.0	149.5	209.2	64.0	29.922	63 0
6 0	14.45	60.7	150.9	202.0	64.7	29 962	60.5
7 0	14.05	62.7	152.5	201.8	65.5	29.971	60.7
10 0	14.04	63.0	152 5	197.7	62.0	29.957	57.5
11 0	13.24	61.6	152.5	196 3	60.0	29 989	54.5
13 0	11.05	62.0	147.0	196.5	58.0	29.995	47.0
h. m. 14 0	+12 32	60.0	153.0	196.3	57 5	30.022	45.0
15 0	12.42	57.9	151.8	196.0	56.5	30 021	45.1
16 0	12 05	57.0	149.2	194.5	55.0	30 024	45.0
17 0	11.47	56 0	144.7	196.8	56.6	30.010	45.1
18 0	11.39	55.5	148.0	199.0	61.1	30.022	43.3
19 0	11.39	55.0	146.3	199.5	63.5	30.010	44.1
20 0	11.41	53 5	149.0	201.0	63.5	29.959	43.0
22 0	11.37	55.5	151.0	199.0	62.0	29.950	43.0
23 0	10.03	54.0	147.0	199.3		29.954	44.0
Sept. 30.							
1 0	11.44	54.0	148.0	200 4	62.0	29.990	44.0
1 50	11.19	55.5	148.4	199.0	60 0	30.003	53.5
2 0	11.19	55.7	146.9	199.4	60.0		
2 10	11.25	55 7	147.0	199.3	60 5	29.980	55.5
3 0	12.18	57.4	152.4	202.0	63.0	29.962	58.2
5 0	13.41	61.8	149.5	204.5	63 4	29.905	60.9
10 0	12 11	60 0	150.0	198.2	59.5	29.844	58.0
11 0	12 35	60.0	148.5	202.2	59.0	29 837	57.4
12 0	12 32	60.0	151.5	198.2	59.0	29.848	57.0
13 0	10.05	58.5	152.0	199.5	59 0	29.863	55.0
14 0	9.24	60.0	158.5	200.5	59.0	29.857	54.0
15 0	10.11	60.0	153.0	203.6	61.0	29.797	52.0
16 0	10.03	59 0	153.0	202.3	64.0	29.806	49.0
17 0	10.41	58.5	155.0	204.0	66.0	29 849	48.0
18 0	9.30	57 5	156.0	201.0	65.0	29 870	49.2
19 0	9.40	57.5	155.0	203.0	65.0	29.866	48.0
20 0	10.27	58.0	154.0	204.0	66 0	29.840	45.0
21 0	11.00	56.0	153.5	202.0	64.0	29.826	44.0
22 0	11.00	55.5	150.0	203.0	64.0	29.853	44.0
23 0	11.05	55.0	144.0	201.4	63.8	29.851	43.3
Oct. 1.							
24 0	11.20	54 5	155.0	197.2	63.5	29.814	43.0
1 0	11.25	55.0	157.0	196.5	61.5	29 634	47.0
1 50	11.23	55 7	158.1	199.2	61.5	29.819	51.0
2 0	11.28	55 9	157.7	199.1	61.6		
2 10	11.32	56 1	157.8	199.6	61.8	29.829	54.0
Oct. 3.							
1 50	9 34	49.2	156.4	194.0	49.0	29.777	51.2
2 0	9.40	49.7	158.0	194.2	49.4		
2 10	10 03	50.0	156.8	194.5	49.6	29.762	53 0
4 0	11.05	53.4	153 6	196 4	56 5	29.742	56.1
6 0	10.42	58 5	148.1	199.5	60.0	29.608	59.5
7 50	14 08	61 0	150.0	198 0	62 2	29 656	62.1
8 0	14.25	61.0	150.0	197.8	62.2		
8 10	14.34	61.2	150.0	198.0	62 5	29.698	62.0
10 0	14.10	62.0	152 5	200.0	62.1	29.686	60.2
12 0	14.47	61 3	153.3	197.0	59.5	29.709	52.5
13 50	13.17	58.0	153.8	194 8	57.2	29.757	47.0
14 0	13.45	57.7	155.5	195.3	57.0		
14 10	13.41		155.3	195.3	56 9	29.778	46.0
16 0	12.09	57.5	156.5	197.5	57 0	29.697	46.0
18 0	12.18	56 8	150.5	197.3	58 0	29.765	43.8
19 0	12.36	55.5	150.0	198 0	58 0	29.728	43.2
19 50	11.14	54.7	149.3	199 6	64 6	29.778	41.2
20 0	11.12	54.5	149.5	199.5	64 6		
20 10	11.27	54 8	149.5	199.8	64 8	29.761	41.1
22 0	11.26	52.6	152.0	198.0	62.5	29 650	38.5
Oct. 4.							
24 0	10.32	51.0	154.0	195.0	58.5	29.746	39.0
1 12	9.45	51.5	162.2	195.8	57 5	29 840	44.0
1 50	9.45	51.5	161.2	200.5	57.5	29.748	46.0
2 0	9.48	51.5	161.7	200.7	57.6		
2 10	10.03	51.5	161.2	201.0	58.0	29.841	47.5

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
4 0	+12.29	55.9	150.5	205.1	64.3	29.749	53.8
6 0	10.15	58.5	146.0	201.2	65.0	29.780	58.0
7 50	14.23	62.0	148.0	198.0	63.8	29.786	57.3
8 0	14.29		148.2	198.1			
8 10	14.33	62.1	148.4	198.0	63.3	29.777	58.0
12 0	13.14	61.3	149.1	194.7	58.5	29.834	48.3
13 50	13.31	58.5	141.0	196.8	59.8	29.854	45.8
14 0	13.43	58.5	141.1	196.8	60.0		
14 10	13.37	58.5	141.2	197.0	60.2	29.870	44.3
16 0	12.33	56.1	140.5	197.5	61.0	29.933	42.0
18 0	11.00	52.5		196.0	59.0	29.942	38.4
22 0	9.36	48.5	146.6	192.5	54.0	29.924	35.8
23 0	9.01	48.0	148.6	192.4	53.0	29.934	34.5
Oct. 5.							
24 0	8.15	46.3		194.7	53.5	29.960	34.8
1 50	8.11	46.0	150.0	202.0	60.0	29.958	43.5
2 0	8.05	46.5	159.4	201.0	60.5	29.958	44.0
2 10	8.06	46.7	160.0	201.5	60.6	29.968	44.2
4 0	11.15	52.4	151.6	205.9	64.3	29.921	47.0
6 0	10.19	55.0	144.1	205.5	72.0	29.943	50.0
7 50	13.14	58.5	150.3	202.2	72.0	29.983	51.0
8 0	13.38	58.5	151.0	202.2	71.5		
8 10	13.16	58.6	150.9	202.2	71.3	29.986	51.0
12 0	12.45	57.0	157.9	197.4	61.8	30.063	40.4
13 50	12.08	55.0	157.5	196.0	59.0	30.101	40.0
14 0	12.15	55.0	157.8	196.0	59.0		
14 10	12.24	55.0	157.7	195.9	59.0	30.105	40.0
16 0	11.05	52.5	156.0	195.0	56.8	30.093	36.8
18 0	11.30	51.5	150.0	192.5	59.5	30.199	35.0
Oct. 6.							
4 0	9.09	48.0	151.0	202.8	60.0	30.238	50.0
6 0	13.02	54.0	147.0	201.1	63.6	30.177	55.0
7 50	13.46	57.0	151.0	198.9	62.8	30.177	54.2
8 0	13.42	57.0	150.9	198.3	62.7		
8 10	13.43	56.6	151.0	198.3	62.6	30.197	54.0
Oct. 7.							
1 0	6.23	42.6	154.1	181.4	42.1	30.156	37.2
6 0	12.29	55.0	149.0	202.2	67.0	30.074	61.3
8 0	15.11	63.0	148.0	206.7	68.5	30.027	63.8
10 0	15.49	64.0	148.0	204.1	66.3	30.042	61.8
12 0	15.02	62.2	148.7	201.2	58.0	30.066	51.9
Oct. 10.							
1 50	12.34	52.5	160.3	190.7	52.0	29.733	49.0
2 0	11.13	52.5	150.9	180.8	53.0	29.733	50.0
2 10	12.33	53.0	160.4	180.7	53.5	29.733	52.0
3 0	12.11	53.6	158.9	201.1	57.2	29.748	52.4
4 0	12.26	55.5	156.5	204.2	62.9	29.733	55.4
5 0	14.48	57.9	151.8	206.6	67.6	29.792	57.6
6 0	15.01	61.0	150.3	208.1	69.9	29.790	58.7
7 0	14.36	63.6	149.5	208.1	69.9	29.785	60.0
8 0	16.46	65.2	150.0			29.783	60.0
10 0	17.46	66.0	153.5	202.0	68.5	29.797	59.0
12 0	15.23	63.3	146.3	198.2	63.8	29.705	50.5
13 0	15.38	60.0	147.0	195.3	61.0	29.8[illegible]2	48.0
13 50	14.35	57.3	146.6	194.6	58.3	29.822	47.0
14 0	14.03	57.0	147.3	199.2	57.5		
14 10	14.35	57.2	145.4	195.2	68.3	29.832	45.0
15 0	13.29	57.7	150.0	195.5	56.8	29.695	43.7
16 0	13.11	55.7	146.0	197.0	57.5	29.836	42.0
17 0	13.49	55.0	148.0	198.0	61.0	29.863	41.2
18 0	13.37	55.2	147.5	200.5	62.8	29.797	41.7
19 0	12.35	54.0	148.0	198.6	62.5	29.782	38.0
20 0	12.03	53.0	149.5	200.0	62.3	29.778	37.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
22 0	+11.20	51.5	151.0	198.0	60.9	29.754	39.0
23 0	11.46	51.0	150.0	198.7	62.8	29.771	35.0
Oct. 11.							
24 0	11.30	50.4	151.0	198.0	61.8	29.766	35.3
1 0	10.37	49.0	158.0	197.5	60.8	29.516	38.4
1 50	10.37	49.5	159.3	197.1	60.4	29.742	45.3
2 0	10.44	50.1	160.0	197.2	60.4		45.3
2 10	10.47	50.3	159.4	197.1	60.6	29.740	45.8
3 0	12.00	54.0	158.0	202.5	65.8	29.622	51.7
4 0	14.00	58.0	156.5	206.5	72.6	29.622	58.9
5 0	15.10	60.2	152.0	211.5	76.6	29.522	60.7
6 0	16.30	63.8	150.3	205.0	77.3	29.639	63.4
7 0	15.27	66.6	149.7	209.9	75.3	29.589	61.7
8 0	12.12	68.5	151.0	208.5	65.7	29.596	65.1
9 0	18.12	69.5	152.7	205.7	74.8	29.519	64.8
10 0	18.26	69.5	154.0	204.0	73.9	29.511	63.8
11 0	18.05	68.5	150.0	204.0	71.4	29.447	58.8
12 0	17.04	66.3	150.0	198.9	69.0	29.530	53.0
13 0	16.34	65.0	150.0	198.5	67.0	29.533	51.2
13 50	16.35	65.5	149.7	200.4	66.7	29.486	49.4
14 0	16.35	65.5	150.0	200.3	67.2		
14 10	17.27	65.6	149.9	200.0	67.0	29.496	48.3
15 0	16.30	64.9	149.8	200.1	66.5	29.465	48.1
16 0	16.20	63.6	150.5	197.5	64.5	29.472	46.2
17 0	15.22	62.5	150.8	197.7	63.8	29.440	45.8
18 0	15.07	59.5	150.9	200.1	65.2	29.445	44.5
19 0	14.35	59.5	149.5	201.0	67.0	29.416	46.0
20 0	14.22	68.5	150.4	197.5	64.3	29.428	47.0
21 0	14.36	68.5	151.3	198.9	63.5	29.341	46.0
22 0	14.25	68.5	149.0	199.0	64.0	29.468	45.5
23 0	14.06	57.0	151.0	200.0	66.0	29.462	45.0
Oct. 12.							
24 0	14.28	58.4	151.0	200.7	65.7	29.514	46.0
1 0	14.34	58.8	157.0	200.0	65.0	29.510	50.0
1 50	14.07	58.5	159.5	201.0	64.8	29.509	57.8
2 0	14.05	59.0	160.0	201.2	64.8		
2 10	14.05	59.4	160.0	201.0	64.8	29.543	58.6
3 0	14.31	60.0	161.5	203.5	67.0	29.500	59.5
4 0	15.32	61.1	150.8	206.0	71.3	29.503	60.7
5 0	17.03	63.2	157.2	209.7	74.8	29.525	61.5
6 0	17.30	64.8	154.0	210.5	75.0	29.532	62.8
7 0	17.40	65.8	152.0	208.4	72.5	29.549	61.5
8 0	18.48	66.3	151.3	206.1	72.2	29.532	61.1
9 0	17.27	67.0	145.3	206.2	69.5	29.599	65.0
10 0	16.11	64.0	153.5	201.6	67.5	29.606	59.0
12 0	16.32	61.3	155.5	197.8	63.3	29.717	53.1
13 0	17.44	65.5	156.5	197.0	61.3	29.716	48.8
13 50	15.37	60.5	155.7	197.4	60.8	29.733	49.1
14 0	15.13	60.5	156.1	197.2	60.4		
14 10	15.42	60.5	155.5	196.5	60.0	29.780	48.5
15 0	15.15	59.4	157.5	199.6	61.0	29.802	49.0
16 0	14.28	58.0	156.8	201.3	63.5	29.794	47.8
17 0	14.32	57.8	160.0	203.0	65.9	29.835	46.0
18 0	15.45	56.3	152.5	201.3	65.2	29.860	45.0
19 0	15.44	55.8	156.8	201.0	64.5	29.856	44.0
20 0	13.33	55.0	155.6	198.9	64.0	29.895	42.0
21 0	13.24	53.5	157.6	196.2	61.8	29.891	41.0
22 0	12.25	52.5	157.5	195.5	61.0	29.921	41.2
23 0	12.49	51.7	158.5	196.1	60.9	29.915	39.4
Oct. 13.							
24 0	12.35	50.5	160.5	196.8	61.5	29.935	38.2
1 0	12.38	51.6	157.5	198.2	59.4	29.901	42.3

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
1 50	+12.35	50.6	153 5	197.8	59.3	29.943	44.4
2 0	12.45	50.9	154.4	196 7	59 6		
2 10	12.45	51.1	155.5	196 1	59 6	29.952	45.3
3 0	12.33	52.5	158.0	203.0	62.1	29.973	48.2
4 0	14 47	54.4	154.9	208 5	66.4	29.961	51 0
5 0	14.18	56 8	147.0	211.0	70.8	29.839	55.2
6 0	15.18	59.5	148.2	211.3	71.6	29.930	57.0
7 0	15.25	61 8	147.0	209.5	71.1	29.949	59.1
8 0	15.23	64 0	147.0	210.2	71 0	29.893	59.3
9 0	17.35	65 5	140.5	208 2	70 5	29.941	59 5
10 0	17.24	65.0	147.5	206.4	57.6	29 968	57.8
12 0	15.04	61.6	152 8	188.0	63 5	29 905	47.3
13 50	15.34	58 5	153.2	196 8	59.3	29.963	42.1
14 0	12.35	59.0	153.8	195 8	59.2		
14 10	14.35	60.4	154.0	196 6	59.1	29 959	41 5
15 0	14.00	57 4	153.9	199.5	59.6	29.989	41.0
16 0	14.05	57.7	165.0	202 4	59 8	29 988	37.2
17 0	15.40	55.0	160 7	210.5	59.3	29 977	36 0
18 0	11 05	51.0	156.0	201 4	58.0	29 995	34.2
19 0	11.03	50.0	151.0	198.5	58 7	29.997	33 0
20 0	11.04	50.0	150.6	194 0	57.5	29.992	32 3
21 0	11.36	48.2	153.0	194.0	54 5	30.005	31.5
22 0	10.14	47.0	152.5	192.6	52.5	30.008	30 5
23 0	15.42	46.0	156.4	194.1	51.9	29.978	30.2
Oct. 14							
24 0	9.15	46.0	155.0	195.5	54.0	29.983	29.5
1 0	15 32	46.3	153 0	197.5	54 0	29.994	33 0
1 50	9 43	44.0	150.5	190.7	54 0	30.357	35.0
2 0	8 35	44.0	150.6	190 8	54.0		
2 10	9 37	44.0	160.2	190.7	53 5	30.377	37 0
3 0	10 04	46.5	158.9	201.5	57.2	30 071	45.8
4 0	7.30	50.0	154 0	210.0	63.0	29.960	55.0
6 0	14.35	55 5	158.0	210.9	67.0	29.922	60.0
7 0	14.06	56.9	152.0	207.9	67.1	29.859	61.1
8 0	15.04	60 0	151.0	205 0	67.6	29 805	62.5
9 0	15.48	62.5	150 0	202 7	66.0	29 827	60.5
12 0	15.22	61 0	148 0	200.0	60.5	29 829	51.0
13 0	14.48	61 3	150.6	199.0	60.3	29 839	49.2
13 50	15.45	58.5	149 0	198 5	59.5	29.865	47.8
14 0	18.12	58.5	150.0	199.5	59.7		
14 10	15.25	58.5	150 0	198 0	59 5	29 861	48.0
15 0	14.24	58.5	150.0	200.0	60 0	29.730	49.0
16 0	15.26	58.5	156.0	200.0	61.5	29.638	51.5
17 0	15.24	58.5	156 0	201.0	62 5	29.632	52.0
18 0	14.24	58.5	153 0	201.0	64.5	29.635	53 4
19 0	15.26	58.0	152.5	203.0	64.0	29 436	51.5
20 0	15.26	58 5	149 5	192.0	63.5	29.548	53.5
21 0	15 46	59 0	150.0	202.0	63.0	29.508	54.0
22 0	13.37	57.5	153.0	201.2	64.4	29 524	55.5
23 0	14.30	58.4	154.0	201.5	65.0	29.405	55.6
Oct. 15.							
24 0	15.38	58.5	153.0	202.0	65.0	29.506	58.3
Oct. 17.							
2 0	13.45	53.0	153 0	196.0	52.0	29.579	52.0
3 0	14.35	55 0	154.0	198.0	58 7	29.913	56.0
4 0	14 42	57 5	150.0	203.3	64.0	29.919	57.5
6 0	15.14	60.5	148.2	210.8	67.5	29.919	60.0
7 0	15.21	63.0	146.0	206.3	66.0	29.929	60.0
8 0	15.01	62.6	146.0	203.6	65.5	29 919	60.5
9 0	13.41	62.5	152 3	205.7	64.3	29.962	59.4
11 0	13 44	59.5	150.5	200.7	61.2	30.014	49.2
12 0	11.49	59.0	153.5	199.1	60.5	30.032	47.8
13 0	11.35	55.0	156.0	199.5	55.0	30.102	43.5
Oct. 18.							
h. m.							
1 0	+6.32	39.5	156.6	186.9	40.5	30.060	38.3
3 0	9.13	44 0	148 0	197.3	45.5	30 156	50.5
4 0	vibrating	47.0	150.5	199.0	49 0	29 969	54.0
11 0	15 35	61 0	147.5	203.8	62.3	29 642	61.0
12 0	14 46	61.0	148.2	204.6	62 0	29 620	59 0
13 0	12.25	61.0	157.0	207.0	61.0	29.620	58.5
Oct. 19.							
1 0	13.33	54 5		198 4	53.0	29.712	44.1
3 0	13.24	52.5	155.4	198.9	51.0	29.764	44.0
4 0	13 28	53.0	151.7	201 7	52.0	29 767	46.2
6 0	13 04	56.0	147.0	202 7	61.0	29 667	56.5
7 0	14 27	57.5	148.5	200.6	61.5	29.778	50.0
	Term	day	omit	ted.			
Oct. 20.							
11 0	11.23	51.0	153.0	200.0	62.0	29.997	42.4
Oct. 21							
7 0	11 31	48 5	148.0	195.8	55.5	30.045	45.0
9 0	11.48	52.5	150 0	196 2	56.2	30.028	45.5
11 0	11.27	51.0	149.0	196 4	53 3	30.034	39.6
13 0	9.18	47.0	153 0	195.0	46.0	30.104	38.0
Oct. 24.							
1 0	6.23	37.6	146 9	188.7	37.2	30 020	35.9
1 50	7.13	40.0	152 3	191.2	37.5	30 036	41.5
2 0	7.23	40.3	151.5	192 5	37.5	30 016	42.2
2 10	7.36	40.5	151.8	193.5	37.6	30 009	43.0
4 0	10.17	45.0	152.1	196 9	46.0	30.005	55.0
6 0	11.25	52.5	149.5	200.5	53.4	29 983	63·0
7 50	14.02	54.5	150.5	199.0	57 8	29.907	63.0
8 0	15.19	54.3	151.0	199.0	58.4		
8 10	14.45	54.2	151.0	198.1	58.3	29 944	62.9
10 0	15.44	59.6	142 9	198.0	59.4	29 948	57.0
12 0	14 45	57.5	147.0	198.9	57.5	29 903	50 0
13 50	14.06	56.3	147.0	198 1	57 0	29.935	48.6
14 0	14.06	56.2	147.2	198.1	57.0		
14 10	14.12	56.3	147·2	198 1	57.5	29 926	48.5
15 0	13.16	55.8	147 0	198.6	59.5	29.926	48.4
16 0	14.32	55 5	150.0	201.1	62 0	29 915	48.5
17 0	13 28	55.2	144.0	202 0	63 5	29.899	49.8
18 0	13 33	55.5	146.0	203.2	64.2	29 840	50.0
19 0	13 33	55.5	143 8	203.4	65.0	29.754	51.0
20 0	14.02	56.5	151 0	202.0	65 0	29.785	51.0
21 0	14.02	56 5	148.0	203.0	66.0	29.760	50.0
22 0	14 02	56.0	157.0	202.5	66.0	29.776	52.0
23 0	13.37	56.5	158 0	202.8	66.0	29.698	52.0
Oct. 25.							
24 0	14.22	56.5	158.5	203.0	66.0	29.694	52.0
1 50	14.03	56.5	152.0	204.5	63 0	29.822	57.5
2 0	14.43	57.0	152.0	204.5	63.4		
2 10	14.44	57.0	151 0	205.0	63.2	29.801	59.0
4 0	16.09	60.0				29.796	66.0
4 30	16.30	61.5	149.1	210.0	64.1	29.734	66.8
6 0	18.30	65 5	146.7	210.0	64.4	29.602	68.4
7 50	17.15	65.7	147.0	208 6	66.0	29.634	62.9
8 0	16.25	65.6	146.0	207 9	66 0		
8 10	17.26	65.5	146.0	208.2	65.8	29.620	61.8
12 0	17.49	64 2	153.1	201.7	64.5	29.532	60.6
Oct. 26.							
1 50	14.18	52.5	154.6	194.0	50.5	29.747	45.0
2 0	14 17	52.5	156.2	193.4	50.5		
2 10	14.18	52.5	158.3	195.1	50 5	29.752	45 5
4 20	13.19	53.6	152.5	200.3	52.0	29.761	50.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.		°			°		°
7 50	+12.41	56.0	147 0	198 8	55.7	29.763	50.5
8 0	12.08	56.0	146.8	198.3	56.0		
8 10	13.11	56.0	146.5	198.9	55.9	29.765	51.8
10 0	10.38	54.0	149.6	199.8	55.0	29.819	47.6
12 0	11.15	54 6	153.2	203.3	56.1	29.859	41.1
13 50	11.40	51.7	156 0	202 8	60.2	29.859	37.0
14 0	11.20	51 6	155.0	202 9	60.3		
14 10	11.22	51.5	155 6	201 8	60.4	29.861	36.5
15 0	12.21	51.3	154.7	201.8	60.0	29.852	35.5
16 0	11.42	50.5	154 0	201.9	60.0	29.884	34 5
17 0	11.24	49.0	154.9	203.0	61.0	29.902	33.5
18 0	11.01	48.2	152.4	198 8		29.870	32.8
19 0	10.35	47.4	148 6	198.1	59.9	29.862	32.1
19 50	9.35	45.5	149 9	200.6	58.9	29.897	30.5
20 0	9.36	45 5	149 9	200.0	58.9		
20 10	8 11	45.5	149.7	200.1	58 8	29.883	30 2
21 0	8.21	45.1	149.7	201.2	58.4	29.933	29.9
22 0	10.11	49 5	151.0	199 2	59.6	29.915	32.0
23 0	8.27	43.0	142.4	202.8	59.4	29.912	27.0
Oct. 27.							
24 0	8.14	42.3	143 7	197 8	58 6	29.943	28.0
1 50	8.09	41.2	154.0	199 2	55.0	29.999	35.6
2 0	8.24	41.3	153.9	199.4	55.0		
2 10	8 30	41 5	153 7	200 6	55.1	29.979	37.0
4 0	10.21	42.0	146.0	197 0	61.0	30.020	45.4
6 0	13.29	54.0	148.5	205.8	66.0	29.974	50.7
8 0	14.30	56 5	145.5	200 3	64.2		51.0
8 10	14.31	56 7	145.0	200 6	64.0	30.185	50.8
10 0	13.19	46.5	149.9	196.7	60.0	30.091	47.2
13 50	11.28	51 0	156.4	191 4	49.5	30.182	37.6
14 0	12.27	51.0	155.5	193.1	49.0		
14 10	11.32	50.5	155.5	193.9	49.0	30.191	37.0
Oct. 28.							
6 0	11.15	48.0					50 7
10 0	12.00	52 5	153.3	196 0	55 3	30.309	43.5
12 0	11.33	50.0	159.0	192 4	51.0	30.298	39.0
14 0	9.43	47.0	162.5	195.0	46.0	30.317	34 0
15 0	9.43	47.5	151.5	194.6	44.5	30.330	34.0
16 0	9.46	45.0	148.2	186.7	43.0	30 321	32.0
17 0	9.31	48.0	154.5	189.1	41.5	30.273	31.5
Oct. 31							
1 50	5 51	33 5	158.0	185.0	31.3	30.426	29.4
2 0	4.31	33.5	158.0	184.5	31.3		
2 10	4.33	33 7	159.0	186 0	31.5	30.419	31.2
4 0	7.26	38.0		194.5	40.7	30.290	40.0
6 0	8.44	42.5	147.5	197.0	46.5	30.315	46.0
7 50	10 18	46.0	148.0	195.5	49.0	30.250	46.0
8 0	11.02	46.5	148.0	196.0	49.0		
8 10	10.36	47.0	149.0	195.2	49.0	30.249	46.0
10 0	10.22	48 0	152.0	193.0	48.6	30.264	42 5
12 0	10.45	45.5	148.2	199.0	44.9	30 296	36.4
13 50	8 47	44.5	148.3	189.0	41.7	30.214	33.4
14 0	9.04	44.3	149.4	188.4	41.8		
14 10	8.46	44.3	149.3	190.0	41.6	30.236	33.1
15 0	9.40	43 6	151.0	190.0	40.9	30.244	32.3
16 0	9.22	44.0	151.0	190.5	43.0	30.222	32.2
17 0	9.47	44.9	147.8	192.3	45.2	30.225	31.8
18 0	10.28	47.5	147.7	193.5	48.2	30.203	30.6
19 0	10 06	45.7	157.3	192.3	46.9	30.147	31 5
20 0	9.15	43.7	156.0	194.0	48.5	30.166	30.9
21 0	9.09	43.3	150.0	195.0	50.6	30.169	30.0
22 0	8.23	42.8	150.5	195.2	52.0	30.160	30.0
23 0	8.11	42.5	150.0	197.0	54.6	30.119	30.6

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Nov. 1.							
h. m.							
24 0	+8 11	42.0°	149.0	198.0	56.2°	30.105	30.8°
1 50	10.33	46.0	146.5	198.0	53.4	30.248	38.3
2 0	10.39	46.1	151.5	198.7	53.5		
2 10	10.03	46.4	152.0	200.0	53.3	30.056	40.1
4 0	11.08	49.0	151.0	201.0	56.5	30.029	46.8
6 0	13.26	53.5	149.0	202 6	63.0	30.035	55.0
7 50	15.35	57.5	135.5	200.2	62.5	29.833	58.5
8 0	15.35	57.5	135.4	200.3			58.0
8 10	15.35	57.5	140.1	200.2	62.5	29.844	57.5
12 0	12.44	56.3	152.1	197.5	67.6	29.935	49.4
15 0	13 47	54.0	155 0	195.5	53.7	30.062	43.7
16 0	14 38	53.5	152.0	197.5	54.8	30.039	42.0
17 0	13.27	52.0	147.0	199.0	54.3	30.110	39.5
18 0	13.47	51.5	147.0	200.0	56.0	30.079	40.0
19 0	13.32	50.6	146 0	201.0	55.1	30.069	41.5
20 0	13.07	50.0	135 0	199.0	54.0	30.111	42.0
21 0	14 49	50.5	141.0	198 5	53.5	30.104	42.0
22 0	13.48	49.7	148.0	200.0	55 5	30.064	42 0
23 0	12.22	49.3	148.0	200.4	58.0	30.117	42.0
Nov. 2.							
24 0	12 19	49.0	150.0	197.0	58.8	30.031	41.5
1 50	11.45	50.0	149.2	197.4	56.1	30.161	40.0
2 0	12.34	50 0	148.5	198.1	55.5		
2 10	12.35	50.0	148.5	198.0	55 5	30.164	40.5
4 0	12.23	51.0		206.9	67.2	30.031	45.1
6 0	15.47	56 6	144.0	206.0	70.8	30.028	49.0
7 50	16.14	60.4	147 0	202 1	68.6	30.065	52.4
8 0	16 10	60.6	147.5	203.8	68.4		
8 10	16.10	60.6	148.0	203 8	68.3	30.072	52.2
10 0	14.16	60.0	145.5	207.9	64.5	30.099	48.2
11 0	13.18	56.5	142.0	203.9	60 5	30.126	44.0
12 0	13.45	55.1	145 2	203.5	58.2	30 017	41.8
13 50	12.28	51.6	146.5		52.5	30.176	37.0
14 0	12 32	51.5	147.4			30.187	32.0
14 10	12.43	51 5	147.1				
15 0	11.25	50.0	147.5	198.5	49.0	30.177	35.0
16 0	10.49	48.0	145.7	197.5	48 0	30.191	32.0
17 0	10 00	47.0	145.0	198.5	50.0	30 288	31.0
18 0	9.00	45.0	145.0	201.0	54 0	30.235	28.0
19 0	11.25	44 0	143.0	202.0	54.6	30.236	27.7
20 0	10 06	43.5	139.0	199.0	55.7	30.251	25.8
21 0	9.15	43.2	146.0	199.5	54.0	30.269	25 0
22 0	9.26	41.5	146.0	199.0	53.5	30.269	23.4
23 0	9.12	40.0	141.5	198.0	54.0	30.267	24.0
Nov. 3.							
24 0	7.00	38 6	140.0	198.0	54.5	30.343	23.7
1 50	7.38	37.6	143.4		52.0	30.303	28.5
2 0	8.03	37.4					
2 10	7.40	37.6	145.1			30.313	29.5
3 15	8.44	39.5	148.0	204.5	60.0	30.313	35 5
4 0	8.21	41.0	146.0	206.0	65.5	30.311	38.0
5 0	9.02	42.5	144.0	207.5	68 5	30.288	41.2
6 0	10.03	45.0	143.0	209.0	71.0	30.258	44.0
7 50	12 35	51.4	139.0	200.0	65.5	30.178	44.8
8 0	12.39	51.4	139.0				
8 10	12.47	51.5	140.0	198.9	65 5	30.101	45 2
13 50	9.49	45.4	144.2	192.9	46 2	30.180	33.8
14 0	9.04	45.2	144.0	193.0	46.2		
14 10	9.29	45.2	144.0	192.6	46.7	30.259	33.3
15 0	9.11	44.4	144.8	192 8	45 2	30.209	31.5
16 0	9.15	43.8	152.6	194.6	46.5	30.166	30.8
17 0	8.26	43.2	151.2	195.3	49.2	30.222	27.8

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
18 0	+8.11	43.5°	150.1	195.9	51.2°	30.222	27.2°
19 0	7.25	40.9	152.2	197.0	53.8	30.174	27.2
20 0	7.02	39.9	153.5	197.4	53.9	30.163	26.9
21 0	6.27	39.1	154.5	198.2	55.0	30.128	25.1
22 0	6.26	38.7	146 2	198.8	54.8	30.130	26.2
23 0	6.22	38.3	146.7	199.2	54.6	30.212	23 8
Nov. 4.							
24 0	6.11	39.9	146.1	200.2	54.2	30.200	22.9
1 50	6.39	37.0	150.5	190.9	53.2	29.915	30.0
2 0	6.38		150.6	190.9	53.5		
2 10	6.38	37.5	150.6	190.9	53.5	29 898	31.5
3 0	9.45	43.0	150.1	200.7	64.3	30.160	39.5
7 50	12.36	53.5	147.9	203.4	62.6	30.065	49.3
8 0	12.21	53.6	147.6	203 6	62.5		
8 10	13.00	53.7	147.6	202.3	62.3	30.092	49.1
10 0	12.10	52.2	144.1	195 5	55.9	30.105	30.0
12 0	9.45	44.0	150.3	201.6	65.4	30.151	39.6
13 50	10.15	48.0	144.2	193.1	49.0	30.073	37.5
14 0	10.17	47.8	144.4	193.2	48.5		
14 10	10.44	47.0	144.6	194.6	48.0	30.060	36.5
15 0	9.34	46.2	144.5	193.5	46.7	30.005	35.4
16 0	9.11	44.5	144 0	191.5	46.2	29.975	33.5
17 0	9.11	44.0	146.0	195.0	48.5	30.090	32 0
18 0	9.22	42.6	145.0	196.0	59.6	30.083	31.1
19 0	9.22	42.4	144.0	197.0	49.8	30.101	30.5
21 0	7.17	40 2	145.0	197.0	49.7	30.076	29.2
22 0	7.25	39.3	143.0	195.0	48.3	30.073	29.0
23 0	6.32	38.6	146.0	195.0	47.7	30.121	30.6
Nov. 5.							
24 0	6.16	38 6	147.0	194.0	47.2	30.102	31.5
1 50	6.03	38.5	156.2	196.0	46.1	30.094	37.9
2 0	6.16	38 5	157.5	196.5	45.9	30.092	38.5
2 10	6.18	38.7	157.0	197.0	46.0	30.092	38.9
Nov. 7.							
1 50	10.48	48.0	157.6	194.9	45.4	29.753	43.7
2 0	10.48	48.0	157.3	195.6	45.5	29.774	44.8
2 10	10.49	47.2	158.9	194.7	45.4		
4 0	12.04		151.5	200.5	51.0	29.759	53.0
5 0	13.05	53.0	149.0	200.5	58.5	29.625	56.0
7 0			145.0	200.0	58.0		
10 0	12 25	54.0	150.0	196.0	55.2	29.783	51.0
12 0	12.27	52 6	152.7	196.2	53.5	29.782	47.0
15 50	12.05	50.0	152.8	194.5	51.5	29.742	46.0
16 0	12.00	49.5	152.6	194.2	51.0	29.744	45 5
16 10	11.04	49.0	153.0	194.0	50.0	29.735	44.5
Nov. 8.							
24 0	10.30	47.0	153.6	191.0	47.0	29.651	43 0
1 0	11.00	48.5	154.5	193 5	47.0	29.603	45.0
1 50	11.37	48.4	156.1	195.5	47.0	29.574	44.0
2 0	11.37	48.4	156.0	195.7	47.0		
2 10	11.31	48.2	156.0	195.6	47.0	29.573	44.1
3 0	11.00	48.4	155.5	196.0	47.0	29.547	44.0
5 0	11.03	48.0	149.0	197.0	48.0	29.446	45.0
6 0	9.28	49.0	147.0	195.8	47.0	29.416	44.5
7 0	10.06	51.0	147.1	197.8	47.0	29.387	44.5
8 0	10.13	48.3	148.1	191.6	47.0	29.334	44.0
9 0	10.06	48.0	149.2	192.2	47.0	29.316	42.5
12 0	12.03	46.6	151.3	189.8	45.0	29.199	40.0
15 0	9.32	45.0	152.5	187.0	43.0	29.442	34.0
16 0	9.33	44.5	145.0	189.0	41.0	29.488	34.0
17 0	9.12	43.5	145.0	189.0	42.0	29.549	32.0
18 0	9.13	44.0	146.0	191.0	44.0	29.518	31.0
19 0	9.40	44.0	147.0	192.5	49.0	29.539	34.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
20 0	+9.48	44.0°	152.0	195.0	53.0°	29.572	35.0°
Nov. 9.							
1 0	8.02	42.0	156.0	192.0	49.0	29.685	36.0
1 50	8.44	42.3	158.0	192.2	48.0	29.692	37.0
2 0	8.43	42.4	155.5	192 2	47.8	29.696	
2 10	8.40	42.4	154.9	192.2	47.7	29.689	37.3
6 0	10.25	43.0	145.5	193.7	44.6	29.672	41.0
7 0	8.29	43.5	147.0	197.0	44.5	29.665	41.0
8 0			149.0	190.5	44.6	29.681	43.0
12 0	9.40	45.0	147.5	195.0	44.3	29.675	44.0
Nov. 10.							
0 50	10.29	43.5	134.4	197.9	43.0	29.674	34.5
1 0	10.30	43.5	134.5	193.0	43.0	29.667	34.5
1 10	10.33	43.5	135.7	189 9	43.0	29.672	35.0
1 50	10.24	43.0	144.1	189 4	42.0	29.673	
2 0	10.22	43.0	145.9	191.2	42.0	29.672	36.0
2 10	10.18	43.0	148.4	192.6	42.0	29.674	
6 0			139.6	211.0	65.0	29.635	48.2
7 0	12.15	55.0	144.0	207.2	62.0	29.647	48.0
12 0	10.32	47.5	149.7	199.7	46.0	29.698	36.0
12 50	9.09	47.5	155.7	201.7	47.0	29.794	34.0
13 0	9.07	47.5	155.0	202.6	47.5	29.794	34.0
13 10	10.28	47.5	155.2	203.8	47.5	29.786	34.0
13 30	10.35	47.3	158.0	204.0	49.5	29.746	33.5
14 0	9.46	47.0	157.0	205.0	53.0	29.771	33.5
15 0	7.23	44.5	158.5	202.5	54.0	29.801	32.0
Nov. 11.							
1 0	6.01	38.5	148.6	191.7	39.0	29.795	35.0
1 30	6.02	38.0	146.6	195 4	39 0	29.793	37.5
1 50	6.03	39.0	147.0	196.5	41.0	29.771	38.0
2 0	6.45	39.0	147.3	195.1	41.0	29.754	38.0
2 10	6.44	39.0	147.2	195.3	41.0	29 758	38.5
7 0	9.42	46.0	146 2	200.7	57.0	29 796	46.0
9 0	8.19	46.0	148.6		55.0	29.881	43.0
12 0	9.33	45.0	144.2	195.9	52.0	30.277	36.5
13 0	9.07	45.0	146.0	198.0	52 0	30.146	35 5
14 0	9.03	45.0	141.0	199.5	56.0	30.045	35.0
15 0	8.13	44.5	141.2	201.2	59.0	30.020	33.4
Nov. 12							
1 0	4.25	36.5	145.0	198.5	54.5	30.022	26 5
1-50	5.06	37.0	143.0	201.2	55.0	30.107	30.0
2 0	5.07	37.0	142 5	201.2	55.0	30.110	34.0
2 10	5.16	37.0	141.5	207 5	55.5	30.119	34.5
Nov. 14.							
2 0	6.21	39 0	141.5	189.9	37.5	30.017	36.4
4 0	7.40	40.1	148.7	192.3	39.0	29 989	40.5
7 50	8.46	43.0	148.3	190 8	43.0	29.841	43.8
8 0	8.44	43.1	148.5	191.0	43.0		
8 10	8.42	43.3	149.0	190.5	43.0	29.833	43.2
10 0	8.05	43 4	145.2	190.5	42.6	29.806	40.9
15 0	8.33	44.0	145.1	189.2		29.736	42 5
16 0	8.41	44 0	145.2	189.8	43.0	29.703	41.0
17 0	8.40	44.0	146.2	192 1	47.5	29.658	40.2
18 0	9.04	45.0	146.2	196 0	55.0	29.649	41.2
19 0	9.20	46.0	146.0	199.2	58.0	29.671	41.0
20 0	9.03	45.5	146 5	198.3	56.0	29.683	40.0
21 0	9.03	45.5	146.8	199.7	56 0	29.719	39.0
22 0	8.42	45.0	146.5	200.7	59.0	29.741	38.0
Nov. 15.							
5 0	10.04			207.0	70.0	29.751	46.0
7 50	11.25	52.4	149.4	201.0	61.6	29.772	45.3
8 0	11.30	52 5	148.6	200.1	61.0		
8 10	11.22	52.6	150.1	199.3	60.0	29 800	44.6

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
10 15	+11.15	41°.2	150.8	196.2	55°.3	29.895	40°.1
Nov. 16.							
4 0	5.49	36.5			36.5	28.985	37.0
8 5	6.36	39.6	144.0		40.0	29.819	38.5
13 4	2.35	30.7	152.2	186.0	29.0	29.954	27.8
14 15	2.32	30 8	154.3	186.6	29.4	29.955	28.3
Nov. 18.							
17 34	12.18	54.0	145.0	202.0	57.3	29.018	54.5
Nov. 19							
2 0	3.35	30.0	147.5	183.5	25.5	29.521	25.0
Nov. 21.							
2 50	2 32	28.4	152.5	182.0	24.8	29.949	24.8
3 0	2 33	28.5	154.0	182.3	24.8		
3 10	2.33	28.5	153.0	183.2	25.0	30.061	25 8
4 0	4.40	31.2	148.5	195.8	45.2	30.122	31 0
7 50	8.42	42.8	166.7	196.0	47.5	30.048	37 5
8 0	8.42	42.8	167.0	196.0	47 5	29.981	36.5
8 10	9.04	43.0	167.0	196.0	47.5		
10 0	6.44	41 6	146.0	197.0	44.2	30.102	33.1
12 0	1.39	39.2	150.2	200.4	39.2	30.509	29.7
14 0	2.13	37.0	148.0	203.4		30.112	25.0
14 30	3.05	37.0	160.7	205 9		30.210	24.0
15 0	5.20	35.5	165 2	205 0	31.4	30.192	24.6
16 0	13.28	34.6	164.5	191.9	36.0	30 161	24.5
17 0	8.15	33.7	151.0	202.5	43.0	30.163	22.6
18 0	15.37	33.5	156.7	202.0	47.6	30.141	22.5
19 0	10.20	33 5	155.0	196.0	49.5	30.159	20.3
20 0	15.47	31 7	122.4	227.7	50.0	30.149	19.8
21 0	11.26	31.2	141.2	208.2	50.3	30.146	18.8
22 0	6.43	30.6	132.4	202.5	51.0	30.142	17.9
23 0	4.24	30.5	144.2	199.2	50.3	30.157	17.0
Nov. 22.							
24 0	4.25	30.3	146.5	198 4	50.0	30.167	18.2
1 50	6.03	34.0	137.9	201.5	44.3	30.174	20.0
2 0	5.35	34.0	136.5	201.7			
2 10	5.26	34.0	136.2	201.9		30.158	22.0
4 0	4.39	38.5	140.0	207.0	53.9	30.032	29.0
6 0	6 47	37.0	146 0	201.5	55.0	30.149	33.0
8 0	9.04	43.5	147.5	200.5	51.2	30.126	36.0
10 0	8.03	43 3	150.5	196 2	46.5	30.097	31.2
15 0	4.34	34.1	157.4	192.7	33.0	30.105	20.6
16 0	4.17	33.6	160.6	194.0	33 0	30.152	19.2
17 0	7.14	32.5	169.0	181.0	37.7	30.143	18 6
18 0	6.27		159.0	190.0	41.6	30.130	17.8
19 0	5.05	31.4	155.0	197.2	46.0	30.143	17.6
20 0	4.14	31.2	152.0	202 0	50.0	30.068	18.0
21 0	4.40	31.2	144.1	200.0	50.6	30.131	17.2
22 0	5.56	31.6	147.0	199.0	50.5	30.115	18.0
23 0	5.21	30.7	134.0	206 0	51.1	30.148	19.0
Nov. 23							
24 0	4.07	31.5	146.5	202.0	50.5	30.137	17.1
2 0	3.49	30.0	153.0	195.0	44.0	30.216	20.0
4 20	4.17	32.0	151.0	209.5	61.0	30.139	31.0
6 0	9.19	45.3	149.4	205.0	56.5	30.068	39.5
10 0	9.36	44.0	141.0	197.6	51.8	30.060	36.0
13 50	6.34	40.0	158.0	196 2	43.5	30.113	29.0
14 0	6 29	39.5	157.5	195.7	42.0	30.034	28.0
14 10	6.26	39.5	155.9	196.3	42.0	30.028	28.0
15 0	5.37	39 5	155.0	197.0	41.0	30.026	28.0
16 0	6.09	39 5	152.0	198.0	44.0	30.007	28.0
17 0	6.02	38.5	151.7	200.5	51.0	30.010	27.0
18 0	5.43	38.0	151.0	203.0	54.5	29.962	27.0
19 0	5.41	37.5	151.0	203.7	55.0	29.866	28.0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
20 0	+5.27	37°.0	151.0	203.0	55°.0	29.913	29°.0
21 0	6.06	38.0	151.0	203 0	55.0	29.861	31.0
22 0	6.40	37.0	148.5	203.5	60.0	29.740	34.0
23 0	6.22	38.5	152.0	203.7	56.6	29.718	35.0
Nov. 24.							
24 0	7.08	39.4	153.2	203.0	59.5	29.711	39.5
Dec. 6.							
1 50	5.11	30.3	149.1	187.1	28.4	30.219	22.6
2 0	5.04	30.3	149.3	189.9	28.0		
2 10	5.04	30.3	150.5	188.9	29.3	30.215	22.6
3 0	4.44	29 6	150.9	190.8	31.0	30 217	23.2
4 0	4.10	30.3	150.7	194.9	38.8	32.500	24.3
5 0	3 30	32.8	147.0	203.2	50.0	31.346	25.0
6 0	10.04	33.0	146.5	202.7	55.0	30.174	25.0
8 0	5.39	35.5	147.0	201.8	48.0	30.192	26.0
9 0	6.06	35.6	148.2	200 6	46 0	30.271	23.5
12 12	4.00	31.0		190 5	37.0	30.286	19.0
16 0	3.00	27.0	138.0	200.0	42.0	30.292	16.5
17 0	3.00	24.0	139 0	198.0	43.0	30.245	16.0
18 0	2.40	27.0	139.6	197 5	42.5	30 250	16.0
19 0	2.38	27.5	140.5	202 3	50 0	30.248	17.4
20 0	vibrating		136 7	199.8	50.0	30.243	17.3
21 0	"		141.7	200 2	49 0	30.220	18.0
22 0	3.37	27.0	142.5	199.3	47.8	30.180	18.2
Dec. 7.							
24 0	3.00	27.0	140.8	195.7	45.0	30.127	20 0
1 50	4.14	27.4	145.1	197.8	43.0	30.098	22.3
2 0	4.14	27.4	143.6	197.0	43.8		
2 10	4.21	27.4	142.9	198.0	43.4	30.102	23.0
3 0	3.20	27.5	140.2	200 0	45.5	30.088	23.4
4 0	3.35	33.0	145.9	201.3	46.1	30.133	24.7
5 0	3.32	28 5	143.2	203.1	45 0	30.086	26.8
6 0	4.01	30.0	143.0	201.3	46.0	30.034	29.5
10 0	vibrating		148 0	205.0	49.5	30.053	28.0
11 0	5.02	34.5	147.2	203.8	47.0	29.966	26.3
Dec. 8.							
1 0	2.48	27.6				29.966	25.2
1 50	3.49	28 2		191 6	28 0	30.018	26.8
2 0	4.18	28.2	149.7	191 6	28.0		
2 10	4.13	28.3	150.7	191.7	28.6	30.015	27.7
5 0	4.13	30.0		190.3	30.0	29.985	31.7
6 0	4 20	31.0		195.4	31.0	29.900	32.0
6 45	4.31	31.7	145.0	194.3	32 5	29.887	32.0
7 0			145.0	194.9	32.5	29.887	32.0
8 0	3.42	31.5		198.0	31 0	29.916	30.2
9 0	3.48	32 0	145.0	194.0	31.0	29 913	28 2
12 0	4.00	32 0	148 0	191 0	31.0	29 882	25.0
15 0	4.31	31.5	151.2	190.0	30 0	29.780	30.5
16 0	5 00	33.0	145.0	192.0	32.0	29.593	30 5
17 0	5.03	32.0	148 0	190.0	36.0	29.567	31.5
18 0	6.01	33 0	151.0	196.0	40 0	29.523	32.3
19 0	6.05	34 0	150.0	198.0	44.0	29.497	32.0
20 0	6 03	35.0	150.0	199.1	43 0	29.528	32 5
21 0	6.31	35.5	150 0	200 0	46.0	29.581	32.5
22 0	7 00	36.0	149.1	202.2	52 0	29.565	33.8
23 0	7.16	36.5	149.8	203.9	56.0	29.564	34.0
Dec. 9.							
24 0	7.25	36.0	151.8	205.0	58.0	29.558	33 0
1 50	8 24	37.3		206.5	57.0	29.519	32.7
2 0	8 20	37.3		206.4	56 6		
2 10	8.19	37.6		206 3	56.6	29.524	32.6
3 0	7.13	37.0	153.0	204.0	54.2	29.580	25.0
8 15	4 20	34.0	138.7	205.0	41.0	29.562	26 0

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
9 0	+3.09	33.6	137.0	203.1	40.0	29.592	25.0
10 0	2.30	33.0	144.0	202.2	38.0	29 633	23.0
12 0	0.00	32.6	150.0	210.0	36.7	29.633	21.1
15 0	3.44	30.0	155.0	194.5	30.5	29.717	20.0
Dec. 10.							
1 0	1.40	26.4	152.5	189.0	25.5	30.103	22.7
Dec. 13.							
5 0	2.30	25.5	149.0	188.7	24.0	30.191	31.0
{ 5 50	5.35	14 0	150.0	180.3	10.5	29.148	10.0
{ 6 0	6.20	14.0	150 4	180.0	10 5		10 0
{ 6 10	7.25	14.5	150.8	180.2	11.0	29.196	10.0
7 0	—1.14	15.9	148.0	188.5	13.1	29.665	19.6
{ 7 50	+1.12	21.5	146.5	187.5	19.0	29.525	25.0
{ 8 0	1.18	22.5	146.5	187.7	19.5	29.530	25.0
{ 8 10	1.25	22.5	146.5	187.8	20.0	29.510	25.5
10 0	1.23	23.8	143.1	189.9	22.2	29.509	24.0
12 0	2.13	25.0	147.0	192.5	23.0	29.524	24.5
{ 13 50	2.17	25.5	144.0	192.5	24.0	29.524	23.0
{ 14 0	2 17	25.5	144.0	192 3	24.0		
{ 14 10	2.17	25.6	144.1	193 0	24.0	29.524	23.0
15 0	2.19	25.8	143.5	193.0	24.5	29.594	19.4
16 0	2.00	25.5	143.5	196.0	30 5	29.627	20.3
17 0	2.17	25.5	140.0	199.0	30.0	29.899	20.5
18 0	2.43	26.0	139.0	201.4	41.4	29.559	17.2
19 0	3.12	26.0	140.0	203.7	45.8	29.776	18 2
20 0	2.20	26.1	147.0	205.0	48.3	29.935	14.5
21 0	3.25	26.1	145.0	206.0	49.0	29.948	17.0
23 0	2.30	25.3	143.0	205.0	49.5	29.880	13.0
Dec. 20.							
24 0	1.43	25.3	140.0	205.0	19.0	30.077	11.0
{ 1 50	1.49	23.5	147.5	203.0	45.0	29.984	11.5
{ 2 0	1.35	23 6	147.0	203.0	45.0		
{ 2 10	1.11	23.7	147.0	203.0	45.0	29.986	12.0
4 0	2.42	24.0	152 0	206.0	47.0	30.001	19.0
{ 7 50	6.48	36.4	147.8	206.3	53.6	29.982	32.2
{ 8 0	7.02	36 6	148.0	206.4	53.5		
{ 8 10	7.46	37.4	148.2	205 8	53 2	30.010	32.1
10 0	7.29	35.8	150.0	204.2	47.6	30 040	27.4
{ 13 50	6.31	33.0	152.0	197.2	38.7	30.017	22.2
{ 14 0	6.09	33.4	153.0				
{ 14 10	7.05	33.5	153.1	195.9	39.9	30.026	
15 0	5.32	33.2	149.5	200.7	39.2	30.004	23.0
16 0	6.31	32.5	151.0	200.0	42.5	29.996	22.6

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
17 0	+6.25	32.5	150.0	204.3	46.3	29.968	22.4
18 0	6.23	32.3	150.0	206.0	50.5	30.010	21.0
19 0	6.18	32.2	149.0	205.5	52.7	29.961	22.0
20 0	6.01	31.5	150.0	206.5	53.3	29.968	18.4
21 0	5.45	31.5	149.6	206 4	53.3	29.946	22.0
22 0	6.49	31.5	150.0	206.0	52.8	29.957	22 7
23 0	6.01	31.6	150.9	206.0	53.0	29.941	25.0
Dec. 22.							
24 0	5.34	32.2	152.0	207.0	54.5	29.947	21.3
{ 1 50	5.17	32.6	154.1	205.0	51 3	29.854	30.0
{ 2 0	6 00	32.7	154.0	203.5	50.9		
{ 2 10	6.01	32.8	154.0	202 8	50.8	29.845	30.3
4 0	6.22	33.7	149.8	208.5	48.8	29.874	31.5
6 0	8.08	38.0	144.0	206.0	47.5	29.692	31.8
{ 7 50	8.34	36.9	146 7	200.0	46.6	29.595	31.8
{ 8 0	7.16	36.8	147.1	199 8	45.8		
{ 8 10	8.00	36.8	147.3	199.7	45.7	29.599	31.8
12 0	9.47	41.5	155.5	202 5	51.0	29.403	33.0
13 0	9.20	41.0	156.0	202.1	49 0	29.452	31.0
{ 13 50	9.01	40.5	155.8	203 4	47.0	29.472	27.5
{ 14 0	8.35	40.5	155.4	204.0	47.0		
{ 14 10	8.49	40 0	154.0	201.7	46 5	29.509	28.6
15 0	9.45	39.5	154.0	201.2	44.3	29.525	26.2
16 0	9.10	38.5	150.6	207.7	43 2	29.493	24.0
17 0	9.00	37.1	157.0	207.0	41.3	29.538	24.0
18 0	8.27	35 5	153.8	207.0	48.0	29.563	22.1
19 0	7.31	34.7	151 8	207.0	49.0	29.574	20.5
20 0	6.10	34.1	153.0	207.0	48.6	29.596	19.7
21 0	6.08	33.0	153 5	205.4	42.1	29.592	20.8
22 0	6.21	31.6	154.0	200.9	45.1	29.596	20.9
23 0	6.17	30.5	154.5	198.2	43.0	29.608	19.6
Dec. 23.							
24 0	4.41	28.5	154.0	199.0	41.9	29.704	16.8
{ 1 50	4.08	26 5	153.7	197 5	37.5	29.733	14.0
{ 2 0	4.02	26.3	155 5	197.5	37.0	29.720	14.5
{ 2 10	3.25	26.2	155 5	196.7	36.5	29.743	14.3
4 0	2.47	26 2	153 9	204.5	42.1	29.769	19.1
6 0	4.13	28.5	148 4	202.7	45.0	29.770	18.0
{ 7 50	5.35	32 5	148 0	200 9	48.5	29.790	21.2
{ 8 0	5.40	32.8	148.5	200.4	48 0		
{ 8 10	6.19	33.2	149.0	197.7	47.5	29 801	20.5
12 0	3.43	27.5	152.7	193.5	31.0	29.966	14.8

The observations in March, 1842, *which were accidentally omitted in their proper place, are introduced here.*

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Mar. 1.							
h. m.							
1 50	+4.49	35.0	143.8	158.1	32.5	30.122	34.0
2 0	5.25	35.4	140 6	158.6	33.2	30.104	
2 10	5.06	35.5	141.0	158.5	34.2	30.095	35.0
Mar. 2.							
1 50	6.47	40.6	136 1	158.4	41 0	29.640	39.2
2 0	7.04	40.8	136.8	158.3	41.0	29.638	
2 10	7.19	40.9	135.6	158 4	41.0	29.624	39.8
Mar. 3.							
1 50	9.12	46.4	142.7	158.1	45.2	29.569	44.8
2 0	9.19	46.4	143 0	158 3	45 2	29.554	45.0
2 10	9.20	46.5	142.5	158.2	45.2	29.538	46.4
Mar. 4.							
1 50	10.38	50.0	141.2	158.1	48.5	29.659	52.7
2 0	10.30	50.0	141.2	158.5	49.0	29 664	51.8
2 10	10.37	50.0	141.6	158 7	49.0	29.658	51.2
Mar. 7.							
1 50	4.46	36.8	142 5	158 8	33.5	29.854	34.0
2 0	4.39	36.8	142.1	158 9		29.839	
2 10	5.03	37.0	141 2	159.0	33.5	29.849	34.0
4 0	5 25	38.0	136.5	159 0	35.3	29 877	35.5
10 0	5.35	40.3	136.2	159.0	39.9	29 864	37 5
Mar. 8.							
1 52	4 08	33.6	143.0	159.1	31.0	30.180	30.2
2 0	4.01	33.8	140 6	159.1	31.1	30.196	
2 10	4.02	33.8	141.2	159.0	31.2	30.182	31.0
4 45			134 5	158 0	43.0	30.223	33.4
10 0	2 00	43 5	135 9	158.9	51.4	30.309	41 0
14 0	5.32	40 0	136 6	156.9	42 3	30.241	28.5
16 0	5.44	37.6	139.5	157.7	37 0	30.204	29.5
18 0	5.55	37.5	138 0	159.6	40 0	30.163	32.5
20 0	5.59	38.0	139 0	159.9	50.5	30.114	35.5
22 0	6.48	37.5	138.0	159.3	57.8	30.074	37.4
Mar. 9.							
24 0	6.00	38.5	141.0	159.0	58.0	30.049	38.0
1 50	6.14	39.7	142.7	159.0	56.8	29.914	38.1
2 0	6.27	39.7	141.8	159.0	62.0		
2 10	6.23	39.9	142.3	158 9	56.2	29.925	38.9
4 0	7 33	40.2	140 6	158.6	54.5	29.899	43.6
6 0	7.25	43.7	130 5	158.5	54.7	29.913	50.0
15 0	7.24	42.7	144.9	157.5	45.5	29.468	41.0
16 0	8.09	43.0	139 7	158.1	45.0	29.410	41.0
17 0	8 06	43.5	140.0	159.5	48.5	29.404	42.0
18 0	8 48	43.6	140.0	159.5	54 0	29.434	42.0
19 0	8 19	45 0	140 0	159.5	57.5	29.453	42.5
20 0	8.16	45.5	139 0	159.2	59.0	29.434	42.5
21 0	8 20	45 3	138 8	159.0	58.5	29.451	42 0
22 0	8.14	45.3	138 5	159.2	58.5	29.463	43 0
23 0	8.15	45.4	138.7	158.9	58.5	29.447	39.5
Mar. 10.							
24 0	7.49	45.3	139.5	159.0	58.7	29.463	39 2
1 0	7.33	45.0	141.5	159.0	58.4	29 466	42 0
1 50	8.08	44.2	142 5	160.2		29.432	42.0
2 0	8.11	44 5	142 3			29.449	
2 10	8.23	44.5	142.1	155.3		29.446	43.0
4 0	9.35	47.3	139.5	dist'rb'd		29.360	62.0
5 0	11.10	50.2	137.2	158.2		29.373	64.0
h. m.							
6 0	+11.37	52.7	133.8	158.5	70.0	29.393	64.5
10 0	13.03	56.7	136.2	158.0	68.5	29.511	57.2
12 0	11.48	54.7	138.4	156.9	63.5	29 642	49.0
13 0	12.50	54.5	139.0	156.9	60.0	29.676	47.0
14 0	10.30	53.5	139.5	157.9	59.5	29.687	45.0
15 0	11.24	53.0	139.7	158.5	59.1	29.684	45.0
16 0	11.15	53.0	137.5	158.9	60.2	29.705	43.2
17 0	11.01	52.3	138.1	158.1	60.6	29.636	42.7
18 0	11.03	52.6	138.0	159.1	60.5	29.626	41.5
19 0	12.27	53.3	138.4	158.2	60.0	29.617	41.0
20 0	11.00	51.3	138.5	157 9	58.8	29.618	40.6
21 0	10.23	50.0	138 7	158.0	57.2	29.623	40.2
22 0	9.37	48.5	138.7	157.8	56.3	29.626	38.8
23 0	9.45	48.5	140.8	158.1	55.2	29.654	38.2
Mar. 11.							
24 0	9.27	48.2	140.6	158.6	55 3	29.647	37.9
1 0	9.10	47.2	143.8	158.6	55 7	29.630	34.5
1 50			142.2	157.5	54.2	29.659	32.0
2 0		46.3	142.9	157.6	54 0	29.657	
2 10	8.41	46.2	142.9	157.5	53.8	29.635	32.3
3 0	9.46	45.8	143.3	157.2	51.5	29.605	32 0
4 0	8.41	45.0	139.8	157.1	50.0	29.592	32.0
5 0	8.41	45 0	140.0	156.8	47.5	29 576	34.0
7 0	8.22	44.5	131.8	156.8	46.8	29.516	34.1
8 0	7.47	43.4	132.0	156.8	44 8	29.542	33.0
9 0	7.27	42 7	133 8	152.4	44.2	29.548	32.0
10 0	7.10	42.5	135.0	158.9	45.5	29.585	31.2
11 0	6.26	41.8	137.0	158 9	50.6	29.612	31.0
12 0	6.37	41.6	137.5	158 0	53.0	29.706	28.0
13 0	6 43	42.0	137.0	158.5	51.0	29.765	26.0
14 0	6.38	40.0	137.8	158.5	50 0	29.780	23.0
15 0	5.31	38.0	138.4	158.0	47 0	29 759	21.6
16 0	5 11	37.2	141.9	157 4	45.6	29.777	21.0
17 0	5.10	36.5	140.0	158.8	45 2	29 878	21.0
18 0	4.23	35 5	140.0	159 0	47.5	30.092	20.0
19 0	4.49	34.2	139 0	159.0	49.8	30.036	18.0
20 0	5.24	33.5	140.0	159.0	52.0	30.019	17.0
21 0	3.15	32.3	139.9	158.6	58 5	30.084	16.0
22 0	3.40	31.5	140 6	158 5	50.0	30.072	15.0
23 0	2.04	30.4	140.0	158.7	49 5	30.154	14.0
Mar. 12.							
24 0	1.37	29.6	141.9	159.0		30.176	12.8
1 30			143 0			30.250	15.0
1 50	1.22	27.6	143.5	158 2		30.263	15.0
2 0	1.26	27.7	144.5	158.2			
2 10	1.28	27.7	145 5			30.270	16.2
Mar. 14.							
1 50	2.05	30.1	143 9			30.066	32.5
2 0	2.20	30.2	143.5			30.058	
2 10	2.21	30 4	145.8			30.112	32.8
3 0	3.07	31.8	143 6	93.6	34.0	30.096	38.1
4 0	3.36	33.2	140.0	93.8	39.0	30.091	40.0
5 0	5.42	36.0	136.5	93.2	44.0	30.114	41.5
6 0	6.02	38.5	132 8	93.8		30.174	43.3
7 0	6.22	39.7	131.1	93 6		30.152	42.3
8 0	6.44	40.7	130.2	93 5	50.0	30.020	43.0
9 0	6.36	42.2	133.0	93.3	49.5	30.086	43 7

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m							
10 0	+6 25	41.0	131.0	93.0	48.2	30.077	43.0
11 0	6.10	40.2	137.9	92 7	47.0	30.046	39 0
12 0	6.09	40.0	138.3	92 9	46.0	30.054	36.0
13 0	4.36	39.5	137.9	93 5	46 5	30.077	33.0
13 50	5.21	38.8	137 6	93 8	50.0	30.095	31.0
14 0	5.11	39.0	138 5	93.8	50 1		30.1
14 10	5.35	39.0	138.8	93.8	50.5	30.093	30.4
15 0	5.25	37.5	140 0	93.8	51.0	30.090	30.0
16 0			144 2	94 0	55.5	30 075	29.5
17 0	5.01	37.0	140.5	94.0	57 0	30.075	29.0
18 0	5.00	37.0	140 2	93 4	58.2	30.100	28.4
19 0	5.00	37.0	140 6	93.6	58.0	30.105	27.6
20 0	4.38	36.8	139.4	93 8	59.5	30 027	26.7
21 0	4.35	30.2	140.0	93.4	60.0	30.042	26.7
22 0	4.36	36.0	140.3	93 3	58.5	30.045	27.1
23 0	4.20	35.6	141.0	93.4	58.3	30 019	26.0
Mar. 15.							
24 0	4.20	35.0	142.2	93 0	56 0	30.026	24.8
1 0	4.07	35 5	145.5	93.2	54.5	30.056	29.0
1 50	4.18	35.6	146.7	93 8	56.5	30 055	32 0
2 0	4.24	35.6	146 6	93.9	57.0	30.053	
2 10	4.41	36.0	146.4	93 9	57.5	30.047	32.3
3 0	5.26	37.0	145.1	94.0	63.0	30.089	36.7
5 0	8.00	42.2	137.2	93.5	71.0	30.007	43 5
7 0	8.38	45 0	128 9	93.4	73.0	29.991	45.0
8 0	8.02	46.5	128.7	93.3	72 0	29.967	43.4
10 0	8.00	49 0	127.0	91 8	65.5	29.958	41.1
11 0	7.05	48.0	125.5	92.1	62.0	29 956	39 1
12 0			128.1	91.3	58.9	29.966	36.5
13 0	7.41	46.5	138.1	91.5	55.4	29 972	33.7
15 0	8.13	44.5	140.1	92 2	51.7	29.975	35.0
16 0	8.10	45.0	139.0	93.7	54 0	29 935	33.0
17 30	7.47	43.6	138.5	93.2	55.0	29.975	34.3
Mar. 16.							
1 0	5.48	39.1	146.9	92.5	50.5	30.107	31.2
1 50	6.05	38.6	149.5	93.5	50 0	30 115	32.2
2 0	5.40	38.6	148.8	93.5	50.0	30 111	
2 10	6.02	38.6	151 6	93.5	50.0	30.113	32.3
3 0	6.45	38.5	153 7	93.6	50.2	30.133	33.7
4 0	7.06	39.2	145.2	93.8	52.2	30.144	35.9
5 0	7.17	41.0	136.0	93.0	55.0	30.144	37.5
6 0	8.44	42.4	133.8	93.4	56.5	30.129	39.8
7 0	9.07	43.4	124.5	93.0	59.5	30.078	41.0
8 0	8.12	45.0	125 5	93.5	63.8	30.075	42.5
9 0	7.28	46.5	125.7	93.8	67.0	30.073	43.5
10 0			127.0	93.8	67.5	30.084	44.0
11 0	5.54	47.5	154.5	93.0	64.5	30 218	42 8
12 0	6.25		133.9	91.6	61.5	30 092	36.1
13 0	6.25	46.0	136.5	92.0	57.5	30.101	33.6
13 50	6.15	44.4	153.1	93.0	56.5	30.085	32.0
14 0	6.27	44.4	153.1	93.3	56.5	30.093	31.7
14 10	6.37	44.4	150.6	93.4	56.6	30.088	31.7
15 0	8.08	43.5	155.0	93 9	58.8	30.082	33.0
16 0	8 21	43.0	145.1	93.7	60.0	30.038	37.0
17 0	8.00	43.0	132.0	93.5	59.5	30.005	37.0
18 0	8.00	43.5	148.9	93.4	58.0	30.003	37.0
19 0	7.17	43.0	141.2	83 4	57.2	29.973	38.0
20 0	7.48	43.4	138.0	93.6	58.3	29.941	38.6
21 0	8 25	43.0	129.0	93.8	59 0	29.910	37.4
22 0	8.20	43.3	133.7	93.8	60.0	29.869	37.9
23 0	8.20	43.0	139.0	94.0	63.0	29.880	32.5

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m							
Mar. 17.							
24 0	+7.46	43.0	140.5	93.7	63 0	29.837	38.9
1 0	6 38	43.5	142 8	93.4	62 0	29.801	41.5
1 50	7.04	43.5	144 0	92.6	59.8	29.784	43.5
2 0	7.12	43.5	144.6	91.8	59.2	29 768	44 0
2 10	7.13	43.7	143.7	91.8	58 8	29 766	44.2
3 0	7.39	45.1	144 6	93.5	58.9	29.726	47.7
4 0	8.48	46.0	142.0	93.6	60.0	29.694	51.1
6 0	9.36	48.4	133.4	93.5	60 2	29.644	55.5
8 0	9.43	49.7	130.0	93 4	59 9	29.568	55.7
9 0	9.30	50.0	133.0	93 2	59.4	29.562	54.0
10 0	9.25	50 0	133.8	93.0	58 0	29.550	52.2
11 0	9·22	50·0	135.5	63.0	57.0	29.542	50.5
12 0	9 08	48.4	135.7	92 7	56.0	29.575	49.0
13 0	9.04	49 6	139.0	93.1	55 5	28.568	48.0
13 50	9.23	51.0	137.7	93.9	57.5	29.576	51.8
14 0	9.20	51.0	137.5	93 6	58 0	29.584	51.0
14 10	9.21	51.0	137.7	93.9	58.0	29.578	51.6
15 0	9.28	50.0	138 0	94 3	62 0	29.615	47.5
16 0	9.28	50.0	136.5	94.2	65.0	29.622	47.5
17 0	9.38	50.0	138.2	93 9	65 6	29.637	48.9
18 0	9.40	50.0	138.3	93.7	65 0	29.657	49.0
19 0	9.40	50.0	138.3	93.7	64.0	29 706	46.0
20 0	9.35	49 5	138 0	93 7	63·5	29.744	43.0
21 0	9.23	48.6	140 0	93.3	62.5	29.761	43.0
22 0	9.12	48.0	139 2	93.6	62.0	29.799	40.0
23 0	8.39	47.0	138.7	93 5	61.0	29.802	39.0
Mar. 18.							
24 0	8.20	46.5	141.0	93 5	61.0	29.835	38.0
1 0	7.48	45.5	143.0	92 5	59 0	29 957	41.9
1 50	8.28	45.5	144.3	93.2	58.0	29.963	42.5
2 0	8.25	45.5	143.7	93 2	58.0	29.964	43.0
2 10	8.40	45.6	144.1	93.2	58.2	29 972	43.8
3 0	9.40	47.0	143.0	93.5	59.2	29.986	44.6
4 0	9.18	47.0	140.5	93.6	61.0	30.007	47.0
6 0	11.03	50.4	132.0	93 5	66.7	30 017	49.4
7 0	11.19	51.7	130 5	93 6	68.5	30.006	50.0
8 0	11.47	52.8	132.2	93.7	69.0	29.980	50.8
9 0	11.40	54.0	133.0	93 4	68.2	29.977	50.0
10 0	11 33	54 0	133 0	90 7	66.0	30.000	49.8
11 0	11 28	53.0	137.0	93.1	64.0	30.001	48.3
12 0	10.28	51.6	136.8	91 8	60.0	30.037	42.1
13 0	11.27	51.0	136.0	91.5	56.0	30.034	39.0
13 50	10.15	50.0	139.0	92.5	55.6	30 052	38.0
14 0	10.15	49 6	139.2	92.5	55.6	30.052	37.6
14 10	10.22	49 6	139.0	92.7	55.6	30.042	37.0
15 0	10.07	49.0	139 0	92 7	56.0	30.036	35.5
16 0	9.25	47.6	139 2	92.6	55.5	30.048	34.5
17 0	9.03	47.0	140.0	93 0	54 5	30.038	33.0
18 0	9.34	46.0	140.0	93.0	50.0	30.004	31.0
19 0	8.19	45 0	140 0	93.7	55.5	30.035	30.0
20 0	8.01	44.5	140.0	93.7	57.0	30.033	29.0
21 0	9.05	44.0	147.5	93 5	56.5	30.071	29.5
22 0	8.00	43.0	146 0	93.2	55.0	29.974	30.0
23 0	7.25	42.5	143.0	94.0	55.0	29.950	29.0
Mar. 19.							
24 0	7.24	41.5	141.0	94.0	56.5	29.922	29.5
1 0	8.15	31.8	139.4	94.1	60.0	29 906	37.0
1 50	8 24	42.5	135.0	94.0	61.4	29.913	42.0
2 0	8.07	43.0	136.5	93.8	61.0	29.905	42.8
2 10	9.36	43.0	138.0	93.5	61.0	29.898	43.5

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
Mar. 21.							
h. m.							
1 0	+4.49	35.5	145.1	96.0	32.0	30.013	28.0
1 50			144 2	93.1	33.5		29 1
2 0	4.21	35.2	143.4	93 1	33.5	30.011	30 3
2 10	4.22	35.3	141.7	93.0	34.0	30.030	31.0
3 0	5.41	36.0	142 3	93 8	37.0	30.084	34.0
4 0	6.37	38.0	140.0	93.6	42.1	30.056	36.0
5 0	6.18	39.7	135.0	93.6	46.4	30.097	38.0
6 0	7.15	42.0	134.2	93 5	50.0	30.147	41.5
7 0	8.10	44.0	134 0	93 6	53.5	30.076	44.0
8 0	8.22	45.0	133.0	93.8	55.5	30.012	43.0
9 0	8.12	45.0	133 0	93.8	55.5	30.010	43.5
10 0	7.26	43.5	137.0	91 8	49.0	29.979	36.0
11 0	7.21	43.4	149.3	92.5	47.0	29.982	34.9
12 0			146.5			29.977	34.4
13 50	7.16	42.8	141.7	92.2	45.5	30.062	34.0
14 0	7.21	42.6	140.9	92 3	45.2	30.018	
14 10	7.20	42 7	138.9	92.3	45.0	30.055	33.7
15 0	6.27	42.0	139.0	92.6	44 2	30.055	33.0
16 0	6 29	41 4	138.0	94.1	48 5	30.062	31.8
17 0	6 27	41.2	137.9	94.2	50.0	30.062	31.9
19 0	6.31	41.6	137 8	94.2	56.6	30.053	31.4
20 0	6.02	40.3	139.8	94.3	58.2	30 050	31.3
21 0	6.12	40.5	140 0	93.9	57.8	30.030	33.3
22 0	6.47	41.5	138 7	94.0	57.6	30.029	34.0
23 0	6.12	41.5	139.3	94.0	58.0	30.022	32.8
Mar. 22.							
24 0	5.24	41.0	141.3	93 8	57.6	30.015	32.2
1 0	6.36	40 5	143.2	93.2	55.8	29.990	33.5
1 50	5 43	40.5	142.4	93.3	54.3	29.985	34.2
2 0	5.49	40.5	142.2	93.3	54.2	29.973	34.3
2 10	6.09	40.5	142 2	93.3	54 1	29.979	34.3
3 0	6.48	40.5	139.8	93.2	53.5	29.986	35.3
4 0	6.48	40 5	136.2	93.7	52.5	29.972	35.0
5 0	6.16	41.5	130 6	93.5	52.7	29.956	35.0
6 0	6 06	41.0	128.0	94.0	54.0	29 950	34.5
7 0	6.20	40.5	127.6	93.5	53.8	29.876	34.0
8 0	6.17	40.5	130.5	93.0	52.2	29.910	31.5
9 0	5.12	38.0	134 8	92.2	50.7	29 869	31 0
10 0	6.32	38 5	135.5	92.2	49.8	29.870	31.1
11 0	4.42	38 7	137.0	93.0	48.9	29.955	29 8
12 0	4.24	38.0	137.0	93 2	48.2	29.950	30.2
13 0	4 24	37.8	137.0	93.0	47.5	29.977	
13 50	5.33	37.5	136 5	92.7	46.6		
14 10	3.21	37.5	136.9	92.8	46 5	30 012	31.8
15 0	4 20	37.0	139.5	92.1	45.0	30.017	30.0
16 0	3.43	36.5	148 9	93 6	44.8	30.025	27.8
17 0	4 31	36.0	138.0	94.0	46 1	30.048	26 5
18 0	4.00	35.5	143.5	94.1	48.5	30.053	26.0
19 0	3.21	36 0	141.0	94.0	50 0	30.053	24.0
20 0	3.40	36 0	140 7	93 6	49.0	29.911	24.0
21 0	3 23	35.0	140.5	94.0	49.0	29.905	24.0
22 0	3.18	35.0	140.6	94.0	50.5	29.939	22.5
23 0	3.19	34.0	141.1	94.3	54.0	29.927	20.0
Mar. 23.							
24 0	4.46	34.0	133.2	94 0	56.0	29.982	20.0
1 0	4.47	34 5	144.0	93.8	55 0	30.130	22.0
1 50	4.13	35 0	147 2	93.9	54.2	30 125	23.0
2 0	4.19	35 0	148 0	93.8	54 2	30.137	
2 10	4.26	35.0	146.7	93 7	54 2	30.134	23.0
3 0	5 30	36.0	142.7	93.7	55.0	30 132	25.0
3 55	5.52	37.0	136 6	93.6	56.0	30.131	27.0
5 0	6.48	38.0	137.0	93 6	56.0	30.173	27.0
h. m							
6 0	+6.35	39.8	130.0	93.5	55.8	30.167	27.0
8 0	6.51	40.5	130.0	93.2	55.5	30.154	29.5
9 0			146.0	93.2	51.4	30.210	19.5
	Term	day	omit	ted.			
Mar. 24.							
12 0	7.25	46.5	143 0	173.3	59.6	30.193	31.7
13 50	8.17	46 0	145 4	170.7	54 1	30.188	30.2
14 0	8.13	46 0	144 8	169.9	54.0		
14 10	8.16	45.9	144.3	169.0	53.9	30.192	30.0
15 0	7.37	44.8	138 0	170 7	52 0	30 187	29.4
16 0	7.19	43.5	140 0	171 0	54.0	30.170	28.8
17 0	8.20	43.0	137.0	171.4	57.2	30.156	28.3
18 0	7.44	42.5	137.0	171.8	59.7	30.160	28.0
19 0	7.00	42.0	138 0	173.8	60.0	30.114	27.0
20 0	6.37	42.0	138.9	174.9	60.0	30.103	28.8
21 0	7.48	42.0	133.6	176 7	60.1	30.081	30.0
22 0	8.06	41.5	134.6	175.5	60.0	30.082	30.5
Mar. 25.							
24 0	6.13	41.0	143.8	174 5	60.0	30.076	31.7
1 0	6.11	40.4	146.0	174.6	59.0	30.065	33.1
1 50	6.24	40 5	145.7	175 5	57.0	30.015	35.0
2 0	6.19	40.5	145.7	174.9	56.2		
2 10	6.30		145.0	174.6	54.7	30.024	34.2
3 0	6.18	40.7	142.8	177 8	54.7	30 051	33.8
4 0	6 25	40.6	134 2	181.3	53.0	30.020	34.3
5 0	6.57	41.0	134.8	182.0	55.5	30.000	34.3
6 0	5.25	40.7	131.3	178 6	55.0	29.957	32.9
7 30	6.36	41.0	129.1	178.1	55.5	29.901	31.0
8 0	6.21	40.0	129.0	173.0	55.0	29.902	32.0
9 0	4.26	39.5	134.0	175.0	53.5	29 869	32.5
10 0	4.14	39.5	136.0	166 0	50.5	29.820	33.0
11 0	4.23	39.5	140.0	166.5	49.0	29.798	33.5
12 0	6.36	39.5	142 5	165.9	45.0	29.848	34.5
12 50	6.36	39.5	141.7	166.4	45 0		
13 0	6.42	39.5	141.4	165.6	44 9	29.711	33.5
13 10	6.32	39.5	140.0	166.6	44 5	29.662	33.5
14 0	7.34	39 5	140.0	168.8	46 8	29.618	36.0
15 0	7.34	39.5	138.0	169.8	51.0	29.600	35.8
16 0	7.28	39.7	137.5	170.8	51.5	29.587	35.0
Mar. 28.							
4 0	8 44	45.3	135.5	181.1	44.5	29.752	44.5
6 0	9.06	46.2	133.3	178.5	48.8	29.762	43.8
7 0	9.12	47.5	127 5	176.1	50 5	29.762	41.5
8 0	11.25	46.5	129.2	171.5	49.6	29.826	41.2
9 0	8.24	46.7	132 0	168.1	48 5	29.892	39.0
10 0	7.31	46.0	132.0	159.0	49.0	29.859	37.5
11 0	8.45	45.0	136.6	172.7	52.5	29.963	36.0
12 0	8.10	45.5	137.6	172 6	52.0	30.029	34.0
13 0	7.40	44.5	138.2	171.2	50.5	30.042	33.0
14 0	7.30	43 5	138.0	172.1	50.5	30.095	31.9
15 0	7.04	42.7	140.0	176.0	54.2	30.101	30.0
16 0	6.46	41.5	139.8	176.5	52 0	30.128	29.3
17 0	6.30	40.7	139.8	174.7	50.2	30.143	29.0
18 0	6.14	40.0	138.5	173.0	50.5	30.139	29.0
19 0	6.10	39.6	138.8	173.2	50.3	30.133	28.5
20 0	5.45	39.0	138.5	171.2	49.5	30.158	28.5
21 0	5.29	38.1	139 8	170.5	48.5	30.174	28.2
22 0	5.22	37.5	139.0	170.1	47.6	30.185	28.5
23 0	5.22	37.2	142.2	171.0	48.0	30.188	28.3
Mar. 29.							
24 0	5.10	37.0	137.9	173.6	48.0	30.192	28 6
1 0	5.13	36.8	142.0	172.5	49.0	30.206	32.5

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
1 50	+5.33	37.5	144.7	174.2	50 0	30.218	32.5
2 0	5.42	37.6	145 2	174.0	50.2	30 222	35.0
2 10	5.39	37.7	144.7	174.5	50.5	30.216	36.0
3 0	6.49	40.0	144.0	180.5	52.0	30.217	45 5
4 0	8.40	43.0	139.0	184.7	54.0	30.223	44.0
5 0	8.26	42.7	132.0	184.0	57.0	30.167	47 5
6 0	9 35	46.7	130.5	182.0	59.0	30.147	47 5
7 0	9.35	49.0	125.0	185.4	60 1	30.159	43 9
8 0	8.41	50 2	127.9	181.9	59.8	30.154	43.2
9 0	10.19	50.4	132 0	177.5	58.8	30.138	42.0
10 0	10.16	50.3	133.5	176.7	58.0	30.057	41.0
11 0	9 37	49.0	134.2	175.6	56 0	30.048	41.0
12 0	8.45	47.3	136.1	172.6	52.5	30.088	39.0
13 0	8.35	47.5	135.8	174.3	51.0	30.090	38.8
13 50	8.42	47.0	143.1	172.7	50.5	30.064	38.5
14 0	9.02	47.0	143.1	172 5	50.5		
14 10	9.01	47.0	142.5	172.9	50.5	30.057	38.4
15 0	9.08	46.9	139.9	173.0	51.0	30.051	38.2
16 0	10 09	46.5	144.1	173.5	54.0	30.035	38.2
17 0	10.21	46.5	146.1	176.0	56 8	30.026	38.8
18 0	10.32	46.0	146.0	183.2	59.5	30 036	36.0
19 0	10.32	45.7	144.1	182.4	59.0	29.985	34.7
20 0	9.40	46.5	142.0	180.1	58.0	29.964	34.8
21 0	9.01	45.0	134.8	177.1	58.0	29.925	35.5
22 0	8.31	44.8	138.5	177.8	60.9	29.845	35.5
23 0	8.18	44.6	138.5	178.3	62.5	29.805	36.7
Mar. 30.							
24 0	8.12	44.3	141.8	179.6	59.8	29.787	37.2
1 0	8.04	43.7	141.2	178.0	56.5	29.720	40.7
1 50	8.36	44.5	137.5	179.2	55.0	29.700	42.0
2 0	8.38	44.5	138.5	178.0	55.0	29.686	
2 10	8.41	44 5	139.1	178.1	54.6	29.697	41.3
3 0	8.49	45.0	141.5	178.2	53.0	29.669	43.5
4 0	9.04	45.0	138.0	177.2	52.0	29 553	44.0
5 0	9.29	46.5	131.5	181.9	52 5	29.656	51.8
6 0	9.40	47.0	126.0	182.2	53.6	29.561	52 0
7 0	9.45	48.4	131.0	178.0	55.0	29.433	53 5
11 0	9.12	48.8	136.9	173.3	53.5	29.516	47.0
12 0	9.23	48.6	135.5	173.7	52.0	29.471	46.5
13 0	9.32	49.5	136.5	174.0	51.7	29.480	45.8

Gottingen Mean Time.	V. F.	Att. Th.	Dec.	H. F.	Att. Th.	Corr. Bar.	Ex. Th.
h. m.							
13 50	+9.32	49.5	137.5	173.5	51.0	29.573	44.8
14 0	9 32	49.5	137.0	173.7	51.0		
14 10	9.32	49 6	138 5	174.1	50.8	29.563	44.0
15 0	10 12	49 2	143.5	173.5	50 0	29.571	42.9
16 0	10.06	49.0	146 5	176 2	50 0	29.550	40.6
17 0	9.26	47.0	138.8	176.7	53.3	29.529	38.0
18 0	9.05	46.5	136 5	179.2	57.0	29.514	36.3
19 0	9 32	47.0	134.0	180 2	59.5	29.513	35.0
20 0	9.30	46.0	136.4	180.3	60 0	29 517	32.5
21 0	9.55	46.0	136.0	180.0	60.5	29.514	33.0
22 0	9 49	45.0	136.0	177.8	59.9	29.516	32.0
23 0	8.19	45.0	137.0	178.0	59.5	29.524	31.0
Mar. 31.							
24 0	7.45	44.0	142.0	177.0	58 0	29.564	33.2
1 0	7.40	44.2	144.5	175 3	56.5	29.605	39.0
1 50	8.17	44.6	145 4	175.1	54.5	29.630	42.0
2 0	8.25	44.8	147.2	178.0	54.5	29 630	42.5
2 10	8 33	45.0	148.0	179 0	54.5	29.631	43.5
3 0	9.19	46.0	144.2	182.7	55 5	29.635	45.0
4 0	10.15	47.0	141.4	184 1	56.5	29 645	46.0
5 0	10.21	48.0	134.5	184.0	57.5	29.660	44.0
6 0	9.30	47.5	131 5	182 8	58 0	29.664	40.0
7 0	8.47	46.3	130.8	177.5	56.9	29 534	37.0
8 0	8.23	45.5	130 0	172.6	55 0	29.679	31.0
9 0	7.23	43.7	131.3	169.4	51.3	29 775	28.0
10 0	6.34	42 5	130.7	167.4	48 0	29 702	29.0
11 0	6.20	41.0	133.0	165 8	45.5	29.804	28.0
12 0	6 47	39 8	142.0	163.7	41 5	29.914	26.0
13 0	5.39	39.3	142.5	164 3	40.0	29.925	25.0
13 50	5.13	37.5	138.5	165.0	39 0	29 954	25.0
14 0	5.06	37.5	138 0	165.1	39 0		
14 10	5.01	37.5	137.6	165.8	39 0	29.979	24.8
15 0	4.38	36.0	140.9	169.0	40.5	30.003	23.8
16 0	4.19	35 3	138.0	169.0	43 0	30 055	23.0
17 0	4.14	34.5	138.5	169 1	43.5	30.102	22.8
18 0	4.02	34.0	138.0	167.4	46.0	30.091	22.0
19 0	4.45	33 5	139.9	170 9	49.0	30.101	21.6
20 0	4.37	33.0	139.0	169 9	48.5	30.114	21.0
21 0	3.45	32.5	135 0	170.0	48.5	30 166	20.1
22 0	3.34	31.8	138.0	169.3	50.0	30.174	19.0
23 0	3.34	31.5	138.0	170.8	51.5	30.182	18.0

EXTRA OBSERVATIONS.

It has been the custom at the Cambridge Observatory, as elsewhere, to observe, at the shortest possible intervals, the magnetic elements, whenever symptoms of any great magnetic disturbance were discovered, or the presence of an Aurora made it probable that the Magnetometers would be unusually deranged. The following results of the extra observations made at these irregular periods may be of some value in determining how far such magnetic storms extend, what are their laws, and what, if any, is their connection with the Aurora. At such periods the observer has generally marked the extreme limit of every vibration of the Magnetometer, and noted the time as often and as accurately as practicable.

Gottingen Mean Time.	Dec.	Gottingen Mean Time.	Dec.	Gottingen Mean Time.	Dec.	Gottingen Mean Time.	Dec.	Gottingen Mean Time.	Dec.	Gottingen Mean Time.	Dec.
Nov. 18,	1841.	h. m. s.		h. m. s		h. m. s.		h. m. s.		h. m. s.	
h. m. s.		12 48 0	120.0	15 51 35	167.0	16 15 35	120.0[2]	16 33 40	46.0	18 36 0	105.0
11 13 0	138.0[1]	12 48 30	118.2	15 51 55	158.0	16 15 50	124.0	16 34 0	63.0	18 36 15	102.0
11 22 0	122.0	12 49 0	112.2	15 52 30	150.0	16 16 10	118.0	16 34 20	48.0	18 37 20	107.0
11 25 0	138.0[2]	12 49 30	111.5	15 52 45	159.0	16 17 30	137.0	16 34 45	68.0	18 37 40	108.0
11 30 0	171.0[3]	12 49 45	110.7	15 53 0	148.0	16 17 35	124.0	16 35 0	43.0	18 38 0	106.0
11 35 0	155.0	12 50 0	112.0	15 53 15	151.0	16 17 55	140.0	16 35 30	54.0	18 38 23	110.0
11 40 0	150.0	12 50 30	111.0	15 53 33	137.0	16 18 35	133.0	16 35 55	75.0	18 38 37	108.0
11 45 0	140.0	12 51 0	112.3	15 54 0	140.0	16 19 21	115.0	16 36 10	59.0[4]	18 39 30	112.0
11 50 0	137.0	12 51 30	113.6	15 54 25	123.0	16 20 0	97.0	16 36 23	79.0	18 39 55	114.0
11 55 0	156.0	12 52 0	115.2	15 55 0	111.0	16 20 15	107.0	16 36 42	57.0[5]	18 40 32	112.0
12 7 0	143.0	12 52 30	116.3	15 55 27	106.0	16 20 30	78.0[3]	16 37 0	77.0	18 41 0	111.0
12 10 0	147.0	12 53 0	117.2	15 55 45	90.0	16 20 50	86.0	16 37 20	65.0	18 41 30	114.0
12 27 0	137.3	12 53 30	118.8	15 56 15	79.0	16 21 5	70.0	16 38 0	65.0	18 41 50	112.0
12 32 30	138.8	12 54 0	121.0	15 56 30	90.0	16 21 25	85.0	16 38 10	77.0[6]	18 42 0	114.0
	137.0	12 54 30	122.8		80.0	16 21 45	62.0		64.0	18 42 32	117.0
12 34 0	135.0	12 55 0	126.1	15 57 0	86.0	16 22 15	57.0		72.0	18 42 47	115.0
12 35 0	135.0	12 55 30	130.0	15 57 30	75.0	16 22 32	69.0		62.0	18 43 15	115.0
12 36 0	137.0	12 56 0	134.0	15 57 45	82.0	16 22 50	50.0		77.0	18 43 35	116.5
12 36 10	138.0	12 56 30	135.5	15 58 0	70.0	16 23 11	64.0	16 39 45	68.0	18 43 50	116.0
12 37 0	139.8	12 57 0	139.0	15 58 15	83.0	16 23 27	45.0	16 40 0	77.0	18 44 10	119.0
12 37 30	141.5	12 57 30	140.7	15 58 32	73.0	16 23 50	63.0	16 40 40	82.0[6]	18 44 30	118.0
12 38 0	139.5	12 58 0	143.0	15 58 50	85.0	16 24 10	53.0	16 42 32	101.0	18 44 50	120.0
12 38 30	138.3	12 58 30	145.8	15 59 0	78.0	16 24 27	63.0	16 43 0	109.0	18 45 21	123.0
12 39 0	136.5	12 59 0	147.2	15 59 30	89.0	16 24 40	76.0	16 43 30	116.0	18 45 40	121.0
12 39 30	134.3	12 59 30	150.5	16 0 0	94.0	16 25 10	47.0	18 30 15	95.0	18 46 10	124.0
12 40 0	134.3	13 0 0	152.2	16 0 30	97.0[7]	16 25 45	37.0	18 30 26	100.0	18 46 30	125.0
12 40 30	134.6	13 3 0	154.0	16 1 0	105.0	16 26 0	40.0	18 30 44	93.0	18 47 0	126.0
12 41 0	135.4	13 4 0	156.2	16 1 30	97.0	16 26 30	25.0	18 31 0	98.0	18 48 0	127.0
12 41 30	136.2	14 0 0	[4]	16 1 37	107.0[8]	16 26 40	41.0	18 31 20	94.0	18 48 30	128.0
12 42 0	137.0	15 46 0	[5]	16 2 0	100.0	16 27 0	18.0	18 31 39	98.0	18 49 15	127.0
12 42 30	138.0	15 47 30	151.0	16 2 15	111.0[9]	16 27 15	21.0	18 32 0	94.0	18 50 20	129.0
12 43 0	138.9	15 48 0	153.0[6]	16 2 30	104.0	16 27 33	8.0	18 32 19	98.0	18 52 20	130.0
12 43 30	140.0	15 48 30	158.0	16 2 50	114.0	16 28 0	6.0	18 32 40	95.0	18 54 0	130.0
12 44 0	139.6	15 49 0	151.0	16 3 5	107.0	16 28 50	19.0	18 32 55	97.0	18 54 20	129.0
12 44 30	138.9	15 49 20	158.0	16 3 25	115.0	16 30 0	40.0	18 33 21	99.0	18 54 40	128.0
12 45 0	138.0	15 49 30	148.0	16 3 45	109.0	16 31 0	50.0	18 33 43	97.0	18 55 5	127.0
12 45 30	137.2	15 49 45	165.0	16 4 0	116.0[1]	16 31 15	44.0	18 34 0	99.0	18 55 30	128.0
12 46 0	135.5	15 50 10	155.0	16 4 30	118.0	16 31 43	58.0	18 34 30	101.0		
12 46 30	133.2	15 50 30	168.0	16 4 45	113.0	16 32 15	54.0	18 35 0	100.0		
12 47 0	129.0	15 51 2	169.0	16 5 0	118.0	16 33 0	57.0	18 35 22	103.0		
12 47 30	122.0	15 51 20	161.0	16 15 27	125.0	16 33 30	44.0	18 35 40	101.0		

[1] Bright shoots. [2] Arch forms. [3] Disappears. [4] Bright arch. [5] Beautiful shoots. [6] Aurora shoots up brightly. [7] Aurora fades. [8] Shoots up again. [9] Ceases. [1] Merry dancers. [2] Colored. [3] Merry dancers up to zenith. [4] Fades. [5] Dances. [6] Still dances.

Gottingen Mean Time.	H. F.
Nov. 18,	1841.
h. m. s	
15 45 0	165.0
	171.0[1]
	164.0
	168.0
	166.0
	164.0
	161.0
	154.0
	156.5
	145.5
	149.0
	144.5
	149.0
	148.0
	158.5
	153.5
	161.0
	172.5
	170.0
	176.0
	171.0
	176.5[2]
	174.0
15 57 0	182.5
	178.0
	184.0
	180.0
	187.5
	192.5
	184.0
16 0 0	192.2
	184.0
	191.1
	185.0
	194.0
16 1 0	186.5
	192.4
	186.5
	192.5
	186.0
	190.0
16 2 0	186.0
	186.5
	183.5
	184.0
	183.0
	183.2
	181.5
16 4 20	182.0
16 4 30	180.0
	178.0
	176.0
	177.0
	175.0
4 6 30	176.0
4 15 0	181.0
	194.0[3]
	178.0
16 16 0	195.0
	186.5
	196.0[4]
	197.5

Gottingen Mean Time.	H. F.
h. m. s.	
16 17 32	189.5
	204.0
	195.5
16 18 0	204.0
	201.0
	205.0
16 19 0	216.0
	205.0
	217.0
	206.0
16 20 0	219.0
	212.0
16 20 30	238.0
	230.5
16 21 15	241.5
	234.8
16 21 45	243.5
	243.0
16 22 15	245.0
	238.0
16 22 50	247.9
16 23 27	248.5
	239.0
	241.0
16 24 15	234.0
	240.5
	227.0
16 25 10	234.5
	229.0
	232.1
16 26 0	231.5
	236.5
16 26 30	228.0
16 26 40	241.0
16 27 0	234.0
	244.8
	242.5
16 27 40	255.5
	248.5
16 28 15	262.0
	252.0
16 28 50	267.0
16 29 20	268.2
	258.5
16 30 0	266.5
	252.5
	263.0
	252.5
	265.5
	258.2
16 31 43	273.3
	261.2
	269.2
16 32 23	253.5
	265.4
16 33 0	249.2
	259.0
16 33 30	245.8
	260.4
16 34 0	241.7
	261.5
	241.0

Gottingen Mean Time.	H. F.
h. m. s.	
16 35 0	254.4
	241.2
	255.3
	244.8
	256.2
	246.0
	262.0
	248.5
16 37 0	255.5
	240.1
	246.2
	232.2
	240.2
	225.0
	231.0
	220.8
	228.8
	221.5
	222.2
	225.2
	227.3
	220.2
	232.0
	219.0
	231.0
	221.6
16 43 0	231.7
	220.2
	231.0
	219.0
	217.0
	227.0
	210.6
	219.4
	208.0
	208.0
	218.0
	208.0
	214.0
16 46 25	201.5
	211.0
16 47 0	199.9
	207.5
16 47 32	198.8
	204.5
16 48 10	195.6
	201.1
	194.9
	197.8
	192.7
	199.8
16 50 0	192.1
	195.1
16 50 30	190.1
16 50 40	192.0
	189.5
16 51 10	192.5
	188.5
	190.2
16 52 0	186.7
	189.8
	189.0
	189.0

Gottingen Mean Time.	H. F.
h. m. s.	
	187.0
	187.8
16 53 35	185.0
	186.0
16 54 7	183.1
	183.7
16 55 15	180.3
	182.8
	181.1
	183.8
	180.7
16 56 40	182.6
	180.3
	181.0
	181.0
	180.7
16 57 40	181.0
	179.2
16 58 15	181.9
16 58 22	181.5
16 58 40	184.9
	184.2
16 59 15	187.0
16 59 33	184.8
	185.6
17 0 0	185.5
	187.7
	186.0
	188.4
17 1 20	188.1
	189.8
	188.6
Dec. 27, 1841.	Dec.
12 37 20	149.5
	140.1
	147.0
	141.5
12 39 10	147.0
	142.0
	146.0
	139.9
	149.0
12 40 50	140.0
	145.5
	142.5
12 42 20	146.0
	143.0
	146.0
	142.0
	148.5
	139.0
12 44 0	150.0
	139.0
12 44 30	149.5
	139.0
	151.0
	136.5
	151.5
12 46 0	137.5
	151.5
	139.0

Gottingen Mean Time.	Dec.
h. m. s.	
12 47 0	149.0
	139.5
	149.5
12 48 0	140.0
	149.0
	142.0
	148.0
12 49 20	140.0
	148.0
	140.0
	149.0
	139.0
	153.0
	135.0
	153.0
12 51 30	134.5
	154.0
	135.0
12 52 30	152.0
	135.5
	153.5
	135.5
	152.0
12 54 0	139.5
	147.0
13 16 0	141.0
	149.0
	141.0
	149.5
13 21 0	141.0
	148.0
	141.0
13 27 20	152.0
	137.0
	149.0
	140.2
13 28 20	147.0
	142.5
	147.0
	141.0
13 29 30	145.5
	139.0
	148.0
	139.5
13 30 50	149.0
	140.5
	149.5
	138.0
13 32 0	151.0
	138.5
	149.0
	140.5
	146.5
	140.0
13 33 50	148.0
	139.0
	148.5
	140.5
	148.0
13 35 10	143.0
	140.0
	142.0
	146.0

Gottingen Mean Time.	Dec.
h. m. s.	140.5
13 36 20	147.5
	141.7
13 37 0	146.5
	142.0
13 37 30	146.0
	142.0
13 38 30	146.0
	141.0
	148.5
13 39 40	140.5
	147.0
	141.5
13 40 30	147.0
	141.5
	147.0
13 41 20	139.5
	146.5
	140.0
	149.0
	139.5
	139.5
13 42 50	149.0
	139.0
	149.0
13 43 40	141.0
	148.0
	143.0
13 44 30	146.0
	140.0
	147.5
	142.0
13 47 30	147.5
	146.0
	142.0
	144.5
	142.0
	147.5
13 50 0	141.5
	144.0
	147.0
	142.0
13 51 0	145.0
	143.0
	155.1
	150.5
	155.2
	149.5
	156.6
	150.5
	152.9
	150.7
	154.1
	149.8
	154.1
	149.4
	156.8
	149.1
	154.1

[1] Brilliant shoots of Aurora. [2] Aurora shoots. [3] Brilliant Aurora dancing. [4] Purple shoots.

Gottingen Mean Time.	Dec.	Gottingen Mean Time.	Dec.	Gottingen Mean Time.	Dec.	Gottingen Mean Time.	Dec.	Gottingen Mean Time.	H. F.	Gottingen Mean Time.	H. F.
Jan. 2.	1842.	h. m. s.		h. m. s.		h. m. s.		h. m. s.		h. m. s.	
h. m. s.		0 3 40	123.0	0 21 39	152.0		142.0		139.2		142.0
23 47 55	162.0	0 4 3	159.0	0 21 57	131.0		148.0		139.5		132.6
23 48 20	121.0	0 4 20	124.0	0 22 12	151.0	1 27 0	143.0	Jan. 3.			141.3
23 48 35	164.5	0 4 40	160.0	0 22 28	132 0		147.0	24 0 0	142 0		135.0
23 48 56	119.0	0 4 58	123.0	0 22 43	152.0		144.0		137.3		141.8
23 49 9	165.0	0 5 17	163.0	0 23 2	138.0		148 0		144.3		135.2
23 49 23	118.5	0 5 31	121.0	0 23 22	157.0		143.0		136.0		140.0
23 49 41	167.5	0 5 49	163.4	1 11 0	140.0		146.0		146 8	24 18 0	135.0
23 49 58	115.5	0 6 4	121.0		148 0		143.0		133.0		141.0
23 50 20	167 0	0 6 25	161.3		142.0	1 28 0	147.0	24 2 10	146.0		133 6
23 50 35	117.0	0 6 40	125.0		145.0	1 38 0	145.0		134.0		142.0
23 50 51	166.0	0 7 0	157.8		142.0		147.0		145.0		134.5
23 51 16	117.7	0 7 20	128.0		144.0		145.0		135.0		141.0
23 51 28	164.0	0 7 35	158.3		143.0	Jan. 2,	H. F.		146.0	24 20 0	135.0
23 51 41	121.0	0 7 51	125.0	1 13 0	146 0	1842.			135.2		139.5
23 52 9	163 0	0 8 10	162.0		142 0	23 48 0	140.0		141.5		137.5
23 52 19	119.0	0 8 39	121.0		147.0		139.0		138.2		139.0
23 52 32	162 3	0 8 47	161.5		142.0		140.0		143.0		137.3
23 52 56	124.9	0 9 2	124.0		147.0		137.0		138 5		140 0
23 53 18	157.0	0 9 11	160.0		142 0		144.2		143 0		136.0
	124.0	0 9 40	125.0		149.0		135 0		137.0		141.5
23 53 40	155.0	0 10 0	158.0	1 16 0	140.0		145.0		144.0		135.0
23 54 0	124.5	0 10 12	125.0		151.0		135.5		134.5		140 0
23 54 15	160.0	0 10 31	160.0		139·0		144.5		142.7		136.5
23 54 30	122.0	0 11 59	123.0		150.0		134.3		135.0		133 0
23 54 47	162.0	0 12 18	163.5		140.0		145.5		146.5		143.0
23 55 4	121.0	0 12 36	118.0		149 0		135.0		134.0		132.0
23 55 19	162.0	0 12 55	165.5	1 17 0	140.0		146.0		145 8		143.0
23 55 34	120.0	0 13 11	119.0		150.0		135.0		134.3		135.0
23 55 52	163.0	0 13 28	165.0		140.0		144.0		143.0		142.0
23 56 13	120.5	0 13 42	118 0		150 0		136.0		138.0	1 8 0	136.5
23 56 32	160.0	0 14 0	165.5		142.0		142.0		143.0		139 0
23 56 50	124.0	0 14 18	120.0		148.0		140.0		134.6		136.0
23 57 3	159.0	0 14 38	164.0	1 18 30	140 0	23 53 0	140.0	24 9 35	142 0		141.0
23 57 25	123.7	0 14 52	119 5		149.0		142.5		132.5		136.0
23 57 38	157.0	0 15 11	162.0		141.0		136.0		144.0		140.0
23 57 51	126.0	0 15 27	122 0		149.0		144.0		134.0	1 16 0	133.5
23 58 13	156.0	0 15 40	161.0		141.0		135.0		139.0		141.4
23 58 30	125.0	0 16 0	123.0	1 20 0	149.0		143 4		133.3		132.5
23 58 48	158.0	0 16 17	160.0		141.0		139.0		141.2		140.5
23 59 2	122 5	0 16 34	123 5		147.0		142.0		134.0		133 0
23 59 19	161.5	0 16 50	158.5	1 21 0	142.0		136.0		140.3		140.5
23 59 33	119.0	0 17 9	125.5		148.0		143 2		130.3		133.9
23 59 50	163.5	0 17 27	155.0		142.0		137.0		141.0		140.0
Jan. 3.		0 17 44	129.0		147.0		143.5		133.0		134.9
0 0 15	119.0	0 18 0	153.0		142.0		136.0	24 11 48	142.0		140.5
	165.0	0 18 17	129.0	1 22 30	147.0		146.0	24 13 5	131.5		133.0
0 0 41	118.5	0 18 34	154 0		143.0		136.0		141.3		139.0
0 1 1	165.0	0 18 51	130.0		148.0		144.0		135.2		134.5
0 1 22	117.0	0 19 8	152.0		143.0		135.0		142 0	1 20 0	140.0
0 1 39	164.5	0 19 27	134 0		146.0		144.5		135.0		133.5
0 1 51	121.0	0 19 38	147.0		145.0		134.0		143.0		139.0
0 2 13	163.0	0 20 2	136.0		147.0		145.5		133.0		134.0
0 2 33	123.0	0 20 20	147.0	1 24 0	144.0		136.3		142.5		138.0
0 2 51	160.0	0 20 40	136.5		147.0		143.3		133.0		136.0
0 3 10	124.5	0 20 56	148.0		143.0		137.0		143.0		138.0
0 3 28	159.0	0 21 18	134.0	1 25 0	147.0		142 0		133.0	1 22 30	135.3

Sky clear; wind N. W. Moon bright. No trace of Aurora. Corr. Barometer, 29.725. Ex. Thermometer, 24° Fah.

Gottingen Mean Time.	Dec.	H. F.	Gottingen Mean Time.	Dec.	H. F.	Gottingen Mean Time.	Dec.	H. F.	Gottingen Mean Time.	Dec.	H. F.
Jan. 15,	1842.		h. m. s.			h. m. s.			h. m. s.		
h. m. s.			12 58 30		158.8	13 11 0	148.0	159.0		136.3	159.0
12 46 36	130.4	147.4		106.5	141.8		126.5	143.1		151.0	142 0
12 47 0	139.8	155.3	12 59 0	164.2	155.5		148.9	157.7	13 24 0	135.0	156 0
	127.0	148.6	12 59 30	106.3	143.0	13 12 0	128.0	143.2		152.5	143.8
	144.4	155.4		164.0	156.0		146.0	157.9		134.8	156.1
	124.6	144.0	13 0 0	106.0	145.3		132.0	141.0	13 25 0	152.0	143.9
12 48 0	146.8	159.8		163.2	155.6		143.0	158.2		134.2	157.0
12 48 15	123.0	140.8		107.0	145.2	13 13 0	134.1	141.8		151.6	143.1
12 48 30	148.0	162.1	13 0 30	161.8	153.1	13 13 30	140.6	157.2		138.0	155.9
12 49 0	121.2	141.3		108.1	143.4		136.1	142.9	13 26 0		143.4
	150.0	158.3	13 1 11	159.5	155.2		139.4	158.0		148.0	155.1
	120 8	144.8		109.5	143.0	13 14 0	136.2	143.1		141.1	145.1
	151.0	158.0	13 2 0	157.3	156.9		140 8	158.3		147.0	154.1
12 50 0	120.8	144.9		115 2	141.9		136.3	139.9	13 27 0	142.0	146.0
	149.0	159.2		153.0	155.8	13 15 0	138.8	159.9		145.6	153.2
	121.2	142.9	13 2 30	117.0	141.9		138.1	139.5		141.0	147.7
12 50 45	150.6	160.5		149.1	159.0		136.1	160.3		147.0	152.1
12 51 0	120.5	141.8			141.2		136.1	140.3	13 28 0	140.0	146.9
	153.5	158.8	13 3 0	121.2	159.6		141.4	161.9		148.0	152.0
	114 8	145 5		150.0	140.4	13 16 0	132.8	138.8		139.1	148.0
	160.0	156 5		119.0	161.0		144.2	162 9		148.0	151.3
	112.1	145.3	13 4 0	151.9	1 37.9		132.0	138.1	13 29 0	138.8	149.0
	162.8	157.0		119.5	163.8	13 17 0	147.5	161.7		147.6	150.8
	107.8	146.0		152.0	139.0		131.1	137.2		140 5	146.8
12 53 0	166.0	156.7	13 5 0	119.4	158.2		148.0	162.8	13 30 0	146.0	152.1
	107.2	147.0		152.9	141.3		132.8	139.1		143.0	145.2
		155.8		119.0	156.0	13 18 0	146 8	159.2		145.0	154.6
	164.0	144.2		152 0	144.4		133.1	141.0	13 31 0	140.0	147.1
	109.0	154.6	13 6 0	120.2	155.0		148.0	159.0		147.0	151.8
12 54 30	162.4	147.0		151.8	145.4	13 19 0	134.8	143.8			147.3
	109.5	155 3		122.5	152.5	13 19 8	144.7	158.0		139.8	153.5
	162.2	147.8	13 7 0	148.0	144.9		139 8	144.3	13 32 0	146.5	147.6
12 55 0	108.6	152.9		124.0	153.9		141.5	155.0		139.8	152.8
	163.8	148.1		146.8	145.1		140.8	145.9		144.8	147.7
12 55 30		153.2		125.5	154.9	13 20 0	140.0	153.2		140.7	151.9
	109.0	148.8	13 8 0	145.0	147.2		144.0	148.9	13 33 0	144.9	147.9
12 56 0	163.5	152.0	13 9 0	126.2	152.2		138.0	151.1		140.9	150.1
	110.0	151.0		146.1	144.9		147.0	148.9		144.5	148.1
		150.0		124.0	155.2	13 21 0	136 0	154.0	13 34 0	140.0	151.5
	162.5	151.0			143.2		149.0	147.8			148.3
12 57 0	108.0	153.0		147.4	156.0		137.6	153.2		145.0	152 2
	164.0	146.0		123.1	144.2		138.0	144.0		140.0	147.5
12 57 30	109.0	156.8	13 10 0	148.8	156.9	13 2[illegible]	149.5	156.1		147.0	152 5
	163.0	141.3		124.7	140.0		135.0	141.7	13 35 0	139.5	148.4
12 58 0	107.4	159.2		148.7	159.2			158.2	13 35 30	146.0	150.7
	164 2	142.2		125 2	140.9	13 23 0	150.0	148.3			

Thermometer Internal, 39 6 ; Ex. 26.0.

A Brief Abstract of the Observatory Records, giving some Account of the most conspicuous Auroras, and other Meteorological Phenomena that have been noticed and registered at Cambridge, during the Period embraced by the Magnetic Observations.

[The time is mean solar astronomical for Gottingen.]

November 18, 1841. — 13h. 44m. At this time a very beautiful Aurora was seen. The period of greatest brightness was 13h. 25m. The Horizontal-Force Magnetometer was then vibrating rapidly, and at 13h. 44m. it moved over ten divisions of the scale (201 – 212), but its disturbed movements gradually died away. At 13h. 50m. the Aurora had nearly vanished, leaving only faint traces of columns. The Declination-Magnetometer had its ordinary slow motion. The readings of the Horizontal-Force Magnetometer, for a short time, commencing at 13h. 47m. 30s., were:

200.5	196.0		195.8	204.0
204.0	202.0		200.5	201.6
198.0	197.3		195.8	205.8
204.0	201.0	1h. 56m.	205.0	202.0
199.0	196.3		199.0	205.0
200.5	201.3			

At 14h. 30m. there was observed in the north a large, bright arch of light, moving slowly westward, and also small, drifting spots of bright light near the horizon. At 14h. 40m. the illumination extended from the northern horizon up to 30° of altitude. At 17h. the Aurora was shining brightly again.

December 24, 1841. — At 12h. delicate shoots of Aurora nearly up to the zenith were visible. At 12h. 10m. the Aurora disappeared near Capella, but grew brighter in the zenith. At 12h. 12m. it disappeared from the zenith, and shone again in Auriga. At 12h. 16m. no trace of the Aurora could be seen; the Magnetometers swung over fifteen divisions of the scale. At 12h. 21m. the Aurora was invisible. The declination stood at 144.8; the Horizontal Force read 149 – 158.

January 4, 1842. — From 11h. 45m. to 12h. 15m. an Aurora was seen in the northeast and northwest. The Magnetometers were stationary, except in the interval from 12h. 2m. to 12h. 8m., when the Declination changed from 140.8 to 143.2, and the Horizontal-

Force Magnetometer from 151.1 to 153.3. At this time the Aurora had begun to fade.

January 5, 1842. — About 12h. an auroral arch was visible in the northeast, at the altitude of 8°, but it soon died away.

January 7, 1842. — At 16h. 14m. an arch of Aurora, 12° high, was seen in the north-northwest. The same arch, with another resting on it, at 20° altitude, was visible at 16h. 24m.; at 16h. 34m. the upper arch was partly broken; at 16h. 39m. a similar appearance was presented in the southeast. In both these arches stars were visible, though nowhere else, as it was cloudy.

January 9, 1842. — At 14h. 45m. a light appeared, shining through the clouds in the north. The following readings of the Declination were taken, commencing at 15h.: — 137, 145, 138, 142, 141.5, 142, 138, 144, 137, 146, 142, 142.3, 142.1, 145, 138, 144. At 0h. 15m. of January 10, the Declination Magnetometer had the same irregular vibration; at all these times, the Horizontal-Force Magnetometer was moving apparently at random, from 139 to 149; the attached thermometer standing at 35°.

January 15, 1842. — During the extra observations of this day a feeble Aurora was noticed. A few columns and heaps of light were moving slowly from east to west. The Aurora still continued at the end of the observations. A diffused arch was visible in the north-northeast, whose apex was from 10° to 12° high. From 2h. 50m., when the arch was bright, till 3h. 5m., the Declination Magnetometer was observed, during which time it crept from 134 to 144, and then began to vibrate from 144 to 145.

February 11, 1842. — At 14h. a slight Aurora was observed.

February 19, 1842.

At 3h. the Barometer stood at	29.400, and the Ex. Therm. at	53.8	Violent rain, wind S. W. 3.
4 0	29.387	53.8	" " " W.S.W. 5.
4 10	29 416		" " " "
4·20	29.393	52.3	" " " S. W. 3.
4 30	29 378	52.1	Moderate rain.
10 12	29.520	40.0	Wane clouds, 1; wind W. 2.
Feb. 20.			
7 10	30.290	29.0	Clear and calm.

August 8, 1842. — At 20h. 0m. an auroral light was seen in the north.

MEANS OF THE DECLINATION.

Camb. Mean Time.	Gott. Mean Time.	1841. Oct.	Nov.	Dec.	1842. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	MEANS.	
A. M.																	
h. m.	h. m.																
6 36	0 0	147.7	145.5	143.5	142.8	144.0	140.1	141.1	155.7	158.2	157.9	160.4	155.8	153.5	148.0	149 6	149.7
7 6	0 30	149 1	146.1	142.7													
7 36	1 0	148.5	146.2	142.8			143.7	144.0	156 6	157.4	160.5		155.2	155.0	151.0	151.0	151.0
8 6	1 30	149.8	147.3	143 8													
8 36	2 0	149.3	146.6	143.4	144.8	144.0	143 2	141.3	154.2	158 0	160.3	158.6	156 6	155.8	149.4	150.4	150.7
9 6	2 30	149.0	146.0	144.9													
9 36	3 0	148.0	145.2	144.2			143.0	140.6	151.7	153.8	155 6		154.1	156.6	151.9	149.5	149.5
10 6	3 30	147.4	142.8	142 0													
10 36	4 0	147.1	141.4	139.8	140.4	141.2	138.8	136.2	147.3	150.4	152 1	148.3	150.2	152.1	147.5	145.2	145.7
11 6	4 30	145.7	141.1	138.9													
11 36	5 0	142.5	140.0	137.3			135.0	133.7	143.6	146.1	149.6		149.3	152.0	147.3	143.3	143.3
P. M.																	
12 6	5 30	144.1	138.3	135.8													
12 36	6 0	143.1	137.7	135.8	135.6	137.1	131.3	132.1	142.6	144.8	145.3	143.5	147.7	148.9	145.4	140.8	141.3
1 6	6 30	143 9	138.0	134.7													
1 36	7 0	142.5	138.7	134.6			129.8	131.2	141.8	144.3	145 6		147.9	149.1	145.9	141.0	141.0
2 6	7 30	141.8	139.2	135.0													
2 36	8 0	142.7	140.4	136.7	136.8	136.3	130.4	131.0	143.7	145.5	144.1	147.6	148.2	148.8	147.5	141.4	141.7
3 6	8 30	144.8	140.2	136.2													
3 36	9 0	146.0	141.1	137.2			132.8	132.3	146.3	147.2	147.1		150.1	148.5	148.9	143.4	143.4
4 6	9 30	147.1	141.4	138.5													
4 36	10 0	148.3	142.4	140.8	139.1	137 5	134.3	133.0	147.4	150.3	147.3	153.6	151.6	150.6	146.0	144.4	144.7
5 6	10 30	147.6	142.8	141.4													
5 36	11 0	148 4	143.4	142.1			136.7	135.6	148.8	151.2	150.1		150.2	150.0		145 6	145.6
6 6	11 30	149.6	144.1	142.5													
6 36	12 0	150.1	145.0	143.7	140.2	139.9	138.4	137.0	149.8	151.8	149.8	153.0	151.2	151.7	149.2	146 5	147.1
7 6	12 30	151.3	145.1	142.7													
7 36	13 0	152.5	145.7	142.7			137.8	138.1	150.4	151.5	153.4		150.1	152.9	149.1	147.7	147.7
8 6	13 30	152.5	146.2	143.2													
8 36	14 0	152.8	146.7	144.5	142.6	141.5	139.1	138.6	151.7	153.1	149.6	151.6	153 9	152.1	149.2	147.6	148.3
9 6	14 30	153 5	145.5	144.1													
9 36	15 0	152.0	145.2	144.4			139.6	140.7	151.6	153.1	152.3		152.6	151.7	150.1	148.5	148.5
10 6	15 30	151.0	145.2	143.0													
10 36	16 0	153.8	144.9	143.1	143.1	143.4	139.7	139.1	153.7	153.8	150.7	153.1	151.8	152 5	151.4	148.1	148.6
11 6	16 30	148.3	145.0	142.9													
11 36	17 0	149.4	144.3	142.0			139.4	138.7	151.8	152.8	151.8		152.8	153.0	147.9	147.6	147.6
A. M.																	
12 6	17 30	145.4	144 5	142 4													
12 36	18 0	146.5	144.5	142.5	141.7	143 0	139.0	138.5	151.3	154.1	151.0	153.0	153 4	150.6	149.5	147.0	147.4
1 6	18 30	145 8	143.2	141.5													
1 36	19 0	146.2	144 4	140.1			139.2	138.9	151.5	154 5	152 4		150.2	150.8	148.8	147.0	147.0
2 6	19 30	147.5	144 2	140.1													
2 36	20 0	150.1	145.2	142.3	141.3	142.9	139.1	138.5	151.9	154.2	151.2	151.6	151.2	150.9	147.0	147.0	147.4
3 6	20 30	149.3	144.7	143.0													
3 36	21 0	149.7	145.2	143.3			138.8	138.6	152.2	153.2	151.2		153.3	151.4	146.2	147.6	147.6
4 6	21 30	150.4	145.4	143.2													
4 36	22 0	150.3	146.2	142.4	141.0	141 5	138.7	139.6	152.8	153.5	149.9	155.9	151.1	152.6	146.5	147.3	147.6
5 6	22 30	146.5	145.6	143 7													
5 36	23 0	146.0	145.3	143 8			139.9	141.6	156.6	156 4	152 5		151.2	152.1	144.6	148.2	148.2
6 6	23 30	147.2	144.8	143.0													
Means,		148.0	143.5	139.2	140.8	141.0	137.8	137.5	150.2	152.0	151.3	152.5	151.6	151.8	148.2	146.5	145.8
Absolute Values,		9° 28′ 38″	33′ 3″	35′ 9″	33′ 1″	31′ 10″	33′ 52″	36′ 44″	36′ 3″	35′ 8″	35′ 49″	35′ 12″	34′ 46″	34′ 48″	37′ 26″	34′ 21″	34′ 52″

BAROMETRIC MEANS.

Camb. Mean Time.	Gott. Mean Time	1841. Oct.	Nov.	Dec.	1842. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	MEANS.	
A. M. h. m.	h. m.																	
6 36	0 0	30 207	29 747	29 898	29.806	29.631	29.896	29.819	29.827	29.980	29.912	30.046	29.859	29.807	30 048	29.883	29.891	29 907
7 36	1 0	30.223	29.691	30.133			29.904	29.820	29 862	29.887	29.934		29.883	29.834	29.754		29 902	29.902
8 36	2 0	30.183	29.770	29.894	29.923	29.823	29.888	29.792	29.791	29.965	29.942	30.036	29.839	29.852	29.984	29.915	29.906	29.901
9 36	3 0	30.165	29.809	30.017			29 955	29.822	29.825	29.925	30.011		29.830	29.843	30.006	29.991	29.933	29 933
10 36	4 0	30.109	29.807	29.931	29.977	29.970	29.858	29.853	29.741	29.907	29.833	30.008	29.814	29 879	29.992	29.944	29.908	29.889
11 36	5 0	30.149	29.786	29.996			29.910	29 814	29.783	29.912	30.000		29.798	29.669	29.777	30.087	29.890	29 890
P. M.																		
12 36	6 0	30.124	29.768	29.913	29.903	29.929	29.837	29.770	29.812	29 919	29.835	29.993	29.734	29.866	29.908	29.790	29.873	29.856
1 36	7 0	30.114	29.741	29.985			29.871	29.789	29.707	29.912	29.798		29.675	29.811	29.624	29 776	29.817	29.817
2 36	8 0	30.107	29.752	29.956	29.895	29.885	29.899	29.776	29.664	29.889	29.818	29.979	29.728	29.871	29 881	29.855	29.864	29.850
3 36	9 0	30.111	29.737	29.952			29.917	29.747	29.694	29.842	29.885		29 832	29.813	29.598	29.925	29.838	29.838
4 36	10 0	30 093	29.684	29 892	29.892	29.795	29.835	29.755	29.753	29.934	29.860	29.964	29.868	29.913	29.997	29.809	29.870	29 866
5 36	11 0	30.128	29.753	29.942			29.880	29.818	29 677	29.816	29.887		29.752	29.827	30.126	29 966	29.881	29.881
6 36	12 0	30.106	29.784	29.937	29.875	29.769	29 903	29.785	29.788	29.888	29.868	30.008	29.753	29.767	29 916	29.782	29 862	29.856
7 36	13 0	30.127	29.765	29.938			29.892	29.764	29.789	29.865	29.906		29.825	29.821	29.965	29 452	29 842	29.842
8 36	14 0	30.120	29.760	29 880	29.884	29 742	29.938	29.758	29.808	29.954	29.900	30.018	29.866	29.935	29.924	29.678	29.876	29 877
9 36	15 0	30.154	29.765	29.890			29.893	29.768	29.831	30.013	29.928		29.866	29.923	29.980	29.724	29.895	29 895
10 36	16 0	30.090	29.761	29.911	29.846	29.682	29.907	29.772	29.834	29.996	29.917	30.027	29.853	29.899	29.963	29.800	29.884	29.892
11 36	17 0	30.115	29.751	29.888			29.910	29.734	29 812	29.983	29.995		29.859	29.894	30.026	29.843	29.901	29.901
A. M.																		
12 36	18 0	30.127	29.757	29.888	29.802	29.652	29 934	29.795	29.869	29.989	29.887	30.022	29 860	29.868	30 002	29.781	29.882	29.896
1 36	19 0	30 138	29.754	29.934			29.920	29.766	29 797	29.934	29 981		29 842	29.775	29 995	29.811	29.887	29.890
2 36	20 0	30.131	29.758	29.911	29.778	29.637	29.936	29.754	29 801	29.992	29.891	30.016	29.836	29 806	29.989	29.854	29.873	29.888
3 36	21 0	30.121	29.753	29.869			29.910	29 744	29.813	29.961	29.966		29.785	29.801	30.054	29.857	29.886	29.886
4 36	22 0	30.149	29.758	29.884	29.809	29.635	29.912	29 766	29.828	29 958	29.889	30.031	29.828	29 809	30 284	29 824	29.891	29.907
5 36	23 0	30.183	29.768	29.867			29.881	29 768	29.814	29.900	29.973		29 873	29.799	30.106	29 748	29.890	29 890
Means,		30.137	29.757	29.929	29.866	29.762	29.899	29 781	29.788	29.930	29.909	30.012	29.819	29.837	29.954	29 830	29.881	29 881

DIURNAL OSCILLATION OF THE DECLINATION.

		1841.			1842.													
		WINTER MONTHS.							SUMMER MONTHS.							WINTER MONTHS.		
Gott. M.T.	Camb. M. T.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Mean	April.	May.	June.	July.	Aug.	Sept.	Mean.	Oct.	Nov.	Mean of all.
	A. M. h. m.																	
0	6 36	5.2	7.8	8.9	7.2	7.7	10.3	7.8	10.1	13 9	13.9	13.8	16.9	8.1	12.8	5.6	2.6	8.8
1	7 36	6.0	8.5	7.2			13.9	8.9	13.0	14 8	13.1	16.4		7.5	13.0	7.5	5.6	10 2
2	8 36	6.8	8.9	8.8	9.2	7.7	13.4	9.1	10.3	12.4	13.7	16 2	15.1	8.9	12.8	7.3	4.0	9.6
3	9 36	5.5	7.5	9.6			13.2	8.9	9.1	9.6	9.9	9.5	11.5	6.4	9.3	8.1	6.5	8.7
4	10 36	4.6	3.7	5.2	4.8	4.9	9.0	5.4	5 2	5.5	6.1	8.0	4.8	2.5	5.3	3.6	2.1	4.4
5	11 36	0.0	2.3	2.7			5 2	2.5	2.7	1.8	1.8	5.5		1.6	2.7	3.5	1.9	2.5
	P. M.																	
6	12 36	0.6	0.0	1 2	0.0	0.8	1.5	0.7	1.1	0.8	0.5	1.2	0.0	0.0	0.6	0.4	0 0	0.0
7	1 36	0.0	1.0	0.0			0.0	0.2	0 2	0.0	0.0	1.5		0.2	0.4	0.6	0.5	0.2
8	2 36	0.2	2.7	2.1	1.2	0.0	0.6	1.1	0.0	1.9	1.2	0.0	4.1	0.5	1.3	0.3	2.1	0.6
9	3 36	3.5	3.4	2.6			3.0	3.1	1.3	4.5	2 9	3.0		2.4	2.8	0.0	3.5	2 6
10	4 36	5.8	4.7	5.2	3.5	1.2	4.5	4.2	2.0	5.6	6.0	3 2	10.1	3.9	5.1	2.1	0.6	3.6
11	5 36	5.9	5.7	7.5			6 9	6.5	4.6	7.0	6.9	6.0		2.5	5.4	2 5		4 8
12	6 36	7.6	7.3	8.1	4.6	3.6	8.6	6.6	6.0	8.0	7.5	5.7	9.5	3.5	6.7	3.2	3.8	5.7
13	7 36	10.0	7.0	7.1			8.0	8.0	7.1	8.6	7.2	9.3		2 4	6.9	4 4	3.7	6.9
14	8 36	10.3	9.0	9.9	7.0	5.2	9.3	8.4	7.6	9.9	8.8	5 5	8.1	5.2	7.5	3.6	3.8	6.8
15	9 36	9.5	7.5	9.8			9.8	9.1	9.7	9.8	8.8	8.2		4.9	8.3	3.2	4.7	7.7
16	10 36	10.3	7.2	8.5	7.5	7.1	9.9	8.4	8.1	11.9	9.5	6.6	9.6	4.1	8.3	4.0	6.0	7.3
17	11 36	6.9	6.6	7.4			9.6	7.6	7.7	10.0	8.5	7.7		5.1	7.8	4.5	2.5	6.8
	A. M.																	
18	12 36	3 0	5.8	7.9	6.1	6.7	9.2	6.4	7.5	9 5	9.8	6.9	9.5	5.7	8.1	2.1	4.1	6.2
19	1 36	3.7	6.7	5.5			9.4	6.3	7.9	9.7	10.2	8.3		2.5	7.7	2.3	3.4	6.2
20	2 36	7.6	7.5	7.7	5.7	6.6	9.3	7.4	7.5	10.1	9.9	7.1	8.1	3.5	7.7	2.4	1.6	6.2
21	3 36	6.2	7.5	8.7			9.0	7.8	7.6	10.4	8.9	7.1		5.6	7.9	2.9	0.8	6.8
22	4 36	7.8	8.5	7.8	5.4	5.2	8.9	7.3	8.6	11.0	9.2	5.8	12.4	3.4	8.4	4.1	1.1	6.5
23	5 36	3 5	7.6	8.2			10.1	7.3	10.6	14.8	12.1	8.4		3.5	9.9	3 6	0.8	7.4

MAGNETIC DECLINATION.

Date.	A.	B.	β.	C.	γ.	D.	δ.	E.	ε.	M.
1841.			h. m.		h. m.		h. m.		h. m.	
Oct. 26.	147.90	3.11	14 50	2.80	2 31	.80	6 13			
Nov. 1.	149.80	3.96	10 56	2.19	2 11	1.34	6 35			
8.	141.85	2.98	9 50	2.60	1 59	.72	4 1			+.050
15.	141.75	1 88	9 32	2.01	2 28	.89	6 28			
22.	141.37	3 15	10 56	2.55	2 59	.48	7 39			
29.	142.11	2.22	10 52	1.54	0 55	1.00	7 22			
Dec. 7.	141.60	2.05	10 13	1.68	1 35	1.10	3 16			
13.	142.10	1.90	12 12	2.52	1 53	.64	6 45			+.012
20.	140.97	1.22	15 0	3.46	1 15	.91	7 25			+.016
27.	142.00	2.82	11 29	1.95	2 5	.27	7 52			—.017
1842.										
Jan. 3.	140.80	2 54	10 28	1.98	1 52	2 22	0 11			+.001
10.	140.70	2.45	10 20	1.89	2 21	1.37	7 55			+.001
17.	141.28	2.70	9 29	3.31	1 23	1.38	1 39	1.05	4 44	—.035
24.	139.70	2.05	7 57	2.07	0 35	.47	6 47			+.063
31.	141.60	3.10	9 56	2.62	1 34	1.96	0 18			
Feb. 7.	139.02	1.45	8 12	2.40	0 4	1.95	7 38			
14.	144.10	5 24	9 13	2.40	0 34	1.63	5 3			— 200
21.	141.10	2.28	6 6	1 21	0 49	.50	0 0			

The above are the co-efficients of the formula

$$D = A + B \sin(t+\beta) + C \sin 2(t+\gamma) + D \sin 3(t+\delta)$$

expressing the mean diurnal curve of the week commencing with the annexed dates; t being the time, counted from mean noon at Gottingen.

M is the mean hourly change, *independent* of solar time. To the above formula may be added, then,

$$\pm M\,(t - 2h.).$$

BAROMETER.

Date.	A.	B.	β		C.	γ.		D.	δ.		M.
1841.			h.	m.		h.	m.		h.	m.	
Oct. 26.	30.128	.029	4	43	.021	1	5	.006	1	7	+.001
Nov. 1.	29.712	.007	3	54	.022	11	28	.004	4	19	—.009
8.	30.068	.041	6	0	.010	11	37	.011	5	40	—.006
15.	29 519	.009	11	32	.008	1	37	.005	5	5	
22.	29.740	.023	4	28	.023	1	0	.008	0	0	—.001
29.	30.109	.034	2	8	.012	1	23	.017	6	13	—.007
Dec. 7.	29.846	.009	15	24	.014	2	16	.003	0	25	—.004
13.	29.781	.010	9	0	.024	0	0.5	.021	6	48	+.008
20.	30.207	.029	16	14	.008	0	28	.013	7	36	
27.	30.039	.036	3	24	.017	0	1	.014	7	32	+.00025
1842.											
Jan. 3.	29 915	.032	16	20	.018	1	15	.018	7	15	+ 004
10.	29.814	.072	5	53	.029	1	2	.021	6	54	—.001
17.	29 869	.011	7	48	.022	0	48	.013	5	54	—.009
24.	30.181	.030	17	30	.009	10	52	.005	1	52	—.020
31.	29.834	.036	3	14	.017	5	32	.011	6	14	
Feb. 7.	29.926	.029	22	48	.019	11	10	.004	7	0	—.011
14.	29.714	.124	1	37	.037	2	13	.019	5	9	—.015
21.	30.193	.009	10	15	.012	11	50	.004	6	56	—.002

The above are the co-efficients of the formula

$$H = A + B \sin (t + \beta) + C \sin 2 (t + \gamma) + D \sin 3 (t + \delta)$$

expressing the mean diurnal curve, during the week commencing with the annexed date; t being the hour, counted from mean noon at Gottingen.

M is the mean hourly change, *independent* of solar time, to be applied by the formula

$$\pm M (t - 2h.).$$

THERMOMETER.

Date.	A.	B.	β.		C.	γ.		D.	δ.		M.
1841.			h.	m.		h.	m.		h.	m.	
Oct. 26.	38.53	8.36	22	32	3.03	8	58	.12	4	27	+.18
Nov. 1.	50.90	6.85	22	36	4.29	10	45	.39	4	6	—.15
8.	33.12	4.06	23	3	1 64	7	57	.18	7	10	+.05
15.	33.80	3.74	22	12	1.45	9	30	.44	4	30	
22.	39.79	2.75	21	25	1.74	12	0	.61	4	56	—.09
29.	28.71	3.42	22	48	2 70	8	23	.92	4	12	
Dec. 7.	33.50	3.84	23	18	2 24	8	27	.63	4	27	+.26
13.	38.90	3.16	21	41	.99	7	30	.13	4	18	+ 04
20.	22.70	3.38	22	44	.82	9	28	.22	1	24	+.04
27.	29.90	5.19	20	52	2.09	8	42	.64	2	59	—.04
1842.											
Jan. 3.	16.60	3.86	22	34	1.18	8	50	.22	3	36	+.04
10.	34 20	4.80	18	41	3.12	8	1	1.04	4	12	
17.	36.97	8 01	22	4	3.92	8	1	1.20	3	39	
24.	20.25	6.96	22	29	3 01	7	44	1.07	4	1	
31.	43.70	4.39	21	15	1.81	9	13	1.10	4	8	
Feb. 7.	28.70	5.96	21	48	2 94	7	48	.90	4	6	
14.	35.80	5.50	19	48	3 21	9	3	.53	0	29	
21.	24.27	4.73	21	52	2 08	7	50	.07	7	0	

The above are the co-efficients of the formula

$$T = A + B \sin (t + \beta) + C \sin 2 (t + \gamma) + D \sin 3 (t + \delta)$$

expressing the mean diurnal curve for the week succeeding the annexed dates; t being the time, counted from mean noon at Gottingen.

M is the mean hourly change, *independent* of solar time. It may be added to the formula, thus,

$$\pm M (t - 2h.).$$

part of the whole; that is, we have to measure effects, such as would be produced by shifting the centre of gravity through the *one-millionth of an inch.* It will be easily understood, from this statement, how great must be the effect of a minute disturbance of the relative parts of the instrument, or of inequalities in the bearing points of the axle; and experience has accordingly shown that it is altogether unavailable for the determination of changes of long period.

"The same difficulties, and from the same source, have been found to attach to the usual method of observing the *magnetic inclination,* and its changes, however refined the construction of the instrument. The sources of error seem, in fact, to be inherent in every direct process of determining the third element; and it is only by an *indirect* method that we can hope to evade them.* Of this character is the method now proposed.

"If a soft iron bar, perfectly devoid of magnetic polarity, be held in a vertical position, it immediately becomes a temporary magnet under the inducing action of the earth's magnetic force, the lower extremity becoming a north pole, and the upper a south pole. Accordingly, if a freely suspended horizontal magnet, whose dimensions are small in comparison with those of the bar, be situated near, in a plane passing through one of these poles, it will be deflected from the magnetic meridian. The deflecting force is the induced force of the bar, which may be regarded as

* Two such indirect methods of determining the inclination have been proposed in Germany, one by Professors Gauss and Weber, the other by Dr. Sartorius von Walterhausen. That now suggested bears a close analogy, in principle, to the former of these; it differs from it, however, not only in the means employed, but also in the end in view, — the main object of the present method being the determination of the inclination-changes.

proportional to the energy of the inducing cause, that is, to the *vertical component* of the earth's force; while the counteracting force is the *horizontal component* of the same force, acting directly on the magnet itself, to bring it back to the magnetic meridian. Thus the magnet will take up a position of equilibrium, under the action of these opposing forces; and this position will serve to determine the ratio which subsists between them. When the right line connecting the centre of the horizontal magnet, and the acting pole of the bar, is perpendicular to the magnetic meridian, the tangent of the angle of deflection will measure the ratio of the two forces, and will therefore be proportional to the *tangent of the magnetic inclination.* Accordingly, by observing the changes of position of the horizontal magnet, so circumstanced, we can infer those of the inclination itself.

"But the iron bar may have (and generally will have) a certain portion of *permanent* magnetism, which will concur with the induced magnetism in producing the deflection; and it becomes necessary to institute the observations in such a manner as to be able to eliminate the effects of this extraneous cause. For this purpose we have only to invert the bar, so that the acting pole, which was uppermost in one part of the observation, shall be lowermost in the other. The induced polarity will, under these circumstances, be opposite in the two cases; and the acting force will, in one case, be the *sum* of the *induced* and *permanent* forces, and in the other their *difference.*"

In another communication made soon after, Professor Lloyd assures the Irish Academy of his confidence in his new instrument for observing *changes* of inclination, though he is distrustful of its value for giving *absolute* results. He justly remarks, that sources of error or disturbance, which mutually compensate when an instrument is used for differential quantities, may stand out in their full magnitude in the other application of it. It appears, therefore, that the Inclination and the Vertical Component, which are functions of each other and of the Horizontal Force, are not yet susceptible of the same accurate determination which is claimed for the other elements of Terrestrial Magnetism. All the methods that have been used for observing inclination require so much time as to preclude the idea of observing directly momentary *changes* of inclination, and deducing from them corresponding variations in the Vertical Force. The Dipping Needle of Mr. Fox, a full description of which may be found in several scientific journals, furnishes a more convenient and exact method of determining dip and intensity than the ordinary Dipping Needle. An observation was made on the dip at Cambridge with one of these improved instruments, by Lieutenant Lefroy, of the Toronto Magnetic Observatory, which gave the mean dip at that place on October 3d, 1842, between 10h. 30m. and 11h. 30m., mean solar time at Cambridge, 74° 19.5′. An instrument of this kind is now placed at the Cambridge Observatory, from which more accurate observations on dip may be expected than have yet been made at this place.

The observations at Cambridge have been published chiefly with a view to their easy distribution, and not with the expectation of deducing from them alone any of the great laws of magnetic influence on our planet. However long and complete such a series of observations might have been considered formerly, it forms but a small part of the rich fund that has been or will be created by the recent coöperation of so many observers in remote parts of the earth, in Observatories stationed and appointed for this purpose, with all the wisdom and munificence which come from the advice of learned societies and the patronage of government.

Any conclusive inference drawn from the phenomena at one place before they have been compared with contemporaneous observations elsewhere, made with the same kind of instruments, would be unsafe, and might be prejudicial to the truth. Still, an early publication, besides being the best mode of making what it contains generally accessible, may be of service in enlarging the experience of observers, and pointing out modifications in the system to be hereafter pursued. With a view, probably, to some such object, and in anticipation of a more comprehensive work at last, Colonel Sabine has recently published, in the name of the British Government, the observations which have been made at several of the magnetic stations *during days of unusual magnetic disturbance.* The period included is between March, 1840, and January, 1842. These extraordinary derangements in the earth's magnetism constitute that residual portion of the whole force which stands out after the periodical and secular changes have been compensated or eliminated. They may very properly, therefore, be separated from the regular changes, and become a distinct object of investigation. Perhaps they are destined, at a future time, to present an *experimentum crucis* of a just theory of Terrestrial Magnetism, induced from the ordinary facts of the science, and developed into some such remarkable consequence as a magnetic hurricane. A comparison of observations made at the different stations shows that a magnetic storm, although it may commence later, or be felt longer or more violently, at one spot than another, has the range of the whole globe for its play-room, and manifests itself, beyond doubt, in the most distant parts of the planet at the same general period. In our former communication, this opinion was advanced on the strength of limited comparisons made between Cambridge and Toronto, and the authority of others who had given attention to the same point. But the proof is accumulated to a demonstration in the volume of Colonel Sabine, where we have the comparison of Toronto with Prague, in the heart of Europe, and Van Diemen's Land; and, on some occasions, with the Cape of Good Hope, St. Helena, and the wastes of the Southern waters. The practice of these Observatories has been, to watch the instruments with great care, whenever the changes exhibited any extraordinary extent or frequency. Mr. Sabine finds from the records, that out of twenty-nine principal disturbances, in 1841, the largest number manifested themselves under various modifications at the three first mentioned stations, and that the days of greatest disturbance in the year were the same at each. It is further observed, that on thirteen days out of the twenty-four days of unusual disturbance at Toronto, in 1841, the Aurora was visible, and that all these days were marked by magnetic disturbances at Prague and Van Diemen's Land. On the remaining thirteen days, the sky at Toronto was so far overcast that the Aurora could not have been seen, on the supposition that it existed. Mr. Sabine concludes that the Aurora, which has long been associated, in the time of its appearance, with *local* magnetic changes, must now be considered as more especially a *local manifestation* of those grand magnetic hurricanes which swell over large portions of the planet, breaking furiously upon certain favored spots, and acting nearly simultaneously in places widely separated from each other.

As some of the magnetic Observatories had not gone into full operation till the commencement of 1841, the comparison is limited to that year. It would have been desirable to have included Cambridge in the same examination, but our observations for that year are too defective. The observations which are now published will furnish ample materials for this purpose, whenever the extra observations, made at the other stations in 1842, shall be published. Although I have not thought it advisable to bring the short time at the close of 1841, during which we had observations at Cambridge, into a public comparison with Mr. Sabine's Table, for fear of anticipating a more satisfactory examination of this question hereafter, I have privately done so, and will simply state, that October 26 seems to bear the traces of that disturbance which prevailed at Prague, Van Diemen's Land, St. Helena, and Toronto, on October 24, 25, and 26, accompanied at the latter place by the Aurora; that November 18 and 19, which were marked at all these other places by great disturbances and by the Aurora also at Toronto, are noted at Cambridge for the Aurora and extraordinary magnetic perturbations; and that December 3, 8, and 30, are remarkable with us, as they also appear by Mr. Sabine's Table to have been at two or more of the four other Observatories. It is particularly matter of regret that no observations were made at Cambridge on the twenty-fifth and twenty-sixth of September, 1841, that we might have seen whether the disturbing energy which swept for several days so large a portion of the globe, and which was felt at Toronto, Greenwich, Prague, Cape of Good Hope, St. Helena, Trevandrum, in India, Van Diemen's Land, and possibly at the Bay of Islands, in New Zealand, extended to our own latitude and longitude.

We have just had the pleasure of receiving, as a present from the British Government, a beautiful volume, containing the *regular* observations made at Toronto during the first magnetic campaign of 1840–1842 inclusive. This was the period originally comprised in the grand magnetic confederation. Three years, constituting the second crusade, have now been added, so that the whole enterprise will not be concluded till the close of 1845. In this volume, which is published under the care of Mr. Sabine, the curves for all the Term-days are projected and placed side by side with the corresponding ones derived from the observations made at Cambridge and Philadelphia, on this Western Continent, and at Prague, in Europe. The simultaneous character of the American disturbances is exceedingly striking; the magnetic impulse is felt over the whole continent. But Mr. Sabine concludes, from the data before him, that the same derangement does not always sweep both continents; and this difference will appear on an examination of the beautiful plates with which the volume is enriched. We shall do him and the subject better justice to transcribe his conclusion in his own words.

"The correspondence which is so strikingly manifested in the fluctuations of the declination and horizontal-force in America, and which has its counterpart in the correspondence shown by the term observations at the different stations in Europe, is not found to prevail in any thing like the same degree between the curves of the two continents when they are exhibited in comparison. Nevertheless, indications are not wanting of participation in disturbances having a common cause. The character of the Term-day in respect to the degree of the disturbance by which the magnetometers are affected may always be derived alike, whether we view the European or the American curves: and instances are not infrequent of individual perturbations, common to both continents, having their culminating points at the same observation instant. These are sometimes disturbances in the same direction in both continents, and sometimes in opposite directions. On the other hand, there are perturbations, and occasionally of considerable magnitude, in the one continent, of which no trace is visible in the observations on the other. The Term-day observations in this volume bear testimony, therefore, to the manifestation of simultaneous disturbances on the two continents; and from the volume of 'Observations on Days of unusual Disturbance,' we know that this simultaneity extends to stations much more remote from each other than Europe and America. In reviewing this result, we must combine with it the no less certain conclusion, derived from the discussion to which the disturbances occurring at the regular observation hours at Toronto have been subjected, that these interesting and remarkable phenomena exhibit at Toronto a systematic action connected with, and apparently having relation to, the hours of the day."

The period embraced in this communication has been deficient, it would seem, in that most beautiful of all meteoric phenomena, the Aurora. Several feeble manifestations of it are recorded, but only on one occasion did it assume its usual brilliancy in this latitude. This was on the 18th of November, 1841, when extra observations were made on the disturbed magnetometers. The Toronto observations show that a similar derangement, accompanied with a brilliant Aurora, occurred on the same day at that place. On the 15th of January, 1842, the same coincidence is noticed at Cambridge between the appearance of this mysterious visitant and the derangement of the earth's magnetic axis. It is satisfactory to find this additional confirmation to that law of dependence between the two phenomena, which has forced itself on the minds of meteorologists, however difficult or impossible even it has been for them to assign its definite character, or mould it to any precise mathematical expression. If facts are better than unaided speculation, and if induction is still the true method of our philosophy, we may promise ourselves that a rich harvest will come from the diligence and fidelity which are now toiling in the various fields of meteorology, although we ourselves may not live to reap it.

The following Table is compiled from pages 52–3 of my former communication, and pages 139–40 of the present one. In a parallel column by the side of the Cambridge record, I have placed an abstract from the Toronto Meteorological Journal for the same date, that it may appear how often the appearance of the Aurora is simultaneous at both stations, and how often the failure is explained by the sky being overcast at Toronto. I have not given the precise hour and minute when the several phases of the Aurora were seen at the two places. In some cases, the coincidence of time is striking; in other instances, the dates assigned to the phenomena differ by several hours. I content myself with pointing out the general agreement as to the nights when the phenomena are witnessed, referring, for minuter comparisons, to my own paper and the volume of Col. Sabine. It seems, that on some of the days when the Aurora was seen at Cambridge, no entry of any kind is made in the Toronto journal. This fact, from which we infer fair weather at that place, is indicated by a straight mark in the line corresponding to those days.

1840.	CAMBRIDGE.	TORONTO.
April 24–5.	Slight Aurora.	———
May 28–9.	Remarkable Aurora.	Cloudy.
May 29–30.	Brilliant Aurora.	Brilliant Aurora.
June 26–7.	Aurora.	Cloudy.
July 4–5.	Aurora.	———
July 29–30.	Aurora.	———
August 19–20.	Aurora.	Aurora.
August 28–9.	Fine Aurora.	Fine Aurora.
October 22–3.	Aurora.	Aurora.
November 30–1.	Aurora.	Probably overcast.
1841.		
November 18–19.	Beautiful Aurora.	Brilliant Aurora.
December 24–5.	Aurora.	Overcast.
1842.		
January 4–5.	Aurora.	Overcast.
January 5–6.	Aurora.	———
January 7–8.	Aurora.	Overcast.
January 9–10.	Aurora.	Overcast.
January 15–16.	Aurora.	Aurora.
February 11–12.	Aurora.	Overcast.
August 8–9.	Aurora.	7-8 cloudy.

One word is necessary in regard to the barometric observations made at Cambridge. They have been corrected for temperature, and the data are furnished for the correction due to elevation, capillarity, and the constant instrumental error. But the result indicates not the pressure of the air merely, but the sum of the pressures of the gas and the vapor in it. Now it appears, from a paper which Mr. Sabine read before the British Association in 1844, that in many places, if not everywhere, and always, the changes in the amount of vapor in the air correspond in such a way to the changes in the true gaseous pressure that they are mutually masked so far as the barometer indicates them. In this way we account for that want of distinctness in the barometric curve (either the daily or the yearly one) which we find in the curves which represent the corresponding variations of temperature and the magnetic meridian. It seems from the Toronto observations, that when the vapor pressure is separated from the gaseous pressure, both are subject to regular mean daily and yearly fluctuations, which almost entirely neutralize one another when taken together, leaving a smaller residuum of change which exhibits, also, a less striking relation to the hour of the day or the season of the year. I may illustrate these remarks by the daily curve. The maximum of gaseous pressure occurs at eight in the morning, and the minimum at two or three in the afternoon: but the maximum of vapor pressure takes place at the last period, and the minimum at the former. Mr. Sabine further shows, that the periods of maxima and minima for vapor and gaseous pressure not only correspond in this way, but that they are the same as the times of maxima and minima for temperature and the force of the wind. In a word, the maxima and minima for temperature, force of the wind, and vapor pressure, are *all* found at the same general periods, and these periods alternate with the times of maxima and minima of gaseous pressure, so that the maxima of the former nearly correspond to the minima of the latter. The diurnal march of the other three forces from maximum to minimum, and from minimum back again to maximum, are continuous, like that of the temperature, while the blending of the gaseous and vapor pressures in the mercurial column produce the apparent double maxima and minima of the barometer. This might be expected from the common dependence of the changes in the force of the wind, the amount of evaporation, and the oscillations of the atmosphere upon the antecedent changes of temperature. The Greenwich observations, as published in the volume for 1841, by Mr. Airy, confirm the deduction drawn from the Toronto observations. We thank Mr. Sabine for having so distinctly brought out this relation, and we allude to it here as showing the necessity hereafter of accurate and full hygrometric observations, from which we may deduce the amount of vapor pressure which must be applied as a new correction to the indications of the barometer.

In deriving correct and valuable mean results from the daily observations, there are two difficulties. 1. A single day of extraordinary disturbance may be sufficient to vitiate the true character of a whole month. I have endeavoured to diminish this source of error by discarding from the means those observations which were largely and notoriously warped by such abnormal influences. 2. It is important that each of the means should be derived from the same number of daily observations, made on the same days; otherwise it may happen, that a day, whose declination curve, for example, is regularly formed, but whose average value indicates a great easterly or westerly tendency, will be allowed to impart its own peculiar character to those hours when observations were made on that day, and not to the other hours. No account has been made of this difficulty in the *monthly* means; but, in making up the *yearly* mean, two columns are placed at the left hand of the Table on page 141, the second of which omits the months of January, February, and August, when observations were made only every even hour; the other retains them. Of course, the hourly means derived from the whole time will give a more accurate mean daily curve of declination changes when taken from the extreme right column, than when drawn from the one next to it on the left. Similar remarks apply to the barometric means of page 142.

Concluding Remarks, explanatory of the Tables.

The moment of observation has been given in mean *astronomical* time, reckoned from mean noon at Gottingen. It is apparent that so many instruments as were under observation could not all be registered at the same moment by one person. The time, given in the first column of the Tables which contain the *ordinary* observations, belongs strictly only to the observations on the Declination. The Horizontal-Force Component was observed two and a half minutes *before,* and the Vertical-Force Component two and a half minutes *after* that time. The attached Thermometers were observed after their respective instruments. The Barometer and the external Thermometer may, with sufficient accuracy, be assigned to the same moment as the Vertical-Force Magnetometer. The three lines that are inclosed in braces make what is called a Triple Observation. This consists of nine magnetic observations, three upon each of the three instruments. The moment when each of these observations was made will appear from the following Table, which may be regarded as representing the Triple Observations at 2 o'clock, on October 27, 1841.

	1	2	3	4	5	6	7	8	9
h. m. s.	1 50 0	1 52 30	1 55 0	1 57 30	2 0 0	2 2 30	2 5 0	2 7 30	2 10 0
	V.	D.	H	V.	D.	H.	V.	D.	H.

In the case of the *extra* observations, the time belongs, as nearly as it could be determined, to the observation which stands beside it.

One division on the scale of the Declination-Magnetometer amounts to .73 of a minute of arc, and one division on the scale of the Horizontal-Force Magnetometer amounts to 1.079 minutes of arc.

A *decrease* of numbers on the scale of the Declination-Magnetometer corresponds to an *increase* of Westerly Declination in the marked end of the instrument.

A *decrease* of numbers on the scale of the Horizontal-Force Magnetometer corresponds to a diminution in the amount of the Horizontal-Force Component.

After the close of the February Term-day, a copper bar was substituted for the Horizontal-Force Magnetometer, and the observations were continued with that until March 14, when a small steel magnet was added to the copper bar. Observations were made with this last arrangement until the commencement of the March Term-day, when the original Horizontal-Force Magnetometer was restored.

The Barometric Observations were made with one of Cary's mountain brass instruments belonging to Mr. W. Cranch Bond. The tube of this barometer had a diameter of .17 of an inch. The instrument was stationed, according to Mr. Bond's determination, at an elevation of about thirty-eight and a half feet above the mean high-water mark of Charles River, at Brighton Bridge.

These Observations have not been corrected for capillarity or elevation, but only for temperature. The correction for temperature, which was derived from Professor Schumacher's Tables, as published in the Report of the Committee of the Royal Society, reduces the observation to the standard of 32° Fahrenheit. Previous to each observation, the mercury in the cistern was adjusted to the proper level. Observations made at different times by Mr. Bond show that the instrumental error of this barometer, as compared with No. 57 of Newman, described on page 3 of a former paper, is .068 of an inch. The difference between this and .038 of an inch, the capillary correction, or .03 of an inch, must be *added* to Cary's instrument, when corrected for capillarity, to make it correspond with Newman. The Cambridge standard by Newman has already been compared with the standard of the Royal Society of London, as may be seen on the page just referred to.

Thus, the mean of all the barometric observations is	29.881
Adding for the capillary correction,	0.38
we have	29.919
Adding difference between Cary and Newman, or	.030
we have	29.949
Now we have, as the mean of four daily observations on Newman, during the same period of time as that to which our own observations refer, by Mr. Bond,	29.937
Difference,	.012

If we deduct this last difference from .030 we have .018 as the value of the correction to reduce Cary to Newman, and which we prefer to the former correction of .030 of an inch, because it is derived from so long a series of observations. Indeed, another series of observations in 1842, by Mr. Bond, makes this correction only .019 of an inch.

Each observation on the external Thermometer is, in general, the mean of three separate observations on as many instruments, having different exposures, and calculated to eliminate, by their average value, whatever might be regarded as especially local and irregular.

The observations on the Horizontal-Force and Vertical-Force Magnetometers have *not* been corrected for temperature, but the readings of the attached internal Thermometers are published in a parallel column next to the magnetic observations. I hope, at some future time, to present the Horizontal-Force observations in a corrected state; and the means of this element, deduced from the whole series of observations. But the temperature coefficients are imperfectly known, and experiments must be made to obtain an accurate determination of these constants. Such experiments, and the calculation required for making the reduction, would make a greater demand on my time than my present leisure could meet. I also hope, on some early opportunity, to present the absolute values of the Horizontal and Vertical-Force components at Cambridge. The absolute values of the Declination have been given in the lowest line of the Table of Means on page 141. They were obtained from Mr. W. Cranch Bond's observations with a Variation Transit, made by Troughton and Simms. The observers have relied on Mr. Bond, throughout the whole operation, for their time and the adjustment of the instruments, so that we feel confident that no error has come from that direction. Acknowledgments are also due to Mr. Thomas Hill, who was at the time an undergraduate in the University, and who devoted much time and ability to this enterprise. The coefficients contained in the Tables on part of page 143, and the whole of page 144, were calculated by Mr. Hill, according to the method of Professor Pierce, of which some account was given on page 44 of our former paper.

The instruments for these observations were furnished by the American Academy of Boston, and the buildings were paid for with funds raised by private subscription, with the assistance of Harvard University: but the whole labor of conducting the observations has been the voluntary contribution of those who have been engaged in it. Under such circumstances, it cannot be expected that our observations can compare, for accuracy or completeness, with those made at the regular Magnetic Observatories, by a *personnel* of five or more observers, who are commissioned and paid for giving their whole time and energy to this single object.

JOSEPH LOVERING.

CAMBRIDGE, May 1, 1845.

ERRATA.—The two observations on the Barometer at four and five o'clock on Dec. 6, 1842, are obviously inaccurate. I am not certain, from an examination of the original record, in what way the mistake was made, and what the true numbers should be, though I incline to think they should be 30.210 and 30.086. These observations would more properly have been omitted altogether; they crept into the printed copy from inadvertence.

MEMOIRS

OF THE

AMERICAN ACADEMY.

III.

On the Practice of Circummeridian Altitudes at Sea or on Shore.

BY CAPTAIN W. F. W. OWEN, R. N.,

NAVAL SURVEYOR.

---

1. Find the number of seconds that the sun has less altitude at ($1^{m.}$) one minute from the meridian than the meridian altitude; call this a''. It is found by this form, or, in some books, by a table.

Ex. Latitude,	44	26	log. cosine,	9.854
Declination,	20	6	log. cosine,	9.973
Difference, = Mer. Zen. Distance,	24	20	log. cosecant,	0.385
Constant log.				0.293
$a''=3''.20$			log.	0.505

2. Within a convenient time from the meridian take altitudes and the time by any common watch, noting seconds; generally it will be more convenient, and sufficiently precise, to note the times to tenths of a minute.

3. If convenient, altitudes should be taken about one minute

apart, until the sun falls to a similar altitude as that first taken, (presuming we may have altitudes on both sides of meridian, or of the greatest altitude,) the time, to minutes and tenths, must be noted at each altitude, as well as the altitude itself.

4. When the sun is within reach of the sextant at both horizons, or his altitude more than 55°, alternate altitudes from each horizon should be taken, because by this the corrections for semi-diameter, dip, and instrumental error are avoided, the refraction and parallax only remaining to be applied. The sets from each horizon to be noted separately.

5. Mean the altitudes from each horizon separately, take the difference of these means, halve it, which will be the mean Zenith Distance.

If altitudes have been taken from one horizon only, their mean will of course be the mean altitude.

6. Now note all the times (from the time of apparent meridian passage, or the middle time by equal altitudes by watch, if any have been taken) in minutes and tenths only.

7. Square these times, and carry them out conveniently.

8. Collect these squares into one sum, and mean them by dividing by the number of observations; this mean divided by 60 will reduce it to miles and decimal parts, which, multiplied by *a*, as reserved, will give the reduction to the greatest altitude, or least Zenith Distance.

Generally, when the observer has been stationary, and the object observed was the sun, near noon, and the latitude only be required, no further reduction to the meridian will be necessary than that to the greatest altitude. Example, for form: —

Example. On 20th May, 1844, had ten altitudes of the sun, near noon, whose mean, when corrected, gave the altitude of the sun's centre, 65°.36′.5.

Times from apparent noon.	Squares.
13m.	169
9.9	8.9
	89.1
6.1	0.6
	36.6
2.7	1 9
	5.4
0.2	——
2.3	.7
	4.6
6	36
7.9	7.1
	55.3
9 3	2.8
	83·7
11.	121.
	10)622.7
	60)62.27
	1.04
	a 23
	3.12
	21
	3′.33
	65.36.5
Meridian altitude,	65.39.83
Z. D.	24.20.17
Declination,	20. 6
	44.26.2 North lat.

Remarks on the foregoing Practice.

1st. It precludes the necessity of using books at the place and time of observation, often very inconvenient, and gives immediate results, which is generally satisfactory, and saves time and trouble.

2d. If the precise time were desired for the epoch of noon, it may be deduced from the observations generally, for the instant of the greatest altitude, and a special problem shall be given to reduce this last named to the meridian, or to noon.

3d. Mariners generally commence their observations at seven bells, or $11\frac{1}{2}^{h.}$, for their meridian observations. Now if they extend their observations to $12\frac{1}{2}^{h.}$, this will always be sufficient for good equal altitudes, if the sun's meridian altitude exceed 55°, and will very commonly preclude the necessity of observations earlier or later for the chronometers, and probably will give the precise epoch of noon, or of the object's meridian passage, better; remarking, that for common sea practice, whenever the object observed has a motion in altitude exceeding 3′ miles in a minute of time, it is favorable for equal altitudes, presuming the horizon to be good; and in low latitudes, or within the tropics, twenty minutes on each side the meridian has been found sufficient generally. This sort of practice shall now be shown to be available to surveyors and geographers on shore, with a good common theodolite, so constructed that the telescope, having a diagonal eye-piece, may traverse through the zenith, clear of the azimuth circle, or horizontal plate and glass, or, at least, so as to observe the greatest altitudes required.

Supposing an observer on shore to be furnished with such a theodolite as described, usually called Transit Theodolites, or azimuth and altitude instruments, by it alone he will be able to observe, under favorable circumstances, the latitude, by the use of azimuths, or theodolite bearings, instead of times by watch.

Method of observing and noting Azimuths and Altitudes.

The instrument being well set up, well adjusted, and well levelled, it is unimportant where the zero of the azimuth falls, because we want only the differences of azimuth for this sort of observation; but to make all reasonable use of the observations, not only for latitude, but for the variation of the needle, the first bearing taken should be for the direction of the needle from zero, or it will generally be more convenient to adjust the zero to the magnet, as commonly done. Then write in the field-book as follows:

At ———, 20th May, 1844, about $11\frac{1}{4}^{h.}$ A. M., set up theodolite, adjusted with zero to north magnetic, and obtained the following azimuthal bearings of the sun's east and west limbs, and altitudes of his upper and lower limbs.

Note these observations in the form following, or some such form, viz.:

At ——— D[d.] 20th May, 1844, Theodolite Zero 360°.00.0 North Magnetic.

Bearing or Azimuth.		Altitudes.		
Zero	00°.00′.0	North end of magnet.		These observations must be made at the centre wire of the telescope, and repeated as often as required; each observation to be separately noted.
"	" " "	|⊙ altitude	$\underline{\odot}$ " ° " ′ "	
"	" " "	⊙|	$\overline{\odot}$ " " "	

If the variation of the needle be known, then the direction of the true meridian is known, or taking the observations at equal intervals of 30′ or 1° of azimuth, and noting the changes of the successive altitudes, the precise azimuth of equal altitudes rising and falling may be elicited, which note thus, under the observations, being the mean of azimuths to equal altitudes.

Zero, 000°.00′.0 North magnetic.
" " " " Apparent south meridian.

1. Collect into one column the differences of the apparent meridian azimuth, and each of the other azimuths observed, and, in another column, all the altitudes observed, and mean the latter. Carry out, into other columns, first, the azimuthal differences from the apparent meridian noted in degrees and tenths only, and, second, the squares of these quantities.

2. Sum the squares, and mean them by the number of observations, which call Q.

3. Let the motion of sun in one degree of azimuth from the meridian $= a$ be either calculated, or taken from a prepared table. The form for calculation is the following:

Latitude,	44° 26′	log. cosine,	9.854	60)9.863 $= a''$
Declination,	20 6	log. secant,	0.027	0 1644 $= a'$
Zen. Dist.	24 20	log. sine,	9.615	
Constant,	31″.4144	log.	1.49754	
$a = 9''.863$		log.	0.994	

The mean sum of all the squares $=$ Q, being multiplied by the prepared number a divided by 60, or $\frac{a''}{60}=a'$, the product will be the number of miles and decimal parts to be added to the mean of all the altitudes corrected for refraction, will give the greatest altitude, from which and the declination the latitude may be found as usual, and the direction of the apparent meridian, or of the greatest altitude, and the apparent variation of the needle will have been found by the operations directed.

Remark.—If the observations were by the sun, or a star, or by a planet with no very sensible motion in declination, the foregoing results will not err sensibly from the truth. But when the object observed is the moon, a comet, or any other body having any considerable proper motion in declination and right ascension, it is of importance that the distance in time or azimuth from the meridian, as well as the excess of the greatest altitude over the meridian altitude, be applied, let d express the motion in declination, north or south, and z the motion of the zenith north or south by change of place, then $z+d=d''$, and let a express the motion in altitude in ($1^{m.}$) one minute of time from the meridian, when ε, the equation of the apex in time is required, and let Q$'$ express the motion in altitude for 1° of azimuth at the meridian, and d' the motion of declination for 1° of azimuth near the meridian, when ε' the equation of the apex in azimuth is required, ε being the distance in time of the greatest altitude from the meridian, and ε' its distance in arc of azimuth, and r in all cases may express the excess of the greatest altitude above the meridian altitude in seconds of arc, then $\frac{d}{2a}=\varepsilon^{m.}$, and $\frac{d''}{2a''}=\varepsilon''^{m.}$; and $\varepsilon^{m.}$ is always + to the middle time of equal altitudes, or to the time of the greatest altitude, when the object is receding from the observer's zenith; and when advancing —, and

$\frac{d^2}{4a} = r''$ always — to the greatest altitude. So, also, $\frac{d'^2}{4a'} = r''$, and, for azimuth, $\frac{d'}{2a'} = \varepsilon^{\circ} \pm$ as before, and $\frac{d'^2}{4a'} = r''$, the excess of altitude.

Now in the example of circummeridian altitudes on the 20th May, the sun's motion in declination was $0''.5$ for one minute of time, or $0''.9$ for degree of azimuth $= d$, and $Q = 3''.2$ then $\frac{d}{2Q} = \frac{0.5}{6.4} = 0^{m}.08$ or $4^{s}.8 = \varepsilon$ and $r = 0''.02$ for time. For an observation by azimuth, $d' = 0''.9$ in 1° of azimuth, and $a' = 9''.9$ $\frac{d'}{2a'} = \frac{0.9}{19.8} = 0^{\circ}.45 = 0^{\circ}.2'.7$ and $r = 0''.02$ for azimuth.

Remark. — This equation of $0^{\circ}.2'.7$ in azimuth at the meridian in very common cases of the sun's azimuths may account for some of the diurnal and annual fluctuations sometimes attributed to the magnetic needle, where the true meridian may have been determined by equal altitudes, and may be important in the art of dialling; this equation (here $0^{\circ}.2'.7) = \varepsilon'$ is $+$ to the instrumental azimuth of the meridian, if the (lunar) object be receding in declination from the observer's zenith, otherwise —.

It may be remarked, also, that it is desirable that a system of practical geographical astronomy for determining positions of places, and times and measures on the surface, &c., should be developed, in which the azimuths may enter as an element, either as a substitute for time as used at sea, or in combination with it, specifically for shore practice.

There is, however, no method given in the usual treatises on navigation or practical astronomy for converting an arc of time into arc of azimuth, and all the ephemeral elements are necessarily given for certain times, because they are uniform in motion.

This, at the meridian, is simply done, as follows: when we found the *a*, either for motion in time or azimuth, we used the log. cosines or secants of approximate latitude, declination, and of the meridian zenith distance (which, in all cases, must either be the sum or difference of the latitude and declination) with a constant quantity. Using the same elements in part, we shall find the value in arc of azimuth of $1^{m.}$ of time at and near the meridian, and consequently the value of 1° of azimuth in time, viz. for example,

Meridian true distance,	24° 20′	cosecant,	0.385
Declination,	20 6	cosine,	9.973
	$1^{m.}$	log. sine,	7.640
Azimuthal arc, for $1^{m.}$ of time at meridian,	34′.2	log. sine,	7.998

and $34'.2)60(1^{m}.79 = 1^{m}.47^{s}.4 =$ the value of one degree of azimuth, at the meridian, in time, and the same analogy will apply at every other altitude, to convert time into azimuth, or azimuth to time. These values might be deduced from a and a' for $\overset{a}{3.2})\overset{a'}{9.862}(3.08 =$ square of the time corresponding to 1° of azimuth, and $\sqrt{3.08} = 1^{m}.76 = 1^{m}.46^{s.}$ nearly as before.

Having the value of 1° of azimuth in time, we can easily find from the ephemeris the motion (d) in declination in that time, which, in our example, is $= 0''.90 = d$, and in example $\frac{d}{2\,a} = \frac{0''.9}{19''.726}$ $= 0°.046 = \varepsilon' = 2'.76$ for the azimuthal deviation from the meridian, and the excess of greatest above the meridian altitude $= \frac{de}{2} = \frac{0''.0414}{2}$ $= 0''.021$.

For surveying on shore, and for geographers who desire to use theodolites, a ready rule for converting arcs of time into corresponding arc of azimuth will be convenient at other parts of the sun's (or other object's) diurnal path, as well as at the meridian. The following was given to me, and demonstrated some years ago, by Lieutenant Raper, R. N., the author of a Treatise on Navigation, viz.:

Given two altitudes of a known heavenly body, and the interval in time (limited) between them, to find thence the difference of azimuth in the same interval.

RULE. — Convert the interval of time into degrees and decimals, and multiply it by the (natural) cosine of the declination; call the product z'; and take the difference of the altitudes in degrees and decimals; call this Q°; add the log. of $z' + Q$ to the log. of $z' - Q$ and halve the sum, to which add the log. secant of the middle altitude; this last sum is the log. of the corresponding arc in azimuth in degrees and decimals.

		° ′		h. m. s.
EXAMPLE.	First altitude	49.42.4	Time	1.20.00 P. M.
	Second altitude	49. 7.5		1.40.46
		34′.9		20.46
		= 0°.58 = Q.		= 5°.2

	° ′
The declination at the Middle Time	11.23
or Polar Distance	78.37

Now, the interval $5^{\circ}.2 \times 0.98$ Nat. cosine of declination
89.0
468
42
$5.10 = z'$

$z' + Q = 5^{\circ}.1 + 0^{\circ}.58 = 5.68$ log.	0.754
$z' - Q = 5.1 - 0.58 = 4.52$ log.	0.655
sum	1.409
half	0.7045
Middle altitude 49°.25′ secant	0.1867
Arc of azimuth 7°.784 log.	0.8912

Corresponding to 20$^{m.}$ 46$^{s.}$
Interval of time = 7° 47′

If z be put for an arc in azimuth and t for its corresponding arc in time, and a = difference of altitude,

$$\overline{t \times \text{cos. decl.}}^2 = \overline{z \times \text{cos. alt.}}^2 + a^2$$

for small arcs with a mean altitude, which is Mr. Raper's rule.

To convert an Arc of Azimuth into corresponding Arc of Time at any Altitude of the Object.

To the logarithm of the arc (z) in azimuth expressed in degrees and decimals, add the log. cosine of the middle altitude; the sum will be the log. of $z \times$ cosine of declination; this log. doubled will give the log. of its square (or $z^2 . A'^2$); to $z^2 . A'^2$ add a^2 (twice log. a = log. of a^2); the sum will be $t^2 . D'^2$; the half its log. will be the log. $t . D'$, to which add the log. secant of the declination; the sum will be the log. of t, the interval of time in degrees and decimals;—

A' expressing the log. cosine of middle altitude.

D' the log. cosine of the declination.

a expresses the difference of the altitude, noted in degrees and decimals.

t, an arc of time noted in degrees and decimals.

z, a corresponding arc of azimuth, also noted in degrees and decimals.

Both these rules result from the foregoing equation, or, $t^2 . D'^2 = a^2 + z^2 . A'^2$; and $t^2 . D'^2 - a^2 =$ sum $\times$ difference $= z^2 . A'^2$. Or, $(t . D' + a) \times (t . D' - a) = z^2 . A'^2$.

But perhaps the simplest and most convenient practical method of converting an arc of time into its corresponding arc of azimuth, is to assume a proximate latitude, and calculate them trigonometrically, by finding both the times and the azimuths for each altitude, and taking their differences as calculated.

If, however, it be convenient, let the observer with the theodolite note the times by a good common watch at each observation also; then will the calculation be unnecessary, and some curious and useful problems be deduced from such simultaneous observations.

To convert a small Arc of Time to its equivalent Azimuth.

Mr. Raper's rule is applicable to small arcs only, and is founded on the differential triangle here adopted; his demonstration is labored and circuitous.

Owen's is as follows:—

$$\overline{t\,.\,D'}^2 - a^2 = \overline{z\,.\,A'}^2$$

D' = cosine declination.
A' = cosine altitude.

But the sum multiplied by difference = difference of their squares, therefore

t = time in arc.
z = azimuth in same.
a = diff. altitude.

$t\,.\,D' + a$	log.	. , ...	
$t\,.\,D' - a$	log.	. , ...	
$\overline{z\,.\,A'}^2$	log.	. , ...	sum.
$z\,.\,A'$	log.	. , ...	half.
$-$ A'	log. —	. , ...	sub^t. or log. sec^t. add.
Azimuth z	log. —	. , ...	difference. Q. E. D.

The converse of this is similar.

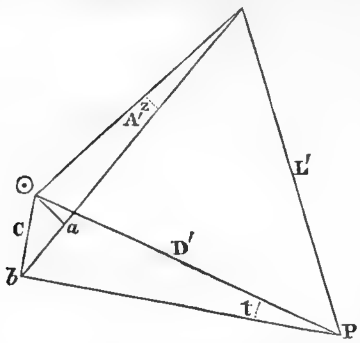
To convert an Arc of Azimuth into equivalent Time.

Given z	log.	. , ...	
A' middle altitude	log. cosine	. , ...	
$z\,.\,A'$	log.	. , ...	sum.
$\overline{z\,.\,A'}^2$	log.	. , ...	double.
$+ a^2$			log. of a^2.
Sum $= \overline{t\,.\,D'}^2$		. , ...	log.
$t\,.\,D'$	log.	. , ...	half.
$-$ D	log. cosine —	. , ...	or add log. sec^t.
	Acc^t. log. =	. , ...	difference.

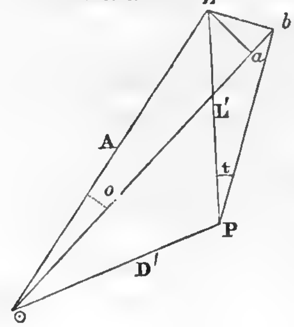
For turning Azimuth into corresponding Time.

RULE.—To the log. of azimuthal difference z, add the log. cosine middle altitude, the sum is $z\,.\,A'$; double this sum will be log. of $\overline{z\,.\,A'}^2$; find the square of a, as convenient, $= a^2$; add it to $\overline{z\,.\,A'}^2$, sum is $\overline{t\,D'}^2$, half its log. is log. of t D', from which deduct log. cosine D, leaves the log. of t.—Q. E. D.

No. 1.



No. 2.



In the figure No. 1, let Z represent the Zenith, P the Pole, and ⊙ the celestial object: the side L' = Colatitude (L = Latitude).

A' = Zenith Distance (A = Altitude).

D' = Polar Distance (D = Declination).

Now suppose the object moved from ⊙ to b, the latitude and declination remaining unchanged (that is, L' is common to both, and P ⊙ = P b = D'), then $\angle$ ⊙ Z $b = z =$ change of azimuth, and $b\,a$ the corresponding change of altitude, also ⊙ P $b = t =$ the corresponding change of time.

Then in the small differential $\triangle$ ⊙ $a\,b$, right angled at a.

$b\,a =$ difference of altitudes $= a$.

⊙ a . secant A $= z$ and ⊙ b . secant D $= t$.

For the Conversion of small Arc of Time into corresponding Arc of Azimuth; or of Azimuth into Time.

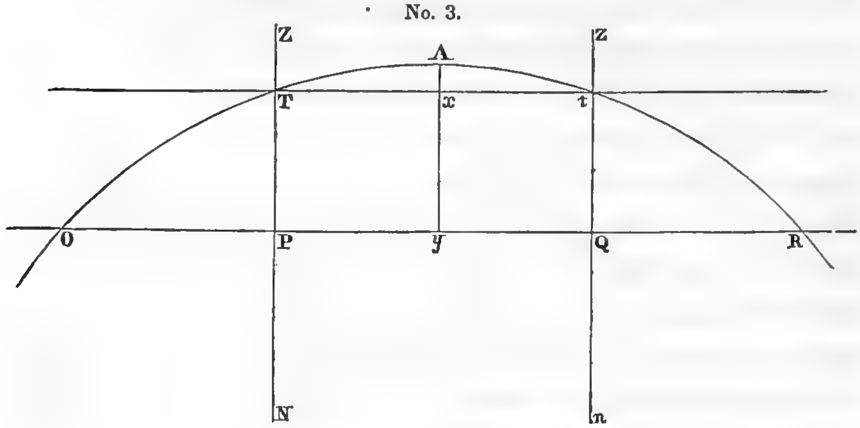
Let us consider their relations in small subsidiary or differential rectangular triangles, at the zenith, or at the object itself, in the great celestial spherical triangle (P Z ⊙) formed by the elevated pole, the zenith, and the object. Supposing, in Fig. 1, the object to change its place from ⊙ to b by a change of altitude $= a\,b$ and a change of time $= \angle t = \angle \odot P b$, these two changes (when P Z, the colatitude, and P ⊙ ($= P b$) = codeclination, both remain constant) must also cause a change in the azimuth $= \angle z = \angle \odot Z b$, and the change in $\angle \odot z P$ may be esteemed also to be the change at $\angle P \odot Z$ of position, for $\angle P \odot Z = \angle P b Z + \angle b Z \odot$ nearly. It may be remarked, that if the triangle had been supposed to change to the middle point C, and to become P C Z, whose quantities (for our purposes in calculation where the differences are small) may be considered permanent, as L\`, the colatitude, and D\`, the codeclination, are really so by hypothesis, and the effect of the changes will be, one half on one side of C, and one half on the other; but in similar triangles, the halves have the similar ratios, or relations to each other, as the wholes, therefore we need only consider them in the differential triangle $\odot\, b\, a$ right angled at a. Wherein $\odot\, b = t =$ interval of time in arc × cosine D, the declination, $a\,b =$ change of altitude in arc of same denomination as t, $\odot\, a = z =$ interval in azimuth, in arc (same as t) × cosine A, the altitude. Now any two of these three corresponding changes, represented truly by the three sides of the triangle $\odot\, a\, b$, not only may the other be found, but also the angles $a \odot b = \angle P \odot Z$ of position and its complement $\angle \odot\, b\, a$. Then the following analogies are evident, viz. where $\odot\, b = t' =$ the reduced interval of time $\odot\, a = z' =$ reduced interval of azimuth, and $a =$ difference of altitude,

$$t'^2 = z'^2 + a^2 \text{ rad. : } t' : : \text{sin. } \angle \odot : a : : \text{cos. } \angle \odot : z'.$$

Also removing the differential triangle to Z, in Fig. 2, we perceive the same relations, except that L\` is substituted for D\`, and angle Z for $\angle \odot$, and $t''^2 = a^2 + o'^2$; also t'' : rad. : : a : sin. Z : : o' : cos.

Z; o' being $o \times$ sin. A' and $t' = t \times$ sin. L'; since, then, the ∠PZ⊙, P⊙Z may be found by any two of the three differences, and A' and D' are given, so L', the colatitude, may be found. (To reduce t to t'', a near latitude may be used without error.)

No. 3.



Explanation of Figure No. 3.

Let OTAtR represent a part of the apparent track of a celestial object near the meridian.

Let ZTPN represent a part of the meridian, in which Z the zenith, N the nadir, T the point of the object's meridian passage, or $z t$ Q n may represent the meridian in which t is the point of the object's meridian transit.

Let T$x t$ be a parallel of altitude equal to the altitude when the object is in the meridian, and

Let OPyQR be another parallel of altitude, taken at any given time from (T or A) the meridian, or from the apex A (the point where the celestial object attained its greatest altitude, or nearest approach to the zenith).

Let A be the apex or summit of the celestial object's apparent track, or point of its nearest approach to the zenith.

Let the arc A T or A t in time = E, the equation of the apex, or apicial equation, and let A T O or A t R represent an arc in time equal to any given time from the apex A or from the meridian T, within certain limits.

If the object were stationary with respect to the pole and zenith, viz. had no motion in declination, and the zenith also stationary as regards the object, then the points A and T would coincide, and the meridian altitude would also be the greatest altitude, and the point of meridian transit would be the apex of the apparent celestial track. But when the object has motion in declination, or the observer has motion in terrestrial latitude, under every such circumstance the greatest altitude is always greater than the meridian altitude; for suppose the object (the moon for example) to appear at O in her track about five minutes before her meridian passage, and that her declination moved towards the zenith at the rate of 9 miles an hour, or 9″ per minute; if the moon had not this motion in declination, and had attained to T in the meridian, she would there have had no motion in altitude, and from that point she would have commenced her downward course, but her motion of 9″ in $1^{m.}$ of time towards the zenith must cause her to rise through the meridian precisely at that rate. Again, at $1^{m.}$ after her transit, she will have risen 9″, and would have fallen (assuming a quantity = a) 1″.5, the difference would be 7″.5 by which amount the moon would have had a greater altitude $1^{m.}$ after she had passed the meridian, than her meridian altitude; at the second minute after her meridian passage, she would have fallen 6″ (= 1″.5 × 2^2); in the same time she has risen 18″ by her motion in declination, the difference 12″ by which amount her altitude at two minutes after her passage would be higher than her meridian altitude; at $3^{m.}$ she would have fallen 13″.5 and risen 27″, or 13″.5 higher; at

$4^{m.}$ she would have fallen 24″ and risen 36″, difference 12″; at $5^{m.}$ she would have fallen 37″.5 and have risen 45″, difference 7″.5; and at $6^{m.}$ have fallen 54″, and have risen 54″, difference 0; therefore at T on the meridian, and at six minutes after, the altitude was the meridian altitude, but at A, the apex, at $3^{m.}$ after the meridian passage, the moon was 13″.5 higher than when on the meridian, and which was her greatest altitude.

d. Let the rate of motion in declination be expressed by *d*, prefix to it the sign + if the object be advancing towards the observer, or rather towards his zenith, by its motion in declination; but prefix to *d* the sign — if the object be, by its motion in declination, receding from the observer's zenith, and note *d* in seconds of arc, equal to the amount of motion in declination in ($1^{m.}$) one minute of time, at the observer's place and time.

a. Let *a* express the number of seconds of arc, of the proper motion of the object in altitude (supposing it to have no motion in declination) in ($1^{m.}$) one minute of time from the meridian, to which prefix the contrary sign to that of $d \odot (t^{m.})$. Let $t^{m.}$ express the minutes of time corresponding to any arc in question.

Now at T and at *t* in the diagram, the object observed is shown to have equal altitudes, equal to the meridian altitude. To find the value of the arc $T\,t^{m.} = t$, we have seen by analyzing the diagram, and by hypothesis, that the proper motion in altitude at $t = -a\,t^2$, and that the excess of motion in declination at the same point $t = +d\,t$; and $d\,t - a\,t^2 = o$.

$\therefore t = \frac{d}{a}$, and if $d = 9''$ as in the diagram, and $a = 1''.5$, then $t =$ arc $T\,t^{m.} = 6^{m.}$; now, although by the foregoing analysis it may be seen that the apex A exactly bisects the arc T *t*, this may be demonstrated by the fluxional differentials of the original equation. Thus $d\,t' - a\,t'^2 = o$, where their difference A x is a maximum, then $d = 2\,a\,t$, and $t = \frac{d}{2a} =$ arc $\text{TA}^{\text{m.}} =$ the equation of the apex $= \varepsilon$.

Now to find the excess of the greatest altitude above the meridian altitude $= \text{A}\,x$ in the diagram, let us substitute $\frac{d}{2a}$ for t in the original equation, then $\frac{d^2}{2a} - \frac{d^2}{4a} = \text{A}\,x = r = \frac{d^2}{4a} = \frac{d\varepsilon}{2} = \text{Q}\,\varepsilon^2$; for $\varepsilon = \frac{d}{2a}$. This expression reduced gives $\frac{d^2}{4a} = r = \text{A}\,x = \text{Q}\,\varepsilon^2 = \frac{d^2}{4a} = \frac{d\varepsilon}{2}$. We thus obtain the following rules, viz.

1. To find the equation of the apex, or its distance in time from the meridian $= \varepsilon = \frac{d}{2a}$:—

Divide the motion in declination in ($1^{\text{m.}}$) one minute of time by the proper motion in altitude for one minute from the meridian, both motions being of the same denomination; the quotient will be the equation of the apex in minutes of time $= \varepsilon = \text{T}^{\text{m.}}$ A, being the difference of time between the passage of the object over the meridian, and of its attaining its greatest altitude.

2. To find the excess ($= r$) of the greatest altitude above the meridian altitude ($= \text{A}\,x$) $= \text{Q}\,\varepsilon^2 = \frac{d^2}{4a} = \frac{d\varepsilon}{2}$:—

Divide the square of (d^2) the motion in declination in one minute of time by four times the proper motion in altitude ($4\,a$) in ($1^{\text{m.}}$) one minute from the meridian, the quotient will be (r) the apicial excess of altitude ($= \text{A}\,x = d\,\varepsilon^2$) above the meridian altitude, of the same denomination as the motions (a and d).

In the foregoing analysis, it was assumed that the object was approaching the zenith of the observer. Now let us examine and analyze the motions by reference to the same diagram, when the object is receding from the zenith. $d = 9''$; $\text{Q} = 1''.5$ as before.

Now suppose the (moon) object to enter on her track at o in the diagram, moving thence to T, she will, by the hypothesis, have an altitude equal to the meridian altitude, now at t, from which she is distant $T^{m.} t$ ($= 6^{m.}$) and is rising by her proper motion in altitude ($= Q t^2$); at $5^{m.}$ she will have to rise 37″.5 by her proper motion in altitude, and from T she will have to rise 54″ ($= 6^2 \times$ 1″.5) to her meridian altitude at t, the difference 54″ — 37″.5 = 16″.5, but she has fallen by her motion 9″, and 16″.5 — 9 = 7″.5, or she will have risen 7″.5 in one minute above her meridian altitude at T or t. In like manner, at four minutes from t she will have risen from T 54″ — 24″ = 30″ by her proper motion in altitude, and in two minutes will have fallen by her motion in declination, now receding, 18″, the difference = 12″ higher than the meridian altitude at T and t.

Again, at $3^{m.}$ (the apex in this example), 54″ — 13″.5 = 40″.5 the quantity she has risen by her proper motion in altitude from T in 3 minutes, and she will in the same time have fallen by her motion in declination $3 \times 9'' = 27$, the difference 40″.5 — 27″ = 13″.5, her excess of altitude above the meridian altitude at 3 minutes before her meridian passage (in this example the maximum excess).

At $2^{m.}$ from t, the point of meridian transit, she will have risen from T 54″ — 6″ = 48″, and have fallen by her motion in declination $4 \times 9 = 36''$, and 48″ — 36″ = 12″; so that at 2 minutes before her meridian passage, her altitude will be 12″ higher than at the meridian. Again, at $1^{m.}$ before meridian passage 54″ — 1″.5 = 52″.5 — 45 = 7″.5, and at t the meridian 54″ — 0″ — 54″ = 0, or the altitude at t the meridian is equal to the altitude at T ($6^{m.}$) six minutes before she came to the meridian. In the first case of a motion in declination advancing to the zenith, she came to the meridian before she attained her greatest altitude ($3^{m.}$) three minutes; and the excess of her greatest altitude above her meridian altitude was 13″.5, and she rose through the meridian.

In this case of a receding motion in declination, she falls through the meridian, and comes to it after she has attained her greatest altitude; in this case, also, the apicial excess of altitude ($=r$) is 13″.5.

So that in all cases where the object has any motion in declination, its greatest altitude is always higher than the meridian altitude, and the excess ($=r$) and the equation ($=\varepsilon$) of the apex, are the same in quantity in both cases, and found by like process. And r is always $-$ to the greatest altitude. But ε is $+$ to the time of meridian passage, when the motion in declination is towards the zenith, and $-$ when receding.

The foregoing development unfolds to us another very pretty and equally important practical principle. Whether the object by its change in declination move to or from the zenith, or the zenith move to or from the celestial object, the relative effect is the same, and the greatest altitude near the meridian would be in excess, or greater than the meridian altitude.

Example. — A steamer going 13 knots, steering due south, or directly towards the moon, whose motion towards the zenith is 17″ per minute (a case that may well happen), the sum of these two motions would be 30″, and suppose her proper motion in altitude, when motionless in declination, was 1″.5 in one minute from the meridian, then her equation of the apex would be $10^{m.}$ ($=\varepsilon = \frac{30''}{2 \times 1''.5}$) and she would get her greatest altitude ten minutes after the calculated time of the moon's transit, and the excess ($a\,\varepsilon^2 = 150'' = \frac{d^2}{4a} = \frac{900''}{6} = 150'' = \frac{d\iota}{2} = \frac{300}{2} = 150''$) of her greatest above her true meridian altitude would be (2′.5) two minutes and a half.

Had the steamer been steering north, and the moon's motion in declination receding from the zenith, the effect would have been similar, but she would have had the greatest altitude ($10^{m.}$) ten minutes before she came to the meridian, but the excess of the greatest altitude would be — 2′.5 likewise.

Observe that the zenith moves to or from the object only by a quantity equal to the difference of latitude made by her true course and distance, and that the easting or westing, viz. the longitude, must be disregarded altogether in this problem, so far as it has yet been considered in this paper.

Circummeridian or Proximeridian Altitudes considered with Reference to this Problem.

It is evident, on mere inspection of the diagram, that the apex of the celestial object's path is the point to which all altitudes taken near the meridian must be reduced. The calculation is equally simple from the apex and from the meridian, and the proper motion in altitude, *a*, is precisely the same in both cases, or differs by an insensible quantity only, but the times by whose squares this quantity is to be multiplied must be reckoned from the apex, not from the meridian. Thus, in the first example, $a =$ 1″.5; when on the meridian at $3^{m.}$ from the apex, the correction for $3^{m.}$ would have been 13″.5 as before shown by the analysis.

Of equal Altitudes of the same Object, when the Motion in Declination is a constant Quantity, or may be so esteemed.

Equal altitudes can be demonstrated to be equally distant in arc and time from the apex, when the motive forces are constant, and not from the meridian, except when there is no motion equivalent to a change of declination; therefore the equation of the apex (ε) is the only and a constant equation of equal altitudes by which the middle time between such equal altitudes is to be reduced to the meridian, within certain limits from the meridian, depending on the minute changes of d, the motion in declination, and of minute changes in the velocity of the vessel in latitude.

The effect of a motion in declination on the least altitudes at the lower transit, is manifest; the lower apex is as much below the meridian altitude there, as the greatest altitude exceeds the meridian altitude, at the upper transit.

I will forbear, at this time, to draw all the practical consequences from the foregoing development of this problem, which are derivable from it, although they are numerous, and some, I think, important.

MEMOIRS

OF THE

AMERICAN ACADEMY.

IV.

The Latitude of the Cambridge Observatory, in Massachusetts, determined, from Transits of Stars over the Prime Vertical observed during the Months of December, 1844, *and January,* 1845, *by*

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MAJOR JAMES D. GRAHAM, A. A. S.,
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AND

GEORGE P. BOND,
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BY BENJAMIN PEIRCE, A. A. S.,
PERKINS PROFESSOR OF ASTRONOMY AND MATHEMATICS IN HARVARD UNIVERSITY.

THE latitude of Harvard Hall in Cambridge was determined by Professor Williams, in the years 1782 and 1783. His observations were made upon meridian altitudes of the sun, and of north and south stars, including the pole star, with a Sisson's quadrant of two and a half feet radius. They are published in the first volume of the Transactions of this Society, and agree together quite creditably to the observer. They give for the latitude of the observatory 42° 23′ 52″ N.

Mr. Paine's 584 observations of the latitude of Boston, made, in 1828 and 1829, with two of Ramsden's sextants (the results of the two different instruments agreeing to the tenth of a second), and published in the first volume of the new series of the Transactions, give for the latitude of the Observatory* 42° 22′ 22″.3 N.

Mr. Paine's more recent observations of the latitude of Boston, made for the survey of the State and published in the Memoirs of the American Philosophical Society, give for the latitude of the Observatory* 42° 22′ 47″.2 N.

Mr. Paine's observations of the latitude of the Unitarian Church in Old Cambridge give for the latitude of the Observatory* 42° 22′ 46″.7 N.

The latitude resulting from the series of observations contained in this memoir is 42° 22′ 49″ N.

The agreement of the observations with each other, no one of which differs from the mean more than *three seconds*, shows that this latitude may be depended upon as accurate to about a second. Had simultaneous observations of the stars employed been made at Greenwich, or some other established observatory, the resulting latitude might have been depended upon to one half or one third of a second; and it is probable that, under favorable circumstances, this system of observation will give differences of lati-

* The differences of latitude necessary for these reductions were obtained from Mr. Charles O. Boutelle, who has made some careful trigonometrical observations of these differences of latitude, and has kindly communicated to the Observatory a copy of his results.

tude accurate to the tenth of a second, and thereby resolve some interesting inquiries in topography and geology.

Great changes of temperature occurred in the course of the observations, which materially affected the level, and thereby most seriously interfered with the efforts to attain accurate results. The observers were, moreover, wholly unused to this class of observations, neither of them having before observed upon the prime vertical.

Description of the Instruments.

Chronometer. — The time was kept, throughout the observations, by a chronometer belonging to Major Graham, and numbered 2419. This watch had been proved, by previous use, to be of uncommon excellence. Its rate, determined by means of the meridian transit instrument, was small, and is shown in Table I.

Transit Instrument. — The transit instrument, which was employed in the observations upon the prime vertical, was made by Troughton and Simms, of London, and was kindly lent to the Observatory, for this purpose, by Major Graham. It is of about four feet focal length, and three inches aperture, with very clear and distinct vision. It has seven vertical and three horizontal wires; the seven vertical wires are described in the observations as *A, B, C, D, E, F, G*; the order in which they are lettered commences with the wire nearest to the illuminated end of the axis. The intervals between the wires were not known from any independent astronomical observations; but this is unimportant, for a knowledge of them is not required in the methods of observation and reduction here employed. These intervals have, however, been approximately determined by terrestrial observations and the micrometer; and a comparison of them with their values deduced from the transit observations, which is made in Table V., will serve to test the accuracy of the observations.

The transit instrument has two very delicate levels, adapted to different temperatures, and each divided to seconds.

The middle wire (D), was carefully adjusted by Mr. Bond previously to the observations; and he could not detect any error of collimation, either at that time or at the close of the series.

The telescope was mounted upon heavy stone piers, which rested securely upon a stone foundation.

Method of Observation.

Each star was observed at its east and west transit over each wire of the telescope. The axis of the telescope was reversed every few days, which is indicated in the tabular account of the observations by the column which gives the position of the illuminated axis as being north or south.

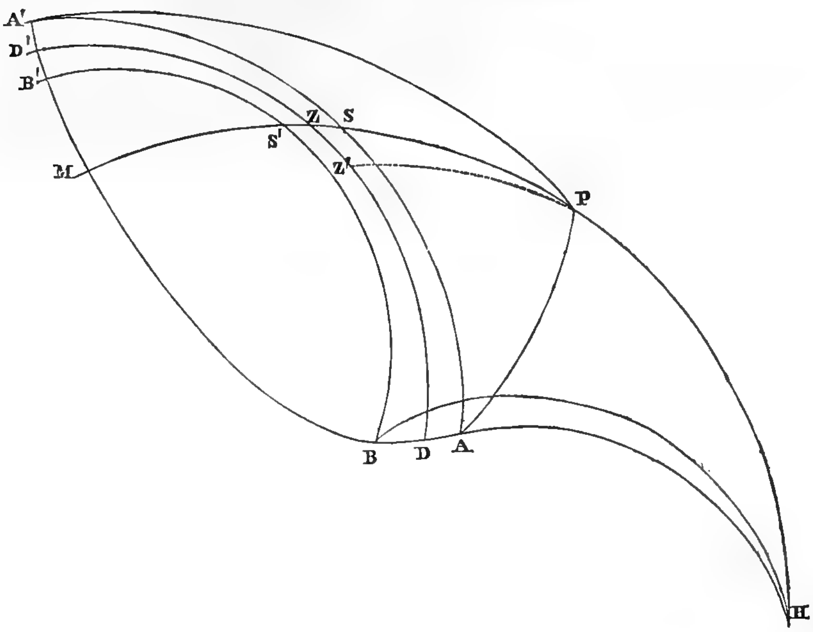
The level was usually read before and after each observation, and was commonly reversed three or five times. About five minutes were allowed, after each reversal, for the level to settle.

Since each observation of the level often corresponded to two different observations of a star, it is convenient to print all the observations of the level in the single Table III.

The observations of the transits of the stars are given in Table IV. The time is that of the chronometer, No. 2419.

Method of Computation.

Let DZD' be the arc of a great circle described by the axis of collimation of the telescope; PZM the meridian perpendicular to DZD'; DMD' the arc of a small circle described by the star. A and A' are the east and west points, at which the star makes



its transits over one of the wires, when this wire is north of the axis of collimation. But when the axis of the telescope is reversed, so as to bring this wire south of the axis of collimation, B and B' are the points of east and west transit.

Let

$h_n = A\,P\,Z = \frac{1}{2}\,(A\,P\,A')$

$= \frac{1}{2}$ the sidereal interval between the times of east and west transit, when the wire is north of the axis of collimation.

$h_s = B\,P\,Z = \frac{1}{2}$ the sidereal interval, when the wire is south of the axis of collimation.

$A\,S\,A'$ is the arc of a great circle joining A and A'.

$B\,S'\,B'$ is the arc of a great circle joining B and B'.

Each of these circles is perpendicular to $P\,Z\,M$.

Let $D =$ the star's declination.

$L_n =$ the declination of the point S.

$L_s =$ the declination of the point S'.

The right triangles $A\,P\,S$ and $B\,P\,S'$ give the following formulæ for determining L_n and L_s: —

$$\tan. L_n = \tan. D \sec. h_n,$$
$$\tan. L_s = \tan. D \sec. h_s;$$

or, when the star passes near the zenith, as it always should do in these observations, these equations give

$$\cos. h_n = \frac{\tan. D}{\tan. L_n},$$

$$\frac{1 - \cos. h_n}{1 + \cos. h_n} = \frac{\tan. L_n - \tan. D}{\tan. L_n + \tan. D},$$

$$\tan.^2 \tfrac{1}{2} h_n = \frac{\sin. (L_n - D)}{\sin. (L_n + D)},$$

$$\sin. (L_n - D) = \tan.^2 \tfrac{1}{2} h_n \,.\, \sin. (L_n + D),$$

and, in the same way,

$$\sin. (L_s - D) = \tan.^2 \tfrac{1}{2} h_s \,.\, \sin. (L_s + D);$$

and these two formulas are, in this case, to be preferred in computing the values of L_n and L_s. When the star passes very near the zenith, they are reduced to

$$L_n - D = \tfrac{1}{4} h_n^2 \sin. 1'' \sin. (L_n + D)$$
$$L_s - D = \tfrac{1}{4} h_s^2 \sin. 1'' \sin. (L_s + D).$$

In order to determine the declination of the point Z, which will be denoted by L, let

δi = the distance of the wire from the axis of collimation; produce ZP to the horizon at H, so that ZH may be a quadrant. The right triangles HAS and PAS give, by Bowditch's rules for the solution of oblique spherical triangles,

$$\frac{\cos. HA}{\cos. AP} = \frac{\cos. HS}{\cos. PS},$$

or

$$\frac{\cos. (90° - \delta i)}{\cos. (90° - D)} = \frac{\cos. (90° - L_n + L)}{\cos. (90° - L_n)},$$

or

$$\frac{\sin. \delta i}{\sin. D} = \frac{\sin. (L_n - L)}{\sin. L_n}.$$

In the same way, the right triangles HBS' and PBS' give

$$\frac{\sin. \delta i}{\sin. D} = \frac{\sin. (L - L_s)}{\sin. L_s};$$

hence

$$\frac{\sin. (L_n - L)}{\sin. L_n} = \frac{\sin. (L - L_s)}{\sin. L_s},$$

and
$$\frac{\sin.\ (L_n - L)}{\sin.\ (L - L_s)} = \frac{\sin.\ L_n}{\sin.\ L_s};$$

whence
$$\frac{\sin.\ (L_n - L) - \sin.\ (L - L_s)}{\sin.\ (L_n - L) + \sin.\ (L - L_s)} = \frac{\sin.\ L_n - \sin.\ L_s}{\sin.\ L_n + \sin.\ L_s},$$

or
$$\frac{\tan.\ [\frac{1}{2}(L_n + L_s) - L]}{\tan.\ \frac{1}{2}(L_n - L_s)} = \frac{\tan.\ \frac{1}{2}(L_n - L_s)}{\tan.\ \frac{1}{2}(L_n + L_s)},$$

and
$$\tan.\ [\tfrac{1}{2}(L_n + L_s) - L] = \tan.^2\ \tfrac{1}{2}(L_n - L_s) \cot.\ \tfrac{1}{2}(L_n + L_s).$$

But L_n differs very little from L_s; and L is so near a mean between L_n and L_s, that it may be substituted for this mean, in the second member of this equation; whence

$$\tfrac{1}{2}(L_n + L_s) - L = \tfrac{1}{4}(L_n - L_s)^2 \sin.\ 1'' \cot.\ L,$$

or
$$L = \tfrac{1}{2}(L_n + L_s) - \tfrac{1}{4}(L_n - L_s)^2 \sin.\ 1'' \cot.\ L.$$

The term $\frac{1}{4}(L_n - L_s)^2 \sin.\ 1'' \cot.\ L$, which may be denoted by δL, is then a small correction to be subtracted from the mean of the declinations of S and S', in order to obtain that of Z. It needs to be computed but once for each wire and star; for no changes in the place of the star and no errors of observation can perceptibly affect its value. The same remark is applicable with regard to the values of $L_n - L$ and $L - L_s$, that they need to be determined only once, and their values are given by the formulæ,

$$L_n - L = \tfrac{1}{2}(L_n - L_s) + \delta L,$$
$$L - L_s = \tfrac{1}{2}(L_n - L_s) - \delta L;$$

and they have been determined for each of the stars, except α Lyræ, by the mean of all the observations in which both the east and west transits of the star have been observed. The determination of these values is given in Table VI. The letters n and s, which are annexed in this table to L, denote the direction of the illuminated axis of the telescope, and their use differs, therefore, slightly from that of this explanation.

A different method of computation, and one which is more rapid in practice, has been applied to the reduction of the observations of α Lyræ.

The triangles APH and BPH give

$$\begin{aligned}\text{sin. } \delta i &= \text{sin. } D \text{ cos. } L - \text{cos. } D \text{ sin. } L \text{ cos. } h_n \\ &= -\text{sin. } D \text{ cos. } L + \text{cos. } D \text{ sin. } L \text{ cos. } h_s\,;\end{aligned}$$

whence

$$\text{tan. } D \text{ cot. } L = \tfrac{1}{2}\,(\text{cos. } h_n + \text{cos. } h_s).$$

But the right triangle PDZ gives, by putting

$$h = DPZ,$$
$$\text{cos. } h = \text{tan. } D \text{ cot. } L.$$

Hence

$$\begin{aligned}\text{cos. } h &= \tfrac{1}{2}\,(\text{cos. } h_n + \text{cos. } h_s) \\ &= \text{cos. } \tfrac{1}{2}\,(h_n + h_s) \text{ cos. } \tfrac{1}{2}\,(h_n - h_s).\end{aligned}$$

$$\text{cos. } \tfrac{1}{2}\,(h_n - h_s) = \frac{\text{cos. } h}{\text{cos. } \tfrac{1}{2}\,(h_n + h_s)}$$

$$\frac{1 - \text{cos. } \tfrac{1}{2}\,(h_n - h_s)}{1 + \text{cos. } \tfrac{1}{2}\,(h_n - h_s)} = \frac{\text{cos. } \tfrac{1}{2}\,(h_n + h_s) - \text{cos. } h}{\text{cos. } \tfrac{1}{2}\,(h_n + h_s) + \text{cos. } h}$$

$$\text{tan.}^2 \tfrac{1}{4}\,(h_n - h_s) = \text{tan. } \tfrac{1}{2}\,[h - \tfrac{1}{2}\,(h_n + h_s)] \text{ tan. } \tfrac{1}{2}\,[h + \tfrac{1}{2}\,(h_n + h_s)].$$

But $h_s - h_n$ is very small, and h differs very little from $\frac{1}{2}\,(h_n + h_s)$; whence

$$h - \tfrac{1}{2}\,(h_n + h_s) = \tfrac{1}{8}\,(h_n - h_s)^2 \text{ tan. } 1'' \text{ cot. } h\,;$$

and the second member of this equation, which may be denoted by δh, is a correction which must be added to $\frac{1}{2}\,(h_n + h_s)$ to obtain h. And in the same way, the corrections for reducing h_n and h_s to h are obtained by the following formulæ: —

$$h_n - h = \tfrac{1}{2}\,(h_n - h_s) - \delta h,$$
$$h - h_s = \tfrac{1}{2}\,(h_n - h_s) + \delta h.$$

These corrections need be computed but once; and the computation of them for α Lyræ, from the mean of all the observations on those days on which the east and west transits were both observed, is contained in Table VII. The corrections of h for changes in the declination of the point Z, that is, for changes in the level, are obtained from the differential of the above value of cos. h, which is, if Dh and DL denote these corresponding changes,

$$\text{sin. } h \,.\, Dh = \frac{\text{tan. } D}{\text{sin.}^2 L} \,.\, DL\,.$$

This equation, divided by the value of cos. h, becomes

$$\tan. h \,.\, D h = \frac{D L}{\sin. L \,.\, \cos. L} = \frac{2 D L}{\sin. 2 L},$$

and will also answer well enough, for a star so high as α Lyræ, in computing the change of h, corresponding to a change $-D L$ of the declination.

When the value of h is found, that of L is readily determined by the formula

$$\sin. (L - D) - \tan.^2 \tfrac{1}{2} h \sin. (L + D),$$

which it will be convenient to compute for a mean value of h, and determine the corrections of L for another value of h, by the preceding formulæ between $D L$ and $D h$, in which sin. 2 L and tan. h may be regarded as constant.

This method of reduction, although exceedingly expeditious, cannot be applied to those stars which pass very near the zenith, because the observation of the time of transit of such a star over one of the wires is much more uncertain when the wire is south of the axis of collimation, than when it is north; that is, the value of h_s is less accurate than that of h_n. The values of h, therefore, and those of L, computed from h_s, will be less accurate than those computed from h_n, although the contrary should be the case; for it is obvious that the southern observations ought to have rather the advantage over the northern ones in the determination of the latitude. The observer will find, in fact, that if he undertake to reduce, by this method, his observations of a star which passes so near the zenith as not to make a transit over his most southern wires, which is the case with μ Ursæ Majoris and 8 Canum Venaticorum in this series, he will obtain most unsatisfactory results.

The value of L is, finally, the latitude of the place of observation, if the telescope is exactly in the prime vertical. But if the plane of the telescope makes a small angle a, with the prime vertical, so that the zenith is at Z', instead of Z; and if Dh denotes the hour angle of PZ, while L_o denotes the latitude; L_o may be obtained from L by the solution of the right triangle $ZP'Z'$, or by the formula

$$L_o = L - (\tfrac{15}{2} Dh)^2 \text{ sin. } 1'' \text{ sin. } 2\,L.$$

The value of Dh may be determined from the transits of low stars, and is the difference between the times of transit of one of these stars over the true prime vertical and over the axis of collimation of the telescope. This value, as also that of a and of $L - L_o$, is computed in Table IX. The value of a is derived from the formula

$$a = 15\,Dh \text{ sin. } L.$$

The places of the stars were not taken from any of the published tables, but from all the observations which have been published at Greenwich, Edinburgh, and Cambridge, within the last ten years. The declinations are given in Table II., for the purpose of future revision. The values of L given by the different stars, with the means, are contained in Tables VIII. and X.

After this memoir was presented to the Academy, a note was received, through the kind attentions of Captain Beaufort, R. N., from the astronomer royal, Mr. Airy, in which he has liberally communicated the results of all the Greenwich observations upon the stars here observed, to the end of the year 1844. These observations induce me to increase the declinations, given in Table II., of α Lyræ, by $0''.10$; of γ^1 Andromedæ, by $-0''.01$; of μ Ursæ Majoris, by $-0''.14$; and of 8 Canum Venaticorum, by $0''.18$. These corrections are incorporated into the results of Table X.

TABLE I.

Time and Rate of Chronometer No. 2419.

Date.		Sid. Time.		Chronometer slow.		Rate during interval.
		h.	m.	m.	s.	s.
1844.	Dec. 12,	5	20	1	41.09	
	" 15,	6	0	1	42.70	—0.52
	" 20,	0	30	1	46.83	—0.86
	" 24,	2	00	1	48.74	—0.46
	" 25,	2	15	1	49.55	—0.81
	" 26,	2	45	1	47.78	+1.77
	" 29,	0	30	1	48.13	—0.12
1845.	Jan. 2,	5	15	1	51.10	—0.71
					Mean rate =	—0.48

TABLE II.

Declinations of the Stars, computed from the Greenwich, Edinburgh, and Cambridge Observations.

Name of Star.	Mean Declination, for Jan. 1, 1845.	Apparent Declination, for Dec. 15.	Dec. 20.	Dec. 25.	Dec. 30.	Jan. 4.
	° ′ ″	″	″	″	″	″
α Lyræ . .	38 38 33.54	42.34	40.87	39.36	37.83	36.28
β Persei . .	40 21 15.27	24.97	25.43	25.83	26.15	26.41
γ[1] Andromedæ .	41 34 58.71	72.92	73.25	73.48	73.63	73.69
μ Ursæ Majoris	42 16 36.51	17.67	17.18	16.86	16 64	16.57
8 Canum Venaticorum	42 11 61.70	44.22	43.14	42.18	41.33	40.64

TABLE III.

Observations of the Level.

In the column of Observers, B¹ denotes W. C. Bond.
B² " G. P. Bond.*
G " Major Graham.

Observer.	Date.	Crossed End.	N.	S.	Mean.	North end of axis too high.	Mean.	Observer.	Date.	Crossed End.	N.	S.	Mean.	North end of axis too high.	Mean.
	d. h		″	″	″	″			d. h.		″	″	″	″	
		N.	93.0	93.0	0.00	—1.00				N.	92.0	93.0	0.50	0 00	
		S.	91.0	95 0	—2.00			B¹	Dec. 12 3	S.	92.0	93.0	—0 50		—0.12
B¹	Dec. 12 1¼	N.	94.0	93.0	0.50	—1.25	—1.08			N.	95.0	93.0	1.00	—0.25	
		S.	90.0	96.0	—3.00					S.	92.0	95.0	—1.50		
		N.	94.0	93.0	0.50	—1.00									
		S.	91.0	96.0	—2 50										

* I cannot refrain from thanking Mr. G. P. Bond for his valuable assistance in the reduction of the observations. It is due to him, also, to call attention to the fact, that all the observations upon 8 Canum Venaticorum were made by him, and that this star was his own selection. B. P.

TABLE III. — Continued.

Observer.	Date.	Crossed End.	N.	S.	Mean.	North end of axis too high.	Mean.
	d. h.		″	″	″	″	″
B¹	Dec. 12 4	N.	94.0	94.0	0.00	0.00	−0.12
		S.	94.0	94.0	0.00		
		N.	94.0	95.0	−0.50	−0.25	
		S.	95.0	93.0	1.00		
B¹	12 4½	N.	95.0	95.0	0.00	0.00	0.00
		S.	96.0	96.0	0.00		
B¹	12 11¼	N.	98.0	102.0	−2.00	−1.00	−1.00
		S.	100.0	100.0	0.00		
B²	14 1¾	N.	89.0	84.0	2.50	1.75	1.87
		S.	88.0	86.0	1.00		
		N.	90.0	84.0	3.00	2.00	
		S.	88.0	86.0	1.00		
B¹	14 3	N.	87.0	86.0	0.50	0.25	0.37
		S.	87.0	87.0	0.00		
		N.	88.0	86.0	1.00	0.50	
		S.	87.0	87.0	0.00		
B²	14 4½	N.	91.0	83.0	4.00	1.75	1.62
		S.	86.0	87.0	−0.50		
		N.	91.0	83.0	4.00	1.50	
		S.	86.0	88.0	−1.00		
B²	15 20¼	N.	90.0	89.0	0.50	0.25	0.25
		S.	90.0	90.0	0.00		
B²	16 1¼	S.	91.3	89.0	1.15	0.70	0.56
		N.	90.7	90.2	0.25		
		S.	91.7	89.0	1.35	0.42	
		N.	90.0	91.0	−0.50		
		S.	91.7	89.0	1.35	0.57	
		N.	90.0	90.4	−0.20		
B²	16 1¾	N.	91.0	89.5	0.75	1.12	1.02
		S.	92.0	89.0	1.50		
		N.	90.0	90.8	−0.40	0.92	
		S.	92.5	88.0	2.25		
B¹	16 3	N.	91.8	90.3	0.75	0.00	−0.06
		S.	90.5	92.0	−0.75		
		N.	91.0	91.0	0.00	−0.12	
		S.	91.0	91.5	−0.25		
B²	16 4½	N.	92.0	93.0	−0.50	−1.00	−1.06
		S.	91.0	94.0	−1.50		
		N.	92.0	93.0	−0.50	−1.12	
		S.	91.0	94.5	−1.75		
B¹	16 16¾	N.	94.5	94.5	0.00	0.00	−0.02
		S.	94.3	94.3	0.00		
		N.	94.0	94.2	−0.10	−0.05	
		S.	94.0	94.0	0.00		
B²	17 1¼	N.	95.0	92.5	1.25	0.12	0.06
		S.	93.0	95.0	−1.00		
		N.	95.0	93.0	1.00	0.00	
		S.	93.0	95.0	−1.00		
B²	17 1¾	N.	94.0	94.0	0.00	0.00	0.00
		S.	94.5	94.5	0.00		
B¹	17 3	N.	96.7	94.0	1.35	0.47	0.13
		S.	95.0	95.8	−0.40		
		N.	96.0	95.0	0.50	0.00	
		S.	95.0	96.0	−0.50		
		N.	96.0	95.0	0.50	−0.07	
		S.	94.7	96.0	−0.65		
B²	17 10¼	N.	95.0	100.0	−2.50	−0.40	−0.40
		S.	99.8	96.4	1.70		
B²	Dec. 17 10¾	N.	100.5	98.4	1.05	−0.10	−0.65
		S.	97.0	102.0	−1.25		
		N.	100.0	98.5	0.75	−1.00	
		S.	96.5	102.0	−2.75		
		N.	99.5	99.5	0.00	−0.85	
		S.	97.6	101.0	−1.70		
B¹	18 1¼	N	96.0	97.0	−0.50	−0.25	−0.21
		S.	96.6	96.5	0.00		
		N.	96.0	97.0	−0.50	−0.37	
		S.	96.5	97.0	−0.25		
		N.	97.0	98.0	−0.50	0.00	
		S.	98.0	97.0	0.50		
B¹	18 1¾	N.	97.3	98.0	−0.35	0.00	−0.07
		S.	98.0	97.3	0.35		
		N.	97.3	98.0	−0.35	−0.17	
		S.	98.0	98.0	0.00		
		N.	97.5	98.0	−0.25	−0.05	
		S.	98.3	98.0	0.15		
B¹	18 3	N.	97.0	100.5	−1.75	−0.62	−0.85
		S.	99.3	98.3	0.50		
		N.	97.0	101.0	−2.00	−1.00	
		S.	99.0	99.0	0.00		
		N.	97.3	101.0	−1.85	−0.92	
		S	99.3	99.3	0.00		
B¹	18 16¾	N.	95.0	95.0	0.00	−0.50	−0.58
		S	94.0	96.0	−1.00		
		N.	95.0	95.0	0.00	−0.75	
		S	93.5	96.5	−1.50		
		N.	95.0	95.0	0.00	−0.50	
		S	94.0	96.0	−1.00		
B¹	18 20½	N.	95.0	96.0	−0.50	−0.75	−0.75
		S.	95.0	97.0	−1.00		
		N.	95.0	96.0	−0.50	−0.75	
		S.	94.5	96.5	−1.00		
B²	20 1¼	N.	93.5	96.0	−1.25	−0.05	−0.14
		S.	96.1	93.8	1.15		
		N.	93.5	97.0	−1.75	−0.23	
		S.	97.0	94.4	1.30		
B²	20 1¾	N	94.8	98.0	−1.60	−0.07	−0.07
		S.	98.1	95.0	1.55		
B²	20 3½	S.	97.8	96.5	0.65	−0.92	−0.83
		N.	96.0	101.0	−2.50		
		S.	99.8	98.0	0.90	−0.75	
		N.	96.2	101.0	−2.40		
B²	20 4½	N.	96.0	103.0	−3.50	−1.75	−1.31
		S.	100.0	100.0	0.00		
		N.	97.5	103.0	−2.75	−0.87	
		S.	101.5	99.5	1.00		
B²	20 16¾	N.	97.2	105.0	−3.90	−1.95	−1.85
		S.	101.0	101.0	0.00		
		N.	97.5	104.5	−3.50	−1.75	
		S.	101.0	101.0	0.00		
G	23 16¾	N.	90.4	86.4	2.00	0.50	0.41
		S.	87.5	89.5	−1.00		
		N.	90.0	87.2	1.40	0.27	
		S.	87.5	89.2	−0.85		
		N.	89.4	87.0	1.20	0.47	
		S.	88.0	88.5	−0.25		

TABLE III. — Continued.

Observer.	Date.	Crossed End.	N.	S.	Mean.	North end of axis too high.	Mean.
	d. h.		″	″	″	″	″
G	Dec. 23 20½	N.	86.3	85.2	0.55	—0.07	0.02
		S.	84.8	86.2	—0.70		
		N.	85.8	85.0	0.40	0.12	
		S.	85.0	85.3	—0.15		
G	24 2	N.	87.0	89.0	—1.00	0.00	0.07
		S.	89.0	87.0	1.00		
		N.	87.7	88.3	—0.30	0.15	
		S.	88.4	87.2	0 60		
G	24 16¾	N.	87 6	89.2	—0.80	—0.45	—0.30
		S.	87.8	88.0	—0.10		
		N.	87.0	87.5	—0.25	—0.25	
		S.	86.5	87 0	—0.25		
		N.	86.1	86.3	—0.10	—0.20	
		S.	85.4	86.0	—0.30		
G	25 2	N.	85.6	83.8	0.90	0.05	0.15
		S	83 2	84.8	—0 80		
		N.	84.3	83.0	0 65	0.25	
		S.	83.2	83.5	—0 15		
G	25 4½	N.	84.8	83.6	0.60	0.12	0.22
		S	83.6	84.3	—0.35		
		N.	85.0	83 3	0.85	0.22	
		S.	83.0	83 8	—0 40		
		N.	83.8	82 0	0 90	0 32	
		S	82.5	83.0	—0.25		
G	26 2	N.	82 6	74.7	3.95	0.97	0.87
		S.	76.3	80.3	—2.00		
		N.	82 0	74.3	3.85	1.00	
		S.	76.3	80.0	—1.85		
		N.	81.5	74.5	3 50	0 65	
		S.	75.8	80.2	—2 20		
B^2	28 11	N.	103.5	103.7	—0.10	—0.82	—0.99
		S.	102 4	105 5	—1.55		
		N.	103 5	104.9	—0.70	—1.17	
		S.	102.9	106 2	—1.65		
		N.	104.5	105.2	—0.35	—0.97	
		S.	103.2	106.4	—1 60		
B^2	28 13¼	N.	103 5	103.8	—0 15	—1.65	—1 58
		S.	101 5	107.8	—3.15		
		N.	105.8	105.6	0.10	—1.52	
		S.	103 2	109.5	—3.15		
B^1	28 16¾	N.	102 5	105.5	—1.50	—1.00	—1.25
		S.	103 0	104.0	—0.50		
		N.	102.0	105 0	—1.50	—1.50	
		S.	102 0	105.0	—1.50		
		N.	102 0	105.0	—1 50	—1.25	
		S.	102.5	104.5	—1.00		
B^1	28 20½	N.	99.5	100.2	—0 35	—1.42	—1.32
		S.	97 5	102.5	—2.50		
		N.	99 5	99.5	0.00	—1.25	
		S.	96.5	101.5	—2 50		
B^2	29 11	N.	96.7	96.5	0.10	—0.70	—0.44
		S.	95 0	98.0	—1.50		
		N.	97.5	96.0	0.75	—0 37	
		S.	95 0	98 0	—1.50		
		N.	98.0	95.0	1 50	—0.25	
		S.	94.0	98.0	—2 00		
B^2	30 9½	N.	83.2	88.7	—2.75	0.37	0.37
		S.	89.5	82.5	3.50		
B^2	Dec. 30 10¼	N.	84.9	87.1	—1.10	1.10	0.85
		S.	89.3	82.7	3.30		
		N.	84 5	87.9	—1.70	0.60	
		S.	89.1	83.3	2.90		
B^2	30 10¾	S.	89.4	84.2	2.60	0.25	0.25
		N.	85.2	89.4	—2.10		
B^2	30 11¾	N.	90.9	83.1	3.90	0.15	0.15
		S.	83.5	90.7	—3.60		
B^2	30 12½	S.	86.0	88.5	—1.25	1.02	0.77
		N.	90.6	84.0	3.30		
		S.	85.8	88.4	—1.30	0.52	
		N.	89.6	84.9	2.35		
B^2	30 13	S.	85 0	89.6	—2 30	0.12	0.12
		N.	89.7	84.6	2.55		
B^2	Jan. 1 9½	N.	88.0	83.5	2.25	—0.25	—0.25
		S.	83.2	88.7	—2 75		
B^2	1 10	S.	84.7	90.0	—2.65	—0.20	—0.36
		N.	90.0	85.0	2.25		
		S.	84.6	90.3	—2.85	—0.52	
		N.	89.6	86.0	1.80		
B^2	1 10¾	S.	83.0	94.3	—5.65	—2.42	—2.50
		N.	89.6	88.0	0.80		
		N.	90.0	88 5	0.75	—2.57	
		S.	83.6	95.4	—5.90		
		N.	91.0	89.4	0.80	—2.50	
		S.	84.8	96.4	—5.80		
B^1	1 20½	N.	96.0	92.0	2.00	—0.75	—1.12
		S.	85.0	102.0	—3.50		
		N.	96.0	92.0	2.00	—1.25	
		S.	84.0	103.0	—4 50		
		N.	95.0	92.0	1.50	—1.37	
		S.	84.0	102.5	—4.25		
B^1	1 1¼	N.	91.0	98.0	—3.50	—2.75	—2.75
		S.	92.0	96.0	—2.00		
		N.	91.0	98.0	—3.50	—2.75	
		S.	92.0	96.0	—2.00		
		N.	91.0	98.0	—3 50	—2 75	
		S.	92.0	96.0	—2.00		
B^1	1 3	N.	93 0	98.0	—2 50	—3.12	—3.04
		S.	91.5	99.0	—3.75		
		N.	92.0	98.0	—3.00	—3.00	
		S.	92.0	98.0	—3.00		
		N.	92 0	98.0	—3.00	—3.00	
		S.	92.0	98.0	—3.00		
B^2	5 9½	N.	66.3	77 3	—5.50	—4.20	—4.12
		S.	68.7	74.5	—2 90		
		S.	68.8	74.3	—2.85	—4.05	
		N.	66.8	77.3	—5 25		
B^2	5 10½	N.	65.0	78.0	—6 50	—4.22	—4.01
		S.	69.9	73.8	—1.95		
		N.	66.5	77.7	—5.60	—3.80	
		S.	70.3	74.3	—2.00		
		S.	73.0	74.3	—0.65	—4.00	
		N.	67.0	81.7	—7.35		
B^2	5 11½	N.	67 5	87.2	—7.85	—4.17	—4.17
		S.	78.0	77.0	0 50		
B^2	5 12¼	N.	68 0	87.2	—9.60	—4.55	—4.55
		S	78.0	77.0	0.50		
B^2	5 13¼	S.	80 0	78.2	0.90	—4.80	—4.85
		N.	69.0	90.0	--10 50		
		S.	81.0	79.0	1.00	—4.90	
		N.	69.0	90.6	--10.80		

TABLE IV.

Observations of the Transits of Stars for determining the Latitude.

Name of Star.	Observer.	Date.	Ill. end of axis.	Transit.	Time of transit over Wire. A.	B.	C.	D.	E.	F.	G.	Error of Level, N. end too high.	Ex. Th.
					h. m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	"	°
α Lyræ.	B^2	Dec. 15	N.	W.	20			25 14.2				0.25	
"	B^1	16	S	E.	16 38 11.0	37 3.0	35 55.2	34 47.3	33 40.2	32 32.5		—0.02	32
"	B^1	16	S.	W.	20 21 49.7	22 58.8	24 6.8	25 14.0	26 21.3	27 27.7	28 33.2	—0.02	
"	B^1	19	N.	E.	16 31 24.2	32 30.0	33 36.0	34 43.1	35 50.8	36 58.8	38 7.8	—0.58	27
"	B^1	19	N.	W.	20 28 29.2	27 23.0	26 17 2	25 10.5	24 2.8	22 55.0	21 46.3	—0.75	
"	B^2	20	S.	E.	16 38 5 6	36 57 0	35 48.8	34 41.4	33 34.2	32 28.0	31 22.2	—1.85	8
"	G	23	S.	E.	16 38 5.8	36 57.2	35 49.0	34 42 0	33 34.5	32 28.2	31 22.5	0 41	
"	G	23	S.	W.	20 21 45.0	22 54.0	24 1.5	25 9.0	26 16 2	27 22.5	28 28.1	—0.02	
"	G	24	N.	E.	16 31 22.0	32 28 4	33 34.5	34 40 9	35 48.7	36 56 8	38 5.4	—0.30	
"	B^1	29	N.	E.	16 31 22.3	32 28.5	33 34.3	34 41.2	35 47.1	36 55.2	37 5.5	—1.25	10
"	B^1	29	N.	W.	20 28 28.3	27 22.5	26 18.4		24 2.0			—1.32	
"	B^1	Jan. 2	S.	E.	20 21 44.3	22 54 0	24 1.2	25 8.4	16 15.2	27 21.3		—1.12	21
β Persei.	B^2	Dec. 14	N.	E.	1 26 35.0	28 3 0	29 31.0	31 1.2	32 33.2	34 6.8	35 42.4	1.87	
"	B^2	14	N.	W.	4 26 23.2	24 55.6	23 26.9	21 57.0	20 24.7	18 51.5	17 16.2	1.62	
"	B^2	16	S.	E.	1 35 41.2	34 5.3	32 31.6	31 0.0	29 29.5	28 0.5	26 33.9	0.79	
"	B^2	16	S.	W.	4 17 17.3	18 52.8	20 25.8	21 57.0	23 28.0	24 57.2	26 25.0	—1.06	
"	B^2	17	S.	E.	1 35 40.5	34 4.7	32 32.5	31 0.0	29 29.2	28 1.0	26 33 3	0.03	
"	B^1	18	N.	E.	1 26 33.0	28 0 5	29 29.0	30 58.2	32 30.0	34 5.0	35 40.0	—0 14	
"	B^2	20	N.	E.	1 26 30 7	27 58.7	29 26.8	30 57.0	32 29.0	34 2 5	35 38.0	—0.10	
"	B^2	20	N.	W.	4 26 20.0	24 52.2	23 23.7	21 53.2	20 21.5	18 48.0	17 13.0	—1.31	
"	G	23	S.	E.	1		32 27.3	30 55.0	29 25.0	27 56.5	26 29.0		
"	G	24	S.	E.	1 35 35.6	34 0.0	32 27.0	30 55 3	29 24.3	27 56.0	26 28 3	0.07	30
"	G	25	N.	E.	1 26 29.0	27 57.0	29 25 0	30 55 5	32 27.8	34 1.5	35 36.5	0.15	37
"	G	25	N.	W.	4 26 17.8	24 49.5	23 21.4	21 50 8	20 19.0	18 45 5	17 10.0	0.22	
"	G	26	S.	E.	1 35 36.5	34 0.5	32 27.5	30 55.6	29 24.5	27 56 5	26 28.5	0.87	
"	G	26	S.	W.	4 17 11.0	18 46.0	20 19.6	21 51 0				0 87	41
γ^1 Andromedæ.	B^1	12	N.	E.	0		56 37.3	58 58.9	61 28.0	64 4.0	66 49.6	—1.08	20
"	B^1	12	N.	W.	2 53 28.8	51 16.7	49 0.7	46 38.5	44 8 5	41 33.2	38 48.0	—0.12	
"	B^1	14	N.	E.	0			58 58.0	61 26.8	64 3.7	66 47.6	1.87	30
"	B^1	14	N.	W.	2 53 26.6	51 13.8	48 58.2	46 37.0	44 6.7	41 30 5	38 46.5	0.37	
"	B^1	16	S.	E.	0 66 47.0	64 0.9	61 25.0	58 55.9	56 34.4	54 17.7	52 6 3	1.02	23
"	B^1	16	S.	W.	2 38 47.5	41 33.6	44 8.4	46 37.0	49 0.0	51 16.9	53 27 9	—0.06	
"	B^2	17	S.	E.	0 66 45.5	63 59.5	61 24.7	58 55.7	56 33.4	54 17.4	52 6.1	0.03	19
"	B^1	17	S.	W.	2 38 47.2	41 33.3	44 9.0	46 37.0	49 0 7	51 17.0	53 27.0	0.13	
"	B^1	18	N.	E.	0 52 5.2	54 17 2	56 33.4	58 54.2	61 25.0	64 0.0	66 44.3	—0.14	15
"	B^1	18	N.	W.	2 53 25.3	51 12 5	48 56.0	46 34.0	44 7.0	41 30.2	38 44.3	—0.46	
"	B^2	20	N.	E.	0 52 3.0	54 15.0	56 31.3	58 53.0	61 22.8	63 58.8	66 43.0	—0.10	19
"	B^2	20	N.	W.	2 53 22.3	51 11.0	48 54.8	46 33.0	44 3.3	41 27.7	38 43.0	—0.45	
"	G	24	S.	E.	0 66 40.8	63 55.7	61 19.0	58 51.0	56 28.5	54 12.2	52 0.0	0.07	
"	G	25	N.	E.	0 52 1.0	54 13.5	56 29.7	58 50 9	61 21.5	63 57.0	66 42.0	0.15	
"	G	25	N.	W.	2 53 20.5	51 8 0	48 52.5	46 30 0	44 0.8	41 24.2		0.22	
"	G	26	S.	E.	0 66 41.0	63 55 0	61 20.6	58 51.7	56 29.4	54 12.7	52 2.5	0.87	45
"	G	26	S.	W.	2 38 40.5	41 26.7	41 1.5	46 30.7	48 53.2	51 9.5	53 20.7	0.87	42
"	B^1	Jan. 2	S.	E.	0 66 35.5	63 50.0	61 15.2	58 46 0	56 22 8	54 7.2	51 56.0	—2 75	15
"	B^1	2	S.	W.	2 38 41.8	41 27.2	43 2.5	46 30.2	48 53.4	51 9.8	53 20 5	—3 04	
α Ursæ Majoris.	B^1	Dec. 12	N.	E.	9			51 25.0				—1.00	
"	B^2	17	S.	E.	9			51 23.0	45 39 5	40 59.5	36 59.5	—0.40	20
"	B^2	17	S.	W.	10			31 27.5	37 11.0	41 49.5	45 52.5	—0.52	
"	B^2	28	N.	E.	9		45 42.3	51 23.0	59 37.5			—0.99	3
"	B^2	28	N.	W.	10 45 50.0	41 45.5		31 27.0	23 8 5			—0.99	
"	B^2	29	S.	E.	9		59 26.5	51 17.6	45 34.2	40 56.0		—0.44	19
"	B^1	29	S.	W.	10		23 16.2	31 26.0	37 8.7			—0 44	
"	B^2	30	N.	E.	9	41 0.5	45 38.7	51 23.5	59 40.5			0 60	32
"	B^2	30	N.	W.	10 45 45.5	41 42.5	37 2.5	31 20.0	23 1.0			0.55	
"	B^2	Jan. 1	S.	E.	9		59 26.5	51 15.5	45 32.5	40 53.0		—1.40	20
"	B^2	1	S.	W.	10		23 10.0	31 22.5	37 6.0			—1.40	
"	B^2	5	S.	E.	9		59 22.5	51 13.0	45 29.7	40 50.5	36 48.5	—4.12	24
"	B^2	5	S.	W.	10			31 25.3	37 8.5	41 47.5	45 49.5	—4.12	
8 Canum venaticorum.	B^2	Dec. 28	N.	E.	11 46 22.0		53 56.5	58 33.5	64 10.5	72 6.0		—0.99	
"	B^2	28	N.	W.	12 62 55.5	59 20.0		50 45 0	45 6.4			—1.58	
"	B^2	30	N.	E.	11 46 22.3	49 58.5	35 58.5	58 33.0	64 12.8	72 8.0		0 46	
"	B^2	30	N.	W.	12 62 52.5	59 15.5	55 16.5	50 41.0	45 1 5	37 5.0		0.45	
"	B^2	Jan. 5	S.	E.	11	71 49.0	64 0 5	58 25.0	53 48.5	49 49 0	46 14.0	—4.36	
"	B^2	5	S.	W.	12	37 24.5	45 9.5	50 47.0	55 23 0	59 23.2	62 57.0	—4.70	

TABLE V.

Computation of the Intervals of the Wires.

1. *From Observations of α Lyræ.*

Observer.	Date.	Ill. end of axis.	Transit.	Interval of Passage between Wire D and Wire A.	B.	C.	E.	F.	G.
				s.	s.	s.	s.	s.	s.
B[1]	Dec. 16	S.	E.	203.7	135 7	67.9	67.1	134.8	
B[1]	16	S.	W.	204.3	135.2	67.2	67.3	133.7	199 2
B[2]	20	S.	E.	204.2	135.6	67.4	67.2	133.4	199.2
G	23	S.	E.	203.8	135.2	67.0	67.5	133.8	199.5
G	23	S.	W.	204 0	135.0	67.5	67.2	133.5	199.1
B[1]	Jan. 2	S.	E.	204 1	134.4	67.2	66.8	132.9	
Mean		S.		204.02	135.18	67.37	67.18	133.68	199.25
B[1]	Dec. 19	N.	E	198.9	133.1	67.1	67.7	135.7	204.7
B[1]	19	N.	W.	198 7	132.5	66.7	67.7	135 5	204.2
G	24	N.	E.	198.9	132.5	66.4	67.8	135.9	204.5
B[1]	29	N.	E.	198.9	132.7	66.9	65.9	134.0	204.3
Mean		N.		198 85	132 70	66.78	67.18	135.18	204.42

2. *From Observations of β Persei.*

Observer.	Date.	Ill. end of axis.	Transit.	A.	B.	C.	E.	F.	G.
B[2]	Dec. 16	S.	E.	281.2	185.3	91.6	90.5	179.5	266.1
B[2]	16	S.	W.	279.7	184 2	91.2	91.0	180.2	268.0
B[2]	17	S.	E.	280.5	184.7	92 5	90.8	179.0	266.7
G	23	S.	E.			92.3	90.0	178.5	266.0
G	24	S.	E.	280.3	184.7	91.7	91.0	179.3	267.0
G	26	S.	E.	280.9	184.9	91.9	91.1	179.1	267.1
G	26	S.	W.	280 0	185.0	91.4			
Mean		S.		280 43	184.80	91.80	90.73	179.27	266.82
B[2]	Dec. 14	N.	E.	266.2	178.2	90.2	92.0	185.6	281.2
B[2]	14	N.	W.	266 2	178.6	89.9	92.3	185.5	280.8
B[1]	18	N.	E.	265.2	177.7	89.2	91.8	186.8	281.8
B[2]	20	N.	E.	266.3	178.3	90.2	92.0	185.5	281.0
B[2]	20	N.	W.	266.8	179.0	90 5	91 7	185.2	280.2
G	25	N.	E.	266.5	178.5	90.5	92.3	186.0	281.0
G	25	N.	W.	267.0	178.7	90.6	91.8	185 3	280.8
Mean		N.		266.31	178.43	90.16	91.99	185.70	280.97

3. *From Observations of γ[1] Andromedæ.*

Observer.	Date.	Ill. end of axis.	Transit.	A.	B.	C.	E.	F.	G.
B[1]	Dec. 16	S.	E.	471.1	305.0	149.1	141.5	278 2	409.6
B[1]	16	S.	W.	469.5	303.4	148.6	143.0	279.9	410 9
B[2]	17	S.	E.	469.8	303.8	149.0	142 3	278.3	409.6
B[1]	17	S.	W.	469 8	303.7	148.0	143.7	280.0	410 0
G	24	S.	E.	469.8	304.7	148.0	142.5	278.8	411.0
G	26	S.	E.	469.3	303 3	148.9	142.3	279.0	409.2
G	26	S.	W.	470.0	304.0	149.2	142.5	278.8	410.0
B[1]	Jan. 2	S.	E.	469.5	304.0	149.2	143.2	278 8	410.0
B[1]	2	S.	W.	468.4	303.0	147.7	143.2	279.6	410.3
Mean		S.		469.69	303.86	148.63	142 69	279 04	410.07
B[1]	Dec. 12	N.	E.			141.6	149.1	305.1	470.7
B[1]	12	N	W.	410.3	278.2	142.2	150 0	305.3	470.5
B[1]	14	N.	E.				148 8	305 7	469.6
B[1]	14	N.	W.	409.6	276.8	141.2	150 3	306.5	470.5
B[1]	18	N.	E.	409.0	277.0	140.8	150.8	305.8	470.1
B[1]	18	N.	W.	411.3	278 5	142 0	147.0	303.8	469.7
B[2]	20	N.	E.	410.0	278 0	141.7	149.8	305 8	470.0
B[2]	20	N.	W.	409.3	278.0	141.8	149 7	305.3	470 0
G	25	N.	E.	409.9	277.4	141.2	150.6	306 1	471.1
G	25	N.	W.	410.5	278.0	142.5	149.2	305.8	
Mean		N.		409.96	277.74	141 67	149.53	305.52	470 24

TABLE V. — Continued.

4. *From Observations of* μ *Ursæ Majoris.*

Observ-er.	Date.	Ill. end of axis.	Transit.	Interval of Passage between Wire D and Wire A.	B.	C.	E.	F.	G.
				s.	s.	s.	s.	s.	s.
B^2	Dec. 17	S.	E.				343.5	623.5	863.5
B^2	17	S.	W.				343.5	622.0	865.0
B^2_1	29	S.	E.			488.9	343.4	621.6	
B^1	29	S.	W.			489.8	342.7		
B^2	Jan. 1	S.	E.			491.0	343.0	622 5	
B^2	1	S.	W.			492.5	343.5		
B^2	5	S.	E.			489.5	343.3	622.5	864.5
B^2	5	S.	W.			.	343.2	622.2	864.2
Mean		S.				490 34	343.26	622.38	864.30
B^2	Dec. 28	N.	E.			340.7	494.5		
B^2	28	N.	W.	863.0	618.5		498.5		
B^2	30	N.	E.		623.0	344.8	497.0		
B^2	30	N.	W.	865 5	622.5	342.5	499.0		
Mean		N.		864.25	621.33	342.67	497.25		

5. *From Observations of* 8 *Canum Venaticorum.*

Observ-er.	Date.	Ill. end of axis.	Transit.	A.	B.	C.	E.	F.	G.
B^2	Jan. 2	S.	E.		804.0	335.5	276.5	516 0	731.0
B^2	2	S.	W.		802.5	337.5	276.0	516.2	730.0
Mean		S.			803.25	336 50	276 25	516.10	730.50
B^2	Dec. 28	N.	E.	731.5		277.0	337.0	812.5	
B^2	28	N.	W.	730.5	515.0		338.6		
B^2	30	N.	E.	730.7	514.5	274.5	339.8	815.0	
B^2	30	N.	W.	731.5	514.5	275.5	339.5	816.0	
Mean		N.		731.05	514.67	275.67	338.72	814.50	

Values of the Intervals between the Wires.

Name of Star.	Ill. end of Axis.	Equatorial Interval between Wire D and Wire A.	B.	C.	E.	F.	G.
		s.	s.	s.	s.	s.	s.
α Lyræ	S.	51.05	33.98	17.01	17.12	34 21	51.21
"	N.	51.10	33.96	17.02	16.97	33 98	51.15
β Persei	S.	51.11	33.99	17.03	17.12	34.11	51.17
"	N.	51.07	33.94	17.01	17.07	34.15	51.21
γ^1 Andromedæ	S.	51.18	34.01	17.05	17.11	34.13	51.11
"	N.	51.10	33.96	16.98	17.15	34.18	51 23
μ Ursæ Majoris	S.			17.00	17.08	34.09	51.11
"	N.	51.11	34.02	17.04	17 18		
8 Canum Venaticorum	S.		33.98	17.07	17.07	34.12	51.11
"	N.	51.16	34.02	17.03	17.17	34.29	
Mean		51.11	33.98	17.02	17.10	34.14	51.16
By Micrometer			34.34	17.16	17.09	34.17	51.16

TABLE VI.

Determination of the Constants for the Computation of the Latitude.

1. *For β Persei.*

Observer.	Date.	Ill. end of axis.	Interval of Passage from E. to W. Transit over Wire A.	B.	C.	D.	E.	F.	G.	Seconds of Dec. + lev. corr.
			h. m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	
B^2	Dec. 16	S.	2 41 36.1	44 47.5	47 54.2	50 57.0	53 58.5	56 56.7	59 51.1	23″.83
G	26	S.	34.5	45.5	52.1	55.4				25.66
Mean		S.	2 41 35.30	44 46.50	47 53.15	50 56.20	53 58.50	56 56.70	59 51.10	24.74
Val. of $L_s - D$			1° 48′ 9″.02	52′ 34″.55	56′ 58″.90	61′ 23″.68	65′ 52″.65	70′ 20″.67	74′ 47″.93	
Corresponding seconds of lev. and dec.			24.74	24.74	24.74	24.74	23.83	23.83	23.83	
			h. m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	
B^2	Dec. 14	N.	2 59 48.2	56 52.6	53 55.9	50 55.8	47 51.5	44 44.7	41 33 8	25″.52
B^2	20	N.	49.3	53.5	56.9	56.2	52.5	45.5	35 0	23.43
G	25	N.	48.8	52.5	56.4	55.3	51.2	44.0	33 5	24.90
Mean		N.	2 59 48.77	56 52.87	53 56 40	50 55.77	47 51.73	44 44.73	41 34.10	24.62
Val. of $L_n - D$			1° 74′ 44″.36	70′ 14″.91	65′ 49″.54	61′ 23″.05	56′ 56″.88	52′ 31″.46	48′ 7″.38	
$L_n - D$ reduced to lev. and dec. of $L_s - D$			1 74 44.24	70 14.79	65 49.42	61 22.93	56 56.67	52 31.25	48 7.17	
$\frac{1}{2}(L_n \backsim L_s)$			13 17.61	8 50.12	4 25.26	0.38	4 27.99	8 54.71	13 20.38	
$\frac{1}{2}(L_n + L_s) - L$			3.37	1.49	0.37	0.00	0.37	1.49	3.37	
$L_s \backsim L$			13 14.24	8 48.63	4 24.89	0.38	4 28.36	8 56.20	13 23.75	
$L_n \backsim L$			13 20.98	8 51.61	4 25.63	0.38	4 27.62	8 53.22	13 17.01	

2. *For γ^1 Andromedæ.*

Observer.	Date.	Ill. end of axis.	A.	B.	C.	D.	E.	F.	G.	Seconds of Dec. + lev. corr.
			h. m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	
B^1	Dec. 16	S.	1 31 60.5	37 32.7	42 43.4	47 41.1	52 25.6	56 59.2	61 21.6	13″.74
B^1_2	17	S.	61.1	33.8	44.3	41.3	27.3	59.6	20.9	13.42
G	26	S.	59.5	31.7	40.9	39.0	23.8	56.8	18.2	14.67
B^1	Jan. 2	S.	66.3	37.2	47.3	44.2	30.6	62.6	24.5	11.06
Mean		S.	1 32 1.85	37 33.85	42 43.98	47 41.40	52 26.8	56 59.55	61 21.30	13.22
Val. of $L_s - D$			34′ 40″.43	39′ 0″.41	43′ 17″.33	47′ 36″.87	51′ 57″.95	56′ 18″.41	60′ 38″.59	
			h. m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	
B^1	Dec. 12	N.	1		52 23.4	47 39.6	42 40.5	37 29.2	31 58.4	12″.41
B^1	14	N.				39.0	39.9	26.8	58.9	14.26
B^1	18	N.	61 20.1	56 55.3	22.6	39.8	42.0	30.2	60.0	13.11
B^2	20	N.	19.3	56.0	22.5	40.0	40.5	28.9	60.0	13.26
G	25	N.	19.5	54.5	22.8	39.1	39.3	27.2		13.91
Mean		N.	1 61 19.63	56 55 27	52 22.82	47 39.50	42 40.44	37 28.46	31 59.32	13.39
Val. of $L_n - D$			60′ 36″.89	56′ 14″25	51′ 54″.22	47′ 35″.24	43′ 14″.45	38′ 56″06	34′ 38″.50	
Corresponding seconds of lev. and dec.			13.43	13.43	13.17	13.39	13.39	13.39	13.26	
$L_n - D$ reduced to lev. and dec. of $L_s - D$			60 37.10	56 14.46	51 54.17	47 35.41	43 14.62	38 56.23	34 38.54	
$\frac{1}{2}(L_n \backsim L_s)$			12 58.34	8 37.02	4 18 42	0.73	4 21.66	8 41.09	13 0.02	
$\frac{1}{2}(L_n + L_s) - L$			3.24	1.44	0.36	0.00	0.36	1.44	3.24	
$L_s \backsim L$			12 55.10	8 35.58	4 18.06	0.73	4 22.02	8 42.53	13 3.26	
$L_n \backsim L$			13 1.58	8 38.46	4 18.78	0.73	4 21.30	8 39.65	12 56.78	

TABLE VI. — Continued.

3. *For μ Ursæ Majoris.*

Observer.	Date.	Ill. end of axis.	A.	B.	C.	D.	E.	F.	G.	Seconds of Dec. + lev. corr.
					m. s.	m. s.	m. s.	m. s.	m. s.	″
B^2	Dec. 17	S.				40 4 5	51 31.5	60 50.0	68 53.0	17.01
$B_1^?$	29	S.			23 49.7	8.4	34.5			16.22
B^2	Jan. 1	S.			43.5	7.0	33.5			15.57
B^2	5	S.				12 3	38.8	57.0	61.0	12.50
Mean		S.			23 46.60	40 8.05	51 34.58	60 53.50	68 57.00	15.32
Val. of $L_s - D$					2′ 18″.20	6′ 34″.12	10′ 51″.35			
Corresponding seconds of lev. and dec.					15.90	15.32	15.32			
				m. s.	m. s.	m. s.	m. s.			
B^2	Dec. 28	N.				39 64.0	23 31.0			15.″71
B^2	30	N.		60 42 0	51 23.8	56 5	20.5			17 20
Mean		N.		60 42.00	51 23.80	40 0.25	23 25.75			16.46
Val. of $L_n - D$					10′ 46″.96	6′ 31″.56	2′ 14″.18			
Corresponding seconds of lev. and dec.					17.20	16.46	16.46			
$L_n - D$ reduced to lev. and dec. of $L_s - D$					10 48.26	6 32.70	2 15.32			
$\frac{1}{2}(L_n \backsim L_s)$					4 15.03	0.71	4 18.01			
$\frac{1}{2}(L_n + L_s) - L$					0.35	0.00	0.35			
$L_s \backsim L$					4 14.68	0 71	4 18.36			
$L_n \backsim L$					4 15.38	0.71	4 17.66			

4. *For 8 Canum Venaticorum.*

Observer.	Date.	Ill. end of axis.	A.	B.	C.	D.	E.	F.	G.	Seconds of Dec. + lev. corr.
				m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	″
B^2	Jan. 5	S.		25 35.5	41 9.0	52 22.0	61 34.5	69 34.2	76 43.0	35.78
Val. of $L_s - D$				2′ 40″.08	6′ 54″24	11′ 11″.50	15′ 29″.31	19′ 47″.44		
			m. s.	m. s.	m. s.	m. s.	m. s.	m. s.		″
B^2	Dec. 28	N.	76 33.5			52 11.5	40 55.9			40.30
B^2	30	N.	30.2	69 17 0	61 18 5	8.0	48.7	24 57.0		41.71
Mean		N.	76 31.85	69 17.00	61 18.50	52 9.75	40 52.30	24 57.00		41.00
Val. of $L_n - D$				19′ 37″.69	15′ 21″.25	11′ 6″.26	6′ 48″.66	2′ 32″.14		
$L_n - D$ reduced to $L_s - D$				19 43.62	15 27.18	11 11.48	6 53 88	2 38 07		
$\frac{1}{2}(L_n \backsim L_s)$				8 31.77	4 16.47	0.01	4 17.72	8 34.68		
$\frac{1}{2}(L_n + L_s) - L$				1.39	0.35	0 00	0.35	1.40		
$L_n \backsim L_s$				8 33.16	4 16 82	0.01	4 17.37	8 33.28		
$L_s \backsim L$				8 30.38	4 16.12	0.01	4 18.07	8 36.08		

TABLE VII.

Computation of the Constants for the Reduction of the Hour Angles of α Lyræ to the Axis of Collimation.

Observer.	Date.	Ill. end of axis.	Interval of Passage from E. to W. Transit over Wire A.	B.	C.	D.	E.	F.	G.	Seconds of Dec. + lev. corr.
			h. m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	″
B^1	Dec. 16	S.	3 43 37.7	45 55.8	48 11.6	50 26.7	52 41.1	54 55.2		42.04
G	23	S.	39 2	56 8	12.5	27.0	41.7	54 3	57 5.6	40.16
Mean		S.	3 43 38 95	45 56 30	48 12.05	50 26.85	52 41.40	54 54.75	5.60	41.10
B^1	Dec. 19	N.	3 57 5.0	54 53 0	52 41 2	50 27.4	48 12.0	45 56.2	43 38.5	40.91
B^1	29	N.	6.0	54.0	42.1		14.9			36.85
Mean		N.	3 57 5.50	54 53 50	52 41.65	50 27.40	48 13.45	45 56.20	43 38 50	38.88
N. Interval reduced to lev. and decl. of S. int.			3 57 4.25	54 52.27	52 40.43	50 27.11	48 12.27	45 55.92	43 38.67	
½ diff. of N. and S. intervals			6 42.65	4 27.98	2 14.19	0 0.13	2 14.56	4 29.42	6 43.46	
Corr. of half sum of N. and S. intervals			5.36	2.37	0.60	0.00	0.60	2.37	5.36	
Corr. of intervals		S.	6 48 01	4 30.35	2 14.79	0 13	2 13.96	4 27.01	6 38 10	
Corr. of intervals		N.	6 37.29	4 25.61	2 13.59	0.13	2 13.16	4 31.79	6 48 82	

TABLE VIII.

Latitude of the Cambridge Observatory, neglecting the Deviation of the Plane of the Telescope from the Prime Vertical.

1. *From α Lyræ.*

Observer.	Date.	Ill. end of axis.	Transit.	Latitude from Wire A.	B.	C.	D.	E.	F.	G.	Mean	No. of Obs.
				° ′ ″	″	″	″	″	″	″	″	
B^2	Dec. 15	N.	W.	42 22			50.41				50.41	½
B^1	16	S.	E. & W.	48.23	47.11	47.59	48.47	49.09	51.11	48 41 W.	48.59	6½
B^1	19	N.	E. & W.	48.80	48.16	48 60	47.92	47.70	49.36	48 02	48.37	7
B^2	20	S.	E.	49.27	49.15	50.82	50.59	51.74	50.43	51.46	50.49	3
G	23	S.	E. & W.	47.45	47.28	47.61	47.29	48.51	47.53	48 03	47.67	7
G	24	N.	E.	50.66	48.42	48.05	49.89	49.76	49.62	49.27	49.3[illegible]	3
B^1	29	N.	E. & W.	47.45	46 81	47.05	45 95 E	51.25	46.41 E.	47.03 E.	47.67	5½
B^1	Jan. 1	S.	W.	47.93	50.33	48.07	47 83	46.57	50.07		48 47	3
Mean				42 22 48.33	47.87	48.06	48.36	49.19	49.23	48.47	48.47	35½

2. *From β Persei.*

Observer.	Date.	Ill. end of axis.	Transit.	A.	B.	C.	D.	E.	F.	G.	Mean	No. of Obs.
B^2	Dec. 14	N.	E. & W.	42 22 48.01	48.40	48.64	49.00	49.64	50.21	49.49	49.12	7
B^2	16	S.	E. & W.	48.26	48.16	49.12	48.10	49 85	48.30	48.01	48 54	7
B^2	17	S.	E.	47.91	48 17	45.92	48.02	49.49	45.37	46.51	47.34	2
B^1	18	N.	E.	47.78	49.05	48.87	51.65		49.61	49 78	49.46	2
B^2	20	N.	E. & W.	47.63	47.64	48.05	47.48	49 05	49.59	49.04	48 35	7
G	24	S.	E.	49 00	49.47	49.40	49.43	50.01	47.79	49.03	49 16	2
G	25	N.	E. & W.	48.41	47.63	48 81	47 26	48 65	48.54	48 45	48.19	7
G	26	S.	E. & W.	48.07	47.20	47.97	47.79	48 61 E	46.01 E.	47.53 E.	47.66	5½
Mean				42 22 48 10	47 99	48.44	48.22	49.29	48 63	48 62	48.47	39½

TABLE VIII. — CONTINUED.

3. *From γ^1 Andromedæ.*

Observer.	Date.	Ill. end of axis.	Transit.	Latitude from Wire A	B.	C.	D.	E.	F.	G.	Mean.	No. of Obs.
B^1	Dec. 12	N.	E. & W.	42° 22′ 48″09 W.	48″69 W	48″37	48″47	48″20	48″06	46″98	48″08	6
B^1	14	N.	E. & W.	48.92 W.	48 20 W.	49.11 W.	49 79	49.56	48.61	49.23	49.15	5½
B^1	16	S.	E. & W.	47.98	48.79	48.76	49 69	48 45	49.28	49.36	48.87	7
B^2_1	17	S.	E. & W.	48 82	49 35	49.19	49 50	49 80	49.34	48.33	49.16	7
B^1	18	N.	E. & W.	48.90	48.93	48 26	49.34	50.18	50.29	48.79	49.24	7
B^2	20	N.	E. & W.	48.49	49.75	49 31	49.59	49.08	49.44	48.95	49.23	7
G	24	S.	E.	48.98	47.98	50 20	49.65	49.04	48.84	49.17	49.12	3
G	25	N.	E. & W	49.09	48.95	49.32	49.54	48.73	48.60	47.79 E	48.94	6½
G	26	S.	E. & W.	48.40	48.97	47.57	48.84	47.77	47.86	46.86	48.04	7
B^1	Jan. 2	S.	E. & W.	49.91	49 80	49.40	49.75	50.59	49 91	49.39	49.82	7
Mean				42 22 48.78	49.07	18.87	49.40	49.15	49 04	48.49	48.96	63

4. *From μ Ursæ Majoris.*

Observer.	Date.	Ill. end of axis.	Transit.	Latitude from Wire A	B.	C.	D.	E.	F.	G.	Mean.	No. of Obs.
B^1	Dec. 12	N.	E.	42 22			48.84				48 84	½
B^2	17	S.	E. & W.				49.25	48.45			18.85	2
B^2	28	N.	E. & W.			47.49 E.	48.86	48.48			48.43	2½
B^2_1	29	S.	E. & W.			50 02	49.74	50.07			49.94	3
B^2	30	N.	E & W.			49.14	48.25	48.05			48.48	3
B^2	Jan. 1	S.	E. & W.			47.47	48.62	48 25			48.11	3
B^2	5	S.	E. & W.			47.25 E.	47.30	47.26			47.27	2½
Mean				42 22		48.50	48.68	48.44			48.54	16½

5. *From 8 Canum Venaticorum.*

Observer.	Date.	Ill. end of axis.	Transit.	Latitude from Wire A	B.	C.	D.	E.	F.	G.	Mean.	No. of Obs.
B^2	Dec. 28	N.	E. & W.	42 22	47.29 W.	47.79 E.	47.31	47.53	46.47		47 32	3½
B^2	30	N.	E. & W.		46.24	46.14	47.23	46 54	47.13		46 66	5
B^2	Jan. 2	S.	E & W.		46.24	46 14	47.28	47 02	47.14		46.76	5
Mean				42 22	46 45	46.41	47.27	47 03	47.00		46 87	13½

TABLE IX.

Observations for the Azimuth of the Telescope.

(All the transits were east of the meridian.)

Observer.	Date.	Ill. end of axis.	Name of Star.	Time of Transit over Wire A.	B.	C.	D.	E.	F.	G.	Mean Time of Transit.	Computed Time of Transit over Prime Vertical by Chronom.	Error from Azimuth
				h. m. s.	s.	s.	.	s.	s.	s.	s.	s.	s.
B^1	Dec. 12	N.	α CAN. MIN.	1 53 3.6	29.4	54 5	80 5	105.6	131 5	156.8	80.2	76 5	3 7
B^1	12	N.	α^2 GEMINO	3 57 45.5	81.0	116.1	151.7	187.6	223.5	259.2	152.0	148.3	3.7
B^1	12	N.	β GEMINO	4 15 46.7	87.7	123.9	169.8	211.7	253.4	294.5	170.3	167.0	3.3
B^2	14	N.	α CAN. MIN.	1 53 2.0	27 5	53.0	78 5	104.0	129.5	155.5	78.5	75.4	3.1
B^2	17	S.	α CAN. MIN.	1 53 154.3	129.0	103.5	78 0	52 7	26.6	1.5	78.0	73.1	4.9
B^2	20	N.	α CAN. MIN.	1 52 58.0	83.5	109 0	134.7	160.5	186.0	211.5	134.6	130.9	3.7
G	24	S.	α CAN. MIN.	1 52 209.6	184.0	158.5	133.0	107 5	81.2	36.0	132.9	129 1	3.8
G	25	N.	α CAN. MIN.	1 52			133.0	158 6	184.5	210.0	133.2	128 4	3.8
G	25	N.	β GEMINO	3 57 37.6	73.4	108.5	144.3	180 2	156.0	251.8	144.3	140 2	4.1
G	26	S.	α CAN. MIN.	1 52 210.0	184.0	158 5	133.0				133.1	130 0	3.1

Azimuth Error from Observations of α CAN. MIN. = 37″ 6   Corr. of Lat. = 0″004
"   " α^2 GEMINO = 37.4   "   " = 0.004
"   " β GEMINO = 37.4   "   " = 0.004

so that the correction of latitude is insensible.

TABLE X.

Latitude, of the Cambridge Observatory, from each Observer and Star.

Name of Star.	W. C. Bond.		Major Graham.		George P. Bond.		Mean.	
		No. of Observations.		No. of Observations.		No. of Observations.		No. of Observations.
α Lyræ . . .	42° 22′ 48″.37	22	48″.28	10	50″.58	3½	48″.57	35½
β Persei . .	49.46	2	48.12	14½	48.55	23	48.47	39½
γ¹ Andromedæ . .	49.10	36	48.47	16½	49.20	10½	48.95	63
8 Canum Venaticorum					47.05	13½	47.05	13½
μ Ursæ Majoris .	49.53	2			48.25	14½	48.40	16½
Mean Latitude	42 22 48.83	62	48.29	41	48 86	65	48.60	168

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V.

On the Language and Inhabitants of Lord North's Island in the Indian Archipelago; with a Vocabulary.

BY JOHN PICKERING,

PRESIDENT OF THE ACADEMY.

THE immediate subject of the present communication is a brief account of the language and inhabitants of a very small island in the Indian Archipelago, commonly known to navigators by the name of Lord North's Island, but sometimes called Nevil's Island, and Johnston's Island, the native name, however, being *Tóbi,* or, as we should pronounce it in English, *Tóbee.* It lies southwesterly from the well-known group called the Pelew Islands, and a little more than half way from that group towards the island of Gilolo, or Gilolo Passage, being, according to the best English authorities, in latitude 3° 2¾′ N. and longitude 131° 20′ E.,* but,

* Horsburgh's "India Directory," p. 571, 5th edit. London, 1841.

according to a modern French voyager of authority, it is in latitude 3° 3′ N. and longitude 128° 44′ E.*

The vocabulary accompanying this communication derives its principal value from the circumstance of its being the only one, which has been yet collected, of the language of these secluded islanders. As, however, a long time will probably elapse before we shall have the means of obtaining any additional information of this dialect, or of the wretchedly destitute and inconsiderable tribe of people who inhabit this little island, it will be of some utility, with a view to philological and ethnographical researches, to preserve this as one of the specimens of human speech, — as one fact in the history of the human race.

Before proceeding, however, to any details respecting the language and people in question, I beg leave to ask the attention of the Academy to a few general remarks on that division of the globe to which, geographically speaking, this little island may be said to belong, and which is part of that general region commonly known by the name of Polynesia, or Oceania.

This portion of the globe, in a general view, may be described as comprehending the belt of intertropical islands which extends from the western coast of America across the whole Pacific Ocean to the eastern shores of Asia, including, also, New Holland, New Zealand, and a few less considerable islands, some of which, however, lie several degrees without the southern tropic, though included in the description of Oceania.

That whole region has not hitherto attracted so much attention

* M. de Rienzi, the well known navigator. See his valuable and copious description of "Oceanie," published in the collection entitled "L'Univers Pittoresque, ou Histoire et Description de tous les Peuples," etc. 3 vols. 8vo. Paris, 1836.

as it has been justly entitled to from its intrinsic importance and character. Indeed, until the above-cited work of M. de Rienzi, who was himself a voyager throughout that part of the globe for twenty-one years of his life, we had, as he himself remarks, "no particular and complete book" on this fifth division of the earth, though it is, as he justly observes, the most curious and most diversified region of the globe. "It is," says he, "the land of prodigies; it contains races of men of the most opposite characters, the most extraordinary wonders of nature, and the most admirable monuments of art. We there see the pigmy by the side of the giant, and the white man by the side of the black; a cannibal people in the neighbourhood of a patriarchal tribe; and, at a small distance from the most brutal savages, nations that were civilized before we were; while earthquakes and aërolites desolate the fields of the country, and volcanoes overwhelm whole towns. Upon its southern continent, New Holland, the most whimsically formed animals, and on its largest island, Borneo, the orang-outan, that two-handed image of man, present to the philosophic inquirer a subject for profound contemplation; and while one of its islands prides itself on the majesty of its temples and its ancient palaces, — superior to the monuments of Persia and Mexico, and worthy to be compared with the chef-d'œuvres of India and Egypt, — others display their pagodas, their mosques, and their modern tombs, which rival, in elegance and grace, every thing that the East and China may offer us, even the most perfect of the kind."

If, now, we take our departure from Lima, on the American coast, and proceed westerly across the Pacific Ocean, — as the same writer continues, in glowing, but highly colored language, — "nothing meets the wandering eye but the ocean and the heavens, for the distance of six hundred leagues from the coast of Peru; but soon there begin to appear numerous clusters or groups of pleasant islands, which have probably risen up through the waves — though scarcely above their surface — within a few centuries past; while others, more ancient, shoot their heads of granite to the very clouds. If we continue our voyage through this vast labyrinth of islands, we encounter, in about the middle of the passage, a fifth continent, New Holland, almost as large as all Europe, and presenting the picture of a world that seems to be reversed. We find there other constellations in the heavens, other beings, and other climates; there we salute the rising sun at an hour when night covers us here with darkness; there we enjoy the season of summer at the time of the year when winter spreads its gloom over us at home; the autumn takes the place of our spring; the barometer falls on the approach of good weather, and rises when it forebodes a storm; sometimes the forests spontaneously take fire in December, and, at others, the northwest wind, like the *khamsin* of Egypt, scorches the earth, reduces it to powder, and thus augments the vast deserts of Australia. There you may see, with astonishment, a volcano without a crater or lava, but continually throwing out flames; gigantic plants, some growing in the waters of the ocean, and others in the dry sand; cherries growing with the stone on the outside; pears with the stem at the broadest end of the fruit; singular birds, as the white eagle and the red throat, black swans and cockatoos, the cassowary, which can run but not fly; blue crabs; lobsters without claws; dogs which do not bark; the kangaroo, a strange compound of the cat, the rat, the ape, the opossum, and the squirrel; the spinous echidnus; mammiferous animals without mammæ, and which appear to be oviparous; and the ornithorhyncus, which belongs at the same time to the phocæ and to quadrupeds, to birds and to reptiles,—a fantastic creature, which the Deity has cast upon the globe, in order to overthrow, by its presence, all the systems of naturalists, and to confound the pride of the learned." *

To considerations like these, of general importance to the philosophical inquirer, we may add, (as I have remarked in another place, †) that our countrymen have a particular interest in this subject, from circumstances which it will not be out of place to allude to.

One important group of the islands of the Pacific Ocean is an American discovery; I mean the group originally named, after their discoverer, Ingraham's Islands, but which the discoverer himself called the Washington Islands, and which, with the Marquesas, form the Archipelago of Mendana, as it is now denominated by geographers.‡

Another intertropical group, the Sandwich Islands, long well known to every reader, has a particular claim to our attention on account of the American missionary establishment there, which was begun in the year 1819, by missionaries from Boston, and which, independently of the important objects of the mission, will, with its American and European population, now amounting to many hundred persons, be of incalculable importance to the United States in many respects.

* See Cuvier's "Revolutions of the Globe," p. 41, Amer. edit. "L'Univers," Tom. I., Oceanie, pp. 3, 4.

† American Quarterly Review for September, 1836.

‡ See the original account of this discovery, extracted from the journal of Captain Ingraham, of Boston, in Massachusetts, published in the "Collections of the Massachusetts Historical Society," Vol. I., p. 20; see, also, Vol. IV., p. 241, of the same work.

This group, at present the most important of all in relation to the civilized world, has for many years been the resort of American whaling-ships; and at the time when the American Mission was established there, the rude inhabitants led such a life as would be the natural consequence of a native ignorance, which had been just enough enlightened to be trained to the most disgusting licentiousness and depravity by an unrestrained intercourse with the profligate part of their civilized visiters, from the time of their discovery by Captain Cook; but since the establishment of the American Mission, now a little more than twenty years ago, an essential change has taken place in the condition of the people of these islands; and, when it is stated that reading and writing, and printing, too, are extensively diffused, and that the natives feel the most intense interest in those precious arts, an intelligent reader will desire no more in order to enable him to form an estimate of their present condition and future prospects.

For this important change in their condition, — of which the natives are fully sensible, — they have been indebted to Americans. Their curiously constructed language, of more than Italian softness, was first reduced to writing by American missionaries; * and they now have in their own language elementary books of all the most useful and necessary kinds; an annual almanac, primers, spelling-books, and reading-books; and among these I cannot omit mentioning books of *arithmetic*, the study of which is almost a passion with them, and, as some persons believe, has done more to excite their thinking powers than any other works which have ever been published for their use. The Old and New Testaments have been translated into their language, and have been for some

* According to the principles of a systematic orthography recommended by the author of this paper, in "Memoirs of the American Academy," Vol. IV., p. 319.

time in common use among them,—the types being set up, and the printing done, by native workmen,—and, what will, perhaps, still more surprise the reader, I have now lying before me two different *newspapers* published in the native language, and which, in their external appearance and contents, are as respectable as the greater part of our own gazettes.

One further remark may be made, which is suggested by the subject of their language. Our English tongue is now, beyond all question, destined soon to be the language of *commercial intercourse* throughout the Pacific Ocean and the coast of America, and, perhaps, at a more remote period, of the Eastern Asiatic coast also. The enterprise and activity of the two greatest commercial powers — England and the United States — will probably defy all competition, and the common language and commerce of these two nations will mutually coöperate in giving additional interest to that whole region of the globe.

These are some of the considerations, which must excite an interest in all Americans to acquire a more accurate knowledge of the various parts of this division of the earth. But, in a more enlarged view, the physical characters of the islands throughout the Pacific Ocean, and of the races of people who have inhabited them for ages, present the most noble and interesting objects of philosophical research, that can at this day be offered to the contemplation of civilized man; and I trust it will not be deemed out of place to advert very briefly to some of them.

The general extent of the Oceanic region has been already stated; but I may here add, that the whole quantity of land comprehended in it is estimated by some geographers at not less than 2,500,000 square miles, while others have even reckoned it at 3,500,000. New Holland alone is nearly equal to all Europe, and the several islands together present a surface considerably larger than Europe. We have here, then, as has been justly observed, countries greater in extent than China and Hindostan together; Australia is larger than the Chinese empire, Borneo three times the size of Great Britain, and Sumatra larger than Great Britain and Ireland together. And these regions, says a well known geographer, "present in every quarter scenes adapted to move the most frigid imagination. Many nations are here found in their earliest infancy. The amplest openings have been afforded for commercial activity. Numberless valuable productions have been already laid under contribution to our insatiable luxury. Here many natural treasures still remain concealed from scientific observation. How numerous are the gulfs, the ports, the straits, the lofty mountains, and the smiling plains! What magnificence, what solitude, what originality, and what variety!" *

What a field for philosophical research is here found in those mighty agents of nature, the volcanoes, which are more numerous than in any other part of the globe! The island of Java alone is said to contain at least fifteen, Sumatra has a number of them, the Philippine and Molucca Islands are full of them, and in the Sandwich Islands is found the very largest among the whole of those which are still in activity, having a crater of melted lava said to be 900 feet in diameter.

In the animal kingdom it has been remarked, that the larger species of quadrupeds are found only in the larger islands, and that the smaller quadrupeds are comparatively few. The elephant, for example, is known only on the Peninsula, Sumatra, and the northeasterly part of Borneo; the tiger is said not to be found

* Malte Brun's Geography, Book LIII., Part I., Percival's edition, vol. I., p. 556.

in any of the smaller islands, even when those are in the vicinity of large ones which abound in that animal; and this, and other animals of the same tribe, though numerous in the larger islands to the westward, gradually disappear as we proceed eastward.

Among the peculiarities which have been thought worthy of distinct notice in the products of Australia, in particular, the greatest is the total absence of large quadrupeds, and the scarcity of the smaller; the latter of which, too, are so remarkable in their structure as to appear almost anomalous. Australia has been termed the land of contrarieties, as if Nature, in creating the forms intended for this region, had departed altogether from those rules to which she had otherwise so universally adhered. The particular form, for instance, which, in other parts of the world, she has given to the smallest race of quadrupeds, — the rats and dormice, — she here bestows upon the kangaroo, the largest animal throughout the whole of Australia.* Two thirds of the Australian quadrupeds are provided with the marsupial pouch, forming a natural nest in the soft folds of their own skin for the protection of their young, like the opossum of America; and they make their way with more rapidity, by springing or vaulting through the air, than by walking on the ground.

The ornithology of this region is distinguished by the vast proportion of suctorial birds, or such as derive their principal support from sucking the nectar of flowers. This peculiar organization, which, in Africa, India, and America is restricted to the smallest birds in creation, is here developed very generally, and given to species as large as the thrushes, and seems to be possessed by a great number of the parrots. The conchology comprehends many of the most beautiful and rare shells known to our cabinets.

* Swainson, on the Geography of Animals, in the Cabinet Cyclopædia, No. 66, p. 115.

The zoölogy of the Pacific Islands, those "magnificent fragments of a former world," as they have been called,* strictly speaking, has been but insufficiently investigated, as those islands have not, till recently, been much visited by scientific naturalists since the period of Captain Cook's voyages, now seventy years. The quadrupeds, as far as known, are few in number; and none of the islands seem to possess any one species of the kangaroo. The birds are little better known.† In every department of natural science, however, in relation to these islands, we may now expect a highly valuable addition to our present stock of information, from the researches made by the members of the late Exploring Expedition, fitted out by the government of the United States; an ample account of which is to be published, as soon as practicable, under the direction of the government, in a style becoming the subject and worthy of the nation.‡

But it would be out of place to extend any farther these remarks upon the Polynesian region in general; and I now return to the immediate subject of this communication, — *the Language and Inhabitants of Lord North's Island;* — in connection with which there will be occasion to make some allusion, also, to the Pelew group.

The geographical position of the island in question has been already mentioned.§ The native name of it, as before stated, is

* Malte Brun's Geography.

† Swainson, on the Geography of Animals, in the Cabinet Cylopædia, No. 66, p. 115.

‡ Since this paper was read before the Academy, a part of this valuable work has been published, comprising the general narrative of the Expedition, by Charles Wilkes, Esq., the commander; and it appears in a style that justifies the expectations which had been formed of it.

§ Ante, p. 205.

Tóbi, or Tóbee, and it appears to have taken its most common English name from the English ship *Lord North*, by which it was seen on the 14th of July, 1782; before that time, as Mr. Horsburgh says, "it seems not to have been known." *

But, although this may have been the first knowledge which English navigators had of it, yet, as the island lies in an archipelago which was within the field of the earliest Spanish and Portuguese voyages, and as the natives had pieces of iron in their possession, and had also in common use in their vocabulary two words that must have been taken from the Spanish and Portuguese languages, we may infer that it had been previously known to the enterprising navigators of those nations.† Subsequently to the voyage of the ship *Lord North*, it was seen, but not visited, by other English vessels (the *Raymond*, *Asia*, and *Montrose*), on the 1st of January, 1789, again in April, 1794, by Captain Seton, of the *Helen*, and since that time by several other ships.

The island is small and low; in Horsburgh's work, above cited, it is said to be about one mile or one mile and a half in extent, east-southeast and west-northwest; but according to the estimate of two American seamen, who lived upon it for two years (and who will be mentioned hereafter), it is only about three quarters of a mile long, and about half a mile in width; or about as large as the island in this immediate vicinity now called East Boston.

This little spot of earth, if the comparison may be allowed, stands like a lofty tower rising from the depths of the ocean, and just

* India Directory, p. 571, 5th edit., 1841.

† These two words are (as pronounced by the seamen) *shambaráro* and *shappo*, by which the natives called a *hat*, and which are manifestly corrupted from the Spanish *sombréro*, and the Portuguese *chapéo*, or, possibly, from the French *chapeau*.

showing its summit a few feet above the surface of the boundless waters that environ it; solitary, in sight of no other land, and encircled with its coral reef, from an eighth to half a mile in breadth, and on its outside washed by the bottomless ocean, of darkest blue, in which the sounding-lead of the mariner

> "Drops plumb down
> Ten thousand fathom deep."*

The whole island rises so little above the level of the sea, that the swell often rolls up to a considerable distance inland.

It was long supposed to be uninhabited; and the two seamen above alluded to were told by the natives, that no white man had ever before been on the island. Horsburgh, however, correctly describes it as being inhabited, and states, that the inhabitants sometimes come off in their canoes to ships that pass near the island.† The two seamen before mentioned state, that there were three villages upon it, situated on the shores, and containing, in all, between three and four hundred souls at the time when they were first taken there; but that the number was considerably diminished by famine and disease before they left the place.

As the residence of these two American seamen on the island has been the means of our obtaining more minute information than we before possessed, or shall be likely to obtain of this people and their language for a long time to come, it will not be uninteresting to give a very concise narrative of the circumstances by which those men were thrown upon this inhospitable spot of earth. The leading facts of their shipwreck and captivity are stated at large in an unpretending "Narrative," published by one of them, Horace Holden; and that they are faithfully stated I can have no

* Milton's Paradise Lost.

† East India Directory, p. 571.

doubt. The published narrative contains the same particulars which I had heard them relate in conversation; and, though I had frequent opportunities of interrogating each of them separately, I never found any material discrepancies in their statements; which, I may add, agreed also with the published narrative.

The two individuals in question were seamen on board of an American whale-ship, called *The Mentor*, belonging to the port of New Bedford, in Massachusetts. This ship, with her company of twenty-two persons, under the command of Captain Edward C. Barnard, sailed from the United States in the month of July, 1831, for the Indian Ocean, on a whaling voyage. While cruising there, and just after passing the Molucca Islands, they experienced very severe weather; which, continuing for several days, prevented their taking any observation that would enable them to determine their latitude and longitude; and, during the night of the 21st of May, 1832, when they were not apprehending any danger, the ship suddenly struck with great violence upon what they afterwards found was a coral reef, extending to the northward and eastward of the Pelew Islands. In the midst of the confusion and horrors of the moment, one of the ship's boats was lowered down, and ten of the crew threw themselves into it, believing it to be safer than to remain in the ship. But the boat and men were immediately swallowed up in the waves, and nothing was ever seen of them again except some shattered fragments of the boat, which were observed the next morning lying on the rocks, at a distance from the ship. Another boat was shortly afterwards let down from the ship, but was immediately dashed to pieces; the captain and some of the crew, who were in her, were all in imminent hazard of their lives, and one actually perished. It was then decided to remain on the wreck till daylight; which they effected, though with great difficulty, by clinging to the rigging as well as their exhausted strength would permit.

At daybreak they discovered that a part of the reef, estimated to be about three miles to leeward, was dry; and, shortly afterwards, they observed land to the eastward, but at the distance of twenty or thirty miles from them.

One of their boats was still left; but that was in a poor condition for carrying the remainder of the ship's company, eleven in number, to so considerable a distance as the land appeared to be from them. However, there was no alternative; and, accordingly, after taking into the boat a small quantity of bread, water, wearing apparel, a musket and brace of pistols, with gunpowder, cutlasses, and a tinder-box, they quitted the wreck.

On leaving the ship they steered for the reef before mentioned; the part of which, that was out of water, being only about sixteen rods long and quite narrow. They soon decided, that it was better to throw themselves into the hands of the natives of the neighbouring islands, whoever they might be, than to run the hazard of going to sea in a boat wholly unseaworthy, and when they had only a few pounds of bread and but little water for their subsistence. The dreary night was passed upon the reef; where, however, they had, to their great joy, succeeded in taking an eel, and a few crabs and snails, which they cooked with some sticks of drift wood that had lodged upon the rocks.

Before sunrise the next morning they observed a canoe at a short distance from them, containing twenty-two of the natives of the neighbouring island; which, as it afterwards appeared, was Baubelthouap, the largest of the Pelew group. The islanders, however, being evidently in fear, did not approach nearer until the seamen attached a shirt to an oar and hoisted it, as a token of a wish to treat them as friends; upon which the islanders immediately rowed up to the rock, and eagerly offered them cocoa-nuts, and bread made of the cocoa-nut boiled in a liquor extracted from the tree.

The Pelew Islanders are described by the two seamen, in most respects, as they are in the well known but highly colored work of Keate, published about fifty years before.* But their first rough and ferocious reception of their American prisoners was not such as was to have been expected, from the benevolent and amiable character given of them by that writer. The men were entirely naked; their eyes had a very singular appearance, being of a reddish color; their noses somewhat flat, but not so flat as those of the African, nor their lips so thick. Each of the men was armed with a spear and a tomahawk, or hatchet, and some had battle-axes. They were fancifully *tattooed*, on various parts of their bodies; their hair, naturally coarse and black, like that of the American Indians, was very long, and hung loosely over their shoulders, giving them a singular and frightful appearance; their teeth were entirely black, being rendered so by chewing what they called *abooak* (written in Keate's work *pook*), that is, the *aréca* or *betel* nut. They also manifested the same disposition to take, without leave, any European articles which were new or interesting to them; among which were the nautical instruments and some clothing. The women wore a sort of apron, fastened to the waist by a curiously wrought girdle, and extending nearly to the knees, and left open at the sides.

They are said to have been excessively fond of trinkets; and, (to adopt the language of the "Narrative,") "it would cause a fash-

* M. de Rienzi has given a brief abstract in his valuable work, before cited, Vol. III., p. 81.

ionable lady of America to smile, on observing the pains taken by those simple daughters of nature to set off their persons. In their ears, they wear an ornament made of a peculiar kind of grass, which they work into a tassel, and this is painted and richly perfumed. In their noses they wear a stem of the *kabooa* leaf, which answers the double purpose of an ornament and a smelling-bottle; and their arms, in addition to being *tattooed*, are adorned with a profusion of shells." The "Narrative" adds: — "Our fair readers may judge how much we were amazed, on finding that the copper-colored females of the island cut up our old shoes into substitutes for jewelry, and seemed highly delighted with wearing the shreds suspended from their ears!" *

In the same spirit (though this circumstance is not related in the "Narrative," but was mentioned to me by the seamen,) they turned into ornaments another article, which was apparently as useless as we can well conceive any one thing to have been to them; that is, a copy of the "Practical Navigator," published by our lamented President, Dr. Bowditch; the leaves of which were torn out by the ingenious females, then made up into little rolls of the size of one's finger, and inserted in their ears instead of the tufts of grass before mentioned!

But it is not my intention to pursue these details in relation to the Pelew Islanders, of whom sufficient information is to be found in the publications already referred to. It need only be added, that a residence among them was found uncomfortable by the shipwrecked Americans, and they decided to quit the island. An arrangement was made for that purpose with the natives; and, after consulting their prophetess, according to custom, the execution of the plan was entered upon. By a singular concurrence of

* Pages 48, 49.

circumstances, they were able to obtain, though with great difficulty, a mariner's compass, which had been left on the island by Captain Henry Wilson, who was shipwrecked there in the *Antelope*, fifty years before, and whose voyage is the subject of Mr. Keate's work. With this, their only nautical instrument, — much impaired, too, by time and improper use, — and after a promise that they would, upon reaching America, send to the islanders two hundred muskets, ten casks of gunpowder, and a corresponding quantity of balls and flints, with articles of ornament, such as beads, belts, combs, and trinkets of various kinds, — they took leave of the island, hoping to fall in with some of the European settlements in the Indian Archipelago.

It was agreed, however, that three of the Americans should remain behind as hostages; and, on the other hand, that three of the natives (two chiefs and one of the common people) should accompany the American crew, to see that the agreement was faithfully executed.* Upon putting to sea, however, it was found that the boat was too leaky to proceed, and they were obliged to return to the island again; when, after another month's delay in repairing her, they again took a final leave of the island, and not without emotions of regret, after the kindness and hospitality they had experienced among the rude but friendly natives; who, indeed, as we are told, looked upon their European visiters as beings of a higher order than themselves, and who had won their confidence.

After being at sea but a short time, in their crazy and ill-furnished boat, accompanied with a canoe to carry their supplies, they

* Of these three American hostages left at the Pelew Islands, one, it is said, has since been released, or has made his escape ; but nothing, it is believed, has yet been heard of the other two.

encountered tempestuous weather and a heavy sea, and lost nearly their whole stock of provisions by a squall which overset the canoe. In this destitute condition they remained at sea nine days and nights longer; having, after the first five days, divided equally among them the small remnant of their means of subsistence, which gave them four cocoa-nuts and a few pieces over, for each person. While in that condition, debilitated beyond belief, and reduced to skeletons as they were, and while on the point of abandoning themselves to despair, they unexpectedly and to their inexpressible joy, discovered land at the distance of six miles. Their joy at this event, however, was soon embittered by sufferings exceeding any which had been before experienced by them.

The land, which they had naturally, though prematurely, congratulated themselves upon discovering, proved to be the inconsiderable island, now in question, — Lord North's Island, or Tóbi. As they were approaching the land, a fleet of canoes made towards them, filled with naked savages, who displayed the most brutal ferocity, and to whom, in their feeble state, they fell an easy prey. Their boat was instantly broken into fragments; and while the seamen were swimming from one canoe to another, begging for mercy, they were beaten on the head and body with the war-clubs of the savages, who for a long time refused to spare their lives.

After being kept in this distressing condition for some time, they were permitted to get into the canoes of the natives, but were then compelled to row them to land; they were stripped of all their clothing, and suffered so severely, that their bodies were blistered by the burning sun.

They at length reached the land, and saw near the beach a row of small and badly constructed huts. They were compelled to jump from the canoes into the water and wade to the shore. On landing, they found the beach lined with women and children, who made the air resound with horrid yells and screams; "and their gestures and violent contortions of countenance resembled the frantic ravings of Bedlamites." *

Their treatment of the American captives on the land was not less severe and painful than it had just been on the water; and, by a rare exception, and contrary to what had been experienced at the Pelew Islands, the women were, if possible, more harsh and unfeeling than the men. The prisoners were soon divided among the captors, but not without some controversies as to their respective claims. The author of the "Narrative" (Holden) had the good fortune to fall into the hands of a comparatively humane master; as was also the case with the captain of the ship, who, it may be remarked, was the more highly valued by them on account of his being a large, fleshy man.

The condition of these islanders, socially and physically, though they form so small a portion of the human family, may, like every other *fact*, deserve notice and be entitled to a place in one of the chapters of the history of our race; and a brief account of them, as related by the two American seamen, and by the captain of the ship, will now be given.

They are, in the first place, insulated from the rest of their fellow-beings, though occasionally having that slight intercourse with European ships, which was not lasting or frequent enough to produce any effect upon their habits and manners. Like the Pelew Islanders, they were, when first seen on the water, entirely naked; but it was their custom to wear a sort of girdle or belt made of the bark of a tree; this is girded round the loins, so as to leave

* Holden's "Narrative," pp. 74, &c.

one end to hang loose behind, while the other is brought forward and fastened to the belt in front. The females wear an apron made of the leaves of a plant called by them *kurremung*, split into fine strips and plaited. This extends from the loins nearly to the knees. Some few wear rings upon their wrists, made of white shells, and some had a similar ornament made of turtle-shell. In their ears, which are always bored, they sometimes wear a leaf; and round their necks a necklace made of the shell of the cocoa-nut, and a small white shell, called *keem* shell. The children go entirely naked.

The complexion of these islanders is described as a light copper-color, of rather a deeper yellow than the Chinese, and resembling the Manilla Spaniards, being much lighter than the Malays or the Pelew Islanders; which last, however, they resemble in the breadth of their faces, high cheek-bones, and broad, flattened noses. They do not color their teeth by chewing any thing, as many of the other islanders do; but their teeth are so strong, that they can husk a cocoa-nut with them instantly.

Their principal food is the cocoa-nut. They occasionally take fish, but the supply of these was very small during the stay of the Americans in the island. Their fish-hooks are made of turtle-shell and not well contrived for the purpose; but the seamen could not induce them to use our fish-hooks, till they had heated them and altered their form so that they would not hold the fish. They did this, as they told the seamen, because Yarris (God) would be angry with them if they used our hooks without preparing them according to their fashion. Sometimes they are so fortunate as to catch a sea-turtle; but this animal has something of a sacred character with them; five only were taken during the two years that the Americans remained there. They also raise a small vegetable somewhat like the yam; but they were unsuccessful in cultivating it during the stay of the Americans. With these slender supplies, they are barely kept from actual death by famine, but are continually on the verge of starving; and when any one of them begins to fail for want of food, so that his death is pretty certain, they turn him off from among them, to starve to death.

They are not without some religious notions; and they have a rudely built hut, about fifty feet long and thirty feet wide, which is their place of public worship. In the centre of this, there is suspended a sort of altar, into which they suppose their deity comes to hold communication with their priests; and a brief account of one of their religious ceremonies, as described by the seamen, will not be uninteresting.

At the beginning of the ceremony the priest walks round the altar just described, and takes from it a mat, appropriated to the purpose, and lays it upon the ground. He then seats himself upon it, and begins to make a hooting noise, at the same time throwing himself into a variety of attitudes, for the purpose, as is supposed, of calling down the divinity into the altar. At intervals the congregation sing, but instantly stop when the priest breaks out in his devotions. By the side of the altar is always placed a large bowl and six cocoa-nuts. After this kind of incantation is gone through, and the divinity is supposed to be present, the bowl is turned up and four of the nuts are broken and put into it, two being reserved for the exclusive use of the priest, who, as well as their divinity, is called by the name of Yarris. As soon as the nuts are broken, one of the company begins to shout, and, rushing to the centre, seizes the bowl and drinks of the milk of the nut, generally spilling a considerable part of it on the ground. After this a few pieces of the nut are thrown to the images, and the rest are eaten by the priests. This closes the ceremony; after which they indulge themselves in different recreations according to their tastes.

In connection with this subject it may be mentioned, that while the Americans were on the island several shocks of earthquakes were felt, and some of them, in the language of the seamen, "pretty severe." This caused great terror among the natives; they would not let their children speak a word; and they said among themselves, *Zabitu Yarris, Tobi yettámen* (pronounced *zah-beétoo Yarris, Tóbee yettáhmen*), that is, Yarris (God) is coming, and Tóbi (the island) will sink.

They were also much alarmed at thunder and lightning, and would say on such occasions, *Yarris titri* (pronounced *teétree*), Yarris is talking. How they would have been affected by an eclipse of the sun or moon was not known, as it was not observed that any happened while the Americans were among them.

Like other uncivilized people, they reckon time by moons; and it could not be discovered that they had any other divisions of time than moons and days.

Their implements of war are spears and clubs, but no bows and arrows. The spears are made of the cocoa-nut wood, the points of them being set with rows of shark's teeth, and, as they are very heavy and from ten to twenty feet long, they are formidable weapons.

Their canoes are made of logs, which drift to their island from other places, there being no trees on it that are large enough for that purpose; they are hollowed out with great labor, and are of very clumsy workmanship; and in order to prevent their oversetting, they are fitted up with outriggers, like those of the Pelew Islanders.

They kindled their fires, as they informed the Americans, by rubbing two pieces of wood together, as is practised in other islands of the Pacific Ocean; but the Americans had no opportunity of observing this process, as fire was always preserved in some part of the island, and there was no occasion for kindling it anew. They cooked their turtle or other meat (when they were so fortunate as to have any) and their vegetables also, by covering them with heated stones.

They take pride in their hair, and are particularly careful to wash and cleanse it almost every day; but they do not color it, as the natives of some of the islands are said to do; they moisten it, however, with the juice pressed out from the cocoa-nut, which gives it a very glossy appearance, and it is frequently so long as to reach down to the waist.

Their mode of salutation is, to clasp each other in their arms and touch their noses together, as is practised in many other islands.

No musical instruments of any kind were found among them; but on particular occasions they would sing, or rather howl out something like a rude tune or song, which was unintelligible. The Americans tried to teach them to whistle, but they never could learn to do it, and their awkward attempts were amusing.

In their names of persons, it could not be ascertained that they had any thing like a family name, but only a single one, corresponding to our Christian names, as in other islands. The Americans could not learn, that those names were significant either of animals or other objects, as the Indian proper names are in America; but no two persons were ever found of the same name.

Children do not address their parents by any word corresponding to *father* or *mother*, *papa* or *mamma*, but by their proper names.

The parents treat their children on the footing of equality; yet the children are generally well behaved and are never punished, except occasionally when impatient for food.

Such were the natives, among whom it was the unfortunate lot of a part of this American ship's company to be held in captivity.

It will be recollected, that at the time of their capture off Lord North's Island, — which was on the 6th of December, 1832, — there were in their boat twelve Americans and the three Pelew Islanders, who were carried with them as hostages for the three Americans left on the Pelew Islands. But on the 3d of February following, the captain, Edward C. Barnard, and a seaman, Bartlett Rollins, effected their escape, by means of a ship which came in sight of the island, and which the natives prepared to visit in their canoes, in order to obtain iron or some other articles of value. The other Americans attempted to accompany them in the canoes; but their savage masters, by blows and menaces, prevented it; many were severely beaten, and all but two, the captain and seaman just mentioned, were detained by force; these two were severely beaten, but were allowed to accompany the natives to the ship and escaped. The others, relying upon the humanity of the captain and crew of the ship, for some time confidently expected to be released in some way from their captivity. The ship remained in sight about three hours, and at one time was so near, that the Americans remaining on the island could distinctly see the hands on board; but suddenly their hopes were blasted; the ship was observed to be pursuing her course; and the wretched captives were obliged to suffer the agony of seeing her gradually fading in the distance, and at last wholly vanishing from their sight! Most feelingly has the author of the "Narrative" said, that "their minds, after having been gladdened by the hope of once more enjoying the society of civilized beings,—of once more reaching the shores of our beloved country,—sunk back into a state of despair; we wept like children."*

When the natives returned from the ship, they had brought with them a small quantity of iron hoops, and a few other articles of little value; but they were highly dissatisfied with the amount received, and became greatly enraged. The division of the property caused much difficulty, and they quarrelled on account of it for several days. The seamen who remained in their hands, though innocent, were made the sufferers; they were held accountable for the conduct of those who had left them, and the natives vented their malignity upon them. The captives were given to understand that their doom was now fixed; which proved to be but too true in respect to all except two of them.

After the departure of the captain and the seaman Rollins, the natives treated the captives with increased severity; and the sufferers gradually sunk under their laborious tasks, or perished from actual starving or blows. Generally they were roused from their broken slumbers about sunrise, and compelled to go to work, which was, usually, the cultivation of a vegetable or root somewhat resembling the yam, and called by them *koreï.* It is raised in beds of mud, which are prepared by digging out the sand and filling the place with mould. This labor was performed wholly by the hand; they were compelled, day after day, from morning till night, to stand in the mud, and to turn it up with their hands; and frequently this was done without their having a morsel of food till noon, and sometimes till night; at best they could get no more than a small piece of cocoa-nut—hardly a common mouthful—at

* Holden's Narrative, p. 97.

a time; and, if from exhaustion or any other cause the required task was not performed, the food was withheld altogether. But farther misfortunes awaited them.

After having been on the island about four months, a violent storm nearly swept away the whole growth of nut-trees, and injured the fruit on those which had withstood the blast; in addition to which, the low grounds, where they raised the *koreï* root, were mostly filled with sand; and "famine stared them in the face." *

The natives ascribed this misfortune to the displeasure of their god, and resorted to such means as they imagined would appease him. At the same time they employed their captives, for months, in carrying on their shoulders and in their arms pieces of coral rock, in order to make a sort of sea-wall to prevent the waves from washing away the trees; and this labor was performed by the captives under a burning tropical sun, without having any clothing, and after they had been "reduced to nothing but skin and bones." †

Nor was this the end of their sufferings. The natives insisted upon *tattooing* them, and they were compelled to submit to this painful operation, which, in that hot climate, was also attended with danger; for it caused such an inflammation, that only a portion could be done at one time; and, as fast as the inflammation subsided, other portions were successively operated upon, till the whole body was covered; their faces as well as bodies would have been tattooed, had they not resisted, and threatened to submit to death rather than to suffer it. Besides this operation, they were obliged to pluck all the hair from their bodies, and to pluck their beards about every ten days, which proved excessively painful, as at every successive operation, according to their account, the beard grew out harder and stiffer.‡

* Holden's Narrative, p. 99. † Ibid. p. 100. ‡ Ibid. p. 103.

In the course of the first five months, vessels passed in sight of the island; and one remained near it for three days; so that the men on board could be distinctly seen from the land. But the Americans were kept on shore and closely guarded; while the canoes visited the ship, from which the natives brought back pieces of iron, fish-hooks, glass bottles, &c. On these occasions, all attempts to escape were vain.

The captives gradually sunk under their excessive labors and scanty food; and at the end of the first year, one of them, William Sedon, became so emaciated, that he could only crawl from place to place; and then his inhuman masters placed him in an old canoe and sent him adrift on the ocean; as was afterwards the case with another of the seamen.*

It should be observed, that it is not their custom to bury in the earth any of their dead except very young children; all grown people, after death, are placed in a canoe and committed to the ocean.

Another of the captives was accused by the natives of some trifling offence and put to death; the savages knocked him down with their clubs, and then despatched him in a barbarous manner; and the author of the "Narrative" and his surviving companions also narrowly escaped being massacred; in this instance, contrary to what had been experienced on their first arrival at the island, the natural sensibility of woman manifested itself in protecting them from the fury of the men. The next that perished was one of the three Pelew Islanders, who actually starved to death, and, according to custom, was committed to the ocean in an old canoe. Shortly afterwards, one of the two surviving Pelew Islanders was detected in taking a few cocoa-nuts without leave; and for

* Holden's Narrative, pp. 105, 103.

this he had his hands tied behind him, and was put into a canoe and sent adrift; this, it seems, was their usual punishment for various offences.

By these successive deaths, the only remaining survivors were now two of the seamen, Holden and Nute, and the Pelew chief, Kobac, who had become so much attached to them, that he seemed like a brother, and this fidelity and affection had produced a reciprocal friendship for him. When they left the island, this estimable chief was but just alive.

After dragging out a miserable existence on the island for two years, and having become so emaciated and feeble as to be unable to labor, and therefore of no further use, the two surviving Americans succeeded in persuading the natives to exempt them from working, and to agree to put them on board of the first vessel that should come to the island. But they were at the same time told, that if they did not work they should not have even the miserable allowance of cocoa-nuts which they had thus far shared. They crawled from place to place, subsisting upon leaves, and now and then begging a morsel of cocoa-nut.

In this wretched condition they remained for two months longer, when they received the reviving intelligence that a vessel was in sight and approaching the island. They prevailed upon the islanders to visit the ship, which was found to be the British bark Britannia, then on her way to Canton, under the command of Captain Henry Short, who published, at Lintin, a short statement of his passing the island on the 27th of November, 1834, and receiving the two survivors on board of his ship.

It appears, that while off the island, he observed ten or eleven canoes, containing upwards of one hundred men, approaching the vessel, in a calm, or nearly so, with the intention of coming along-side. But as he had only the small complement of thirteen men, he considered it prudent to keep them off, which he did by firing a few six-pound shots in an opposite direction to the canoes some of which were then within pistol-shot. At the same time his attention was suddenly arrested by hearing cries in the *English* language from some persons in the canoes, begging to be taken on board the ship; a boat was despatched from the ship towards the canoes, in order to ascertain the cause of the cries, when it was found, that there was an American in one of the canoes. The ship's boat was sent back a second time, with strict orders to act with caution, and the man, having got from the canoe into the sea, was taken up by the boat and brought on board the ship. He then informed the captain that there was another of his countrymen in the canoes. It was instantly decided, that, if the canoes could be dispersed, every thing practicable should be done for the release of the other captive. The canoes were all dispersed but three, and the ship's boat being again despatched in search of the remaining seaman, soon found him, but in a most deplorable condition, afflicted with a fever from the effects of a miserable subsistence. Both of them were entirely naked, and had suffered severely under the burning sun of that latitude; and the last of them would not probably have survived more than two or three days longer.

By the humane attentions of Captain Short and his officers and crew, the two Americans gradually recovered their health, in some degree, and were at length enabled to reach the shores of their own country, where they arrived in feeble health and in a most destitute condition, and were obliged to throw themselves upon the charity of their countrymen. They were made known to me, in Boston, by the owner of the ship in which they had been wrecked (William Rodman, Esq., a distinguished merchant, of New Bedford, in Massachusetts), and recommended by him as entitled to the charitable regard of the public. The simple but affecting narrative of their shipwreck and sufferings, and their account of the social condition of the hitherto unknown people inhabiting the little island on which they had been so long held in the most painful captivity, could not fail to excite an interest in their case. The occasion, moreover, seemed to me to be a proper one for collecting some new materials, however inconsiderable they might be, for making additions to our stock of information respecting any portion of the human family; and a specimen from a secluded spot of the globe, on which no European had ever landed, or would for a long time to come, and whose inhabitants, certainly, had not had sufficient intercourse with the rest of our race to be materially affected by such communication, seemed to be peculiarly entitled to notice.

The present paper, and the Vocabulary accompanying it, are the only fruits of the inquiries which my time allowed me to make.

In respect to the affinity of these islanders to others in the Indian or Pacific Oceans, I will only add, that, from a comparison of ten of their numerals, I at once inferred that they were connected with some part of the group called the Caroline Islands; but it should be borne in mind, that *numerals* do not afford so unequivocal data for inferences in ethnographical researches, as words of many other classes; because the numerals are more likely to be disseminated by the commercial or other intercourse of nations; as we ourselves use what are commonly called Arabic numerals, though we should not be said to have a national affinity to the people of that stock. In the present instance, however, the inference from those few words was the more to be relied on, as the local situation of this island and the condition of its inhabitants rendered it improbable, that they should have had so much intercourse with other islanders as to have received their numerals from any other source than they did the rest of their language. It was highly satisfactory to find afterwards, that the inference I had thus made was confirmed by the intelligent philologist of the American Exploring Expedition, Mr. Hale, who had an opportunity of personally obtaining a more copious vocabulary of the languages of the Caroline Islands than has yet been collected. Two words, however, that were in use on Lord North's Island, betray their European origin; — these were, their two names for a *hat*, which, as pronounced by the seamen, were *shamberáro* and *sháppo;* both evidently corruptions of the Spanish *sombrero*, and the Portuguese *chapeo*, or, perhaps, the French *chapeau*.

A Vocabulary of the Language of Lord North's Island, called by the Natives Tóbi, in the Indian Archipelago; with Phrases and Dialogues in the Language.

The orthography used in this vocabulary is conformable to the principles of a practical "uniform orthography," formerly proposed by the author for the unwritten Indian languages of North America, and now used by the missionaries among the Indian tribes.* This system was adopted many years ago by the American missionaries at the Sandwich Islands. The basis of it is, that the vowels should have what we generally term the *foreign*, or *Italian* sounds, namely: — *a*, as in the English word *father; e*, as in *there; i*, as in *machine; o*, as in *note; u*, as in *rule;* and *y*, as in *you*, or like the *i*. A few modifications of these fundamental sounds are distinguished by diacritical

* See Memoirs of the American Academy, Vol. IV., p. 319 (1818).

marks, as follows ; the short *o*, in the English word *not*, by *ŏ ;* short *u* in *but* by *ŭ; zh* represents the French *j*.

The *consonants* have their ordinary English sounds ; but the *g* is always hard, as in *game*, *get*, *give*, &c.

The *accentual marks* only denote the syllable on which the stress of the voice is to be laid, and not a modification of the vowel sound. The accentual stress is always on the penultimate, except where otherwise denoted by the accentual mark.

A.

And, ma.
Arm. *See* Hand.

B.

Back, tŭkkalek′.
Bad, tŭmma′.
Bamboo, shil. (This does not grow on the island, but drifts from other places; the natives make knives of it.)
Be (verb *to be ;* this verb is believed not to be found in the language).
Beard, kusŭm. *See* Hair.
Belly, mish′ium.
Big, yennŭp. *See* Large.
Bird (in general), karrŭm. *Examples :* nang zamiagi karrŭm agŭr′, *I saw your bird;* nang zamiagi a karrum, *I saw a bird*, or *birds;* mi′tchimŭm a karrum, *the head of a bird;* karrum a nang, *my bird*, literally, *the bird of me;* wu′shitu a karrum moa a Rollo, *give the bird to Rollo* (the name by which Holden was called on the island); gŭr za subiji a karrum a Rollo wŭsh′itu a tidi, *do you go and get the bird from Rollo and bring it to me.*
Black, waïzerris.
Boat, prau.
Bone, chil.
Boy. *See* Man.
Brass (*or* copper), mara bara.
Break (to break as a stick), vitching′.
Breakers, arau, *or* rau.
Breast (of a female), tut.
Brother, bizzhim. *Example :* bizzhim a gŭr, *he is your brother.*
By and by, tapuï a tŭrt.

C.

Canoe. *See* Boat.
Carry (to); *to carry sand*, wohogi api; *to carry stone*, wohogi avas ; *to carry a man*, wohogi a mara ; nang za hogi karapa, *I will carry the cocoa-nut.*
Child (of two, three, or four years old), labo; nang wa werri wedj, *I am like a child;* tchi-a-tchi labo, *to sing to a child.*
Child-birth, yisse.
Clean, bŭtch′ibŭtch.
Clouds, kŏtcho.
Cocoa-nut; in different stages this fruit has different names; as, (1.) *sub*, when in a very young state, so that they eat husk and all; it is then very bitter, and like a cabbage-stump; (2.) *ub*, when about four months old, and the part next to the stem is still soft; (3.) *tchau*, when the husk is so hard as to require breaking with a stone, the meat of the nut having begun to form and the milk being formed; (4.) *karapa*, when it is at the hardest, but still

green outside, and nearly fit to be gathered; *karapa waïzerris,* a black or old cocoa-nut.

Cocoa-nut tree, (specific name) lu. *See* Tree.

Cold, makkrazm′.

Come, *or* arrive (*the same as* to go), morabitu; nang morabitu wŏrra-zura, *I will come to-morrow;* nang morabitu nimagŭr wŏrra-zura, *I will come to your house to-morrow;* nang morabitu, Rollo, gŭr yu tamen, *I came to your house yesterday, Rollo, and you were gone; I did not see you,* taï miadji gŭr. But they also have these expressions: — Taï tu atidi, *come to me here;* taï tu, *come to me;* nang taï tu, *I come;* gŭr taï tu, *you come;* praü morabitu thawup, *the boat is gone to sea.*

Copper. *See* Brass.

Crying, atang, *or* zatang.

D.

Darkness; klowaïzerris, *very great darkness,* or *very dark.*

Daughter. *See* Son.

Day, yaro; *the same as* Sun.

Dead, mati; gŭr mati, (*are*) *you dead?*

Dirt, dirty, yŭbŭr; *also,* a dirty person, *or* woman.

Drink, lima.

Dust. *See* Dirt.

E.

Earth (*or* dirt), bŭr.

Eat (to), mŭkka; nang mŭkka a tchau, *I eat a green cocoa-nut;* nang mŭkka alus, *I eat a ripe cocoa-nut;* nang mŭkka pipi ika, *I eat many fish; I shall eat to-morrow,* nang mŭkka wŏrra-zura, *or* wŏrra-zura nang mŭkka; *we eat* (*thou and I*), gŭr a nang mŭkka; *you eat,* gŭr mŭkka; nang za mŭkka wŏrra-zura, *I shall eat to-morrow;* nang za mŭkka, *I will eat.*

F.

Far, afar off, yatau; yatauva, *a very great distance off,* or *hardly in sight.*

Father, wŭr′timŭm; wŭr′timŭm nang, *my father,* or *my friend.*

Fæces, yeppŭk.

Feel (to), suligi (?).

Fingers, ka′ïmŭk; *the same as* Hand. They distinguish between the fingers and the thumb, but the distinction is not recollected.

Fire, ya, *or* yaf.

Fish, ika; gŭr yiwu pipi a ika, *you have got a great many fish;* hah! ara simŭl a ika patchi gitchi gi, *only one fish, a very small one;* taw a ika, *no fish;* ika a nang, *my fish;* ika a gŭr, *your fish.*

Fish-hook, kaü, kaü ika.

Fishing-net, shibbo′.

Fly (a), lang.

Foot, petchem′; petchem′ a nang matak′, *my foot is sore.* The word *petchem′* includes foot, leg, and thigh.

Friend. *See* Father.

G.

Girl (a small one), patchik vaïva (patchik, *small*).

Give (to); *I gave,* or *I will give, to Sŭvrŭkamŭk a cocoa-nut,* nang zali Sŭvrŭkamŭk a karapa; *give me those fish,* kuzzito; *no, they are not mine,* taw, igawmŭt; *or* igri igawmŭt, *the fish* (ika) *are not mine;* taï ushit, *I will not part with them;* ba? *what is the reason?*

Go (to), (*the same as* to come,) morabitu; *are you going by night,* gŭr morabitu nebo′? nang za bitu, *I will go;* nang morabitu, *I go,* or *I went.* *See* Come.

God, *or* a divinity, Yar′ris. They reckon eighteen of these gods or spiritual beings; and one end of the island is called *Verri Yarris*, or *God's Ground*, and is under a perpetual *tabu'*. The only persons allowed to enter it are the priests, and such individuals as are tattooed from head to foot. This name is also given to the priest while in the act of performing his religious duties, on the mat, in the temple.

Good, yissŭng, *or* yissŭn; Sŭvrŭkamŭk yissŭng a mara, *Sŭvrŭkamŭk is a good man;* Rollo mak Timit yissŭng a mara, *Rollo and Timit* [i. e. Holden and Nute] *are good men;* atia karapa yissŭng, *this cocoa-nut is good;* *yissŭn* means also *elegant, beautiful,* when applied to the face, or looks. They also use *mapia;* as, Rollo mapia ma, *Rollo is a good man;* this word is not so strong as *yissŭn*, which last may be rendered *very good;* the word *good*, when applied to the taste, is expressed by *yenno.*

Grass, wŏrri. They weave a kind of cloth of grass, which they say they learned, not many years ago, of some Ternate women.

H.

Hair (of the head), tchim; the beard, kusŭm. They do not color their hair, as is said to be practised in some islands; but they squeeze the juice from the cocoa-nut, which makes their hair glossy; they are very proud of their hair, which reaches down to their waist.

Hand, ka'ĭmuk; this word includes the whole arm; a few of the natives of Lord North's and the Pelew Islands were observed to be left-handed, and some used both hands alike.

Head, mi'tchimŭm.

Here, atidi, *or* etidi.

His. No corresponding word in the language is recollected.

He. See remarks under the word "Pronouns," in this Vocabulary.

House. *See* Hut.

Hungry, shat'tĕri maü.

Hut, or house, yim; mora yim, *in the house;* mora gŭttŭm, *out of doors;* kutchi vara mora gŭttŭm, *throw it out of doors.*

I.

I (myself), nang.

Iron, pang-ŭl; *also* pishu.

Iron-hoop, chipa; *i. e.* pieces of iron hoops, of which they make knives, &c.

L.

Labor, yakilah; *also used for* strength.

Large, yennŭp.

Laugh (to), mimi; nang mimi, *I laugh;* gŭr mimi, *thou laughest*, or *you laugh;* Rollo za mimi, *Rollo* [for *he*] *laughs.*

Leg. *See* Foot.

Lightning, vizhik.

Little. *See* Small.

Lizard, pilil.

Lord North's Island, Tobi.

M.

Mama The children have no corresponding term for this and our word *papa*, but speak to their parents by their names; they are treated as equals, but are corrected when they cry for food, &c.; they are not corrected for misbehaviour in general, but are well behaved.

Man, ma, *or* mari, *or* mara; patchit ma, *or* patchik ma, *a boy*, i. e. *a little man;* werriwagi mari, *a young man.*

N. B. Mara *is used for a* male *bird, or other animal, and* vaïva *for a female.*
Many, a great many, several, pipi.
Man-of-war bird, kŭttŭf; nang za miägi kŭttŭf mata tu etŭrna, *I see a man-of-war bird sitting there.*
Mat (worn by the women), tivetti′; that worn by the men, vitivvit.
Milk (of the breast), tut. *See* Breast.
Mine; *the cocoa-nuts are mine,* tcho igŏmut; *my cocoa-nut,* karapa a nang; *your cocoa-nut,* karapa a gŭr; ŭkkum yŭ gŭmmŭt, *it belongs to some other person.*
Moon, mŭkkŭm.
Mosquitoes, lam.
Mouse. *See* Rats.

N.

Near to, ya petetto.
Night (*and* by night), nibo′. *See* To go.
No, taw.
Numerals: —

1,	one,	yat.
2,	two,	gŭh-lu.
3,	three,	ya.
4,	four,	van
5,	five,	ni.
6,	six,	wŏr.
7,	seven,	vish.
8,	eight,	wawr.
9,	nine,	tiŭ′.
10,	ten,	se, *or* sek.
11,	eleven,	sekŭm asu′.
12,	twelve,	sekŭm guo′.
13,	thirteen,	sekŭm saru′.
14,	fourteen,	sekŭm vaŭ.
15,	fifteen,	sekŭm limo′.
16,	sixteen,	sekŭm waru′.
17,	seventeen,	sekŭm vishu′.
18,	eighteen,	sekŭm waru′.
19,	nineteen,	sekŭm tiŭ′.
20,	twenty,	sekŭm gluo′.
30,	thirty,	guwaïk.
40,	forty,	serik′.
50,	fifty,	vaïk.
60,	sixty,	limaïk.
70,	seventy,	vishik.
80,	eighty,	warik.
90,	ninety,	tuwik.
100,	one hundred,	surbŭng.
200,	two hundred,	gurbŭng.
300,	three hundred,	sururbŭng.
400,	four hundred,	vabŭng.
500,	five hundred,	nimibŭng.
600,	six hundred,	wari-bŭng.
700,	seven hundred,	vishi-bŭng.
800,	eight hundred,	wari-bŭng.
900,	nine hundred,	tu-i-bŭng.
1000,	one thousand,	se′kabŭng.*

* The following Numerals of the Caroline Islands are from Freycinet's "Voyage round the World"; the French orthography is preserved:

1,	iot, *or* hiot.
2,	ru.
3,	iel, ieli, iol, hiel.
4,	fan, fel, fang.
5,	limmé, libé, mimmé, lim.
6,	hob.
7,	fiz, fus, fis.
8,	ouab, ouané, ouhané, hual.
9,	ti-hou, lihu.
10,	sek, secke, seg.
11,	segmacéou, segmacéo.
12,	segmaroua-au, segmaru.
13,	segmasalu, segméhaloa.
14,	segméfaou, segméfohu.
15,	segmalimou, segmalimu.
16,	segmahoutoau, segmahulu.
17,	segmafissou, segmafisu.
18,	segmahoualou, segmahoulou.
19,	segmatouoau.
20,	ruek; mentérucké.
30,	serik, selik, elig.
40,	fahik.
50,	limèk, néméké.
60,	holik, oulik, oulek.
70,	fizik.
80,	onalik.
90,	ti-houéké.
100,	sia pogou, siapougou.

N. B. They seldom count above a hundred; and when they wish to express a larger number than that, they do it by a repetition of the syllable *sek* (ten), thus: — sekŭm a sek, a sek, a sek, &c.

In counting *cocoa-nuts* they use the following numerals: —

1, su.	6, waru.
2, guo′.	7, vishu′.
3, saru′.	8, tiü.
4, vao.	9, *wanting*.
5, limo′.	10, sek.

In speaking of any number of *fishes* (ika) they would use the following numerals: —

simŭl ika, one fish.
gwimŭl ika, two fishes.
srimŭl ika, three "
vamŭl ika, four "
nimŭl ika, five "
wawrimŭl ika, six "
vishi-emŭl ika, seven "
wawrimŭl ika, eight "
tuïmŭl ika, nine "
sek ika, ten "

But in the act of counting out *fish*, they proceed by pairs or couples; as, two, four, six, &c.*

In counting *fish-hooks* they use a still different set of numerals, which, however, are not recollected.

Other examples of reckoning are the following: —

suavas, one stone.
guo karŭm, two birds.
su yarŭ, one sun, *i. e.* one day.
guo yarŭ, two days.
simŭl a mari, one man.
srimŭl vaïva, three women.

* So, in the Tonga Islands, in counting out yams and fish, they reckon by pairs or couples. See Mariner's "Tonga Islands."

O.

Old (that is, from twenty years upwards), mazuï; *very old*, mazuï ava′; also, bŭtch′ibŭtch tchim, which literally means, *the hair is white*.

P.

Papa. *See* Mama.

Parent. No word equivalent to this.

People. This is expressed by adding pipi, *many*, to mari, *man*; as, pipi a mari, *many men*; pipi a vaïva, *many women*.

Pronouns:
I, *myself*, nang.
thou, or *you*, gŭr.*
he; this pronoun seems to be wanting in the language.
we (you and I, *or* they and I), gŭr nang; and there appears to be no other way of expressing *we*.

R.

Rain (to); *it rains*, ut; *it does not rain*, or *it is done raining*, taw ut.

Rats, tŭm′miŭm.

Reef (of rocks), araü.

Rind. *See* Cocoa-nut.

S.

Sand (of a shoal in the sea), pi; but it means simply *sand*.

Sea (salt water), tat.

See (to), oma′ïga, *or* miägi; miägi, *I saw*, or *did see*.

Shark, po.

Sharp; yĕ ka′ïla, *it is sharpened* (speaking of a piece of iron that is sharpened); but *yĕ ka′ïla* is also used thus: Nang yĕ ka′ïla, *I am well*, or *strong*.

Ship, waw-wia.

Short, yŭ-mot, *or* yă-mot; applied to persons and things.

* In the language of the Tonga Islands, also, *ger*, pronounced *gŭr*. See Mariner's work.

Sick, makakes; nang taï makakes, *I am not sick;* nang yĕ ka'ïla, *or* nang yŭ-kaïl, *I am well,* or *strong;* nang taï kaïl, *I am weak,* or *not strong.*

Sister, miangŭm; Kobowŭt miangŭm a gŭr, *Kobowut is your sister.*

Sleep, mŭssi; *to sleep,* mŭmma tidi; *I sleep,* nang mŭmma tidi.

Small, patchik; *very small,* patchi gĭt-tchi-gi; in speaking of a grain of sand, a mote in one's eye, &c., *bugis-baichu.*

Son (and daughter); it is not recollected that they made any distinction in speaking of sons and daughters; they would say, *labo nang,* for *my son,* and *my daughter,* without discrimination.

Speak (to), titri. *See under* Talk *and* Thunder.

Stars, vish.

Stone, vas. *See* Carry.

Stop (when a person is going away); to-paï tai-tu a tidi mata tu tillinŭp, *stop somewhere and sit down and talk.*

Storm, pipi ut, i. e. *much rain.*

Strong. *See* Sick.

Sun, yaro.

T.

Tabu' (as a substantive), the taboo, or religious prohibition or interdict put upon places and things which are not to be used, &c.; common in the islands of the Pacific Ocean.

Talk (to), titri; titri Inglish, *talk English;* titri Tobi, *talk Tobi,* that is, the language of Tobi, or Lord North's Island. When it thunders, they say, Yárris titri, *Yarris* (God) *talks;* they are in great fear of thunder.

Tattoo (to), verri verri; old persons are the most tattooed.

That, amana.

There, etŭrna.

Thief. See the Dialogues subjoined.

This, atia, *or* tia; tia karapa, *this cocoa-nut.*

Thumb. *See* Finger.

Thunder, pa; paza titri, *it thunders,* or, literally, *the thunder speaks.* *See also under* Talk.

Tie (to), bŭzhanet'; nang bŭzhanet' amenna, *I tie it.*

Tired, shat'tĕri raïmŭs. *See* Hungry.

Tree, *or* Wood, tebŭrra ika, *i. e.* the trunk or stem. *See* Wood. (One of the seamen gave *lew* or *lu.*)

Turtle, wari. (Five only were caught at the island during the two years' captivity.)

U.

Urine (to), kuru kul.

W.

Warm, wŭrbŭtch.

Water (salt), tat.

" (fresh), taru.

Well (not sick). *See* Sick.

Whale, kas.

What; *what is that?* matamen a menno? *Answer,* wonap a mana, *it is a wonap,* or the fish called *a skip-jack ; what* is also expressed by a kind of grunt, *h'ng* or *h'n; what* or *who,* as, Verra mata a mana, *what is his name?* i. e. *who is that?*

Where, ama'? *Answer,* etŭrna, *there, in that place.*

White, bŭtchi; bŭt'chi, *a white man* or *European.*

Why, ba.

Wind, yang.

Woman, vaïva; *a lying-in woman,* yessi; *a young woman,* werri-wagi vaïva; applied also to female birds.

Wood, tŭmmŭtch. *See* Tree.

Work (to). *I shall not work on the canoe to-morrow,* i. e. in hollowing her out by chopping, nang taï rava a praŭ wŏr-ra-zura. (Their canoes are made of the drift-wood from other islands.)

Y.

Yellow, arreng′.
Yes, ira, *or* ila.
Yesterday, rollo.
Yesterday night, rollo nibo′.
You. *See under* Pronouns.

The names of the different members of the family in which the seaman Horace Holden lived were: —

Parabua, the father of the family.
Nakĭt, the mother.
Bŭwŭr′timŭr, the eldest child, then twelve or fourteen years of age.
Kobowŭt, the second, a daughter.
Kobanuŭk, the third, a daughter also.
Wa′ribo, the fourth, a son.

Tobi and English Vocabulary; being the preceding Vocabulary reversed.

A.

Ama′, where.
Amana, that.
Araü, *or* raü, a reef of rocks, breakers.
Arreng′, yellow.
Atang, *or* zatang, crying.
Atia, *or* tia, this.
Atidi, here.
Aturna, *or* eturna, there.

B.

Ba, why. *See English* Why.
Bizzhim, brother.
Bŭr, earth, dirt.
Bŭtch′ibŭtch, clean.
Bŭtch′ibŭtch chim, old; *literally*, the hair is white; *butchi butchi*, white.
Bŭzhanet′, to tie.

C.

Chau, a cocoa-nut. *See English Vocabulary*, Cocoa-nut.
Chil, bone.
Chim, hair of the head. *See* Kusŭm.
Chipa, iron hoop. *See* Pang-ŭl.

E.

Etidi, *or* atidi, here.
Etŭrna, there.

G.

Gŭr, thou, you; *gŭr nang*, we, *i. e.* you and I. *See* He, *in English Vocabulary*.

H.

H'n (*an indistinct sound, resembling a grunt*), what.

I.

Ika, fish.
Ila, *or* ira, yes.

K.

Ka′ïmŭk, hand, *including* the arm and fingers.
Karapa, a cocoa-nut, when it is hard, but still green outside, and nearly fit to be gathered; *karapa waïzerris*, a black *or* old cocoa-nut. (*Malay*, kalapa; *Sunda*, kalapa (Crawf.); *Javanese*, klapa.)

Karŭm, bird, *in general.*
Kas, a whale.
Kaü, *or* kaü ika, a fish-hook.
Krel, a fishing-line. *See* Tari.
Klowaïzerris, very dark, *or* very great darkness.
Kŏtcho, clouds.
Kuru kul, to urine.
Kusŭm, beard, hair.

L.

Labo, a child of two or three years old; my son, *or* my daughter.
Lam, mosquitoes.
Lang, a fly.
Lĭmma, to drink.
Lu, the cocoa-nut tree, *in particular.*

M.

Ma, and.
Ma, *or* mari, man; *pipi a mari,* many men; *pipi a vaïva,* many women; — *equivalent to* people.
Makakes, sick.
Makkrazm′, cold.
Mapia, good. *See* Yissŭng.
Mara bara, brass *or* copper.
Matamen, what.
Mate′, to kill.
Mati, dead. (Holden says *purŭk.*) *See* Mariner, i. 63.
Maü. *See* Shat′tĕri.
Mazuï, old, *i. e.* from twenty years upwards; *mazuï a va,* very old. *See also* Bŭtchi.
Miangŭm, sister.
Mimi, to laugh.
Mish′iŭm, belly.
Misherŭm, mother.
Mi′tchimŭm, head.
Morabitu, to come (*same as* to go).
Mŭkkŭm, moon.
Mŭmma tidi, to sleep; *nang mŭmma tidi,* I sleep.
Mŭng′-a, *or* mŭkka, to eat.
Mussi, sleep.

N.

Nang, I, myself; mine.
Nibo′, night, by night. *See* Morabitu, *to go.*

O.

Oma′ïga, *or* miägi, to see; *miägi,* I saw, *or* did see.

P.

Pa, thunder.
Pang-ŭl, iron; *used also for* a nail. *See* Chipa.
Patchik, small, very small.
Petchem′, foot (includes leg and thigh).
Petetto. *See* Ya petetto.
Pi, sand (of the sea), a shoal.
Pilil, a lizard.
Pipi, many, great many.
Pipi a ut, rain and storm.
Po, a shark.
Praü, boat, canoe.
Purŭk. *See* Mati.

R.

Raü, breakers. *See* Wurrapi *and* Araü.
Rava, to work. *See* Work.
Rollo, yesterday; *rollo nibo′,* yesterday night.

S.

Shat′tĕri maü, hungry.
Shat′tĕri raïmŭs, tired.
Shĭbbo, a fishing-net.
Shil, bamboo.
Sub, cocoa-nut, when in a very young state, so that they can eat it, husk and all; it is very bitter, and is like a cabbage-stump in eating.

T.

Tat, sea, salt water; *taru*, fresh.
Tabu′, to taboo, *or* interdict.
Tabŭrra ika, wood, *i. e.* the stem *or* trunk.
Tapuï a tŭrt, by and by.
Tari, a small cord *or* twine. *See* Krel.
Taru, fresh. *See* Tat.
Taw, no.
Tchau. *See* Chau.
Tia, *or* atia, this.
Titri, to talk.
Tivviti′, mat worn by women. *See* Vitivvit.
Tobi, *the native name for* Lord North's Island.
Topaï, to stop, &c. *See* Stop.
Tŭkkalek′, the back.
Tŭmma, bad.
Tŭm′miŭm, rats.
Tŭmmŭtch, wood (trees).
Tut, breast of a female; *also*, milk of the breast.

U.

Ub, cocoa-nut, when about four months old. *See* Chau, Karapa, Sub.
Ut, it rains; *taw ut*, it does not rain, *or* it has done raining.

V.

Vaïva, a woman; *patchik vaïva*, a girl, *or* a little woman.
Vas, stones.
Verra, what, *or* who.
Verri verri, to tattoo.
Vish, stars.
Vitching, to break (as a stick).
Vitivvit, mat worn by men.
Vizhik, lightning.

W.

Waituti, to wash.
Waïzerris, black.
Wari, a turtle.
Waw-wia, a ship.
Wohogi, to carry.
Wŏrra-zura, to-morrow.
Wŏrri, grass.
Wŭrbŭtch, warm.
Wurrapi, beach. *See* Raŭ.
Wŭr′timŭm, father, *or* friend.

Y.

Yah, *or* yaf, fire.
Ya peteto, *or* ya petetto, near to.
Yămmot′, *or* yŭmmot′, short, *applied to persons or things.*
Yang, wind.
Yaro, day (*same as* sun), sun.
Yarris, God, divinity, spirit.
Yat, one. *See* Numerals *in the preceding Vocabulary.*
Yatau, *or* yatauva, far off, a great distance off.
Yĕ ka′ïla, it is sharp (speaking of an iron hoop sharpened). But *yĕ ka′ïla* is also used thus: *Nang yĕ ka′ïla*, I am well *or* strong.
Yenno, good (to the taste). *See English Vocabulary, word* Good.
Yennŭp, big, large.
Yeppŭk, fæces.
Yĭm, house, hut.
Yissŭng, *or* yissŭn, good, beautiful, elegant.
Yŭbbŭr, dirt, dirty.
Yŭkila, labor, strength.

Z.

Zali, to give. *See under* Cocoa-nut.
Zatang. *See* Atang.

Dialogues between Natives of Lord North's Island and Horace Holden, one of the American Captives, who was called by the Natives TIMIT (Teemeet); *the Captain (Barnard) was called* PETER INGLISH.

Native. Timit, taï tu atidi, nang verri verri gŭr; mari Tobi taï verri verri man Inglish mori purŭk; zabitu Yarris yettamen man Inglish.

Horace, come here, for I am going to tattoo you; if Tobi man does not tattoo Englishman, he will die; Yarris (God) will come, and Englishman will go immediately out of sight; i. e. be destroyed.

After Captain Barnard and Rollins escaped from the island, the natives would often ask of Holden and Nute, where they supposed Peter Inglish was; and, when told that he was on his way to England, they would say, —

Ah! Pitŭr Inglish taw borobito Inglish; Pitŭr Inglish yipilĭf tang a ni mari a Tobi a pang-ŭl; Pitŭr Inglish mori purŭk wor a tat; Pitŭr Inglish titri titri mari Tobi pipi a pang-ŭl, pipi a ligo', pipi a mŭllibadi; shaïk! man Inglish yipilĭf tŭmma'; mari a Tobi za so za titri Yarris, wawrwa a Inglish tcher praü taï bito wor Inglish.

Ah! the captain will never get to England; the captain was a thief; he had not given Tobi man any iron, and he would die at sea; the captain talked, and talked with Tobi men, (that they should have) much iron, great many clothes, and much brass; for shame! Englishmen (are) all thieves and bad men; Tobi men (are) very angry; (we) will speak to God, and he will make the ship founder at sea, and the captain never will arrive in England.

Whenever Holden or Nute expressed a wish to go to England, the natives would say, —

Gŭr za bito Inglish ba? Taw a mŭkka wor Inglish; gŭr za bito Inglish, gŭr mori purŭk; mari Inglish mŭkka ketchi etchi, oma a yeppŭk gŭr mŭmmi tidi a Tobi, yevvĕrs mari Tobi yissŭng a mŭkka.

What do you (wish to) go to England for? There is nothing to eat in England; if you go to England, you will die; Englishmen eat rats, and snails, and filth; if you stay in Tobi, you will live; Tobi men have very good (food) to eat.

Dialogue between Horace Holden and his Master, Parabua.

Holden. Parabua, gŭr za woshito a nang wor a praŭ, nang za bito Inglish; nang za mŭmma tidi a Tobi za purŭk, taw a mŭkka wor Tobi; wor Inglish pipi a mŭkka, pipi, pipi; gŭr za woshito a nang wor a praŭ nang za li a gŭr pipi a pang-ŭl, pipi a ligo′, pipi a mŭllibadi; gŭr taï woshito a nang za purŭk wor a Tobi gŭr taw a pishu.

H. Parabua, if you will put me on board of a ship, I will go to England; if I remain at Tobi (Lord North's), I shall die, for there is nothing to eat on Tobi; in England, much food, much, much; and if you will put me on board of a ship, I will give you much iron, many clothes, and much brass; if you do not put me (on board) I shall die on Tobi, and you (will get) no iron.

Parabua. Ha! nang taï woshito a gŭr; gŭr titri tŭmma; gŭr tang a ni nang a pang-ŭl; Pitŭr Inglish yipilĭf, gŭr yipilĭf, mari a Inglish yipilĭf sinamessen′; tŭmma man Inglish; gŭr mŭmma tidi wor Tobi, za purŭk a Tobi.

P. Ah! I will not let you go; you talk bad; you will not give me any iron; Peter Inglish is a thief, you are a thief, all Englishmen (are) thieves and liars; Englishmen (are) bad men; you (are) to stay on Tobi, to die on Tobi.

Another Dialogue between the same Persons.

P. Timit, gŭr za bito Inglish gŭr za ni mari Tobi a pang-ŭl yennŭp waïsa tibiriïka yennŭp a tipoï a wawsa, a ligo′, kaŭ ika, zis a pishu′ a tit a tŭv′vatĭf, a mŭllibadi, za bito Tobi za li wŭr′timŭm a gŭr?

P. Horace, if you go to England, will you give the men of Tobi iron of a large size, as big as a stick of wood, and big axes, and knives, and cloth, and fish-hooks, an anvil and hammer, and needles, a trunk, and brass, and then come back to Tobi and give them to your father?

H. Ha, nang za bito Inglish nang za ni mari Tobi a pang-ŭl yennŭp, a tipoï, a wawsa, a ligo′, kaŭ ika zis a pishu′, a tit, a tŭv′vatĭf, a mŭllibadi, za bito Tobi, za li wŭr′timŭm a nang.

H. Yes, I will go to England, and I will give to the men of Tobi iron of a large size, and big axes, and knives, and cloth, and fish-hooks, an anvil, and needles, and trunks, and brass, and then come back to Tobi and give them to my father.

P. Gŭr za bito Inglish gŭr di mŭmma tidi wor Inglish, taw borobito Tobi, gŭr za yŭwun; tŭmma taw mŭpir klo dungarangus.

P. If you go to England, you will stop (sleep) there, and not return to Tobi; this (will be) bad and not friendly, and you will be a bad man.

H. Nang za bito Inglish, nang dak mŭmma tidi wor Inglish, nang za bito Tobi.

H. If I go to England, I will not stop (sleep) there, but return to Tobi immediately.

P. Gŭr tuay gora bito Inglish; gŭr mori purŭk wor a tat, gŭr tay bito Tobi.

H. Ha! nang yegora bito Inglish, taw mori purŭk wor a tat.

P. Gŭr ani a praü wor Inglish, pipi a pang-ŭl, a ligo′, karapa, a vaïva pipi, a mari pipi, a labo ?

H. Ila, nang yŭwo′ a praü wor Inglish, pipi a pang-ŭl, a ligo′, karapa, a vaïva, pipi a mari, pipi a labo.

P. Timit, gŭr za bito Inglish gŭr tay bito Tobi, mari Tobi za titri Yarris, gŭr mori purŭk.

H. Nang za bito Inglish, nang di mŭmma tidi, a tŭrt za bito Tobi.

P. Timit, gŭr za bito vene Yarris, gŭr tay bito, gŭr mori purŭk.

H. Tŭr pay; nang za bito.

P. You do not know the way to England ; you will die (or be lost) at sea, and not come to Tobi.

H. Aye, I do know the way to England; I shall not die (or be lost) at sea.

P. Have you got ships in England, and a great deal of iron, and cloths, and cocoa-nuts, and many men, women, and children ?

H. Yes, I have got ships in England, much iron, and cloths, and cocoanuts, and women, and a great many men and children.

P. Horace, if you go to England, and do not come back to Tobi, the men of Tobi will talk to God, and you will die.

H. I will go to England and stop a short time (i. e. sleep there), and shall return to Tobi.

P. Horace, if you do not go to Yarris's house (i. e. the place of worship), you will die.

H. Wait a minute; I will go.

*** It was the intention of the author of this communication to have added some remarks upon the grammatical structure and affinities of the dialect of Lord North's Island; but continued ill health prevents his doing it in season for the publication of the present volume. Those remarks, therefore, are necessarily deferred to a future occasion.

MEMOIRS

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VI.

A Vocabulary of the Soahili Language, on the Eastern Coast of Africa; by Samuel K. Masury.

Communicated by Charles Pickering, M. D.

The following Vocabulary was obtained by Dr. Charles Pickering, during his stay at Zanzibar, in 1844. It was collected with care by an intelligent gentleman of Salem, Massachusetts, who had resided for some time in Zanzibar; and it is so difficult to procure authentic specimens of languages from the less frequented quarters of the globe, that it appeared desirable to preserve this in the Memoirs of the Academy. The following short note of Dr. Pickering will give all the necessary information respecting it.

JOHN PICKERING.

Boston, July, 1845.

To John Pickering, *President of the American Academy of Arts and Sciences.*

Sir: — The accompanying Vocabulary was obtained by Mr. Masury, of Salem, Massachusetts, from a native of the Comoro Islands, who had resided several years at Zanzibar. The *Soahili* language, besides being vernacular at the last named place, is the language of commerce on the eastern coast of Africa, like the Malay among the East India Islands. The native above mentioned stated, that it is different from either of the tongues indigenous to his own country.

C. P.

Boston, July, 1845.

Vocabulary of the Soahili Language.

Lao, to-day.
Cassio, to-morrow.
Cassio cuto, day after to-morrow.
Mise,* month.
Marka, year.
Secoo, day.
Gama, good.
Acouna gama, no good, bad.
Vouta, pull.
Nenda, go.
Nouse [noos], half.
Aroba, quarter.
Real, dollar.
Cas robo real, three quarters of a dollar.
Thumoney, twelve and a half cents.
Nouse thumoney, six and a quarter cents.
Bettle, pound.
Lette, bring.
Anjo, come.
Zeasevacu, yams.
Dese, bananas.
Machungo, orange.
Nanas, pine-apples.
Desem beche, green plantain.
Desem befou, ripe plantain.
Pemba, ivory.
Wahed,† one.
Theneen, two.
Thalatha, three.
Aroba, four.
Cumsa, five.
Seita, six.
Sebah, seven.
Themania, eight.
Tissa, nine.
Asher, ten.
Hedasher, eleven.
Thenasha, twelve.
Thalatasha, thirteen.
Arobasha, fourteen.
Cunstasher, fifteen.
Setasher, sixteen.
Sabatasher, seventeen.
Themaniatasher, eighteen.
Tissatasher, nineteen.
Asharen, twenty.
Thalathen, thirty.
Aroben, forty.
Cumseen, fifty.
Seiteen, sixty.
Sebeen, seventy.
Themaneen, eighty.
Tissen, ninety.
Meã, one hundred.
Alfe, one thousand.
Mopã, white.
Māzungo, white man.
Pemã, weigh.
Hāme, cotton [unbleached].

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* *Qu. Portuguese,* mese? — Edit.
† These numerals are from the Arabic.

Bondook, musket.
Chirsas, lead.
Kesu, knife.
Opangā, sword.
Kete, chair.
Nenā tā kā, what do you want ?
Mechalā, rice.
Marge, water.
Māpoongā, paddy.
Matamā, corn.
Mohinde, Indian corn.
Nazee, cocoa-nut.
Mādafou, green cocoa-nut.
Māfoutā, oil.
Māfoutā oto, Simsim oil.
Waku, keep.
Nā yew-ā, I know that.
Pata, ring.
Casca-se, northeast monsoon.
Co-se, southwest monsoon.
Papo, wind.
Motto, fire.
Coo-ne, wood.
Gooza, hide.
Sā, clock.
Coo-ko, chicken.
Maze, moon.
Juā, sun.
Kepanda, quadrant.
Soca-re, wheel for ships.
Cambā, rope.
Deva, compass for ships.
Dorbeen, spy-glass.
Keo, looking-glass.
Dārushā, window.
Foongoā, open.
Melango, door.
Numba, house.
Frass, horse.
Cadogā, small.
Bāhāre, sea.
Booza, goat.
Cutoonga, onions.
Boone, coffee.
Māsepe, line.
Doana, hook.
Gopā, afraid.
Way-yā, you.
Mattooma, slave.
Daga, bird.
Ouliā, England.
Americano, American.
Hāpā, here.
Kudthen, apart.
Meshāharā, wages, *or* pay.
Karamoo, feast.
Pāne, lightning.
Tookānā, blackguardism, *or* swearing.
Goom bāna, not friends.
Lenā, where.
Sā fe re, going to sea.
Marrā en gāpe, how many times.
En gāpe, how many.
Mahala gana, what place.
Mala, merchandise.
Lahabu, gold.
Feather, silver.
Chābā, brass.
Poo-ā, steel.
Chuma, iron.
Me-te, tree.
Pouma-le, yards [of a ship].
Negota, mast [of a ship].
Mabing-oo, cloud.
Nayota, star.
Qua ka, at his house.
Tanga, sail.
Mācaboo, vessel.
Mo-she, smoke.
Roodeza, return.
Wa than egā, what do you think of it.
Ouwāwā, fine.
Oochomgoo, bitter.
Tam-oo, sweet.
Cāseā, owe.
Mahareba, sundown.
A la se-re, about four o'clock [in the morning at cock-crowing].
Mechana, noon.
Hā nā, he has not any.

Boudā, old man.
Keza, dark.
Negoomoo, hard.
Māpeā, new.
Alāmā, number.
Mavoole, umbrella.
Ooma que ba, you stole it.
Hapananitoo, nobody.
Coopatare, last.
Toon goosha, turn it round.
See meka, stand it up.
Sama-ke, fish.
Me me ra, pour it out.
Se ma gee, don't spill it.
E-majar, full.
Neja, outside.
He-itosha, enough.
Tan gooka, it will fall.
Gwabere-ke, thank you.
Feneka, cover.
Ga-le, dear.
Taka, duty.
Zema, put out.
Cartar* se, paper.
Cālāmo, pen.
Kondeker, write.
Winnu, ink.
Zeātoo,† shoes.
Māungo, back.
Ouso, forehead.
Māchābou, cheek.
Zedola zumgo, toes.
Naye, foot.
Segegu, heel.
Segeno, ancle.
Chaff, calf.
Padyā, thigh.
Coffee, palm of hand.
Conda, hand.
Mākoochā, finger-nail.
Zedola, finger.
Kewoongo, wrist.

* *Portuguese*, carta. — Edit.
† *Qu. Portuguese*, zapáto? — Edit.

Cā-pwā, arm-pit.
Kefrua, breast.
Maga, leg.
Beggā, shoulder.
Segero, elbow.
Mercono, arm.
Go-at, knee.
Tumbo, belly.
Davu, beard.
King-wa, jaw.
Oulemā, tongue.
Cādavu, chin.
Domo, mouth.
Mano, teeth.
Noush, eyebrow.
Oucopawādu, eyelash.
Macho, eye.
Pouā, nose.
Muskeo, ear.
Kechor, head.
Sofera, pot.
Chooroona, missing.
Cooyou-a, drink.
Sān gārpy sarsa, what o'clock.
Cassa gā-ne, what price.
Coubā, large.
Wā-le, boiled rice.
Wemba, razor.
Dare-ne, up stairs.
Ramgā, paint.
Megā-me, grass.
Bon, board.
Neyou-ala, hair.
Mecā seā, ear.
Kouse, black.
Munjano, yellow.
Mecotanaze, green.
Pomgoosha, wipe.
Vevu, lazy.
Neja, outside.
Cutecate, mud.
Toneka, cover.
Choocooā, carry.
Coonja, double.
Nayola, shave.

Tiare, ready.
Potaza, lost.
Poorooma, push.
Popota, any time.
Rahese, cheap.
Reesha, thin.
Wa ka oo pan da roo, put it this side.
Wa ka oo pan da wa pe la, put it that side.
Wā kam ba la, keep separate.
Pala pala, the same place.
Ta fa tha le, if you please.
Me me na, put it down.
Whas a ta, light the lamp.
Ye a to ra, where did it come from.
Ye a nooka, smells bad.
High do roo, never mind.
Coo me za, did it hurt?
Se ta ra, I don't want to.
Pa soo a, don't tear it.
Coo na ne ne, what 's the matter?
Wa cha ka ne ne, why do you laugh?
Ha too fa-ne-be-a-cha-ra, we can't trade.
Na rwe ta, he calls you.
Wen da na nane, who are you going with?
Se pen da, I don't like it.
Wa to ka whappy, where did you come from?
Na ne gin ā lā roo, what is your name?
Ye a maza ma na no, stop that talk.
Nde vio, that is it.
Goza, piece.
Car-le, hot.
Nau our ba, I hope.
Papata, lifted.
Sahaboo, raisins.
Ca na he, same as this.
Yaka, own.
Quanga, before.
Haba-re, news.
Duffta-re, book.
Sena, have not any.
Newnew-a, buy.
Cooza, sold.
Sheka, hold.
Muesha, last.
Cavoo, dry.
Maquetā, call.
Rupta, bale.
Hesaboo, figures.
Bāre-de, cold.
Machora, tired.
La bou dā, I think so.
Se gu ā, I don't know.
Quālā, true.
Fida, profit
Sāfā, clean.
Yaomu, ache.
Mapeshe, cook.
Cosha, wash.
Kejana, boy.
Hā-re, sweat.
Tuā, lower.
Twaka, hoist.
Yarrebo, try.
Ma-un-go, God.
Shatan, devil.
E-māmu, priest.
Vouā, rain.
Godoro, bed.
Tabebe, doctor.
Chuo-ne, school.
Marlim, teacher.
Car-the, judge.
Papo-ne, heaven.
Motto-ne, hell.

These words are written in English as they sound when pronounced by a native. [The *long* quantity over the vowel *ā* gives it the sound of *ah* in English; and *ou* is to be pronounced like *oo*. — Edit.]

SAMUEL K. MASURY.

November 8, 1844.

MEMOIRS

OF THE

AMERICAN ACADEMY.

VII.

A Synopsis of the Fishes of North America.

BY DAVID HUMPHREYS STORER, M. D., A. A. S.

Communicated to the Meeting of the American Naturalists, at New Haven, April 3d, 1845.

Several years since, at the suggestion of my friend, Dr. Harris, of Cambridge, I was induced to commence the preparation of a Synopsis of the Fishes of the United States. After having been diligently engaged in this undertaking for a number of months, learning that Dr. Dekay intended to describe, in his contemplated Zoölogical Report of the State of New York, under the head of "Extra-limital," all the fishes of the United States not found in that State, I at once determined to proceed no further until the appearance of that work. Upon the publication of his Report, in the early part of 1842, I found so much had been done by Dr. Dekay towards the execution of the task I had contemplated, that I dismissed from my mind all thoughts of prosecuting the subject. This Association, at its annual meeting at Albany, in 1843, did me the honor to request me to prepare a paper "On the Comparative Ichthyology of North America and Europe." Grateful for this expression of their confidence, and desirous of acknowledging my sense of obligation, I extended my original plan, and have the pleasure now to present to you "A Synopsis of the Fishes of North America."

The paper I offer you claims but little, I might say, perhaps, no originality. With most of the species found out of the waters of Massachusetts, my acquaintance is but slight. Many of them I have had no opportunities of examining. In characterizing them, I have accordingly oftentimes used the very language of the discoverer, or of those who may have heretofore described them. Knowing that the American ichthyologist has no dictionary to refer to, in which *all the described species of this country are contained,* I have endeavoured, by no inconsiderable amount of labor, to supply the deficiency. If, to my fellow-laborers in this extensive and as yet, when compared with the other departments of natural science, almost untrodden domain, it shall appear that I have added any facilities or removed any obstacles to their advancement, I shall ever recur to the time occupied in the preparation of this Report with pleasure and with pride.

To accomplish the duty required of me by this Association, I have prepared a series of tables, exhibiting the geographical distribution of genera.

The first column includes those genera which are found both in Europe and North America.

The second, points out those genera which are found in North America, but which are not peculiar to it, and not found in Europe.

The third, enumerates genera peculiar to America, and, if not mentioned in the fourth column, confined to North America.

The fourth, comprises genera found in North America, and extending to South America.

I have also catalogued the *species* found to exist both in Europe and North America; and those extending from North into South America; and those which are peculiar to the Northwest Coast of America; and, finally, I have enumerated the *genera* found in North America, with the number of *species* contained in each genus.

The *Synopsis* concludes the paper. In this, I have pointed out the characters of each family, genus, and species, with the localities of the last, and the authorities for the localities, and have exhibited as full a list of synonymes as my opportunities have given me power.

Seventeen volumes only of the "Histoire Naturelle des Poissons," by Cuvier and Valenciennes, have as yet been published; the last which appeared containing the commencement of the family Cyprinidæ. The ensuing volumes will undoubtedly contain many species, from the Antilles particularly, as yet unknown to naturalists. Dr. Parnell, of Scotland, writes me, that he is now investigating the fishes of the West Indies. Dr. Holbrook, of Charleston, is preparing for publication a work on the fishes of South Carolina. Ichthyologists in different parts of our country will, each succeeding year, add to our catalogue. Full well am I aware, that but a short period will elapse ere this Synopsis shall be looked upon as meagre and unsatisfactory. When that time arrives, I trust some one will take up the subject where I have left it, and, supplying all my deficiencies and adding what may have been recently discovered, present us with a work worthy the science of our country.

Geographical Distribution of Genera.

Family.	Genera found both in Europe and North America.	Genera found in North America, but not peculiar to it.	Genera peculiar to America.	Genera found in North America, and extending to South America.
Percidæ.	Perca. Labrax. Lucio-perca. Uranoscopus. Serranus. Sphyræna.	Plectropoma. Mesoprion. Centropristis. Grystes. Priacanthus. Dules. Trichodon. Myripristis. Holocentrum. Polynemus. Upeneus.	Huro. Percina. Centropomus. Rypticus. Centrarchus. Pomotis. Bryttus. Aphredoderus. Lepisoma.	Plectropoma. Mesoprion. Priacanthus. Rypticus. Centrarchus. Pomotis.
Triglidæ.	Trigla. Cottus. Aspidophorus. Sebastes. Gasterosteus. Dactylopterus. Scorpæna.	Hemilepidotus. Blepsias.	Hemitripterus. Prionotus. Cryptacanthodes. Temnistia.	Sebastes. Trigla. Dactylopterus. Scorpæna. Prionotus.
Scienidæ.	Corvina. Umbrina.	Otolithus. Lobotes. Glyphisodon. Heliasus.	Leiostomus. Larimus. Pogonias. Conodon.	Otolithus. Corvina. Larimus. Eques. Umbrina. Micropogon. Hæmulon. Pristipoma. Lobotes. Pomacentrus. Heliasus.
Sparidæ.	Sargus. Chrysophris. Pagrus. Pagellus.			Sargus.
Menidæ.	Smaris.	Gerres.		Smaris. Gerres.
Chetodontidæ.		Chætodon. Ephippus. Holacanthus. Pimelepterus.	Pomacanthus.	Ephippus.

Family.	Genera found both in Europe and North America.	Genera found in North America, but not peculiar to it.	Genera peculiar to America.	Genera found in North America, and extending to South America.
SCOMBRIDÆ.	Scomber. Thynnus. Auxis. Pelamys. Xiphias. Naucrates. Lichia. Caranx. Seriola. Coryphæna. Lampugus. Lampris.	Cybium. Gempylus. Elacate. Trachinotus. Blepharis. Temnodon. Pteraclis.	Argyreiosus. Vomer. Rhombus.	Scomber. Thynnus. Pelamys. Cybium. Trichiurus. Elacate. Chorinemus. Trachinotus. Caranx. Vomer. Seriola. Temnodon. Coryphæna. Rhombus.
TEUTHIDÆ.		Acanthurus.		Acanthurus.
TÆNIDÆ.			Stylephorus.	
ATHERINIDÆ.	Atherina.			Atherina.
MUGILIDÆ.	Mugil.		Dajaus.	Mugil.
GOBIDÆ.	Blennius. Pholis. Clinus. Gunnellus. Zoarcus. Anarrhicas. Gobius.	Salarias. Sicidium. Eleotris.	Chasmodes. Philypnus.	Blennius. Clinus. Gobius.
LOPHIDÆ.	Lophius.	Chironectes. Malthea. Batrachus.	Malthea.	Chironectes. Batrachus.
LABRIDÆ.	Ctenolabrus. Acantholabrus. Tautoga. Julis. Xyrichthys.	Cossyphus. Malacanthus. Scarus. Callyodon.	Clepticus. Lachnolaimus.	Cossyphus. Julis. Xyrichthys. Scarus. Callyodon.
SILURIDÆ.		Bagrus. Galeichthys. Arius. Pimelodus.	Noturus.	Bagrus. Arius. Pimelodus. Galeichthys.

Family.	Genera found both in Europe and North America.	Genera found in North America, but not peculiar to it.	Genera peculiar to America.	Genera found in North America, and extending to South America.
CYPRINIDÆ.	Gobio. Cyprinus. Leuciscus. Lebias. Cyprinodon.	Catostomus.	Sclerognathus. Exoglossum. Hydrargyra. Molinesia.	Pœcilia. Hydrargyra. Lebias.
HYPSOCIDÆ.			Amblyopsis.	
ESOCIDÆ.	Esox. Belone. Scomberesox. Exocetus. Hemiramphus.			Belone.
FISTULARIDÆ.		Fistularia.		Fistularia.
SALMONIDÆ.	Salmo. Osmerus. Scopelus. Coregonus.		Mallotus.	
CLUPEIDÆ.	Clupea. Alosa.	Chatoëssus. Elops. Butirinus.	Hyodon. Amia.	Butirinus.
SAURIDÆ.			Lepisosteus.	
GADIDÆ.	Morrhua. Merluccius. Lota. Merlangus. Brosmius. Phycis. Macrourus.			
PLANIDÆ.	Hippoglossus. Platessa. Pleuronectes.	Plagusia.		Achirus. Platessa.
CYCLOPTERIDÆ.	Lumpus. Liparis.			
ECHENEIDÆ.	Echeneis.			
ANGUILLIDÆ.	Anguilla. Conger. Ophidium. Fierasfer. Ammodytes.			Conger.

Family.	Genera found both in Europe and North America.	Genera found in North America, but not peculiar to it.	Genera peculiar to America.	Genera found in North America, and extending to South America.
SYNGNATHIDÆ.	Syngnathus. Hippocampus.			
GYMNODONTIDÆ.	Tetraodon. Orthagoriscus.	Diodon.	Acanthosoma.	
BALISTIDÆ.	Balistes.	Monocanthus. Aluteres.		
OSTRACIONIDÆ.		Lactophrys.		
STURIONIDÆ.	Acipenser.		Polyodon. Platirostra.	
SQUALIDÆ.	Carcharias. Lamna. Mustelus. Selache. Acanthias. Scymnus. Zygæna. Squatina.	Pristis.		
RAIIDÆ.	Raia. Trygon. Myliobatis.	Aëtobatis.		Aëtobatis. Trygon.
PETROMYZONIDÆ.	Petromyzon. Ammocœtes.			

Although it will be seen, by the above catalogue, that quite a number of *genera* are found to inhabit the coasts of both Europe and North America, but few of the *species* belonging to these genera have been detected upon the shores of both countries.

They are as follows: —

Trigla cuculus.
Cottus gobio.
Dactylopterus volitans.
Aspidophorus Europæus.
Scorpæna porcus.
Sebastes Norvegicus.
Gasterosteus aculeatus.
Scomber colias.
Scomber grex.
Pelamys sarda.
Trichiurus lepturus.
Auxis vulgaris.
Anarrhicas lupus.
Salmo salar.

Scopelus Humboldtii.
Morrhua æglefinus.
Morrhua minuta.
Merlangus carbonarius.
Zygæna malleus.
Selache maximus.
Alopias vulpes.
Scymnus borealis.
Hippoglossus vulgaris.
Cyclopterus lumpus.
Orthagoriscus mola.
Carcharias vulgaris.

Many others of the North American *genera* will doubtless be met with on the coast of South America, by subsequent observers. Several of the *species* have been found to have a very extensive range; even from Massachusetts and New York to Brazil.

Among these are, —

Dules auriga.
Dactylopterus volitans.
Micropogon costatus.
Lobotes Surinamensis.
Trichiurus lepturus.
Ephippus faber.
Ephippus gigas.
Elacate Atlantica.
Temnodon saltator.
Scomber grex.
Pelamys sarda.
Cybium maculatum.
Trachinotus argenteus.
Vomer Brownii.
Mugil petrosus.
Mugil Plumieri.
Galeichthys Parra.
Zygæna malleus.

The following species inhabit the Northwestern Coast of America: —

Trichodon Stelleri.
Cottus pistilliger.
Cottus polyacanthocephalus.
Cottus asper.
Aspidophorus acipenserinus.
Hemilepidotus Tilesii.
Blepsias trilobus.
Sebastes variabilis.
Cyprinus balteatus.
Leuciscus caurinus.
Leuciscus Oregonensis.
Salmo salar.
Salmo quinnat.
Salmo Gairdnerii.
Salmo paucidens.
Salmo Scouleri.
Salmo tsuppitch.
Salmo nitidus.
Mallotus Pacificus.
Cyclopterus ventricosus.
Acipenser transmontanus.

An Enumeration of the Genera found in North America, with the Number of Species contained in each Genus.

Division I. — Osseous Fishes.

Family I. — Percidæ.

Genera.	No. of Species.
1. Perca,	2
2. Percina,	11
3. Labrax,	7
4. Centropomus,	1
5. Lucio-perca,	3
6. Huro,	1
7. Serranus,	20
8. Plectropoma,	4
9. Mesoprion,	16
10. Centropristis,	5
11. Grystes,	1
12. Rypticus,	1
13. Centrarchus,	10
14. Pomotis,	10
15. Bryttus,	3
16. Priacanthus,	1
17. Dules,	1
18. Trichodon,	1
19. Myripristis,	1
20. Holocentrum,	2
21. Uranoscopus,	1
22. Aphredoderus,	1
23. Sphyræna,	4
24. Polynemus,	1
25. Upeneus,	4
26. Lepisoma,	1

Genera, 26
Species, 113

Family II. — Triglidæ.

Genera.	No. of Species.
1. Trigla,	1
2. Prionotus,	4
3. Dactylopterus,	1
4. Cottus,	12
5. Aspidophorus,	3
6. Cryptacanthodes,	1
7. Hemitripterus,	1
8. Hemilepidotus,	1
9. Scorpæna,	4
10. Sebastes,	2
11. Blepsias,	1
12. Gasterosteus,	10
13. Temnistia,	1

Genera, 13
Species, 42

Family III. — Scienidæ.

Genera.	No. of Species.
1. Otolithus,	3
2. Corvina,	7
3. Leiostomus,	2
4. Larimus,	1
5. Conodon,	1
6. Eques,	2
7. Umbrina,	4
8. Pogonias,	2
9. Micropogon,	2
10. Hæmulon,	12
11. Pristipoma,	7
12. Lobotes,	2
13. Pomacentrus,	1
14. Glyphisodon,	2
15. Heliasus,	1

Genera, 15
Species, 49

Family IV. — SPARIDÆ.

Genera.	No. of Species.
1. Sargus,	5
2. Chrysophris,	1
3. Pagrus,	1
4. Pagellus,	1

Genera, 4
Species, 8

Family V. — MENIDÆ.

1. Smaris,	1
2. Gerres,	5

Genera, 2
Species, 6

Family VI. — CHETODONTIDÆ.

1. Chætodon,	3
2. Ephippus,	2
3. Holacanthus,	2
4. Pomacanthus,	3
5. Pimelepterus,	1

Genera, 5
Species, 11

Family VII. — SCOMBRIDÆ.

Genera.	No. of Species.
1. Scomber,	3
2. Pelamys,	1
3. Thynnus,	2
4. Auxis,	2
5. Cybium,	5
6. Gempylus,	1
7. Trichiurus,	1
8. Xiphias,	1
9. Naucrates,	2
10. Lichia,	2
11. Chorinemus,	3
12. Trachinotus,	5
13. Palinurus,	1
14. Notacanthus,	1
15. Caranx,	11
16. Blepharis,	3
17. Argyreiosus,	2
18. Vomer,	1
19. Seriola,	6
20. Coryphæna,	5
21. Temnodon,	1
22. Lampugus,	1
23. Pteraclis,	1
24. Rhombus,	2
25. Lampris,	1
26. Elacate,	1

Genera, 26
Species, 65

Family VIII. — TEUTHIDÆ.

1. Acanthurus,	3

Genus, 1
Species, 3

Family IX. — TÆNIDÆ.

1. Stylephorus,	1

Genus, 1
Species, 1

Family X. — ATHERINIDÆ.

1. Atherina,	6

Genus, 1
Species, 6

Family XI. — MUGILIDÆ.

1. Mugil,	6
2. Dajaus,	1

Genera, 2
Species, 7

Family XII. — GOBIDÆ.

1. Blennius,	3
2. Pholis,	2

Genera.	No. of Species.
3. Chasmodes,	3
4. Salarias,	2
5. Clinus,	1
6. Gunnellus,	7
7. Zoarcus,	3
8. Anarrhicas,	1
9. Gobius,	8
10. Sicidium,	1
11. Eleotris,	5
12. Philypnus,	1

Genera, 12
Species, 37

Family XIII. — Lophidæ.

1. Lophius,	1
2. Chironectes,	5
3. Malthea,	3
4. Batrachus,	3

Genera, 4
Species, 12

Family XIV. — Labridæ.

1. Cossyphus,	1
2. Ctenolabrus,	1
3. Acantholabrus,	1
4. Clepticus,	1
5. Lachnolaimus,	5
6. Tautoga,	1
7. Malacanthus,	1
8. Julis,	9
9. Xyrichthys,	3
10. Scarus,	18
11. Callyodon,	2

Genera, 11
Species, 43

Family XV. — Siluridæ.

Genera.	No. of Species.
1. Bagrus,	2
2. Galeichthys,	1
3. Arius,	1
4. Pimelodus,	16
5. Noturus,	1

Genera, 5
Species, 21

Family XVI. — Cyprinidæ.

1. Cyprinus,	2
2. Gobio,	1
3. Leuciscus,	38
4. Pimephales,	1
5. Catostomus,	27
6. Sclerognathus,	2
7. Exoglossum,	6
8. Pœcilia,	3
9. Lebias,	1
10. Fundulus,	1
11. Hydrargyra,	9
12. Molinesia,	1
13. Cyprinodon,	1

Genera, 13
Species, 93

Family XVII. — Hypsocidæ.

1. Amblyopsis,	1

Genus, 1
Species, 1

Family XVIII. — Esocidæ.

1. Esox,	5
2. Belone,	3
3. Scomberesox,	1
4. Exocetus,	5
5. Hemiramphus,	2

Genera, 5
Species, 16

Family XIX. — Fistularidæ.

1. Fistularia,	2

Genus, 1
Species, 2

Family XX. — Salmonidæ.

Genera.	No. of Species.
1. Salmo,	18
2. Osmerus,	1
3. Scopelus,	1
4. Coregonus,	8
5. Mallotus,	2
6. Thymallus,	1
7. Saurus,	1

Genera, 7
Species, 32

Family XXI. — Clupeidæ.

1. Clupea,	8
2. Alosa,	6
3. Pomolobus,	1
4. Chatoëssus,	5
5. Hyodon,	2
6. Elops,	1
7. Butirinus,	1
8. Amia,	1

Genera, 8
Species, 25

Family XXII. — Sauridæ.

1. Lepisosteus,	3

Genus, 1
Species, 3

Family XXIII. — Gadidæ.

1. Morrhua,	8
2. Merluccius,	1
3. Lota,	3
4. Merlangus,	4
5. Brosmius,	1
6. Phycis,	3
7. Macrourus,	1

Genera, 7
Species, 21

Family XXIV. — Planidæ.

Genera.	No. of Species
1. Hippoglossus,	1
2. Platessa,	7
3. Pleuronectes,	3
4. Achirus,	2
5. Plagusia,	1

Genera, 5
Species, 14

Family XXV. — Cyclopteridæ.

1. Lumpus,	4
2. Liparis,	2

Genera, 2
Species, 6

Family XXVI. — Echeneidæ.

1. Echeneis,	4

Genus, 1
Species, 4

Family XXVII. — Anguillidæ.

1. Anguilla,	7
2. Conger,	1
3. Muræna,	1
4. Ophidium,	2
5. Fierasfer,	2
6. Saccopharynx,	1
7. Ammodytes,	2

Genera, 7
Species, 16

Family XXVIII. — Syngnathidæ.

1. Syngnathus,	1
2. Hippocampus,	1

Genera, 2
Species, 2

Family XXIX. — Gymnodontidæ.

1. Diodon,	3
2. Tetraodon,	4

Genera.	No. of Species.
3. Acanthosoma,	1
4. Orthagoriscus,	1

Genera, 4
Species, 9

Genera.	No. of Species.
3. Aluteres,	3

Genera, 3
Species, 8

Family XXX. — Balistidæ.

1. Balistes,	1
2. Monocanthus,	4

Family XXXI. — Ostracionidæ.

1. Lactophrys,	3

Genus, 1
Species, 3

Division II. — Cartilaginous Fishes.

Family XXXII. — Sturionidæ.

Genera.	No. of Species.
1. Acipenser,	6
2. Polyodon,	1
3. Platirostra,	1

Genera, 3
Species, 8

Family XXXIII. — Squalidæ.

1. Carcharias,	4
2. Lamna,	2
3. Alopias,	1
4. Mustelus,	1
5. Selache,	1
6. Acanthias,	1
7. Scymnus,	1
8. Zygæna,	1
9. Squatina,	1
10. Pristis,	1

Genera, 10
Species, 14

Family XXXIV. — Raiidæ.

Genera.	No. of Species.
1. Raia,	8
2. Trygon,	3
3. Myliobatis,	3
4. Aëtobatis,	1
5. Rhinoptera,	1
6. Cephaloptera,	1
7. Torpedo,	1

Genera, 7
Species, 18

Family XXXV. — Petromyzonidæ.

1. Petromyzon,	7
2. Ammocœtes,	3

Genera, 2
Species, 10

Making a total of, —

Families, 35
Genera, 218
Species, 729

It may be observed that I have followed the Family arrangement of Dr. Dekay.

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SYNOPSIS.

CLASS I. OSSEOUS FISHES.

Skeleton bony, the osseous matter being deposited in fibres. Sutures of the cranium distinct, with maxillary or intermaxillary bones, always one, and generally both, present. Gill-membrane with rays.

ORDER I. ACANTHOPTERYGII. SPINE RAYED.

They are known by the spines which represent the first rays of the dorsal fin, or which alone sustain the anterior fin of the back, when they have two. Sometimes, instead of an anterior dorsal fin, they have nothing but a few free spines. Their anal fin has also some spines instead of the first rays, and there is, in general, one to each ventral.

FAMILY I. PERCIDÆ.

Comprehends fishes with an elongated body, covered with hard or rough scales, in which the operculum or preoperculum, and frequently both, have indented or spinous edges, and in which the jaws, the front of the vomer, and almost always the palatines, are furnished with teeth.

GENUS I. PERCA.

Two dorsal fins distinct, separated ; the rays of the first spinous, those of the second, flexible : tongue smooth : teeth in both jaws, in front of the vomer, and on the palatine bones: preoperculum notched below, serrated on the posterior edge: operculum bony, ending in a flattened point directed backwards. Branchiostegous rays. Scales roughened, and not easily detached.

1. Perca flavescens, Mitchill.

Above, greenish yellow; sides and abdomen, golden yellow. Six to ten vertical black bands descend from the back to the inferior portion of the sides, the alternate ones being shorter. Pectorals, ventrals, and anal, orange.

The fin rays are, — D. 13. 1 – 13. P. 15. V. 1 – 5. A. 2 – 8. C. 17. Length, 4 to 12 inches.

Lake Huron, Richardson. Massachusetts, Storer. Connecticut, Ayres, Linsley. New York, Mitchill, Dekay. Ohio, Kirtland. Pennsylvania, Haldeman.

Bodianus flavescens, Yellow Perch, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 421.
La Perche jaunatre d'Amérique, Perca flavescens, Cuv. et Val., ii. p. 46.
Perca flavescens, American Perch, Rich., Fauna Boreal. Americ., iii. p. 1, pl. 74.
Perca flavescens, Common Perch of Massachusetts, Storer's Report, p. 5.
Bodianus flavescens, Yellow Perch, Kirtland's Rep. on Zoöl. of Ohio, pp. 168, 190.
Perca flavescens, American Yellow Perch, Dekay's Report, p. 3, pl. 1, fig. 1.
" " " " " Linsley's Cat. of Fishes of Conn.
La Perche à opercules grenues, Perca serrato-granulata, Cuv. et Val., ii. p. 47.
" " " Griffith's Cuv., x. pl. 39, fig. 1.
" " " Dekay's Report, p. 5, pl. 22, fig. 64.
La Perche à tête grenue, Perca granulata, Cuv. et Val., vii. p. 48, pl. 9.
" " Jardine, Nat. Lib., i. p. 92, pl. 1.
" " Dekay's Report, p. 5, pl. 48, fig. 220.
" " Linsley's Cat. of Fishes of Conn.
La Perche à museau pointu, Perca acuta, Cuv. et Val., ii. p. 49, pl. 10.
" " Sharp-nosed Perch, Rich., Fauna Boreal. Americ., iii. p. 4.
" " Sharp-nosed Yellow Perch, Dekay's Rep., p. 6, pl. 68, fig. 222.
La Perche grêle, Perca gracilis, Cuv. et Val., ii. p. 50.
" " Rich., Fauna Boreal. Americ., iii. p. 4.
" " Slender Yellow Perch, Dekay's Report, p. 6.

2. Perca Plumieri, Bloch.

Whitish, with four longitudinal yellow ribands, and eight vertical blackish bands. The first dorsal and pectorals, gray; the other fins, yellow.

D. 9. 2 – 8. P. 13. V. 1 – 6. A. 7. C. 22. Bloch. Length, (?).

Caribbean Sea, Cuv.

Sciæna Plumieri, Bloch, pl. 306.
" " Plumier's Sciæna, Shaw's Gen. Zoöl., iv. p. 537.
La Perche de Plumier, Perca Plumieri, Cuv. et Val., ii. p. 51.

GENUS II. ETHEOSTOMA,* Raf.

Body nearly cylindrical, and scaly. Mouth variable, with small teeth. Gill-cover double or triple, unserrate, with a spine on the opercle, and without

* Haldeman formed a genus, which he calls Percina; and Dekay, in his "Report on the Zoölogy of New York," characterizes two genera under the names of Pileoma and Boleosoma, to receive the fishes which Rafinesque introduced into his genus Etheostoma. As Dr.

scales: six branchial rays. Thoracic fins with six rays, one of which is spinous; no appendage. One dorsal fin, more or less divided into two parts, the anterior one entirely with spinous rays. Vent medial, or rather anterior.

1. Etheostoma caprodes, Raf.

Body quite cylindrical, whitish, with about twenty transverse bands, alternately shorter. Head elongate, obtuse: upper jaw the longer. Lateral line quite straight. A black spot at the base of the tail.

D. 15–16. P. 14. V. 1–5. A. 13. C. 17. Length, 6 inches.

Western rivers, Raf., Kirtland.

Etheostoma caprodes, Common Hog-fish, Raf., Ichth. Ohien., p. 33.
" " " " Kirtland's Rep. on Zoöl. of Ohio, pp. 168, 192.
" " " " Bost. Journ. Nat. Hist., III. p. 346, pl. 5, fig. 3.

2. Etheostoma blennioides, Raf.

Body elongate: head small, snout rounded, mouth small beneath, lower jaw shorter. Olivaceous, almost diaphanous, some brown spots on the back, and some brown geminate transversal lines across the lateral line, which is straight, but rising at the base.

D. 15–13. P. 16. V. 1–5. A. 2–9. C. 13. Length, 2 or 3 inches.

Western rivers, Raf., Kirtland.

Etheostoma blennioides, Blunt-nose Hog-fish, Raf., Ichth. Ohien., p. 37.
" " Blenny-like Hog-fish, Kirtland's Rep. on Zoöl. of Ohio, p. 168.
" " " " " Bost. Journ. Nat. Hist., III. p. 349, pl. 6, fig. 1.

3. Etheostoma variata, Kirtland.

Body sub-cylindric, back gibbous, abdomen rectilinear; scales rough, apparently hexagonal. Head conical, gibbous; orbits prominent. Pectorals large, elongated almost to the origin of the anal fin. Caudal, fan-shaped. Body banded, behind the pectorals, with seven or eight white zones, spotted with orange, the intervening spaces green; an orange stripe beneath the pectoral fins, on the sides of the body. Back and head olive and green. Anterior dorsal fin edged with orange, and banded through its middle with indigo. Anal fin verditer.

D. 12–13. P. (?). V. (?). A. (?). C. (?). Length, (?).

Mahoning River, Ohio, Kirtland.

Etheostoma variata, Variegated Etheostome, or Darter, Kirtland, Bost. Journ. Nat. History, III. p. 274, pl. 2, fig. 2.

Kirtland has been able, by means of Rafinesque's descriptions, to identify several of his species, I do not feel at liberty, objectionable as his genus may be in some respects, to substitute any other for it.

4. Etheostoma maculata, Kirtland.

Body flattish, tapering gradually to tail. Head narrow, compressed. Jaws equal. Back and head, olive and black; sides and abdomen, sea-green, with from twelve to twenty carmine dots near the medial line.

D. 10 – 13. P. 14. V. 1 – 5. A. 1 – 7. C. 22. Length, 2½ inches.

Mahoning River, Ohio, Kirtland.

Etheostoma maculata, Black Darter, or Speckled Hog-fish, Kirtland, Bost. Journ. Nat. Hist., iii. p. 276, pl. 2, fig. 3.

5. Etheostoma Olmstedi, Storer.

Body cylindrical, very slightly compressed. Head small. Pectoral fins very long. Lateral line nearly straight. Yellowish, marked upon the back and sides with reddish brown blotches, which, when looked upon from either extremity of the fish, resemble interrupted longitudinal bands; when the fish is examined from above, these markings present more or less distinct transverse bands upon the back, which are situated at the origin, the middle, and the termination of both the dorsal fins. A narrow, deep black band passes from the snout to the eyes, and another from above the eyes, interrupted by them, to the lower edge of the cheeks.

D. 9 – 13. P. 15. V. 6. A. 11. C. 15. Length, (?).

Massachusetts, Storer. Connecticut, Olmsted, Ayres. New York, Dekay. Susquehannah River, Pennsylvania, Haldeman.

Etheostoma Olmstedi, Storer, Bost. Journ. Nat. Hist., iv. p. 60, pl. 5, fig. 2.
" " Ayres, " " " p. 257.
Percina minima, Hald., Journ. Acad. Nat. Scien., viii. p. 330.
Boleosoma tessellatum, Tessellated Darter, Dekay's Report, p. 20, pl. 20, fig. 57.
Etheostoma Olmstedi, Ground Fish, Linsley's Cat. of Fishes of Connecticut.
Perca minima, Dekay's Report, p. 7.

6. Etheostoma nebulosa, Hald.

Body slender, slightly compressed; head and mouth small; dorsal fins separated; lateral line straight; scales small, and strongly serrated; tail truncated; pectoral fins very long; branchiostegous rays, six. Yellowish brown, with irregular dark transverse bands.

D. 14 – 15. P. 14. V. 7. A. 11. C. 18. Length, 5½ inches.

Susquehannah River, Pennsylvania, Haldeman.

Percina nebulosa, Hald., Journ. Acad. Nat. Scien., viii. p. 330.
Perca nebulosa, Dekay's Report, p. 7.

7. Etheostoma semifasciata, Dekay.

Body oblong, cylindrical. Head small, sloping; scales moderate in size. Caudal fin broad, and very slightly emarginated. Olive-green, with about twenty dark olive or brownish transverse stripes on the sides, alternately but not regularly longer. A dark round spot at the base of the caudal.

D. 13 – 15. P. 15. V. 1 – 5. A. 12. C. 15$\frac{3}{3}$. Length, 2 inches.

Lake Champlain, DEKAY.

Pileoma semifasciatum, Champlain Pickering, DEKAY's Report, p. 16, pl. 50, fig. 162.

May not this prove to be the *Percina nebulosa* of Haldeman ?

8. Etheostoma bimaculata, HALD.

Slender, lateral line sub-rectilinear above the middle. Light yellow ; sides transversely and irregularly banded with black, and dorsal fins clouded with brown ; a distinct black spot at the extremity of the lateral line. Ten or twelve irregular transverse bands upon the back and sides ; rays of the second dorsal and caudal fins crossed by dark brown bands.

D. 15 – 15. P. 13. V. 6. A. 11. C. 17. Length, (?).

Susquehannah River, Pennsylvania, HALDEMAN.

Percina bimaculata, HALDEMAN, Proceedings of the Bost. Soc. Nat. Hist., p. 157.

9. Etheostoma cœrulea, STORER.

Body oblong. Head slightly gibbous anterior to the eyes, which are prominent. When alive, reddish above, orange-colored upon lower portion of the sides, with nine or ten transverse blue bands, which are not seen upon the red above. Anterior dorsal, yellow, margined with blue ; posterior dorsal, with a longitudinal blue band at its base and margin ; ventral, anal, and caudal fins, bluish ; pectorals, light yellow. A blue blotch upon the cheeks.

In spirits, the colors disappear, leaving the fish of a yellowish green, with ten dark brown, perfectly regular transverse bands extending from the dorsum to the abdomen : the bands at the edge of the first dorsal, and base of the second, are nearly black, and that at the margin of the second entirely disappears.

D. 10 – 13. P. 13. V. 1 – 5. A. 9. C. 16. Length, 2½ inches.

Fox River, Illinois, STORER.

Etheostoma cœrulea, STORER, Proceedings of the Bost. Soc. Nat. Hist., 1845.

10. Etheostoma tessellata, STORER.

Body oblong. Head gibbous, less than one fourth the length of the body. Lateral line straight. Top of the head and upper portion of the sides of a greenish brown color ; eight or ten transverse bluish bands upon the sides ; the intervals between these bands are yellowish, and in the centre of each is a bluish rhomb. A black blotch at the base of the tail. The lips, opercles, and rays of the first dorsal, gamboge yellow.

D. 12 – 13. P. 13. V. 6. A. 12. C. 17. Length, 3 inches ?

Florence, Alabama, Storer. Caught in running water.

Etheostoma tessellata, Storer, Proceedings of the Bost. Soc. Nat. Hist., 1845.

11. Etheostoma cinerea, Storer.

Body oblong, compressed. Head gibbous directly over the eyes. The upper portion of the sides is of a light yellow color, crossed longitudinally by three or four cinereous interrupted narrow bands, one or two of which commence at the snout, the others back of the head, and are lost anterior to the tail. Beneath these bands is a series of longitudinally arranged oval blotches, of a similar color, and from these blotches descend obliquely backward and downward to the abdomen, narrow transverse lines; lower portion of the sides yellowish white. First dorsal margined with red; second dorsal and anal variegated with red dots.

D. 11 – 13. P. 15. V. 6. A. 10. C. 17. Length, 3 to 4 inches.

Florence, Alabama, Storer. Caught in deep, still water, when fishing for Perch.

Etheostoma cinerea, Storer, Proceedings of the Bost. Soc. Nat. Hist., 1845.

GENUS III. LABRAX, Cuv.

Distinguished from the Perch by the scaly opercula, terminating with two spines, and by a tongue covered with prickles.

1. Labrax lineatus, Cuv.

Cylindrical, tapering. The upper part of the body is of a silvery brown color; the lower part of the sides and abdomen of a beautiful, clear silver color; eight or more longitudinal black bands on each side, commencing just back of the opercula, the upper bands running the whole length of the fish, the lower ones terminating directly above the anal fin.

D. 9, 1 - 12. P. 18. V. 1 – 4. A. 3 – 11. C. 18. Length, 3 to 4 feet.

Maine, New Hampshire, and Massachusetts, Storer. Connecticut, Ayres. New York, Mitchill, Cuv., Dekay.

Sciæna lineata, Bloch, pl. 304.
Perca Mitchilli, Striped Bass, or Rock-fish, Mitchill, Trans. Lit. et Phil. Soc., I. p. 413, pl. 3, fig. 4.
Rock-fish, Mease, " " I. p. 502.
Le Bar Rayé (ou Rock-fish) des Etats-Unis, Labrax lineatus, Cuv. et Val., II. p. 79.
" " Griffith's Cuv., X. p. 103.
" " Rich., Fauna Boreal. Americ., III. p. 10.
" " Storer's Report, p. 7.
" " Ayres, Bost. Journ. Nat. Hist., IV. p. 257.
" " Dekay's Report, p. 7, pl. 1, fig. 3.
" " Linsley's Cat. of Fishes of Connecticut.

2. Labrax rufus, Mitchill.

Body deep compressed. Color, a silvery gray; in very large specimens, all the upper part of the body, as well as the head and fins, are of a rusty black. The spinous ray of the second dorsal fin about two thirds the height of the first membranous ray.

D. 9, 1 – 12. P. 15. V. 1 – 5. A. 3 – 9. C. 17. Length, 6 to 15 inches. Usual weight about half a pound. This is known by the fishermen of Massachusetts as the White Perch.

Massachusetts, Storer. Connecticut, Ayres. New York, Mitchill, Cuv., Dekay. South Carolina, Dekay.

Bodianus rufus, Red Perch, Mitchill, Trans. Lit. et Phil. Soc., I. p. 420.
Le Petit Bar d'Amérique, Labrax mucronatus, Cuv. et Val., II. p. 86, pl. 12.
" " Small American Bass, or White Perch, Storer's Report, p. 8
Labrax rufus, Ruddy Bass, Dekay's Report, p. 10, pl. 3, fig. 7.
Labrax mucronatus, Ayres, Bost. Journ. Nat. Hist., IV. p. 257.
" " White Perch, Linsley's Cat. of Fishes of Connecticut.

3. Labrax pallidus, Mitchill.

Body compressed, small, light colored. First ray of the posterior dorsal nearly as long as the second. Opercle with a single spine.

D. 9 – 13. P. 17. V. 1 – 5. A. 3 – 7. C. $17\frac{3}{3}$. Length, 4 inches.

Massachusetts, Storer. New York, Mitchill, Dekay.

Merone pallida, Mitchill's Report on the Fishes of New York, p. 18.
Bodianus pallidus, " Trans. Lit. and Phil. Soc. N. Y., I. p. 420.
Labrax pallidus, Little White Bass, or White Perch, Dekay's Report, p. 11, pl. 1, fig. 2.

4. Labrax notatus, Smith.

This species differs from the L. lineatus in being more robust, and in being marked with rows of spots, five above and five below the lateral line, so regularly interrupted and transposed as to appear like ancient church-music. The back is brilliant with iridescent green, gold, and pink colors; the sides, silvery.

D. 9, 1 – 12. P. (?). V. 1 – 6. A. 1 – 12. C. 17. Length, 1 to 2 feet.

The river St. Lawrence, at Quebec, Richardson.

Labrax notatus, Bar-fish, or Canadian Bass, Lt. Col. C. H. Smith; Rich., Fauna Boreal. Americ., III. p. 8.
" " Dekay's Report, p. 14.

5. Labrax multilineatus, Cuv.

Of a dark olive upon the head and back, silvery upon the sides, white beneath. Interrupted dark brown longitudinal stripes, varying in their number, upon the sides. Cuvier, in his description of this species, from a specimen taken in the Wabash, describes the number of stripes as being from sixteen to nineteen. Kirtland, in his account of the same, speaks of six or seven. This species differs from the *lineatus* by its deeper body, shorter head, smaller teeth, coarser asperities upon the tongue, and particularly by the scales upon the maxillary bones being much larger, and similar to those of the *mucronatus*.

Cuvier's and Kirtland's species may, perhaps, by future research, be ascertained to be distinct species.

D. 9, 1 – 14. P. 16. V. 1 – 5. A. 3 – 13. C. 16$\frac{4}{4}$. Length, 8 to 15 inches.

The Striped Bass of the Ohio. White Bass of Lake Erie.

Wabash River, Indiana, Cuv. Ohio River, Lake Erie, Kirtland.

Perca chrysops, Raf., Ichth. Ohien., p. 32.
Perca multilineatus, Lesueur, Cuv. et Val., iii. p. 488.
Le Petit Bar d'Amérique, Labrax mucronatus, Cuv. et Val., iii. p. 488.
Labrax multilineatus, Kirtland, Bost. Journ. Nat. Hist., v. p. 21, pl. 7, fig. 1.
" " DeKay's Report, p. 14.

6. Labrax nigricans, DeKay.

Dark colored, with a tinge of yellowish. First dorsal more elevated than the second.

D. 9 or 10, 1 – 12. P. 16. V. 1 – 5. A. 3 – 8. C. 15$\frac{3}{3}$. Length, 6 to 12 inches.

New York, DeKay.

Labrax nigricans, Small Black Bass, DeKay's Report, p. 12, pl. 50, fig. 160.

7. Labrax albidus, DeKay.

Bluish white, with a few narrow dusky lines. Anal fin with twelve soft rays. Second dorsal scarcely emarginate.

D. 9, 1 – 13. P. 17. V. 1 – 5. A. 3 – 12. C. 17$\frac{3}{3}$. Length, 10 inches.

Lake Erie, DeKay.

Labrax albidus, White Lake Bass, DeKay's Report, p. 13, pl. 51, fig. 165.

GENUS IV. CENTROPOMUS, Lacep.

The preoperculum is indented, but the operculum is obtuse and unarmed.

1. Centropomus undecimalis, Cuv.

In its general form it resembles somewhat the Pike. Silvery, tinged with brownish or greenish towards the back; lateral line brown and very distinct. Fins yellowish, and dotted with black towards their edges; dorsal fin gray, dotted throughout with black. The second fin has eleven rays; hence its specific name.

D. 8, 1 – 10. P. 15. V. 1 – 5. A. 3 – 6. C. 17. Length, 12 inches.

Caribbean Sea, Cuv.

Sciæna undecimalis, Bloch, 305?
" " Pike-headed Sciæna, Shaw's Gen. Zoöl., iv. p. 535.
Le Centropome brachet de mer, Centropomus undecimalis, Cuv. et Val., ii. p. 102, pl. 14.

GENUS V. LUCIO-PERCA, Cuv.

So named because, to the characters of the Perch, they join teeth which have some relation to those of the Pike. The edge of their preoperculum has merely a simple indentation; their dorsal fins are separated; some of their jaw and palatine teeth are long and pointed.

1. Lucio-perca Americana, Cuv.

Of a grayish yellow upon the sides, darker upon the back. The operculum terminates in a strong, flat spine. The lower edge of the operculum smooth. A black spot upon the posterior part of the spinous dorsal. The first dorsal higher than the second.

D. 14, 1–20. P. 13. V. 1–5. A. 2–11. C. 17. Cuv. et Val. Length, 2 feet.

D. 14, 1–21. P. 13. V. 1–5. A. 1–13. C. $17\frac{11}{11}$. Richardson.

Salmon, of the Ohio River. *Pike*, of Lake Erie. *Pickerel*, of the settlers on Lake Huron. *Sandre*, of the French Canadians. *Horn-fish*, of the fur-traders.

Vermont, Thompson. Lake Huron, Richardson. Lake Erie, Kirtland. New York, Mitchill, Cuv., Dekay.

Perca vitrea, Mitchill, Supp. Am. Month. Mag., ii. p. 247.
" salmonea, Raf., Ichth. Ohien., p. 21.
" nigro-punctata, Raf., Ichth. Ohien., p. 23. (The male.)
Le Sandre d'Amérique, Lucio-perca Americana, Cuv. et Val., ii. p. 122, pl. 16.
Perca fluviatilis, Var? Rich., Franklin's Journal, 1823, p. 725.
Lucio-perca Americana, American Sandre, Rich., Fauna Boreal. Americ., iii. p. 10.
" " Okow, or Horn-fish, " " " " p. 14.
" " American Pike-Perch, Thompson, Hist. Vermont, p. 130, fig.
" " Salmon of the Ohio, &c., Kirtland's Report, p. 190.
" " Yellow Pike-Perch, Dekay's Report, p. 17, pl. 50, fig. 163.
" " American Sandre, Kirtland, Bost. Journ. Nat. Hist., iv. p. 237, pl. 9, fig. 2.

2. Lucio-perca Canadensis, Smith.

The upper part of the body dark olive-green; the lower whitish; a few pale yellow spots below the lateral line. The posterior margin of the bony operculum armed with five acute spines. The two dorsal fins nearly equal in height, and marked with black spots.

D. 12, 1–17. P. 12. V. 1–5. A. 12. C. 17. Length, 14 inches.

The river St. Lawrence, at Quebec, Richardson, Smith.

Lucio-perca Canadensis, Green Pickering, Lieut. Col. C. H. Smith; Griffith's Cuv., x. p. 275, fig.
" " Canadian Sandre, Rich., Fauna Boreal. Americ., iii. p. 17.
" " Dekay's Report, p. 19.

3. Lucio-perca grisea, Dekay.

General hue grayish. Membrane of the spinous dorsal fin without the black spots. Invariably smaller than the L. Americana.

D. 14, 1–17. P. 15. V. 1–5. A. 13. C. $17\frac{8}{8}$. Length, 10 to 12 inches.

Found with the L. Americana, DEKAY.

Lucio-perca grisea, Gray Pike-perch, DEKAY'S Report, p. 19.

GENUS VI. HURO, CUV.

Have all the characters of the Perch, properly so called, except that the preoperculum is not indented.

1. Huro nigricans, CUV.

Above, of an olive-brown, changing into yellowish white on the belly, and along the central ridge of each scale is a line of the same color with the upper parts, giving it a striped appearance on the sides. The first dorsal fin is smaller than that of the Perch, and is placed at a considerable distance in front of the second. The anal fin is somewhat larger in proportion.

D. 6, 2–12. P. 15. V. 1–5. A. 3–11. C. 17. CUV. et VAL. Length, 16 inches.

D. 6, 2–8. P. 15. V. 1–5. A. 3–11. C. $17\frac{7}{7}$. RICHARDSON.

Lake Huron, RICHARDSON, CUV.

Le Huron, Huro nigricans, CUV. et VAL., II. p. 124, fig. 17.
" " Huron, RICH., Fauna Boreal. Americ., III. p. 4.
" " Black Bass of the Huron, JARDINE, Nat. Lib., I., Perches, p. 108, pl. 6.
" " Black Huron, DEKAY'S Report, p. 15.

GENUS VII. SERRANUS, CUV.

Have the preoperculum denticulated, and the bony operculum terminated with one or two points, and long and pointed teeth distributed in a greater or less number among the smooth teeth of the lower jaw.

1. Serranus morio, CUV.

Brownish above, reddish beneath. The extremities of the maxillaries, the lower jaw, and the branchial membrane, red. The spinous portion of the dorsal is of a deeper color than the soft portion. The caudal is brown ; the anal is dark orange, margined with brown ; the pectorals are orange-colored, and the ventrals are ornamented with large red spots.

D. 11–17. P. (?). V. (?). A. 3–9. C. 17. Length, 30 inches.

New York, Caribbean Sea, CUV.

Called "Nègre," at St. Domingo.

Le Mérou nègre d'Amérique, Serranus morio, CUV. et VAL., II. p. 285.
" " DEKAY'S Report, p. 23.

2. Serranus lunulatus, Cuv.

Of a dull white, with lunated red spots. Fins blackish; ventrals spotted like the body.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Gulf of Mexico, Parra.

Called "Cabrilla," at Havana.

Cabrilla, Parra, p. 93, pl. 36, fig. 1.
Le Mérou à croissant, Serranus lunulatus, Cuv. et Val., ii. p. 379.

3. Serranus ouatalibi, Cuv.

Of a bright red color, brownish upon the sides; it has a large number of small violet dots, encircled with black. The dorsal, particularly its membranous portion, edged with olive; anal, violet; extremity of the caudal red, its base violet; pectorals olive, margined with bright orange.

D. 9–15. P. 17. V. 1–5. A. 3–8. C. 17. Length, 10 or 11 inches.

Gulf of Mexico, Parra. Caribbean Sea, Cuv.

Called, at Martinique, "Ouatalibé"; at St. Thomas, "Butter-fish."

Guativere, Parra, p. 7, pl. 5, fig. 2.
Le Mérou ouatalibi, Serranus ouatalibi, Parra, Cuv. et Val., ii. p. 381.

4. Serranus guativere, Parra.

Red upon the back, yellow upon the remainder of the body; tail yellow, with two black spots. Black dots upon the head; a large one in front of the eyes.

Gulf of Mexico, Parra.

Guativere, Parra, p. 8, pl. 5, fig. 1.
Le Mérou guativère, Serranus guativere, Parra, Cuv. et Val., ii. p. 383.

5. Serranus creolus, Cuv.

Red, deeper upon the back, rose-colored beneath. Sixteen to eighteen parallel lines cross the sides obliquely towards the back. A bright orange spot at the base of the pectorals. The dorsal is spotted with green.

D. 9–19. P. 19. V. 1–5. A. 3–9. C. 17. Length, (?).

Gulf of Mexico, Caribbean Sea, Cuv.

Called "Creole," at Martinique.

Rabirrubia de lo alto, Parra, p. 43, pl. 20, fig. 2.
Le Barbier, Serranus creolus, Cuv. et Val., ii. p. 265.

6. Serranus striatus, Cuv.

Two longitudinal bands upon the forehead; four or five irregular wide, vertical bands upon the body, and two upon the tail. Back of the dorsal fin, above the tail, a large, square black spot. Three spines upon the operculum. Very fine denticulations upon the preoperculum.

D. 11 - 17. P. 17. V. 1 - 5. A. 3 - 8. C. 16. Length, 3 feet.

Gulf of Mexico, Caribbean Sea, Cuv.

Called "Cabrilla," at Porto Rico.

Cherna, Parra, p. 50, pl. 24, fig. 1.
Le Mérou à croupe noire, ou Cherna des Espagnols d'Amérique, Serranus striatus, Cuv. et Val., ii. p. 288.

7. Serranus arara, Parra.

Dark brown, with gilded brown spots ; fins, bluish black ; the margin of the soft dorsal, of the anal, and of the caudal, black. No spots upon the fins.

Gulf of Mexico, Cuv.

Bonaci arara, Parra, p. 30, pl. 16, fig. 2.
Le Mérou arara, Serranus arara, Cuv., Cuv. et Val., ii. p. 377.

8. Serranus cardinalis, Parra.

Red, with black spots. The sides, and beneath the head, yellow, with red spots ; abdomen white, spotted with red. The soft dorsal, anal, and caudal fins, spotted with red and black ; ventrals half red and half yellow ; pectorals red, margined with blackish.

Gulf of Mexico, Parra.

Bonaci cardenal, Parra, p. 29, pl. 16, fig. 1.
Le Mérou cardinal, Serranus cardinalis, Cuv., Cuv. et Val., ii. p. 378.

9. Serranus bivittatus, Cuv.

Two longitudinal brown bands upon each side of the body ; one above and one below the lateral line. A broad violet stripe arises upon the neck, passes between the eyes, and bifurcates over each nostril ; two more upon the suborbitals ; and a shorter one upon the preopercle.

D. 10 - 12. P. 16. V. 1 - 5. A. 3 - 7. C. 17. Length, 4 to 5 inches.

Gulf of Mexico and Caribbean Sea, Cuv.

Le Serran à deux rubans, Serranus bivittatus, Cuv., Cuv. et Val., ii. p. 241.

10. Serranus oculatus, Cuv.

Elongated, of a beautiful golden aurora color. Caudal fin deeply forked. The dorsal fin much emarginated between its spinous and membranous portions. Eyes larger than in any other species of the genus. Two very short spines upon the operculum.

D. 10 - 11. P. 16. V. 1 - 5. A. 3 - 8. C. 17. Length, 24 inches.

Caribbean Sea, Cuv.

Called "Gros yeux," at Martinique.

Le Barbier, Serranus oculatus, Cuv. et Val., ii. p. 266, pl. 32.

11. Serranus catus, Cuv.

Resembles considerably the preceding. The spots are larger and less numerous. Vertical fins, with white spots at their base, and their margin blackish. Pectorals yellowish at their base, blackish at their extremities.

D. 11-17. P. 16. V. 1-5. A. 3-9. C. 17. Length, (?).

Caribbean Sea, Cuv.

Perca maculata, Bl., pl. 213.
Le Mérou chat (Serranus catus, Cuv., Perca maculata, Bl.), Cuv. et Val., II. p. 373.

12. Serranus coronatus, Cuv.

Body brown, variegated with rose and violet-colored spots; three moderate-sized spines upon the operculum.

D. 9-15. P. 16. V. 1-5. A. 3-8. C. 17. Length, (?).

Caribbean Sea, Cuv.

Le Mérou couronné (Serranus coronatus, Cuv., Perca guttata, Bl.), Cuv et Val., II. p. 371.

13. Serranus nigriculus, Cuv.

Violet, with numerous dull, round spots upon the orbits, lips, and vertical fins. Upon the posterior portion of the body these spots become more clouded. Pectorals and ventrals dotted with brown; very fine denticulations upon the preopercle; opercular spines feeble.

D. 11-17. P. 16. V. 1-5. A. 3-9. C. 17. Length, (?).

Caribbean Sea, Cuv.

Called, at Martinique, "Petit Nègre," "Grande Gueule," "Vieille."

Le Mérou petit nègre, Serranus nigriculus, Cuv., Cuv. et Val., II. p. 375.

14. Serranus flavescens, Cuv.

Body elongated, snout short and thick; head flattened above; preoperculum rounded and finely denticulated; three opercular spines. Yellowish brown upon the back, orange upon the sides; more bright or red upon the abdomen, without spots or bands. Head above, bluish. Fins gray. Caudal margined above and beneath with deeper brown.

D. 9-12. P. 15. V. 1-5. A. 3-7. C. 17. Length, 7 inches.

Caribbean Sea, Cuv.

Le Serran jaunatre, Serranus flavescens, Cuv. et Val., VI. p. 506.

15. Serranus fascicularis, Cuv.

With five or six longitudinal bands. Preoperculum with two groups of radiating spines on the lower part of its posterior margin. Three transverse lines on the top of the head.

D. 10 – 12. P. 15. V. 1 – 5. A. 3 – 7. C. 15. Length, 10 inches.

South Carolina, Cuv.

Le Serran à deux faisceaux, Serranus fascicularis, Cuv. et Val., ii. p. 245, and ix. p. 431.
" " Dekay's Report, p. 23.

16. Serranus acutirostris, Cuv.

Entirely brown. Snout more elongated than in the other species. Preopercle very minutely denticulated.

D. 12 – 16. P. 15. V. 1 – 5. A. 3 – 11. C. 18. Length, (?).

South Carolina, Cuv.

Le Mérou à museau aigu, Serranus acutirostris, Cuv. et Val., ii. p. 286, and ix. p. 432.
" " Dekay's Report, p. 23.

17. Serranus inermis, Cuv.

Preoperculum with very small denticulations. The opercular spine hardly visible; hence its specific name. The dried fish is reddish brown, with large, round white spots; brown spots upon the head; the dorsal, anal, and caudal fins blackish, spotted with white; pectorals and ventrals greenish black, sprinkled with olive spots; beneath the angles of the lower jaw, four round white spots.

D. 11 – 19. P. 18. V. 1 – 5. A. 3 – 10. C. 17. Length, (?).

Caribbean Sea, Cuv.

Le Mérou inerme, Serranus inermis, Cuv. et Val., ix. p. 436.

18. Serranus rupestris, Cuv.

Violet-colored above, sprinkled with large, irregularly rounded spots, of a beautiful vermilion red upon the back, base of the dorsal, and upon the ventrals; these are violet upon the head and sides, and upon the throat they become more vivid than the general color of the fish. Its height is nearly a fourth of its length; its thickness is between a half and a third of its height. An emargination above the angle of the preopercle.

D. 11 – 16. P. (?). V. (?). A. 3 – 10. C. (?). Length, 15 inches.

Caribbean Sea, Cuv.

Called "Rock-fish," at St. Domingo.

Le Mérou des roches, Serranus rupestris, Cuv. et Val., ix. p. 437.

19. Serranus tigris, Cuv.

The preopercle has no emargination. Body violet-colored more or less deep upon the back, and sprinkled with greenish brown spots; brighter beneath. Eight oblique lilac-colored rays cross the body.

D. 11-17. P. (?). V. (?). A. 3-11. C. (?) Length, 13 inches.

Caribbean Sea, Cuv.

Le Mérou tigre, Serranus tigris, Cuv. et Val., ix. p. 440.

20. Serranus erythrogaster, Dekay.

Olive-brown above; beneath red. Dorsal, caudal, ventral, and anal fins bordered with blue, and edged with dusky.

D. 11-16. P. 16. V. 1-5. A. 2-10. C. 16. Length, 2 feet.

Florida, Dekay.

Serranus erythrogaster, Groper, Dekay, p. 21, pl. 19, fig. 52.

GENUS VIII. PLECTROPOMA, Cuv.

Differ from the Serrani only in having the teeth, which are more or less numerous on the preoperculum, directed obliquely forward, slightly resembling the teeth of the rowel of a spur.

1. Plectropoma Hispanum, Cuv.

Of a beautiful aurora color, marked with red and yellow. Eight dorsal spines; but one tooth beneath the preoperculum. Canines short. Suboperculum denticulated. The twelfth anal spine very stout.

D. 8-12. P. 16. V. 1-5. A. 3-7. C. 17. Length, (?).

Caribbean Sea, Cuv.

Called, at Martinique, "Ouatalibé Espagnol."

Le Plectropome pavillon d'Espagne, Plectropoma Hispanum, Cuv. et Val., ii. p. 396.

2. Plectropoma chloropterum, Cuv.

Olive, marbled with black. Throat olive, spotted with white. Opercular spines very small. Edge of the preoperculum rounded, with two teeth beneath the angle directed forward. Pectorals green.

D. 11-17. P. 16. V. 1-5. A. 3-8. C. 17. Length, 10 inches.

Caribbean Sea, Cuv.

Called, at St. Domingo, "Farlate."

Le Plectropome à pectorales vertes, Plectropoma chloropterum, Cuv. et Val., ii. p. 393.

3. Plectropoma puella, Cuv.

Olive, crossed by six violet-black bands; the third, in the centre of the body, is very broad and conspicuous, and is immediately followed by one of narrow dimensions. Blue bands upon the head and breast.

D. 10 – 16. P. 13. V. 1 – 5. A. 3 – 7. C. 17. Length, 4 inches.

Caribbean Sea, Cuv.

Called, at Martinique, " Demoiselle blanche."

Le Plectropome demoiselle, Plectropoma puella, Cuv. et Val., ii., p. 405, pl. 37.
" " Jardine, Nat. Lib., Vol. i., Ichthyology, p. 143, pl. 22.

4. Plectropoma chlorurum, Cuv.

Of a beautiful brown. Caudal and pectorals yellow. The other fins black. Three points to the operculum. Six teeth at the lower edge of the preoperculum ; its edge is very finely denticulated ; three stouter teeth towards the angle.

D. 10 – 15. P. 12. V. 1 – 5. A. 3 – 7. C. 15. Length, (?).

Caribbean Sea, Cuv.

Called, at Martinique, " Petit Nègre."

Le Plectropome à caudale jaune, Plectropoma chlorurum, Cuv. et Val., ii. p. 406.

GENUS IX. MESOPRION.

Agrees with Serranus in its teeth, fins, and dentated preoperculum, but differs in its opercle being terminated by an obtuse angle, not spinous.

1. Mesoprion uninotatus, Cuv.

The back, upper part of the head, and cheeks are of a brownish steel-blue ; the lower part of the cheeks and sides of a rich rose-color, and the belly silvery. The entire body striped with seven or eight longitudinal golden bands, irregular and disconnected towards the dorsum. Dorsal fin rose-colored, with three yellow bands; the other fins a jonquil yellow. A dark-colored spot beneath the posterior portion of dorsal fin.

D. 10 – 12. P. 16. V. 1 – 5. A. 3 – 8. C. 17. Length, 13 or 14 inches.

Caribbean Sea, Cuv.

Called, at St. Domingo, " Sarde Dorée."

Salpa purpurascens variegata, Lane Snapper, Catesby, ii. p. 17, pl. 17.
Sparus Synagris, Lin., Shaw's Gen. Zoöl., iv. p. 419.
Le Mésoprion doré, Mesoprion uninotatus, Cuv. et Val., ii. p. 449, pl. 39.
" " Wilson's Art. Ichth., p. 169, pl. 298, fig. 5.
" " Jardine, Nat. Lib., i., Ichthyology, p. 148, pl. 24.

2. Mesoprion chrysurus, Cuv.

Above the lateral line, grayish, obliquely rayed with golden yellow; beneath it, of a bright purple, with three longitudinal golden stripes. The upper, which is broadest, passes along the middle of the body. Dorsal and anal, olive-yellow ; caudal, a bright yellow, margined with two rose-colored lines ; pectorals, rose-colored ; ventrals, orange. Tail very much forked.

D. 10 – 13. P. 14. V. 1 – 5. A. 3 – 9. C. 17. Length, 20 inches.

Caribbean Sea, Cuv.

Rabirrubia, Parra, p. 42, pl. 20, fig. 1.
Sparus chrysurus, Gold-tailed Sparus, Bl., pl. 262? Shaw's Gen. Zoöl., iv. p. 414, pl. 60.
Le Mésoprion à queue d'or, Mesoprion chrysurus, Cuv., Cuv. et Val., ii. p. 459, pl. 40.
" " Golden-tailed Mesoprion, Jard., Nat. Lib., i. p. 150, pl. 25.

3. Mesoprion cynodon, Cuv.

Back tinged with orange; abdomen white; fins and sides greenish yellow. The upper canine teeth very stout; also all the lower lateral teeth.

D. 10 – 14. P. 16. V. 1 – 5. A. 3 – 9. C. 17. Length (?).

Gulf of Mexico, Parra. Caribbean Sea, Cuv.

Caballerote, Parra, p. 52, pl. 25, fig. 1.
Sparus cynodon, Bl., 278? Shaw's Gen. Zoöl., Dog-toothed Sparus, iv. p. 411.
Le Mésoprion à dents de chien, Mesoprion cynodon, Cuv. et Val., ii. p. 465.

4. Mesoprion jocu, Parra.

Rose-colored; fins yellowish, except pectorals. A series of silvery spots, edged with brown, upon the cheeks and suborbitals.

D. 10 – 15. P. 17. V. 1 – 5. A. 3 – 9. C. 19. Weight, 12 to 15 pounds.

Caribbean Sea, Cuv.

Jocú, Parra, p. 53, pl. 25, fig. 2.
Le Mésoprion jocu, Mesoprion jocu, Cuv., Anthias jocu, Bl., Cuv. et Val., ii. p. 466.

5. Mesoprion mahogoni, Cuv.

Of a copper-colored russet-brown, which changes to a golden upon the sides, and silvery upon the back.

D. 10 – 12. P. 15. V. 1 – 5. A. 3 – 8. C. 17. Length, 5 inches.

Caribbean Sea, Cuv.

Called, at Martinique, " Sarde acajou."

Le Mésoprion acajou, Mesoprion mahogoni, Cuv. et Val., ii. p. 447.

6. Mesoprion analis, Cuv.

All the upper part of the body and sides marked with irregular longitudinal golden and silvery lines. The lower part of the sides, and the space between the golden and silvery lines, of a rose-red color. The ventrals, the greater part of the anal, and the edges of the caudal fin, of a bright rose-color; the dorsal bluish, rose-colored at its margin, with a wide yellow band at its base and upon its entire soft portion.

D. 10 – 14. P. (?). V. (?) A. (?). C. (?). Length, 5 inches.

Caribbean Sea, Cuv.

Called, at St. Domingo, " Sarde Haut-dos."

Le Mésoprion à anale rouge, Mesoprion analis, Cuv. et Val., ii. p. 452.

7. Mesoprion vivanus, Cuv.

Of a golden aurora color, with oblique brown lines upon the back, and longitudinal lines upon the sides. A brownish spot at the posterior portion of the body. The extremity of the caudal fin bordered with black.

D. 10-13. P. 16. V. 1-5. A. 3-8. C. 17. Weight, 40 pounds.

Caribbean Sea, Cuv.

Called, at Martinique, "Vivaneau."

Le Mésoprion vivaneau, Mesoprion vivanus, Cuv. et Val., ii. p. 451.

8. Mesoprion sobra, Cuv.

Of a brilliant olive-yellow, longitudinally marked with thirteen or fourteen blue bands, some of which bifurcate upon the back; three blue rays upon the cheeks. The dorsal fins olive, spotted with bluish. The caudal, olive, tinged with red. The anal and ventrals, red. The pectorals, rose-colored. A deep violet-colored spot upon the posterior part of the body.

D. 10-14. P. 16. V. 1-6. A. 3-8. C. 17. Length, (?).

Caribbean Sea, Cuv.

Called, at Martinique, "Sobre."

Le Mésoprion sobre, Mesoprion sobra, Cuv. et Val., ii. p. 453.

9. Mesoprion buccanella, Cuv.

Red; each scale edged with silver. The caudal and anal fins, yellow; the other fins, reddish. A black crescent-shaped spot at the base of the pectorals, — and hence its name, *Oreille noire*.

D. 10-14. P. 15. V. 1-5. A. 3-8. C. 17. Weight, 15 to 20 pounds.

Caribbean Sea, Cuv.

Called, at Martinique, "Oreille noire," and "Noper."

Le Mésoprion oreille noire, Mesoprion buccanella, Cuv. et Val., ii. p. 455.

10. Mesoprion aya, Cuv.

Of a beautiful carmine-red color, scales edged with silver; no black spot upon the pectorals, as in the preceding species. Four anal spines.

D. 10-14. P. (?). V. (?). A. 4-9. C. (?). Length, 28 inches.

Caribbean Sea, Cuv.

Called "Garanha."

Le Mésoprion rouge, Mesoprion aya, Cuv. et Val., ii. p. 457.

11. Mesoprion litura, Cuv.

Of a beautiful red color; a continued blue line upon the cheeks. Perhaps a variety of the M. jocu.

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D. 10 – 15. P. 16. V. 1 – 5. A. 3 – 8. C. 17. Weight, 20 to 30 pounds.

Caribbean Sea, Cuv.

Le Mésoprion à raie, Mesoprion litura, Cuv. et Val., II. p. 467.

12. Mesoprion linea, Cuv.

Olive-brown; paler upon the abdomen, with seven or eight vertical yellow bands. Fins olive. A narrow silvery line edged with brown passes from the middle of the maxillary bone to the preopercle, and divides upon the opercle.

D. 10 – 15. P. 15. V. 1 – 5. A. 3 – 8. C. 17. Length, 3 or 4 inches.

Gulf of Mexico, Caribbean Sea, Cuv.

Le Mésoprion à ligne, Mesoprion linea, Cuv. et Val., II. p. 468.

13. Mesoprion griseus, Cuv.

Grayish, verging to lilac upon the back, and upon the margin of the dorsal and caudal fins; aurora-colored at the lower portion of the sides, and on the ventrals; anal fin rose-colored or lilac. Beneath, white; each scale has a yellowish spot, by which longitudinal slightly oblique lines are formed upon the sides, which are more mingled with the gray upon the back.

D. 10 – 14. P. (?). V. (?). A. 3 – 8. C. (?). Length, 18 inches.

Caribbean Sea, Cuv.

Called, at St. Domingo, "Sarde grise."

Le Mésoprion gris, Mesoprion griseus, Cuv. et Val., II. p. 469.

14. Mesoprion flavescens, Cuv.

With vertical yellowish bands, lighter upon the back and fins. Neither lines nor dots upon the cheeks.

D. 10 – 15. P. 17. V. 1 – 5. A. 3 – 8. C. 17. Length, (?).

Caribbean Sea, Cuv.

Le Mésoprion jaunatre, Mesoprion flavescens, Cuv. et Val., II. p. 472.

15. Mesoprion pargus, Cuv.

Of a yellowish brown color, spotted with red. The four upper canines are very stout. A well marked tuberosity upon the interopercle.

D. 10 – 14. P. (?). V. (?). A. 3 – 8. C. (?). Length, 27 inches.

Caribbean Sea, Cuv.

Le Mésoprion pargo, Mesoprion pargus, Cuv. et Val., II. p. 473.

16. Mesoprion isodon, Cuv.

The teeth differ from those of all the other Mesoprions; the upper jaw has three strong canines, and sixteen conical teeth, decreasing regularly from the first, which is less than half the height of the others. The first row of teeth in the lower jaw is similar to that of the upper, except that it has no canines. The dried fish is red above, silvery or golden upon its sides, without bands.

D. 11 - 15. P. 16. V. 1 - 5. A. 3 - 7. C. 17. Length, 21 inches.

Caribbean Sea, CUV.

Le Mésoprion à dents égales, Mesoprion Isodon, CUV. et VAL., IX. p. 413.

GENUS X. CENTROPRISTIS, Cuv.

A single dorsal fin ; branchiostegous rays, seven ; all the teeth small and crowded ; no canines. Their preoperculum is dentated and the operculum spinous.

1. Centropristis nigricans, Cuv.

This species is of a dark brown, almost black, color, lighter beneath ; the head is of a sea or bronze green. The young of this species present clouded transverse bands. The white connecting membrane of the dorsal and anal fins is barred with black. The central rays of the caudal fin, which are usually forked, are elongated somewhat in young specimens: thus this fin is trilobed ; this elongation is less perceptible in old specimens.

D. 10 - 11. P. 18. V. 1 - 5. A. 3 - 7. C. 17. Length, 12 to 14 inches.

Massachusetts, STORER. New York, MITCHILL.

Perca varia, MITCHILL, Trans. Lit. et Phil. Soc. New York, I. p. 415, pl. 3, fig. 6.
Centropristis nigricans, GRIFFITH'S CUV., X. p. 117.
Le Centropriste noir, Centropristis nigricans, CUV. et VAL., III. pp. 37, 44. Lutjanus trilobus, LACEP.?
" " Black Perch, Black Bass, STORER'S Report, p. 9.
" " Black Sea Bass, DEKAY'S Report, p. 24, pl. 11, fig. 5.

2. Centropristis trifurca, L.

It is spotted, and ornamented with seven blue bands. The opercula are finely denticulated. The tail is three-pointed, like the nigricans. The third and fourth dorsal spines are furnished with tentaculæ as long as the spines themselves.

D. 11 - 12. P. 16. V. 1 - 5. A. 3 - 8. C. 20. Length, (?).

South Carolina, CUV.

Le Centropriste trident, Perca trifurca, L., CUV. et VAL., III. p. 43. Lutjanus tridens, LACEP.?
" " DEKAY'S Report, p. 25.

3. Centropristis tabacarius, Cuv.

Of a reddish brown, deeper above, lighter beneath; with an oblong, dull whitish spot upon each side, at the upper edge of the lateral line, opposite the first seven dorsal spines; a second small spot at the first ray of the dorsal fin ; and a third at the base of the last few soft rays of the dorsal. Dorsal fin with clouded brown spots. Three spines upon the operculum.

D. 10 – 12. P. 13. V. 1 – 5. A. 3 – 7. C. 17. Length, (?).

Caribbean Sea, Cuv.

Called, at Martinique, "Le Bout de Tabac."

Le Centropriste bout de tabac, Centropristis tabacarius, Cuv. et Val., iii. p. 44.

4. Centropristis auro-rubens, Cuv.

Upper part of the body of a vermilion-red, which gradually changes upon the sides and abdomen to a rose-red. The sides are sprinkled with oblong, irregular yellow spots. Dorsal and pectoral fins red; ventrals and anal, lighter. One spine upon operculum.

D. 12 - 11. P. 18. V. 1 – 5. A. 3 – 8. C. 17. Length, 1 foot.

Caribbean Sea, Cuv.

At St. Domingo, called "Fadate."

Le Centropriste rouge-doré, Centropristis auro-rubens, Cuv. et Val., iii. p. 45.

5. Centropristis rufus, Cuv.

Of an uniform beautiful deep russet-color. A single spine upon the operculum.

D. 10 – 11. P. 17. V. 1 – 5. A. 3 – 7. C. 17. Length, 8 inches.

Caribbean Sea, Cuv.

Le Centropriste roux, Centropristis rufus, Cuv. et Val., iii. p. 47.

GENUS XI. GRYSTES, Cuv.

Differs only from the Centropristis in having the preoperculum entire, and not denticulated at the edges.

1. Grystes salmoides, Lacep.

The adult fish is of a deep greenish brown color, with a bluish black spot at the angle of the operculum. The posterior portion of the dorsal fin rises high, and resembles somewhat that of some of the Greylings. The tail is shaped much like that of the Salmonidæ, and has a dark brown band crossing its centre. The young are marked with numerous longitudinal bands.

D. 10 – 13 or 14. P. 16. V. 1 – 5. A. 3 – 11 or 12. C. 17. Length, 2 feet

New York, Cuv. Carolina, Lacepede. Wabash River, Indiana, Cuv.

Called "Trout," in the places where it is found.

Le Growler salmoide (Grystes salmoides, Cuv., Labrus salmoides, Lacep.), Cuv. et Val., iii. p. 54, pl. 46.
Grystes salmoides, Salmon-formed Growler, Jardine, Nat. Lib., i. p. 158, pl. 29.
" " Growler, Dekay's Report, p. 26, pl. 69, fig. 223.

GENUS XII. RYPTICUS, Cuv.

A single dorsal fin. Small spines on the opercles; scales small, and concealed beneath a thick epidermis. The species have been called *Savonniers* by the French, in consequence of their soft and soapy surface, which feels as if it had been lubricated by some unctuous matter.

1. Rypticus saponaceus, Bloch.

Oblong and compressed. Of a blackish color, verging to violet; its whole surface covered with very small elliptical scales, which, through the microscope, exhibit radiating striæ, and are crenulated at the edges.

D. 3-25. P. (?). V. (?). A. 17. C. 17. Length, 8 or 9 inches.

Caribbean Sea, Gulf of Mexico, Cuv.

Jabonsillo, Parra, p. 51, pl. 24, fig. 2.
Le Savonnier commun (Rypticus saponaceus, Cuv., Anthias saponaceus, Bl.), Cuv. et Val., iii. p. 63.

GENUS XIII. CENTRARCHUS, Cuv.

Have an oval, compressed body; a single dorsal fin. Velvet-like teeth in both jaws, before the vomer, upon the palatines, and upon the base of the tongue; the preoperculum entire; the operculum divided at its angle into two flattened points.

1. Centrarchus æneus, Lesueur.

Coppery, occasionally tinged with green. Head and back dusky olive, blotched irregularly with darker spots; the jaws, lips, and throat, dusky; the thorax bluish or steel-gray. The spinous portion of the dorsal fin is longer than the membranous portion, and half of its height.

D. 12-11.	P. 16.	V 1-5.	A. 6-10.	C. 17.	Lesueur.	Length, 7 to 10 inches.
D. 11-11.	P. 14.	V. 1-5.	A. 6-10.	C. 17.	Cuv. et Val.	" "
D 11-11.	P. 14.	V. 1-5.	A 6-10.	C. $17\frac{2}{2}$.	Richardson.	" "
D. 11-11.	P. 16.	V. 5.	A. 6-10.	C. $17\frac{2}{2}$.	Kirtland.	" "
D. 11-12.	P. 14.	V. 1-5.	A. 6-11.	C. $17\frac{3}{3}$.	Dekay.	" "

Lake Erie, Lesueur. Lake Ontario, Cuv. Lake Huron, Richardson. Lake Champlain, Dekay. Almost every permanent stream in Ohio, Kirtland.

Called "Rock Bass," "Goggle-eyed Bass," "Black Sun-fish," in Ohio. "Rock Bass," in Lake Champlain.

Cichla ænea, Lesueur, Journ. Acad. Nat. Sc., ii. p. 214, fig.
Le Centrarchus bronzé, Centrarchus æneus, Cuv. et Val., iii. p. 84.
" " Bronzed Centrarchus, Rich., Fauna Boreal. Amer., iii. p. 18, pl. 75.
Cichla ænea, Rock Bass, Kirtland's Report on the Zoöl. of Ohio, pp. 168, 191.
Centrarchus æneus, Fresh-water Bass, Dekay's Report, p. 27, pl. 11, fig. 4.
" " Kirtland, Bost. Journ. Nat. Hist., iv. p. 239, pl. 11, fig. 1.

2. Centrarchus fasciatus, Lesueur.

Body compressed ; back arched and gibbous. Of a dusky bluish color, often with transverse bands. Anal fin with three spines.

D. 9, 1 – 14. P. 18. V. 5. A. 3 – 12. C. $16\frac{6}{6}$. Length, 18 to 20 inches.

Lake Erie, Lesueur. New York, Dekay. Ohio, Kirtland.

Cichla fasciata: Ohiensis: minima, Lesueur, Journ. Acad. Nat. Sc., II. pp. 116, 218.
" " Black Bass of Lake Erie and the Ohio, Kirtland's Report, p. 191.
Centrarchus fasciatus, Black Fresh-water Bass, Dekay's Report, p. 28, pl. 111, fig. 8.
" " Kirtland, Bost. Journ. Nat. Hist., v. p. 28, pl. 9, fig. 1.

3. Centrarchus sparoides, Val.

This species is of a more rounded form than the C. hexacanthus. Its dorsal fin is longer than that of the C. æneus, and its anal fin is higher than that of any other species of the genus. The color is greenish above, and beneath silvery. The whole body exhibits golden reflections, and has numerous large black dots upon its sides, which form fourteen longitudinal lines.

D. 12 – 13. P. 11. V. 1 – 5. A. 9 – 15. C. 17. Length, 7 inches.

South Carolina, Cuv.

Le Centrarchus à neuf épines, Centrarchus sparoides, Cuv. et Val., VII. p. 459.
" " Dekay's Report, p. 31.

4. Centrarchus pentacanthus, Cuv.

Similar in form to the æneus, but its anal fin has but five spines, and the dorsal ten. A narrow blackish line runs longitudinally across each row of scales. The connecting membrane of the fins is also marked with brown.

D. 10 – 10. P. 14. V. 1 – 5. A. 5 – 11. C. 17. Length, 5 inches.

River Wabash, Indiana, Cuv.

Le Centrarchus à cinq épines, Centrarchus pentacanthus, Cuv. et Val., III. p. 88.
" " Dekay's Report, p. 30.

5. Centrarchus hexacanthus, Val.

Forehead and back maculated and variegated with dusky spots on a ground of sea-green ; similar spots extend downwards upon the upper half of the body, in irregular bands, on a ground color of light green or yellow. The sides of the head and body are silvery and iridescent ; below, of a delicate white. Dorsal, anal, and caudal fins bordered with series of irregular dusky spots, more distinct in old than in young specimens. Pectoral and ventral fins ferruginous or yellowish. It differs from the æneus in the form of its dorsal, which is lower before, more elevated at its posterior portion, and has but six spinous rays.

D. 8 – 16. P. 12. V. 1 – 5. A. 6 – 18. C. 17. Cuv. et Val. Length, (?).

D. 6 – 15. P. 12. V. 1 – 6 A. 6 – 19. C. $17\frac{2}{2}$. Kirtland. Length, (?).

Abundant in the fresh waters of Carolina, Bosc. River Wabash, Indiana, Lesueur. Bayous of Cuyahoga, and the Big Miami River, Kirtland.

Le Centrarchus sparoide (Centrarchus sparoides, Cuv., Labrus sparoides, Lacep.), Cuv. et Val., iii. p. 88.
Cantharus nigro-maculatus, Lesueur, Cuv. et Val., iii. p. 88.
Le Centrarchus à six épines, Centrarchus hexacanthus, Val., Cuv. et Val., vii. p. 456, pl. 48.
Cichla Storeria, Kirtland's Report on the Zoöl. of Ohio, p. 191.
Centrarchus hexacanthus, Rock-fish, Grass Bass, Kirtland, Bost. Journ. Nat. Hist., iii. p. 480, pl. 29, fig. 2.
" " Dekay's Report, p. 31.

6. Centrarchus irideus, Cuv.

Grayish brown, dotted and spotted with darker brown. A black spot upon the angle of the operculum. Upon the posterior portion of the dorsal fin is a very broad black spot, bounded above and beneath by a yellow line, and some red dots. All the fins are spotted with brown. It resembles the C. sparoides in the height of its dorsal fin, but its anal fin is similar to that of the C. æneus.

D. 11–14. P. (?). V. (?) A. 7–16. C. (?). Length, 6 inches.

South Carolina, Cuv.

Le Centrarchus iris, Centrarchus irideus, Cuv. et Val., iii. p. 89.
" " Dekay's Report, p. 31.

7. Centrarchus gulosus, Cuv.

This species, which was originally supposed by Cuvier to be a Pomotis, is described as being similar in its color to the Pomotis vulgaris. The body is less orbicular; the black auricle is shorter, and it has fewer soft rays in its dorsal and anal fins. The mouth of this species is exceedingly large.

D. 10–9. P. 15. V. 1–5. A. 3–8. C. 17. Length, 8 inches.

Lake Pontchartrain, and the lagoons in the vicinity of New Orleans, Cuv.

Le Pomotis grande gueule, Pomotis gulosus, Cuv. et Val., iii. p. 498.
Le Centrarchus à trois épines, Centrarchus gulosus, Cuv. et Val., vii. p. 459.
" " Dekay's Report, p. 31.

8. Centrarchus viridis, Val.

It resembles the C. æneus in its form more than other species; but its green color, sprinkled with black spots, reminds us of the hexacanthus.

D. 11–10. P. (?). V. (?) A. 3–8. C. (?). Length, 8 inches.

South Carolina, Val.

Le Centrarchus vert, Centrarchus viridis, Cuv. et Val., vii. p. 460.
" " Dekay's Report, p. 31.

9. Centrarchus tetracanthus, Cuv.

Body compressed; with blackish spots, large towards the head, very small at the posterior part of the body. Four anal spines.

D. 15 – 10. P. 13. V. 1 – 5. A. 4 – 9. C. 16. Length, 8 inches.

Gulf of Mexico, Cuv.

Le Centrarchus à quatre épines, Centrarchus tetracanthus, Cuv. et Val., vii. p. 460.

10. Centrarchus obscurus, Dekay.

Body not gibbous. Of a general greenish brown, or dark olive-color, with faint metallic bronze on the upper parts ; beneath, lighter.

D. 9, 1 – 12. P. 16. V. 1 – 5. A. 3 – 12. C. $17\frac{3}{3}$. Length, 6 inches.

New York, Dekay.

Centrarchus obscurus, Obscure Fresh-water Bass, Dekay's Report, p. 30, pl. 17, fig. 43.

GENUS XIV. POMOTIS, Cuv.

A few denticulations, more or less obvious, on the borders of the preoperculum. Palatines and tongue smooth, and without teeth. Minute teeth on the jaws, vomer, and pharyngeals. Branchial rays, six. A membranous elongation at the angle of the operculum.

1. Pomotis vulgaris, Cuv.

The general color of this species is a greenish brown, with spots of blue and yellow upon each side. Longitudinal, undulating, deep blue lines across preoperculum and operculum, with rusty yellow blotches interspersed. Head of a darker color than the body generally. At the posterior angle of the operculum, a large black spot, embracing a portion of the operculum, and a fleshy prolongation, having a bright scarlet-colored margin. All the fins more or less colored with black.

D. 10 – 12. P. 13. V. 1 – 5. A. 3 – 10. C. 17. Length, 6 to 9 inches.

Massachusetts, Storer. New York, Mitchill. Cleveland Harbour, Bayous of Cuyahoga, Kirtland. Common in the rivers, creeks, and ponds of Kentucky, Rafinesque. Lake Huron, Richardson. South Carolina, Catesby.

Perca fluviatilis gibbosa ventre luteo, Fresh-water Perch, Catesby, ii. p. 8.
Labrus auritus, Turton's Linnæus, i. p. 794.
" " Shaw's Gen. Zoöl., iv. p. 482.
" " Mitchill, Trans. Lit. et Phil. Soc. N. Y., i. p. 403.
Ichthalis aurita, Rafinesque, Ichth. Ohien., p. 29.
Le Pomotis commun, Pomotis vulgaris, Cuv. et Val., iii. p. 91, pl. 49, et vii. p. 465.
Pomotis vulgaris, Northern Pomotis, Rich., Fauna Boreal. Americ., iii. p. 24, fig. 76.
" " Jardine, Nat. Lib., i. 162.
" " Fresh-water Sun-fish, Pond Perch, Bream, Storer's Report on the Fishes of Mass., p. 11.
" " Sun-fish, Roach, Kirtland's Report on Zoöl. of Ohio, p. 191.
" " Harlequin Roach, Bost. Journ. Nat. Hist., iii. p. 471, pl. 23, fig. 11.
" " Common Pond-fish, Dekay's Report, p. 31, pl. 51, fig. 166.

2. Pomotis Ravenelii, Val.

The profile of the back is much more rectilinear, and descends more obliquely, than in the vulgaris, which gives a gibbous appearance at the base of the dorsal fin. The denticulations at the angle of its preoperculum are finer.

D. 10 – 11. P. (?). V. (?). A. 3 – 9. C. (?). Length, 8 inches.

South Carolina, Cuv.

Le Pomotis de Ravenel, Pomotis Ravenelii, Cuv. et Val., vii. p. 465.
" " Dekay's Report, p. 33.

3. Pomotis Holbrookii, Val.

Similar to the vulgaris in its color. Broader and deeper-colored black spots upon the soft portion of the dorsal fin. Preopercle very finely denticulated.

D. 10 – 11. P. (?). V. (?). A. 3 – 11. C. (?). Length, 9 inches.

South Carolina, Cuv.

Le Pomotis d'Holbrook, Pomotis Holbrookii, Cuv. et Val., vii. p. 466.
" " Dekay's Report, p. 33.

4. Pomotis incisor, Val.

The back of this species is more raised between the neck and the dorsal fin than in the vulgaris. The preopercular denticulations are very fine; the teeth of the front row of the upper jaw are a little stronger than in the vulgaris. The back of this species is brown, slightly gilded upon the sides, more brilliant upon the belly. A more or less distinct black *ocellus* exists upon the posterior soft rays of the dorsal. The opercular membrane is quite broad, and upon it is a great portion of the black auricular spot.

D. 10 – 10. P. (?). V. (?). A. 3 – 9. C. (?). Length, 6 inches.

Lake Pontchartrain, Louisiana, Cuv.

Le Pomotis coupeur, Pomotis incisor, Cuv. et Val., vii. p. 466.
" " Dekay's Report, p. 33.

5. Pomotis gibbosus, Val.

The body is broader than that of the preceding species, and a little higher before the dorsal fin. The denticulations at the angle of the operculum are rather stronger than those of the incisor, but less so than in the vulgaris. The back is marked with longitudinal rows of blackish dots. The belly is of a dull green color. A large blackish spot upon the posterior rays of the dorsal. The opercular membrane is broad and striated.

D. 10 – 12. P. (?). V. (?). A. 3 – 11. C. (?). Length, 8 inches.

South Carolina, Val.

Le Pomotis bossu, Pomotis gibbosus, Cuv. et Val., vii. p. 467.
" " Dekay's Report, p. 33.

6. Pomotis solis, Val.

Of a uniform greenish yellow color, more or less gilded, without any trace of spots or rays upon the body or the fins. The auricular membrane longer and narrower than in any other species.

D. 10 – 11. P. (?). V. (?). A. 3 – 10. C. (?). Length, 4 or 5 inches.

Lake Pontchartrain, Louisiana. New York, Val.

Le Pomotis poisson du soleil, Pomotis solis, Cuv. et Val., vii. p. 468.
" " Dekay's Report, p. 33.

7. Pomotis Catesbei, Val.

Body elongated. Oblique brown lines upon its cheeks. The body is of a blackish brown, lighter beneath, with golden reflections; blackish dots upon the dorsal and anal fins.

D. 10 – 10. P. (?). V. (?). A. 3 – 9. C. (?). Length, 4½ inches.

Pennsylvania, Val.

Le Pomotis de Catesby, Pomotis Catesbei, Cuv. et Val., vii. p. 469.
" " Dekay's Report, p. 33.

8. Pomotis appendix, Mitch.

Body sombre-colored, beneath whitish. Appendix entirely black. Body more robust than that of the vulgaris. The pectorals broader, and more rounded than in that species.

D. 10 – 11. P. 13. V. 5. A. 3 – 10. C. 19. Length, 5 to 6 inches.

New York, Mitchill.

Labrus appendix, Black-eared Pond-fish, Mitchill, Supp. to Amer. Month. Mag., ii. p. 247.
Pomotis appendix, Dekay's Report, p. 32.

9. Pomotis macrochira, Raf. The Gilded Sun-fish.

Body somewhat compressed, especially near the back; uniformly oval. Back and head iridescent, brown, and purple, blotched with spots of darker brown; throat, sides, and belly, a brilliant golden yellow. Opercular appendage semicircular, black, and sub-margined with a lighter border.

D. 10 – 12. P. 15. V. 1 – 5. A. 3 – 10. C. 17. Length, 2 to 8 inches.

Tributaries of the Ohio River, Raf., Kirtland.

Ichthelis macrochira, Sun-fish, Gold-fish, Raf., Ichth. Ohien., p. 27.
Pomotis macrochira, Gilded Sun-fish, Kirtland, Bost. Journ. Nat. Hist., iii. p. 469, pl. 27, fig. 3.

10. Pomotis nitida, Kirtland.

Body compressed, oval. Back gibbous between the eyes and dorsal fin. Brilliant, but evanescent. Upper part of the head and back brown, yellowish, and sometimes greenish.

Head, jaws, operculum, and sides beautifully waved and spotted with verditer blue. Lips light blue, sides golden yellow, belly tinged with orange.

D. 10 – 11. P. 12. V. 1 – 5. A. 2 – 9. C. 18. Length, 3 inches.

Ohio, Kirtland.

Pomotis nitida, Sun-fish, Red-eyes, Kirtland, Bost. Journ. Nat. Hist., iii. p. 472, pl. 28, fig. 1.

GENUS XV. BRYTTUS, Val.

The only character which distinguishes this genus from the Pomotis is a small narrow band of short velvety teeth along the external edge of each palatine.

1. Bryttus punctatus, Cuv.

Greenish brown, with golden reflections, having parallel rows of rounded black dots. The operculum has, at its angle, a blackish blue spot, which extends along the lower edge of this bone. The membranous edge is not as highly colored as the bone itself. The dorsal, anal, and caudal fins are greenish, with a whitish edge. The ventrals are greenish at their base, and almost black elsewhere. The first soft ventral ray is filiform ; the appendix is narrow, and not much elongated.

D. 10 – 11. P. 12. V. 1 – 5. A. 3 – 8. C. 17. Length, 5½ inches.

South Carolina, Cuv.

Le Brytte pointillé, Bryttus punctatus, Cuv. et Val. vii. p. 462.
" " Dekay's Report, p. 33.

Cuvier considered this species to be the Ichthelis macrochira of Rafinesque. With all proper respect for the authority of the illustrious naturalist, we cannot refrain from thinking he was incorrect ; as Dr. Kirtland, whose opportunities of investigating the Western fishes have been so admirably improved, describes Rafinesque's species so very differently from this.

2. Bryttus reticulatus, Val.

Of a yellowish green color, presenting a reticulated appearance, owing to the base of each scale being blackish, or of a very deep green color. The teeth of this species are stronger, and the opercular spot is much larger, than in the previous species.

D. 11 – 11. P. (?). V. (?). A. 3 – 11. C. (?). Length, 7 inches.

South Carolina, Cuv.

Le Brytte maillé, Bryttus reticulatus, Val., Cuv. et Val., vii. p. 463.
" " Dekay's Report, p. 33.

3. Bryttus unicolor, Val.

Color uniform. Fins unspotted. This species has but three or four small teeth upon the anterior portion of the palatines.

D. 11 – 11. P. (?) V (?). A. 3 – 9. C. (?). Length, 6 inches.

Pennsylvania, South Carolina, Cuv.

Le Brytte unicolor, Bryttus unicolore, Cuv. et Val., vii. p. 464.
" " Dekay's Report, p. 33.

GENUS XVI. PRIACANTHUS, Cuv.

Have an oblong, compressed body, entirely covered, as well as the head and jaws, with small rough scales. Fine teeth on both jaws; no canines. The lower angle of the preoperculum spinous.

1. Priacanthus macrophthalmus, Bloch.

Oblong. Red. Its height equal to one third of its length; length of the head equal to its height. The angle of the preopercle, in the *male*, is prominent and sharp, and the whole edge of the preopercle is notched; in the *female*, the angle is obtuse, and the denticulations are very fine.

D. 10 – 14. P. 16. V. 1 – 5. A. 3 – 15. C. 17. Length, 10 or 12 inches.

Caribbean Sea, Cuv.

Anthias macrophthalmus, Bloch, pl. 319.
Catalufa, Parra, p. 20, pl. 12, fig. 1.
Le Priacanthe à gros yeux, Priacanthus macrophthalmus, Bl., Cuv. et Val., iii. p. 97.

GENUS XVII. DULES, Cuv.

Six branchial rays. Teeth even. Operculum terminated in a spine. Preoperculum denticulated.

1. Dules auriga, Cuv.

Compressed, arched. Yellowish gray, with three or more dusky vertical bands. The third ray of the dorsal fin elongated into a filament.

D. 10 – 13. P. 17. V. 1 – 5. A. 3 – 7. C. $17\frac{2}{2}$. Length, 6 to 8 inches.

New York, Dekay.

Le Doules cocher, Dules auriga, Cuv. et Val., iii. p. 112, pl. 51.
" " Wilson, Encyclop. Brit., Art. Ichth., p. 169, pl. 298, fig. 7.
" " Dekay's Report, p. 34, pl. 19, fig. 54.

GENUS XVIII. TRICHODON, Steller.

In which the preoperculum has strong spines, and the operculum is terminated in a flat point. They have no scales; their mouth is cleft almost vertically.

1. Trichodon Stelleri, Cuv.

This species, above the lateral line, is plumbeous, and beneath it white; slightly golden towards its posterior extremity. The first dorsal fin is edged with brown, with a band of the same color along its base; the second dorsal has no band at its base. The body of the Trichodon is compared to the blade of a knife. The head is equal to a fourth of its entire length, and is nearly as high as long; above, it is thicker than the body. The eyes are situated upon the sides of the head, and are directed laterally, but their upper edge touches the plane of the forehead. This is the only known species. It resembles the Weevers in its habits: it buries itself in the moist sand at low water, and is dug up with the hand.

D. 14–17. P. 23. V. (?). A. 28. C. 13. Length, 7 to 10 inches.

The northernmost parts of the Pacific. Was found by Steller, at the island of Unalaschka.

Le Trichodon de Steller, Trichodon Stelleri, Cuv. et Val., iii. p. 154, fig. 57.
" " Griffith's Cuv., x. p. 121, pl. 15, fig. 3.
" " Rich., Fauna Boreal. Americ., iii. p. 29.
" " Jardine, Nat. Lib., i. p. 166.
" " Wilson, Encyclop. Brit., Art. Ichthyology, p. 170.

GENUS XIX. MYRIPRISTIS, Cuv.

Have the brilliancy, form, and scales of Holocentrum; but their preoperculum has a double denticulated edge, and is without a spine at its angle. This genus is remarkable for a natatory bladder divided into two, whose anterior portion is bilobed, and is attached to the cranium in two places, merely covered by a membrane, and answering to the cavities of the ear.

1. Myripristis Jacobus, Cuv.

The sides of a cherry-red upon a silvery ground, verging to a vermilion towards the back; marked with longitudinal golden lines. The spinous portion of the dorsal is varied with yellow and rose-color, with two series of vermilion spots; a blackish band descends on each side upon the operculum, to the pectorals. Scales large, ten longitudinal rows on each side; the middle row has thirty-six scales.

B. 8. D. 10, 1–14. P. 15. V. 1–7. A. 4–13. C. 19. Length, 8 inches.

Caribbean Sea, Gulf of Mexico, Cuv.

Called, at Martinique, "Frère Jacques."

Le Myripristis d'Amérique, Myripristis Jacobus, Cuv. et Val., iii. p. 162.

GENUS XX. HOLOCENTRUM, Artedi.

The scales of this genus are brilliant and denticulated; the operculum is spinous and denticulated, and the preoperculum is not merely denticulated, but has at its angle a strong spine directed backwards.

1. Holocentrum longipinne, Cuv.

Oval, slightly compressed; of a deep rose-color, silvery upon the abdomen, with seven or eight longitudinal golden bands along its sides. It is distinguished from all other species of this genus, by having the soft portion of the dorsal fin, and the forks of the caudal, longer and more pointed.

B. 8. D. 11-15. P. 15. V. 1-7. A. 4-11. C. 19. Length, 12 inches.

South Carolina, Catesby. Caribbean Sea, Cuv.

Perca marina gibbosa cinerea, Margate fish, Catesby's Hist. Carol., ii. p. 2, pl. 2.
Matejudo colorado, Parra, p. 23, pl. 13.
Sciæna rubra, Bl., Red Sciæna, Shaw's Gen. Zoöl., iv. p. 540.
Holocentrus sogo, Bl., Sogo holocentrus, Shaw's Gen. Zool., iv. p. 553, pl. 80.
Bodianus pentacanthus, Bl., Five-spined Bodianus, Shaw's Gen. Zoöl., iv. p. 570, pl. 83.
L'Holocentre à longues nageoires, Holocentrum longipinne, Cuv. et Val., iv. p. 185.

2. Holocentrum marianum, Cuv.

Lower jaw projecting. The third anal spine very large. It has no black spot upon the dorsal fin, nor black dots upon the scales. It appears to have been silvery, more or less shaded with gold and red.

D. 11-12. P. 14. V. 1-7. A. 4-9. C. 17. Length, (?).

Caribbean Sea, Cuv.

L'Holocentre à mandibule saillante, Holocentrum marianum, Cuv. et Val., iii. p. 219.

GENUS XXI. URANOSCOPUS, L., Cuv.

Eyes placed on the upper surface of a nearly cubical-shaped head; mouth vertically cleft; preopercle crenate towards its base; a strong spine at each shoulder; gills with only six rays. Many of the species have within the mouth, in front of the tongue, a long fleshy filament, which they are enabled to thrust out at their pleasure, to attract smaller fishes within their reach to prey upon.

1. Uranoscopus anoplos, Cuv.

Greenish above, minutely punctate with black; beneath the lateral line, silvery. First dorsal fin blackish; pectorals greenish; the other fins white, tinged with yellow. Cheeks smooth and unarmed; no projecting filament from within the mouth.

D. 4, 1-12. P. 19. V. 1-5. A. 12. C. $11\frac{4}{4}$. Length, 2 inches.

South Carolina, Le Conte.

L'Uranoscope anoplose, Uranoscopus anoplos, Cuv. et Val., viii. p. 493.
" " Unarmed Uranoscope, Dekay's Report, p. 37, pl. 22, fig. 65.

GENUS XXII. APHREDODERUS, Lesueur.

Six branchial rays. Teeth velvet-like. Denticulations on the two edges of the suborbital. Preopercle denticulated. Opercle with a spine at its angle. Ventral fins without a spinous ray. Vent under the throat.

1. Aphredoderus Sayanus, Gilliams.

Gibbous. Above blackish brown, becoming paler towards the inferior surface, which is light yellowish; fins, except the ventrals, dusky.

B. 6. D. 3 – 11. P. 12. V. 0 – 7. A. 3 – 7. C. 17. Length, 3 inches.

Pennsylvania, Gilliams. Lake Pontchartrain, Louisiana, Cuv.

Scolopsis Sayanus, Gilliams, Journ. Acad. Nat. Sc., iv. p. 81, pl. 3.
L'Aphrédodère bossu, Aphredoderus gibbosus, Lesueur, Cuv. et Val., ix. p. 448.
Aphredoderus Sayanus, Spineless Perch, Dekay's Report, p. 35, pl. 21, fig. 62.

GENUS XXIII. SPHYRÆNA, Cuv.

Body elongated, with two distinct dorsals. Lower jaw longest; both with long teeth. Ventrals back of the pectorals.

1. Sphyræna becuna, Lacep.

Considerably elongated. General color silver-blue, with a series of pretty large, round, dark blue spots along the sides; tail spotted with blue.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, 4 feet.

Caribbean Sea, Cuv.

Picuda, Parra, p. 90, pl. 35, fig. 2.
Sphyræna picuda, Bloch, p. 29, fig. 1.
Esox becuna, Becuna Pike, Shaw's Gen. Zoöl., v. p. 112, pl. 109.
La Sphyrène bécune (Sphyrène becune, Lacep.; Sphyræna picuda, Bl., Schn.; Esox becuna, Sh.), Cuv. et Val., iii. p. 341.

2. Sphyræna barracuda, Catesby.

Very large, elongated. Brown, with whitish abdomen. Operculum terminates in two points. This species is exceedingly ferocious, and is as much dreaded as any of the sharks.

B. 7. D. 5, 1 – 9. P. 12. V. 1 – 5. A. 1 – 9. C. 19. Length, 7 or 8 feet.

Caribbean Sea, Catesby, Cuv.

Barracuda, Catesby's Hist. Carol., ii. pl. 1, fig. 1.
Esox barracuda, Barracuda Pike, Shaw's Gen. Zoöl., v. p. 105.
La grosse Sphyrène, Sphyræna barracuda, Cuv. et Val., iii. p. 343.

3. Sphyræna guachancho, Cuv.

Umber-colored, with a brilliant white lateral line. Caudal fin, green.

D. 5 - 10. P. (?). V. (?). A. 9. C. (?). Length, 20 inches.

Caribbean Sea, Cuv.

Le Guachancho, Sphyræna guachancho, Cuv. et Val., III. p. 342.

4. Sphyræna borealis, Dekay.

Small, much elongated, subcylindrical. Greenish brown above, silvery beneath. Lateral line yellow. Operculum with a single point.

D. 5 - 10. P. 14. V. 6. A. 10. C. 20. Length, 9 inches.

Massachusetts, Storer. New York, Dekay.

Sphyræna borealis, Northern Barracuda, Dekay's Report, p. 39, pl. 60, fig. 196.
" " Storer, Bost. Journ. Nat. Hist., p. 143.

GENUS XXIV. POLYNEMUS, L.

The head entirely scaled ; the preoperculum toothed ; the scales easily deciduous ; the dorsal fins far separated, and, with the anal fin, covered with scales ; before the pectoral fins, there are long filamentous appendages.

1. Polynemus Americanus, Cuv.

Body silvery, greenish or plumbeous above ; pectorals dark brown ; the other fins punctured with black. Seven filaments on each side. Tail forked.

D. 8, 1 -12. P. 16. V. 1 - 5. A. 3 - 13. C. 17. Length, 20 inches.

Caribbean Sea, Cuv.

Called, at Martinique, " Barbu " ; at St. Domingo, " Barbe chau."

Polynemus paradiseus, Bloch, 402.
Paradise Polyneme, Shaw's Gen. Zoöl., v. p. 147, pl. 118.
Le Polynème d'Amérique, Polynemus Americanus, Cuv. et Val., III. p. 393.

GENUS XXV. UPENEUS, Cuv.

Branchiæ with four rays ; teeth on both jaws, but frequently none on the palate ; opercle with a small spine ; a swimming bladder.

1. Upeneus maculatus, Bloch.

Of a red color ; sometimes with two or three spots. Opercular spine strong and pointed. Teeth conical, in a single row. From twenty to twenty-five mucous pores upon the lower edge of the suborbitar bone.

D. 8. P. 17. V. 1 - 5. A. 7. C. 15. Length, 8 inches.

Gulf of Mexico, Caribbean Sea, Cuv.

Mullus maculatus, Bl., pl. 348, fig. 1 ?
" " Bl. ; Spotted Surmullet, Shaw's Gen. Zoöl., IV. p. 617.
L'Upénéus métara, Upeneus maculatus, Cuv. et Val., III. p. 478.

2. Upeneus punctatus, Cuv.

The back and the middle of the cheeks red ; the upper part of the snout, the inferior portion of the cheeks, and the operculum, a greenish yellow ; a yellowish tinge upon the sides ; abdomen white, fins yellow. A small silvery or lilac-colored spot upon each scale, and three narrow lines of a similar color pass from the eye to the snout. Four or five brownish spots upon the sides of the body.

D. 7-9. P. 16. V. 1-5. A. 7. C. 15. Length, (?).

Caribbean Sea, Cuv.

L'Upénéus ponctué, Upeneus punctatus, Cuv. et Val., III. p. 432.

3. Upeneus Martinicus, Cuv.

Scales semicircular, with seven or eight crenulations at their base ; the cirrhi do not extend quite to the angle of the preopercle.

D. 7-9. P. 15. V. 1-5. A. 7. C. (?). Length, 5 inches.

Caribbean Sea, Cuv.

L'Upénéus Martiniquois, Upeneus Martinicus, Cuv. et Val., III. p. 483.

4. Upeneus balteatus, Cuv.

Back violet ; abdomen white ; a bright yellow longitudinal band upon the sides. A black spot at the side of the tail.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Caribbean Sea, Cuv.

L'Upénéus à baudrier, Upeneus balteatus, Cuv. et Val., III. p. 51.

GENUS XXVI. LEPISOMA, Dekay.

Body and fins scaly. Fleshy filaments along the basal line of the head, and on the orbits. A single dorsal fin. Branchial rays, six. Teeth in the jaws, vomer, and palatines. Ventrals before the pectorals.

1. Lepisoma cirrhosum, Dekay.

Soft portion of the dorsal higher and shorter than the spinous part.

D. 18-12. P. 14. V. 3. A. 19. C. $10\frac{2}{2}$. Length, $6\frac{1}{2}$ inches.

Florida, Dekay.

Lepisoma cirrhosum, Cirrous Lepisoma, Dekay's Report, p. 41, pl. 30, fig. 94.

FAMILY II. TRIGLIDÆ.

Contains a numerous series of fish, to which the singular appearance of their head, variously bristled and covered with armor, gives a peculiar physiognomy. Their general character consists in having the suborbitar bone more or less extended over the cheeks, and articulated behind with the preoperculum.

GENUS I. TRIGLA, Cuv.

Head nearly square, covered with bony plates ; gill-cover and shoulder-plate ending in a spine directed backwards ; body elongated, nearly round ; two dorsal fins, the rays of the first spinous, those of the second flexible ; teeth in both jaws and on the front of the vomer, pointed, small, and numerous ; branchiostegous rays, seven ; gill-opening large ; three detached rays at the base of each pectoral fin.

1. Trigla cuculus, L.

Of a beautiful bright red above, sides and belly silvery white. Fins reddish white. The lateral line is crossed throughout its length with small, short, straight, elevated lines, which have the appearance of a series of pins. Bloch compared them to the acicular leaves of the pine, a resemblance which suggested to him the trivial name of *pini* for his species. Linnæus called it *cuculus* on account of its uttering a note similar to the cuckoo when caught.

D. 9 - 18. P. 10. V. 1 - 6. A. 16. C. 11. Length, 8 inches.

New York, Cuv.

Trigla cuculus, Cuckoo Gurnard, L., SHAW's Gen. Zoöl., IV. p. 620, pl. 90.
Polynemus tridigitatus, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 449.
Trigla lineata, MONTAGU, Trans. Wernerian Society, II. p. 460.
" " FLEMING, Brit. Animals, p. 215, spec. 153.
" " JENYNS's Brit. Vert., p. 338.
Le Grondin rouge (Trigla cuculus ? G., Trigla pini, BLOCH, p. 355), Cuv. et VAL., IV. p. 26.
Trigla cuculus, Red Gurnard, Cuckoo Gurnard, YARRELL's Brit. Fishes (2d edit.), p. 33, plate.
" " Red Gurnard, DEKAY's Report, p. 43, pl. 70, fig. 225.

GENUS II. PRIONOTUS, Cuv.

Pectorals very large, with numerous rays. A band of even teeth on the palatines.

1. Prionotus lineatus, MITCHILL.

Above the lateral line of a slate-color, with a few irregularly distributed black spots; sides lighter, with a reddish tint; abdomen white. Beneath the lateral line, parallel to it, a broader brownish line runs the greater part of the length of the body.

D. 9 – 13. P. 12. V. 6. A. 11. C. 15. Length, 9 to 18 inches.

Massachusetts, STORER. New York, MITCHILL, CUV., DEKAY.

Trigla lineata, Gurnard, or Sea-Robin, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., p. 430, pl. 4, fig. 4.
Le Prionote strié, Prionotus strigatus, CUV. et VAL., IV. p. 86.
" " Sea-Robin, Gurnard, Grunter, STORER'S Report, p. 12.
" " AYRES, Bost. Journ. Nat. Hist., IV. p. 258.
Prionotus lineatus, Banded Gurnard, DEKAY'S Report, p. 45, pl. 4, fig. 12.

2. Prionotus Carolinus, CUV.

Above of a reddish brown color, with irregular blotches and shadings of a darker brown; abdomen nearly white. The fleshy free rays, beneath the pectorals, of a yellow color, and widened at their extremities.

D. 9 – 13. P. 14. V. 6. A. 12. C. 21. Length, 12 to 18 inches.

Massachusetts, STORER Connecticut, AYRES. New York, MITCHILL, CUV., DEKAY. Carolina, CUV.

Trigla palmipes, Web-fingered Gurnard, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., p. 431, pl. 4, fig. 5.
Le Prionote de la Caroline, Prionotus Carolinus, CUV. et VAL., IV. p. 90.
" " Web-fingered Grunter, STORER'S Report, p. 14.
" " AYRES, Bost. Journ. Nat. Hist., IV. p. 258.
" " Web-fingered Gurnard, DEKAY'S Report, p. 46, pl. 5, fig. 15.

3. Prionotus tribulus, CUV.

Brown above, white beneath. Pectorals reaching to the end of the anal fin. All the spines upon the head, particularly those behind the orbit, and upon the subscapular, are acute and flattened like sword-blades.

D. 10 – 13. P. 13. V. 1 – 5. A. 12. C. 11. Length, 7 to 8 inches.

New York, Carolina, CUV.

Le Prionote chaussetrape, Prionotus tribulus, CUV., CUV. et VAL., IV. p. 93.
" " Spinous Gurnard, DEKAY'S Report, p. 48, pl. 70, fig. 226.

4. Prionotus punctatus, CUV.

Above grayish brown, with clouded russet spots; sides yellowish; abdomen white. A black spot upon the first dorsal, between the fourth and sixth rays; small russet dots are scattered over the remainder of this fin. Brownish spots upon the pectorals. Two small spines upon each side of the snout.

D. 10 – 12. P. 13 – 3. V. 1 – 5. A. 11. C. 11. Length, 1 foot.

Caribbean Sea, CUV.

Rubio volador, PARRA, p. 98, pl. 38.
Trigla punctata, BLOCH, 353? Punctated Gurnard, SHAW'S Gen. Zoöl., IV. p. 626.
Le Prionote ponctué, Prionotus punctatus, CUV. et VAL., IV. p. 93.
" " DEKAY'S Report, p. 48.

GENUS III. DACTYLOPTERUS, Lacep.

The rays under the pectorals are numerous and large ; and instead of being free, as in the preceding genera, they are united by a membrane into a supernumerary fin, larger than the fish itself, and which supports them in the air for some length of time. Their muzzle, which is very short, appears to be cleft like the lips of a hare ; their mouth is situated underneath ; there are, in the jaws only, certain rounded teeth, arranged like pavement ; their head is flat, rectangular, and granulated ; their preoperculum is terminated by a long and strong spine. All their scales are carinated.

1. Dactylopterus volitans, L.

Light brown above, with irregular dark spots ; beneath, of a flesh-color. The larger pectorals blackish, with bluish spots. Two flexible filaments at the side of each other, in front of the first dorsal. A short, stout triangular spine between the dorsal fins.

D. 2, 4, 1–8. P. 6–30. V. 1–4. A. 6. C. $10\frac{5}{5}$. Length, 6 inches.

Newfoundland, Cuv. Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay. Gulf of Mexico, Parra. Caribbean Sea, Cuv.

Trigla volitans, Flying Gurnard, L., Shaw's Gen. Zoöl., iv. p. 622, pl. 91.
Morcielago, Parra, p. 25, pl. 14.
Polynemus sexradiatus, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. pl. 4, fig. 10.
" " " Suppl. Amer. Month. Mag., ii. p. 323.
Le Dactyloptère commun, Dactylopterus volitans, Cuv. et Val., iv. p. 117.
" " Griffith's Cuv., x. p. 133.
" " Rich., Fauna Boreal. Americ., iii. p. 40.
" " Wilson, Encyclop. Brit., Art. Ichthyology, p. 173
" " Sea-Swallow, Dekay's Report, p. 49, pl. 17, fig. 46.

GENUS IV. COTTUS, Lin.

Head large, depressed ; teeth in both jaws and in front of the vomer, small, sharp, none on the palatine bones ; preoperculum or operculum armed with spines, sometimes both ; branchiostegous rays, six ; gill-openings large ; body attenuated, naked, without scales ; two dorsal fins, distinct, or very slightly connected ; ventral fins small.

1. Cottus gobio, L.

Body very slimy ; yellowish, clouded with black ; the first dorsal fin edged with a very narrow line of orange. Snout to first dorsal ray 0.84, and from here to the last dorsal ray 1.5. The anus is midway between the snout and the base of the caudal rays. The lateral line is straight from the middle of the first dorsal fin backwards.

D. 7–17. P. 14. V. 3. A. 12. C. 13, of which 11 are long. Length, 3 inches.

Connecticut, Olmsted, Ayres. New York, Dekay. Eastern Pennsylvania, Haldeman. Mahoning River, Ohio, Kirtland. Bear Lake, Lat. 67°, Richardson.

Cottus gobio, Lin., Sys. Nat., p. 452.
" " River Bull-head, Shaw's Gen. Zoöl., iv. p. 254, pl. 35.
Le Chabot de rivière, Cottus gobio, L., Bloch, pl. 39; Cuv. et Val., iv. p. 145.
" " River Bull-head, Pennant's Brit. Zoöl., viii., p. 291, pl. 43.
" " Jenyns's Brit. Vert., p. 343.
" " Miller's Thumb, Yarrell's Brit. Fishes (2d edit.), i. p. 71.
Cottus cognatus, Bear Lake Bull-head, Rich., Fauna Boreal. Americ., iii. p. 40.
" " " " Dekay's Report, p. 55.
Cottus viscosus, Haldeman, Supplement, &c., p. 3.
Uranidea quiescens, Little Star-gazer, Dekay's Report, p. 61, pl. 5, fig. 14.
Cottus cognatus; Cottus viscosus; Uranidea quiescens; Cottus gobio, Ayres, Bost. Journ. Nat. Hist., v. p. 116, pl. 11.

2. Cottus Groenlandicus, Cuv.

The upper part of the body of this species is of a dark brown, with large clay-colored blotches on the top of the head and gill-covers, with a few smaller ones on the back and sides, and small circular yellow spots on the sides towards the abdomen. The throat is yellowish white, sprinkled with minute fuliginous specks. Upon the abdomen, beneath the pectoral fins, are large, circular, perfectly white spots. The preopercular spine does not extend to the tip of the opercular spine. A quadrangular area on the head, bounded by four tubercles.

D. 10–18. P. 17. V. 3. A. 13. C. 16. Length, 13 inches.

Greenland, Fabricius, Richardson. Maine and Massachusetts, Storer. New York, Dekay.

Cottus scorpius, Fabricius, Fauna Groenlandica, p. 156, No. 113.
Le Chaboisseau du Groenland (Cottus Groenlandicus, Cuv.), Cuv. et Val., iv. p. 185.
Cottus Groenlandicus, Greenland Bull-head, Rich., Fauna Boreal. Americ., iii. pp. 46 and 297, and admirably figured, pl. 95.
Cottus Groenlandicus, Greenland Sculpin, Storer's Report, p. 16.
" " Greenland Bull-head, Dekay's Report, p. 54, pl. 4, fig. 2.

3. Cottus Virginianus, Willoughby.

The body is of a light brown color above, with darker irregular blotches, looking, when carefully examined, somewhat like transverse bands. The abdomen is pure white, slightly tinged, in portions, with fuliginous stains. Twenty spines upon and about the head; ten on each side, all naked at their extremities. The spine at the posterior angle of the preoperculum extends as far back as the extremity of the opercular spine.

D. 9–16. P. 17. V. 3. A. 14. C. 12. Length, 11 to 18 inches.

Newfoundland, Richardson. Massachusetts, Storer. Connecticut, Ayres. New York, Mitchill, Dekay. Virginia, Willoughby.

Scorpius Virginianus, Willoughby's Hist. Pisc., App., p. 25, pl. 10, fig 15?
Cottus octodecimspinosus, Eighteen-Spined Cottus, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 390.
Le grand Chaboisseau à dix-huit épines de l'Amérique du Nord, Cottus octodecimspinosus, Cuv. et Val., iv. p. 181.

Cottus octodecimspinosus, Sculpin, RICH., Fauna Boreal. Americ., III. p. 46.
" " GRIFFITH'S CUV., pl. 43, fig. 4.
Cottus Virginianus, Common Sculpin, WILL., STORER'S Report, p. 18.
" " Common Bull-head, DEKAY'S Report, p. 51, pl. 5, fig. 13.

4. Cottus scorpioides, FAB.

The upper portion of the body is fuliginous ; the abdomen yellow. A white line extends from the ventral fins to the anus. The anterior portion of the ventrals, and the inferior portion of the sides, are spotted with white. The spines on the head smaller than in the Groenlandicus. Pectorals very large.

D. 10 – 15. P. 15. V. 3. A. 12. C. 15. Smaller than preceding.

Greenland, FABRICIUS.

Cottus scorpioides, FAB., Fauna Groenlandica, p. 157, No. 114.
Le petit Chaboisseau du Groenland (Cottus scorpioides, FAB.), CUV. et VAL., IV. p. 187.
Cottus scorpioides, Pokudluk, RICH., Fauna Boreal. Americ., III. p. 47.
Cottus quadricornis, PARRY'S First Voyage, Appendix.

3. Cottus æneus, MITCHILL.

This species is of a yellowish brown color above, shaded throughout with fuliginous blotches, lighter colored on the sides of the abdomen, beneath the lateral line ; cheeks brazen ; fins yellowish, with brownish bars. A broad band of very minute black points, commencing beneath the pectoral fins, extends even beyond the anus, along the edge of the anal fin ; the portion in front of the anus contains one or more rows of well-marked, large, circular yellow spots. One or two irregular rows of very obvious roughened tubercles above, and quite a number of smaller tubercles scattered over the sides, beneath the lateral line.

D. 10 – 15. P. 16. V. 3. A. 13. C. 17. Length, 5 to 12 inches.

Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, DEKAY.

Cottus æneus, Brazen Bull-head, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 380.
Le Chaboisseau bronzé, Cottus æneus, CUV. et VAL., IV., p. 189.
" " Brazen Bull-head, STORER'S Report, p. 20.
" " " " DEKAY'S Report, p. 52, pl. 6, fig. 19.
Cottus variabilis, AYRES, Bost. Journ. Nat. Hist., IV. p. 259.

6. Cottus pistilliger, PALL.

The body above is brown, with indistinct points of a deeper brown; beneath, it is yellowish. The large spine at the angle of the preoperculum does not extend beyond the operculum, and it has but two spinules at its upper edge, one of them in its centre, the other near the point. The inferior edge of the preoperculum has three strong points directed obliquely forward. The lateral line is marked by a row of roughened tubercles ; and beneath it, upon the sides, are small filaments, terminated by enlarged extremities, causing them to look like little mushrooms.

D. 9 – 13. P. 18. V. 1 – 3. A. 16. C. 13. Length, 5 inches.

Unalaschka, Cuv.

Le Chaboisseau à bois de chevreuil (Cottus pistilliger, Pall.), Cuv. et Val., iv. p. 193.
Cottus pistilliger, Antlered Bull-head, Rich., Fauna Boreal. Americ., iii. p. 48.

7. Cottus polaris, Sabine.

Color light, with clusters of minute dusky spots. The head compressed and armed with two strong spines, placed before and between the eyes; the gill-covers are also armed with four strong spines; the pectoral fins are larger in proportion than those of the C. gobio, and the upper jaw rather exceeds the lower; the lateral line is furnished with a series of small tubercles directed backwards.

D. 6 – 13. P. 15. V. 5. A. 14. C. 14. Sabine. Length, less than 2 inches.

D. 8 – 13. P. 15. V. 5. A. 15. C. 12 – 14. Capt. J. C. Ross. Length, (?).

North Georgia (Lat. 75°), Sabine, Ross.

Cottus polaris, Sabine, App. to Parry's First Voyage, p. 213; J. C. Ross, App. to Third Voyage.
" " (Sabine), North Georgia Bull-head, Rich., Fauna Boreal. Americ., iii. p. 43.
" " DeKay's Report, p. 55.

8. Cottus polyacanthocephalus, Pallas.

The body above is of a greenish brown color, sprinkled with numerous small pale dots; these dots are larger upon the sides; the entire abdomen is whitish. Upon the head are numerous small, pointed granulations, irregularly rayed, those back of the orbit being the largest. A similar collection of granulations, even more irregular still, are seen upon the temple.

D. 10, 1 – 14. P. 17. V. 4. A. 12. C. 15 and some small ones. Length, 14 inches.

Cape St. Elias, Northwest Coast of America (Lat. 60°), Cuv.

Le Cotte à tête très-épineuse (Cottus polyacanthocephalus, Pallas), Cuv. et Val., iv. p. 176.
Cottus polyacanthocephalus, Many-horned Bull-head, Rich., Fauna Boreal. Americ., iii. p. 48.

9. Cottus hexacornis, Richardson.

Of the upper aspect, a clouded admixture of broccoli-brown and olive-green tints; of the belly, white. The fins are striated with bluish black. Six club-shaped, or rather nail-shaped, processes stand erect on the top of the head; their summits flattish, minutely cancellated, and scabrous. The smallest pair stand between the nares; the largest over the posterior angles of the orbits; and the third, of intermediate size, on the occiput.

D. 7 – 13. P. 16. V. 3. A. (?). C. 12. Length, 7 inches.

Coppermine River, Richardson.

Cottus hexacornis, Six-horned Bull-head, Rich., Franklin's Journ., p. 726; Fauna Boreal. Americ., iii. p. 44.
" " DeKay's Report, p. 55.

10. Cottus asper, Richardson.

Colors generally grayish white; top of the head, back, and sides, studded with small clove-brown spots, in some places confluent, and forming patches. Pectorals, dorsals, and caudal, marked with transverse rows of clove-brown spots. Under parts whitish, with minute specks. The skin of the head smooth to the touch, but dotted with minute soft warts. The greater portion of the upper part of the body thickly studded with very small, subulate, acute spines, directed backwards.

B. 6-6. D. 9-21. P. 16. V. 1-4. A. 18. C. $9\frac{6}{6}$. Length, 9 inches, 6 lines.

Columbia River, Richardson.

Cottus asper, Prickly Bull-head, Rich., Fauna Boreal. Americ., III. p. 295.

11. Cottus porosus, Val.

Above grayish, marbled with plumbeous; head lighter. The lateral line is formed of a series of small elevated tubes, pierced at their extremity, which serve as pores. Above and beneath this, and near the orifice of each pore, are seen the openings of smaller pores. A great number of others upon the top of the head, the temples, and along the suborbitars. Between the lateral line and the dorsal fin is a series of small bony plates. This species resembles the C. scorpius of Europe in the armature of the top of the head and gill-covers, and C. Groenlandicus or scorpioides in the great number of its dorsal rays.

D. 11, 1-16. P. 18. V. 1-3. A. 13. C. 17. Length, 6 inches.

Baffin's Bay, Cuv.

Le Chaboisseau poreux, Cottus porosus, Cuv. et Val., VIII. p. 498.
" " Porous Bull-head, Rich., Fauna Boreal Americ., III. p. 47.
" " Dekay's Report, p. 55.

12. Cottus Mitchilli, Cuv.

Yellowish, with confluent bars and blotches; all the fins with interrupted black bars. Orbits unarmed. Preopercle with four spines.

D. 10-4. P. 16. V. 3. A. 11. C. $9\frac{4}{4}$. Length, 3 inches.

New York, Mitchill, Cuv., Dekay.

Cottus scorpio? Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 381.
Cottus Mitchilli, Cuv. et Val., IV. p. 188.
" " Smooth-browed Bull-head, Dekay's Report, p. 53, pl. 17, fig. 47.

GENUS V. ASPIDOPHORUS, Lacep.

Body octagonal, covered with scaly plates; head thicker than the body, with points and depressions above, flattened below; teeth in both jaws only, none on the vomer; snout with recurved spines; branchiostegous rays, six; body tapering to the tail; one or two dorsal fins distinct.

1. Aspidophorus Europæus, Cuv.

Body above brown, with four broad dark-brown bands; tail brown; ventral and anal fins, and all the under parts of the head and body, very light brown, almost white. Two dorsal fins slightly connected by a membrane of a light brown color, mottled with dark brown. Anterior portion of the body hexagonal. Under the muzzle are small barbules, covering the whole surface of the branchiostegous membrane, the corners of the mouth, and border of the interoperculum; there are two at the extremity of the snout, and a minute one before each orbit.

B. 6. D. 5–7. P. 15. V. 1–2. A. 7. C. 11. Length, 3 to 6 inches.

Greenland, Richardson.

L'Aspidophore d'Europe (Aspidophorus Europæus, Cuv., Cottus cataphractus, L., Bloch, pl. 39), Cuv et Val., iv. p. 201.
Cataphractus Schoneveldii, Pogge, Flem., Brit. An., p. 216, pl. 155.
Aspidophorus cataphractus, Pogge, Jenyns's Brit. Vert., p. 344.
Aspidophorus Europæus, Armed Bull-head, Yarrell's British Fishes (2d edit.), i. p. 85.
Cottus (Aspidophorus) Europæus, Pogge, Rich., Fauna Boreal. Americ., iii. p. 48.

2. Aspidophorus acipenserinus, Tilesius.

Of a light, yellowish gray color, browner above, with transverse undulating brownish lines. It is distinguished from the preceding by wanting the barbules on the branchiostegous membrane, and the numerous polygonal plates, marked with stelliform streaks, which cover the breast before the ventrals; while, in the European species, that part is covered by four plates only, arranged in a square form.

B. 6. D. 9–8. P. 17. V. 1–2. A. 8. C. 11. Length, 9 or 10 inches.

Island of Unalaschka, Cuv.

L'Aspidophore esturgeon (Agonus acipenserinus, Til., Phalangistes acipenserinus, Pal.), Cuv. et Val., iv. p. 207.
Aspidophorus acipenserinus, Sterronic Aspidophore, Rich., Fauna Boreal. Americ., iii. p. 49.

3. Aspidophorus monopterygius, Bloch.

Above of a light-brown color, with six transverse broad dark bands, those near the head the broader. A single dorsal fin.

D. 5. P. 10. V. 4. A. 4. C. 16. Length, 4 to 6 inches.

Greenland, Richardson. Massachusetts, Storer.

Cottus monopterygius, Bloch, 178.
" " Single-finned Bull-head, Shaw's Gen. Zoöl., iv. p. 265.
L'Aspidophore à une seule dorsale (Agonus monopterygius, Bl., Schn.; Aspidophoroide Tranquebar, Lacep.), Cuv. et Val., iv. p. 224; vi. p. 554.
Cottus (Aspidophorus) monopterygius, Cuv., Aspidophore with one dorsal, Rich., Fauna Boreal. Americ., iii. p. 50.
Aspidophoroides monopterygius, Bull-head, Storer's Report, p. 22, pl. 1, fig. 1.
Aspidophorus monopterygius, American Aspidophore, Dekay's Report, p. 62, pl. 2, fig. 6.

GENUS VI. CRYPTACANTHODES, Storer.

Body anguilliform, very much compressed, gradually tapering to the tail, destitute of scales. Head broad, with no projecting spines but the angles of the gill-covers. The scapular and humeral spines, and the inferior edge of the preoperculum, prominent to the touch. Numerous depressions in the frontal, suborbitar, inferior maxillary, and preopercular bones. Branchiostegous rays, seven. Mouth oblique. A single dorsal fin, composed of strong spinous rays, runs nearly the entire length of the fish, and is united, as well as the anal, to the caudal fin. No ventral fins. Teeth in the jaws, vomer, and palatines.

1. Cryptacanthodes maculatus, Storer.

Reddish brown, with darker brown blotches, forming two longitudinal series upon the sides.

D. 77. P. 13. V. (?). A. 50. C. 19. Length, 21 inches.

Massachusetts, Storer. Connecticut, Linsley.

Cryptacanthodes maculatus, Spotted Wry-mouth, Storer's Report, p. 28.
" " " " Dekay's Report, p. 63, pl. 18, fig. 50.

GENUS VII. HEMITRIPTERUS, Cuv.

The head depressed ; two dorsals, as in the Cottus ; no regular scales on the skin, but teeth in the palate. The head is bristly and spinous, and has several cutaneous appendages. The first dorsal is deeply emarginate, a circumstance which has led some authors to believe they had three.

1. Hemitripterus Americanus, Gmelin.

This species varies exceedingly in color ; in some specimens being of a blood-red color, or a pinkish purple, or of a yellowish brown, darker on the back, variegated on the head and sides and fins with irregularly defined markings ; body beneath, yellowish. Surface of the body granulated, and studded with innumerable tubercles.

D. 16 – 13. P. 18. V. 3. A. 15. C. 19. Length, 2 feet.

Nova Scotia and Gulf of St. Lawrence, Cuv., Richardson. Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill.

Cottus Acadianus, Acadian Bull-head, Pen., Arc. Zoöl., II. p. 118.
Scorpæna flava, Yellow Scorpæna, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 382, pl. 2, fig. 8.
Scorpæna purpurea and S. rufa, Mitchill, Amer. Month. Mag., II. p. 245.
L'Hémitriptère de l'Amérique, Hemitripterus Americanus, Cuv. et Val., IV. p. 268, pl. 84.
Hemitripterus Americanus, Rich., Fauna Boreal. Americ., III. p. 50.
" " Griffith's Cuv., p. 141, pl. 53, fig. 3.
" " Sea-Raven, Deep-water Sculpin, Storer's Report, p. 23.
" " American Sea-Raven, Dekay's Report, p. 56, pl. 6, fig. 16.

GENUS VIII. HEMILEPIDOTUS, Cuv.

In the form of the head, and in the distribution of its spines, there is a resemblance to the Cotti; but in the solitary dorsal fin, and the teeth on the palatine bones, as well as on the vomer, it partakes of the characters of the Scorpæna; it is distinguished at once from both genera by two broad, longitudinal, scaly stripes on each side, alternating with stripes of smooth skin; the scales become visible as the skin dries.

1. Hemilepidotus Tilesii, Cuv.

In its recent state, it exhibits red, violet, and purple tints; specimens are sometimes seen with yellowish or olive. When dried, it is of a reddish brown, irregularly marbled, spotted, or dotted with blackish.

B. 6. D. 11 – 18. P. 17. V. 1 – 3. A. 1 – 14. C. 12. Length, 7½ to 9 inches.

Aleutian Islands, Cuv.

L'Hémilépidote de Tilesius (Hemilepidotus Tilesii, Cuv., Cottus hemilepidotus, Til., Cottus trachurus, Pall.), Cuv. et Val., iv. p. 276, pl. 85.
Hemilepidotus Tilesii, Griffith's Cuv., x. pl. 53, fig. 4.
Hemilepidotus trachurus, Hiekejak, Rich., Fauna Boreal. Amer., iii. p. 51.

GENUS IX. SCORPÆNA, L.

The Scorpænæ have a strong resemblance to the Cotti, in possessing a large, spiny head, large pectorals, and, in part, the thick simple rays of these fins, but they differ in the compressed form of the head, the undivided dorsal, and in the presence of palatine teeth. Seven branchiostegous rays. Cutaneous filaments on different parts of the body.

1. Scorpæna porcus, L.

Body brownish, marbled by large blotches; beneath, the body and inferior fins of a rosy tint. Six small fleshy appendages at the extremity of the snout.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 8 inches.

New York, Cuv.

Scorpæna porcus, L., Shaw's Gen. Zoöl., iv. p. 267.
La petite Scorpène brune, Scorpæna porcus, L., Cuv. et Val., iv. p. 300.
" " Small Sea-Scorpion, Dekay's Report, p. 58.

2. Scorpæna bufo, Cuv.

Brown, marbled with rosaceous and violet. The base of the pectorals, beneath, black, dotted with round milk-white spots. Sometimes the dorsal fin has a large black spot between the sixth and seventh rays.

B. 7. D. 12–9. P. 19 or 20. V. 1–5. A. 3–5. C. 13 or 14. Length, 17 to 18 inches.

Newfoundland, RICHARDSON. Gulf of Mexico, PARRA. Caribbean Sea, CUV.

Rascacio, PARRA, p. 31, pl. 18, fig. 1.
La Scorpène crapaud de Mer, Scorpæna bufo, CUV. et VAL., IV. p. 306.
Scorpæna bufo, Sea-Toad, RICH., Fauna Boreal. Americ., III. p. 300.
" " Spotted Sea-Scorpion, DEKAY'S Report, p. 59, pl. 70, fig. 227.

3. Scorpæna grandicornis, CUV.

Brownish, abdomen whitish. A brown spot at the base of the pectorals beneath, sprinkled with small white spots. Very large acute spines upon the head. Large filaments resembling feathers are distributed upon different parts of the head, over the eyes, cheeks, and at the snout; also upon the sides of the body.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 4 to 6 inches.

Gulf of Mexico, Caribbean Sea, CUV.

La Scorpène Plumier, LACEPEDE, III. p. 282.
Scorpæna Plumieri, Plumier's Scorpæna, SHAW'S Gen. Zool., IV. p. 270.
La Scorpène à longs tentacules, Scorpæna grandicornis, CUV. et VAL., IV. p. 309.

4. Scorpæna inermis, CUV.

Russet, marbled with deeper brown; beneath, paler; fins with irregularly distributed brown spots. Inconspicuous spines, and crests upon the head. Eyes very large. Very small cirrhi upon the body.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Caribbean Sea, CUV.

La Scorpène sans armes, Scorpæna inermis, CUV. et VAL., IV. p. 311.

GENUS X. SEBASTES, CUV.

Body oblong, compressed, covered with scales; all the upper parts of the head also covered with scales; eyes large; preoperculum and operculum ending in three or more spines; branchiostegous rays, seven; teeth small, numerous, equal in size, placed on both jaws, the vomer, and palatine bones; a single dorsal fin, part spinous, part flexible; inferior rays of the pectoral fin simple.

1. Sebastes Norvegicus, CUV.

All the upper part of the body, and the fins, of a reddish color; darker upon the head and back, lighter upon the sides; nearly white beneath. A brown blotch upon the posterior portion of the operculum.

D. 15-15. P. 18. V. 1-5. A. 3-7. C. 19. Length, 2 feet.

Greenland, FABRICIUS. Gulf of St. Lawrence, Newfoundland, RICHARDSON. Massachusetts, STORER. New York, DEKAY.

Perca Norvegica, FAB., Fauna Groen., p. 167.
Perca marina, Sea-Perch, PENN., Brit. Zoöl., p. 226.
Serranus Norvegicus, FLEM., Brit An., p. 212, sp. 140.
Scorpæna Norvegica, Northern Sebastes, JENYNS's Brit. Vert., p. 347.
Sebastes Norvegicus, GRIFFITH's CUV., X. p. 144.
La Sébaste septentrionale, Sebastes Norvegicus, CUV. et VAL., IV. p. 327, pl. 87.
Scorpæna (Sebastes) Norvegica, Northern Sebastes, RICH., Fauna Boreal. Americ., III. p. 52.
Sebastes Norvegicus, Bergylt, Norway Haddock, YARRELL's Brit. Fishes (2d edit.), I. p. 87.
" " Norway Haddock, Rose-fish, Hemdurgan Snapper, STORER's Report, p. 26.
" " Northern Sebastes, DEKAY's Report, p. 60, pl. 4, fig. 11.

2. Sebastes variabilis, CUV.

Brown; beneath, white; in the female, the abdomen is reddish. This species has the head less armed than any other; there are not even crests on the cranium, or over the orbits, and no teeth on the suborbitars; the preoperculum has five short, obtuse teeth, and the operculum two points.

D. 13-15. P. 18, of which 9 are simple. V. 1-5. A. 13-9. C. 17. Length, 2 feet.

Aleutian Islands, CUV.

La Sébaste variable, Sebastes variabilis, CUV. et VAL., IV. p. 347.
Scorpæna (Sebastes) variabilis, Tochoo, RICH., Fauna Boreal. Americ., III. p. 53.

GENUS XI. BLEPSIAS, CUV.

The spiny preoperculum, compressed head, mailed cheek, palatine teeth, short, simple, and half-detached lower rays of the pectorals, and fleshy appendages of the snout, connect this genus with Scorpæna; from which, however, it is distinguished by its five branchiostegous rays, and its high dorsal, divided into three unequal lobes, as in Hemitripterus; while the compressed head prevents it from entering the latter genus.

1. Blepsias trilobus, CUV.

In its appearance, this species resembles some of the Blennies. The skin is destitute of scales, but is rough, with fine grains, which appear to be disposed in three longitudinal stripes, separated by narrow intervals. It is of a reddish brown color, with three bluish bands upon the cheeks, and a similarly colored spot at the extremity of the operculum. The pectoral and caudal fins are crossed by three brown bands. Oblique or irregularly distributed bands on the dorsal and anal fins.

D. 7-24. P. 11. V. 1-3. A. 20. C. 11. Length, 5 to 5½ inches.

Northwest Coast of America, Cuv.

Le Blepsias trilobé, Blepsias trilobus, Cuv., Cuv. et Val., iv. p. 375, pl. 90.
" " Griffith's Cuv., p. 145, pl. 22, fig. 2.
" " Three-lobed Blepsias, Rich., Fauna Boreal. Americ., iii. p. 53.

GENUS XII. GASTEROSTEUS, Cuv.

Body without scales, more or less plated on the sides ; one dorsal fin with free spines. Ventral fin with one strong spine, and no other rays ; bones of the pelvis forming a shield, pointed behind ; branchiostegous rays, three.

1. Gasterosteus trachurus, Cuv.

Back and sides olivaceous, sometimes passing into yellowish brown or dusky blue ; the throat and breast, in some individuals, bright, fiery red, belly and flanks silvery. Three dorsal spines. The sides are defended throughout their whole length by a series of elongated bony plates, arranged vertically ; these plates are continued along the sides of the tail, there being in all twenty-five or twenty-six, exclusive of five small ones that cover the keel of the tail, and render it more prominent.

D. 111-9. P. 10. V. 1. A. 1-8. C. 12. Length, 2 to 3 inches.

Greenland, Fabricius.

Gasterosteus aculeatus, L.
" " Bl., xi. p. 73, pl. 53, fig. 3.
" " Fab., Fauna Groenlandica, p. 169.
" " Common Stickleback, Shaw's Gen. Zoöl., iv. p. 604, pl. 87, fig. 3.
" " Three-spined Stickleback, Jenyns's Brit. Vert., p. 348.
L'Epinoche à queue armée, Gasterosteus trachurus, Cuv. et Val., iv. p. 481, pl. 98, fig. 1.
Gasterosteus, Burnstickle, Rich., Fauna Boreal. Americ., iii. p. 54.
Gasterosteus trachurus, Rough-tailed Stickleback, Yarrell's Brit. Fishes (2d edit.), i. p. 90.

2. Gasterosteus biaculeatus, Mitchill.

Dark olive-green above, gradually intermixing with light greenish and yellowish on the sides. Fins tinged with yellowish. Two distant spines on the back, and a third near the dorsal fin. A sharp, flat tooth on the external base of each ventral spine ; the European species having simply an enlargement there.

D. 2, 1-12. P. 9. V. 1-1. A. 1-8. C. 12. Length, 2 inches.

Newfoundland, Cuv. New York, Mitchill.

Gasterosteus biaculeatus, Two-spined Stickleback, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 430, pl. 1, fig. 10.
L'Epinoche à deux épines (Gasterosteus biaculeatus, Penn., Shaw, et Mitchill), Cuv. et Val., iv. p. 503.
Gasterosteus biaculeatus, Two-spined Burnstickle, Rich., Fauna Boreal. Americ., iii. p. 56.
" " Two-spined Stickleback, Dekay's Report, p. 65, pl. 3, fig. 8.

3. Gasterosteus Noveboracensis, Cuv.

Dark brown above the lateral line; beneath it, silvery. This species differs from the G. trachurus in having the dorsal plates narrower; the lateral carinæ of the tail more prominent, and the lateral line nearer the back.

Mr. Thompson, Vice-President of the Belfast Natural History Society, Ireland, does not consider this species distinct from the trachurus. See his paper "On the Species of Stickleback found in Ireland," Mag. of Zoölogy and Botany.

D. 3-11. P. 10. V. 1-1. A. 1-8. C. 12. Length, 2½ inches.

Massachusetts, Storer. New York, Cuv., Dekay.

L'Epinoche de New-York, Gasterosteus Noveboracensis, Cuv., Cuv. et Val., iv. p. 502, pl. 98, fig. 3.
Gasterosteus Noveboracensis, Rich., Fauna Boreal. Americ., iii. p. 56.
" " New York Stickleback, Storer's Report, p. 30.
" " " " Dekay's Report, p. 66, pl. 6, fig. 17.

4. Gasterosteus quadracus, Mitchill.

Greenish brown above the lateral line; beneath this line, which is scarcely perceptible, darker and irregularly broken by the extension of the whiteness of the abdomen. In young specimens, the color is distributed in four or five bars, which become indistinct in the mature fish. To the under portion of the ventral spine is attached a reddish membrane, which makes this part to appear as if covered with blood, when the fish is suddenly darting through the water with this spine projecting. Three or four spines in front of the dorsal fin. The three foremost fixed, the posterior movable.

D. 3, 1-4. P. 11. V. 1. A. 10. C. 13. Length, 2 inches.

Massachusetts, Storer. New York, Mitchill, Cuv., Dekay.

Gasterosteus quadracus, Four-spined Stickleback, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 430, pl. 1, fig. 11.
L'Epinoche à quatre aiguilles (Gasterosteus quadracus, Mitch.), Cuv. et Val., iv. p. 504.
L'Epinoche à bassin fendu (Gasterosteus apeltes, Cuv.), Cuv. et Val., iv. p. 505.
Gasterosteus apeltes, Bloody Stickleback, Storer's Report, p. 31.
" " Four-spined Stickleback, Dekay's Report, p. 67, pl. 6, fig. 18.

5. Gasterosteus occidentalis, Cuv.

Very similar to the G. pungitius; its form is more elongated. Olive-green, tinged with yellow. More than seven spines in front of the dorsal fin. Tail armed.

D. 8. P. 11. V. 1-11. A. 1-9. C. 12. Length, 1 to 2 inches.

Newfoundland, Cuv. Massachusetts, Storer. New York, Dekay.

L'Epinochette de Terre-neuve (Gasterosteus occidentalis, Cuv.), Cuv. et Val., iv. p. 509.
Gasterosteus occidentalis, Newfoundland Stickleback, Rich., Fauna Boreal. Americ., iii. p. 58.
" " Many-spined Stickleback, Dekay's Report, p. 68, pl. 42, fig. 135.
Gasterosteus pungitius, Ten-spined Stickleback, Storer's Report, p. 32.

6. Gasterosteus niger, Cuv.

Entirely black. Ventral spines very long. Thirty-three lateral plates. Tail armed. Its form is more elongated, and its spines more slender, than those of the G. trachurus.

D. (?). P. (?). V. (?). A. (?) C. (?) Length, 2 inches.

Newfoundland, Cuv.

L'Epinoche noire (Gasterosteus niger, Cuv.), Cuv. et Val., iv. p. 503.
Gasterosteus niger, Black Burnstickle, Rich., Fauna Boreal. Americ., iii. p. 56.
" " Dekay's Report, p. 68.

7. Gasterosteus concinnus, Richardson.

Olive-green, with a silvery belly, and the whole body and soft parts of the head sprinkled with black dots. Body scaleless. The soft dorsal has nine rays. Contiguous to the anal fin is a separate spine furnished with its proper membrane, like the dorsal spines, the longest of which it equals in size. All the spines, both dorsal and ventral, are movable, and none of them are serrated. Perhaps the smallest of fresh-water fishes.

B. 3. D. 1, 1, 1, 1, 1, 1, 1, 1, 1 - 9. P. 10. V. 1 - 1. A. 1 - 9. C. $12\frac{2}{2}$. Length, 1 inch, 3 lines.

From the Saskatchewan, Lat. 53°, to the Great Bear Lake, in the 65th parallel, Rich.

Gasterosteus concinnus, Tiny Burnstickle, Rich., Fauna Boreal. Americ. iii. p. 57.
Uswae-atheek-asheest, Cree Indians.
Gasterosteus concinnus, Dekay's Report, p. 68.

8. Gasterosteus Mainensis, Storer.

Sides yellowish; beneath, silvery. Several transverse black bands, varying in their width, upon the sides. Seven spines in front of the dorsal fin, that next the fin the largest. A broad, oblong, serrated plate on the side.

D. 7 - 10. P. 10. V. 1. A. 1 - 8. C. 8. Length, 2 inches.

Fresh water, Kennebec County, Maine, Storer.

Gasterosteus Mainensis, Maine Stickleback, Storer, Bost. Journ. Nat. Hist., i. p. 465.
" " Dekay's Report, p. 68.

9. Gasterosteus inconstans, Kirtland.

Olive or black upon the back; faintly maculated with olive upon its sides; a black or fuscous zone often extends along the median line. Throat and abdomen yellowish or white. Five or six movable spines in front of the dorsal fin. Body smooth.

D. 5, 6, 9 - 12. P. (?). V. 1. A. 1 - 9, 12. C. (?). Length, $1\frac{1}{2}$ inches.

Ohio, Kirtland.

Gasterosteus inconstans, Kirtland, Bost. Journ. Nat. Hist., iii. p. 273, pl. 2, fig. 1.

10. Gasterosteus millepunctatus, Ayres.

Greenish olive, thickly clouded over with brown, which latter color is produced by a vast number of small blackish spots, not dispersed uniformly, but gathered in clouds and waves, and sometimes in tolerably well defined vertical bands. Abdomen silvery. Four dorsal spines, three of which are free.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, $1\frac{1}{8}$ inches.

Connecticut, AYRES.

Gasterosteus millepunctatus, AYRES, Bost. Journ. Nat. Hist, IV. p. 294, pl. 12, fig. 13.

GENUS XIII. TEMNISTIA, RICHARDSON.

It has much resemblance, in external form, to Hemilepidotus and Scorpæna. It is separated from the former by its body being wholly scaly, and by the presence of barbels on the head; and from the latter, by having only five gill-rays and a three-lobed dorsal. The want of scales on the head distinguishes it from Sebastes, and its habit, which is very unlike that of a Blenny, its long pectorals and scaly body, detach it from Blepsias.

1. Temnistia ventricosa, RICH.

Brown, with darker spots, and four transverse broad, waved, red bands. Belly white, studded laterally with brown spots. Abdomen greatly inflated, pendulous and hemispherical. Dorsal fin notched anterior to the twelfth ray by the gradual decrease of the six preceding rays. Another but less decided notch at the third ray, the membrane of which reaches only to the middle of the following ray.

B. 5. D. 31. P. 16. V. 5. A. 16. C. $11\frac{1}{1}$. Length, (?).

Northwest Coast of America, RICHARDSON.

Temnistia ventricosa, Northwest Notchfin, RICH., Fauna Boreal. Americ., III. p. 59.

FAMILY III. SCIENIDÆ.

Is very similar to that of the Percoides, and presents nearly all the same combinations of exterior character, especially the denticulations of the preoperculum, and the spines of the operculum; but it has no teeth, either on the vomer or palatines; in general, the bones of the cranium and face are cavernous, and form a snout more or less rounded. It often occurs in this family that the vertical fins are rather scaly. Some of the genera of this family have two dorsals, others but one.

GENUS I. OTOLITHUS, Cuv.

The bones of the anal fin are weak, and there are no barbels; some of the teeth terminate in elongated hooks, or are of the canine form. Their natatory bladder has a horn on each side, projecting forwards.

1. Otolithus regalis, Schn.

Head and back brown, with frequently a tinge of greenish. Ventrals and anal orange. Ventral fins with five branched rays. There are two strong canine teeth in the upper jaw, one of which is often broken; the rest of that mandible is armed with a single row of teeth, which are very small, but distinct and pointed. The under jaw is also furnished with a row of small teeth, which is doubled anteriorly. The two dorsal fins separated, and the second, as well as the caudal and anal fins, is in a great part covered with scales.

D. 9, 1-29. P. 16. V. 1-5. A. 1-13. C. 17. Length, 1 to 2 feet.

Bay of Chaleur, Lieut. Col. Hamilton Smith. Massachusetts, Storer. New York, Mitchill, Dekay. Caribbean Sea, Cuv.

Labrus squeteague, Weak-fish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 396, pl. 2, fig. 6.
L'Otolithe royal (Otolithus regalis, Cuv., Johnius regalis, Schn.), Cuv. et Val., v. p. 67.
Sciæna (Otolithus) regalis, Squeteague, Rich, Fauna Boreal. Americ., iii. p. 63.
Otolithus regalis, Weak-fish, Storer's Report, p. 33.
" " " Dekay's Report, p. 71, pl. 8, fig. 21.

2. Otolithus Drummondii, Richardson.

Slender. In a preserved specimen, received by Richardson, the back appeared to have been dark, and the sides and belly silvery. Many small, rounded, blackish brown spots on the back above the lateral line, and on the second dorsal and caudal. Two distinct rows of small pointed teeth round the upper jaw, the outer row being more widely set. Caudal fin rounded. Sixty-six scales on the lateral line, exclusive of the minute ones which extend pretty far over the caudal.

D. 9, 1-25. P. 16. V. 1-5. A. 1-8. C. 17$\frac{4}{4}$. Length, 11½ inches.

New Orleans, Richardson.

Otolithus Drummondii, Rich., Fauna Boreal. Americ., iii. p. 70.
" " Dekay's Report, p. 72.

3. Otolithus Carolinensis, Cuv.

Blue on the back, with silvery reflections; beneath, white. The dorsals are gray, spotted with black. Caudal spotted. Anal blackish blue. Scales small, more than eighty in a longitudinal line.

D. 10, 1-27. P. (?). V. (?). A. 1-11. C. (?). Length, 14 inches.

South Carolina, Cuv.

L'Otolithe de la Caroline, Otolithus Carolinensis, Cuv. et Val, ix. p. 475
" " Dekay's Report, p. 72

GENUS II. CORVINA, Cuv.

Have neither canine teeth nor barbels; all their teeth are even. They also differ from the Otolithi in the thickness and strength of their second anal spine. Teeth generally even, velvet-like on the jaws; but with a series of teeth larger, pointed, and equal on the upper.

1. Corvina oscula, Lesueur.

The color on the head, snout, and caudal fin is of a bluish gray, tending to black upon the snout and above the eyes, more gray towards the back and above the pectorals; all the other fins are of a lighter gray; some red tints upon the cheeks; a yellowish reflection upon the scales of the back of the tail and of the opercula; abdomen beneath the throat white. Anterior profile sloping, somewhat concave. Snout prominent and rounded.

D. 9 – 30. P. 19. V. 1 – 5. A. 2 – 7. C. 18, 5 – 5. Length, 16 inches.

Lake Erie, Lesueur. Lake Ontario, Dekay. Ohio River, Kirtland.

Amplodon grunniens, Raf., Ichth. Ohien., p. 21.
Sciæna oscula, Lesueur, Journ. Acad. Nat. Sc., ii. p. 252, pl. 13.
Le Corb de Lesueur, Corvina oscula, Cuv. et Val., v. p. 98.
Sciæna (Corvina) oscula, Lesueur's Corvina, Rich., Fauna Boreal. Americ., iii. p. 68.
Sciæna oscula, Kirtland's Report on the Zoöl. of Ohio, pp. 168, 192.
Sciæna grisea, Lesueur, Journ. Acad. Nat. Sc., ii. p. 251.
" " Dekay's Report, p. 76.
Sciæna oscula, White Perch of the Ohio River, Kirtland, Bost. Journ. Nat. Hist., iii. p. 350, pl. 11, fig. 3.
Corvina oscula, Lake Sheepshead, Dekay's Report, p. 73, pl. 21, fig. 63.

2. Corvina ocellata, Cuv.

Bluish above, lighter beneath. Upon the upper part of the tail, on each side, is a black spot, about three quarters of an inch in diameter, resembling the brand of a hot iron upon wood; whence it has been called the *Branded Drum.* Sometimes two spots on one side, which are confluent on the other.

D. 10 or 11, 1 – 25 or 26. P. 17. V. 1 – 5. A. 2 – 7 or 8. C. 17. Length, 3 feet or more.

New York, Mitchill. South Carolina, Linnæus. Lake Pontchartrain, Louisiana, Lesueur.

Called, at Charleston, S. C., "Bass," "Sea Bass," "Red Bass"; at New Orleans, "Red-fish."

Perca ocellata, Ocellated Perch, Lin., Sys. Nat.
" " Shaw's Gen. Zoöl., iv. p. 550.
Sciæna imberbis, Beardless Drum, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 411.
Le Johnius ocellé ou brulé, Corvina ocellata, Cuv. et Val., v. p. 134, pl. 108.
Corvina ocellata, Branded Corvina, Dekay's Report, p. 75, pl. 21, fig. 61.

3. Corvina argyroleuca, Cuv.

The whole complexion whitish. The white of the back relieved by pale brown scales, disposed in rows ascending towards the back, and thence inclining towards the tail. Below the lateral line, the sides and belly are alternated with shades of a silver white, and a milk white disposed into spaces and rows. Ventral and anal fins yellow. Pectorals, caudal, and second dorsal, yellowish. The first four spinous rays of the dorsal fins successively longer.

D. 11, 1-22. P. 17. V. 1-5. A. 2-9. C. 17. Length, 8 inches.

New York, MITCHILL, DEKAY. Caribbean Sea, CUV.

Bodianus argyro leucos, Silvery Perch, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 417, pl. 6, fig. 9.
Le Corb blanc-d'argent, Corvina argyroleuca, CUV., CUV. et VAL., V. p. 105.
" " Silvery Corvina, DEKAY'S Report, p. 74, pl. 18, fig. 51.

4. Corvina Richardsonii, Cuv.

Top of the head and the back greenish gray, with darker bands descending a short way from the latter; sides ash-gray, with silvery tips to the scales; belly cream-yellow. Dorsal with a long membrane behind. Anal with a stout spine.

D. 9, 1-18. P. 15 V. 1-5. A. 1-7. C $17\frac{4}{4}$. Length, 1 to 2 feet.

Lake Huron, RICHARDSON.

Called "Sheepshead," on the borders of Lake Huron.

Sciæna (Corvina) Richardsonii (CUV.), Malasheganè, RICH., Fauna Boreal. Americ., III. p. 64, pl. 77.
Corvina Richardsonii, Malashegany, DEKAY'S Report, p 76.
Le Corb de Richardson, Corvina Richardsonii, CUV. et VAL., V. p. 100.

5. Corvina ronchus, Cuv.

Very similar to the C. argyroleuca. The preopercular teeth are very stout. Anal fin forked. Anal spine stout.

D. 10, 2-23 or 24. P. 18. V. 1-5. A. 3-8. C. 17. Length, 11 inches.

Caribbean Sea, CUV.

Called "Gronde," at St. Domingo.

Le Corb grognant, Corvina ronchus, CUV. et VAL., V. p. 107.

6. Corvina dentex, Cuv.

Silvery, tinged with gray, with very slightly marked longitudinal lines. Fins gray, dotted with brown. Pectorals blackish at their base. Snout slightly prominent. Upon each jaw an outer row of slender, pointed, separated teeth, six or seven on each side.

D. 12, 2-22. P. (?). V. (?) A. 2-9. C. (?). Length, (?).

Caribbean Sea, CUV.

Called "Grondé," at Port au Prince.

Le Grondé de Saint Domingue, Corvina dentex, CUV. et VAL., V. p. 139, pl. 109.
" " WILSON, Encyclop. Brit., Art. Ichth., pl. 299, fig. 12.

7. Corvina oxyptera, Dekay.

Operculum obsoletely serrate, with two spines; preoperculum denticulated. Pectoral fins long and pointed.

D. 10–19. P. 20. V. 1–5. A. 3–7. C. $19\frac{7}{7}$. Length, 8 inches.

New York, DEKAY.

Corvina oxyptera, Sharp-finned Corvina, DEKAY's Report, p. 77, pl. 30, fig. 96.

GENUS III. LEIOSTOMUS, CUV.

Anal spine feeble. Very minute denticulations on the preopercle. Teeth in the jaws even, and exceedingly small. Pharyngeals paved on their posterior border. Snout convex, arched. Two dorsals.

1. Leiostomus obliquus, MITCHILL.

Back convex. Body compressed. Fourteen to eighteen narrow, transverse, oblique bands over the back. A dark rounded spot behind the upper angle of the opercle. Fins yellowish.

D. 10, 1–30. P. 19. V. 1–5. A. 2–13. C. 17. Length, 8 inches.

New York, MITCHILL, CUV., DEKAY. Pennsylvania, CUV.

Labrus obliquus, Little Porgee, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 403.
Sciæna multifasciata, LESUEUR, Journ. Acad. Nat. Sc., II. p. 255.
Le Léiostome à épaule noire, Leiostomus humeralis, CUV. et VAL., V. p. 141, pl. 110.
Leiostomus obliquus, Lafayette, DEKAY's Report, p. 69, pl. 60, fig. 195.

2. Leiostomus xanthurus, LACEP.

Very similar to the preceding species, but the neck is a little more convex. Of a golden brown color, becoming silvery towards the abdomen, without bands or spots.

D. 11, 1–32 or 34. P. 21. V. 1–5. A. 2–13. C. 17. Length, (?).

South Carolina, Caribbean Sea, CUV.

It is called "Yellowtail," in South Carolina.

Le Léiostome à queue jaune (Leiostomus xanthurus, LACEP.), CUV. et VAL., V. p. 142.
Leiostomus xanthurus, DEKAY's Report, p. 70.

GENUS IV. LARIMUS, CUV.

Two dorsal fins. Teeth velvety. Forehead not arched. Snout very blunt. Preoperculum slightly denticulated.

1. Larimus breviceps, CUV.

Silvery, above grayish brown, with brownish oblique lines, which descend forward; towards the tail, these lines are longitudinal. The membrane of the first dorsal is blackish, with a triangular white spot at its base between each of the rays. Snout flat, and very short.

D. 10, 1–28. P. (?). V. (?). A. 2–7. C. 17. Length, 1 foot.

Caribbean Sea, CUV.

Le Larime à court museau, Larimus breviceps, CUV. et VAL., V. p. 146.

GENUS V. CONODON, Cuv.

Distinguished from all the other Scienoides by a row of conical teeth in both jaws.

1. Conodon Antillanus, Cuv.

Silvery, with seven vertical brown bands. Fins brown. A row of eighteen or twenty conical teeth in each jaw ; the six anterior stoutest and longest. The six in the lower, thicker than those in the upper jaw. Preopercular denticulations stout. Two very small pores at the chin.

D. 12, 12 or 11 - 1, 12. P. (?). V. (?). A. 3 - 7. C. (?). Length, 8 inches.

Caribbean Sea, Cuv.

Le Conodon des Antilles, Conodon Antillanus, Cuv. et Val., v. p. 156.

GENUS VI. EQUES, Bl.

Body compressed, long, high on the shoulders, and terminating in a point towards the tail ; their teeth are even ; two dorsal fins, the first high, the second long and scaly.

1. Eques balteatus, Cuv.

Yellowish gray, silvery towards the abdomen, with three broad dark-brown bands ; the first is vertical, passing from over the eye, across to the angle of the mouth ; the second begins upon the occiput, passes down across the operculum in front of the pectoral fin, and, curving a little, extends upon the base of the ventral fins ; the third, commencing at the anterior base of the first dorsal, curves obliquely downward, and extends the whole length of the centre of the body, to the extremity of the tail.

D. 16, 1 - 53. P. 15. V. 1 - 5. A. 2 - 10. C. 19. Length, 6 or 7 inches.

Gulf of Mexico, Parra. Caribbean Sea, Cuv.

Called "Gentilhomme," at Martinique ; "Serrana," at Havana.

Serrana, Parra, p. 2, pl. 2, upper fig.
Eques Americanus, Bloch.
Eques balteatus, Griffith's Cuv, x. pl. 21, fig. 1.
Le Chevalier à baudrier, Eques balteatus, Cuv. et Val, v. p. 165.

2. Eques punctatus, Bloch.

Of a dark brown color, with five narrow, gray, longitudinal bands upon the sides ; the three middle bands curve slightly upwards towards the first dorsal. Two vertical bands upon the head. Dorsal, caudal, and anal, with round bluish or gray spots.

D. 11, 1 - 46. P. 18. V. 1 - 5. A. 2 - 7. C. 19. Length, (?).

Gulf of Mexico, Parra. Caribbean Sea, Cuv.

Called " Maman-baleine," at Martinique.

Serrana, Parra, p. 2, pl. 2, lower figure.
Le Chevalier ponctué (Eques punctatus, Bl.), Cuv. et Val., v. p. 167, pl. 116.
Eques punctatus, Wilson, Encyclop. Brit., Art. Ichth., pl. 229, fig. 14.

GENUS VII. UMBRINA, Cuv.

Distinguished from other Sciænæ by a cirrhus under the symphysis of the lower jaw.

1. Umbrina alburnus, L.

Body elongated, slightly arched over the pectorals, gradually tapering towards the tail; dull gray, with silvery reflections upon the sides, ornamented with irregularly disposed dark bars; some passing obliquely forwards from the dorsal fin; others passing obliquely backwards from the nape of the neck; and one broader one pursues a straight course backwards through the middle of the body, from the extremity of the pectorals to the tail. Beneath, yellowish. Caudal fin emarginated at its upper portion, rounded beneath.

D. 9 – 26. P. 19. V. 5. A. 10. C. 17. Length, 8½ to 15 inches.

Massachusetts, Storer. New York, Carolina, Florida, Mitchill, Cuv., Dekay.

Called " King-fish," at New York; and " Whiting," in Carolina and Florida.

Alburnus Americanus, Carolina Whiting, Catesby's Hist. Carol., ii. pl. 12, fig. 2.
Perca alburnus, L., Gmel.
" " Whiting Perch, Shaw's Gen. Zoöl., iv. p. 548.
Sciæna nebulosa, King-fish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 408, pl. 3, fig. 5.
L'Ombrine des Etats-Unis (Umbrina alburnus, Cuv., Perca alburnus, Lin., Centropomus alburnus, Lacep.), Cuv. et Val., v. p. 180.
Umbrina nebulosa, King-fish, Storer's Report, p. 35.
Umbrina alburnus, King-fish, Dekay's Report, p. 78, pl. 7, fig. 20.

2. Umbrina Martinicensis, Cuv.

Very similar to the U. alburnus. Of an uniform brown color. No spots nor bands. Preopercular teeth prominent. Anterior teeth of the upper jaw, and the middle pharyngeal teeth, stout.

D. 10, 1 – 24. P. 22. V. 1 – 5. A. 1 – 10. C. 17. Length, 1 foot.

Caribbean Sea, Cuv.

L'Ombrine de la Martinique, Umbrina Martinicensis, Cuv. et Val., v. p. 186.

3. Umbrina coroides, Cuv.

Nine broad, dusky, vertical bands; anal fin with two spines; lobes in front of the mouth rounded.

D. 10, 1 – 29. P. 17. V. 1 – 5. A. 2 – 6. C. 17. Length, 8 inches.

South Carolina, Dekay.

L'Ombrine coroide, Umbrina coroides, Cuv. et Val., v. p. 187, pl. 117.
" " Southern King-fish, Dekay's Report, p. 79, pl. 72, fig. 231.

4. Umbrina Broussonnettii, Cuv.

One fourth as high as long. Barbel short and pointed. All the teeth velvety. Preopercular teeth well marked. Dorsal spines slender.

D. 10, 1–25. P. (?). V. (?). A. 2–6. C. (?). Length, (?).

Caribbean Sea, Cuv.

L'Ombrine de Broussonnet, Umbrina Broussonnettii, Cuv. et Val., v. p. 187.

GENUS VIII. POGONIAS, Lacep.

Resembles the Umbrinæ, but instead of a single barbule under the jaw, there are several.

1. Pogonias chromis, Lacep.

Large; body compressed and deep. Brownish bronze, varying from blackish to reddish. A black spot behind the pectorals. Ten or eleven cirrhi suspended from about the chin.

D. 9, 1–22. P. 18. V. 6. A. 2–7. C. $17\frac{3}{3}$. Length, 24 inches.

New York, Mitchill, Cuv., Dekay. New York to Florida, Dekay.

Labrus chromis, Lin.
Sciæna fusca, Black Drum, Sciæna gigas, Red Drum, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. pp. 409, 412, pl. 5, fig. 10.
Le grand Pogonias, Pogonias chromis, Cuv. et Val., v. p. 206.
" " Big Drum, Dekay's Report, p. 80.

2. Pogonias fasciatus, Lacep.

Dusky, banded with four or five blackish vertical bands. The fishermen suppose this species to be the young of the preceding.

B. 7. D. 10–23. P. 17. V. 6. A. 7. C. 19. Length, 7 inches.

New York, Mitchill. South Carolina, Dekay.

Called "Grunter," "Young Drum," "Grunts," "Young Sheepshead."

Labrus grunniens, Grunts, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 405, pl. 3, fig. 3.
Le Pogonias à bandes (Pogonias fasciatus, Lacep.), Cuv. et Val., v. p. 210, pl. 118.
Pogonias fasciatus, Wilson, Encyclop. Brit., Art. Ichthyology, p. 176, pl. 299, fig. 13.
" " Banded Drum, Dekay's Report, p. 81, pl. 14, fig. 40.

GENUS IX. MICROPOGON, Cuv.

The prominent snout and general form of Umbrina, with a few scarcely apparent cirrhi or barbules under the lower jaw. Preoperculum dentated, with two spines at the angle. Operculum with two flat points. Five pores under the chin. Dorsal fin deeply divided.

1. Micropogon costatus, Mitchill.

Silvery; blackish upon the operculum; with about twenty narrow gray or blackish bands over the back and along the sides, directed obliquely forwards. In young specimens, two or three longitudinal bands are formed upon the dorsal fins by small brownish spots. Ventrals yellowish. The other fins gray.

D. 10, 1 - 28 or 29. P. 17. V. 1 - 5. A. 2 - 8. C. 17. Length, 10 to 15 inches.

New York, Mitchill, Cuv. Gulf of Mexico, Caribbean Sea, Cuv.

Bodianus costatus, Middle Grunts, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 417.
Le Micropogon rayé (Micropogon lineatus, Cuv., Umbrina Fournieri, Desmer, Sciæna opercularis, Q. et G.), Cuv. et Val., v. p. 215.
Micropogon costatus, Banded Corvino, Dekay's Report, p. 83, pl. 72, fig. 230.

2. Micropogon undulatus, Cuv.

Neither vertical bands nor oblique lines, but indistinct brownish spots upon the back.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, 13 inches.

Chesapeake and Delaware Bays, Schœpff. Carolina, Catesby. New Orleans, Cuv.

Called "Grunter," at New Orleans, and "Croker," in South Carolina.

Le Micropogon ondulé (Micropogon undulatus, Cuv., Perca undulata, L.), Cuv. et Val., v. p. 219.
Micropogon undulatus, Dekay's Report, p. 84.

GENUS X. HÆMULON, Cuv.

Have rather a lengthened profile, which has been thought to have some resemblance to that of a pig. The lower jaw is compressed, and opens wide, having under its symphysis two pores and a little oval dimple; teeth even; those parts of the lower jaw which are drawn in when the mouth shuts are generally of a bright red, from which they derive their name. Their single dorsal is a little emarginated; the soft part of it is scaly.

1. Hæmulon formosum, Cuv.

Of a golden gray color; the head is marked with about a dozen steel-colored lines on each side. The second anal spine is very robust.

D. 12 - 16. P. 17. V. 1 - 5. A. 3 - 9. C. 17. Length, 11 inches.

New York, Dekay. Carolina, Lin. Caribbean Sea, Cuv.

Called "Crocro doré," at St. Domingo.

Perca marina capite striato, Grunt, CATESBY's Hist. Carol., II. pl. 6, fig. 1.
Perca formosa, LIN., Sys. Nat. (12th edit.), p. 488.
La Belle Gorette (Hæmulon formosum, CUV., Perca formosa, L., Labre Plumierien, LACEP.), CUV. et VAL., v. p. 230.
Hæmulon formosum, Squirrel-fish, DEKAY's Report, p. 86, pl. 20, fig. 59.

2. Hæmulon chrysopteron, CUV.

Silver-colored ; darker above ; obscure dark stripes upon the head. The ventrals and anal are tinged with yellow and orange. The other fins are of a brown horn-color.

D. 12 – 15. P. 17. V. 1 – 5. A. 3 – 9. C. $15\frac{2}{2}$. Length, 11 inches.

New York, CUV., DEKAY. South Carolina, CATESBY.

Perca marina gibbosa cinerea, Margate-fish, CATESBY's Hist. Carol., II. pl. 2, fig. 1.
Perca chrysoptera, LIN., Sys. Nat. (12th edit.), p. 488.
La Gorette à nageoires fauves, Hæmulon chrysopteron, CUV. et VAL., v. p. 240.
Hæmulon chrysopteron, Yellow-finned Red-mouth, DEKAY's Report, p. 85, pl. 7, fig. 22.

3. Hæmulon elegans, CUV.

Yellow, with seven or eight silvery lines upon each side, which are continued on to the head ; those towards the back irregular and more separated. Lips bright red. Ventrals orange. Pectorals rose-colored. Dorsal, anal, and caudal, olive.

D. 12 – 16. P. 17. V. 1 – 5. A. 3 – 9. C. 17. Length, 7 or 8 inches.

Caribbean Sea, CUV.

Called " Ronco," at Porto Rico ; at St. Domingo, " Crocro gueule-rouge."

Anthias formosus, BL., p. 323.
La Gorette élégante, Hæmulon elegans, CUV. et VAL., v. p. 227.

4. Hæmulon canna, CUV.

Silvery, obliquely rayed with fifteen or sixteen wide brown bands. Fins more or less orange or brown.

D. (?). P. (?). V. (?). A. (?). C. (?). Weight, $1\frac{1}{2}$ pounds.

Caribbean Sea, CUV.

Called " Canne-canne," at Martinique.

La Gorette canne-canne, Hæmulon canna, CUV. et VAL., v. p. 233.

5. Hæmulon xanthopteron, CUV.

Golden, with oblique steel-colored lines. Two horizontal brown lines above and beneath the lateral line. Pectorals yellow. A row of conical and pointed teeth in each jaw ; the anterior, in the upper jaw, the larger. The second and third anal spine very stout.

D. 12 – 14. P. 18. V. 1 – 5. A. 3 – 9. C. 17. Length, 13 inches.

Caribbean Sea, CUV.

La Gorette à nageoires jaunes, Hæmulon xanthopteron, CUV. et VAL., v. p. 234.

6. Hæmulon heterodon, Cuv.

Similar to the H. canna in its color, but the bands are less numerous than in that species. The soft portion of the dorsal and anal fins are entirely scaly, also the greater portion of the caudal fin. Some of the lateral teeth of the upper jaw, near the angle, are longer than the others, and slightly diverge.

D. 12 – 14. P. (?). V. (?). A. 3 – 8. C. (?). Length, (?).

Gulf of Mexico, Caribbean Sea, Cuv.

La Gorette Chaponne, Hæmulon heterodon, Cuv. et Val., v. p. 235.

7. Hæmulon aurolineatum, Cuv.

Silvery, with longitudinal lines; the first and fourth of these lines, which are one above and the other beneath the lateral line, at equal distances, are broader than the others. A brown spot at the base of the caudal fin. Fins yellowish gray.

D. 13 – 15. P. (?). V. (?). A. 3 – 8. C. (?). Length, 6 or 7 inches.

Caribbean Sea, Cuv.

Called "Crocro," at St. Domingo.

La Gorette rayée d'or, Hæmulon aurolineatum, Cuv. et Val., v. p. 237.

8. Hæmulon quadrilineatum, Cuv.

Silvery; grayish towards the back, with four longitudinal lines, the two upper brown, the two lower golden; one is above the lateral line; the second includes this line; the third passes through the eye, beneath the lateral line; the fourth runs from the pectorals to the tail. Dorsal fin grayish brown. Caudal brown. The other fins whitish.

D. 13 – 14. P. (?). V. (?). A. 3 – 8. C. (?). Length, 6 or 7 inches.

Caribbean Sea, Cuv.

Called "Cricri," at St. Domingo.

La Gorette à quatre lignes, Hæmulon quadrilineatum, Cuv. et Val., v. p. 238, pl. 120.
" " Wilson, Encyclop. Brit., Art. Ichth., pl. 300, fig. 1.

9. Hæmulon album, Cuv.

Of a dull silvery-white color. No canines. Preopercular denticulations exceedingly fine. A row of compact, small, conical teeth in jaws.

D. 12 – 16. P. 18. V. 1 – 5. A. 3 – 9. C. 17. Length, 2 feet.

Caribbean Sea, Cuv.

La Gorette blanche, Hæmulon album, Cuv. et Val., v. p. 241.

10. Hæmulon chromis, Cuv.

Silvery, with a brown spot between each of the dorsal spines. Teeth similar to those of the H. album.

D. 12 - 17. P. (?). V. (?). A. 3 - 7. C. (?). Length, 6 inches.

Caribbean Sea, Cuv.

La Gorette de Broussonnet, Hæmulon chromis, Cuv. et Val., v. p. 242.

11. Hæmulon fulvo-maculatum, Mitchill.

Rows of yellow-sprinkled oblique stripes above the lateral line, and horizontal stripes of a similar color beneath it.

D. 12 - 15. P. 18. V. 1 - 5. A. 3 - 12. C. 17. Length, 6 inches.

New York, Mitchill, Dekay.

Labrus fulvo-maculatus, Speckled Grunts, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 406.
Hæmulon fulvo-maculatum, Speckled Red-mouth, Dekay's Report, p. 84, pl. 7, fig. 21.

12. Hæmulon arcuatum, Cuv.

Body elevated. Of a dark blackish green color, with a brilliant gilded crescent on each scale. Fins blackish. The teeth, particularly of the lower jaw, very large.

D. 11 - 17. P. (?). V. (?). A. 3 - 9. C. (?). Length, 11 inches.

South Carolina, Cuv.

La Gorette à croissant, Hæmulon arcuatum, Cuv. et Val., ix. p. 481.
" " Dekay's Report, p. 87.

GENUS XI. PRISTIPOMA, Cuv.

Have the same preoperculum, the same pores under the symphysis, as the Hæmulons ; but their snout is thicker, their mouth smaller, their dorsal and anal fins have no scales ; their operculum terminates in a blunt angle, hidden in its membranous edge.

1. Pristipoma rodo, Cuv.

The head and breast of this species are silvery, shaded with gray. A broad black band descends from the nape of the neck across the eye to the angle of the jaws; a second band, situated before the dorsal, descends to and terminates at the pectorals. Behind this, upon each side, the body is divided into fifteen longitudinal lines, alternately golden and steel-colored. The edges of the scales are silvery, and the fins are yellow.

D. 12 - 17. P. 16. V. 1 - 5. A. 3 - 10. C. 17. Length, 8 to 11 inches.

Virginia, Carolina, Lin. Gulf of Mexico, Caribbean Sea, Cuv.

Called "Rodo," at Martinique ; "Fin," at St. Domingo ; "Parapel," at Guadaloupe ; "Catalineta," at Havana ; "Juannita," "Mariquita," at Porto Rico.

Sparus Virginicus, Virginian Sparus, L., Shaw's Gen. Zoöl., iv. p. 436.
Le Pristipome rodo (Pristipoma rodo, Cuv.), Cuv. et Val., v. p. 274.

2. Pristipoma coro, Cuv.

Silvery, with eight transverse brown bands. The outer row of teeth conical; the four anterior, in each jaw, larger than the others; no teeth on the palatine bones. All the head, except the jaws, scaled. The second anal spine is large and very stout.

D. 12 – 13. P. 15. V. 1 – 5. A. 3 – 7. C. 17. Length, 6 inches.

Caribbean Sea, Cuv.

Sciæna coro, Bl., Shaw's Gen. Zoöl., iv. p. 538.
Le Pristipome coro, Pristipoma coro, Cuv. et Val., v. p. 266.

3. Pristipoma fasciatum, Cuv.

Of a grayish brown color, with eight or nine clouded, blackish bands, alternately wider and narrower; oblique lines upon the back, and a longitudinal brown band upon the top of the operculum. Thirteen soft anal rays, of which the third is longer than the second.

D. 12 – 16. P. 16. V. 1 – 5. A. 3 – 13. C. 17. Length, 5 to 8 inches.

New York, Cuv.

Le Pristipome à bandes (Pristipoma fasciatum, Cuv.), Cuv. et Val., v. p. 285.
Pristipoma fasciatum, Banded Pristipoma, Dekay's Report, p. 67.

4. Pristipoma crocro, Cuv.

Silvery brown. Dorsal brown, with a whitish line at its base; the edge of its spinous portion blackish. The other fins brown. Upper jaw slightly projecting. Teeth very fine; preopercular dentations delicate. The second anal spine stout.

D. 13 – 12 or 14 – 11. P. 16. V. 1 – 5. A. 3 – 7. C. 17. Length, 6 or 7 inches.

Caribbean Sea, Cuv.

Called "Crocro," at Martinique.

Le Pristipome crocro, Pristipoma crocro, Cuv. et Val., v. p. 264.

5. Pristipoma bilineatum, Cuv.

Length two and a half times its height. Golden gray, lighter beneath, more silvery upon suborbitars. Two longitudinal dark-brown bands upon the sides; one arising upon the top of the head and passing above the lateral line to the posterior base of the soft portion of the dorsal; the other, arising at the eye, passes through the centre of the body to the tail, where it terminates in a black spot. The anterior teeth rather stouter than the others. Second anal spine very stout; the third spine as stout, but shorter.

D. 12 – 15. P. 17. V. 1 – 5. A. 3 – 9. C. 17. Length, 4½ inches.

Caribbean Sea, Cuv.

Called "Luppé," at Martinique.

Le Pristipome à deux lignes, Pristipoma bilineatum, Cuv. et Val., v. p. 271, pl. 122.
" " Wilson, Encyclop. Brit., Art. Ichth., pl. 300, fig. 3.

6. Pristipoma serrula, Cuv.

More elongated than the bilineatum; eyes larger. Violet-colored above, with four or five longitudinal yellow lines; beneath silvery. The second and third anal rays of equal length.

D. 12-13. P. 15. V. 1-5. A. 3-9. C. 17. Length, 7 inches.

Caribbean Sea, Cuv.

Le Pristipome petite-scie, Pristipoma serrula, Cuv. et Val., v. p. 272.

7. Pristipoma auratum, Cuv.

Of an uniform golden color, throughout. The number of the fin rays the same as in the P. serrula.

D. 12-13. P. 15. V. 1-5. A. 3-9. C. 17. Length, 6 inches.

Caribbean Sea, Cuv.

Le Pristipome doré, Pristipoma auratum, Cuv. et Val., v. p. 272.

Note. Dekay has admitted into his *extra-limital* species the Pristipoma rubrum, although he does not mention its habitat; and Cuvier, in his "Histoire Naturelle des Poissons," speaks of it as being found only in Brazil.

GENUS XII. LOBOTES, Cuv.

The snout is short, the lower jaw turned up in front, the body elevated; the dorsal and anal lengthen their posterior angle, so that, with their rounded caudal, their body seems to terminate in three lobes. Preoperculum with strong dentations. They have four clusters of very small spots towards the end of their jaw.

1. Lobotes Surinamensis, Cuv.

Elliptical, deepest opposite the first dorsal ray. The color of the back and sides is a rusty black; of the belly, a dirty clay, variegated with blackish and yellowish specks. Dorsal, anal, and ventral fins yellowish.

D. 12-15. P. 17. V. 1-5. A. 3-11. C. 17. Length, 13 inches or more.

New York, Mitchill. This species is also found in Brazil, and of course along the whole coast.

Le Lobotes de Surinam (Lobotes Surinamensis, Cuv., Holocentrus Surinamensis, Bl., p. 243, Bodianus triurus, Mitchill?), Cuv. et Val., v. p. 319.
Bodianus triurus, Triple-tailed Perch, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 418, pl. 3, fig. 10.
Lobotes Surinamensis, Black Triple-tail, Dekay's Report, p. 88, pl. 18, fig. 49.

2. Lobotes somnolentus, Cuv.

Silvery brown. The soft portions of the dorsal and anal fins, and the extremity of the caudal fin, black. Pectorals yellowish; ventrals silvery. Dentations upon the preopercle short and wide, and those at its angle truncated and denticulated.

D. 12–16. P. (?). V. (?). A. 3–11. C. (?). Length, 16 inches.

Caribbean Sea, CUV.

Called "Dormeur," at St. Domingo.

Le Lobotes dormeur, Lobotes somnolentus, CUV. et VAL., v. p. 324, pl. 126.
" " WILSON, Encyclop. Brit., Art. Ichth., p. 300, fig 4.

GENUS XIII. POMACENTRUS, LACEP.

Oblong; head obtuse; teeth in a single row; preoperculum denticulated, operculum unarmed; five branchial rays; the lateral line stops beneath the soft portion of the dorsal. Suborbitars sometimes dentated.

1. Pomacentrus planifrons, CUV.

Profile rectilinear. Brown; a black spot at the base of the pectorals, beneath; another back of the dorsal, above the tail. Dorsal and anal pointed.

D. 12–15. P. (?). V. (?). A. 2–13. C. 17. Length, 3 inches.

Caribbean Sea, CUV.

Called, at Martinique, "Petite-jaquette."

Le Pomacentre à front plat, Pomacentrus planifrons, CUV. et VAL., v. p. 431.

GENUS XIV. GLYPHISODON, LACEP.

Body compressed, oval, covered, as well as the head, with large scales. Profile rounded. Operculum and preoperculum smooth; a single row of trenchant and generally notched teeth.

1. Glyphisodon saxatilis, LACEP.

Silvery, with golden reflections towards the back, and blue towards the head. Fins bluish. Tail deeply forked. A single row of from thirty-six to forty compact, equal, straight teeth in each jaw. When preserved, it is of a yellowish gray color, with five broad, blackish vertical bands. Fins blackish.

D. 13–13. P. 18. V. 1–5. A. 2–12. C. 15. Length, 6 to 8 inches.

Caribbean Sea, CUV.

Chætodon saxatilis, BLOCH, pl. 206, fig. 2.
" " Rock Chætodon, SHAW's Gen. Zoöl., IV. p. 364.
Le Glyphysodon saxatile (Glyphisodon saxatilis, LACEP.), CUV. et VAL., v. p. 446.

2. Glyphisodon chrysurus, Cuv.

Chocolate-colored. Caudal fin yellow. Dorsal and anal fins almost covered with scales, as in the true Squamipennes. At least fifty teeth in the lower, and nearly eighty teeth in the upper jaw.

D. 12 – 16. P. 18. V. 1 – 5. A. 2 – 13. C. 17. Length, 5½ inches.

Caribbean Sea, Cuv.

Le Glyphysodon à queue d'or, Glyphisodon chrysurus, Cuv. et Val., v. p. 476.

GENUS XV. HELIASUS, Cuv.

Body ovate, compressed ; mouth small, no denticulations upon the preoperculum ; large scales ; teeth small and rounded.

1. Heliasus insolatus, Cuv.

Grayish. Suborbitars circular and scaled. Eyes large. A narrow band of velvety teeth in each jaw. Caudal emarginated.

D. 13 – 12. P. 17. V. 1 – 5. A. 2 – 12. C. 17. Length, 4 inches.

Caribbean Sea, Cuv.

Called, at Martinique, "Chauffe-soleil."

L'Héliase chauffe soleil, Heliasus insolatus, Cuv. et Val., v. p. 494, pl. 137.

FAMILY IV. SPARIDÆ.

This family is characterized by the opercular pieces being unarmed ; the palate toothless ; the jaws not protractile ; scales large. Branchial rays not exceeding six.

GENUS I. SARGUS, Cuv.

Trenchant incisors in front of the jaws, almost similar to those of man ; molars rounded.

1. Sargus ovis, Mitchill.

Elliptical. White, or obscure silvery, with a smutty daubing over the face and chin, a greenish tinge above the brow, and six or seven dark bands or zones, of an inch or more in breadth, regularly slanting from back to belly; the latter a dull white, approaching in some places and individuals to cream-color. Anal black, with ten soft rays. In front of each jaw, six to eight quadrilateral incisors ; inside of these, above and beneath, two or three series of numerous rounded, flattened, paved teeth. The form of the mouth, and a certain smuttiness of the face, have a distant resemblance to the physiognomy of the sheep.

D. 12 – 13. P. 14. V. 1 – 5. A. 3 – 11. C. 17. CUV.

D. 24. P. 6. V. 6. A. 13. C. 19. MITCHILL. Length, 14 to 20 inches.

Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, CUV., DEKAY. Lake Pontchartrain, Louisiana, LESUEUR.

Sparus ovis, Sheepshead, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 392, pl. 11, fig. 5.
Le Sargue tête-de-mouton, Sargus ovis, CUV. et VAL., VI. p. 53.
Sargus ovis, Sheepshead, STORER'S Report, p. 36.
" " " DEKAY'S Report, p. 89, pl. 8, fig. 23.
" " " AYRES, Bost. Journ. Nat. Hist., IV. 260.

2. Sargus rhomboides, CUV.

Silvery, rayed longitudinally with twenty-four or twenty-five gilded bands. Four or five brownish bands descend from the back upon the sides, being more or less visible as the rays of light glance upon the fish. Behind the shoulder, a blackish spot crosses the lateral line. The dorsal is grayish; the anal yellow, margined with violet; the caudal olive-yellow; the pectorals and ventrals of a brighter yellow than the other fins. Eight cutting teeth above, and eight below, notched on their summits.

D. 12 – 11. P. 17. V. 1 – 5. A. 3 – 10. C. 17. Length, 3 to 5 inches.

New York, Carolina, New Orleans, Lake Pontchartrain, CUV.

Sparus rhomboides, LIN., Syst. Nat. (12th edit.), p. 170.
" " Rhomboid Sparus, SHAW'S Gen. Zoöl., IV. p. 447.
Le Sargue rhomboide, Sargus rhomboides, CUV. et VAL., VI. p. 68, pl. 143.
" " Rhomboid Porgee, DEKAY'S Report, p. 93, pl. 71, fig. 228.

3. Sargus arenosus, DEKAY.

Small. Banded as in the preceding. A short spine directed forwards in front of the dorsal fin. A series of six flat, chisel-shaped teeth in front of the upper jaw, with their tips somewhat enlarged, and a row of eight similar shaped in the lower. Behind these, in both jaws, two or three series of small, rounded, molar-like teeth, which increase in size on the sides of the jaws.

D. 1 – 12, 11. P. 16. V. 1 – 5. A. 3 – 12. C. 20. Length, 6 inches.

New York, DEKAY.

Sargus arenosus, Sand Porgee, DEKAY'S Report, p. 91, pl. 22, fig. 67.

4. Sargus flavolineatus, CUV.

Back bluish, silvery beneath; thirteen or fourteen longitudinal lines upon the sides, scarcely visible upon the abdomen. Dorsal fin bluish; its soft portion reddish. Caudal and anal red, pectorals blackish, ventrals gray. The incisors are broad and vertical; molars of moderate size.

D. 13 – 11. P. 17. V. 1 – 5. A. 3 – 10. C. 17. Length, 9 inches.

Caribbean Sea, Cuv.

Called, at Cuba, "Grand-goré."

Le Sargue à lignes jaunes, Sargus flavolineatus, Cuv. et Val., vi. p. 60.

5. Sargus unimaculatus, Cuv.

Silvery, grayish towards the back, with twenty narrow, golden, longitudinal bands upon each side. Back of the operculum, beneath the lateral line, a blackish spot. The soft portion of the dorsal fin, the anal and caudal, yellow; pectorals pale; ventrals blackish. Six incisors in the upper jaw, eight in the lower jaw, each of which is notched in the middle of its edge. Back of these, in the upper jaw, three rows of small, rounded molars; and two rows in the lower.

D. 13 – 10. P. 14. V. 1 – 5. A. 3 – 10. C. 17. Length, 3 to 7 inches.

Caribbean Sea, Cuv.

Le Sargue unimaculé, Sargus unimaculatus, Cuv. et Val., vi. p. 62.

GENUS II. CHRYSOPHRIS, Cuv.

Round molars on the sides of the jaws, forming at least three rows on the upper one; a few conical or blunt teeth in front.

1. Chrysophris aculeata, Cuv.

Body elongated. A short, stout, recumbent spine before the dorsal. When preserved in spirits, this species is of a silvery white color, with a slight reddish tint upon the sides, which are marked by a score of golden longitudinal lines. The head is very showy, and has golden reflections. The suborbitar bones, the dorsal and anal fins, are reddish. The ventrals are red. The caudal is gray.

D. 12 – 12. P. 16. V. 1 – 5. A. 3 – 12. C. 17. Length, 22 inches.

New York, Cuv.

La Daurade aiguillonnée, Chrysophris aculeata, Cuv. et Val., vi. p. 137.
" " Aculeated Gilt-head, DeKay's Report, p. 94, pl. 71, fig. 229.

GENUS III. PAGRUS, Cuv.

Differs from Chrysophris in having but two rows of small, rounded molar teeth in each jaw.

1. Pagrus argyrops, Lin.

Body very much compressed at its sides; back gibbous, gradually curving towards the tail. General color, beautiful silvery, varying with brown, reddish, and blue. Head scaleless, and of a purple color. Abdomen white. A large, semicircular scale, of a beautiful purple color, at the commencement of the lateral line; between this scale and the outer angle of a naked space, at the posterior angle of the eye, a band, half an inch or more in width, of smaller scales than those of the body, passes obliquely upwards to the anterior portion of the ridge of the back. A short recumbent spine in front of the dorsal fin. The second and third dorsal rays often filamentous.

D. 24. P. 15. V. 6. A. 15. C. 17. Length, 8 to 12 inches.

Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, CUV., DEKAY. South Carolina, LIN.

Sparus argyrops, LIN., Syst. Nat., GMEL., p. 1277.
" " Silver-eyed Sparus, SHAW'S Gen. Zoöl., IV. p. 426.
Labrus versicolor, Big Porgee of New York, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 404, pl. 3, fig. 7.
Le Pagre œil-d'argent, Pagrus argyrops, CUV. et VAL., VI. p. 164.
" " Big Porgee, Scapaug, Scup, STORER'S Report, p. 38.
" " Big Porgee, DEKAY'S Report, p. 95, pl. 9, fig. 25.
" " Porgee, AYRES, Bost. Journ. Nat. Hist., IV. p. 260.

GENUS IV. PAGELLUS, CUV.

Teeth nearly resembling those of Pagrus, but the molars, also in two rows, are smaller; the conical teeth in front are slender and more numerous; and the physiognomy is different, in consequence of a more elongated muzzle.

1. Pagellus calamus, CUV.

Forehead and neck more elevated than in any other species of this genus. Reddish; suborbitars spotted with bluish points. About twenty-two rows of sixty-five scales upon each side. In the upper jaw are two straight, pointed teeth, stouter than the others; molars in three rows upon the upper jaw, and in two rows upon the lower jaw, the inner row stoutest. This species derives its name from the first anal spine, which resembles a quill cut into a pen.

D. 12 – 12. P. 14. V. 1 – 5. A. 3 – 11. C. 17. Length, 1 foot.

Caribbean Sea, CUV.

Le Pagel à plume, Pagellus calamus, CUV. et VAL., VI. p. 206, pl. 152.

FAMILY V. MENIDÆ.

The individuals of this family are similar in their forms to the Sparoides, but they are distinguished from that family by their very protractile mouth, and, in some instances, by the presence of teeth on the vomer, or denticulations on the preoperculum.

GENUS I. SMARIS, Cuv.

Body oblong, compressed, and somewhat similar to that of a herring; an elongated scale above each of the ventrals, and another between them. Teeth in jaws extremely fine, forming a very narrow band. Vomer destitute of teeth.

1. Smaris Martinicus, Cuv.

Body rounded, contracted. Reddish upon the back, silvery beneath; a small black spot upon the side.

D. 11 – 11. P. (?). V. (?). A. 3 – 9. C. (?). Length, 4 inches.

Caribbean Sea, Cuv.

Le Picarel de la Martinique, Smaris Martinicus, Cuv. et Val., vi. p. 424.

GENUS II. GERRES, Cuv.

The mouth protractile, but when advancing it descends; the body is elevated, the anterior part of the dorsal in particular, along the base of whose posterior portion is a scaly sheath.

1. Gerres aprion, Cuv.

Elongated. Silvery, with bluish reflections towards the back, as in the most beautiful herring. The dorsal, in the recent state, is a very pale yellow, finely dotted with blackish. This species receives its name from its preoperculum being unarmed; also the interopercle and suborbitar.

B. 6. D. 9 – 10. P. (?). V. (?). A. 3 – 7. C. (?). Length, 3 to 6 inches.

South Carolina, Catesby. Caribbean Sea, Cuv.

Turdus cinereus peltatus, Shad, Catesby's Hist. Carol., ii. pl. 2, fig. 2.
Le Gerres sans scie, Gerres aprion, Cuv. et Val., vi. p. 461.
" " Dekay's Report, p. 97.

2. Gerres Brasilianus, Cuv.

Height equal to one fifth of its length. Silvery gray, with ten or eleven longitudinal lines upon the sides.

D. 9 – 10. P. 16. V. 1 – 5. A. 3 – 9. C. 17. Length, 8 or 9 inches.

Caribbean Sea, Cuv.

Called, at Porto Rico, " Moharra."

Le Gerres du Brésil, Gerres Brasilianus, Cuv. et Val., vi. p. 458.

3. Gerres Plumieri, Cuv.

Compressed ; height one third of its length ; length three and a half times its thickness. Silvery, with longitudinal grayish lines, seven or eight of which are distinct ; the others disappear towards the abdomen. The lower edge of the suborbitars has a slight reëntering angle, and is denticulated.

D. 9 - 10. P. 15. V. 1 - 5. A. 3 - 9. C. 17. Length, 6 inches to a foot.

Caribbean Sea, Cuv.

Called, at Porto Rico, " El moharra."

Le Gerres de Plumier, Gerres Plumieri, Cuv. et Val., vi. p. 452.

4. Gerres rhombeus, Cuv.

Height equal to one half of its length, not including the tail. Silvery ; the membrane of the dorsal fin a very pale yellow ; the ventrals, and the anterior portion of the anal fin in young specimens, are of a beautiful jonquille-yellow. The lower edge of the suborbitars is without denticulations.

D. 9 - 10. P. 16. V. 1 - 5. A. 2 - 9. C. 17. Length, 7 inches.

Caribbean Sea, Cuv.

Le Gerres rhomboide, Gerres rhombeus, Cuv. et Val., vi. p. 459.

5. Gerres gula, Cuv.

Very similar to the G. aprion in its proportions ; but the second anal spine is shorter in proportion ; it is only a fifth of the height of the fish. In the G. aprion, it is one third. The third spine, also, is longer in this species than the second. Its snout is broader, and its profile more regular. Color same as that of G. aprion.

D. 9 - 10. P. (?). V. (?). A. 3 - 7. C. (?). Length, 5 inches.

Caribbean Sea, Cuv.

Le Gerres petite gueule, Gerres gula, Cuv. et Val., vi. p. 464.

FAMILY VI. CHETODONTIDÆ.

Body compressed, scaly. The dorsal and anal fins covered with scales, especially on the soft portions. Teeth bristly or trenchant. Palatines smooth, or furnished with teeth. Preopercula occasionally spinous. Dorsals two, or one only.

GENUS I. CHÆTODON, Lin.

The body more or less elliptical ; the spinous and soft rays continuing in an uniform curve ; the snout projecting more or less, and sometimes a very fine denticulation on the preoperculum.

1. Chætodon striatus, Lin.

Roundish ovate. Whitish, tinged with yellowish brown, with five vertical dark-brown bands. Several narrow, longitudinal, dusky streaks between the rows of scales.

B. 6. D. 12–20. P. 15. V. 1–5. A. 3–16. C. 17. Length, 5 inches.

Caribbean Sea, Cuv.

Called "Zebre," or "Onagre," at Guadaloupe.

Chætodon striatus, Lin., Gmel., 1249.
" " Bloch, vi. p. 66, pl. 205, fig. 1.
" " " Striped Chætodon, Shaw's Gen. Zoöl., iv. p. 334.
Le Chétodon barré, Chætodon striatus, Lin., Cuv. et Val., vii. p. 10.

2. Chætodon capistratus, Lin.

Ovate. Violet-colored when fresh, with oblique brown lines directed forwards. A large, round, black spot, surrounded with a white margin, at the posterior part of the body. A brown and a whitish line parallel to their borders, upon the dorsal and anal, and two similar vertical bands upon the tail.

D. 13–19. P. (?). V (?). A. 3–17. C. 17. Length, 3½ inches.

Gulf of Mexico, Caribbean Sea, Cuv.

Called "Striped Angel-fish," at Jamaica; "Demoiselle," at Martinique ; "Young Girl," at St. Thomas.

Chætodon capistratus, Lin., Mus. Acad. Fred., pl. 33, fig. 4.
" " Bloch, vi. p. 68, pl. 205, fig. 2.
Le Chétodon bridé, Chætodon capistratus, Lin., Cuv. et Val , vii. p. 64.

3. Chætodon bimaculatus, Bloch.

Roundish ovate. White, fins yellow. The dorsal marked at the base of the hind part by a large, round, black spot, bordered with white, and at its extreme edge by a much smaller spot, of similar colors.

D. 12–21. P. 15. V. 1–5. A. 3–17. C. 17. Length, (?).

Gulf of Mexico, Caribbean Sea, Cuv.

Called "Catalineta," at Havana; "Mariquita," at Porto Rico.

Chætodon bimaculatus, Bloch, pl. 219? fig. 1?
" " " Shaw's Gen. Zoöl., iv. p. 333.
Le Chétodon à deux taches, Chætodon bimaculatus, Bl., Cuv. et Val., vii. p. 67.

GENUS II. EPHIPPUS, Cuv.

Dorsal deeply emarginated between the spinous and soft rays ; the spinous part, which has no scales, can be folded into a groove formed by the scales of the back.

1. Ephippus faber, Bloch.

Orbicular. Brownish, with six broad, vertical, dusky bluish bands ; fins of the same color as the bands. Sixty-five scales between the gills and tail, and forty-eight between the back and abdomen.

D. 9, 3 - 22. P. 18. V. 1 - 5. A. 3 - 18. C. 16. Length, 9 inches.

New York, Mitchill, Cuv., Dekay. Carolina, Caribbean Sea, Cuv.

Called "Three-tailed Sheepshead," "Three-tailed Porgee," and "Angel-fish."

Chætodon faber, Bloch, p. 80, pl. 212, fig. 2.
" " Shaw's Gen. Zoöl., iv. p. 340.
" " Cloudy Chætodon, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. pl. 5, fig. 4.
Chætodon oviformis, Mitchill, Amer. Month. Mag., ii. p. 247.
L'Ephippus forgeron, Ephippus faber, Cuv. et Val., vii. p. 113.
" " Dekay's Report, p. 97, pl. 23, fig. 68.

2. Ephippus gigas, Parkinson.

Oblong oval. Of a uniform silvery or leaden color. Crest of the cranium enlarged. The first interspinous bone of the anal fin is club or mallet-shaped. Much larger than the preceding species.

D. 8, 1 - 21. P. 17. V. 1 - 5. A. 3 - 17. C. 17. Length, 16 inches.

New York, Cuv., Dekay. Caribbean Sea, Cuv.

Called "Moon-fish," in the Antilles.

Chætodon gigas, Parkinson.
L'Ephippus géant, Ephippus gigas, Cuv. et Val., vii. p. 121.
" " Moon-fish, Dekay's Report, p. 99, pl. 23, fig. 71.

GENUS III. HOLACANTHUS, Lacep.

Form oval or oblong. A large spine at the angle of the preoperculum, and the edges of the same bone in most species denticulated.

1. Holacanthus ciliaris, Lacep.

Greenish, with a golden tinge. The pectoral, ventral, and caudal fins of an orange-yellow color. An annular dark-brown spot, with a blue margin, upon the neck before the dorsal fin. Scales moderate, and ciliated round their edges with numerous hair-like processes.

D. 14 - 21. P. 18 V. 1 - 5. A. 3 - 20. C. 17. Length, 14 inches.

Carolina, Catesby ? Richardson. Gulf of Mexico, Caribbean Sea, Cuv.

Called "Hairy Angel-fish," by Bloch ; "Patate," at Martinique ; "Polometa," at Porto Rico.

Isabelita, Parra, p. 11, pl. 7, fig. 1.
Chætodon ciliaris, Bloch, vi. p. 83, pl. 214.
" " " Shaw's Gen. Zoöl., iv. p. 326.
L'Holacanthe ciliare (Holacanthus ciliaris, Lacep.), Cuv. et Val., vii. p. 154.

2. Holacanthus tricolor, Bloch.

Head, neck, shoulders, throat, breast, and also the pectorals and ventrals, yellow. The rest of the body black, except the tail, which is yellow. The preopercular spine, the membrane between the anal spines, and, in the female, a portion of the lower edge of the same fin, a portion also of the dorsal, is of a vermilion-red.

D. 14 - 19. P. 18. V. 1 - 5. A. 3 - 18. C. 17. Length, 11 inches.

Gulf of Mexico, Caribbean Sea, Parra, Cuv.

Called "Moubin," at Martinique.

Catalineta, Parra, p. 12, pl. 7, fig. 2 (male).
Chætodon tricolor, Bloch, p. 425?
" " " Shaw's Gen. Zoöl., iv. p. 360.
L'Holacanthe tricolor (Holacanthus tricolor, Bl.), Cuv. et Val., vii. p. 162.

GENUS IV. POMACANTHUS, Cuv.

Form more elevated than in the Holacanthus; more dorsal spines; no denticulations upon the suborbitars or preopercle.

1. Pomacanthus aureus, Bloch.

Of a bright golden yellow, shaded with orange on the upper part. Ventrals brownish. The extended parts of the dorsal and anal fins reaching beyond the tail.

D. 9 - 30. P. 18. V. 1 - 5. A. 3 - 24. C. 17. Length, 15 inches.

Caribbean Sea, Cuv.

Chirivita, Parra, p. 10, pl. 6, fig. 2.
Chætodon aureus, Bloch, pl. 193, fig. 1?
" " " Golden Chætodon, Shaw's Gen. Zoöl., iv. p. 353.
Le Pomacanthe doré (Chætodon aureus, Bl.), Cuv. et Val., vii. p. 202.

2. Pomacanthus paru, Bloch.

Oval. Black, with a golden tinge, most conspicuous towards the edges of the scales; a yellow band at the base of the pectorals.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 15 inches.

Caribbean Sea, Cuv.

Chirivita, Parra, pl. 6, fig. 1.
Chætodon paru, Bloch, p. 197?
" " " Lin., Syst. Nat., 1256.
" " " Paru Chætodon, Shaw's Gen. Zoöl., iv. p. 325.
Le Pomacanthe noir (Chætodon paru, Bl.), Cuv. et Val., vii. p. 205.

3. Pomacanthus balteatus, Cuv.

Of a yellowish gray color, spotted with dark brown, with a curved white or yellow band upon the side; a whitish band surrounds the base of the tail, and also its three edges; sometimes a whitish line extends from the neck to the posterior edge of the preopercle.

D. 9–33. P. 18. V. 1–5. A. 3–23. C. 17. Length, 8 inches.

Caribbean Sea, Cuv.

Called "Palometta," at Porto Rico.

Le Pomacanthe à écharpe, Pomacanthus balteatus, Cuv. et Val., vii. p. 208.

GENUS V. PIMELEPTERUS, Cuv.

Oval, compressed. With a single dorsal fin. With cutting teeth in both jaws disposed in a single row ; the teeth implanted in the jaws by means of a heel extended horizontally backwards.

1. Pimelepterus Boscii, Lacep.

Regularly oval. Brownish, with twenty to twenty-two longitudinal lines beneath, and ten to twelve above, the lateral line.

D. 11–12. P. 19. V. 1–5. A. 3–13. C. 17. Length, 5 inches.

South Carolina, Cuv.

Le Piméleptère de Bosc (Pimelepterus Boscii, Lacep.), Cuv. et Val., vii. p. 259.
Pimelepterus Boscii, Dekay's Report, p. 100, pl. 20, fig. 56.

FAMILY VII. SCOMBRIDÆ.

The fishes belonging to this family have small scales, causing the greater part of the skin to appear as if entirely smooth ; the ventral fins are destitute of scales ; the opercula are without spines or denticulations ; in most of them the caudal fin is large and powerful, and generally they are furnished with numerous cœca.

GENUS I. SCOMBER, Cuv.

Body fusiform, covered by scales which are uniformly small ; sides of the tail not carinated, but merely raised into two small cutaneous crests ; dorsal fins widely separated ; some of the posterior rays of the second dorsal and the anal fin free, forming finlets ; one row of small conical teeth in each jaw.

1. Scomber colias, Gmel.

Form cylindrical, plump, elongated, tapering towards the tail, at the origin of which it is very small. Upper part of the body of a light green color, with numerous contiguous beautifully undulating lines of a darker green passing down the sides, and just crossing the lateral line; immediately beneath the lateral line, of a dull bluish color, with indistinct circular brown blotches. Abdomen lighter, but, as well as the sides, presenting cupreous reflections.

D. 9 – 12. P. 19. V. 5. A. 13. C. 22. Length, 1 foot.

Massachusetts, STORER. Connecticut, LINSLEY. New York to Carolina, DEKAY.

Scomber maculatus, Spanish Mackerel, COUCH? Mag. Nat. Hist., v. p. 22, fig. 8.
" " " " JENYNS's Brit. Vert., p. 361.
Le Maquereau colias (Scomber colias, GMEL.), CUV. et VAL., VIII. p. 39, pl. 205.
Scomber colias, YARRELL's Brit. Fishes (2d edit.), I. p. 148, fig.
" " Spanish Mackerel, STORER's Report, p. 45.
" " " " DEKAY's Report, p. 104, pl. 11, fig. 33.

2. Scomber vernalis, MITCHILL.

Body fusiform, cylindrical. Upper part of the body of a dark green color, marked throughout its whole extent, from occiput to tail, with beautiful transverse, more or less undulating, broken bands of a deeper hue, commencing on the side of the dorsal ridge and extending below the lateral line. Sides white, with cupreous reflections. Abdomen white. A wide fuliginous line beneath the lateral line. A black spot at the base of the pectoral and ventral fins.

D. 10 – 12. P. 17. V. 5. A. 12. C. 20. Length, 18 inches.

Maine, Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, DEKAY. The whole of the Atlantic coast, RICHARDSON.

Scomber vernalis, Spring Mackerel, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 423.
Le Maquereau printanier (Scomber vernalis, MITCH.), CUV. et VAL., VIII. p. 48.
Scomber vernalis, RICH., Fauna Boreal. Americ., III. p. 80.
" " Spring Mackerel, STORER's Report, p. 41.
" " " " DEKAY's Report, p. 101.

3. Scomber grex, MITCHILL.

Color as in the preceding; the dorsal bands are more tortuous; and there is a dark spot at the tip of the lower jaw.

D. 12, 13 – 5. P. 19. V. 1 – 5. A. 1, 12 – 5. C. 20$\frac{8}{8}$. Length, 9 inches.

New York, MITCHILL, CUV., DEKAY.

Scomber grex, Thimble-eyed, Bull-eyed, or Chub Mackerel, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 422.
Le petit Maquereau de l'Atlantique (Scomber grex, MITCH.), CUV. et VAL., VIII. p. 45.
Scomber grex et vernalis, Chub and Spring Mackerel, RICH., Fauna Boreal. Americ., III. p. 81.
Scomber grex, Fall Mackerel, DEKAY's Report, p. 103, pl. 11, fig. 32.

GENUS II. PELAMYS, CUV.

The fishes of this genus differ from those of the Thynnus, in having strong, separate, and pointed teeth.

1. Pelamys sarda, Cuv.

Form similar to that of the Mackerel. Body of a dull greenish color; abdomen ash-colored. Ten or twelve dark-colored bands pass obliquely downwards and forwards from the dorsum towards the abdomen; the first of these bands commences at the posterior extremity of the dorsal fin; the last at the origin of the caudal fin. Some of these bands pass very low down upon the sides, even to the abdomen. Besides these, several indistinct, lighter colored bands cross the body transversely. Jaws even. Teeth sharp and distinct.

D. 20–14. P. 24. V. 6. A. 14. C. 24. Length, about 2 feet.

Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Scomber sarda, Bloch, x. p. 35?
" " Shaw's Gen. Zoöl., iv. p. 584.
" " Bonetta, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 428.
Le Pélamide commune, ou Bonite à dos rayé (Pelamys sarda, Cuv., Scomber sarda, Bl.), Cuv. et Val., viii. p. 149, pl. 217.
Pelamys sarda, Skip-jack, Storer's Report, p. 49.
" " Striped Bonito, Dekay's Report, p. 106, pl. 9, fig. 27.

GENUS III. THYNNUS, Cuv.

Form of the body like that of the Mackerel, but less compressed. A kind of corselet around the thorax, formed by scales larger and coarser than those of the rest of the body; a long, elevated crest on each side of the tail. The anterior dorsal reaching almost to the posterior one. Numerous finlets behind the dorsal and anal fins. A single row of small, pointed, crowded teeth in each jaw.

1. Thynnus vulgaris, Cuv.

Form elongated; gradually sloping from the beginning of the dorsal fin to the snout, and tapering from the dorsal to the tail. Color of the whole upper part of the body nearly black; sides silvery; beneath white. Scales on the back, in front of the first dorsal, at the base of and beneath the pectorals very large. Gill-covers very large, perfectly smooth, of a silvery-gray color. Nine yellow finlets back of the second dorsal and anal fins.

D. 14, 13–9. P. 34. V. 1–5. A. 2, 12–9. C. 19. Length, 9 feet and 3 inches.

Massachusetts, Storer. Connecticut, Linsley. New York, Dekay.

Scomber thynnus, Lin., Bloch, ii. p. 87, pl. 55.
" " Tunny, Lin., Shaw's Gen. Zoöl., iv. p. 581.
Le Thon commun (Thynnus vulgaris, Cuv., Scomber thynnus, Lin.), Cuv. et Val., viii. p. 58, pl. 210.
Scomber thynnus, Lin., Jenyns's Brit. Vert., p. 362.
Thynnus vulgaris, Cuv., Yarrell's Brit. Fishes (2d edit.), i. p. 151.
" " Wilson, Encyclop. Brit., Art. Ichth., p. 182, pl. 302, fig. 3.
" " Common Tunny, Storer's Report, p. 47.
" " Griffith's Cuv., x. p. 182, pl. 54, fig. 1.
" " Common Tunny, Dekay's Report, p. 105, pl. 10, fig. 28.

2. Thynnus coretta, Cuv.

Corselet truncate ; scarcely emarginate behind. Second dorsal and anal fins low. Plumbeous above, silvery beneath.

D. 13 - 1 | 14 - 8. P. 31. V. 1 - 5. A. 2, 12 - 8. C. 35. Length, 11 inches.

Gulf of Mexico, Cuv.

Le Thon d'Amérique, Thynnus coretta, Cuv. et Val., viii. p. 102.
Thynnus coretta, Dekay's Report, p. 106.

GENUS IV. AUXIS, Cuv.

Have, with the corselet and moderate-sized pectorals of the Tunny, the dorsals separated, like those of the Mackerel.

1. Auxis vulgaris, Cuv.

Similar in form to a Tunny, but more slender. Snout short and pointed, jaws equal. Teeth exceedingly small. The space between the dorsals greater than the length of the first dorsal. The lateral line is very small and hardly perceptible ; it is lost at the anterior portion of the corselet. Above, this species is blue ; with irregular blackish-blue lines and spots upon the sides. The corselet is greenish blue above ; the sides and abdomen are silvery.

D. (?). P. (?). V. (?). A. (?) C. (?) Length, 15 inches.

Caribbean Sea, Cuv.

L'Auxide commune, ou Bonitou (Auxis vulgaris, Cuv., Scomber bisus, Raf., Scomber Rochei, Risso, No. 165), Cuv. et Val., viii. p. 139, pl. 216.

2. Auxis Sloanei, Cuv.

Snout short ; mouth slightly cleft ; teeth small. Space large between the dorsals. Pectorals short. Second dorsal and anal higher and more pointed in proportion than in any other species of the genus.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Caribbean Sea, Sloane.

L'Auxide de Sloane, Scomber Sloanei, Cuv. et Val., viii. p. 148.

GENUS V. CYBIUM, Cuv.

These fishes have an elongated body without a corselet ; and large, compressed, sharp teeth. Their palatines have only short and even teeth.

1. Cybium maculatum, Cuv.

Cylindrical, elongated. The top of the head and the upper part of the sides of the body are of a dark leaden color ; the sides are lighter ; the jaws, opercula, and abdomen are of a beautiful clear white, presenting a satin-like appearance ; the dorsal ridge, throughout its whole extent, is of a beautiful dark green color ; twenty or more bright yellow spots, the largest being three eighths of an inch in diameter, situated above and beneath the lateral line, ornament its sides ; the most anterior of these spots is beneath the pectoral fins ; the largest number of the spots is anterior to the dorsal fin. Lateral line undulating in its course. Eight finlets back of second dorsal and anal fins.

D. 18 – 2 | 15 – 9. P. 20. V. 4. A. 2 | 16. C. 26. Length, about 2 feet.

Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL. Gulf of Mexico, CUV.

Scomber maculatus, Spanish Mackerel, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 426, pl. 6, fig. 8.
Le Tassard tacheté (Cybium maculatum, CUV., Scomber maculatus, MITCH.), CUV. et VAL., VIII. p. 181.
Cybium maculatum, Spotted Mackerel, STORER, Bost. Journ. Nat. Hist., IV. p. 179.
" " Spotted Cybium, DEKAY's Report, p. 108, pl. 73, fig. 232.

2. Cybium regale, CUV.

Back plumbeous, sides and abdomen silvery. A broad, brownish, longitudinal band, with oblong spots above and beneath it. Teeth compressed and trenchant.

D 17 – 2 | 15 – 8. P. 22. V. 1 – 5. A. 2 | 14 – 8. C. 17 and 15. Length, 1 or 2 feet.

Caribbean Sea, CUV.

Scomber regalis, BLOCH, pl. 333 ?
" " Thazard Mackerel, SHAW's Gen. Zoöl., IV. p. 583.
Le Tassard royal (Cybium regale, CUV., Scomber regalis, BL.), CUV. et VAL., VIII. p. 184.
Cybium regale, DEKAY's Report, p. 108.

3. Cybium acervum, CUV.

Silvery, violet, or plumbeous upon the back. The fins are gray, except the first dorsal, which has a black spot extending from the first to the sixth or seventh ray ; the commencement of the second dorsal is blackish. Teeth trenchant, as in C. regale, but less numerous.

D. 17 – 2 | 15 – 8. P. (?). V. (?). A. 2 | 15 – 8. C. (?). Length, 9 inches.

Gulf of Mexico, Caribbean Sea, CUV.

Le Tassard sierra, Cybium acervum, CUV. et VAL., VIII. p. 186.

4. Cybium caballa, CUV.

Above plumbeous ; sides and abdomen silvery ; plumbeous oval spots upon the sides ; pectorals margined with black.

D. 14 – 2 | 15 – 9. P. (?). V (?). A. (?). C. (?). Length, nearly 3 feet.

Caribbean Sea, CUV.

Le Tassard guarapucu, Cybium caballa, CUV. et VAL., VIII. p. 187.

5. Cybium immaculatum, CUV.

Body compressed. Of a russet-gray color ; abdomen silvery ; fins of a russet-gray. No black spot upon the dorsal.

B. 7. D. 15 – 2 | 12 or 13 – 9. P. 22. V. 1 – 5. A. 2 | 14 – 9. C. 30. Length, 6 or 7 inches.

Caribbean Sea, Cuv.

Le Tassard sans taches, Cybium immaculatum, Cuv. et Val., viii. p. 191.

GENUS VI. GEMPYLUS, Cuv.

These fishes have their anterior teeth longer than the others; their palate is without teeth; and their ventrals are almost imperceptible.

1. Gempylus serpens, Cuv.

Skin smooth. Silvery or plumbeous. Upper part of the dorsal fin black. The pectorals are also dusky, except their inferior rays, which are whitish. Jaws with a row of compressed, trenchant, pointed teeth.

D. 31, 13 – 6. P. 14. V. 1 – (?). A. 10 – 6. C. 17 and some accessories. Length, 2 to 3 feet.

Caribbean Sea, Cuv.

Le Gempyle serpent (Gempylus serpens, Cuv., Scomber serpens, Solander), Cuv. et Val., viii. p. 207.

GENUS VII. TRICHIURUS, L.

Head pointed; body without scales, elongated, compressed, thin, riband-shaped. No ventral fins, nor scales instead; no anal fin; a single continuous dorsal fin; tail without rays, ending in a single elongated hair-like filament, from which the generic name is derived. Branchiostegous rays, seven. A single row of compound, cutting, and pointed teeth.

1. Trichiurus lepturus, L.

Silvery, with a golden lateral line. The dorsal fin, which has a yellowish tinge, reaches from the back of the head to the tail, which is finless, and ends in an attenuated point. Lower jaw projects, and has two teeth jutting beyond the upper, when the mouth is shut. The upper jaw has in front from three to six teeth larger than the rest. All the teeth of the larger order are jagged on the inner or hinder sides, with a single barb towards the points.

D. 133, 135, or 136. P. 11 or 12. Length, 2 to 3 feet.

Massachusetts, Storer. New York, Mitchill, Cuv., Dekay. Gulf of Mexico, Caribbean Sea, Cuv.

Called "Sword-fish," at Jamaica.

Trichiurus lepturus, LIN., BLOCH, v. p. 55, pl. 158.
Trichiurus argenteus, Silver Trichiure, SHAW's Gen. Zoöl., IV. p. 90, fig. 12.
Trichiurus lepturus, STRACK's Plates, XX. fig. I.
" " BROWNE's Jamaica, pl. 45, fig. 4.
Trichiurus argenteus, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 364.
Le Trichiure de l'Atlantique (Trichiurus lepturus, L.), CUV. et VAL., VIII. p. 237.
Trichiurus lepturus, Silvery Hair-tail, YARRELL's Brit. Fishes (2d edit.), I. p. 204.
" " STORER, Bost. Journ. Nat. Hist., IV. p. 181.
" " DEKAY's Report, p. 109, pl. 12, fig. 35.

GENUS VIII. XIPHIAS, LIN.

Body fusiform, covered with minute scales ; a single elongated dorsal fin ; ventral fins wanting ; tail strongly carinated ; upper jaws elongated, forming a sword ; mouth without teeth ; branchiostegous rays, seven.

1. Xiphias gladius, LIN.

Body elongated, but slightly compressed. Surface of body smooth. Back and upper part of sides of a sky-blue color, beneath silvery gray. Gill-covers silvery brown. Upper part of the head nearly flat, slightly descending to the base of the sword, which is formed by an extension of the vomer, maxillary, and intermaxillary bones; extremity of sword pointed; upper part of sword dark brown, almost black, having a dorsal ridge, within which is a groove; under portion of the sword lighter colored, smooth, with a velvety feel. In the young fish, the dorsal fin is entire; but in the adult fish a great part of the central portion of the fin is missing, supposed to be worn away by use.

D. 18 – 3. P. 15. A. 11 – 3. C. 17. Length, 10 to 12 feet.

Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

Xiphias gladius, LIN., Syst. Nat, p. 432.
" " Common Sword-fish, SHAW's Gen. Zoöl., IV. p. 99, fig. 14.
" " " " STRACK's Plates, XXI. fig. 1.
" " " " PENNANT's Arc. Zoöl., II. p. 113.
" " " " GRIFFITH's Cuv., X. p. 187, pl. 27, fig. 1, and Supplement, on the Acanthopterygii, p. 349.
L'Espadon épée (Xiphias gladius, LIN.), CUV. et VAL., VIII. p. 255, pl. 225 and 226
Xiphias gladius, WILSON, Encyclop. Brit., Art. Ichth., p. 184, pl. 202.
" " JENYNS's Brit. Vert., p. 361.
" " YARRELL's Brit. Fishes (2d edit.), I. p. 164, fig.
" " STORER's Report, p. 51.
" " DEKAY's Report, p. 111, pl. 26, fig. 79.

GENUS IX. NAUCRATES, RAF.

Body covered with small scales ; dorsal fin single, elongated ; free spinous rays before the dorsal and anal fins ; sides of the tail carinated ; teeth small, numerous ; branchiostegous rays, seven.

1. Naucrates ductor, L.

Form somewhat similar to that of the Mackerel. Of a silvery grayish-blue color, darkest on the back, much paler on the belly; five dark-blue transverse bands pass around the whole body; indications of two other bands, one on the head, the other on the tail; pectoral fins clouded with white and blue; ventrals nearly black.

D. 4-26. P. 18. V. 1-5. A. 2-16. C. 17. Length, 12 inches.

Caribbean Sea, CUV.

The "Common Pilot-fish."

Gasterosteus ductor, LIN., Syst. Nat., I. p. 489.
Scomber ductor, BLOCH, p. 338.
" " SHAW'S Gen. Zoöl., IV. p. 586.
Le Pilote commun (Naucrates ductor, CUV., Scomber ductor, LIN.), CUV. et VAL., VIII. p. 312, pl. 232.
Naucrates ductor, GRIFFITH'S CUV., p. 189, pl. 47, fig. 1.
" " WILSON, Encyclop. Brit., Art. Ichth., p. 184.
Centronotus ductor, CUV., JENYNS'S Brit. Vert., p. 365
Naucrates ductor, YARRELL'S Brit. Fishes (2d edit.), I. p. 170.
" " DEKAY'S Report, p. 113.

2. Naucrates Noveboracensis, CUV.

Four transverse blue bands, and four spines before the dorsal. Opercle not striated.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Connecticut, LINSLEY. New York, MITCHILL, CUV.

Scomber ductor, Pilot-fish, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 424.
Le Pilote de New York, Naucrates Noveboracensis, CUV. et VAL., VIII. p. 325.
Naucrates Noveboracensis, DEKAY'S Report, p. 112.

GENUS X. LICHIA, CUV.

Body compressed; detached spines in front of the dorsal fin, and anterior to these is one inclined forwards; two spines in front of the anal fin; tail without lateral keels.

1. Lichia Carolina, DEKAY.

Body compressed; its height to its length is nearly as one to two. First rays of the second dorsal and anal fins very large. Upper part of the head and body bluish. Gill-covers of a faint flesh-color mingling with yellowish and silvery reflections on the sides and beneath.

D. 1, 6-25. P. 27. V. 1-5. A. 2-20. C. $18\frac{6}{6}$. Length, 1 foot.

New York, Carolina, DEKAY.

Lichia Carolina, Carolina Lichia, DEKAY'S Report, p. 114, pl. 10, fig. 30.

GENUS XI. CHORINEMUS, Cuv.

In the general characters similar to the Lichia; but the rays of the second dorsal or anal are either entirely separated, or united by so delicate a membrane that it is easily destroyed, and they appear like the spinous fins of the Mackerel and Tunny.

1. Chorinemus saliens, Cuv.

Form of the Tunny. Darkish blue upon the back; silvery on the sides and abdomen; fins pale, with a yellowish cast. In spirit, a silvery brown, darker upon the back; the fins are gray or russet, excepting the ventrals, which are white. The anterior portion of the second dorsal brown. Four free spines upon the back, besides the horizontal one.

D. 4, 1-19. P. 17. V. 1-5. A. 2, 1-20. C. 23. Length, 20 inches.

Caribbean Sea, Cuv.

Called "Sauteur," at Martinique.

Scomber saliens, Salient Mackerel, Bloch, pl. 335?
" " " " Shaw's Gen. Zoöl., iv. p. 585.
Le Chorinème sauteur (Scomber saliens, Bl., Scomberoide sauteur, Lacep.), Cuv. et Val., viii. p. 389.

2. Chorinemus saltans, Cuv.

Of a beautiful silvery, bluish upon the back. The profile is slightly concave, which makes the snout to appear a little pointed. The first dorsal composed of five free spines. It receives its specific name from its sudden motions. It is called the *Leather-coat* at Jamaica, on account of the thickness of its skin, which is of the consistence of leather.

D. 5, 1-19. P. 17. V. 1-5. A. 2, 1-19. C. 23. Length, 9 or 10 inches.

Caribbean Sea, Cuv.

Le Chorinème danseur (Chorinemus saltans, Cuv., Gasterosteus occidentalis, Lin.), Cuv. et Val., viii. p. 393.

3. Chorinemus quiebra, Cuv.

Of the same color as the preceding species. Its profile is slightly convex, instead of being concave as in the saltans. The second dorsal is proportionally shorter than in that species.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, (?).

Caribbean Sea, Cuv.

Quiebra-acha, Parra, p. 21, pl. 12, fig. 2.
Le Chorinème quièbre, Chorinemus quiebra, Cuv. et Val., viii. p. 396.

GENUS XII. TRACHINOTUS, Cuv.

Body elevated, compressed. Profile descending abruptly before the eyes. First rays of the dorsal and anal elongated. Free spines before the dorsal and anal fins.

1. Trachinotus glaucus, Cuv.

Compressed, ovate. Of a beautiful silvery color; blue above; on each side, three, four, or five narrow, transverse black bands. Dorsal and anal fins blue, very long, and reaching to the centre of the tail, which is very widely forked.

D. 6, 1-19. P. 17. V. 1-5. A. 2, 1-18. C. 17. Length, 10 to 18 inches.

Gulf of Mexico, Caribbean Sea, Cuv.

Called "Pampano," "Pampaneto," at Havana.

Chætodon glaucus, Bloch, vi. p. 76, pl. 210.
" " Glaucus chætodon, Shaw's Gen. Zoöl., iv. p. 357.
Le Trachinote glauque, Trachinotus glaucus, Cuv. et Val., viii. p. 400.

2. Trachinotus rhomboides, Bloch.

Rhombic, ovate. Above of a gray or greenish blue color, on the sides white, and on the abdomen pale yellow; the blue of the upper parts breaks into the white of the sides in two or three acuminated bars, or fasciæ, reaching almost to the abdomen. Dorsal, anal, and caudal, blue, tinged with yellow at their base; pectorals and ventrals yellow.

D. 6, 1-19. P. 18. V. 1-5. A. 2, 1-19. C. 17. Length, 20 inches.

Caribbean Sea, Cuv.

Chætodon rhomboides, Bloch, vi. p. 75, pl. 209.
" " Rhomboid Chætodon, Shaw's Gen. Zoöl., iv. p. 358.
Le Trachinote rhomboide, Trachinotus rhomboides, Cuv. et Val., viii. p. 407.

3. Trachinotus cupreus, Cuv.

Oblong. Of a copper color, with golden reflections upon the opercula and breast.

D. 5 or 6, 1-24. P. (?). V. (?). A. 2, 1-21. C. (?). Length, 4½ inches.

Caribbean Sea, Cuv.

Le Trachinote cuivré, Trachinotus cupreus, Cuv. et Val., viii. p. 414.

4. Trachinotus spinosus, Mitchill.

Body very much compressed, suborbicular; olive-green on the sides above; with metallic reflections beneath. Seven free spines before the dorsal, and three before the anal fin.

D. 7-19. P. 19. V. 1-5. A. 3-19. C. 18. Length, 3 inches.

New York, Mitchill.

Spinous Dory, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. pl. 6, fig. 10, no description.
" " Zeus spinosus, Mitchill, Amer. Month. Mag., ii. 246.
Trachinotus spinosus, Spinous Trachinote, Dekay's Report, p. 117.

Dr. Dekay considers this distinct from the T. fuscus, Cuv. et Val., viii. p. 410.

5. Trachinotus argenteus, Cuv.

Body elevated; height to its length as one to two. Silvery, with blackish at the extremity of the dorsal, and on the middle of the pectoral. Five or six free spines on the back, besides the recumbent spine and that which is attached to the dorsal.

D. 5 or 6 – 24. P. 18. V. 1 – 5. A. 2, 1 – 21. C. 17⅝. Length, 6 inches.

New York, Cuv.

Le Trachinote argenté, Trachinotus argenteus, Cuv. et Val., viii. p. 413.
Trachinotus argenteus, Dekay's Report, p. 116.

6. Trachinotus pampanus, Cuv.

Of a grayish brown color, changing to a deeper brown upon the back, as appearing when preserved in spirits. Scales very small. The fins are brown, without spots. Five or six very small free spines upon the back. Lateral line almost imperceptibly undulated.

D. 5, 1 – 24. P. 18. V. 1 – 5. A. 2, 1 – 21. C. 17 et 8. Length, 13 or 14 inches.

South Carolina, Cuv.

Le Trachinote pamplé, Trachinotus pampanus, Cuv. et Val., viii. p. 415, pl. 237.

GENUS XIII. PALINURUS, Dekay.

Preopercle serrated, with spines on its margin. Opercle with one or more flat spines, more or less distinctly serrated beneath. Anal with one or more spines in front. Teeth small, pointed, subequal. Body compressed, oblong. The anterior portion of the single dorsal spinous.

1. Palinurus perciformis, Mitchill.

Body oblong, compressed. Seven short spines precede the fleshy rays of the dorsal, which are connected with each other by a low membrane; the posterior is united throughout, about its entire height, to the membrane of the dorsal. Color, in the living fish, a bright bronze black, with obscure reddish hues. Abdomen light colored. When preserved in spirits, it is of a bluish white upon the sides, looking as if covered with black dots, owing to the dark outline of the scales; beneath, of a dull white color.

D. 7, 1 – 19. P. 19. V. 1 – 5. A. 2, 1 – 17. C. 20. Length, 9 inches.

Massachusetts, Storer. New York, Mitchill, Dekay.

Called "Rudder-fish," at Martha's Vineyard.

Rudder-fish, or Perch Coryphene, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. pl. 6, fig. 7, no description.
" " " Coryphæna perciformis, Mitchill, Amer. Month. Mag., ii. p. 244.
Trachinotus argenteus, Storer's Report, p. 55.
Palinurus perciformis, Black Pilot, Dekay's Report, p. 118, pl. 24, fig. 75.

GENUS XIV. NOTACANTHUS, Bloch.

The body is very long, compressed, covered with soft small scales; the snout is obtuse, projecting beyond the mouth, which is furnished with fine and close teeth. A series of free spines, unconnected by a membrane, in place of a dorsal fin; free spines before the anal, which is long, and joins the caudal; ventrals remote from the pectorals, under the abdomen.

1. Notacanthus nasus, Bloch.

Its form is riband-like, being greatly elongated and compressed. The anus is about one seventh of the total length nearer to the snout than to the tip of the caudal. There are about eighty rows of scales in a longitudinal line. There are about thirty cylindrical, slightly flattened teeth crowded into a single row on each side of the upper jaw, and more slender, pointed, and slightly curved ones in the lower jaw, disposed in three or four rows anteriorly, and in one, on the sides.

D. 10. P. 17. V. 1-8. A. 13-116. C. 8. Length, 2½ feet.

Greenland, O. Fabricius.

Acanthonotus nasus, Bloch, xii. p. 113, pl. 431.
" " Snouted Acanthonotus, Shaw's Gen. Zoöl., v. p. 93, fig. 106.
Le Notacanthe nez (Notacanthus nasus, Bl.), Cuv. et Val., viii. p. 467, pl. 241.
Notacanthus nasus, Beaked Notacanth, Rich., Fauna Boreal. Americ., iii. p. 82.

GENUS XV. CARANX, Cuv.

Body covered with small scales, with the exception of the lateral line; lateral line armed with a series of broad scales, those on the posterior half of the body having an elevated horizontal keel in the centre, forming a continuous ridge, each scale ending in a point directed backwards; two distinct dorsal fins; free spines before the anal fin; teeth exceedingly minute; branchiostegous rays, seven.

1. Caranx Plumieri, Cuv.

Above bluish black; beneath silvery; golden reflections upon the sides, forming bands. The lower edge of the operculum is slightly concave, and it has a semicircular emargination. Thirty to thirty-six bony plates upon the lateral line, which is but very slightly curved.

D. 8, 1-26. P. 20. V. 1-5. A. 2, 1-22. C. 17. Length, 8 or 9 inches.

Caribbean Sea, Cuv.

Called "Coulirou," at St. Bartholomew and Guadaloupe.

Scomber Plumieri, Bloch, pl. 311?
" " Plumier's Mackerel, Shaw's Gen. Zoöl., iv. p. 598.
Le Caranx de Plumier, Caranx Plumieri, Cuv. et Val., ix. p. 65.

2. Caranx Blochii, Cuv.

Silvery, tinged with blue or green above. The head is less than a quarter of its whole length; the inferior edge of the operculum convex, and slightly emarginated.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, 11 to 14 inches.

Gulf of Mexico, Cuv.

Scomber ruber, Bloch, pl. 342 ?
" " Red Mackerel, Shaw's Gen. Zoöl., iv. p. 600, pl. 86.
Le Caranx de Bloch, Caranx Blochii, Cuv. et Val., ix. p. 69.

3. Caranx carangus, Cuv.

Body compressed; its greatest height is one third its whole length; its thickness is equal to one third its height. Of a beautiful silver-color, plumbeous or violet above; a black spot upon the operculum. The fins are yellow. The posterior edge of the extremity of the dorsal fin bluish; the margin of the tail brownish. A round black spot at the base of the pectoral fin. Twenty-nine or thirty plates upon the lateral line.

D. 7 or 8, 1 - 19 to 20. P. 22. V. 1 - 5. A. 2, 1 - 17. C. 17. Length, 2½ feet.

Gulf of Mexico, Caribbean Sea, Cuv.

Called "Jiguagua," at Havana.

Scomber carangus, Bloch, pl. 340?
" " Carang Mackerel, Shaw's Gen. Zoöl., iv. p. 599.
Le Carangue, Caranx carangus, Cuv. et Val., ix. p. 91.

4. Caranx punctatus, Cuv.

Cylindrical, with a single finlet behind the dorsal and anal fins. Greenish blue on the back; yellowish along the lateral line and on the caudal fin; silvery white on the throat, and belly whitish. A smutty oblong spot under each eye, and a dark spot on the margin of the operculum. Dorsals brownish. About twelve black points along the unarmed portion of the lateral line.

D. 10 - 7, 21 - 1. P. 19. V. 5. A. 2 - 9, 25 - 1. C. 19. Length, 8 inches.

Caribbean Sea, Cuv. New York, Mitchill.

Called "Quiaquia," at Martinique.

Hippos Mackerel, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. pl. 5, fig. 5.
Scomber hippos, Mitchill, Amer. Month. Mag., ii. p. 246.
Le Caranx ponctué, Caranx punctatus, Cuv. et Val., ix. p. 38.
Caranx punctatus, Spotted Caranx, Dekay's Report, p. 122, pl. 73, fig. 233.

5. Caranx chrysos, Mitchill.

Elongated, compressed. A naked, recumbent spine anterior to the first dorsal. No finlet. Of a greenish blue color upon the back and upper portion of the sides; the greater portion of the sides of a bright yellow color. An obscure dark-brown blotch at the posterior superior angle of the operculum. Abdomen yellowish white. Dorsal and pectoral fins yellowish brown. Ventral and anal fins the color of the sides. Caudal fin yellowish throughout the greater extent. Lateral line armed with about forty-eight bony plates.

D. 8, 1 - 24. P. 21. V. 1 - 4. A. 2, 1 - 20. C. 19¼. Length, 8 inches.

Massachusetts, Storer. New York, Mitchill, Cuv., Dekay.

Scomber chrysos, Yellow Mackerel, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 424.
Le Carangue jaune (Scomber chrysos, MITCH., Scomber hippos, LIN.), CUV. et VAL., IX. p. 98.
Caranx chrysos, Yellow Caranx, DEKAY's Report, p. 121, pl. 27, fig. 85.
" " " " STORER, Proceed. Bost. Soc. Nat. Hist., p. 148.

6. Caranx macarellus, Cuv.

Elongated. Pectorals moderate-sized; a finlet back of the dorsal and anal fins. Silvery, plumbeous above. A small black spot upon the operculum. Twenty-five small plates on the lateral line.

D. 8–1, 33–1. P. (?). V. (?). A. 2–1, 17–1. C. (?). Length, more than a foot.

Caribbean Sea, Cuv.

Le Caranx faux maquereau, Caranx macarellus, CUV. et VAL., IX. p. 40.

7. Caranx fallax, Cuv.

Differs from the carangus in having no black spot upon the operculum; in the second dorsal fin always having twenty-one soft rays; in having the edge of its anterior and pointed portion black; and in having all the fins of a less bright yellow. The number of lateral plates, thirty-five or thirty-six. Breast scaled; in the carangus naked.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 2 feet.

Gulf of Mexico, Caribbean Sea, Cuv.

Le fausse Carangue, Caranx fallax, CUV. et VAL., IX. p. 95.

8. Caranx pisquetus, Cuv.

Body more elongated than that of the carangus and fallax; the fins are greenish; the extremities of the caudal black. Forty-four or forty-five plates upon the lateral line.

D. 8, 1–24. P. (?). V. (?). A. 2, 1–20. C. (?). Length, 14 inches.

Gulf of Mexico, Caribbean Sea, Cuv.

Called "Pisquet," at St. Domingo; "Cojenudo," at Cuba.

Le Carangue pisquet, Caranx pisquetus, CUV. et VAL., IX. p. 97.

9. Caranx Bartholomæi, Cuv.

Less elongated than the pisquetus. Silvery, without any black spot. Fins yellowish; thirty-three to thirty-five plates on the lateral line.

D. 8, 1–26. P. (?). V. (?). A. 2, 1–22. C. (?). Length, 5 inches.

Caribbean Sea, Cuv.

La Carangue de Saint-Barthélémi, Caranx Bartholomæi, CUV. et VAL., IX. p. 100.

10. Caranx fasciatus, Cuv.

Above, greenish. Eight or ten vertical dull bands upon the sides. Lateral line with a high arch, assuming a straight course beneath the commencement of the second dorsal.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Gulf of Mexico, Cuv.

Le Caranx à bandes, Caranx fasciatus, Cuv. et Val., ix. p. 70.

This is described by Cuvier from a figure.

11. Caranx defensor, Dekay.

Elliptical, much compressed. A recumbent spine before the dorsal. No finlet. Back bluish, with a resplendent golden yellow on the sides. Ventrals, anal, and caudal, wax-yellow; the tips of the latter dusky. A dark round spot on the posterior margin of the opercle; another on the inner base of the pectoral, and occasionally a short, black, vertical bar across the middle of the pectoral fin. Dorsals brownish above. Chin satin-white. The straight portion of the lateral line furnished with twenty-five bony plates, commencing obscurely at first, but becoming more elevated, and terminating in acute triangular spines, directed backwards.

D. 7, 1 - 20. P. 20. V. 1 - 5. A. 2 - 17. C. $19\frac{6}{6}$. Length, 9 inches.

New York, Dekay.

Caranx defensor, Southern Caranx, Dekay's Report, p. 120, pl. 24, fig. 72.

GENUS XVI. BLEPHARIS, Cuv.

Body much compressed, trenchant, with a rapidly declivous front. Small and nearly concealed spines in advance of the dorsal fin. Anterior rays of the dorsal and anal fins prolonged into very long filaments. Ventrals elongated.

1. Blepharis crinitus, Akerly.

Body almost circular, much compressed, scaleless. Bluish above, white beneath. Dorsal fin with seven filamentous, and eleven bifid rays. The first filamentous ray much the longest, the others successively shorter; the bifid portion low and subequal.

D. 18. P. 17. V. (?). A. 16. C. (?). Length, 5.5.

Connecticut, Linsley. New York, Akerly.

Zeus crinitus, Hair-finned Dory, Akerly, Amer. Journ. Sc., ii. p. 144, pl.
Blepharis crinitus, Dekay's Report, p. 123, pl. 25, fig. 76.

2. Blepharis sutor, Cuv.

Rhomboidal; its length, including the caudal fin, is equal to once and a third its height. Plumbeous above, silvery upon the sides of the head, sides, and abdomen. Yellow spots upon the operculum. Fins of a yellowish brown. In immature specimens are seen four wide, vertical, dark bands upon the back.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Caribbean Sea, Cuv.

Called "Cordonnier," at Martinique.

Le Blepharis des Antilles, Blepharis sutor, Cuv. et Val., ix. p. 161.

3. Blepharis major, Cuv.

Its height equal to half its length. Silvery, fins of a dark gray color. A black spot at the upper part of the operculum. The first filament of the second dorsal extends beyond the tail. The plates upon the lateral line are angular only upon the sides of the tail.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, (?).

Caribbean Sea, Cuv.

Le grand Cordonnier, Blepharis major, Cuv. et Val., ix. p. 163.

GENUS XVII. ARGYREIOSUS, Lacep.

Body much compressed. Spines between the dorsal fins. Dorsal, ventral, and anal rays filamentous.

1. Argyreiosus vomer, Lacep.

Irregularly rhomboidal, compressed. Of a lustrous silvery color. Dorsal and ventral filaments blackish. One ray of the first dorsal elongated into a filament. The anterior rays of the second dorsal elongated, but not filamentous.

D. 1, 4 - 4. 2d D. 1 - 22. P. 17. V. 1 - 5. A. 2, 1 - 18. C. 17. Length, 3 inches.

New York, Gulf of Mexico, Caribbean Sea, Cuv.

Zeus vomer, Brazilian Dory, Lin., Bloch, vi. p. 33, pl. 193, fig. 2.
" " " " Shaw's Gen. Zoöl., iv. p. 281, pl. 41.
" " " " Silver-fish, Strack's Plates, xxxvii. fig. 3.
Zeus rostratus, Rostrated Dory, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 384, pl. 2, fig. 1.
Argyreiosus vomer, Lacep., iv. p. 569.
Abacatuia, Argyreiosus vomer, Cuv. et Val., ix. p. 177, pl. 255.
Argyreiosus vomer, Rostrated Argyreiose, Dekay's Report, p. 124, pl. 75, fig. 233.

2. Argyreiosus capillaris, Mitchill.

Form very similar to the preceding species. Of a beautiful silvery lustre, with several dark, almost black, transverse bands crossing the upper part of the sides; these bands disappear in the dead fish. The membranous rays of the first dorsal filamentous, the first exceedingly elongated; the anterior rays of the second dorsal also filamentous.

D. 8, 1 - 22. P. 17. V. 1 - 5. A. 2, 1 - 18. C. 17. Length, 4 inches.

Massachusetts, Storer. New York, Mitchill, Dekay.

Zeus capillaris, Hair-finned Dory, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 383, pl. 2, fig. 2.
Argyreiosus capillaris, Hair-finned Argyreiose, Dekay's Report, p. 125, pl. 27, fig. 82.

GENUS XVIII. VOMER, Cuv.

Body much compressed. Profile nearly vertical. No filaments nor prolongations of the fins.

1. Vomer Brownii, Cuv.

Compressed. Back carinate, horizontal, abruptly descending above the eye, and forming a concave profile. Of a lustrous silvery tint, passing into leaden on the back. Pectorals olive-green, verging to dusky. The membrane of the second dorsal minutely punctated with black, tinged at its base with light yellow. The first dorsal composed of seven spines. Ventrals minute.

D. 7, 1-23. P. 1-18. V. 1-3. A. 1-18. C. $16\frac{7}{7}$. Length, 1 foot.

Connecticut, Ayres. New York, Mitchill, Cuv., Dekay. Gulf of Mexico and Caribbean Sea, Cuv.

Zeus setapinnis, Bristly Dory, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 384, pl. 1, fig. 9.
Vomer de Brown, Vomer Brownii, Cuv. et Val., IX. p. 189, pl. 256.
Vomer Brownii, Blunt-nosed Shiner, Dekay's Report, p. 127, pl. 25, fig. 78.

GENUS XIX. SERIOLA, Cuv.

Lateral line with scales not larger than those on the rest of the body. First dorsal fin with a continuous membrane. No finlets.

1. Seriola zonata, Mitchill.

Fusiform, subcompressed. Of a bluish green color, with five or six broad, vertical, dusky bands over the body and tail; an oblique band on each side ascending from the nose through the eye to the first dorsal, and forming a sort of crescent in front. Dorsal fins deep olive; ventrals bright olive-green above; anal olive-green, margined with white.

D 7, 1-34 P. 19. V. 6. A. 1-20. C. $15\frac{3}{3}$. Length, 7.5.

New York, Mitchill, Dekay.

Scomber zonatus, Banded Mackerel, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 427, pl. 4, fig. 3
La Seriole à ceintures, Seriola zonata, Cuv. et Val., IX. p. 213.
Seriola zonata, Banded Seriole, Dekay's Report, p. 123, pl. 9, fig. 26.

Cuvier, in his "Règne Animal," considered this species synonymous with the Nomeus Mauritii; subsequently, however, in the ninth volume of his "Histoire Naturelle des Poissons," he made no reference to it in his genus Nomeus, but arranged it among the Seriolæ.

2. Seriola Boscii, Cuv.

Silvery, with a brownish band upon the temples; faint striæ on the opercles. The spines of the first dorsal fin very short and stout; the second dorsal far anterior.

D. 7, 1-31. P. (?). V. (?). A. 2, 1-20. C. (?). Length, $5\frac{1}{2}$ inches.

South Carolina, Cuv.

La Sériole de Bosc, Seriola Boscii, Cuv. et Val., ix. p. 209.
Seriola Boscii, Dekay's Report, p. 129.

3. Seriola fasciata, Bloch.

The back of a beautiful brown, with greenish metallic reflections. Sides beneath the lateral line a bright yellow. Sixteen narrow ribands in pairs over the body. A black transverse band from one eye to the other. Caudal yellowish; its upper lobe tinged with green; pectorals gray, tinged with green; ventrals green upon their superior face.

D. 7, 1 – 30 or 31. P. (?). V. (?). A. 2, 1 – 20 or 21. C. (?). Length, 6½ inches.

South Carolina, Cuv.

La Sériole rubanée, Seriola fasciata, Cuv. et Val., ix. p. 211.
Seriola fasciata, Dekay's Report, p. 129.

4. Seriola leiarchus, Cuv.

Silvery, plumbeous on the back. Three black spots on the dorsal and two on the anal. The ventral rays are whitish, their connecting membrane is black.

D. 7, 1 – 35. P. (?). V. (?). A. 2, 1 – 20. C. (?). Length, 9 inches.

Delaware, Cuv.

La Sériole à anus désarmé, Seriola leiarchus, Cuv. et Val., ix. p. 213.
Seriola leiarchus, Dekay's Report, p. 129.

5. Seriola cosmopolita, Cuv.

Body elevated and very much compressed. Silvery; back greenish, plumbeous, or violet-colored. A dark-colored spot upon the caudal fin near its base, and also a black spot at the origin of the pectoral fin, and another upon the edge of the operculum; the ventrals are very small.

D. 7, 1 – 28. P. 18. V. 1 – 5. A. 2, 1 – 27. C. 17. Length, 10 inches.

New York, Gulf of Mexico, Caribbean Sea, Cuv.

Called "Pot-pot," at St. Domingo.

La Sériole cosmopolita, Seriola cosmopolita, Cuv. et Val., ix. p. 219.
Seriola cosmopolita, Dekay's Report, p. 129.

6. Seriola falcata, Cuv.

Body elongated. Silvery, bluish upon the back. The anterior portion of the second dorsal, and of the second anal fin, rises up into a point, and is, in the first of these fins, almost as high as the body.

D. 7, 1 – 31. P. (?). V. (?). A. 2, 1 – 21. C. (?). Length, 28 inches.

Gulf of Mexico, Caribbean Sea, Cuv.

Called "El-mereal," at Porto Rico.

La Sériole à dorsale en faux, Seriola falcata, Cuv. et Val., ix. p. 210.

GENUS XX. CORYPHÆNA, Lin.

Body compressed, elongated, covered by small scales ; head compressed, profile circular ; eyes low, approaching the angle of the mouth ; dorsal fin rising from the cranium, and stretching continuously to the tail, towards which it decreases in elevation.

1. Coryphæna globiceps, Dekay.

Body compressed, elongated. Head prominent, rounded, and much compressed above. Length of the lobes of the caudal fin to the whole length as 1 to 4 – 8. According to the colored figure of this species in Dr. Dekay's Report, it is of a bluish green color, with yellow and reddish blotches. The dorsal, pectoral, and ventral fins are reddish brown. The caudal is green at its base, and blue at its extremities.

D. 63. P. 21. V. 7. A. 29. C. $19\frac{7}{7}$. Length, 42 inches.

New York, Mitchill, Dekay.

Coryphæna hippuris, Common Coryphene, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 373.
Coryphæna globiceps, Bottle-headed Dolphin, Dekay's Report, p. 132, pl. 10, fig. 29.

2. Coryphæna Sueurii, Cuv.

The height of the anterior rays of the dorsal fin to its length as one to seven and a half.

D. 64. P. (?). V. (?). A. 26. C. (?). Length, 3 feet.

Coast of the United States, Cuv.

La Coryphène de Lesueur, Coryphæna Sueurii, Cuv. et Val., ix. p. 302.

3. Coryphæna virgata, Cuv.

Back blue or green, spotted with yellow ; the sides of the head and the abdomen white. The lower portion of the dorsal fin yellow, the upper blue ; all the other fins yellow.

D. 44. P. (?). V. (?). A. 25. C. (?). Length, (?).

Caribbean Sea, Cuv.

La Coryphène rayée, Coryphæna virgata, Cuv. et Val., ix. p. 308.

4. Coryphæna dorado, Cuv.

Much more elongated than the C. Sueurii. Spotted with black. The longest rays of the dorsal nearly equal to one sixth the length of the fin. The oblong scales are larger than those of any other Coryphene.

D. 60 or 61. P. (?). V. (?). A. 27. C. (?). Length, 3 feet, 8 inches.

Caribbean Sea, Cuv.

La Coryphène dorade, Coryphæna dorado, Cuv. et Val., ix. p. 303.

5. Coryphæna dolfyn, Cuv.

The crest is lower, the rays of the dorsal fin are more slender, the ventrals are narrower and shorter, and the scales are smaller, than in the C. dorado. Green above, beneath yellow, sprinkled over the entire surface with blue spots; dorsal fin blue, anal yellow.

D. 59. P. (?). V. (?). A. 27. C. (?). Length, 3 feet, 3 inches.

Caribbean Sea, Cuv.

La Coryphène dauphin, Coryphæna dolfyn, Cuv. et Val., ix. p. 305.

GENUS XXI. TEMNODON, Cuv.

Has the tail unarmed, the little fins or the detached spines before the anal, as in Seriola; the first dorsal is fragile and low, the second and the anal are covered with small scales; but the principal character consists in a row of separated, pointed, and cutting teeth at each jaw; behind the upper ones is a row of smaller teeth, and there are some fine as velvet on the vomer, palate, and tongue. The operculum terminates in two points, and there are seven rays to the gills.

1. Temnodon saltator, Cuv.

Body oblong, subcylindrical, compressed. All the upper part of the body of a bluish color; lower part of the sides, as well as of the abdomen, whitish. Pectorals, second dorsal, and caudal fins, greenish brown. Ventral and anal fins white, tinged with blue.

D. 7-26. P. 17. V. 6. A. 28. C. 19. Length, 18 inches.

Massachusetts, Storer. Connecticut, Ayres, Linsley. New York, Mitchill, Dekay. South Carolina, Lin., Cuv.

Saltatrix, Skipjack, Green-fish, Lin., Catesby's Hist. Carol., ii. pl. 14.
Gasterosteus saltatrix, Skipping Stickleback, Shaw's Gen. Zool., iv. p. 609.
Scomber plumbeus, Horse Mackerel, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 424, pl. 4, fig. 1.
Le Temnodon sauteur, Temnodon saltator, Cuv. et Val., ix. p. 225, pl. 260.
Temnodon saltator, Blue-fish, Storer's Report, p. 57.
" " " Dekay's Report, p. 130, pl. 26, fig. 81.

GENUS XXII. LAMPUGUS, Cuv.

Head oblong; central crest of the forehead much lower than in the Coryphæna; dorsal fin equal, and low throughout its whole extent.

1. Lampugus punctulatus, Cuv.

Sea-green above the lateral line; silvery on the sides, with metallic reflections on the opercles. Dark reddish-brown stripes across the head; a series of distant rounded spots along the base of the dorsal fin; a few scattering ones on the back part of the head, and confused series of similar spots on the sides below the lateral line. Dorsal, pectorals, and ventrals, brown; anal and caudal light colored. The last ten or twelve rays of the dorsal somewhat elevated.

D. 53. P. 20. V. 5. A. 25. C. $18\frac{4}{4}$. Length, 2 feet.

New York, DEKAY.

Le Lampuge ponctué, Lampugus punctulatus, CUV. et VAL., IX. p. 327.
Lampugus punctulatus, Spotted Lampugus, DEKAY's Report, p. 134, pl. 11, fig. 31.

GENUS XXIII. PTERACLIS, GRONOV.

Head and teeth as in the Coryphæna, but the scales are larger; the ventrals are very small, and placed upon the throat; the dorsal and anal fins are very much extended, and as high as the fish itself.

1. Pteraclis Carolinus, CUV.

Silvery, with bluish reflections. The fourth dorsal ray longest.

D. 52. P. (?). V. (?). A. 44. C. (?). Length, 4 inches.

South Carolina, CUV.

Le Pteraclis de la Caroline, Pteraclis Carolinus, CUV. et VAL., IX. p. 368.
Pteraclis Carolinus, DEKAY's Report, p. 138.

GENUS XXIV. RHOMBUS, LACEP.

Head and body compressed. Body covered with minute scales. Extremity of the pelvis forming, anterior to the anus, a small, pointed, and cutting blade, which resembles a vestige of the ventral fins. A horizontal, partially concealed spine before the dorsal and anal fins.

1. Rhombus longipinnis, MITCHILL.

Form elevated, oval, and compressed. Silvery, with tints of blue, green, and iridescent; dusky on the head, and with inky patches on the belly towards the tail, which, in certain lights, appear beautifully red and purple; back bluish, with occasional clouds. Anterior rays of the dorsal and anal fins more than half the length of their respective bases.

D. 3-44. P. 23. A. 4-43. C. $19\frac{3}{3}$. Length, 7 inches.

New York, MITCHILL, DEKAY. South Carolina, LIN., CUV.

Chætodon alepidotus, LIN., Syst. Nat.
" " SHAW's Gen. Zool., IV. p. 370.
Stromateus longipinnis, Harvest-fish, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 366.
Le Rhombe à longues nageoires, Rhombus longipinnis, CUV. et VAL., IX. p. 401, pl. 274.
Rhombus longipinnis, Long-finned Harvest-fish, DEKAY's Report, p. 136, pl. 75, fig. 239.

2. Rhombus triacanthus, Peck.

Body ovate, very much compressed, particularly at the abdomen ; more elongated than the preceding ; its anterior dorsal and anal rays slightly elevated. Of a leaden color upon the back, lighter on the sides, silvery upon the abdomen. Cheeks, intermaxillaries, chin, base of pectorals, and base of caudal fin, together with more or less of the abdomen, sprinkled with very minute black dots. Opercles cupreous. Besides the lateral line are two others, one above and the other beneath the lateral, which curve backwards with the body and terminate at the fleshy portion of the tail. Twenty or thirty small circular black punctures, the orifices of numerous ducts, on each side of the base of the dorsal fin.

D. 45. P. 21. A. 43. C. 20. Length, 10 inches.

New Hampshire, Peck. Massachusetts, Storer. Connecticut, Ayres, Linsley. New York, Mitchill, Cuv., Dekay.

Stromateus triacanthus, Peck, Mem. Amer. Acad., II. p. 48, pl. 2, fig. 2.
Stromateus cryptosus, Cryptous Broad Shiner, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 365, pl. 1, fig. 111.
Peprilus cryptosus, Cuv., Griffith's Cuv., x. p. 203.
Le Rhombe à fossettes, Rhombus cryptosus, Cuv. et Val., IX. p. 403.
Peprilus triacanthus, Three-spined Peprilus, Storer's Report, p. 60.
Rhombus triacanthus, Short-finned Harvest-fish, Dekay's Report, p. 137, pl. 75, fig. 80.

If all the species of this genus have the *three spines* which are so well marked in this species, it may be thought necessary to change Peck's specific name, which now has the priority ; in which case Mitchill's specific name will be very appropriately substituted.

GENUS XXV. LAMPRIS, Retzius.

Body oval, greatly compressed, scales small ; a single elevated and elongated dorsal fin, which has but one small spine at the base of its anterior edge ; there are ten very long rays to each ventral ; the lobes of their caudal are also very long, but all these prolongations become worn away with age. Sides of the tail carinated ; teeth wanting ; branchiostegous rays, seven.

1. Lampris guttatus, Retzius.

The upper part of the back and sides are of a rich green, reflecting both purple and gold in different lights, passing into yellowish green below ; above and beneath the lateral line are various round yellowish-white spots, from which the fish received the name of *Luna;* the irides are scarlet ; all the fins are bright vermilion.

D. 2 – 52. P. 28. V. 1 – 9. A. 1 – 25. C. 30. Length, 4 to 5 feet.

Newfoundland, Pennant.

Zeus Luna, GMEL., LIN., Syst. Nat., p. 1225.
Zeus opah, PENN., Brit. Zoöl.
" " Opah Dory, SHAW's Gen. Zoöl., IV. p. 287, pl. 42.
Zeus imperialis, SHAW, Nat. Miscellany, pl. 140.
Lampris Luna, Opah, or King-fish, JENYNS's Brit. Vert., p. 369.
Lampris guttata, RETZ., GRIFFITH's CUV., X. p. 200, pl. 58, fig. 2.
Le Lampris tacheté (Lampris guttatus, RETZ.), CUV. et VAL., X. p. 39, pl. 282.
Lampris guttatus, RICH., Fauna Boreal. Americ., III. p. 83.
" " WILSON, Encyclop. Brit., Art. Ichth., p. 189, pl. 303, fig. 6.
" " YARRELL's Brit. Fishes (2d edit.), I. p. 194, fig.

GENUS XXVI. ELACATE, CUV.

Head depressed. No carina on the sides of the tail. No finlets. No free spines before the anal. Ventral fin thoracic.

1. Elacate Atlantica, CUV.

General form of an Echineis. Black above; lighter on the sides. Beneath the lateral line, a slate-colored longitudinal band extends from the pectoral fin to the tail. Beneath silvery white. Eight triangular spines anterior to the dorsal fin. Dorsal long, triangular anteriorly, situated midway between the base of the pectoral and the origin of the anal fin. Pectorals long, falciform. Caudal deeply lunate, its upper lobe longest, and its rays projecting beyond the membrane.

D. 8-34. P. 20. V. 1-5. A. 23. C. 21. Length, 32 inches.

Massachusetts, South Carolina, DEKAY. New York, MITCHILL.

Scomber niger, Black Mackerel, BLOCH, SHAW's Gen. Zoöl., IV. p. 593.
Centronotus spinosus, Crab-eater, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 490, pl. 3, fig. 9.
L'Ecate d'Amérique, Elacate Atlantica, CUV. et VAL., VIII. p. 334.
Elacate Atlantica, Northern Crab eater, DEKAY's Report, p. 113, pl. 25, fig. 77.

FAMILY VIII. TEUTHIDÆ.

Body compressed, ovate, oblong. Mouth small, not protractile. Teeth often dentated, and disposed in a single row in both jaws. Palate and tongue smooth. A single dorsal, usually long.

GENUS I. ACANTHURUS, BLOCH.

Teeth cutting and serrated. A movable spine on the side of the tail. Head deep, compressed. Eyes placed high up on the head. The skin thick, and usually covered with small scales.

1. Acanthurus phlebotomus, CUV.

Deep brown. Pectorals partly yellow. Opercles deeply striated; the scapular bone also striated. Tail nearly even.

D. 9 - 24. P. 15. V. 1 - 5. A. 3 - 23. C. 16. Length, 7 to 12 inches.

New York, Gulf of Mexico, Caribbean Sea, Cuv.

Barbero, PARRA, p. 45, pl. 21, fig. 2.
L'Acanthure saigneur, Acanthurus phlebotomus, Cuv. et VAL., x. p. 176, pl. 287.
Acanthurus phlebotomus, Surgeon, DEKAY's Report, p. 139, pl. 73, fig. 231.

2. Acanthurus cœruleus, Bloch.

Of a bright blue color. Dorsal and anal rayed alternately with light and dark blue.

D. 9 - 27. P. 15 or 12. V. 1 - 5. A. 3 - 25. C. 16. Length, 4 to 8 inches.

South Carolina, Florida, CATESBY. Caribbean Sea, Cuv.

Turdus rhomboidalis, Tang, CATESBY's Hist. Carol., II. pl. 10, fig. 1.
" " " BROWNE's Jamaica, p. 454.
L'Acanthure bleu (Acanthurus cœruleus, BL.), Cuv. et VAL., x. p. 179.
Acanthurus cœruleus, DEKAY's Report, p. 140.

3. Acanthurus chirurgus, Bloch.

Brown, tinged with yellow. Vertical blackish lines upon the flanks, which do not reach either the back or the belly; in some specimens, where they are most marked, twelve or thirteen exist, which commence back of the ear and terminate in front of the spines anterior to the tail; in some specimens these bands do not exist. Ventrals blackish, pectorals yellowish; very fine, blackish, radiating lines upon the dorsal.

D. 9 - 23. P. 15. V. 1 - 5. A. 3 - 22. C. 16. Length, 10 or 11 inches.

Caribbean Sea, Cuv.

Chætodon chirurgus, BLOCH, VI. p. 74, pl. 208.
Acanthurus chirurgus, Lancet Acanthurus, SHAW's Gen. Zoöl., IV. p. 379, pl. 52.
L'Acanthure chirurgien (Acanthurus chirurgus, BL., SCHN.), Cuv. et VAL., x. p. 168.

FAMILY IX. TÆNIDÆ.

Very similar to the Scombridæ. They often have the elongated dorsal fin, as well as the anal when it exists, united to the caudal. The articulated rays are generally simple. The ventrals are frequently a single ray, or less than five; the position of these fins beneath the throat causes them to resemble the Blennius.

GENUS I. STYLEPHORUS, Shaw.

Body very long, compressed. Snout lengthened, directed upwards, retractile towards the head by means of a membrane. Mouth without teeth. Eyes pedunculated, standing on a short, thick cylinder. Branchiæ, three pairs beneath the throat. Pectorals small; dorsal nearly as long as the back.

1. Stylephorus chordatus, Shaw.

Body elongated, compressed, destitute of scales, of a silvery or pearly color. The caudal fin, looking like a second dorsal, is composed of six rays, the first five of which are short; the sixth forms a hair-like cord, concave upon its sides, rounded above and beneath, which is more than twice the length of the body.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 10 to 11 inches, exclusive of tail.

Caribbean Sea, Shaw.

Stylephorus chordatus, Shaw, Lin. Trans., I. p. 90, pl. 6.
" " " Nat. Miscellany, VIII. pl. 274.
" " Chordated Stylephorus, Shaw's Gen. Zoöl., IV. p. 87, pl. 11.
" " Blainville, Journ. de Physique, LXXXVII. p. 60, pl. 1, fig. 1.
" " Griffith's Cuv., X. p. 211.
Stylephore à corde, Stylephorus chordatus, Cuv. et Val., X. p. 381.

FAMILY X. ATHERINIDÆ.

Mouth protractile; no notch on the upper jaw, nor tubercle on the lower. Suborbital not dentated. A broad silvery band on the side. Very small crowded teeth on the pharyngeals. The first branchial arch with long pectinations. Two dorsal fins, most commonly distant. Ventrals behind the pectorals.

GENUS I. ATHERINA, Lin.

Body elongated. Two dorsals widely separated; ventrals further back than the pectorals; the mouth highly protractile, and furnished with very minute teeth. A broad silvery band along each flank on all the known species.

1. Atherina menidia, Lin.

Light colored, the black points in the edge of the scales very small. Height one seventh of its length; its head is three tenths its whole length. Dorsals distant; the second dorsal nearly over the middle of the anal. One of the most elongated of the genus.

D. 5, 1-9. P. 15. V. 1-5. A. 1-25. C. 19. Length, 5 inches.

New York, Cuv. South Carolina, Lin., Dekay.

Called "Silver-fish," in Carolina.

Atherina menidia, Lin., Syst. Nat. (12th edit.), p. 519.
Atherina viridescens, Green-striped Silver-side, Mitchill, Trans. Lit. et Phil. Soc. of N. Y., I. p. 447.
L'Athérine menidie (Atherina menidia. Lin.), Cuv. et Val., X. p. 462.
Atherina menidia, Slender Silver-side, Dekay's Report, p. 142, pl. 74, fig. 226.

2. Atherina notata, MITCHILL.

Of a greenish brown color. Black points at the base of the anal rays. Dorsals contiguous, the second coterminal with the anal; height one sixth its length; length of head one fifth its whole length.

D. 5-9. P. 14. V. 1-5. A. 25. C. 17. Length, 3 to 5 inches.

Massachusetts, STORER. Connecticut, AYRES, LINSLEY. New York, MITCHILL, CUV., DEKAY. South Carolina, CUV.

Atherina notata, Small Silver-side, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 446, pl. 4, fig. 6.
L'Athérine de Bosc (Atherina Boscii, CUV., Atherina notata, MITCH.), CUV. et VAL., X. p. 465.
Atherina Boscii, Small Silver-side, STORER'S Report, p. 62.
Atherina notata, Dotted Silver-side, DEKAY'S Report, p. 141, pl. 28, fig. 88.

3. Atherina Carolina, CUV.

Snout pointed. Height to its total length as one to six and three quarters.

D. 8, 1-12. P. 15. V. 1-5. A. 1-15 or 16. C. 17. Length, 4 inches.

South Carolina, CUV.

Le Roséré de la Caroline, Atherina Carolina, CUV. et VAL., X. p. 445.
Atherina Carolina, DEKAY'S Report, p. 143.

4. Atherina Martinica, CUV.

Elongated; head small and slightly pointed. Scales large, with their edges crenulated. Eighteen or nineteen soft rays to the anal.

D. 6, 1-7. P. 15. V. 1-5. A. 1-18 or 19. C. 17. Length, 4 inches.

Caribbean Sea, CUV.

L'Athérine de la Martinique, Atherina Martinica, CUV. et VAL., X. p. 459.

5. Atherina Humboldtiana, CUV.

Similar in form to the Perch, but the snout is more pointed and more depressed. The lower jaw the longer. Greenish, with silvery reflections upon the back, and a broad silvery ray upon each side. Caudal edged with blackish. Its greatest height one fifth of its entire length; the length of the head one fourth the length of the body.

D. 5, 1-10. P. 14. V. 1-5. A. 1-19. C. 17. Length, 11 inches.

Mexico, CUV.

L'Athérine de Humboldt, Atherina Humboldtiana, CUV. et VAL., X. p. 479, pl. 306.

6. Atherina vomerina, CUV.

Very similar to the above; but it has small asperities upon the vomer, which are readily distinguished by the finger, and an additional soft ray to the dorsal and anal fins.

D. 5, 1-11. P. (?). V. (?). A. 1-20. C. (?). Length, 8 inches.

Mexico, CUV.

L'Athérine vomérine, Atherina vomerina, CUV. et VAL., X. p. 481.

FAMILY XI. MUGILIDÆ.

The body is almost cylindrical, covered with large scales, and furnished with two distinct dorsal fins, the first of which has only four spinous rays. The ventrals are attached somewhat behind the pectorals. The gills have six rays. The head is rather depressed, also covered with large scales or polygonal plates. The muzzle is very short. The teeth are very fine, sometimes scarcely perceptible.

GENUS I. MUGIL, Lin.

Ventrals placed a short distance behind the pectorals. The first dorsal with four spinous rays. The middle of the under jaw tuberculated within, and a corresponding cavity in the upper jaw. Teeth very small.

1. Mugil albula, Lin.

General hue whitish. Caudal with a blackish border. Lips finely pectinated.

D. 4 - 18. P. 15. V. 1 - 5. A. 1 - 7. C. 15. Length, 9 inches.

Connecticut, Linsley. New York, Mitchill, Cuv., Dekay. Virginia, Schoepff. South Carolina, Lin., Catesby, Schoepff.

Albula Bahamensis, Mullet, Catesby's Hist. Carol., ii. p. 6, pl. 5.
Mugil albula, Lin., Syst. Nat. (12th edit.), p. 520.
" " American Mullet, Shaw's Gen. Zoöl., v. p. 137.
" " New York Mullet, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 447.
Le Muge blanquette (Mugil albula, Lin.), Cuv. et Val., xi. p. 94.
Mugil albula, White Mullet, Dekay's Report, p. 146.

2. Mugil lineatus, Mitchill.

Lower jaw equalling or exceeding the upper in length. Ten or twelve dark longitudinal stripes. Dorsal outline convex.

D. 4 - 8. P. 16. V. 1 - 5. A. 3 - 8. C. $12\frac{4}{4}$. Length, 6 to 8 inches.

Connecticut, Linsley. New York, Cuv., Dekay.

Le Muge rayé (Mugil lineatus, Mitch.), Cuv. et Val., xi. p. 96.
Mugil lineatus, Striped Mullet, Dekay's Report, p. 144, pl. 15, fig. 42.

3. Mugil petrosus, Cuv.

The second dorsal and anal covered with scales. No spot at the base of the pectorals. The edge of the caudal fin blackish.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 6 to 7 inches.

New York, Gulf of Mexico, Cuv.

Le Muge des Roches, Mugil petrosus, Cuv. et Val., xi. p. 89.
Mugil petrosus, Rock Mullet, Dekay's Report, p. 147.

4. Mugil Plumieri, Cuv.

The edges of the scales golden yellow; a blackish-blue spot at the base of the pectorals, and a small spot of the same color on every scale. The second dorsal and anal without scales. Height of the body to its length as one to four and a half, nearly. Scales small.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

New York, Caribbean Sea, Cuv.

Le Muge de Plumier, Mugil Plumieri, Cuv. et Val., xi. p. 90.
Mugil Plumieri, Spotted Mullet, Dekay's Report, p. 147.

5. Mugil liza, Cuv.

Of a silvery gray, tinted with golden. Head one fifth its length; height, at middle, equal to one sixth its length. Thirty-five scales upon the side in a longitudinal series. The skin around the eye naked for some extent.

D. 4, 1-8. P. 14. V. 1-5. A. 3-8. C. 14. Length, 2½ feet.

Caribbean Sea, Cuv.

Le Muge liza, Mugil liza, Cuv. et Val., xi. p. 83.

6. Mugil curema, Cuv.

Silvery, slightly gilded. Caudal edged with blackish. Second dorsal and anal covered with scales. The angle of the suborbitars truncated and denticulated.

D. 4, 1-9. P. (?). V. (?). A. 3-9. C. (?). Length, 9 to 10 inches.

Caribbean Sea, Cuv.

Le Muge curema, Mugil curema, Cuv. et Val., xi. p. 87.

GENUS II. DAJAUS, Cuv.

The cleft of the mouth longitudinal. Velvety teeth upon the palatines and vomer.

1. Dajaus monticola, Bancroft.

Greenish gray, slightly gilded and silvery upon the belly, according to M. Ricord. The figure inserted in Griffith's Cuvier, drawn by Dr. Bancroft, is reddish brown upon the back, gilded upon the side, white beneath; opercles and fins yellowish. Length of the head equal to the height of the body. About forty scales upon the side in a longitudinal series.

D. 4, 1-8. P. 14. V. 1-5. A. 3-9. C. 17. Length, 4 to 8 inches.

Caribbean Sea, Cuv.

Called "El dajao," at Porto Rico.

Mugil monticola, Bancroft, Griffith's Cuv., x. p. 367, pl. 36.
Dejao des Montagnes, Dajaus monticola, Cuv. et Val., xi. p. 164, pl. 316.

FAMILY XII. GOBIDÆ.

Body more or less elongated. Scales small, or entirely wanting. The spines of the dorsal fin slender and flexible. Branchial aperture small. Ventrals, when present, placed in advance of the pectorals. Many viviparous.

GENUS I. BLENNIUS, Cuv.

Head rounded and blunt; body smooth, unctuous, compressed; a single elongated dorsal fin; ventral fins placed before the pectorals, and containing generally but two rays, united at their base; teeth slender, in a single row.

1. Blennius fucorum, Cuv.

Greenish brown, with brown spots above the lateral line. Bifid cirrhi over the eyes, as long as the head.

D. 11 - 17. P. 14. V. 3. A. 18. C. 14. Length, 2 inches.

Coast of New York, Dekay.

Le Blennie des fucus, Blennius fucorum, Cuv. et Val., xi. p. 263, pl. 324.
Blennius fucorum, Sea-weed Blenny, Dekay's Report, p. 149, pl. 22, fig. 66.

2. Blennius geminatus, Wood.

Head with a three-rayed cirrhus over each eye; body with several pairs of brownish spots on the sides, above which are confluent marks on the back, extending a little way upon the dorsal fin. Dorsal fin with an irregular blackish spot anteriorly.

D. 27. P. 13. V. 2. A. 17. C. $14\frac{2}{2}$. Length, $2\frac{3}{8}$ inches.

South Carolina, Wood.

Blennius geminatus, Wood, Journ. Acad. Nat. Sc., iv. p. 278.
Le Blennie geminé (Blennius geminatus, Wood), Cuv. et Val., xi. p. 265.
Blennius geminatus, Dekay's Report, p. 149.

3. Blennius punctatus, Wood.

A bifurcated cirrhus over each eye; dorsal fin with an irregular blackish spot between the first and third rays; body thickly covered with small blackish spots, which are confluent on the sides; caudal fin with five obscure brownish bands.

D. 27. P. 14. V. 3. A. 18. C. 11½. Length, 3 inches.

South Carolina, WOOD.

Blennius punctatus, WOOD, Journ. Acad. Nat. Sc., IV. p. 279.
Le Blennie tacéhté (Blennius punctatus, WOOD), CUV. et VAL., XI. p. 267.
Blennius punctatus, DEKAY's Report, p. 149.

GENUS II. PHOLIS, FLEMING.

Neither cirrhi nor fleshy crests upon the orbits.

1. Pholis subbifurcatus, STORER.

Dorsal fin extending to the tail; filaments upon the nostrils; three dark-colored bands passing from the eyes; lateral line subbifurcated.

D. 43. P. 13. V. 3. A. 30. C. 14. Length, 5 inches, 5 lines.

Massachusetts, STORER.

Pholis subbifurcatus, Subbifurcated Pholis, STORER's Report, p. 63.
" " Radiated Shanny, DEKAY's Report, p. 150.

2. Pholis Carolinus, CUV.

Greenish, with four or five irregular clouded spots along the back. Brown points irregularly scattered upon the fins. Sixteen teeth in the upper, fourteen in the lower jaw, with stout canines.

D. 12 - 18. P. (?). V. (?). A. 18. C. (?). Length, 4 inches.

South Carolina, CUV.

Le Pholis Carolin, Pholis Carolinus, CUV. et VAL., XI. p. 276.
Pholis Carolinus, DEKAY's Report, p. 151.

GENUS III. CHASMODES, CUV.

The branchial aperture open only above the pectoral fin. Mouth deeply cleft, with teeth only on the anterior part of the jaws; these are firm, regular, and in a single row.

1. Chasmodes Bosquianus, CUV.

With six clouded vertical bands. Dorsal united with the caudal. A minute filament over the eye.

D. 29. P. 14. V. 2. A. 19. C. 15. Length, 3 inches.

Chesapeake Bay, MITCHILL. New York, CUV., DEKAY. South Carolina, LESUEUR.

Blennius Bosquianus, LACEP., SHAW's Gen. Zoöl., IV. p. 178.
Blennius Pholis, Smooth Blenny, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 374.
Blennius Hentz, LESUEUR, Journ. Acad. Nat. Sc., IV. p. 363.
Le Chasmodes Bosquien (Chasmodes Bosquianus, CUV.), CUV. et VAL., XI. p. 295, pl. 327.
Chasmodes Bosquianus, Six-banded Chasmodes, DEKAY's Report, p. 151, pl. 21, fig 73.

2. Chasmodes novemlineatus, Wood.

Body with nine whitish longitudinal bands ; dorsal fin with an irregular blackish spot between the first and second rays ; remainder of the fin clouded with dusky brown.

D. 30. P. 13. V. 2. A. 20. C. $12\frac{3}{3}$. Length, $3\frac{1}{4}$ inches.

South Carolina, Wood.

Pholis novemlineatus, Wood, Journ. Acad. Nat. Sc., iv. p. 280.
Le Chasmodes à neuf raies, Chasmodes novemlineatus, Cuv. et Val., xi. p. 299.
Chasmodes novemlineatus, Dekay's Report, p. 152.

3. Chasmodes quadrifasciatus, Wood.

Body with four distinct brownish bands, and an interrupted obscure broad band on the neck ; belly with four yellowish spots over the anal fin ; ventral fin fasciate with brown Dorsal fin not joining the tail.

D. 27. P. 11. V. 2. A. 15. C. 9. Length, $2\frac{1}{2}$ inches.

Maryland (?), Wood.

Pholis quadrifasciatus, Wood, Journ. Acad. Nat. Sc., iv. p. 282, pl. 17, fig. 1.
Le Chasmodes à quatre bandes, Chasmodes quadrifasciatus, Cuv. et Val., xi. p. 298.
Chasmodes quadrifasciatus, Dekay's Report, p. 152.

GENUS IV. SALARIAS, Cuv.

Species whose teeth, forming a single range and placed close to each other, are compressed laterally, hooked at the end, exceedingly slender, and very numerous. They move, in the living subject, like the keys of a harpsichord. Their head, strongly compressed above, is very broad below ; their lips are thick and fleshy ; their profile is completely vertical, and their spirally convoluted intestines are longer and thinner than in the common Blenny.

1. Salarias Atlanticus, Cuv.

Chocolate-brown, lighter towards the abdomen ; caudal blackish in its middle, yellowish upon its upper and lower edge. A black spot back of the eye. Head one fifth the whole length. A simple and very slender tentacle upon the eyebrow, the height of the eye.

D. 11-21. P. 15. V. 2. A. 24. C. 11. Length, $3\frac{1}{2}$ inches.

Caribbean Sea, Cuv.

Le Salarias de l'Atlantique, Salarias Atlanticus, Cuv. et Val., xi. p. 321.

2. Salarias periophthalmus, Cuv.

Olive-green above, with small red points ; abdomen whitish ; dorsal dotted with red, violet at its base, and having six blackish spots upon its anterior portion ; the caudal is orange towards its extremity. Head compressed, a little longer than high. A simple, slender tentacle upon the eyebrow, half the height of the head; and a small one, with five divisions, at the nostril.

D. 12-20. P. 13. V. 2. A. 21. C. 11. Length, 4 to 7 inches.

Caribbean Sea, Cuv.

Le Salarias periophthalme (Salarias periophthalmus, Cuv.), Cuv. et Val., xi. p. 311.

GENUS V. CLINUS, Cuv.

Short, pointed teeth, scattered in several ranges, the first of which is the largest. Their muzzle is less obtuse, their stomach wider, and their intestines shorter than in the Salarias.

1. Clinus gobio, Cuv.

Russet-gray, with traces of clouded brownish bands; one dark-brown band at the base of the tail. Head large; diameter of eyes equal to two fifths the length of the head. Preopercle and opercle rounded. Twenty-six equal teeth in the upper jaw, extending to the angle; sixteen in the lower jaw, occupying half of the length of the jaw on each side, the two last stouter and more hooked.

D. 18-9. P. 14. V. 2. A. 2-17. C. 15. Length, 2 inches.

Caribbean Sea, Cuv.

Le Clinus chabot, Clinus gobio, Cuv. et Val., xi. p. 395.

GENUS VI. GUNNELLUS, Fleming.

Body elongated, much compressed. Head oblong. Mouth small. Teeth velvet-like, or in cards. Dorsal rays spinous throughout. Ventrals excessively small, and reduced often to a single spine.

1. Gunnellus vulgaris, Fleming.

Deep olive, with a row of dark ocellated spots, varying in number, but generally from ten to twelve, along the line of the back, extending partly on to the dorsal fin; belly whitish; pectorals yellow. Dorsal united to the caudal. Ventrals mere spines.

D. 76 or 77. P. 11 or 12. V. 1-1. A. 2-40. C. 15. Length, 4 to 12 inches.

Greenland, Fabricius.

Blennius gunnellus, Lin., Syst. Nat., i. p. 443.
" " Fabricius, Fauna Groenlandica, p. 149.
" " Bloch, ii. p. 162, pl. 171, fig. 1.

Blennius gunnellus, Spotted Blenny, PENNANT'S Brit. Zoöl., III. p. 282, pl. 60.
" " Gunnel Blenny, SHAW'S Gen. Zoöl., IV. p. 179.
" " Spotted Gunnel, JENYNS'S Brit. Vert., p. 383.
Gunnellus vulgaris, FLEM., Brit. An., p. 207, sp. 124.
Murænoides guttata, Spotted Gunnel or Butter-fish, LACEP., YARRELL'S Brit. Fishes (1st edit.), I. p. 239, fig.; (2d edit.), I. p. 269.
Le Gonnelle vulgaire (Gunnellus vulgaris, CUV., Blennius gunnellus, LIN.), CUV. et VAL., XI. p. 419.

2. Gunnellus punctatus, FAB.

Tawny; the head dotted with white; the throat, pectorals, and caudal striped with the same; about seven brown streaks on the cheeks; five black spots, joined to as many white ones, on the dorsal, and about twelve less conspicuous black spots on the anal. The dorsal and anal fins are continued to the caudal, the former being joined to it by a membrane, but the anal is distinct.

D. 50. P. 17. V. 4. A. 38. C. 18. Length, 6 inches.

Greenland, FABRICIUS.

Called "Akulliakitsoc," by the Greenlanders.

Blennius punctatus, FAB., Fauna Groenlandica, p. 153.
Blennius (Clinus) punctatus, FAB., Akooliakeetsok, RICH., Fauna Boreal. Americ., III. p. 88.
Le Gonnelle ponctué, Gunnellus punctatus, CUV. et VAL., XI. p. 428.

3. Gunnellus Fabricii, CUV.

Back and sides palish, marked irregularly with brown spotted circles. Head and pectorals yellowish; belly white, with a yellowish tint behind the anus. The even dorsal occupies the entire back, but is distinct from the obovate caudal. Ventrals with three rays, the lower of which is longest; the upper ray scarcely perceptible.

D. 63. P. 15. V. 3. A. 41. C. 18. Length, 1 foot.

Greenland, FABRICIUS.

Called "Teyarnak," by the Greenlanders.

Blennius lumpenus, FAB., Fauna Groenlandica, p. 151.
Blennius (Clinus) lumpenus, Lumper, FAB., RICH., Fauna Boreal. Americ., III. p. 90.
Le Gonnelle de Fabricius, Gunnellus Fabricii, CUV. et VAL., XI. p. 431.

4. Gunnellus anguillaris, PALLAS.

Olive-yellow, lighter beneath, with five longitudinal, parallel, interrupted brown bands, alternately darker and paler; base of the caudal black; caudal fawn-colored, crossed with brown lines; dorsal yellowish brown; anal yellowish; ventrals four-rayed, the external longest.

D. 67 to 70. P. 14. V. 1–3. A. 45–50. C. 14. Length, 1½ foot.

Northwest Coast of America, east of the Aleutian Islands, CUV.

Called "Kanaise," at Kamtschatka.

Le Gonnelle anguillaire (Blennius anguillaris, PALLAS, Gunnellus anguillaris, CUV.), CUV. et VAL., XI. p. 434.

5. Gunnellus dolichogaster, Pallas.

Olive-brown, clouded with greenish and yellowish. Green spots above the lateral line, and a yellow band along the lower edge of the belly. The dorsal and anal fins are brown, with pale vertical bands. The caudal and pectorals are tinged with yellowish. The lower jaw is the longer. The anus is situated before the middle of the body, but the ovaries are extended far behind it. The ventrals are two small bony tubercles projecting through the skin.

D. 93. P. 14. A. 2 – 50. C. 30. Length, 1 foot.

Northwest Coast, Cuv.

Le Gonnelle à long ventre (Gunnellus dolichogaster, Cuv., Blennius dolichogaster, Pallas), Cuv. et Val., xi. p. 436.

6. Gunnellus Groenlandicus, Reinhardt.

Yellowish gray, marbled with brown upon the back, with a dozen yellowish points above the lateral line between the pectorals and the anus; back of the anus the spots are more numerous, and disposed beneath as above the lateral line in ten or twelve vertical bands. A dozen vertical brown bands anterior to anal fin. Along the base of the dorsal fin a series of ten large, roundish, yellowish spots, which are marbled with blackish spots. Three black lines upon the head. Fins yellowish. Scales very small. Neck and cheeks covered with pores.

D. 89. P. 12. V. 1. A. 2 – 43. C. 24. Length, 5 inches, 9 lines.

Greenland, Reinhardt.

Le Gonnelle du Groenland (Gunnellus Groenlandicus, Reinhardt), Cuv. et Val., xi. p. 442, pl. 340.

7. Gunnellus mucronatus, Mitchill.

Yellowish brown, presenting a waved appearance, with twelve or more ocellated black spots along the base of the dorsal fin, surrounded with a lighter circle. Dorsal continued nearly to, but not united with, the anal fin. Two short spines in the place of the ventrals.

D. 75 to 78. P. 11 or 12. V. 1. A. 2 – 36 to 40. C. 16 to 18. Length, 4 to 12 inches.

Massachusetts, Storer. New York, Mitchill, Dekay.

Ophidium mucronatum, Spinous Ophidium, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 361, pl. 1, fig. 1.
Le Gonnelle épineux (Gunnellus mucronatus, Cuv., Ophidium mucronatum, Mitch.), Cuv. et Val., xi. p. 427.
Blennius (Centronotus) gunnellus, Lin., Spotted Gunnelle, Rich., Fauna Boreal. Americ., iii. p. 91.
Muræenoides guttata, Spotted Gunnel, Lacep., Storer's Report, p. 65.
Gunnellus mucronatus, American Butter-fish, Dekay's Report, p. 153, pl. 12, fig. 36.

GENUS VII. ZOARCES, Cuv.

Body elongated, and covered with a mucous secretion, in which are imbedded very small scales. Dorsal, anal, and caudal united; no spinous rays in the dorsal, except on its posterior part. Ventrals jugular, small. Vent with a tubercle. Teeth conical ; in two or three rows in front ; in a single row on the sides ; none on the palate or tongue. Branchial rays, six.

1. Zoarces anguillaris, Peck.

Elongated, compressed posteriorly. Yellowish brown, mottled with darker blotches ; two more or less distinct oblique bands upon operculum. In the living specimen, the dorsal is almost white, salmon-colored at its edge. Pectorals and ventrals salmon-colored. Anal salmon-colored at edge, flesh-colored at base, with seven distinct white blotches in its extent. Lips very large ; the upper projects much beyond the lower.

D. 118 or 120. P. 19 or 20. V. 2. A. 100. C. 19. Length, 3 feet.

New Hampshire, Peck. Maine, Massachusetts, Storer. New York, Mitchill, Cuv., Dekay.

Blennius anguillaris, Peck, Mem. Amer. Acad., II. pt. 2, p. 46, fig.
Blennius labrosus, Large-lipped Blenny, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 375, pl. 1, fig. 7.
Le Zoarcès à grosses lèvres, Zoarces labrosus, Cuv. et Val., XI. p. 466, pl. 341.
Zoarces anguillaris, Eel-shaped Blenny, Storer's Report, p. 66.
" " Thick-lipped Eel-pout, Dekay's Report, p. 155, pl. 16, fig. 45.

2. Zoarces fimbriatus, Cuv.

Head greenish brown. Body and tail salmon-colored. Dorsal fin dark green, margined with yellowish.

D 95 – 16, 16 – 127. P. 20. V. 4. A. 115. C. 20. Length, 20 inches.

New York, Mitchill.

Blennius ciliatus, Fringed Blenny, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 374, pl. 1, fig. 6.
Le Zoarcès frangé, Zoarces fimbriatus, Cuv. et Val., XI. p. 468.
Zoarces fimbriatus, Bordered Eel-pout, Dekay's Report, p. 156.

3. Zoarces Gronovii, Cuv.

Brown ; teeth fine and sharp, disposed in a single row in the upper jaw, and in the angles of the lower jaw ; but in the front of each jaw a double row. Scales small. Dorsal not emarginated. Caudal pointed. Pectorals very large. Ventrals round.

D. more than 80. P. 16. V. 2. A. more than 6. C. (?). Length, 6 inches.

Precise locality not mentioned.

Le Zoarcès de Gronovius (Zoarces Gronovii, Cuv., Blennius Americanus, Bl., Schn.) Cuv. et Val., XI. p. 469.

GENUS VIII. ANARRHICAS, Lin.

Head smooth, rounded, muzzle obtuse ; body elongated, covered with minute scales ; dorsal and anal fins long, distinct from the caudal ; no ventral fins. Teeth of two kinds; those in front elongated, curved, pointed; the others on the vomer, as also on the jaws, truncated or slightly rounded; branchiostegous rays, six.

1. Anarrhicas lupus, Lin.

Purplish brown, with ten or twelve transverse, nearly black bars, passing from the abdomen high up on the dorsal fin. Pectorals and anal leaden gray. Dorsal rays black. Caudal slate-colored, reddish at extremity. The jaws, vomer, and palatines are covered with large bony tubercles, which support on their summits little enamelled teeth, but the anterior teeth are conical and larger.

D. 74. P. 20. A. 46. C. 161. Length, 3 to 5 feet.

Greenland, Fabricius. Maine and Massachusetts, Storer. New York, Mitchill, Dekay.

Anarrhicas lupus, Lin., Syst. Nat., p. 430.
" " Fabricius, Fauna Groenlandica, p. 138.
" " Bloch, III. p. 18, pl. 74.
" " Shaw's Gen. Zoöl., IV. p. 93, pl. 13.
" " Wolf-fish, Penn., Brit. Zoöl., III. p. 201, pl. 27.
" " Sea-wolf, Mitchill, Amer. Month. Mag., V. p. 242.
L'Anarrhique loup (Anarrhicas lupus, Lin.), Cuv. et Val., XI. p. 473, pl. 342.
Anarrhicas lupus, Wolf-fish, Flem., Brit. An., p. 208, sp. 127.
" " " Jenyns's Brit. Vert., p. 384.
" " Sea-wolf, Wilson, Encyclop. Brit., Art. Ichth., p. 193, pl. 304, fig. 2.
" " Common Wolf-fish, Rich., Fauna Boreal. Americ., III. p. 95.
" " Wolf-fish, Yarrell's Brit. Fishes (2d edit.), I. p. 277.
" " " Storer's Report, p. 69.
" " Sea-wolf, Dekay's Report, p. 158, pl. 16, fig. 43.

GENUS IX. GOBIUS, Cuv.

Ventrals joined together, forming a hollow disk, placed under the thorax. Two dorsals. Teeth velvet-like, or in cards.

1. Gobius lanceolatus, Bloch.

Grayish brown, with three or four blackish points before the first ray of the anterior dorsal; an indistinct black spot on the sides back of the pectorals. Height about one eleventh its length, of which the caudal is nearly a third. The caudal is so much pointed, that the outer rays are only one eighth the length of the middle rays. The base of the tongue pearly, clouded with green or bluish.

D. 5, 1-13. P. 19. V. 1-5. A. 1-14. C. 15. Length, (?).

Gulf of Mexico, Caribbean Sea, Cuv.

Called "Emerelda," or "Emeraude," in Cuba; "Endormi," at Martinique.

La Lancette, Gobius lanceolatus, BLOCH, II. p. 7, pl. 38, fig. 1 and 2.
Gobius lanceolatus, LIN., Syst. Nat., GMEL., p. 1203.
" " Lance-tailed Goby, SHAW's Gen. Zoöl., IV. p. 233, pl. 34.
Le Gobie lancette (Gobius lanceolatus, BL.), CUV. et VAL., XII. p. 114.

2. Gobius alepidotus, Bosc.

Entirely destitute of scales. Height one sixth its length. Greenish brown, with seven vertical dusky bands. Fins brown.

D. 6 – 14. P. 17. V. 12 or 13. A. 11. C. 19. Length, 2½ inches.

New York, MITCHILL, CUV., DEKAY. South Carolina, CUV.

Gobius alepidotus, Bosc, BL., SCHNEIDER, p. 547?
Le Gobie de Bosc, LACEPEDE, Hist. Pois., II. p. 556, pl. 16, fig. 1.
Gobius viridi-pallidus, Variegated Goby, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 379, pl. 1, fig. 8.
Le Gobie de Bosc (Gobius Boscii, LACEP.), CUV. et VAL., XII. p. 96.
Gobius alepidotus, Variegated Goby, DEKAY's Report, p. 160, pl. 23, fig. 70.

3. Gobius soporator, Cuv.

Of a deep bistre-brown color; grayish brown beneath. Fins brown; transverse marks upon the caudal. Jaws nearly equal. The horizontal mouth is cleft to beneath the middle of the eye; the anterior row of teeth project but little beyond the others. The last ray of the second dorsal and anal fins elongated.

D. 6, 1 – 9. P. 15, and 5 filaments. V. 1 – 5. A. 1 – 8, the last double. C. 15. Length, 4 inches.

Gulf of Mexico and Caribbean Sea, CUV.

Called "Mapo," at Havana.

Le Gobie endormeur, Gobius soporator, CUV. et VAL., XII. p. 56.

4. Gobius banana, Cuv.

Brown, with small brown marblings; the points of the dorsal and caudal brown; those of the anal and ventral white; of the pectorals gray. Body elongated. Scales moderate; those on the neck small. Snout elongated; upper jaw quite protractile.

D. 6, 1 – 10. P. (?). V. (?). A. 1 – 10. C. (?). Length, 5 inches.

Caribbean Sea, CUV.

Le Gobie banane, Gobius banana, CUV. et VAL., XII. p. 103.

5. Gobius Martinicus, Cuv.

Gray, with brown spots upon the dorsal and caudal rays, and brown clouds in the intervals between the rays. This species is very similar to the G. banana, perhaps a mere variety.

D. 6 – 10. P. (?). V. (?). A. 1, 1 – 10. C. (?). Length, 6 to 7 inches.

Caribbean Sea, CUV.

Le Gobie de la Martinique, Gobius Martinicus, CUV. et VAL., XII. p. 105.

6. Gobius bacalaus, Cuv.

The lateral spot more obvious than in the G. lanceolatus, and one still better marked, which is often triangular, at the base of the tail. In young specimens, the first dorsal and caudal are sometimes each one third its entire length.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, (?).

Gulf of Mexico, Cuv.

Called "Emeralda," in Cuba.

Le Gobie bacalaou, Gobius bacalaus, Cuv. et Val., xii. p. 119.

7. Gobius smaragdus, Cuv.

Head almost as wide as high. Body and fins of a deep greenish brown, more particularly the head; sprinkled with small, yellow, round spots. Its tongue has the same colored base as the G. lanceolatus.

D. 6 - 11. P. 16. V 1 - 5. A. 1 - 11. C. 15. Length, 4 inches.

Gulf of Mexico, Cuv.

Called "Cabezona," in Cuba.

Le Gobie émeraude, Gobius smaragdus, Cuv. et Val., xii. p. 120.

8. Gobius crista galli, Cuv.

Fawn-color; the first dorsal black, particularly towards the middle of its margin; the second blackish; the other fins gray. Numerous brownish points between the rays of the caudal. Scales large, smaller on the forepart of the back. A small, low membranous crest commences between the eyes, and terminates at the neck.

D. 6, 1 - 9. P. 18. V. 1 - 5. A. 1 - 8. C. 15. Length, 2½ inches.

Gulf of Mexico, Cuv.

Called "Mapo," in Cuba.

Le Gobie à crête de coq, Gobius crista galli, Cuv. et Val., xii. p. 130.

GENUS X. SICYDIUM, Cuv.

The ventrals form a sort of bell, or round, concave basin, almost equally adherent throughout. The jaws have a single row of equal, compact, flexible teeth, and some stronger teeth within, upon the lower jaw. The teeth are somewhat like those of the Salarias; the ventrals resemble those of the Cyclopterus more than those of the Gobius; but in other respects the fishes of this genus resemble the Gobius, with a round tail.

1. Sicydium Plumieri, Cuv.

Deep olive, tinged with yellow upon the sides, and whitish towards the belly. Dorsals, pectorals, and anal tinged with blackish. The third, fourth, and fifth rays of the first dorsal are prolonged into flexible filaments; the third and fourth are double the height of the body. Second dorsal higher than the body. The head, throat, and shoulders near the pectorals, and all the fins, are naked. Scales moderate upon the back and sides, becoming very small upon the belly.

D. 6, 1-10. P. 19. V. 1-5. A. 1-10. C. 17. Length, 5 inches.

Caribbean Sea, Cuv.

Called "El Olivo," at Porto Rico.

Gobius Plumieri, Bloch, pl. 178, fig. 3.
Le Sicidium de Plumier, Sicydium Plumieri, Cuv. et Val., xii. p. 168.

GENUS XI. ELEOTRIS, Gron.

Ventrals entirely distinct. Six branchial rays. Head obtuse and slightly depressed; eyes at a distance from each other.

1. Eleotris gyrinus, Cuv.

Deep, uniform olive-brown, with small lines or brown points upon the rays of the vertical fins. Two brown lines upon the temples, back of the eyes. The scales upon the sides of the head are very small, and scarcely to be seen; the cheeks are capable of being inflated in a remarkable manner.

D. 6, 1-8. P. 16. V. 1-5. A. 1-8. C. 15. Length, 6 inches.

Caribbean Sea, Cuv.

Called "Dormeur," at Martinique.

L'Eléotris têtard, Eleotris gyrinus, Cuv. et Val., xii. p. 220, pl. 356.

2. Eleotris guavina, Cuv.

Deep blackish brown, slightly russet upon the throat, chest, and belly. Fins nearly black, or spotted and dotted with black upon a blackish ground. The edge of the second dorsal, anal, ventrals, and upper and lower edges of the caudal, whitish gray. Scales smaller than in the E. gyrinus. More than ninety scales in a longitudinal line from the branchiæ to the tail, and nearly forty in a vertical line. First dorsal not quite equal to half the height of the body; the second two thirds its height, the last ray elongated.

D. 7, 1-10. P. 16. V. 1-5. A. 1-10, the last double. C. 15, and some small ones. Length, 9 inches.

Caribbean Sea, Cuv.

Guavina, Parra, p. 105, pl. 39, fig. 1.
L'Eléotris guavina, Eleotris guavina, Cuv. et Val., xii. p. 223.

3. Eleotris mugiloides, Cuv.

Blackish brown ; bands or series of black spots upon the fins ; upon the dorsal there are six or seven rows arranged obliquely ; there are three or four rows upon the anal towards its base, and eight or nine upon the caudal. The extremities of the rays of the second dorsal and anal, whitish. Height, at the origin of the dorsal, one fourth its length ; thickness half its height. The number of scales in a longitudinal line upon the side not more than thirty-five ; in a vertical line, rarely more than twelve.

D. 7, 1 – 8. P. 14. V. 1 – 5. A. 1 – 9 or 10. C. 15. Length, 7 inches.

Caribbean Sea, Cuv.

Called "Mulet," at Martinique.

Sciæna maculata, Bloch, p. 299.
L'Eléotris mulet, Eleotris mugiloides, Cuv. et Val., xii. p. 226.

4. Eleotris smaragdus, Cuv.

More elongated than any other of the genus. Deep brown, slightly gray beneath ; fins paler ; browner points upon the dorsal rays. Height one tenth its length. The first dorsal has only very delicate rays. None of the three vertical fins exceed the height of the body. Scales very small.

D. 6 – 16. P. (?). V. (?). A. 1 – 9. C. (?). Length, 5 to 8 inches.

Gulf of Mexico, Cuv.

Called "Esmeralda negro," at Cuba.

L'Eléotris émeraude, Eleotris smaragdus, Cuv. et Val., xii. p. 231.

5. Eleotris sima, Cuv.

The whole body greenish or blackish ; fins gray, with russet dots upon the rays. Snout obtuse. Lower jaw the longer. Thirty-two rows of scales upon the sides. The excretory milt orifice is situated before the genital papilla.

D. 8 – 9. P. 14. V. 1 – 5. A. 10. C. 15. Length, 3 inches.

Mexico, Cuv.

L'Eléotris à museau obtus, Eleotris sima, Cuv. et Val., xii. p. 232.

GENUS XII. PHILYPNUS, Cuv.

Differs from the Eleotris in having card-like teeth upon the vomer.

1. Philypnus dormitator, Cuv.

Elongated, cylindrical, head depressed. Lower jaw longer. Preopercular angle rounded at its entire edge. Back and sides of a deep brown, verging to olive, with large, irregular, blackish cloudings. Beneath yellowish. Fins olive ; the vertical fins have three or four rows of blackish spots between the rays; six or seven pairs of blackish lines along each pectoral. Five or six blackish spots upon each ray of the ventral. Scales at the base of the caudal and pectorals. Back of the anus is the genital papilla, obtuse and slightly denticulated, flattened from before backwards.

D. 6, 1-9. P. 16. V. 1-5. A. 1-9. C. 13. Length, 12 or 14 inches.

Caribbean Sea, Cuv.

Called "Guavina," at Porto Rico.

Le Philypne dormeur (Philypnus dormitator, Cuv., Platescephalus dormitator, Schn.), Cuv. et Val., xii. p. 255, pl. 258.

FAMILY XIII. LOPHIDÆ.

Scales usually absent, or replaced by bony plates, or by small grains armed with spines. The two carpal bones elongated, and forming a kind of arm to support the pectoral fin. Branchial aperture round, or a vertical slit behind the pectorals. Suborbital bone wanting, except in the genus Malthea.

GENUS I. LOPHIUS, Artedi.

Head enormously large, broad, and depressed. Mouth large, armed with slender conical teeth on the jaws, palatines, vomer, and pharyngeals. Tongue smooth. Branchial rays, six; branchial arches, three. Dorsal fins, two; the anterior rays distant, detached, forming long filaments, supporting fleshy slips.

1. Lophius Americanus, Cuv.

Intermaxillary teeth smaller, and those of the vomer larger, than in the European species.

D. 3-11. P. 25. V. 5. A. 9. C. 8. Length, 2 to 3 feet.

Maine, Massachusetts, Storer. New York, Mitchill, Cuv., Dekay. Delaware, Cuv.

Lophius piscator, Bellows-fish or Common Angler, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 465.
Lophius piscatorius, Angler, Frog-fish, Sea-devil, Goose-fish, Wide Gab, Storer's Report, pp. 71 and 404.
La Baudoire d'Amérique, Lophius Americanus, Cuv. et Val., xii. p. 380.
Lophius Americanus, American Angler, Dekay's Report, p. 162, pl. 28, fig. 87.

Note. In a notice of Dekay's Report in Silliman's Journal, I doubted whether our species was distinct from the European. It appeared in that report as a *new species*, Cuv. et Val. not being cited. As I had not seen their twelfth volume, I was not aware that it had been there described under the above-mentioned name. As, however, Cuvier describes ours as distinct from the European species, after having undoubtedly seen both species, I can have no hesitation in admitting it as such.

GENUS II. CHIRONECTES, Cuv.

Head vertically compressed. Three free rays on the summit of the head. Mouth cleft more or less vertically; opening to the gills by a round aperture behind the pectorals. Tongue edentate. Intermaxillaries, lower jaw, vomer, palatines, and pharyngeals with minute card-teeth. Dorsal long.

1. Chironectes gibbus, Mitchill.

Pale brown, variegated along the sides with dark yellowish and ruddy, so as to resemble some sorts of iron-stones or fractures of ferruginous earth; the deeper dark markings cross the dorsal rays obliquely and transversely, and the caudal in concentric curves. Surface of the body granulate. Tail rounded, with concentric bars. Posterior portion of the dorsal fin rounded.

D. 12. P. 10. V. 5. A. 7. C. 9. Length, 2 inches.

New York, Mitchill, Dekay.

Lophius gibbus, Mouse-fish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. pl. 4, fig. 9.
" " " " Amer. Month. Mag., ii. p. 325.
Chironectes gibbus, Gibbous Mouse-fish, Dekay's Report, p. 164, pl. 24, fig. 74.

2. Chironectes lævigatus, Cuv.

A dull white, with irregularly distributed dark-brown blotches, or partially formed longitudinal bands, which are margined with a clear white; clear white spots upon the abdomen. Surface of the body smooth. Posterior portion of the dorsal highest.

D. 11. P. 18. V. 4. A. 6. C. 8. Length, 2 inches.

Massachusetts, Storer. New York, Dekay. South Carolina, Cuv.

Chironectes lævigatus, Cuv., Mémoires du Muséum, iii. p. 423, pl. 16, fig. 1.
Le Chironectes uni, Chironectes lævigatus, Cuv. et Val., xii. p. 399.
Chironectes lævigatus, Smooth Chironectes, Storer's Report, p. 73.
" " Smooth Mouse-fish, Dekay's Report, p. 165, pl. 27, fig. 83.

3. Chironectes scaber, Cuv.

Yellowish brown, with black spots or lines irregularly distributed. Skin rough; tubercles upon the eyebrow, cheeks, and lateral line. The first free ray of the dorsal terminates in two long slits or membranous leaves.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Caribbean Sea, Cuv.

Le Chironecte rude, Chironectes scaber, Cuv. et Val., xii. p. 412.

4. Chironectes ocellatus, Cuv.

White, with three ocellated dark spots encircled with white; one at the middle of the base of the dorsal; one vertically beneath this, opposite the anus; a third at the base of the caudal; numerous black points distributed over the surface of the body. Dorsal and caudal fins irregularly banded.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, (?).

Gulf of Mexico, PARRA.

Pescador, PARRA, p. 1, pl. 1.
Le Chironecte à ocelles, Chironectes ocellatus, CUV. et VAL., XII. p. 419.

5. Chironectes multiocellatus, CUV.

Red, with various black or blackish spots and lines. Upon the eighth, ninth, and tenth rays of the dorsal is a black ocellus, surrounded with a white circle; between the third and fourth ray a half-ocellus, bordered like the former; another upon the anal; three in the form of a triangle upon the caudal, and one upon the side, back of the pectorals. Its first ray is very long and slender, and without a tuft.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, (?).

Caribbean Sea, CUV.

Le Chironecte à beaucoup d'ocelles, Chironectes multiocellatus, CUV. et VAL., XII. p. 420.

GENUS III. MALTHEA, CUV.

Body with a hard and tubercular skin, and furnished with fleshy filaments. Mouth small, prominent, protractile, and placed under the snout. From beneath the snout arises a process supported by a bony ray and terminating in several fleshy threads.

1. Malthea vespertilio, CUV.

Pale reddish-brown above, lighter beneath. Skin rough, covered with numerous pointed tubercles. Snout elongated into a point.

D. 4. P. 11. V. 5. A. 4. C. 9. Length, 8 to 18 inches.

Newfoundland, Caribbean Sea, CUV.

Diablo, PARRA, p. 5, pl. 4.
Lophius vespertilio, LIN., Syst. Nat.
" " BLOCH, IV. p. 8, pl. 110.
" " Sea-Bat, BROWNE'S Jamaica, p. 457, pl. 43.
Lophius rostratus, LIN., Beaked Angler, SHAW'S Gen. Zoöl., V. p. 383, pl. 163.
La Malthée vespertilion, Malthea vespertilio, CUV. et VAL., XII. p. 410.
Malthea vespertilio, Bat-Malthea, DEKAY'S Report, p. 167.

2. Malthea nasuta, SEBA.

Preserved in spirits, of a grayish white above, with brown blotches. Caudal and pectorals whitish, with small round spots. Grayish white beneath. Skin granulated throughout with more or less distinct grains and tubercles. Head very wide. A rounded knob on the forehead; beneath this is a deep circular cavity; from within this proceeds a long barbel, composed of a bony ray, with a thickened tip. Snout short.

D. 5. P. 11. V. 5. A. 4. C. 9. Length, 8 inches.

Labrador, RICHARDSON. New York, DEKAY. Caribbean Sea, CUV.

Lophius (Malthe) cubifrons, Square-browed Malthus, RICH., Fauna Boreal. Americ., III. p. 103, pl. 96.
La Malthée à nez court, Malthea nasuta, CUV. et VAL., XII. p. 452.
Malthea nasuta, Short-nosed Malthea, DEKAY's Report, p. 166.

3. Malthea notata, CUV.

Three or four round black spots on each side of the spine, midway between the eye and branchial orifice. Snout, in its proportions, resembling the preceding.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 3½ inches.

New York, CUV.

La Malthée à stigmates, Malthea notata, CUV. et VAL., XII. p. 453.
Malthea notata, Dotted Malthea, DEKAY's Report, p. 167.

GENUS IV. BATRACHUS, SCHNEIDER.

Head depressed, broader than the body. Ventrals jugular, with three rays; the first elongated. First dorsal small; second low and long. Base of the pectorals elongated. Branchial aperture small, with six rays. Subopercle as large as the opercle, and both spinous. No suborbital. Teeth on the jaws, front of the vomer and palatines.

1. Batrachus tau, LIN.

Head and body olive-green, mottled with darker green. Yellowish after death. Pectorals, ventrals, and caudal fins, orange, the latter with interrupted bars of brown; ventrals uniform; pectorals with two or more concentric bars of deep blackish brown, becoming obsolete towards the base. Dorsals connected; the first with three, the posterior with from twenty-five to twenty-eight spines. Three spines upon operculum.

D. 3-25. P. 16. V. 3. A. 24. C. 14. Length, 1 foot.

Maine, Massachusetts, STORER. New York, MITCHILL, CUV., DEKAY. Gulf of Mexico, CUV.

Called "Sapo," at Havana.

Gadus tau, LIN., Syst. Nat. (12th edit.), p. 440.
" " BLOCH, II. p. 150, pl. 67, fig. 2 and 3.
" " Toad Gadus, SHAW's Gen. Zool., IV. p. 159.
Lophius bufo, Toad-fish, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 463.
Batrachoides variegatus, var. a. b., LESUEUR, Journ. Acad. Nat. Sc., III. pp. 399, 401.
Batrachus variegatus, Toad-fish, STORER's Report, p. 74.
Le Batrachoïde tau, Batrachus tau, CUV. et VAL., XII. p. 478.
Batrachus tau, Common Toad-fish, DEKAY's Report, p. 163, pl. 28, fig. 86.

2. Batrachus variegatus, Lesueur.

Second dorsal distinct and with twenty-one rays. Laciniated processes on the jaws, eyes, and opercles.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 5½ inches.

New Jersey, Lesueur.

Batrachoides variegatus, Lesueur, Journ. Acad. Nat. Sc., III. p. 398.
Le Batrachoïde varié, Batrachus variegatus, Cuv. et Val., XII. p. 484.
Batrachus variegatus, Dekay's Report, p. 171.

3. Batrachus celatus, Dekay.

Head dark olive-brown. Body, on the side, greenish, pale-colored, with irregular dusky-brown transverse bars, which are frequently extended through the vertical fins. Dorsal fins separate. Opercle with two spines.

D. 3-28. P. 18. V. 3. A. 23. C. 15. Length, 1 inch.

New York, Dekay.

Batrachus celatus, Two-spined Toad-fish, Dekay's Report, p. 170, pl. 50, fig. 161.

Dr. Dekay, whose species this is, says, in his description of the preceding species, that he is doubtful whether that and this are not identical.

FAMILY XIV. LABRIDÆ.

Body oblong and scaly ; a single dorsal is supported in front by spines, each of which is generally furnished with a membranous appendage ; the jaws are covered with fleshy lips ; there are three pharyngeals, two upper ones attached to the cranium, and a large lower one, all three armed with teeth, sometimes *en pavé*, sometimes in points or laminæ, but generally stronger than usual ; an intestinal canal without cœca, or with two very small ones, and a strong natatory bladder.

GENUS I. COSSYPHUS, Val.

Maxillaries large ; back of the external row of pointed teeth, there are some small, compact granulations. Opercles generally more scaly than in the genus Labrus. The vertical fins are covered at their base by scales, which are raised or depressed with the rays, and which conceal the rays when they are closed. But they do not form a deep groove, similar to that of the Perches. In most species, deep denticulations upon preopercle.

1. Cossyphus Bodianus, Cuv.

Purple, sometimes orange-red upon the back; beneath gray; sides and fins citron-yellow. A black spot upon the dorsal and the extremity of the anal. Scales large, finely carved; thirty-four in a horizontal line between the branchiæ and tail. Four conical teeth at the extremity of each jaw; the two middle are straight and directed forward; the other teeth are small and like tubercles, even to the angle of the jaw, where there are two others long and prominent, the last stoutest.

D. 13-9. P. 16. V. 1-5. A. 3-12. C. 15. Length, 14 inches.

Gulf of Mexico, Parra. Caribbean Sea, Cuv.

Perro colorado, Parra, p. 3, pl. 3, fig. 1.
Lutjanus verres, Bloch, 255?
Labrus fulvus, Catesby's Hist. Carol., xi. fig. 1?
" " Lin., Syst. Nat. (12th edit.).
Le Cossyphe Bodian, Cossyphus Bodianus, Cuv. et Val., xiii. p. 103.

GENUS II. CTENOLABRUS, Val.

Body elongated, scaly. Preopercle denticulated. A band of velvet-like teeth in front; behind, the conical teeth, in the jaws. Three spinous rays to the anal fin.

1. Ctenolabrus ceruleus, Mitchill.

Color very variable, generally bluish; sometimes, however, of a uniform brown or rust-color; while the ground of others is greenish, with copper-colored spots, or red, with black points or dots sprinkled over their entire surface, including oftentimes the fins.

D. 18-11. P. 15. V. 6. A. 12. C. 16. Length, 6 to 12 inches.

Newfoundland, Cuv. Maine, Massachusetts, Storer. Connecticut, Ayres. New York, Mitchill, Cuv., Dekay.

Tautoga cerulea, Blue-fish or Bergall, Mitchill, Report in part, p. 24.
Labrus chogset, Bergall of New York, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 402, pl. 3, fig.
Crenilabrus burgall, Schoepff., Griffith's Cuv., x. p. 258.
" " Conner, Blue Perch, Chogset, Storer's Report, p. 78.
" " " " Ayres, Bost. Journ. Nat. Hist., iv. p. 263.
Le Ctenolabre chogset, Ctenolabrus chogset, Cuv. et Val., xiii. p. 237.
Ctenolabrus ceruleus, Dekay's Report, p. 172, pl. 29, fig. 93.
Le Ctenolabre mouché, Ctenolabrus uninotatus, Cuv. et Val., xiii. p. 239.
Ctenolabrus uninotatus, Spotted Bergall, Dekay's Report, p. 174, pl. 29, fig. 90.

GENUS III. ACANTHOLABRUS, Val.

The external row of teeth conical and stout; the posterior are small, forming a narrow band. Numerous spinous rays to the anal fin.

1. Acantholabrus exoletus, Val.

Uniform brilliant blue, or with blue lines upon the body. Nineteen spinous rays to the dorsal fin. Five spines to the anal fin.

D. 19–8. P. 13. V. 1–5. A. 5–8. C. 13. Length, (?).

Greenland, Fabricius.

Called "Keblernak," in Greenland.

Labrus exoletus, Lin., Syst. Nat.
" " Fabricius, Fauna Groenlandica, p. 166.
L'Acantholabre du Nord, Acantholabrus exoletus, Cuv. et Val., xiii. p. 247.

GENUS IV. CLEPTICUS, Cuv.

Mouth small, protractile, received under the arch of the suborbitars ; a small number of scarcely visible teeth in a single row ; the pharyngeal teeth forming, by their union, small plates, serrated at their edge ; the vertical fins covered throughout their greater portion with scales similar to those upon the rest of the body. Preopercle denticulated. Lateral line continuous.

1. Clepticus genizara, Parra.

Head obscure carmine ; back brighter, passing to rose ; sides orange ; pectorals black. Scales upon the operculum large ; upon preoperculum small. Portion of head between the nostrils and snout destitute of scales. Posterior portion of the dorsal and anal fins pointed. Caudal lunated.

D. 14–8. P. 18. V. 1–5. A. 5–10. C. 19. Length, 10 inches.

Gulf of Mexico, Parra. Caribbean Sea, Cuv.

Rabirrubia genizara, Parra, p. 44, pl. 21, fig. 1.
Clepticus genizara, Griffith's Cuv., x. p. 259.
Le Cleptique créole, Clepticus genizara, Cuv. et Val., xiii. p. 267, pl. 377.

GENUS V. LACHNOLAIMUS, Cuv.

The general character of a true Labrus, but the pharyngeals have no teeth *en pavés*, except at their posterior part ; the remainder of their extent, as well as a part of the palate, covered with a villous membrane. Their first spinous rays are continued into long flexible filaments. Lateral line parallel to the back, continuous. The anterior teeth strong, projecting forwards ; behind them a series of small, equal teeth.

1. Lachnolaimus aigula, Cuv.

Purple-brown, with a round deep-brown spot at the posterior base of the dorsal fin. When alive, according to Plée, the back is red; the sides red, clouded with white; the lower jaw white; small, oblique blue lines upon the temples and cheeks; the long, spinous rays of the dorsal are very red, and the spot at the posterior angle of this fin deep black. The first three dorsal rays nearly half the length of the body; the fourth is only one third as long as these; the remaining spinous rays are one half as long as the latter. Three short, stout spines to the anal fin; the third and fourth membranous rays of the anal most projecting. The external rays of the caudal are prolonged into sharp points.

D. 15 – 11. P. 15. V. 1 – 5. A. 3 – 10. C. 14. Length, 11 inches.

Caribbean Sea, Cuv.

Called "Aigrette," at St. Bartholomew.

Le Lachnolème aigrette, Lachnolaimus aigula, Cuv. et Val., xiii. p. 277, pl. 378.

2. Lachnolaimus dux, Cuv.

When recent, red, with yellow fins. The fourth dorsal ray only one third shorter than the third ray. In spirit, of an aurora color, with a black spot at the dorsal, blackish tints upon the border of the anal, and a triple series of blackish points upon the membrane of the caudal.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 8 inches.

Caribbean Sea, Cuv.

Called "Capitaine," at St. Bartholomew.

Le Lachnolème capitaine, Lachnolaimus dux, Cuv. et Val., xiii. p. 285.

3. Lachnolaimus suillus, Cuv.

Edge of scales red, their base yellow; top of head purple; sides of the lower jaw of a bright blood-red color; scales of the cheeks of a bright blue upon an orange ground, covered with small red, undulating lines. The spinous portion of the dorsal brown; their long points red or orange, with brownish filaments; the second dorsal margined anteriorly with deep gray, red above; pectorals yellow; ventrals black at their extremities, and yellow spotted with red at their base; caudal half-black, the crescent yellow; its extremities black. The dorsal has three elongated rays; the fourth is as short as the ten succeeding. The angles of the caudal elongated into narrow, sharp points. The anterior teeth very strong, except the intermediate ones below. Besides the row of small teeth on each side, there are upon the internal faces of each jaw two or three rows of irregular, still smaller teeth.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 3 to 4 feet.

Caribbean Sea, Cuv.

Called "Hog-fish," at St. Thomas.

Suillus, Great Hog-fish, Catesby's Hist. Carol., ii. p. 15, pl. 15.
Le Lachnolème à grouin de cochon, Lachnolaimus suillus, Cuv. et Val., xiii. p. 286.

4. Lachnolaimus caninus, Cuv.

Uniform red, without spots upon the sides, or brown upon the dorsal, or purple upon the neck. The three elongated dorsal spines reaching to the spot at the base of the fin. The fourth ray a short spine. In the middle of the upper jaw four very strong, conical, pointed teeth; in the lower, four stouter, the two exterior projecting beyond the others. A single row of teeth along the jaws.

D. (?). P. (?). V. (?). A. (?) C. (?) Length, 10 to 22 inches.

Caribbean Sea, Cuv.

Perro, Parra, p. 4, pl. 3, fig. 2.
Le Lachnolème petit chien, Lachnolaimus caninus, Cuv. et Val., xiii. p. 288.

5. Lachnolaimus psittacus, Cuv.

Rose-red; besides the black spot at the angle of the dorsal, another smaller one at the corresponding angle of the anal fin, which disappears after death.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Caribbean Sea, Cuv.

Called "Cotorra," at Porto Rico.

Le Lachnolème perroquet, Lachnolaimus psittacus, Cuv. et Val., xiii. p. 291.

GENUS VI. TAUTOGA, Mitch.

Jaws with a double row of teeth. Opercle and preopercle without spines or denticulations, and with few or no scales.

1. Tautoga Americana, Bloch.

Bluish black above, diversified with bands and blotches, mottled with darker spots towards the abdomen, which is whitish. Fleshy rays of dorsal fin considerably higher than the spinous portion. Small, floating, fleshy tentaculæ attached to extremities of spinous rays of dorsal.

D. 17-11. P. 15. V. 1-5. A. 3-8. C. 15. Length, 6 to 18 inches.

Maine, Massachusetts, Storer. Connecticut, Ayres. New York, Mitchill, Cuv., Dekay. South Carolina (introduced), Dekay.

Labrus Americanus, Bloch, Schn., p. 261?
Tautoga niger, Mitchill, Report in part, p. 23.
Labrus tautoga, Black-fish or Tautog, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 399.
Labrus Americanus, Black-fish or Tautog, Storer's Report, p. 76.
" " " " Ayres, Bost. Journ. Nat. Hist., iv. 263.
Le Tautogue noir (Tautoga nigra, Mitch.), Cuv. et Val., xiii. p. 293.
Tautoga Americana, New York Tautog, Dekay's Report, p. 175, pl. 14, fig. 39.

GENUS VII. MALACANTHUS, Cuv.

Body elongated, but little compressed ; scales small ; the anal almost as long as the dorsal ; the other fins moderate ; head oblong ; the forehead slightly convex ; eyes moderate, and situated far back ; the mouth quite cloven ; lips fleshy. In each jaw a single row of teeth, among which some are stout and curved ; pharyngeal teeth like those of a card ; a strong spine at the angle of the operculum.

1. Malacanthus Plumieri, Cuv.

Variegated with yellow and lilac, or bluish. Before the eyes and upon the temple, the yellow and lilac are disposed in longitudinal lines. Yellow marblings upon a lilac ground on the operculum. The dorsal is of a reddish lilac, with three longitudinal series of yellow spots. Caudal yellow, its posterior edge bluish and transparent, and tinged with blue at its upper and lower edges. The upper and lower rays of the caudal elongated into slender points, as long again as the rest of the fin. Six strong, pointed teeth in the front of the upper jaw, with two small intermediate ones ; behind these, on each side, a row of fifteen small, conical, and pointed ones, and at the angle a stout one directed slightly forwards. In the lower jaw, in front, six and two small ones ; and then, on each side, five curved, pointed, compressed, increasing to the fifth ; the sixth is one half as large, and after it are ten or twelve, very fine, and a stouter one at the angle, slightly directed forwards, less than the corresponding one in the upper jaw.

D. 6-55. P. 16. V. 1-5. A. 1-50. C. 17. Length, 15 to 18 inches.

Gulf of Mexico, PARRA. Caribbean Sea, Cuv.

Matajuelo blanco, PARRA, p. 22, pl. 13, fig. 1.
Coryphæna Plumieri, LIN., Syst. Nat., GMEL., p. 1191.
" " BLOCH, 175?
" " Plumier's Coryphene, SHAW's Gen. Zoöl., IV. p. 215.
Malacanthus Plumieri, GRIFFITH's Cuv., X. p. 263.
Le Malacanthe de Plumier (Malacanthus Plumieri, Cuv., Sparus oblongus, BL., SCHN.), Cuv. et VAL., XIII. p. 319, pl. 380.

GENUS VIII. JULIS, Cuv.

Head smooth ; cheeks and gill-covers without scales ; the lateral line bent suddenly downwards when opposite the end of the dorsal fin ; in other respects the generic characters are similar to those of the genus Labrus.

1. Julis psittaculus, Cuv.

Brown, more or less red upon the back, lighter beneath ; two longitudinal, parallel violet or lilac bands upon the sides. The upper band arises at the angle of the operculum ; the lower at the suboperculum, and passes beneath the pectoral. A violet band passes from the eye over the occiput, and unites with that of the opposite side, forming an angle upon the top of the head. From the top of this angle, a wide, short bone descends vertically, which anastomoses with another horizontal line, passing from the eye to the angle of the opercle. A transverse bridle passes beneath the lower jaw, and is prolonged in a lighter band, which divides the preopercle and extends to the opercle. Scales large; twenty-four in a longitudinal line between branchiæ and tail.

D. 9–11. P. (?). V. (?). A. 3–12. C. (?). Length, 6 inches.

Caribbean Sea, Cuv.

Called "Patate," at Martinique.

La Girelle perruche (Julis psittaculus, Cuv., Labrus psittaculus, Lacep.), Cuv. et Val., XIII. p. 387.

2. Julis Garnoti, Cuv.

Body blue or greenish, bright red along the back; the spinous portion of the dorsal blackish blue; the soft portion gray, with red spots; the anal of a tint approaching to the lees of wine, with deep blue spots between each ray, near the body; caudal rounded and grayish, rayed transversely with ten alternately narrow and wide rays; pectorals bluish; ventrals greenish.

D. 9–11. P. (?). V. (?). A. 3–11. C. (?). Length, 6 inches.

Caribbean Sea, Cuv.

La Girelle de Garnot, Julis Garnoti, Cuv. et Val., XIII. p. 390.

3. Julis cyanostigma, Cuv.

Head clouded with blue or violet and red. Seven or eight longitudinal rows of azure spots upon the sides; three large black spots at the base of the dorsal; one upon the first simple rays; one at the termination of the fin; the central one includes the first four soft rays. A violet ray along the middle of the base of the anal. The caudal and the dorsal have some traces of violet spots.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 6 inches.

Caribbean Sea, Cuv.

La Girelle aux taches bleues, Julis cyanostigma, Cuv. et Val., XIII. p. 391.

4. Julis opalina, Cuv.

The color of this species is a mixture of blue, green, yellow, orange, and red, which gives it an opaline or iridescent tint. The blue is disposed in four well marked lines upon the belly. Head blue or flesh-color, with deeper blue rays. Dorsal blue. Anal with two violet-colored rays upon a deeper ground; caudal blue, with violet bands, which are vertical or longitudinal.

D. 9 - 11. P. 12. V. 1 - 5. A. 3 - 12. C. 15. Length, 15 inches.

Caribbean Sea, Cuv.

La Girelle opaline, Julis opalina, Cuv. et Val., xiii. p. 392.

5. Julis crotaphus, Cuv.

Green, brownish upon the back ; a well marked green spot at the top of the operculum ; head rayed with red ; an oblique band crosses the top of the opercle, descends upon the anterior portion of the pectoral, and terminates upon the belly, a little back of the insertion of the ventrals ; dorsal red ; caudal green, with three red bands. Small, distant pores upon suborbitars.

D. 9 - 11. P. 12. V. 1 - 5. A. 3 - 12. C. 13. Length, 7 inches.

Gulf of Mexico, Cuv.

Doncella, Parra, pl. 37, fig. 1.
La Girelle aux tempes noires, Julis crotaphus, Cuv. et Val., xiii. p. 395.

6. Julis patatus, Cuv.

Greenish, tinged with yellow. Large brown spots along the base of the dorsal, mingled with yellow. Wide longitudinal bands upon a yellow ground on the body. The top of the head green, its sides yellow, sprinkled with spots or small lines of a beautiful ultramarine blue color. Similarly colored rays upon the caudal, dorsal, and anal fins. Pectorals and ventrals bluish. Eyes small. Two canines in upper jaw, followed by a series of small, conical teeth, and at the angle of the mouth are two projecting hooks. Four canines in lower jaw. Two or three rows of rounded tubercles back of the conical teeth in both jaws.

D. 9 - 11. P. 14. V. 1 - 5. A. 3 - 12. C. 13. Length, 15 inches.

Gulf of Mexico, Cuv.

Called " Doncella," at Havana.

La Girelle patate, Julis patatus, Cuv. et Val., xiii. p. 398.

7. Julis Principis, Cuv.

Covered with a violet-colored network. Three violet rays upon the neck ; large violet rays upon operculum. Dorsal and caudal also rayed with violet. Two violet rays upon anal. Twenty-five longitudinal rows of strongly striated scales upon sides.

D. 9 - 11. P. (?). V. (?). A. 3 - 12. C. (?). Length, 11 inches.

Caribbean Sea, Cuv.

La Girelle du Prince, Julis Principis, Cuv. et Val., xiii. p. 402.

8. Julis dimidiatus, Agass.

Of a deep rose-color upon the back and along the sides. A broad violet band extends from the snout to the caudal. Dorsal rose-colored along its edge to the fifth spine ; the rest is violet. Anal violet, margined with rose; upper lobe of caudal blue, lower, rose; pectorals blue, yellow at their base; ventrals rose-colored. The middle canines are strong and curved; three rows of granulated teeth back of the conical ones, upon the external edge.

D. 9 - 13. P. 12. V. 1 - 5. A. 3 - 13. C. 12. Length, 1 foot.

Caribbean Sea, Cuv.

La Girelle partagée (Julis dimidiatus, Agass.), Cuv. et Val., XIII. p. 407.

9. Julis detersor, Cuv.

Head and breast of a beautiful violet, almost black; the rest of the body a brilliant green. The anterior portion of the dorsal, the extremity of the pectorals, and the forks of the caudal, violet; the rest of the body and anal green; the middle of lunation of the tail gray. The spinous portion of the dorsal is low, and covered with scales.

D. 8 - 13. P. (?). V. (?). A. 3 - 11. C. (?). Length, 7 inches.

Caribbean Sea, Cuv.

Called "Dégraisseur," at Martinique.

La Girelle dégraisseur, Julis detersor, Cuv. et Val., XIII. p. 408.

GENUS IX. XIRICHTHYS, Cuv.

Body compressed, head trenchant. Head higher than long, truncated in front. A single long, uniform dorsal. Teeth in a single row in the jaws; the anterior longest. Tongue and palate smooth; pharyngeals tessellated.

1. Xirichthys Martinicensis, Cuv.

Fawn-colored, with violet tints upon the head and anterior portion of the dorsal.

D. 9 - 12. P. 11. V. 1 - 5. A. 3 - 12. C. 13. Length, 8 inches.

Caribbean Sea, Cuv.

Called "Patate," at Martinique.

Le Rason de la Martinique, Xirichthys Martinicensis, Cuv. et Val., XIV. p. 49.

2. Xirichthys lineatus, Cuv.

A milk-white spot on the sides, from which descend alternately pale and deep red lines. Cheeks with bluish lines. Fins red.

D. 4 - 17. P. 11. V. 1 - 5. A. 3 - 12. C. 13. Length, 5 or 6 inches.

South Carolina, Lin. Caribbean Sea, Cuv.

Coryphæna lineatus, Lin., Syst. Nat., Gmel., p. 1195.
" " Shaw's Gen. Zoöl., IV. p. 224.
Le Rason rayé, Xirichthys lineatus, Cuv. et Val., XIV. p. 50.
Xirichthys lineatus, Dekay's Report, p. 177.

3. Xirichthys vitta, Cuv.

No lines nor spots upon the body or fins. Fawn-colored, with a pale longitudinal band passing through the middle of the body, from the angle of the operculum to the caudal fin.

D. 9–12. P. 11. V. 1–5. A. 3–12. C. 13. Length, 6 inches.

Caribbean Sea, Cuv.

Le Rason bandelette, Xirichthys vitta, Cuv. et Val., xiv. p. 51.

GENUS X. SCARUS, Lin.

Jaws convex, rounded, and furnished with teeth arranged like scales upon their edge and upon their anterior surface; during life, the jaws are covered by fleshy lips, but there is no double one adhering to the suborbital. They have the oblong form of a Labrus, large scales, and an interrupted lateral line; three pharyngeal plates, two above and one below, furnished with teeth as in the Labrus; but these teeth are transverse blades, and not rounded like paving-stones.

1. Scarus Abildgaardii, Bloch.

Back of a beautiful blood-red color, sides paler red; belly a pale rose-color; the edge of the scales brownish, and the operculum edged with black. Scales large, hexagonal, almost smooth; striæ scarcely visible. There is no trunk to the venations of the lateral line, and they divide, from the base, into six or seven branches, which give off branches and extend over almost the whole scale.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 15½ inches.

Caribbean Sea, Cuv.

Called "Red-fish," at St. Thomas.

Sparus Abildgaardii, Bloch, pl. 259.
Vieja, Parra, p. 53, pl. 28, fig. 2.
Sparus Abildgaardii, Abildgaard's Sparus, Shaw's Gen. Zoöl., iv. p. 412.
Le Scare rouge, Scarus Abildgaardii, Cuv. et Val., xiv. p. 175.

2. Scarus guacamaia, Parra.

Bluish green beneath the pectorals, along the sides, and upon the whole posterior portion; head, anterior and upper part of the back, and the belly, yellowish gray; base of the jaws of a verdigris-green color; dorsal and anal fins brown, with green spots along their base; the caudal with green rays in its middle, upon a yellowish gray ground; pectorals and ventrals with green tints. Dorsal spines not very stout. Caudal, when extended, has a slight point at its centre, but its extremities project much beyond this. Scales with granular striæ.

A long trunk to the venations of the lateral line, which is slightly raised, and terminating in a small bouquet of short, irregular branches.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 2 to 3 feet.

Caribbean Sea, Cuv.

Called "Cacabelly," and "Great Parrot-fish," at St. Thomas.

Guacamaia, PARRA, p. 54, pl. 26.
Le Guacamaia, ou grand Scare à machoires bleues, Scarus guacamaia, Cuv. et VAL., XIV. p. 178.

3. Scarus cœlestinus, Cuv.

Blue; the lower jaw nearly all green; the upper green near the edges. The extremities of the caudal fin not half the length of the rest of the fin. Scales granulated like the preceding, but the bouquets produced by the arbuscules of the lateral line more elongated.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 21 inches.

Caribbean Sea, Cuv.

Le Moyen et le petit Scare à machoires bleues, Scarus cœlestinus, Cuv. et VAL., XIV. p. 180.

4. Scarus turchesius, Cuv.

Deep green; belly rose-colored; the extremities of the dorsal and anal rays blue. Jaws turquoise-blue. Scales slightly striated. The arbuscules of the lateral line have a trunk terminated by three or four small branches, one or two of which are forked.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 13 inches.

Caribbean Sea, Cuv.

Called "Cotorra," at Porto Rico.

Le Scare cotorra, Scarus turchesius, Cuv. et VAL., XIV. p. 181.

5. Scarus Catesbæi, Lacep.

Body and caudal green, with a red band upon this fin parallel to its margin; dorsal reddish; anal red, margined with green; ventrals red, edged with blue; pectorals violet, upper edge blue; head deep gray, tinged with violet, with purple at the edges of the opercle and preopercle; a yellow spot upon the suprascapular scale; a purple band upon the temples; a yellow spot upon the side of the tail.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Hispaniola, Cuba, and the Bahama Islands, CATESBY.

Psittacus piscis-viridis Bahamensis, Parrot-fish, CATESBY'S Hist. Carol., II. pl. 29.
Le Scare Catesby (Scarus Catesbæi, LACEP.), Cuv. et VAL., XIV. p. 183.

6. Scarus chrysopterus, Bloch.

Greenish blue; dorsal and irides red. Scales large, striæ scarcely perceptible. The arbuscules of the lateral line consist of a short trunk and six or seven branches, which bear still smaller ones extending over almost the entire scale. When the fish is dry, it is of a green color, changing to blue; fins yellow; a wide green band upon the upper and lower edge of the caudal; the outer edge of the ventrals green, with a brown or bluish spot above, at the base of the pectorals.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 1 foot to 14 inches.

Caribbean Sea, Cuv.

Called "Snoper," at St. Thomas.

Scarus chrysopterus, Bloch, p. 286, No. 5?
Le Scare à nageoires dorées (Scarus chrysopterus, Bl.), Cuv. et Val., xiv. p. 185.

7. Scarus cœruleus, Cuv.

When dry, the whole body appears green or greenish gray. The scales and fins margined with brighter green. Forehead prominent. The points of the caudal fin more than one third of its whole length. Scales with a dead surface, smooth at their edges; the punctations scarcely seen without the lens. The arbuscules of the lateral line have a simple trunk, and three or four unequal, tortuous branches, which do not extend to the sides of the scales.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 16 to 20 inches.

Gulf of Mexico, Parra. Caribbean Sea, Cuv.

Called "Bleu Serin," or "Peau bleue," at St. Thomas.

Trompa, Parra, p. 57, pl. 27, fig. 2.
Mormyrus ex cinereo nigricans, Bone-fish, Catesby's Hist. Carol., ii pl. 13.
Le Scare à front bombé, ou le Scare bleu, Scarus cœruleus, Cuv. et Val., xiv. p. 186.

8. Scarus aurofrenatus, Cuv.

Crimson, tinged with brown upon the back, mingled with green towards the belly. Chest greenish, an orange band passes from the angle of the mouth beneath the eye, backwards, and a small one upon the temple parallel to it. The dorsal is orange, grayish anteriorly; anal red, edged with violet, and violet at its base. Caudal red, with a broad white edge, and extremities black. Pectorals pale orange, first ray violet or blackish; ventrals light red, irides rose-colored. Scales very feebly striated; the arbuscules of the lateral line, with five or six slightly ramified branches, occupying all the exposed part of the scale. Back of the head one and one third longer than high; two spines at the angle of upper jaw. Caudal crescent-shaped.

D. 10 - 9. P. (?). V. (?). A. (?). C. (?). Length, 10 inches.

Caribbean Sea, Cuv.

Le Scare bridé d'or, Scarus aurofrenatus, Cuv. et Val., xiv. p. 191.

9. Scarus quadrispinosus, Cuv.

When preserved, olive-brown; lighter upon the sides and beneath the belly. The inferior fins tinged with yellow; no lines nor bands upon the head or fins. Four sharp points placed longitudinally upon each side of the upper jaw. Scales feebly striated; the trunks of the venations of the lateral line nearly undivided.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 13 inches.

Caribbean Sea, Cuv.

Called "Cacabari," at St. Thomas.

Le Scare à quatre pointes, Scarus quadrispinosus, Cuv. et Val., xiv. p. 197.

10. Scarus vetula, Bloch.

Back olive-green; a wide yellow band arises at the shoulder, and extends upon the side to the middle of the body; belly greenish; a bright green surrounds the lips, forming two bands, which pass from the snout towards the eye, and are continued upon the temple, and also upon the trunk above the yellow band. The dorsal has a longitudinal yellow band between two bands of a bright green. Caudal bright green, with a yellow band above and below. Pectorals and ventrals yellow. Scales smooth to the touch; under the glass they appear finely striated and granulated. The arbuscules of the lateral line are divided into two or three small, short tufts.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 9 or 10 inches.

Gulf of Mexico, Parra. Caribbean Sea, Cuv.

Vieja, Parra, p. 53, pl. 28, fig. 1.
Scarus vetula, Bloch, p. 289, No. 1.
Le Scare à raies vertes, Scarus vetula, Bl., Cuv. et Val., xiv. p. 193.

11. Scarus punctulatus, Cuv.

The middle of the vertical fins yellowish, dotted with green; the edges of the caudal green. Two points on each side of the upper jaw.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 6 inches.

Caribbean Sea, Cuv.

Le Scare pointillé, Scarus punctulatus, Cuv. et Val., xiv. p. 195.

12. Scarus tæniopterus, Desmarest.

Brown, tinged with olive; no green lines upon the head, nor yellow nor orange margins to the tail. An opaque, yellowish-gray band at the base of the dorsal and anal, and a narrow brown line upon their margin.

D. (?) P. (?). V. (?). A. (?). C. (?). Length, 10 inches.

Gulf of Mexico, Cuv.

Le Scare à bandelettes (Scarus tæniopterus, Desmarest), Cuv. et Val., xiv. p. 195.

13. Scarus diadema, Cuv.

Greenish gray; a yellow band across the forehead, and continued back to the top of the temples; a second parallel band beneath this. A line at the base, and upon the edge of the dorsal; round and oval violet spots between these two lines. A row of spots, also, between two lines upon the anal. The arbuscules of the lateral line very slightly divided.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 6 inches.

Caribbean Sea, Cuv.

Called "Perroquet," at Martinique.

Le Scare diadème, Scarus diadema, Cuv. et Val., xiv. p. 193.

14. Scarus alternans, Cuv.

Silvery; head rose-colored, with three brighter-colored, wide bands. All the fins yellow. Scales finely striated and dotted. The arbuscules of the lateral line are simple trunks, having two or three very short branches along the trunk.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 7 to 8 inches.

Caribbean Sea, Cuv.

Called "Perroquet," at Martinique.

Le Scare à raies rouges et blanches, Scarus alternans, Cuv. et Val., xiv. p. 200.

15. Scarus rubripinnis, Cuv.

Olive-green, brownish towards the back, mingled with rose-color upon the breast and belly; ventrals and anal red; dorsal olive-gray, the rays with brownish spots; caudal ash-colored, marbled towards the base with deeper ash-brown; pectorals tinged with olive. Scales large and almost entire. Each arbuscule of the lateral line has four or five branches, which extend in irregular rays upon the scale.

D. 9 – 10. P. (?). V. (?). A. 1 – 10. C. (?). Length, 10 inches.

Caribbean Sea, Cuv.

Le Scare à ventrale et anale rouges, Scarus rubripinnis, Cuv. et Val., xiv. p. 199.

16. Scarus flavo-marginatus, Cuv.

Yellowish green, with neither lines nor bands upon the body or head. Dorsal is spotted with violet, with a yellow line near the edge, and another along the base. Anal similar; no spots upon the caudal.

D. (?). P. (?). V. (?). A. (?). C. (?). Weight, 2 or 3 pounds.

Caribbean Sea, Cuv.

Le Scare rayé de jaune, Scarus flavo-marginatus, Cuv. et Val., xiv. p. 202.

17. Scarus virens, Cuv.

Pale green, with reddish ventrals and caudal. When dried, greenish gray, with brownish tints; pectorals and ventrals yellowish. Small brownish spots upon the caudal, forming irregular bands. The arbuscules of the lateral line composed of one short and concealed trunk, with three or four long and straight branches.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Caribbean Sea, Cuv.

Called "Cotorra," at Porto Rico.

Vieja, Parra, p. 58, pl. 28, fig. 3.
Le Scare vert d'eau, Scarus virens, Cuv. et Val., xiv. p. 203.

18. Scarus radians, Cuv.

Greenish brown, or deep blue, with deeper reflected lines along the rows of scales. The arbuscules of the lateral line have concealed trunks, and three very slightly ramified branches which spread over almost all the scale. Four teeth on each side, occupying the whole circumference of the upper jaw, are directed horizontally and divergent.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Mexico, Cuv.

Le Scare à machoire rayonnée, Scarus radians, Cuv. et Val., xiv. p. 206.

GENUS XI. CALLYODON, Gronov.

Anterior teeth in several imbricated rows; the lateral teeth of the upper jaw separate and pointed, and upon each side of this jaw an inner row of much smaller teeth.

1. Callyodon flavescens, Cuv.

Yellow, with flesh-colored spots; fins rose-colored, with a black spot at the base of the pectorals.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Gulf of Mexico, Parra.

Vieja, Parra, p. 58, pl. 28, fig. 4.
Le Callyodon jaunâtre, Callyodon flavescens, Cuv. et Val., xiv. p. 289.

2. Callyodon auro-punctatus, Cuv.

Greenish. The three vertical fins are sprinkled with small aurora-colored spots, which unite in oblique and irregular bands. Spots of the same color upon the lower jaw. An aurora-colored line passes from the angle of the mouth to the eye, and another extends upon the cheek and towards the temple, where there is still another. Scales nearly smooth; their arbuscules have one principal branch, and four or five lateral branches, which are also but little ramified.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 6 inches.

Caribbean Sea, Cuv.

Le Callyodon à points dorés, Callyodon auro-punctatus, Cuv. et Val., xiv. p. 290.

ORDER II. MALACOPTERYGII. SOFT RAYED.

All the fin rays soft and cartilaginous, with the exception sometimes of the first in the dorsal and the first in the pectoral fins. These rays are of an articulated structure, and generally more or less branched at their extremities.

ABDOMINALES.

The ventrals behind the pectorals, and not attached to the humeral bone.

FAMILY XV. SILURIDÆ.

Skin naked, and covered with a mucous secretion. In some genera, the body is nearly covered by osseous plates. Head depressed, and generally enlarged, with several fleshy filaments. A second adipose dorsal often present. The intermaxillaries, suspended under the ethmoid bone, form the edge of the upper jaw. First ray of the dorsal and pectoral fins usually a strong, articulated spine, with a complicated movement.

GENUS I. BAGRUS, Cuv.

Behind the intermaxillary band of velvety teeth, another band, sometimes velvety and sometimes in a single range. The number of their barbels, and the form of their head, serve as characters for subdivision.

1. Bagrus mesops, Cuv.

Eye at half the distance between the extremity of the snout and the edge of the preopercle; the interparietal is only a sixth the length of the head, and its edges diverge. The entire helmet with compact granulations; the opercle is granulated near the articulation, and has closely crowded veins. Ventrals as long as the pectorals, and their rays singularly knotted. The maxillary barbel does not extend beyond the middle of the pectorals.

D. 1 - 7. P. (?). V. (?). A. 18. C. (?). Length, 16 to 17 inches.

Caribbean Sea, Cuv.

Le Bagre mesops, Bagrus mesops, Cuv. et Val., xiv. p. 456.

2. Bagrus proöps, Cuv.

Of a beautiful plumbeous slate-color, beneath white. The eyes three times nearer to the tip of the snout than to the edge of the preopercle. The opercular angle granulated, sharp, and as long as high ; dorsal and pectoral spines granulated upon their anterior face, dentated slightly behind. Jaws equal. The maxillary barbel extends only to the first quarter of the pectoral.

D. 1-7. P. 1-11. V. 6. A. 19. C. 15. Length, 6 inches to 2 feet.

Caribbean Sea, CUV.

Le Bagre proöps, Bagrus proöps, CUV. et VAL., XIV. p. 457.

GENUS II. GALEICHTHYS, CUV.

Head rounded, smooth, unarmed. Dorsal and pectoral fins long ; the first ray of each roughened, and ending in filaments. An adipose dorsal. Teeth on the jaws and vomer. Branchial rays, six. Mouth wide, with from four to six barbels.

1. Galeichthys marinus, MITCHILL.

Blue above, tinged with green ; sides silvery ; abdomen opaque white. Maxillary barbels not extending to the ventrals. Filament of the pectoral fin reaching to, and occasionally extending beyond, the ventrals. Caudal lunate, with pointed tips.

D. 1-6. P. 1-11. V. 6. A. 22. C. 17. Length, 6 inches to 2 feet.

New York, MITCHILL, DEKAY. New Orleans, South Carolina, CUV. Gulf of Mexico, PARRA.

Bagre, PARRA, p. 68, pl. 31, fig. 1.
Silurus marinus, Salt-water Cat-fish, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 433.
Le Galeichthe de Parra, Galeichthys Parræ, CUV. et VAL., XV. p. 33.
Galeichthys marinus, Oceanic Cat-fish, DEKAY'S Report, p. 178, pl. 37, fig. 118.

GENUS III. ARIUS, CUV.

With the general form of the Galeichthys, but the palatine teeth form two distinct and distant plates ; rarely any on the vomer. Branchial rays, five or six.

1. Arius Milberti, CUV.

Brownish, steel-blue, verging to blackish above ; silvery beneath. Adipose dorsal blackish ; the others gray or brown. Casque granulated all over, and not in radiating striæ. The maxillary barbels extend a little beyond the extremity of the operculum.

D. 1-7. P. 1-10. V. 6. A. 17. C. 15. Length, 5 to 15 inches.

New York, South Carolina, CUV.

L'Arius de Milbert, Arius Milberti, CUV. et VAL., XV. p. 74.
Arius Milberti, Milbert's Arius, DEKAY'S Report, p. 179.

GENUS IV. PIMELODUS, Cuv.

Palate smooth and without teeth. Barbels varying from six to eight. Casque occasionally present.

1. Pimelodus catus, Lin.

Fuliginous, darker upon the head and back, approaching to black; lighter upon the sides, tinged with cupreous; white beneath, in front of the ventrals. Upper jaw the longer. Caudal nearly even, rounded. The barbels at the angle of the upper jaw the longest.

D. 1 - 5. P. 1 - 8. V. 8. A. 21. C. 19. Length, 7 to 9 inches.

Maine, New Hampshire, Massachusetts, Storer. Connecticut, Ayres. New York, Mitchill, Cuv., Dekay. Lake Ontario, Lesueur. South Carolina, Cuv.

Cat-fish, Catesby's Hist. Carol., ii. p. 23, pl. 23.
Silurus catus, Lin., Syst. Nat.
" " Common Fresh-water Cat-fish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 433.
Pimelodus nebulosus, Lesueur, Mémoires du Muséum, v. p. 149.
" " Horned Pout, Storer's Report, p. 102.
Le Pimélode chat, Pimelodus catus, Cuv. et Val., xv. p. 124.
Le Pimélode nébuleux, Pimelodus nebulosus, Cuv. et Val., xv. p. 132.
Pimelodus catus, Common Cat-fish, Dekay's Report, p. 182, pl. 37, fig. 119.

2. Pimelodus cœnosus, Richardson.

Greenish above, marbled with deeper green; paler beneath; fins blackish. Labials ending in a tapering barbel, which reaches to the gill-opening. Pectoral spine serrated at its posterior edge by ten or eleven acute teeth. The outline of the dorsal, anal, and caudal rounded.

B. 9. D. 1 - 7. P. 1 - 8. V. 8. A. 24. C. $17\frac{9}{12}$. Length, 10 inches.

Lake Huron, Richardson.

Silurus (Pimelodus) cœnosus, Huron Pimelode, Rich., Fauna Boreal. Americ., iii. p. 132.
Le Pimélode sali (Pimelodus cœnosus, Rich.), Cuv. et Val., xv. p. 129.
Pimelodus cœnosus, Dekay's Report, p. 186.

3. Pimelodus borealis, Richardson.

Dark greenish brown on the back and sides; on the belly, whitish. Head flat and broad. Neither pectoral nor dorsal spine serrated. Dorsal subquadrangular. Caudal has a wide, shallow fork, with obtusely rounded lobes.

D. 1 - 6. P. 1 - 6. V. 9. A. 25. C. $17\frac{3}{3}$. Length, 30 inches.

Northern regions, Richardson.

Silurus (Pimelodus) borealis, Mæteneg, Rich., Fauna Boreal. Americ., iii. p. 135.
Le Pimélode boréal (Pimelodus borealis, Rich.), Cuv. et Val., xv. p. 130.
Pimelodus borealis, Dekay's Report, p. 187.

4. Pimelodus albidus, Lesueur.

Whitish ash. Fins red, excepting the adipose fin, which is brown.

B. 10. D. 1 - 6. P. 1 - 10. V. 8. A. 22. C. 10. Length, 12 to 15 inches.

Delaware, LESUEUR.

Pimelodus albidus, LESUEUR, Mémoires du Muséum, v. p. 148.
Le Pimélode blanchâtre (Pimelodus albidus, LESUEUR), CUV. et VAL., XV. p. 131.
Pimelodus albidus, DEKAY'S Report, p. 186.

5. Pimelodus nigricans, LESUEUR.

Large. Olive-brown; sides of the body, towards the tail, ash-white, with occasionally large, confluent black spots; a few irregular, distant, round black spots on the upper part of the body. Beneath bluish white, varied with darker. Caudal forked.

D. 1 - 6. P. 1 - 9. V. 1 - 8. A. 26. C. $17\frac{2}{2}$. Length, 2 to 4 feet. Weight, 6 to 30 pounds.

Lakes Erie and Ontario, LESUEUR.

Le Pimélode noirâtre, Pimelodus nigricans, LESUEUR, Mémoires du Muséum, v. p. 153, pl. 16.
Silurus (Pimelodus) nigrescens, Black Pimelode, LESUEUR, RICH., Fauna Boreal. Americ., III. p. 134.
Le Pimélode noirâtre (Pimelodus nigricans, LESUEUR), CUV. et VAL., XV. p. 133.
Pimelodus nigricans, Great Lake Cat-fish, DEKAY'S Report, p. 180.

6. Pimelodus punctulatus, CUV.

Above brown, punctured with black; beneath whitish. Fins brown. When fresh, silvery gray. Branchial rays, twelve. The lower jaw the longer. The maxillary barbel does not extend beyond the middle of the operculum. Caudal even.

D. 1 - 6. P. 1 - 10 or 11. V. 8. A. 16. C. 17. Length, 2 to 3 feet.

Louisiana, CUV.

Called "Black Cat-fish," or "Mud-fish."

Le Pimélode piqueté, Pimelodus punctulatus, CUV. et VAL., XV. p. 134.
Pimelodus punctulatus, DEKAY'S Report, p. 187.

7. Pimelodus æneus, LESUEUR.

Copper-colored, marbled with black. Lower jaw the longer. Caudal truncated. Dorsal spine without teeth; pectoral spine denticulated at its edges.

D. 1 - 6. P. 1 - 8. V. 9. A. 11. C. 25. Length, 2 to 3 feet.

Ohio, CUV.

Pimélode cuivre, Pimelodus æneus, Mémoires du Muséum, v. p. 150.
Le Pimélode cuivre (Pimelodus æneus, LESUEUR), CUV. et VAL., XV. p. 135.
Pimelodus æneus, DEKAY'S Report, p. 187.

8. Pimelodus furcatus, LESUEUR.

Silvery; dull towards the back. Elongated. Tail furcated. Adipose fin small and narrow. Upper jaw longer than the lower. The maxillary barbel scarcely extends beyond the preoperculum. Pectoral and dorsal spines denticulated posteriorly.

D. 1 - 7. P. 1 - 10. V. (?). A. 32 - 33 or 34. C. 15. Length, 1 to 4 feet.

Ohio, Louisiana, Lesueur.

Pimelodus à queue fourchue, Pimelodus cauda-furcatus, Lesueur, Mémoires du Muséum, v. p. 152.
Le Pimélode fourchu (Pimelodus furcatus, Lesueur), Cuv. et Val., xv. p. 136.
Pimelodus furcatus, Dekay's Report, p. 187.

9. Pimelodus pullus, Dekay.

Uniform dusky brown above, approaching to black; beneath bluish white. Fins and cirrhi black, the former tinged with red. Pectorals pointed; ventrals subacute; caudal fins emarginate.

D. 1-5. P. 1-7. V. 8. A. 17. C. $19\frac{3}{3}$. Length, 9 inches to 1 foot.

New York, Dekay.

Pimelodus pullus, Brown Cat-fish, Dekay's Report, p. 184, pl. 37, fig. 117.

10. Pimelodus atrarius, Dekay.

Deep black, occasionally blackish brown above and on the sides; ashen-gray beneath. Adipose dorsal long and slender; the rays of the fins passing beyond the membrane. Caudal emarginate, round, with numerous accessary rays.

D. 1-6. P. 1-7. V. 8. A. 20. C. $17\frac{6}{6}$. Length, 4 to 5 inches.

New York, Dekay.

Pimelodus atrarius, Black Cat-fish, Dekay's Report, p. 185, pl. 36, fig. 116.

11. Pimelodus cupreus, Raf.

The upper surface of the head and back is olivaceous; the sides and beneath coppery yellow, and the fins often orange or reddish. Upper jaw projecting. Maxillary barbels short, reaching only half the length of the head. Adipose small and narrow, and does not reach as far back as the termination of the base of the anal fin. Anal rounded anteriorly; acute at its posterior angle.

D. 1-7. P. 1-7. V. 1-7. A. 21. C. $21\frac{4}{4}$. Length, 1 to 4 feet.

Lake Erie, Ohio River, and their tributaries, Raf., Kirtland.

Pimelodus cupreus, Yellow Cat-fish, Raf., Ichth. Ohien., p. 65.
" " " " Kirtland's Report, pp. 169, 194; catalogued, not described.
" " " " Dekay's Report, p. 187; catalogued, not described.
" " " " Kirtland's Manuscript for publication in Bost. Journ. Nat. Hist

12. Pimelodus limosus, Raf.

Dusky, clouded with irregular muddy spots on the head and back, and lighter gray on the abdomen and throat. Maxillary barbels extend to the pectoral fin. Lower jaw the longer. Anal rounded; caudal nearly even.

D. 1-7. P. 1-10. V. 9. A. 1. C. 20. Length, 18 inches.

Ohio River, Raf., Kirtland.

Pimelodus limosus, Mud Cat-fish, RAF., Ichth. Ohien., p. 66.
Pimelodus nebulosus, Mud Cat-fish, RAF. (a variety from age), Ichth. Ohien., p. 64.
" " " " KIRTLAND'S Report, pp. 169, 194; catalogued, not described.
" " " " DEKAY'S Report, p. 187; catalogued, not described.
Pimelodus limosus, Mud Cat-fish, KIRTLAND'S Manuscript for publication in Bost. Journ. Nat. Hist.

13. Pimelodus natalis, LESUEUR.

Color of the fins deep red, mingled with yellow. The top of the head is of a deep olive, which is lighter upon the back, passing into yellow upon the sides, and becoming a bright yellow upon the abdomen. Body equal. Caudal fin truncated in a straight line; anal long, rounded. The barbels of the inferior jaw are unequal; the central two the shorter.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, 8 inches.

Habitat, (?). Lesueur does not mention, although probably a southerner.

Pimelode noel, Pimelodus natalis, LESUEUR, Mémoires du Muséum, v. p. 155.

14. Pimelodus lemniscatus, LESUEUR.

Pale and russet-colored. The first dorsal, anal, caudal, and pectorals, edged with black. Skin smooth, with small pustules upon the back. Its long and low adipose fin is united to the caudal fin. Tail round, wide, and united to anal fin by a membrane. The dorsal spine not denticulated; that of the pectorals short, and denticulated anteriorly.

D. 8. P. 12. V. 9. A. 20. C. 50. All the fin rays subdivided. Length, 4 to 8 inches.

Southern States, DEKAY.

Pimelodon livrée, Pimelodus lemniscatus, LESUEUR, Mémoires du Muséum, v. p. 155.
Pimelodus lemniscatus, DEKAY'S Report, p. 187.

15. Pimelodus cœrulescens, RAF.

Back, head, and sides of the belly, dusky or lead color; forehead dark brown, sides of the head yellowish; belly and throat white. The maxillary barbels extend beyond the pectoral fins. Adipose fin broad, oblong-oval. Caudal fin merely lunate in old specimens; deeply and acutely forked in the young. Pectoral spine serrated upon its posterior edge.

D. 1-6. P. 1-7. V. 8. A. 30. C. 20. Length, 22 inches.

Lake Erie and the Ohio River, KIRTLAND. Alabama, STORER.

Pimelodus cœrulescens, Blue Cat-fish, RAF., Ichth. Ohien., p. 63.
" " " " KIRTLAND'S Report, pp. 169, 194.
Pimelodus maculatus, Spotted Cat-fish, RAF., Ichth. Ohien., p. 62 (the young).
Pimelodus pallidus, White Cat-fish, RAF., Ichth. Ohien., p. 63 (the middle-aged).
" " " " KIRTLAND'S Report, pp. 169, 194.
Pimelodus argyrus, Silvery Cat-fish, RAF., Ichth. Ohien., p. 64 (variety from locality).

16. Pimelodus xanthocephalus, RAF.

Iron-gray, with the whole or part of the head yellow. Belly white. Upper jaw the longer. Barbels shorter than the head. Tail entirely truncate?

D. 1-6. P. (?). V. (?). A. 22. C. 24. Length, 1 foot.

Ohio River and tributaries, RAF.

The " Small Black Bull-head " of the northern streams and lakes.

Pimelodus xanthocephalus, Yellow-head Cat-fish, RAF., Ichth. Ohien., p. 66.
" " " " KIRTLAND'S Report, pp. 169, 191.
" " " " DEKAY'S Report, p. 187.

GENUS V. NOTURUS, RAF.

Adipose dorsal fin very long, decurrent, and united with the tail, which is decurrent on each side, but unconnected with the anal fin. It differs from the genus Plotosus of Lacepede by having the anal fin free, and from Pimelodus by the connection of the tail with the second dorsal fin.

1. Noturus flavus, RAF.

Back and head yellowish olive ; sides yellow ; nose, throat, and abdomen, white. Fins diaphanous, slightly dusky. Maxillary barbels not as long as the head. Rudiments of an immature adipose fin. Anal elongate, widened behind.

D. 1 – 7. P. 1 – 7. V. 8. A. 1 – 7. C. (?). Length, 4 to 12 inches.

Ohio, Mahoning River, and Lake Erie, RAF., KIRTLAND.

Noturus flavus, Yellow Back-tail, RAF., Ichth. Ohien., p. 68.
" " " " KIRTLAND'S Report on the Zoöl. of Ohio, pp. 169, 195.
Pimelodus flavus, Young Cat-fish, with the rudiments of an adipose fin, DEKAY'S Report, p. 187.
Noturus flavus, RAF., KIRTLAND'S Manuscript for publication in the Bost. Journ. Nat. Hist.

Dr. Kirtland considers this a full grown species, and distinct ; and has, therefore, adopted Rafinesque's genus.

FAMILY XVI. CYPRINIDÆ.

Mouth but slightly cleft ; weak jaws, most frequently without teeth, and the edge of which is formed by the intermaxillaries ; pharyngeals strongly dentated. Branchial rays not very numerous. Body scaly. One dorsal fin. No adipose dorsal. Their stomach has no cul-de-sac, nor their pylorus any cœcal appendages. They are the least carnivorous of all fishes.

GENUS I. CYPRINUS, LIN.

Body covered with large scales ; a single elongated dorsal fin ; lips fleshy ; mouth small ; teeth in the pharynx, but none on the jaws ; branchial rays, three.

1. Cyprinus carpio, Lin.

Golden olive-brown, head darkest; belly yellowish white; fins dark brown. Dorsal fin long, emarginate; the second dorsal ray and first anal ray serrated posteriorly. Two barbels at the angle of the mouth. Tail forked. Twelve rows of scales between the ventral and dorsal fins.

D. 22. P. 17. V. 9. A. 8. C. 19. Length, 6 to 12 inches.

Introduced into Newburgh, Orange County, New York, from France, Dekay.

Cyprinus carpio, Lin., Syst. Nat.
La Carpe, Cyprinus carpio, Bloch, i. p. 77, pl. 16.
Cyprinus carpio, Common Carp, Shaw's Gen. Zoöl., v. p. 179, pl. 121.
" " " " Pennant's Brit. Zoöl., iii. p. 467, pl. 81.
" " " " Griffith's Cuv., x. p. 376.
" " " " Jenyns's Brit. Vert., p. 401.
" " " " Yarrell's Brit. Fishes (2d edit.), i. p. 319.
" " " " Strack's Plates, p. 134, fig. 1.
" " " " Dekay's Report, p. 188.
La Carpe vulgaire, Cyprinus carpio, Cuv. et Val., xvi. p. 23.

2. Cyprinus auratus, Lin.

Blackish at first, it assumes by degrees the fine golden red by which it is characterized; but some are found of a silvery hue, and others variegated with these shades of color. Some individuals have no dorsal, others a very small one; others have a very large caudal, divided into three or four lobes; the dorsal and anal spines are denticulated as in the common Carp.

D. 16. P. 15. V. 9. A. 18. C. 17. Length, 4 to 10 inches.

A native of China. Introduced. Breeds freely in ponds in New York, Dekay, and in some portions of Massachusetts, Storer.

Cyprinus auratus, Lin., Syst. Nat.
" " Bloch, iii. pl. 93, 94.
" " Gold Carp, Pennant's Brit. Zoöl., iii. p. 490.
" " Golden Carp, Jenyns's Brit. Vert., p. 403.
" " Gold Carp, Yarrell's Brit. Fishes (2d edit.), i. p. 361.
" " Golden Carp, Gold-fish, Griffith's Cuv., x. p. 377.
" " " " Storer's Report, p. 82.
" " Gold Carp, Dekay's Report, p. 190.
La Carpe dorée, Cyprinus auratus, Cuv. et Val., xvi. p. 101.

GENUS II. GOBIO, Cuv.

Dorsal and anal short, and without spines. Pharyngeal teeth conic, feebly bent at their summits, and in two series. Barbels at the angles of the mouth.

1. Gobio cataractæ, Val.

Body elongated and rounded. The dorsal, in the middle of its length, is small; caudal emarginate, and with rounded lobes; anal rounded, and larger than the dorsal; ventrals small; pectorals large. A barbel, very small, at each angle of the mouth. Scales small, smooth, not striated, with seventy in a longitudinal series. Back deep gray, passing into plumbeous, and becoming silvery on the belly. Pectorals, dorsal, and caudal, gray; ventrals and anal slate.

D. 3 - 6. P. (?). V. (?). A. 2 - 6. C. 19. Length, 5 inches.

Niagara Falls, VAL.

Le Goujon des cataractes (Gobio cataractæ, VAL.), CUV. et VAL., XVI. p. 315, pl. 483.
Gobio cataractæ, Niagara Gudgeon, DEKAY's Report, p. 394.

GENUS III. LEUCISCUS, KLEIN.

The dorsal and anal fins short, without strong rays at their commencement. No cirrhi nor barbels on the head. The dorsal either above the ventrals, or between them and the anal.

1. Leuciscus Americanus, LACEP.

Blackish, with shining white scales. Gill-covers golden, with a tinge of the same along the belly. Head often greenish; and when the scales fall off, the back is frequently tinged with green and blue. Dorsal and abdominal outlines convex.

D. 9. P. 17. V. 9. A. 14. C. 19. MITCHILL.

D. 9. P. 17. V. 9. A. 13. C. 19. STORER. Length, 5 to 7 inches.

D. 10. P. 15. V. 10. A. 14. C. 19$\frac{2}{2}$. DEKAY.

Massachusetts, STORER. New York, MITCHILL, DEKAY. Ohio River, KIRTLAND. Pennsylvania, South Carolina, CUV.

Cyprinus Americanus, LACEPEDE, v. pl. 15, fig. 3.
" " American Carp, SHAW's Gen. Zoöl., v. p. 204.
Cyprinus crysoleucas, New York Shiner, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 459.
Luxilus cryso-cephalus? RAF., Ichth. Ohien., p. 43.
Cyprinus (Leuciscus) crysoleucas, RICH., Fauna Boreal. Americ., III. p. 122.
Leuciscus crysoleucas, STORER's Report, p. 83.
Stilbe crysoleucas, New York Shiner, DEKAY's Report, p. 204, pl. 29, fig. 91.
Leuciscus crysoleucas, Gold Shiner, KIRTLAND, Bost. Journ. Nat. Hist., IV. p. 305, pl. 15, fig. 1.
L'Able de Bosc (Leuciscus Boscii, VAL.), CUV. et VAL., XVII. p. 313.

2. Leuciscus atronasus, MITCHILL.

Above greenish. A broad dark-brown or blackish band passes from the nose, including the lower half of the eyes, and proceeds in a straight line to the tail. Abdomen silvery, with a few blackish stains. Tail forked.

D. 7. P. 12. V. 9. A. 7. C. 19. MITCHILL. Length, 3 inches.

D. 8. P. 15. V. 8. A. 8. C. 19$\frac{3}{3}$. DEKAY. " "

Massachusetts, STORER. New York, MITCHILL, DEKAY.

Cyprinus atronasus, Brook Minnow, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. 460.
" " Black-nosed Dace, DEKAY's Report, p. 205, pl. 33, fig. 69.
L'Able à nez noir (Leuciscus atronasus, MITCH.), CUV. et VAL., XVII. p. 376.

3. Leuciscus cornutus, Mitchill.

Above blackish brown, with metallic reflections; sides brilliant cupreous. Dorsal and caudal fins dark brown, sometimes mottled with darker clouds; ventrals and pectorals light colored; all the fins and the opercles margined with crimson. Numerous tubercles on the head.

D. 8. P. 15. V. 8. A. 9. C. $19\frac{7}{7}$. Length, 5 inches.

Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Cyprinus cornutus, Red-fin, or Rough-head, Mitchill, Amer. Month. Mag., II. p. 324.
Leuciscus cornutus, Red-fin, Storer's Supplement, Bost. Journ. Nat. Hist., III.
" " " Dekay's Report, p. 207, pl. 29, fig. 92.

Called, also, "Red Dace."

4. Leuciscus atromaculatus, Mitchill.

Above dark olive-green, with a broad, dark, longitudinal band extending from the gill-covers to the tail. Flanks golden-yellow. Beneath silvery-white. Head deep brownish-black. Dorsal fin with a dark spot at the anterior portion of its base. Back, anterior to the dorsal, with a depression in the vertebral line. Lips fleshy.

D. 7. P. 13. V. 7. A. 7. C. 21.

D. 9. P. 15. V. 8. A. 9. C. $18\frac{5}{5}$. Length, 10 inches.

New York, Mitchill, Dekay.

Called "Lake Chub," and "Lake Dace."

Cyprinus atromaculatus, Mud-fish, Mitchill, Amer. Month. Mag., II. p. 324.
Leuciscus atromaculatus, Black-headed Dace, Dekay's Report, p. 210, pl. 32, fig. 102.

5. Leuciscus Hudsonius, De Witt Clinton.

A broad satin stripe extending from the gill-covers to the tail, and a dark, rounded spot at the base of the tail. Opercles silvery. Tips of the ventrals nearly reaching to the anal fin.

D. 8. P. 11. V. 8. A. 8. C. $20\frac{3}{3}$. De Witt Clinton.

D. 8. P. 15. V. 8. A. (?). C. $19\frac{6}{6}$. Dekay. Length, 4 inches.

New York, Clinton, Dekay.

Clupea Hudsonia, Spawn-eater, Clinton, Annals of Lyc. Nat. Hist. of N. York, I. p. 49, pl. 2, fig. 2.
Leuciscus Hudsonius, Spawn-eater, Dekay's Report, p. 206, pl. 34, fig. 109.

6. Leuciscus compressus, Raf.

Head and back yellowish brown, sides and beneath silvery; pectorals yellow; abdominal fins bright orange. Body very much compressed. Scales moderate size. Abdomen slightly carinated at the base of the anal fin.

D. 9. P. 14. V. (?). A. 9. C. 30. Length, 2 to 4 inches.

Ohio, Raf., Kirtland.

Rutilus compressus, Fall-fish, Raf., Ichth. Ohien., p. 51.
" " Flat Shiner, Kirtland's Report, p. 169.
Leuciscus compressus, Fall-fish, Kirtland, Bost. Journ Nat. Hist., IV. p. 306, pl. 15, fig. 2.

7. Leuciscus erythrogaster, Raf.

Two longitudinal black stripes upon sides; the space between the stripes white and silvery; abdomen white, occasionally tinged with carmine in some specimens, and wholly of a bright carmine in others. Head short.

D. 8. P. 12. V. 8. A. 8. C. 20. Length, 3 to 6 inches.

All the small brooks and rivulets of the West, Kirtland. Alabama, Storer.

Luxilus erythrogaster, Red-bellied Shiner, Raf., Ichth. Ohien., p. 47.
" " " " Kirtland's Report, Catalogue, p. 169.
" " " " " Bost. Journ. Nat. Hist., iv. p. 23, pl. 11, fig. 2.

8. Leuciscus plargyrus, Raf.

Olivaceous and brown on the back and head; white and silvery on the sides and operculum, occasionally iridescent. A brown band extends from the base of the head to the caudal fin, and involves the lateral line in its posterior half; beneath this band, a delicate blue or purplish tint is finally lost in the pure white of the abdomen. Mouth diagonal. Eyes large.

D. 9. P. 15 to 20. V. 9. A. 9. C. 20. Length, 4 inches.

Kentucky, Raf. Every permanent stream in the State of Ohio, Kirtland.

Rutilus plargyrus, Silver-side Fall-fish, Raf., Ichth. Ohien., p. 50.
" " Common Shiner of Ohio, Kirtland, Bost. Journ. Nat. Hist., v. p. 26, pl. 8, fig. 2.

9. Leuciscus cephalus, Raf.

Silvery. Back brownish. Sometimes the base of the caudal fin is marked like the dorsal, with a round black or olive spot. The upper surface of the head and upper jaw often ornamented with prominent spines, varying in height and number.

D. 9. P. 15. V. (?). A. 9. C. 20. Length, 6 to 8 inches.

Ohio, Raf., Kirtland.

Semotilus cephalus, Big-head Chubby, Raf., Ichth. Ohien., p. 49.
" " Horned Chub, Kirtland's Report, p. 169.
" " " " " Bost. Journ. Nat. Hist., iii. p. 345, pl. 5, fig. 2.
Leuciscus cephalus, Horned Chub, Dekay's Report, p. 214.

10. Leuciscus Kentuckiensis, Raf.

Upper surface of the head and back dark umber, running into a lighter brown as it descends the sides, which are of a faint blue, that fades into a silvery white on the abdomen. Head of the male studded with minute tubercles above. Scales large. Caudal fin large, acutely lobed.

D. 8. P. 12. V. (?). A. 8. C. 22. Length, 3 to 5 inches.

Kentucky, Raf. Ohio, Kirtland.

Luxilus Kentuckiensis, Kentuckian Shiner, Raf., Ichth. Ohien., p. 48.
" " White and Yellow-winged Shiner, Kirtland's Report, Catalogue, p. 169.
" " Kentucky Shiner, Kirtland, Bost. Journ. Nat. Hist., v. p. 27, pl. 8, fig. 3.

11. Leuciscus diplemia, Raf.

Back olive, abdomen white and silvery, the sides iridescent and violaceous, marked with irregular and interrupted black lines on the posterior edges of the scales. Fins orange-colored in the females, violet or red in the males. Head flat between the eyes. Snout rounded, and in the males warty. Opercular angle with a diaphanous membrane. Under jaw slightly projecting. Back elevated in front of the dorsal.

D. 9. P. 14. V. 8. A. 9. C. 22. Length, 2 to 4 inches.

All the Western streams, Kirtland.

Semotilus diplemia, Warty Chubby, Raf., Ichth. Ohien., p. 50.
" " Red-sided Chub, Kirtland's Report, Catalogue, p. 169.
" " Red-sides, Warty Chub, Kirtland, Bost. Journ. Nat. Hist., v. p. 276, pl. 22, fig. 3.

12. Leuciscus dorsalis, Raf.

Head and back bronzed. A brown stripe extends from the base of the tail to the head above the lateral line. Abdomen white and silvery. Fins fulvous, the anterior part of the base of the dorsal and the centre of the base of the caudal marked with a dark brown or black spot. Back gibbous anterior to the dorsal fin.

D. 8. P. (?). V. 8. A. 8. C. 20. Length, 6 to 10 inches.

All the Western streams, Kirtland.

Semotilus dorsalis, Big-back Chubby, Raf., Ichth. Ohien., p. 49.
" " Smooth-headed Chub, Kirtland's Report, p. 169.
" " Common Chub, Kirtland, Bost. Journ. Nat. Hist., v. p. 274, pl. 22, fig. 1.

13. Leuciscus gracilis, Richardson.

Pale oil-green on the back, fading to white on the belly. Sides of the head nacreous. Head small. Scales large and thin. Lateral line straight, with fifty-five scales; seventeen scales in a vertical row under the dorsal, of which seven are above the lateral line.

D. 9. P. 17. V. 8. A. 10. C. $19\frac{4}{5}$. Length, 12 inches.

Northern regions, Richardson.

Cyprinus (Leuciscus) gracilis, Saskatchewan Dace, Rich., Fauna Boreal. Americ., III. p. 120, pl. 78.
No-natcheegaes, Cree Indians.
L'Able grêle (Leuciscus gracilis, Rich.), Cuv. et Val., xvii. p. 324.

14. Leuciscus caurinus, Rich.

Moderately compressed. Head one fourth of its entire length, exclusive of caudal. Scales suborbicular, crenated exteriorly, and impressed with from fourteen to twenty fine but conspicuous lines, radiating from near the base, which is neither furrowed nor crenated. Seventy-five on the lateral line, twenty-four in a vertical line before the dorsal, and ten in a linear inch measured on the fore part of the sides. Caudal deeply forked.

D. 10. P. 18. V. 10. A. 9. C. $19\frac{6}{6}$. Length, $12\frac{1}{2}$ inches.

Columbia River, RICHARDSON.

Cyprinus (Leuciscus) caurinus, Northwest Dace, RICH., Fauna Boreal. Americ., III. p. 304.
Leuciscus caurinus, DEKAY's Report, p. 215.
L'Able du Nord-ouest (Leuciscus caurinus, RICH.), CUV. et VAL., XVII. p. 325.

15. Leuciscus Oregonensis, RICH.

Brownish, belly silvery white. More elongated than the preceding; head longer. Scales more perfectly orbicular than those of the L. caurinus, and those on the belly are proportionally smaller.

D. 10. P. 15. V. 9. A. 9. C. $19\frac{3}{3}$. Length, 13 inches.

Columbia River, RICHARDSON.

Cyprinus (Leuciscus) Oregonensis, Columbia River Dace, RICH., Fauna Boreal. Americ., III. p. 305.
Leuciscus Oregonensis, DEKAY's Report, p. 215.
L'Able de l'Oregon (Leuciscus Oregonensis, RICH.), CUV. et VAL., XVII. p. 326.

16. Leuciscus Smithii, RICH.

Lateral line straight, containing sixty scales. Scales commencing on the forehead above the eyes, rather large, shining, and pellucid, reflecting a brilliant green on the back, but having a silvery lustre on the sides and abdomen. Tongue toothed. Caudal forked. Eyes very large. Under jaw longest. Nostrils on the tip of the snout.

D. 1 – 12. P. 12. V. 7. A. 1 – 27. C. 18. Length, 9 to 10 inches.

St. Lawrence River, LIEUT. COL. C. H. SMITH.

Cyprinus (Abramis?) Smithii, La Quesche, RICH., Fauna Boreal. Amer., III. p. 110, fig.
Abramis Smithii, DEKAY's Report, p. 192.
L'Able à baudrier (Leuciscus Smithii, RICH.), CUV. et VAL., XVII. p. 327.

17. Leuciscus balteatus, RICH.

Back of the head and body mountain-green, with iridescent tints of yellow and blue. Belly silvery white. A bright golden-yellow band behind the eye, on the margin of the preoperculum, and a broad scarlet-red stripe beneath the lateral line, extending from the gill-opening to the anal fin. Fins of a uniform greenish-gray color, without brilliancy. About fifty-seven scales on the lateral line. The head is exactly one fourth the length of the fish. Nostrils near the eyes.

D. 11. P. 17. V. 9. A. 19 to 22. C. $19\frac{7}{7}$. Length, 5 to 6 inches.

Columbia River, RICHARDSON.

Cyprinus (Abramis) balteatus, Red-sided Bream, RICH., Fauna Boreal. Americ., III. p. 301.
Abramis balteatus, DEKAY's Report, p. 192.
L'Able de Smith (Leuciscus balteatus, RICH.), CUV. et VAL., XVII. p. 329.

18. Leuciscus pulchellus, STORER.

Back dark brown; sides and abdomen of a beautiful flesh-color, tinged with golden reflections. Head bluish on the top; gill-covers silvery, with cupreous and flesh-colored tints, and edged with a brown, membranous prolongation. Scales large, transparent, rounded at their summit, truncated at their base, striated; at the base of each scale is a fleshy, dark-colored membrane, which, projecting as far as the apex of the preceding scale, gives the appearance of indistinct oblique bands across the fish. The lateral line contains fifty-one scales; nine scales in an oblique line above the lateral line, and six below it. Dorsal nearly as high again as long. Anal higher than long.

D. 10. P. 17. V. 8. A. 10. C. 22. Length, 6 to 14 inches.

Massachusetts, STORER. New York, VALENCIENNES.

Leuciscus pulchellus, Beautiful Leuciscus, STORER's Report, p. 91.
" " Roach Dace, DEKAY's Report, p. 208.
Leuciscus argenteus, Silvery Leuciscus, STORER's Report, p. 90.
" " Silvery Dace, DEKAY's Report, p. 212.
Cyprinus corporalis? Corporal? MITCHILL, Amer. Month. Mag., VII. p. 324.
Leuciscus? corporalis, Corporaalen, DEKAY's Report, p. 213.
L'Able gentil (Leuciscus pulchellus, STORER), CUV. et VAL., XVII. p. 320.
L'Able de Storer (Leuciscus Storeri, VAL.), CUV. et VAL., XVII. p. 319, pl. 505.

19. Leuciscus biguttatus, KIRTLAND.

Olive and bluish above the medial line; sides and abdomen faintly cupreous. Fins orange, tinged with ferruginous; a black spot at the base of the caudal fin. Body and fins irregularly punctated with small black dots, and a large vermilion dot behind each eye. The older individuals, especially the males, have the upper surface of the head and upper jaw studded with numerous spines in the spring of the year.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, 6 inches.

Ohio, KIRTLAND.

Vulgar name, the "Jerker."

Semotilus biguttatus, Two-spotted Chub, KIRTLAND, Bost. Journ. Nat. Hist., III. p. 344, pl. 5, fig. 1.
Leuciscus biguttatus, DEKAY's Report, p. 211.

20. Leuciscus elongatus, KIRTLAND.

Back a beautiful sky-blue, edged below with a gilt band; below this is an interrupted black band, extending from the point of the upper jaw to the tail, passing through the iris of the eye, but broken by a carmine, or, in others, a vermilion stripe terminating above the end of the ventrals. Sides and belly silvery. Body elongated, slim. Dorsal high; caudal deeply forked.

D. 8. P. (?). V. (?). A. 9. C. 20. Length, 3 inches.

Tributaries of Lake Erie, near Cleveland, and of the Mahoning River, Trumbull county, Ohio, KIRTLAND.

Luxilus elongatus, Red-bellied Shiner of the Lake, KIRTLAND's Report, pp. 169, 193.
" " " " " KIRTLAND, Bost. Journ. Nat. Hist., III. p. 339, pl. 4, fig. 1.
Leuciscus elongatus, DEKAY's Report, p. 214.

21. Leuciscus dissimilis, Kirtland.

Back brownish or olive ; a belt of gilt along the lateral line, with about twelve bluish dots, which enlarge towards the tail ; an ochreous band runs along the back, which is faintly marked with darker spots ; abdomen white and silvery ; fins pale, rays slightly marked with dark tints. Head flat between the eyes ; nose prominent ; lower lip slightly fleshy and projecting.

D. 8 or 9. P. (?). V. 8. A. 7. C. 20. Length, 4½ inches.

Mahoning River and Lake Erie, Kirtland.

Luxilus dissimilis, Spotted Shiner, Kirtland, Bost. Journ. Nat. Hist., iii. p. 341, pl. 4, fig. 2.
Leuciscus dissimilis, Dekay's Report, p. 214.

22. Leuciscus nitidus, Dekay.

Olive-brown above ; sides silvery. Head with mucous pores. Tail deeply emarginate, not furcate. Scales large, forty-six along the lateral line. Seven scales in an oblique line from the first dorsal ray to the lateral line, and five below it.

D. 8. P. 16. V. 10. A. 9. C. $19\frac{5}{5}$. Length, 2 inches.

Lake Champlain, Dekay.

Leuciscus nitidus, Shining Dace, Dekay's Report, p. 209, pl. 33, fig. 105.

23. Leuciscus chrysopterus, Dekay.

A general silvery color, with a darker hue above. Fins yellowish. Ventrals with an accessory scale. Dorsal emarginate. Scales large, subequal. Forty-five scales in a longitudinal series. In a transverse series to the ventrals, seven above and six below the lateral line.

D. 9. P. 15. V. 9. A. 10. C. $19\frac{6}{6}$. Length, 6 inches.

New York, Dekay.

Leuciscus chrysopterus, Bay Shiner, Dekay's Report, p. 211, pl. 30, fig. 95.

24. Leuciscus vittatus, Dekay.

Olive-green, with a golden dorsal stripe ; silvery beneath, tinged with flesh-color. Caudal deeply forked. Scales moderate. Upper edge of the anal slightly emarginate.

D. 9. P. 15. V. 8. A. 8. C. $19\frac{4}{4}$. Length, 4 inches.

New York, Dekay.

Leuciscus vittatus, Banded Dace, Dekay's Report, p. 212, pl. 34, fig. 108.

25. Leuciscus pygmæus, Dekay.

Very small. Head and back uniform dark brown or black above, and lighter towards the abdomen. One or more black ocellate spots on the base of the oblong, pointed tail. Scales soft, large in proportion to the size of the body. Caudal long, lanceolate.

D. 14. P. 16. V. 6. A. 13. C. 17. Length, 1 inch.

New York, DEKAY.

Leuciscus pygmæus, Pigmy Dace, DEKAY's Report, p. 214, pl. 42, fig. 134.

26. Leuciscus versicolor, DEKAY.

Silvery, varied with green, blue, and golden. Dorsal and abdominal outlines very convex. Scales very large, orbicular, with eccentric striæ. Pectorals broad, placed very low; anal with fourteen rays; caudal forked, base covered with scales.

D. 9. P. 14. V. 9. A. 14. C. 19$\frac{4}{4}$. Length, 4 inches.

New York, DEKAY.

Called "Dace," at Peekskill. Known, also, by the names of "Yellow-bellied Perch," and "Wind-fish."

Abramis versicolor, Variegated Bream, DEKAY's Report, p. 191, pl. 32, fig. 103.

27. Leuciscus nasutus, AYRES.

Above and on the sides dark bluish brown; beneath nearly white. Dorsal and caudal fins light brown; ventrals and anal nearly transparent; pectorals a little darker than the ventrals. Snout projecting. Mouth small, semicircular. Dorsal trapezoidal; pectorals situated very low, almost beneath the body; caudal beautifully lunated.

D. 10. P. 16. V. 9. A. 8. C. 19. Length, 3½ inches.

Massachusetts, OLMSTED. Connecticut, AYRES.

Leuciscus nasutus, AYRES, Bost. Journ. Nat. Hist., IV. p. 299, pl. 13, fig. 3.

28. Leuciscus gardoneus, VAL.

Height of the body equal to one fourth its whole length; length of the head equal to about one sixth the length of the body. Five pharyngeal teeth in a single row. The trapezoidal dorsal fin arises half way between the extremity of the snout and the base of the caudal fin. Anal short; caudal slightly forked. Thirty-nine rows of scales upon the sides, seven above and three beneath the lateral line. Striæ upon the upper portion of the operculum; but one or two striæ upon the scales.

D. 11. P. (?). V. (?). A. 10. C. (?). Length, 6 inches.

L'Able gardonnet (Leuciscus gardoneus, VAL.), CUV. et VAL., XVII. p. 316.

29. Leuciscus vandoisulus, VAL.

Body elongated and compressed; lower jaw longer than the upper; pharyngeal teeth hooked, in two rows, one with five, the other with two teeth. Height equal to one fourth the length of the body, not including the tail. Head equal in length to height of body.

Caudal short; the dorsal and anal similar to the same fins in the L. vulgaris. Scales small; forty-seven longitudinal rows upon the sides, eight above, and three beneath the lateral line.

D. 10. P. (?). V. (?). A. 11. C. (?). Length, 7 inches.

L'Able vandoisule (Leuciscus vandoisulus, Val.), Cuv. et Val., xvii. p. 317.

30. Leuciscus rotengulus, Val.

Back much arched; abdomen nearly straight; jaws equal; pharyngeal teeth in two rows, five and two. Three and a half times as long as high. The dorsal slightly posterior.

D. 11. P. (?). V. (?). A. 11. C. (?). Length, 6 inches.

L'Able rotengule (Leuciscus rotengulus, Val.), Cuv. et Val., xvii. p. 318.

Valenciennes has not given the *habitat* of the last three species; but as they are all contained in Bosc's collection, they were probably obtained in South Carolina.

31. Leuciscus spirlingulus, Val.

Body compressed, outline straight along the back, curved beneath the belly; its height a little more than one fifth its whole length. The dorsal is situated upon the anterior half of the body. There are thirty-five to thirty-nine rows of very thin, caducous scales, which are concentrically striated, but are not longitudinally furrowed or rayed. Back reddish brown, with a silvery band; belly silvery. Fins colorless, irregularly variegated with black. Pharyngeal teeth curved and sharp pointed, in two rows, one with four, the other with two.

D. 9. P. (?). V. (?). A. 10. C. (?). Length, (?).

New Jersey, Ohio, Valenciennes.

L'Able éperlanule (Leuciscus spirlingulus, Val.), Cuv. et Val., xvii. p. 321, pl. 506.

32. Leuciscus tincella, Val.

Similar in appearance to a Tench. Head small, snout slightly pointed; lower jaw shorter than the upper; four pharyngeal teeth. Caudal scarcely emarginated. Scales small and very finely granulated; seventy in a longitudinal series; fifteen above the lateral line, and twelve beneath it. Lateral line nearly straight. A very deep golden-green upon the back, brilliant upon the sides, yellowish beneath. Dorsal, caudal, and pectorals, green; ventrals and anal paler.

D. 9. P. 17. V. 9. A. 7. C. 21. Length, 5 inches.

Mexico, Val.

L'Able petite tanche (Leuciscus tincella, Val.), Cuv. et Val., xvii. p. 323.

33. Leuciscus productus, Storer.

Head broad, flattened above, and rather longer than the height of the body. Scales small; seventy-five in a longitudinal row up the sides. Dorsal fin upon the posterior portion of the body. Silvery, with a bluish longitudinal line.

D. 9. P. (?). V. (?). A. 8. C. (?). Length, 4 inches.

Wabash, LESUEUR.

L'Able alongé (Leuciscus elongatus, VAL.), CUV. et VAL., XVII. p. 494.

This species is called *elongatus* by Valenciennes, in the seventeenth volume of the "Histoire Naturelle des Poissons," but as that name has previously been applied by Kirtland to a species from the West, I have felt compelled to change it here.

34. Leuciscus Storerianus, KIRTLAND.

Back and upper surface of the body and head olivaceous; sides silvery, and of a brilliant metallic lustre, with a brownish band extending the whole length of the lateral line. Pectoral and ventral fins yellowish, anal white and translucent. Snout obtuse, projecting beyond the mouth. Back convex in front of the dorsal. The lobes of the caudal acute.

D. 9. P. 15. V. 9. A. 9. C. 23. Length, 8 inches.

Lake Erie, KIRTLAND.

Leuciscus Storerianus, Storer's Leuciscus, KIRTLAND, Bost. Journ. Nat. Hist., v. p. 36, pl. 9, fig. 2.

35. Leuciscus croceus, STORER.

Body oblong, convex in front of the dorsal fin. Lateral line straight. Head large. All upper portion of body greenish, throat flesh-colored. An indistinct brown band runs along the middle of the sides from the operculum to the base of the tail; at its termination is seen a small black blotch. All the fins orange. Surface of body covered with a slimy secretion.

D. 8. P. 14. V. 8. A. 7. C. 19. Length, 3½ inches.

Alabama, STORER.

Leuciscus croceus, STORER, Proceed. Bost. Soc. Nat. Hist., July, 1845.

36. Leuciscus prolixus, STORER.

Body much elongated. Head flattened above. Lateral line descends obliquely to a point above posterior extremities of the pectorals, then pursues a straight course to the tail. Top of head brown, with numerous minute tubercles; dorsum greenish; upper portion of sides blue, with lilac tints; lower portion of sides white. Dorsal fin brown, the other fins yellowish.

D. 9. P. 14. V. 8. A. 9. C. 19. Length, 4 inches.

Alabama, STORER.

Leuciscus prolixus, STORER, Proceed. Bost. Soc. Nat. Hist., July, 1845.

37. Leuciscus obesus, Storer.

Body short, chubby. Head large. Abdominal arch very convex. Dorsal ridge green; sides yellow, with deep lilac intermixed, so as to appear like a longitudinal band of the latter color; lower portion of the sides bluish; top of the head fuliginous. Pupils black, irides golden. Lateral line assumes the curve of the body. Fins straw-colored.

D. (?). P. (?). V. (?). A. (?) C. (?) Length, 3½ inches.

Florence, Alabama, Storer.

Leuciscus obesus, Storer, Proceed. Bost. Soc. Nat. Hist., July, 1845.

38. Leuciscus gibbosus, Storer.

Body very convex above. All upper portion of body green; lower portion of sides a light lilac color; fins greenish yellow; opercles light, with lilac tints.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 4 inches.

Tuscaloosa, Alabama, Storer.

Leuciscus gibbosus, Storer, Proceed. Bost. Soc. Nat. Hist., July, 1845.

GENUS IV. PIMEPHALES, Raf.

Body oblong, thick, scaly. Vent posterior, nearer to the tail. Head scaleless, fleshy all over, even over the gill-covers, rounded, convex, and short. Mouth terminal, small, toothless, with hard, cartilaginous lips. Opercle double, three branchial rays. Nostrils simple. Dorsal fin opposite the abdominals, with the first ray simple and cartilaginous. Abdominal fins with eight rays.

1. Pimephales promelas, Raf.

Diameter one fourth of the length, body olivaceous-silvery, head blackish, snout truncated and with soft warts; fins whitish; dorsal with a large, irregular black spot at its anterior base, with eight forked rays, and one simple, shorter, obtuse, hard; anal with eight rays; lateral line flexuous and raised at the base; tail lunulate.

D. 1–8. P. 15. V. 7. A. 8. C. 20. Length, 3 inches.

Kentucky, Ohio, Raf., Kirtland.

Pimephales promelas, Raf., Ichth. Ohien., p. 53.
" " Kirtland's Report, p. 194.
" " Black-headed Flat-head, Kirtland, Bost. Journ. Nat. Hist., III. p. 475, pl. 27, fig. 2.

GENUS V. CATOSTOMUS, Lesueur.

Back with a single dorsal fin. Gill-membrane three-rayed. Head and opercula smooth. Jaws toothless and retractile. Mouth beneath the snout, lips plaited, lobed, or caruncalated, suitable for sucking. Throat with pectinated teeth.

1. Catostomus Hudsonius, Lesueur.

Back and sides bluish gray, with considerable lustre, the back being darkest, and the tint of the sides gradually passing into the pearl-white of the belly. Dorsal and caudal fins bluish gray; pectorals and ventrals ochre-yellow, tinged with red; anal flesh-red. Irides saffron-yellow, with pearly lustre. Scales for the the most part broadly oval, or nearly orbicular, and of a medium size; large towards the tail, and smaller on the belly, particularly between the pectorals. The anal extends to within its own length of the caudal. When this fin is turned backwards, its tip reaches the base of the caudal. Dorsal quadrangular.

D. 12 to 14. P. 17. V. 10. A. 7. C. $18\frac{3}{3}$. Length, 21 inches.

Hudson River, Forster. Columbia River and its tributaries, Richardson.

Cyprinus catostomus, Forster, Phil. Trans., lxiii. p. 158, pl. 6.
Naymaypeeth, and Sucker, Pennant's Arc. Zoöl., Introduct., p. 299, and ii. p. 402.
Catostomus Hudsonius, Lesueur, Journ Acad. Nat. Sc., i. p. 107.
" " Rich., Franklin's Journal, p. 717.
" " Gray Sucking Carp, Rich., Fauna Boreal. Americ., iii. p. 112.
Gray Sucker, Fur-traders. Carpe blanche, Canadians. Namaypeeth, Crees.
Le Catostome Hudsonien (Catostomus Hudsonius, Lesueur), Cuv. et Val., xvii. p. 459.

2. Catostomus Forsterianus, Rich.

Color of the back intermediate between honey-yellow and olive-green (like old olive-oil); the sides are occupied by a series of patches of light lake-red, more or less continuous, forming a broad, irregular stripe; belly white. The under fins are tinged with ochre-yellow, and at some seasons have a red hue; the dorsal and upper part of the caudal have nearly the tint of the back. Scales broadly oblong, radiated. From ninety-eight to one hundred and seven scales on the lateral line; thirty in a vertical row behind the pectorals, and twenty-three just before the ventrals. Dorsal fin higher than long; anal does not reach quite to the base of the caudal.

D. 12 to 14. P. 18. V. 10. A. 8 or 9. C. $18\frac{3}{3}$. Length, 22 inches.

Northern Regions, Richardson.

Cyprinus catostomus, var., Forster, Phil. Trans., lxiii. p. 158.
Mithomapeth, Pennant's Arc. Zool., Introd., p. 299.
Catostomus Forsterianus, Rich., Franklin's Journal, p. 720.
Cyprinus (Catostomus) Forsterianus, Red Sucking Carp, Rich., Fauna Boreal. Americ., iii. p. 116.
Catostomus Forsterianus, Red Sucker, Dekay's Report, p. 203.
Le Catostome de Forster (Catostomus Forsterianus, Rich.), Cuv. et Val., xvii. p. 463.
Red Sucker, Fur-traders. Meethqua-maypeth, Crees.

3. Catostomus Suceti, Lacep.

Fins and back brown; sides silvery, with brown spots at the base of the scales. Head compressed and flat. Lower lip very thick, crenated and curved outwardly. Scales semi-rhomboidal.

D. 12. P. 13. V. 9. A. 9. C. 18. Length, 2 feet.

South Carolina, Bosc.

Cyprinus Sucetta, LACEPEDE.
Catostomus Sucetta, LESUEUR, Journ. Acad. Nat. Sc., I p. 109.
" " DEKAY'S Report, p. 203.
Le Catostome Sucet (Catostomus Suceti, VAL.), CUV. et VAL., XVII. p. 466.

4. Catostomus gibbosus, LESUEUR.

Back elevated in front of the dorsal fin, which is almost as high as broad, and rounded; anal fin bilobated. Back deep blue, with golden reflections; pectoral, ventral, and anal fins of a fine reddish-orange color; caudal fin tinted with carmine and violet; dorsal bluish green; abdominal scales red at their base. Body marked with four or five faint transverse bands. At some seasons of the year, three or four prominent horns or tubercles are seen on each side of the head, between the eyes and snout.

D. 15, 16, or 17. P. 16. V. 8 or 9. A. 8, 9, or 10. C. 18 or $19\frac{2}{2}$. Length, 5 to 14 inches.

New Hampshire, Connecticut, New Jersey, DEKAY. Massachusetts, LESUEUR, STORER. Pennsylvania, LESUEUR.

Catostomus gibbosus, Chub Sucker, LESUEUR, Journ. Acad. Nat. Sc., I. p. 92, fig.
" " Gibbous Sucker, STORER'S Report, p. 88
Catostomus tuberculatus, LESUEUR, Journ. Acad. Nat. Sc., I. p. 93, fig.
" " Horned Sucker, STORER'S Report, p. 85.
Labeo gibbosus, Gibbous Chub Sucker, DEKAY'S Report, p. 194, pl. 32, fig. 101.
Catostomus tuberculatus, Horned Sucker, DEKAY'S Report, p. 199, pl. 31, fig. 97.
Le Catostome bossu (Catostomus gibbosus, LESUEUR), CUV. et VAL., XVII. p. 443.
Le Catostome aux tubercules (Catostomus tuberculatus, LESUEUR), CUV. et VAL., XVII. p. 444.

5. Catostomus macrolepidotus, LESUEUR.

Back dark blue, base of the scales brown; sides whitish, with yellow reflections; opercula yellowish. Head reddish brown. Dorsal, anal, and ventral fins tinged with blue and yellow; caudal gray. Dorsal fin short, deeply emarginated, upper lobe elevated and pointed, lower lobe rounded. Scales large, and disposed in a lozenge form.

D. 16. P. 18. V. 9. A. 9. C. $18\frac{5}{5}$. Length, $14\frac{1}{2}$ inches.

Delaware River, LESUEUR. Lake Ontario, VAL.

Catostomus macrolepidotus, LESUEUR, Journ. Acad. Nat. Sc., I. p. 94, fig.
" " Large-scaled Sucker, DEKAY'S Report, p. 202, pl. 77, fig. 242.
Le Catostome aux grandes écailles (Catostomus macrolepidotus, LESUEUR), CUV. et VAL., XVII. p. 447.

6. Catostomus aureolus, LESUEUR.

Body of a beautiful orange-color, deepest on the back; the base of the scales dark red; the sides are heightened with golden reflections; pectorals, ventrals, and anal, of a fine red orange-color; caudal of a deep carmine. Anal fin long, pointed, and passing considerably beyond the base of the caudal, which is forked with pointed lobes, the inferior of which is the larger; abdominal fin truncated.

D. 14. P. 18. V. 9. A. 8. C. 18. Length, 12 to 18 inches.

Lake Erie, LESUEUR, DEKAY.

Known, at Buffalo, under the names of "Mullet," "Golden Mullet," "Red-Horse."

Catostomus aureolus, LESUEUR, Journ. Acad. Nat. Sc., I. p. 95, fig.
Cyprinus (Catostomus) aureolus, Gilt Sucking Carp, LESUEUR, RICH., Fauna Boreal. Americ., III. p. 119.
Catostomus auroleus, Mullet Sucker, DEKAY'S Report, p. 201, pl. 42, fig. 133.
" " Mullet of the Lake, KIRTLAND, Bost. Journ. Nat. Hist., III. p. 349, pl. 6, fig. 2.
" " " " " Report, pp. 169, 192.
Le Catostome doré (Catostomus aureolus, LESUEUR), CUV. et VAL., XVII. p. 439.

7. Catostomus communis, LESUEUR.

General color of the head and back a reddish brown, in some specimens darker than in others; sides reflecting golden tints; abdomen whitish; pectoral, ventral, and anal fins reddish brown; caudal reddish violet; dorsal blue and yellow. Dorsal quadrangular; anal narrow, and extends as far as the base of the caudal fin.

D. 14. P. 18. V. 10. A. 9. C. 24. Length, 14 to 16 inches.

Maryland, LESUEUR. New York, DEKAY.

Catostomus communis, LESUEUR, Journ. Acad. Nat. Sc., I. p. 95, fig.
" " Common Sucker, DEKAY'S Report, p. 196, pl. 33, fig. 106.
Catostomus gracilis, KIRTLAND'S Report, pp. 169, 193.
Catostomus communis, Brook Sucker, KIRTLAND, Bost. Journ. Nat. Hist., V. p. 265, pl. 19, fig. 1.
Le Catostome commun (Catostomus communis, LESUEUR), CUV. et VAL., XVII. p. 426.

8. Catostomus longirostrum, LESUEUR.

Above reddish, paler on the sides; abdomen white, with a bluish tint. Head horizontal, terminated in a long snout. The extremity of the anal does not reach the base of the caudal. Scales very small and roundish.

D. 12. P. 16. V. 9. A. 7. C. 18. Length, 5 inches.

Vermont, LESUEUR.

Catostomus longirostrum, LESUEUR, Journ. Acad. Nat. Sc., I. p. 102.
Catostomus longirostris, DEKAY'S Report, p. 203.
Le Catostome longirostre (Catostomus longirostrum, LESUEUR), CUV. et VAL., XVII. p. 453.

9. Catostomus nigricans, LESUEUR.

Back black; sides reddish yellow, with black blotches; beneath white, with golden reflections. Pectoral, ventral, and anal fins reddish; caudal and dorsal fins blackish. Head large, quadrangular. Anal fin straight, its extremity reaching the base of the caudal fin. Dorsal fin small and quadrangular.

D. 11. P. 18. V. 9. A. 8. C. 18. Length, 13 inches.

Massachusetts, STORER. Lake Erie, LESUEUR. Every permanent stream in the West, KIRTLAND.

Called "Shoemaker," at Lake Erie.

Catostomus nigricans, LESUEUR, Journ. Acad. Nat. Sc., I. p. 102.
Cyprinus (Catostomus) nigricans, Black Sucking Carp, RICH., Fauna Boreal. Americ., III. p. 120.
Catostomus nigricans, Black Sucker, STORER'S Report, p. 86.
" " Mud Sucker, KIRTLAND'S Report, pp. 169, 193.
" " Black Sucker, DEKAY'S Report, p. 202.
" " Mullet, Mud Sucker, KIRTLAND, Bost. Journ. Nat. Hist., v. p. 273, pl. 21, fig. 3.
Le Catostome noirâtre (Catostomus nigricans, LESUEUR), CUV. et VAL., XVII. p. 453.

10. Catostomus maculosus, LESUEUR.

Reddish, with irregular black blotches; pectorals and ventrals reddish, dashed with black; anal and caudal reddish white; dorsal bluish, with black marks on the rays. Head large, quadrangular, declivous; eyes small; the lateral line straight, and runs from the operculum on a line with the eye.

D. 12. P. 16. V. 9. A. 9. C. 18. Length, 8 inches.

Maryland, LESUEUR.

Called "Black Sucker," in Maryland.

Catostomus maculosus, LESUEUR, Journ. Acad. Nat. Sc., I. p. 103.
" " DEKAY'S Report, p. 203.
Le Catostome tacheté (Catostomus maculosus, LESUEUR), CUV. et VAL., XVII. p. 451.

11. Catostomus elongatus, LESUEUR.

Head dusky above, coppery on its sides; back black, often slightly mottled; sides and beneath dusky and cupreous. Fins dusky and livid. Body subcylindric, very long. Dorsal fin very long, low, its anterior part high and falciform. Anal fin very small, and truncated. Scales large, flexible on the flanks, and a little quadrangular towards the tail.

D. 35. P. 15. V. 9. A. 8. C. 18. Length, 2 to 3 feet.

Ohio River, LESUEUR, KIRTLAND.

Catostomus elongatus, LESUEUR, Journ. Acad. Nat. Sc., I. p. 103, fig.
Catostomus niger, RAF., Ichth. Ohien., p. 56.
Catostomus elongatus, Missouri Sucker, Black-Horse, Black-Buffalo, KIRTLAND'S Report, pp. 169, 192.
" " " " KIRTLAND, Bost. Journ. Nat. Hist., v. p. 267, pl. 19, fig. 3.
" " " " DEKAY'S Report, p. 203.
Le Catostome alongé (Catostomus elongatus, LESUEUR), CUV. et VAL., XVII. p. 455.

12. Catostomus vittatus, LESUEUR.

Back pale yellowish-red, abdomen and lower fins white. A black stripe passes from the snout, through the eye, to the caudal fin, dividing the body equally; dorsal fin quadrangular; tail forked. Scales very small, rounded.

D. (?). P. 16. V. 9. A. 8. C. 18. Length, 2 inches.

Pennsylvania, LESUEUR.

Catostomus vittatus, LESUEUR, Journ. Acad. Nat. Sc., I. p. 104.
" " DEKAY'S Report, p. 203.
Le Catostome à bandelettes (Catostomus vittatus, LESUEUR), CUV. et VAL., XVII. p. 459.

13. Catostomus Duquesnii, Lesueur.

Back and forehead dusky olive and coppery, sometimes iridescent with pale blue; sides coppery; abdomen white. Head about one fifth the length of the entire fish. Scales strong, greatly radiated, and as wide again as long; scales nearly of same size over the entire body. The anal fin extends as far as the base of the caudal fin, which is greatly forked. Mouth wide.

D. 14. P. 17. V. 10. A. 9. C. $18\frac{4}{4}$. Length, 19 inches.

Ohio River, Pennsylvania, Lesueur.

Catostomus Duquesnii, Lesueur, Journ. Acad. Nat. Sc., I. p. 105, fig.
" " White Sucker, Kirtland's Report, pp. 169, 192.
" " " " Dekay's Report, p. 203.
" " Pittsburg Sucker, Red-Horse of the fishermen, Kirtland, Bost. Journ. Nat. Hist., v. p. 268, pl. 20, fig. 1 (male), pl. 21, fig. 2 (female).
Le Catostome de Duquesne (Catostomus Duquesnii, Lesueur), Cuv. et Val., XVII. p. 458.

14. Catostomus Bostoniensis, Lesueur.

Brownish, darker towards the head, which is nearly olive-colored; sides reddish brown, presenting a beautiful metallic lustre; beneath white. Pectoral, ventral, and anal fins, reddish; dorsal and caudal dark brown. Caudal deeply forked. Mouth very small. Sixty-four scales along the lateral line. Scales on the anterior portion of the body smaller than those on the posterior portion.

D. 13. P. 18. V. 10. A. 9. C. 18. Length, 8 to 15 inches.

New Hampshire, Peck. Massachusetts, Lesueur, Storer. New York, Pennsylvania, Cuv.

Cyprinus catostomus, Forster, Peck, Mem. Amer. Acad., II. pt. 2, p. 55.
Catostomus Bostoniensis, Lesueur, Journ. Acad. Nat. Sc., I. p. 106, fig.
" " Storer's Report, p. 84.
Le Catostome Bostonien (Catostomus Bostoniensis, Lesueur), Cuv. et Val., XVII. p. 432.

15. Catostomus teres, Mitchill.

Back and sides a speckled black and white. Belly whitish. Pectoral, abdominal, and anal fins yellowish. Dorsal and caudal dark brown. Elongated, round body. Tail almost even.

D. 13. P. 17. V. 9. A. 8. C. 19. Length, 12 to 15 inches.

New York, Mitchill.

Cyprinus teres, Fresh-water Sucker, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 458.
Catostomus teres, Fresh-water Sucker, Lesueur, Journ. Acad. Nat. Sc., I. p. 108.
Le Catostome grêle (Catostomus teres, Lesueur), Cuv. et Val., XVII. p. 468.

16. Catostomus oblongus, Mitchill.

Upper part of head a dark slate-color. Back greenish, fading into brilliant lemon-yellow on the sides. Four to six vertical obsolete bands, resplendent bluish green on the back, and becoming effaced on the sides. Dorsal, caudal, and anterior portion of anal brown;

pectorals brownish, red at the base; ventrals yellow. Second lobe of anal dull red. Head somewhat depressed. Back arched, approaching to gibbous.

D. 14. P. 15. V. 9. A. 8. C. 19. Length, 6 to 12 inches.

New York, MITCHILL, DEKAY. Charleston, South Carolina, VAL.

Cyprinus oblongus, Chub of New York, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 459.
Catostomus oblongus, Chub of New York, LESUEUR, Journ. Acad. Nat. Sc., I. p. 108.
Labeo oblongus, Brilliant Chub Sucker, DEKAY'S Report, p. 193, pl. 42, fig. 136.
Le Catostome chub (Catostomus oblongus, LESUEUR), CUV. et VAL., XVII. p. 441.

17. Catostomus anisurus, RAF.

Body and head brownish above; sides and abdomen silvery; dorsal and caudal fins olive; anal reddish; ventrals and pectorals orange. A deep transverse sulcation before the eyes. Snout gibbous. Anal reaches the base of the caudal.

D. 17. P. 15. V. (?). A. 8. C. $22\frac{4}{4}$. Length, 1 to 2 feet.

Ohio, and most of its tributaries, RAF., KIRTLAND.

Catostomus anisurus, Ohio Carp-Sucker, RAF., Ichth. Ohien., p. 54.
" " White Sucker, White-Nose of the fishermen, KIRTLAND, Bost. Journ. Nat. Hist., V. p. 269, pl. 20, fig. 2.

18. Catostomus melanops, RAF.

Back olivaceous; sides whitish, with scattered black dots; a black spot on the gill-cover, and a large one between the dorsal and caudal fins. Caudal slightly lunated; anal fin reaches the base of the caudal. Scales large.

D. 14. P. 18. V. 9. A. 9. C. $18\frac{4}{4}$. Length, 18 inches.

Ohio and Big Miami Rivers, RAF., KIRTLAND.

Catostomus melanops, Black-faced Sucker, RAF., Ichth. Ohien., p. 57.
" " Spotted Sucker, KIRTLAND'S Report, pp. 169, 193.
" " Black-nosed Sucker, Spotted Sucker, KIRTLAND, Bost. Journ. Nat. Hist., V, p. 271, pl. 20, fig. 3.

19. Catostomus bubalus, RAF.

Back and head brown, sides bronzy and metallic; abdomen whitish. Back gibbous. Dorsal long, terminating over the middle of the anal fin; its anterior portion elevated, the posterior low. The lower lobe of the caudal fin the broader. Anal extends as far as the base of the caudal. Scales large, somewhat radiate with minute lines.

D. 28. P. 16. V. (?). A. 11. C. $18\frac{2}{2}$. Length, 1 to 3 feet.

Ohio, Mississippi, Missouri, and their tributaries, RAF. Ohio River, KIRTLAND.

Catostomus bubalus, Brown Buffalo-fish, RAF., Ichth. Ohien., p. 55.
" " KIRTLAND'S Report, pp. 169, 192.
" " Buffalo Sucker, Brown Buffalo, KIRTLAND, Bost. Journ. Nat. Hist., V. p. 266, pl. 19, fig. 2.

20. Catostomus Sueurii, Rich.

Back, sides, and gill-covers wood-brown, reflecting, when opposed to the light, many brilliant tints, in which emerald-green and gold-yellow predominate; bases of the scales bluish gray, producing an appearance of reticulation; belly reddish white. The dorsal has the hue of the back, with a reddish margin; the other fins are almost all entirely red. Scales very large, quadrangular. Forty-seven scales on the lateral line. Air-bladder divided into three portions, the central one the largest.

D. 14. P. 16. V. 9 or 10. A. 9. C. $18\frac{3}{3}$. Length, 19 inches.

Northern Regions, Richardson.

Cyprinus (Catostomus) Suerii, Picconow, Rich., Fauna Boreal. Americ., III. p. 118.
Catostomus Sueurii, Dekay's Report, p. 203.
Le Catostome de Lesueur (Catostomus Sueurii, Rich.), Cuv. et Val., XVII. p. 465.

21. Catostomus elegans, Dekay.

Above dark bluish; beneath whitish, with pinkish suffusions along the abdomen. Head brilliant green, passing into yellowish and golden on the opercles. Dorsal and anal brown; pectorals and ventrals faint orange; caudal rosaceous. Dorsal subquadrate, rounded above. Scales large, with from three to six radiating impressed lines, crossed by others waved and concentric.

D. 12. P. 15. V. 9. A. 8. C. 17. Length, 8 inches.

New York, Dekay.

Labeo elegans, New York Chub Sucker, Dekay's Report, p. 192, pl. 31, fig. 100.

22. Catostomus esopus, Dekay.

Back elevated. Scales large, oblong, the triangular area on the free portion with four radiating lines, the interstices between these lines with concentric wrinkles. Lateral line not obvious. Snout prominent.

D. 12. P. 16. V. 9. A. 7. C. $19\frac{3}{3}$. Length, 10 inches.

New York, Dekay.

Labeo esopus, Round-backed Chub Sucker, Dekay's Report, p. 195.

23. Catostomus Oneida, Dekay.

Dark bluish brown above; lighter on the sides; whitish beneath. Back gibbous, with two short subspinous rays to the dorsal fin. Head smooth, with numerous mucous pores. Scales very large. Seventeen in an oblique series from the dorsal fin.

D. 2-13. P. 15. V. 9. A. 8. C. $18\frac{3}{3}$. Length, 12 inches.

Lake Oneida, Dekay.

Called "Sucker," and "Mullet," at Lake Oneida.

Catostomus Oneida, Oneida Sucker, Dekay's Report, p. 198.

24. Catostomus pallidus, Dekay.

Back light bluish, becoming mixed with yellow, and paler on the sides; abdomen white; dorsal and caudal dark brown, mixed with yellow; anal with a faint tinge of yellow; pectorals and ventrals orange. Caudal fin falcate. Scales small on the back and shoulders, becoming gradually larger towards the tail. The two portions of the air-bladder united by a wide aperture.

D. 13. P. 16. V. 9. A. 8. C. 18$\frac{4}{4}$. Length, 9 inches.

New York, Dekay.

Catostomus pallidus, Pale Sucker, Dekay's Report, p. 200, pl. 33, fig. 104.

25. Catostomus fasciatus, Lesueur.

Body elongated, four times and three quarters longer than high. Height of dorsal equal to its length. Caudal deeply emarginated. Anal as high as the dorsal. Scales large and striated; forty-five to forty-eight in a longitudinal series. The fish, when dried, is gray or plumbeous, variegated with green upon the back, with ten or twelve deeper gray lines, made more conspicuous with large blackish dots; beneath white, unspotted.

D. 14. P. (?). V. (?). A. 9. C. (?). Length, 15½ inches.

Mississippi, Val.

Le Catostome rayé (Catostomus fasciatus, Lesueur), Cuv. et Val., xvii. p. 449.

26. Catostomus planiceps, Val.

Body rounded anteriorly, slender, compressed posteriorly; height equal to one sixth its length. Profile rectilinear from the neck to the eye, from whence it descends in a very convex curve towards the mouth. Abdomen arched. Preoperculum very broad; operculum narrow at its insertion, enlarging as it descends towards the angle of the pectorals. Dorsal short, height equal to three quarters its length. Anal rounded, height a little more than twice its length. Caudal emarginated, its lobes rather longer than the anal. The pectorals and ventrals are truncated. Forty-eight scales in a longitudinal series upon the sides; the radiating striæ upon them are very conspicuous; the circular ones very numerous and delicate. A green marbling, deep upon the back and sides; in scattered points upon the white belly. Fins greenish and dotted.

D. 13. P. 13. V. 8. A. 8. C. 4, 19 – 4. Length, 13½ inches.

Wabash River, Val.

Le Catostome à tête plate (Catostomus planiceps, Val.), Cuv. et Val., xvii. p. 450.

27. Catostomus carpio, Val.

Body elongated, rounded. The third ray of the dorsal two thirds the length of the base of the fin. Dorsal longer than in the other species. The length of the anal equal to one fifth its height; this fin is higher than that of any other species of the genus, exceeding in length the caudal lobes. Pectorals very broad. Scales large, rounded, very strongly striated circularly, slightly in rays; forty-five in a longitudinal series. Golden green.

D. 16. P. 16. V. 8. A. 8. C. 4, 19–4. Length, 25 inches.

Lake Ontario, Val.

Le Catostome carpe (Catostomus carpio, Val.), Cuv. et Val., xvii. p. 457.

GENUS VI. SCLEROGNATHUS, Val.

Snout slightly advanced beyond the mouth; the extremity of the mouth is supported, as in the Catostomi, by the intermaxillary, which is furnished in front with a well developed, projecting, cartilaginous ethmoid. The upright branch is long, and of a styloid form, while the horizontal one is shortened, and a mere keel, the inferior edge of which serves merely to support the superior angle of the mouth. The remainder of the maxillary arch is formed by a fibrous ligament covered by a thin, undilated lip, reduced to a thin and fleshy protuberance. The upper jaw is a wide, very solid bony piece, under which the upper lip is partly drawn; this bone is concealed by the first two suborbitars, being wider and no less advanced than those of the Catostomi. The lower lip is straight and delicate; hence the mouth of the fish cannot exercise suction in the manner of the Catostomi. As to its lips, it is a Leuciscus; but the osteology of its mouth resembles that of the Catostomi. The dorsal is long, like that of the Carps. The head is naked, marked by lines of mucous pores. Pharyngeal teeth comb-like, finer and more equal than those of the Catostomi. The air-bladder is divided into two large lobes; the anterior is large and rounded, with a slight depression at its superior face; the second conical, twice as long as the first, and followed by two small lobes; the second communicates with the œsophagus by an air-pipe.

1. Sclerognathus cyprinus, Lesueur.

Body compressed, elliptic, sharp at the base of the dorsal fin, which is very long and falciform on its anterior part, and low behind. Fins of a gray-blue color. Anal fin lunated. Caudal forked, with pointed lobes. Scales very large, semirhomboidal, and variegated with blue, yellow, and green reflections; thirty-five in a longitudinal series; seven rows of scales above, and six rows below, the lateral line.

D. 31. P. 18. V. 9. A. 10. C. $18\frac{4}{4}$. Length, 20 inches.

Ohio River, Lake Erie, RAF., KIRTLAND. The fresh-water tributary streams of Chesapeake Bay, LESUEUR. Lake Pontchartrain, VAL.

Called "Sailor-fish," "Flying-fish," and "Skimback."

Catostomus cyprinus, Carp, LESUEUR, Journ. Acad. Nat. Sc., I. p. 91, fig.
Catostomus velifer, Sailing Sucker, RAF., Ichth. Ohien., p. 56.
Labeo cyprinus, GRIFFITH'S CUV., X. p. 380.
Catostomus velifer, Carp of the Ohio, KIRTLAND'S Report, pp. 169, 192.
Labeo cyprinus, Long-finned Chub Sucker, DEKAY'S Report, p. 194, pl. 77, fig. 243.
Le Sclérognathe cyprin (Sclerognathus cyprinus, VAL.), CUV. et VAL., XVII. p. 474.
Sclerognathus cyprinus, KIRTLAND, Bost. Journ. Nat. Hist., V. p. 275, pl. 22, fig. 2.

2. Sclerognathus cyprinella, VAL.

Body similar in form to that of the preceding species. The dorsal fin resembles that of the preceding; but the anal fin is more pointed. The scales are much smaller; there are forty-one in a longitudinal series, ten above and seven below the lateral line. Greenish gold, fins of a deeper color.

D. 33. P. (?). V. (?). A. 12. C. (?). Length, (?).

Lake Pontchartrain, VAL.

Le Sclérognathe cyprinelle (Sclerognathus cyprinella, VAL.), CUV. et VAL., XVII. p. 477.

GENUS VII. EXOGLOSSUM, RAF.

Body elongated, slightly compressed, covered with small scales, vent nearest to the tail. Head scaleless, flattened above, mouth terminal, toothless; lower jaw shorter, with three or five lobes, the middle one larger, simulating a tongue; lips very small. Ventral fins with nine rays; dorsal fin opposed to them.

1. Exoglossum Lesueurianum, RAF.

Head large, snout very short, broad, and convex; lateral line curves regularly to the middle of the body, and descends thence in nearly a straight line to the tail. The dorsal fin is large, quadrangular, in the centre of the body; the caudal is forked. Back brownish olive; sides blue, with a brownish band; a black spot at the base of the caudal fin; beneath silvery gray.

D. 9. P. 18. V. 8. A. 9. C. 9 principal rays. LESUEUR.

D. 9. P. 15. V. 7. A. 8. C. $19\frac{5}{7}$. VALENCIENNES. Length, 4 inches.

Maryland, LESUEUR. Lake Owaska, VAL.

Cyprinus maxilingua, Little Sucker, LESUEUR, Journ. Acad. Nat. Sc., I. p. 86.
Exoglossum Lesueurianum, RAF., Journ. Acad. Nat. Sc., I. p. 420.
Catostomus maxilingua, Little Sucker, DEKAY'S Report, p. 203.
L'Exoglosse de Lesueur (Exoglossum Lesueurianum, RAF.), CUV. et VAL., XVII. p. 483.

2. Exoglossum macropterum, RAF.

Head nearly square, forehead truncate, tuberculated, mouth protractile, lower lip five-lobed, pyramidal, silvered, variegated, and reticulated with blackish; lateral line straight, but faint. All the lower fins elongated; the pectorals reaching the abdominal, the anal reaching the tail, dorsal fin with twelve rays; tail forked. Scales very minute.

D. 12. P. 12. V. (?). A. 10. C. 20. Length, 2 to 3 inches.

Ohio River, RAF.

Exoglossum macropterum, Stone Toter, RAF., Journ. Acad. Nat. Sc., I. p. 421, pl. 17, fig. 3.
L'Exoglosse macroptère (Exoglossum macropterum, RAF.), CUV. et VAL., XVII. p. 486.

3. Exoglossum annulatum, RAF.

Head narrow, forehead smooth and convex, lower lip trilobated; body oblong, olivaceous, back blackish, a black ring at the base of the tail; lateral line curved downwards at the base. Fins olivaceous; pectoral fins elliptic, obtuse, not reaching the abdominal; dorsal fins in the middle of the back with nine rays; caudal fin forked. Scales larger than in the preceding.

D. 9. P. 15. V. (?). A. 9. C. 24. Length, 3 to 6 inches.

New York, RAF.

Exoglossum annulatum, Black Chub, RAF., Journ. Acad. Nat. Sc., I. p. 421, pl. 17, fig. 4.
L'Exoglosse à anneau (Exoglossum annulatum, RAF.), CUV. et VAL., XVII. p. 487.

4. Exoglossum nigrescens, RAF.

Head short, forehead smooth and convex, lower lip trilobated; body oblong; lateral line nearly straight; pectoral fins short, oval; dorsal fin in the middle of the back; tail slightly forked. Black, which color extends to the fins; no caudal ring.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 2 to 8 inches.

Lake Champlain, RAF.

Exoglossum nigrescens, Black Chub, RAF., Journ. Acad. Nat. Sc., I. p. 422.
L'Exoglosse noirâtre (Exoglossum nigrescens, RAF.), CUV. et VAL., XVII. p. 488.

5. Exoglossum spinicephalum, VAL.

Head short, less than one sixth the length of the body. Dorsal very small; anal larger; pectorals pointed. Scales smooth. Back greenish; the remainder of the body silvery.

D. 7. P. (?). V. (?). A. 9. C. (?). Length, 4 inches.

Wabash River, LESUEUR.

Leuciscus spinicephalus, LESUEUR, CUV. et VAL., XVII. p. 489.
L'Exoglosse spinicephale (Exoglossum spinicephalum, VAL.), CUV. et VAL., XVII. p. 489.

6. Exoglossum dubium, KIRTLAND.

Head and back olive; operculum iridescent; sides dusky, abdomen white. Fins fulvous. Head elongated. The upper jaw projects beyond the lower, which is small, semicircular, and mostly concealed by the projection of the upper when the mouth is closed. Scales small, oval. The upper lobe of the caudal fin is acuminate, the lower is obtuse.

D. 8. P. 14. V. 8. A. 7. C. 20. Length, 4 to 6 inches.

Ohio, KIRTLAND.

Exoglossum Lesueurianum, Rough-nosed Dace, RAF., KIRTLAND'S Report, pp. 169, 193.
Exoglossum dubium, Sucker-mouthed Chub, KIRTLAND, Bost. Journ. Nat. Hist., v. p. 272, pl. 21, fig. 1.

GENUS VIII. PŒCILIA, SCHN.

Body but little elongated, the ventrals not very far back, and the dorsal just above the anal. Upper part of the head flat, the opercula large, rays three. Jaws flattened horizontally, protractile, but little cleft, furnished with a single range of small and very fi.e teeth.

1. Pœcilia multilineata, LESUEUR.

Body compressed, wider towards the operculum. Lines and black spots forming longitudinal bands upon the sides. Dorsal twice as long as high. Snout cuneiform seen in the profile, flat and wide seen from above. Scales moderate, rounded, and concentrically lined.

D. 14. P. 16. V. 6. A. 9. C. 26. Length, 1½ inches.

Florida, LESUEUR.

Pœcilia multilineata, LESUEUR, Journ. Acad. Nat. Sc., II. p. 4, pl. 1, fig. 1.
" " DEKAY'S Report, p. 215.

2. Pœcilia olivacea, STORER.

Body oblong, head flattened above. All the upper portion of the body olive-colored, sprinkled with minute black dots; a light spot on the top of the head. A broad black band, commencing at the angle of the jaws, is continued the whole length of the body to the caudal rays. The throat and abdomen are white. The fins yellowish green; the caudal rounded, and spotted like the upper portion of the body. This species is caught at all seasons, swimming on the surface of the water, catching at floating objects, and hence commonly called *Top minnow.*

D. 9. P. 13. V. 6. A. 12. C. 19. Length, 2½ inches.

Florence, Alabama, STORER.

Pœcilia olivacea, STORER, Proceed. Bost. Soc. Nat. Hist., July, 1845.

3. Pœcilia catenata, STORER.

Body oblong, compressed. Eight or ten interrupted longitudinal orange lines upon the sides; spots of a similar color upon opercles. Two bands passing from eyes to mouth; the upper yellowish green, the lower blue. Pectoral, dorsal, and anal fins yellow, and each of them more or less dotted with deep orange, so arranged in the dorsal as to appear like a longitudinal band at its base. Base of caudal spotted with similar dots ; its centre ash-colored ; a black transverse band at its posterior extremity, margined with yellow. A bluish tint upon the body at the base of the pectorals, and upon the sides below the dorsal.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 4½ inches.

Florence, Alabama, STORER.

GENUS IX. LEBIAS, CUV.

Resemble Pœcilia, with the exception that their teeth are denticulated.

1. Lebias ellipsoides, LESUEUR.

Deep brown. Greatest thickness of body is between the opercula, very compressed towards the tail. Eyes large. Scales large. Dorsal high, rounded ; anal small and round ; caudal unequal, enlarged and elongated posteriorly, and obliquely truncated. The young pale, generally with white belly, and silvery gill-covers. A few faint traces of longitudinal lines, and brownish mottles or marks, not quite amounting to bands or zones, distinguishing the sides perpendicularly.

D. 11. P. (?). V. 6. A. 10. C. 20. Length, 2 inches.

Connecticut, AYRES. New York, MITCHILL, DEKAY. Florida, LESUEUR.

Esox ovinus, Sheeps head, Killifish, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 441, pl. 4, fig. 7.
Lebias ellipsoides, LESUEUR, Journ. Acad. Nat. Sc., II. p. 6, pl. 2, figs. 1 and 2.
Cyprinodon ovinus, VAL., HUMBOLDT et BONPLAND, II. p. 164.
Lebias ellipsoides, AYRES, Bost. Journ. Nat. Hist., IV. p. 261.
Lebias ovinus, Sheeps-head Lebias, DEKAY's Report, p. 215, pl. 27, fig. 84; young.
Lebias ellipsoides, LESUEUR, DEKAY's Report, p. 216.
" " " AYRES, Bost. Journ. Nat. Hist., IV. p. 265.

GENUS X. FUNDULUS, LACEP.

Have many relations with Pœcilia ; but their teeth are small and crowded, and those of the anterior range are bent ; they have some conical teeth rather strong at the pharynx ; there are but four rays to the gills.

1. Fundulus fuscus, AYRES.

Body rather rounded, somewhat compressed towards the tail. Above and on the sides very dark brown, striped longitudinally with narrow lines, which are lighter. Abdomen white. A transverse black band at the base of the caudal fin.

D. 15. P. 14. V. 6. A. 9. C. 13. Length, 2 to 3 inches.

Connecticut River, AYRES.

Fundulus fuscus, AYRES, Bost. Journ. Nat. Hist., IV. p. 296, pl. 13, fig. 2.

GENUS XI. HYDRARGYRA, Lesueur.

Head flat, shielded above with large scales, the centre scale largest. Teeth in the jaws and throat; those of the jaws conic and recurved; none in the palate; jaws protractile; lower jaw the longer. Scales on the opercula and body. Branchial rays, four to five. Ventral fins six-rayed. The dorsal fin situated nearer to the tail than the head, opposite to the anal.

1. Hydrargyra fasciata, Schn.

Back and sides greenish or olive. The sides are crossed by from ten to twenty vertical white lines or spots. Within these are numerous silvery-white and steel-blue dots, which extend over the dorsal and anal fins. In the spawning season, the abdomen is of a brilliant golden yellow; but during the rest of the year it is white.

D. 12. P. 15. V. 6. A. 11. C. 27. Mitchill. Length, 4 inches.

D. 10. P. 17. V. 6. A. 10. C. $19\frac{5}{5}$. Dekay.

Connecticut, Ayres. New York, Mitchill, Dekay. Carolina, Dekay.

Esox pisciculus, Yellow-bellied Killifish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 441.
Fundulus fasciatus, Val., Humboldt et Bonpland, ii. p. 162, pl. 62, figs. 1, 4, 5.
Fundulus zebra, Barred Killifish, Dekay's Report, p. 218.
Hydrargyra fasciata (Schn.), Ayres, Bost. Journ. Nat. Hist., iv. p. 266.

2. Hydrargyra pisculenta, Mitchill.

Olive-green above; lighter on the sides, and becoming whitish, tinged with yellowish on the abdomen. Opercles, pectorals, and ventrals light greenish-yellow. Caudal nearly even, round. In large specimens, the color of the sides is uniform; in very small specimens are black vertical bands, constituting the Esox zonatus of Mitchill.

D. 13. P. 15. V. 6. A. 11. C. 27. Mitchill.

D. 11. P. 17. V. 6. A. 11. C. 25. Dekay. Length, 1 to 4 inches.

Connecticut, Ayres. New York, Mitchill, Dekay.

Esox pisculentus, White-bellied Killifish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 441.
Esox zonatus, Banded Killifish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 443.
Fundulus viridescens, Big Killifish, Dekay's Report, p. 217, pl. 31, fig. 99.
Hydrargyra pisculenta, Ayres, Bost. Journ. Nat. Hist., iv. p. 267.

3. Hydrargyra flavula, Mitchill.

Female. Yellowish green above, lighter upon the sides, white beneath; opercles, and upper portion of abdomen, golden. Several interrupted longitudinal black bands, varying from one to four, upon the sides. From two to four transverse bands of a similar color, at the base of the caudal fin. Dorsal rather longer than high.

Male. Back and sides greenish black; sides crossed by numerous slate-colored, nearly black, vertical bands, varying in their number from ten to twenty, or even more. Lower portion of sides, as well as of the abdomen, of a beautiful yellowish green. A large black blotch upon the operculum. A black spot upon the posterior rays of the dorsal fin, which is violet-colored; caudal orange-colored, margined at its extremity with black; anal emarginated posteriorly.

D. 14 to 16. P. 16 to 18. V. 6. A. 11. C. 18 to 23. Length, 1 to 4 inches.

Massachusetts, STORER. Connecticut, AYRES. New York, MITCHILL, DEKAY.

Esox flavulus, New York Gudgeon, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 439, pl. 4, fig. 8.
Cyprinodon flavulus, VAL., HUMBOLDT et BONPLAND, II. p. 164, pl. 62, fig. 3.
Hydrargyra trifasciata, STORER, Bost. Journ. Nat. Hist., I. p. 417.
Hydrargyra flavula, STORER'S Report, p. 95.
Hydrargyra formosa (male), STORER, Proceed. Bost Soc. Nat. Hist., p. 76.
Fundulus fasciatus, Striped Killifish, DEKAY'S Report, p. 216, pl. 31, fig. 93.
Hydrargyra flavula, MITCH., AYRES, Bost. Journ. Nat. Hist., IV. p. 267.

4. Hydrargyra diaphana, LESUEUR.

Body diaphanous, with sixteen irregular transverse brown bands confluent on the back. Back and upper part of the head brown-olive, lower parts white; sides with delicate blue tints. Dorsal almost double the size of the anal fin.

D. 13. P. 18. V. 6. A. 12. C. 18^{5}_{5}. Length, 5 inches.

Saratoga Lake, New York, LESUEUR.

Hydrargyra diaphana, LESUEUR, Journ. Acad. Nat. Sc., I. p. 130.
" " Transparent Minnow, DEKAY'S Report, p. 219.

5. Hydrargyra multifasciata, LESUEUR.

Fifty transverse bands on the sides, alternately olive-brown and blue. Dorsal and anal almost equal. Extremities of pectorals extending beyond the base of the ventrals.

D. 14. P. 18. V. 6. A. 12. C. 16^{5}_{5}. Length, 3 inches.

New York, LESUEUR.

Hydrargyra multifasciata, LESUEUR, Journ. Acad. Nat. Sc., I. p. 131.
" " Barred Minnow, DEKAY'S Report, p. 220.

6. Hydrargyra ornata, LESUEUR.

Sides of a bright blue, with small white spots, and ornamented with fifteen or sixteen transverse, narrow silvery stripes; dorsal clear blue, with yellow spots, posteriorly marked with a large, deep-blue patch, surrounded with a white band, and another of blue. Back elevated. Dorsal and anal large.

D. 11. P. 18. V. 6. A. 12. C. 18^{5}_{5}. Length, 3 inches.

Massachusetts, LESUEUR, STORER. Delaware River, LESUEUR.

Hydrargyra ornata, LESUEUR, Journ. Acad. Nat. Sc., I. p. 131.
" " Ornamented Minnow, STORER'S Report, p. 94.
" " DEKAY'S Report, p. 221.

7. Hydrargyra nigro-fasciata, Lesueur.

Body above, a reddish yellow, deeper on the back; abdomen yellowish white; caudal greenish blue, the other fins yellow; body with thirteen or fourteen transverse black bands. Back considerably elevated opposite the pectorals. Dorsal and anal fins long and narrow.

D. 12. P. 18. V. 6. A. 10. C. 16$\frac{2}{3}$. Length, 2 inches.

Massachusetts, Storer. Rhode Island, Lesueur.

Hydrargyra nigro-fasciata, Lesueur, Journ. Acad. Nat. Sc., I. p. 133.
" " Banded Minnow, Storer's Report, p. 94.
" " Dekay's Report, p. 221.

8. Hydrargyra limi, Kirtland.

Body uniformly cylindric, fusiform, slightly compressed behind the dorsal and anal fins. Dark olive, irregularly waved with fuscous; abdomen free from the olive; an irregular transverse black band on the body, near the base of the caudal fin.

D. 13. P. (?). V. (?). A. 10. C. 14. Length, 2 to 3 inches.

Ohio, Kirtland.

Hydrargyra limi, Kirtland, Bost. Journ. Nat. Hist., III. p. 277, pl. 2, fig. 4.

9. Hydrargyra fusca, Thompson.

Above dark olive, mottled with blackish; sides mottled with brown, green, and golden, with faint indications of yellowish bars; belly dull brownish, bronzy yellow; fins dusky yellow; sides yellowish at the base of the tail, crossed by a vertical black bar, with a brownish crescent-shaped line along the base of the caudal rays, marking, with a vertical line, the form of the letter D. Scales large; thirty-six along the lateral line.

D. 14. P. 15. V. 6. A. 10. C. 16. Length, 2 to 4 inches.

Lake Champlain, Thompson.

Hydrargyra fusca, Mud-fish, Thompson's Hist. of Vermont, p. 137, fig.
Hydrargyra atricauda, Champlain Minnow, Dekay's Report, p. 220.

GENUS XII. MOLLINESIA, Lesueur.

Head flat; operculum large; branchial rays or gills, four or five. Jaws flattened; mouth horizontal, very small, furnished with small and slender teeth, anteriorly hooked, and with minute posterior ones resembling velvet. Body short, thick, and compressed. Anal between the ventrals.

1. Mollinesia latipinna, Lesueur.

Reddish. Scales posteriorly spotted with black, forming interrupted lines. Body most elevated anteriorly. Dorsal very large and long.

D. 14. P. 16. V. 6. A. 16. C. (?). Length, 2½ inches.

Fresh water, Louisiana, Lesueur.

Mollinesia latipinna, Lesueur, Journ. Acad. Nat. Sc., II. p. 3, pl. 3, fig. 1.
" " Dekay's Report, p. 221.

GENUS XIII. CYPRINODON, Lacep.

Have fine and crowded teeth, and six rays to the gills ; in other respects they resemble the Lebias, Fundulus, and Mollinesia.

1. Cyprinodon variegatus, Lacep.

Body subovate, variegated with brown spots and bands.

D. 12. P. 14. V. 6. A. 11. C. 20. Length, (?).

Rivers of Carolina, Val.

Cyprinodon variegatus (Lacep.), Val., Humboldt et Bonpland, II. p. 165.

FAMILY XVII. HYPSÆIDÆ,* Storer.

The jaws of this family are provided with lips ; the intermaxillaries and lower jaw are armed with minute, slender, and slightly recurved teeth, most abundant a short distance from the median line ; upper maxillaries destitute of teeth. The intermaxillaries form the borders of the mouth above, and extend nearly to its angles. No eyes to be seen on dissection. Body covered with circular scales, which are so imbedded in the cuticle as not to present free edges. No adipose dorsal. Intestinal canal shorter than the body ; stomach cylindrical, terminating posteriorly in a short triangular *cul de sac* ; pylorus situated near the posterior extremity of the stomach, has a distinct valve which projects into the cavity of the duodenum ; two short, pyriform cœcal appendages open by distinct orifices on opposite sides of the intestine. Air-bladder cordiform, deeply cleft anteriorly.

This family, which I have formed in a great measure from the dissection of the only known species (Amblyopsis spelæus) by my friend, Jeffries Wyman, M. D., published in Silliman's Journal, appears to be more nearly allied to the Cyprinidæ than to any other family of the Malacopterygii. It differs, however, from it, in the existence of a *cul de sac* to the stomach, and

* Hypsæa cæcior. *Hor.*

cœcal appendages to the pylorus, and in possessing a cordiform natatory bladder. From the Esoces, it is distinguished by the presence of cœcal appendages. From the Siluridæ, it differs in the existence of scales and cœca, and by the absence of cirrhi. From the Salmonidæ, by the existence of but two cœcal appendages, and by the absence of the adipose dorsal fin.

GENUS I. AMBLYOPSIS, Dekay.

Body with scales. Vent anterior to the base of the pectorals. Eyes not apparent, even upon careful dissection. Ventrals minute. A single dorsal. Teeth on the jaws and palatines. No scales upon head, but slightly elevated, transverse ridges are observed upon it. No barbels.

1. Amblyopsis spelæus, Dekay.

Whitish. Head broad and flattened. Mouth large. Most of the fins with filamentous tips.

D. 7. P. 12. V. 5. A. 8. C. $16\frac{5}{5}$. Length, $3\frac{1}{2}$ inches.

Mammoth Cave, Kentucky, Dekay.

Amblyopsis spelæus, Dekay's Report, p. 187.
" " Wyman, Silliman's Journal, xlv. p. 94.

FAMILY XVIII. ESOCIDÆ.

Body elongated. One dorsal, and generally opposite to the anal. Edge of the upper jaw either formed solely by the intermaxillaries, or if the labials enter at all into its composition, they are destitute of teeth. Intestinal canal short, without cœca. Branchial rays vary from three to eighteen. Mouth large, and without sharp teeth.

GENUS I. ESOX, Cuv.

Head depressed, large, oblong, blunt; intermaxillaries small, with small pointed teeth at the middle of the upper jaw, of which they form two bands. The maxillaries forming the sides have no teeth. The vomer, palatines, tongue, pharyngeals, and branchial arches, bristled with card-like teeth. Sides of the lower jaw with a row of long, pointed teeth.

1. Esox estor, Lesueur.

Back deep greenish-brown; sides with numerous rounded and oblong pale-yellowish spots;

abdomen white. Fins reddish yellow, marbled with blackish and deep green. Scales small; about one hundred and sixty along the lateral line, and forty-five in a vertical row before the ventrals. Caudal large, lunated, with equal and rounded lobes.

D. 22. P. 18. V. 11. A. 20. C. $20\frac{7}{7}$. LESUEUR. Length, 1 to 3 feet.

D. 21. P. 14. V. 11. A. 17. C. 26. MITCHILL. " " "

D. 21. P. 12. V. 11. A. 21. C. $19\frac{7}{7}$. DEKAY. " " "

Lake Erie, LESUEUR. Lake Huron, RICHARDSON. Ohio River, KIRTLAND.

Esox estor, Pike, Pickerel, Maskallongé, LESUEUR, Journ. Acad. Nat. Sc., I. p. 413.
" " GRIFFITH'S CUV., X. p. 390.
" " Maskinongé, RICH., Fauna Boreal. Americ., III. p. 127.
" " Muskallonge, KIRTLAND'S Report, pp. 169, 194.
" " Muskellunge, DEKAY'S Report, p. 222.
" " Muskallonge, KIRTLAND'S Manuscript for Bost. Journ. Nat. Hist.

2. Esox reticulatus, LESUEUR.

Yellowish green, with more or less distinct irregularly-distributed longitudinal black lines. Beneath white. Fins greenish. Pectorals, anal, and ventrals become reddish after death. A vertical black band beneath the eye. Caudal deeply emarginated.

D. 18. P. 13. V. 11. A. 17. C. 19. Length, 1 to 2 feet.

Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, DEKAY. Ohio, KIRTLAND.

Esox lucius, Pickerel, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 440.
Esox reticulatus, LESUEUR, Journ. Acad. Nat. Sc., I. p. 414.
" " Common Pickerel, STORER'S Report, p. 97.
" " Pike, KIRTLAND'S Report, p. 194.
" " Common Pickerel, DEKAY'S Report, p. 223, pl. 34, fig. 107.
Esox fasciatus, Varied Pickerel, DEKAY'S Report, p. 224, pl. 34, fig. 110 (young).
Esox reticulatus, Pickerel, THOMPSON'S Hist. of Vermont, p. 138.
" " LESUEUR, AYRES, Bost. Journ. Nat. Hist., IV. p. 269.
" " Pickerel, Pike, KIRTLAND, Bost. Journ. Nat. Hist., IV. p. 233, pl. 10, fig. 2.
Esox tredecem-lineatus, Federation Pike, MITCHILL, Mirror, 1825, p. 361.
Esox tredecem-radiatus, Federation Pike, DEKAY'S Report, p. 225.

3. Esox niger, LESUEUR.

Golden yellow upon sides, with numerous black bands interrupted into about three parts, more distinct towards the head. Belly white, immaculate. Back and head deep black, immaculate. Pectoral and anal fins orange-yellow; dorsal and caudal bluish, the latter slightly emarginate, lobes acute; dorsal and anal fins opposite, subequal, rounded.

D. 14. P. 15. V. 9. A. 14. C. $19\frac{10}{10}$. Length, 8 or 10 inches.

Saratoga Lake, LESUEUR.

Esox niger, Black Pike, LESUEUR, Journ. Acad. Nat. Sc., I. p. 415.

Dr. Dekay thinks this may be the young of the E. reticulatus.

4. Esox phaleratus, SAY.

Body dusky, with a vertical fulvous vitta, and three or four fulvous fasciæ.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

East Florida, SAY.

Esox phaleratus, SAY, Journ. Acad. Nat. Sc., I. p. 416.
" " " DEKAY'S Report, p. 226.

5. Esox lucius (?), LIN.

Back tinged with blackish green, which changes on the sides to light greenish-gray, and on the belly to pearl-white; on the tip of each scale, there is a bright speck having the form of the letter V, and there are seven or eight longitudinal rows of oblong yellowish-gray spots on the sides of the head, body, and tail. Scales thin, broadly oval, their outer edge semicircular, their covered portion deeply divided by fissures into three or four lobes, whose edges overlap; one hundred and twenty-four on the lateral line, thirty-six in a vertical row before the ventrals.

D. 20. P. 16. V. 10. A. 18. C. $18\frac{?}{?}$. Length, 26 inches.

Northern regions, RICHARDSON.

Esox lucius, Common Pike, RICH., Fauna Boreal. Americ., III. p. 124.
" " (?), DEKAY'S Report, p. 226.

Richardson says, "One specimen, taken in Lake Huron, was submitted to Cuvier's inspection, and it has also been carefully compared with the English Pike, without any specific differences having been detected."

GENUS II. BELONE, CUV.

Head and body greatly elongated; the latter covered with minute scales. Both jaws very much produced, straight, narrow, and pointed; armed with numerous small teeth, those of the pharynx paved. Scales not very apparent, except a longitudinal range, carinated on each side, near the inferior edge.

1. Belone truncata, LESUEUR.

Above light green, beneath clear silvery-white. Just above the base of the pectorals a deep blue band arises and passes in a straight line to the origin of the dorsal fin. Lower mandible the longer. Caudal fin obliquely truncated. Ventrals small.

D. 16. P. 16. V. 6. A. 19. C. 20. LESUEUR. Length, 1 to 2 feet.
D. 15. P. 12. V. 6. A. 18. C. 19. MITCHILL. " " "
D. 15. P. 12. V. 6. A. 19. C. 20. STORER. " " "
D. 16. P. 12. V. 6. A. 19. C. $19\frac{3}{3}$. DEKAY. " " "

Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, LESUEUR, MITCHILL, DEKAY. Pennsylvania, Rhode Island, LESUEUR.

Esox belone, Bill-fish, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 443.
Esox longirostris, Long-jawed Fresh-water Pike, MITCHILL, Amer. Month. Mag., II. p. 322.
Belone truncata, Gar or Bill-fish, LESUEUR, Journ. Acad. Nat. Sc., II. p. 126, fig.
" " Gar-fish, STORER'S Report, p. 98.
" " Banded Gar-fish, DEKAY'S Report, p. 227, pl. 35, fig. 112.

2. Belone argalus, LESUEUR.

Bright blue upon the back; the under side and opercula silvery. Dorsal and anal fins unequal; tail deeply forked, lobes rounded, the inferior the longer; pectorals small. Lateral line very low, interrupted by the ventral fins, and beginning to rise above the base of the anal, is then continued along the middle of the tail.

D. 16. P. 18. V. 6. A. 19. C. 26. Length, (?).

Island of Guadaloupe, LESUEUR.

Belone argalus, LESUEUR, Journ. Acad. Nat. Sc., II. p. 125.

3. Belone Caribbœa, LESUEUR.

Back deep blue; whitish beneath. Mandibles equal, slender, and pointed; dorsal continued farther back than the anal fin, the last rays also longer; caudal scolloped, lobes rounded, the inferior twice as long as the superior; ventrals rather long.

D. 24. P. 13. V. 6. A. 22. C. $30\frac{7}{7}$. Length, (?).

Caribbean Sea, LESUEUR.

Belone Caribbœa, LESUEUR, Journ. Acad. Nat. Sc., II. p. 127.
" " BENNETT, Sowb. Zool. Journ., V. p. 88.

GENUS III. SCOMBERESOX, CUV.

Have the same structure of the jaws as those of the Belone; and are similar, also, in the form of the body and scales, with a keel-like edge to the belly; but the posterior portions of the dorsal and anal fins are divided, forming finlets, as in the Mackerel.

1. Scomberesox Storeri, DEKAY.

Back olive-green; a silvery band half an inch wide, almost as strongly marked as in the Atherines, runs the whole length of the body, divided in its centre by a narrow longitudinal line of the color of the back. Abdomen silvery, with a cupreous tinge. The lower jaw the longer. Five or six finlets back of the dorsal fin; five to seven finlets back of the anal fin. A longitudinal furrow along the sides.

D. 10. P. 14. V. 6. A. 12. C. 20. Length, 10 inches.

Newfoundland, LESUEUR. Massachusetts, STORER. New York, DEKAY.

Scomberesox equirostrum, Lesueur, Journ. Acad. Nat. Sc., II. p. 132.
Scomberesox scutellatum, " " " "
Scomberesox equirostrum, Bill-fish, Storer's Report, p. 100.
Scomberesox Storeri, Bill-fish, Dekay's Report, p. 229, pl. 35, fig. 111.

In my "Report on the Fishes of Massachusetts," I pointed out the error into which all ichthyologists might be led by Lesueur's specific name; unquestionably it should be changed. Dr. Dekay has thought proper to affix mine; I retain it, until some future ichthyologist prefers another.

GENUS IV. EXOCETUS, Lin., Cuv.

Head and body covered with scales; pectoral fins very large, nearly as long as the body; dorsal fin placed over the anal; upper half of the tail the smaller; both jaws furnished with small teeth.

1. Exocetus comatus, Mitchill.

Above brown, beneath white. Scales deciduous. Pectorals reach as far back as the posterior extremity of the dorsal; ventrals long. A long black cirrhus depending from the chin.

D. 11. P. 12. V. 6. A. 6. C. (?). Length, 5 inches.

New York, Mitchill.

Exocetus comatus, Single-bearded Flying-fish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 448, pl. 5, fig. 1.
Exocetus appendiculatus (?), Wood, Journ. Acad. Nat. Sc., IV. p. 283, pl. 17, fig. 2.
Exocetus comatus, Single-bearded Flying-fish, Dekay's Report, p. 231, pl. 36, fig. 115.

2. Exocetus furcatus, Mitchill.

Bluish above, silvery on the sides. Pectorals and ventrals with brown bands. Abdomen carinated. Scales small. Two cirrhi or tough appendages suspended from the lower jaw.

D. 15. P. (?). V. 10. A. 8. C. 17. Length, (?).

New York, Mitchill. Gulf of Mexico, Lesueur.

Exocetus furcatus, Double-bearded Flying-fish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 449, pl. 5, fig. 2.
Exocetus Nuttallii (?), Lesueur, Journ. Acad. Nat. Sc., II. p. 10, pl. 4, fig. 1.
Exocetus furcatus, Double-bearded Flying-fish, Dekay's Report, p. 231.

Cuvier suspects the E. furcatus and E. Nuttallii to be one species.

3. Exocetus Noveboracensis, Mitchill.

Dark green above; beneath white and silvery. Abdomen carinated on its sides. Ventrals very long. Caudal forked, the lower lobe almost twice as long as the upper. Teeth very minute. No filaments to lower jaw.

D. 14. P. 15. V. 6. A. 8. C. (?). Length, 12 inches.

New York, Mitchill.

Exocetus Noveboracensis, New York Flying-fish, MITCHILL, Amer. Month. Mag., II. p. 323.
" " " " DEKAY's Report, p. 230, pl. 36, fig. 114.

4. Exocetus exiliens, BLOCH.

Bright silvery, with a blue or dusky tinge on the upper part; fins dusky. Pectorals lanceolate, and scarcely extend to caudal; anal and dorsal straight, low, and about equal; caudal deeply forked, lower lobe nearly twice the length of the upper; ventrals large, situated a little beyond the middle of the abdomen. In young specimens, there are brown bands on the pectorals and ventrals.

D. 12. P. 18. V. 16. A. 10. C. 20. Length, 12 to 16 inches.

Gulf of Mexico, LESUEUR.

Exocetus exiliens, BLOCH, 397.
" " LIN., Syst. Nat., p. 1400.
" " Mediterranean Flying-fish, SHAW's Gen. Zoöl., v. p. 142, pl. 116.
" " RICH., Fauna Boreal. Americ., III. p. 129.
Exocetus fasciatus, LESUEUR, Journ. Acad. Nat. Sc., II. p. 9; young (?).

Cuvier, in his "Règne Animal," says, he thinks the Exocetus fasciatus of Lesueur is the young of Bloch's E. exiliens. Dekay is of the same opinion; therefore I have thus arranged them.

5. Exocetus mesogaster, BLOCH.

Silvery blue, with the ventral fins situated on the middle of the abdomen; they are moderately large, and rounded.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 4 inches.

Caribbean Sea, PLUMIER.

Exocetus mesogaster, BLOCH, 399?
" " American Flying-fish, SHAW's Gen. Zoöl., v. p. 146, pl. 116.
" " Middling Flying-fish, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 448.

Although Cuvier observes, that "it is not easy to distinguish the exiliens and mesogaster in the relations and the figures given by travellers," and Richardson (Fauna Boreal. Americ., p. 131) observes that Dr. Mitchill's notice of the E. mesogaster "is too slight to prove that he has applied the name rightly," I have introduced this species here, because it was noticed by Plumier in the Caribbean Sea, and by Mitchill's using, in his description of this species, the very words of Shaw when describing this species (Gen. Zoöl., v. p. 146), it is evident they answer perfectly to the description of his fish. Richardson is in error when he says, "Dr. Mitchill mentions the mesogaster as an inhabitant of the sea of New York"; for although this might be inferred from the fact of its being contained in his "Memoir," yet Mitchill says, "The specimen I examined was brought from the ocean, somewhere to the south."

GENUS V. HEMIRAMPHUS, CUV.

The upper jaw short, lower jaw elongated and pointed; both furnished, on their edges, with minute teeth ; in other respects the species, in their fins, viscera, and general aspect, resemble the Gar-fish.

1. Hemiramphus Brasiliensis, Bloch.

Upper part of the body blue, paler along the sides, and silvery upon the abdomen. Head a clear blue and silvery ; tail yellow and bluish ; beak brown and deep blue. Body three times the length of the lower jaw ; pectoral fins shorter than the half of the lower jaw ; posterior fins almost equal. Caudal deeply cleft. The upper mandible shorter than the semidiameter of the eye. The inferior very long and flexible. Scales large.

D. 14. P. 10. V. 6. A. 12. C. 20 to 24. Length, 12 or 15 inches.

Caribbean Sea, near Guadaloupe and Martinique, Lesueur.

Called "Balao," at Guadaloupe and Martinique.

Esox Brasiliensis, Bloch. 391.
" " Lin., Syst. Nat., p. 517.
" " Piper, Browne's Jamaica, p. 443. pl. 15, fig 2.
" " Brazilian Pike, Shaw's Gen. Zoöl., v. p. 109.
Esox marginatus (?), Lacepede, v. pl. 7, fig. 2.
Hemiramphus marginatus, Lesueur, Journ. Acad. Nat. Sc., II. p. 135.
Hemiramphus Brasiliensis (Cuv.), Griffith's Cuv., x. p. 395.

2. Hemiramphus balao, Lesueur.

Color a little deeper than that of preceding, and tail bluish. Body four times the length of the lower jaw ; pectoral fin a third part shorter than the lower mandible ; anal fin as long as the dorsal.

D. 14. P. 10. V. 6. A. 12. C. 20 to 24. Length, (?).

Caribbean Sea, near Guadaloupe, Martinique, and St. Domingo, Lesueur.

Also called "Balao."

Hemiramphus balao, Lesueur, Journ. Acad. Nat. Sc., II. p. 136.

FAMILY XIX. FISTULARIDÆ.

Characterized by a long tube in the fore part of the cranium, formed by the prolongation of the ethmoid, vomer, preopercula, interopercula, pterygoideals, and tympanals, and at the extremity of which is the mouth, composed, as usual, of the intermaxillaries, maxillaries, and the palatine and mandibulary bones. Their intestine has neither great inequalities nor many folds, and their ribs are short or wanting. Some of them, the Fistulariæ, have a cylindrical body ; in others, the Centrisci, it is oval and compressed.

This family concluded the order Acanthopterygii in the "Règne Animal."

But in the "Histoire Naturelle des Poissons," of Cuv. et Val., it does not appear in that family. That work is not yet sufficiently advanced for us to learn where Valenciennes will place it; but as it has been considered by some ichthyologists a subfamily of the Scombridæ, I follow the arrangement of Dekay, although he observes, "Its true place is probably near or among the Syngnathidæ."

GENUS I. FISTULARIA, LACEP.

Body elongated, cylindrical. Dorsal opposite to the anal. The intermaxillaries and the lower jaw are armed with small teeth. From between the two lobes of the caudal proceeds a filament which is sometimes as long as the body. The tube of the snout is very long and depressed. The natatory bladder excessively small, and the scales are invisible.

1. Fistularia serrata, BLOCH.

Upper part of the body of a reddish-brown color; a narrow bluish band upon the sides, through the centre of which runs the lateral line; back of the dorsal, this line is quite strongly serrated. Tube hard, horny, and strongly serrated laterally. Caudal deeply forked, with a filament between them, strong at its origin, very delicate at its termination.

D. 14. P. 16. V. 6. A. 14. C. 16. Length, including filament, 27 inches.

Jamaica, CATESBY. Massachusetts, STORER.

Petimbuabo Brazil, Tobacco-pipe Fish, CATESBY's Hist. Carol., II. p. 17.
Fistularia serrata (?), BLOCH, variety of tabacaria.
" " SHAW's Gen. Zoöl., v. pl. 107, fig. of tube.
" " Tobacco-pipe Fish, STORER's Report, 80.
" " American Pipe-fish, DEKAY's Report, p. 232, pl. 35, fig. 113.

2. Fistularia tabacaria, BLOCH.

Brownish, with a row of pale spots. Belly white in the middle, and semidiaphanous on the right and left. Orbits of the eye with angular processes or spines.

D. 16. P. 16. V. 6. A. 16. C. $16\frac{3}{3}$. Length, 14 inches.

New York, MITCHILL.

Fistularia tabacaria, BLOCH, 387.
" " LIN., Syst. Nat., p. 515.
" " Slender Fistularia, SHAW's Gen. Zoöl., v. p. 96, pl. 107.
Fistularia Noveboracensis, New York Trumpet-fish, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 437, pl. 3, fig. 8.
Fistularia tabacaria, Spotted Pipe-fish, DEKAY's Report, p. 233.

FAMILY XX. SALMONIDÆ.

Body scaly. First dorsal with soft rays, the second small and adipose. Numerous cœca, and a natatory bladder. The structure and armature of the jaws vary surprisingly. Almost all of them ascend rivers.

GENUS I. SALMO, Lin.

Head smooth ; teeth on the vomer, both palatine bones, and all the maxillary bones ; branchiostegous rays varying in number, generally from ten to twelve, but sometimes unequal on the two sides of the head of the same fish.

1. Salmo salar, Lin.

A beautiful, brilliant bluish silver-color above ; lighter upon the sides, white beneath ; black blotches upon the sides, much more numerous above the lateral line. Dorsal, pectorals, and caudal, bluish ; ventrals dusky ; anal white.

D. 12. P. 15. V. 9. A. 10. C. 19. Length, 2 to 3 feet.

Labrador, Canada, Newfoundland, and Nova Scotia, Richardson, Dekay. Maine, Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Salmo salar, Lin., Syst. Nat. (12th edit.), p. 509.
" " Bloch, i. pl. 20 (female) ; iii. p. 98 (male).
" " Salmon, Pennant's Brit. Zoöl., viii. p. 382.
" " Common Sea-Salmon, Shaw's Gen. Zoöl., v. p. 40, fig. 102.
" " Salmon, Fleming's Brit. An., p. 179, sp. 40.
" " " Jenyns's Brit. Vert., p. 421.
" " " Griffith's Cuv., x. p. 416.
" " " Fabricius, Fauna Groenlandica, p. 170.
" " Common Salmon, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 435.
" " " " De Witt Clinton, Trans. Lit. and Phil. Soc. of N. Y., i. pp. 147, 498.
" " " " Rich., Fauna Boreal. Americ., iii. p. 145.
" " Salmon, Storer's Report, p. 104.
" " Common Sea-Salmon. Dekay's Report, p. 241, pl. 38, fig. 122.
" " Salmon, Thompson's Hist. of Vermont, p. 140.

2. Salmo fontinalis, Mitchill.

Above pale brown ; a large number of circular yellow spots, varying in their size, often having in their centres a bright red spot ; sometimes, the yellow color surrounding them having partially disappeared, they seem distinct from the circular spots. In some specimens, but three or four red spots are observable, while in others are seen twenty or more. Gill-covers golden, with fuliginous. Scales very small, those on the lateral line largest.

D. 11. P. 13. V. 8. A. 11. C. 19. Length, 8 to 14 inches.

Maine, Massachusetts, Storer. Connecticut, Linsley, Ayres. Vermont, Thompson. New York, Mitchill, Dekay. Pennsylvania, Dekay. Ohio, Kirtland. Lake Huron, Rich.

Salmo fontinalis, Common Trout, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 435.
Salmo nigrescens, Black Trout, RAF., Ichth. Ohien., p. 45.
Red-spotted Trout, DOUGHTY, Cabinet of Nat. Hist., I. p. 145, pl. 13.
Salmo fontinalis, New York Char, MITCH., RICH., Fauna Boreal. Americ., III. p. 176, pl. 83, fig. 1; pl. 87, fig. 2 (head).
Salmo fontinalis, Common Brook-Trout, STORER'S Report, p. 106.
" " Speckled Trout, KIRTLAND'S Report, pp. 169, 191.
" " Brook Trout, THOMPSON'S Hist. of Vermont, p. 141.
" " " " DEKAY'S Report, p. 235, pl. 37, fig. 120.
Baione fontinalis, Spotted Troutlet, DEKAY'S Report, p. 244, pl. 20, fig. 58.
Salmo fontinalis, Brook Trout, AYRES, Bost. Journ. Nat. Hist., IV. p. 273.
" " Common Brook-Trout, KIRTLAND, Bost Journ. Nat. Hist., IV. p. 305.

3. Salmo amethystus, MITCHILL.

Head, back, and sides of a dark greenish-gray color, which, when examined closely, is resolved into small, roundish, yellowish-gray spots on a bluish-gray ground, which covers less space than the spots. Teeth, gums, and roof of the mouth have a tinge of purple. Scales small; one hundred and thirty-three on the lateral line; a vertical row beneath the commencement of the dorsal contains eighty-two, of which thirty-two are above the lateral line.

D. 14. P. 14. V. 9. A. 11. C. $19\frac{6}{6}$. Length, 2 to 5 feet.

All the great lakes that lie between the United States and the Arctic Sea, RICHARDSON.

Called "Nammècoos," by Cree Indians; "Thlooeesinneh," by Chippewayans; "Keyteeleek," by Esquimaux; "Salmon Trout," by Canadians.

Namaycush Salmon, PENNANT'S Arct. Zool., II. Suppl., p. 139.
Salmo amethystus, Great Trout of the Lakes, MITCHILL, Journ. Acad. Nat. Sc., I. p. 410.
Salmo namaycush, Namaycush (PENN.), RICH., Fauna Boreal. Americ., III. p. 179, pl. 79.
" " KIRTLAND'S Report, pp. 169, 195.
" " Namaycush, Great Trout of the Lakes, KIRTLAND, Bost. Journ. Nat. Hist., IV. p. 25, pl. 3, fig. 2.
Salmo amethystus, Mackinaw Salmon, DEKAY'S Report, p. 240, pl. 76, fig. 241.

4. Salmo erythrogaster, DOUGHTY.

Above, mottled with dark olive-green and light horn-color. Sides of the abdomen reddish orange, separated by a distinct line from the pearl-color beneath. Tail broadly margined with bright red. Scales very small and rounded. Dorsal varied with dark green and opaque or horn-color.

D. 10. P. 14. V. 8. A. 10. C. $17\frac{5}{5}$. Length, 15 to 20 inches.

New York, Pennsylvania, DEKAY.

Creek Trout (?), DOUGHTY, Cabinet of Nat. Hist., I. p. 134, pl. 13, fig. 2.
Salmo erythrogaster, Red-bellied Trout, DEKAY'S Report, p. 236, pl. 39, fig. 136.

5. Salmo confinis, DOUGHTY.

Upper portion of the head and body bluish black. Sides of the head and body, base of the first dorsal, of the caudal, and anal fins, with numerous round, crowded, irregular, light-gray spots. Body stout, thicker and shorter than the common Salmon. Scales small, orbicular, and minutely striate. Caudal furcate, with a sinuous margin.

D. 14. P. 14. V. 9. A. 12. C. $21\frac{3}{3}$. Length, 2 to 4 feet.

New York, Pennsylvania, DEKAY.

Called "Lake Salmon," "Lake Trout," and "Salmon Trout," in the State of New York.

Lake Trout, DOUGHTY, Cabinet of Nat. Hist., I. p. 145, pl. 13, fig. 1.
Salmo confinis, Lake Trout, DEKAY's Report, p. 238, pl. 38, fig. 123.

6. Salmo Scouleri, RICH.

Back anterior to the dorsal fin gibbous. Jaws elongated; the upper jaw much incurved and arched. Nine very strong incurved teeth in a row on each intermaxillary, exclusive of four smaller ones which occupy the tip of the snout on both sides of the principal rows. Scales small; some oval, others four-sided, with the corners rounded; one hundred and seventy scales on the lateral line, and seventy in a vertical row anterior to the ventrals, of which thirty are above the lateral line.

D. 14. P. 16. V. 11. A. 17. C. $19\frac{9}{9}$. Length, 2 feet.

Northwest Coast, RICHARDSON.

Salmo Scouleri, Observatory Inlet Salmon, RICH., Fauna Boreal. Americ., III. p. 158, pl. 93.
" " DEKAY's Report, p. 242.

7. Salmo Rossii, RICH.

Long, cylindrical. Back, top of the head, dorsal and caudal fins, have a hue intermediate between oil-green and hair-brown; cheeks are nacreous, and the sides pearl-gray, with a blush of lilac and a silvery lustre; a number of carmine dots in the vicinity of the lateral line; beneath red. Scales small, ovate or oval, each scale surrounded by a distinct space of smooth skin; one hundred and thirty-four on the lateral line; seventy-eight in a vertical row under the dorsal, thirty of them being above the lateral line; between two hundred and forty and two hundred and fifty rows on the sides.

D. 13. P. 14. V. 10. A. 11. C. $21\frac{6}{6}$. Length, 2 to 3 feet.

Arctic Seas, RICHARDSON.

Called "Eekalook," by the Esquimaux of Boothia Felix.

Salmo Rossii, RICH., Nat. Hist., Appendix to Ross's Voyage, p. 56.
" " Ross's Arctic Salmon, RICH., Fauna Boreal. Americ., III. p. 163, pl. 80.
" " DEKAY's Report, p. 242.

8. Salmo Hearnii, RICH.

Olive-green above; belly bluish; several longitudinal rows of large flesh-red spots on the back and sides. Scales small, pearly. Teeth subulate, in a thin row on the labials and lower jaw; a solitary tooth of the same size stands on each side of the intermaxillary notch.

D. (?). P. (?). V. (?). A. 10. C. (?). Length, 12 inches.

Coppermine River, RICHARDSON.

Salmo Hearnii, RICH., Franklin's First Journal, p. 706.
" " Coppermine River Salmon, RICH., Fauna Boreal. Americ., III. p. 167.
" " DEKAY'S Report, p. 242.

9. Salmo alipes, RICH.

Slender. Hair-brown above, sides paler, with yellowish marks, belly white or yellow, and the under fins orange, with some darker streaks. Scales small, thin, and roundish ; one hundred and twenty-six compose the lateral line. Labials, intermaxillaries, and lower jaw are armed with short conical, acute, and very slightly curved teeth, in a single series. A projecting cluster of six or seven on the knob of the vomer. Fins very long.

D. 13. P. 15. V. 9. A. 10 or 11. C. $19\frac{6}{6}$. Length, 2 feet.

Arctic regions, RICHARDSON.

Salmo alipes, RICH., Nat. Hist., App. to Ross's Voyage, p. 57.
" " Long-finned Char, RICH., Fauna Boreal. Americ., III. p. 169, pl. 81.
" " DEKAY'S Report, p. 242.

10. Salmo nitidus, RICH.

Deep green above ; orange-red beneath, with several rows of ocellate red spots along the course of the lateral line. Form less elongated than preceding. Scales small, roundish ; one hundred and twenty on the lateral line ; ninety-two in a vertical row, of which thirty-six are above the lateral line, forty-two betwixt it and the ventral, and twelve or fourteen below the first ray of the latter. Teeth as in S. alipes.

D. 14. P. 17. V. 10. A. 12. C. $19\frac{8}{8}$. Length, 20 inches.

Arctic regions, RICHARDSON.

Salmo nitidus, RICH., Nat. Hist., App. to Ross's Voyage, p. 57.
" " Angmalook, RICH., Fauna Boreal. Amer., III. p. 171, pl. 82.
" " DEKAY'S Report, p. 242.

11. Salmo Hoodii, RICH.

Slender, cylindrical. Olive-green above, and covered with numerous yellowish-gray spots ; beneath white. Scales like those of S. nitidus ; one hundred and twenty-six on the lateral line ; fifty-three in a vertical row before the ventrals, of which twenty-eight are above the lateral line. A single row of teeth on each side of the tongue, which meet in a curve at the tip.

D. 12. P. 15. V. 10. A. 11. C. $19\frac{7}{8}$. Length, 2 feet.

Northern Regions, RICHARDSON.

Salmo Hoodii, RICH., Nat. Hist., App. to Ross's Voyage, p. 58.
" " Masamacush, RICH., Fauna Boreal. Americ. III. p. 173, pl. 83.
" " DEKAY'S Report, p. 242.

12. Salmo Mackenzii, Rich.

Head long, compressed, flattened above. Grayish, tinged with blue on the sides and beneath. Scales suborbicular. Teeth *en velours*. Dorsal obliquely quadrangular; anal slightly crescentic; caudal large, and forked.

D. 15. P. 17. V. 12. A. 18. C. $22\frac{6}{6}$. Length, 20 inches.

Arctic Sea, Richardson.

Inconnu, Mackenzie's Voyage in North America, p. 9.
Salmo Mackenzii, Rich., Franklin's Journal, p. 707, plate.
" " Inconnu, Rich., Fauna Boreal. Americ., III. p. 183, pl. 81.
" " Dekay's Report, p. 242.

13. Salmo quinnat, Rich.

Bluish gray; dark spots along the lateral line; whole body below the lateral line unspotted. Scales large. Teeth disappearing on the medial line of the upper jaw. Branchial rays, seventeen.

D. 14. P. 16. V. 10. A. 16. C. $19\frac{6}{6}$. Length, 2 to 3 feet.

Columbia River, Richardson.

Called "Quinnat," by the natives of the banks of the Columbia River.

Salmo quinnat, Quinnat, Rich., Fauna Boreal. Americ., III. p. 219.
" " Dekay's Report, p. 242.

14. Salmo Gairdnerii, Rich.

Dorsal line nearly straight. Back of head and body bluish gray; sides ash-gray; belly white. A few faint spots at the base of the caudal. Jaws fully armed with strong hooked teeth, except a small space in the centre of the upper jaw.

D. (?). P. 13. V. 11. A. 12. C. (?). Length, 2 to 3 feet.

Columbia River, Richardson.

Called "Queachts," by the natives of the banks of the Columbia.

Salmo Gairdnerii, Gairdner's Salmon, Rich., Fauna Boreal. Americ., III. p. 221.
" " Dekay's Report, p. 243.

15. Salmo paucidens, Rich.

Back of head and body bluish gray; sides ash-gray, with a reddish tinge; belly white. No spots on body or fins. Teeth sparsely scattered and feeble on the jaws; only a few short, weak ones on the anterior extremity of the vomer, and on the palatine bones.

D. 12. P. 17. V. 12. A. 17. C. (?). Length, 2 feet.

Columbia River, Richardson.

Called "Quannich," by the natives of the banks of the Columbia.

Salmo paucidens, Weak-toothed Salmon, Rich., Fauna Boreal. Americ., III. p. 222.

16. Salmo tsuppitch, Rich.

Back of body and head studded with oval and circular spots; sides and fins destitute of spots. General color of the fins ash-gray. Back convex in front of dorsal. Snout pointed. Minute sharp teeth in jaws. Caudal forked.

D. 12. P. 13. V. 10. A. 13. C. (?). Length, 21 inches.

Columbia River, Richardson.

Called "Tsuppitch," by the natives of the banks of the Columbia.

Salmo tsuppitch, Tsuppitch, Rich., Fauna Boreal. Americ., iii. p. 224.

17. Salmo Clarkii, Rich.

Brownish purple-red above, passing on the sides into ash-gray, and into reddish white on the belly. Large patches of dark purplish red on the back. Back, dorsal, and caudal fins studded with semilunar spots. A large patch of arterial red on the opercle and margin of the preopercle. Jaws with strong, hooked teeth. Caudal nearly even.

D. 11. P. 12. V. 8. A. 13. C. (?). Length, 14 inches.

Columbia River, Richardson.

Salmo Clarkii, Clark's Salmon, Rich., Fauna Boreal. Americ., iii. p. 225.

18. Salmo Canadensis, Hamilton Smith.

Above olive-green, sides lighter; abdomen scarlet; throat white. White ocelli along the sides, with a blood-red central dot. Pectorals, dorsal, and caudal barred with black.

D. (?). P. (?). V. (?). A. (?) C. (?) Length, 10 inches.

River St. Lawrence, H. Smith.

Salmo Canadensis, Griffith's Cuv., x. p. 474, pl. 41.
" " Dekay's Report, p. 243.

GENUS II. OSMERUS, Artedi.

Body elongated, covered with small scales; two dorsal fins, the first with rays, the second fleshy, without rays; ventral fins in a vertical line under the commencement of the first dorsal fin; teeth on the jaws and tongue very long, two distinct rows on each palatine bone, none on the vomer, except at the most anterior part; branchiostegous rays, eight.

1. Osmerus viridescens, Lesueur.

Yellowish-green above the lateral line; silvery-white beneath; a longitudinal satin band on the side. Lower jaw longer than the upper. Dorsal brownish. Scales equal, rhomboidal. Air-bladder fusiform, swollen at the middle. Stomach with a few short cœca.

D. 11. P. 14 or 16. V. 9. A. 15. C. 19. Length, 10 inches.

Maine, Massachusetts, Lesueur, Storer. New York, Mitchill, Dekay. "From the waters of Hudson River to the coast of Labrador," Dekay.

Salmo eperlanus, Smelt, Mitchill, Trans. Lit. and Phil Soc. of N. Y., i. p. 435.
Osmerus viridescens, Lesueur, Journ. Acad. Nat. Sc., i. p. 230.
Salmo (Osmerus) eperlanus, Rich., Fauna Boreal. Americ., iii. p. 183.
Osmerus eperlanus, Smelt, Art., Storer's Report, p. 108.
Osmerus viridescens, American Smelt, Lesueur, Dekay's Report, p. 243, pl. 39, fig. 124

As Cuvier, in his "Règne Animal," did not acknowledge our fish to be distinct from the Osmerus eperlanus, I arranged it as that species in my "Report upon the Fishes of Massachusetts." Dr. Dekay, in his "Report on the Fishes of New York," considers it as a distinct species, without stating, however, that he had ever seen the European Smelt, or giving any reason for doubting the opinion of Cuvier. To determine this matter definitely, I wrote to Mr. Yarrell upon the subject, who kindly sent me several specimens of the Osmerus eperlanus. Upon examination, they differ from our species, which, of course, will bear Lesueur's name of O. viridescens. With specimens of both the foreign and our fish, of the same size, before me, the difference was quite perceptible. Mr. Yarrell writes me as follows respecting the two species. "Our fish is considerably lighter in color, particularly on the back and on the dorsal and caudal fins. The double series of transverse lines on the sides in our fish are wider apart, and the lozenge-shaped spaces are in every sense larger. Our fish is deeper for the same length than yours; the body thicker, but the head, particularly the parts about the jaws, is narrower. Our fish has the gape opening more freely vertically. The eye in our fish is smaller, the preopercle deeper, and its posterior edge more truly forming a vertical line."

GENUS III. SCOPELUS, Cuv.

Body long, slender; the principal dorsal fin over the interval between the ventral and anal fins; a second dorsal fin so small as to be scarcely perceptible. The head short; the mouth and gill-aperture large; small teeth on both jaws; palate and tongue smooth.

1. Scopelus Humboldtii, Cuv.

Back greenish; sides, including gill-covers, silvery. A row of circular, brilliant metallic-colored spots runs along the belly, from before the pectorals to the anus; just above, parallel to them, extending to the ventral, a second row, commencing on the os hyoides. Behind these, a single row of smaller dots is continued to the base of the tail. An insulated spot between the anus and lateral line. Five oblong spots of a similar appearance upon the preoperculum. A slight ridge on the dorsum, back of dorsal fin (adipose ?). Body much compressed. Lateral line almost imperceptible, nearly straight. Mouth widely cleft. Eyes large.

D. 10. P. 17. V. 8. A. 15. C. 19. Length, 2 inches, 1 line.

Massachusetts Bay, STORER.

Scopelus Humboldtii, CLARKE, Magazine of Natural History, 1833.
" " CUV., YARRELL'S Brit. Fishes (2d edit.), II. p. 162.

Dr. Clarke's description and figure, which Yarrell gives on pages 162 *et seq.*, Vol. II., agree so perfectly with my specimen as to leave no doubt of the identity of the European and American species.

GENUS IV. COREGONUS, CUV.

Body in appearance herring-like; with two dorsal fins, the first higher than long, the second adipose; the scales large; the mouth small, sometimes with minute teeth on the jaws or tongue, or both.

1. Coregonus albus, LESUEUR.

Bluish-gray on the back, lighter on the sides, and white on the belly. Scales large, orbicular. About eighty scales in the course of the lateral line, and twenty in an oblique series from the dorsal. Teeth on jaws scarcely to be felt; vomer and palate smooth. Jaws equal.

D. 15. P. 16. V. 11. A. 15. C. $19\frac{7}{7}$. RICHARDSON. Length, 17 to 20 inches.

Lake Champlain, THOMPSON. Lake Erie, LESUEUR. All the interior lakes of America, from Erie to the Arctic Sea, RICHARDSON.

Called "White-fish," by the fur-traders; "Poisson blanc," by the Canadians; "Attihhawmegh," by the Cree Indians; "Lake Shad," in Vermont.

Salmo lavaretus (Guiniad and Tickomeg), PENNANT'S Arct. Zoöl., Introd., p. 298, and II. p. 293.
Coregonus albus, White-fish, LESUEUR, Journ. Acad. Nat. Sc., I. p. 232, pl.
Salmo (Coregonus) albus, Attihawmeg, RICH., Fauna Boreal. Americ., III. p. 195, pl. 89, fig. 2.
Coregonus albus, White-fish, KIRTLAND'S Report, pp. 169, 195.
" " " KIRTLAND, Bost. Journ. Nat. Hist., III. p. 477, pl. 28, fig. 3.
" " Lake Shad or White-fish, THOMPSON'S Hist. of Vermont, p. 143, fig.
" " White-fish, DEKAY'S Report, p. 247, pl. 76, fig. 240.

2. Coregonus Artedi, LESUEUR.

Ash-blue upon the back; paler and silvery on the rest of the body, with yellow tints on the tail, head, and dorsal. Form of the body elongated in the males, deeper and more compressed in the females. Scales large, ascending high up on the caudal fin. No teeth on margin of jaws.

D. 12. P. 16. V. 12. A. 14. C. $19\frac{5}{5}$. Length, 10 to 15 inches.

Lake Ontario, DEKAY. Lake Erie, LESUEUR. Lake Huron, Cayuga Lake, MITCHILL.

Coregonus Artedi, Herring-Salmon, LESUEUR, Journ. Acad. Nat. Sc., I. p. 231.
Salmo clupeiformis, White-fish of the Lakes, MITCHILL, Amer. Month. Mag., II. p. 321.
Salmo (Coregonus) Artedi, Lesueur's Herring-Salmon, RICH., Fauna Boreal. Americ., III. p. 203.
Coregonus Artedi, Shad of the Lakes, KIRTLAND'S Report, pp. 169, 195.
" " Herring-Salmon, KIRTLAND, Bost. Journ. Nat. Hist., IV. p. 231, pl. 9, fig. 1.
Coregonus clupeiformis, Common Shad-Salmon, DEKAY'S Report, p. 248, pl. 60, fig. 198.

To Dr. Mitchill is due the credit of first distinguishing this from the preceding species. His notice was published in March, 1818. Lesueur's scientific description appeared the same month, a week or two afterwards; and his must be the acknowledged one among scientific men.

3. Coregonus Otsego, DE WITT CLINTON.

Elongate, subcylindrical, compressed. Back arched. Dusky above the lateral line; silvery beneath it. Six or eight dusky longitudinal lines upon the sides. Scales very small. Upper lip protuberant and bifid.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 17 inches.

Otsego Lake, DE WITT CLINTON.

Salmo Otsego, Otsego Bass, CLINTON, Med. and Phil. Register, III. p. 188, pl.
Coregonus Otsego, Otsego Shad-Salmon, DEKAY'S Report, p. 248.

4. Coregonus tullibee, RICH.

Much compressed, belly rounded, back rather more acute. When exposed to light, the whole body is silvery. In the shade, the back is greenish-gray, the belly white, the sides of an intermediate hue. Scales large, oblong, of an uniform size; eighty-eight on the lateral line; twenty-three in a vertical row under first ray of dorsal. A small plate of minute teeth on the centre of the tongue. Lower jaw the longer. Caudal slightly forked.

D. 14. P. 16. V. 12. A. 14 or 15. C. $19\frac{7}{7}$. Length, 14 inches.

Northern Regions, RICHARDSON.

Called "Ottonneebees," by the Cree Indians; "Tullibee," by the fur-traders.

Salmo (Coregonus) tullibee, Tullibee, RICH., Fauna Boreal. Americ., III. pp. 201, 309.
Coregonus tullibee, DEKAY'S Report, p. 249.

5. Coregonus quadrilateralis, RICH.

Subcylindrical, quadrilateral. Color of back and sides intermediate between horny-yellow and wood-brown, with a narrow blackish gray border to each scale. Sides paler, belly white. Scales rhomboidal. The lower jaw the shorter. Edentate. Ninety-six scales along the lateral line; twenty-three or twenty-four in a vertical line before the dorsal, of which nine are above the lateral line, and eight between it and the ventrals.

D. 15. P. 15. V. 11. A. 13. C. $19\frac{7}{7}$. Length, 18 inches.

Polar Sea, RICHARDSON.

Called "Kathèh," by the Copper Indians; "Okeugnak," by the Esquimaux.

Coregonus quadrilateralis, Rich., Franklin's Journal, p. 714.
Salmo (Coregonus) quadrilateralis, Round-fish, Rich., Fauna Boreal. Americ., III. p. 204.
Coregonus quadrilateralis, Dekay's Report, p. 249.

6. Coregonus lucidus, Rich.

Body compressed. Mouth large; when the jaws are extended, the intermaxillaries are brought into a line with the forehead, instead of dropping vertically, as in the C. quadrilateralis; lower jaw the longer; no teeth. Scales pearly and iridescent, transversely oval; eighty-eight scales on the lateral line; ten rows above that line at the dorsal, eight between it and the ventral, and three or four from thence to the mesial line of the belly. Scales on sides larger than on back.

D. 14. P. 19. V. 11. A. 14. C. 19^{9}_{9}. Length, 18 inches.

Northern regions, Richardson.

Salmo (Coregonus) lucidus, Bear-Lake Herring-Salmon, Rich., Fauna Boreal. Americ., III. p. 207, pl. 90, fig. 1.
Coregonus lucidus, Dekay's Report, p. 249.

7. Coregonus harengus, Rich.

Body compressed, back rounded, belly slightly flattened. Olive-green on the back, silvery on sides and belly, and blackish green on top of the head. Gill-covers, cheeks, and irides are whitish and nacreous. Lower jaw the longer. No teeth on the jaws; but three rows of microscopic teeth on the tongue. Scales of same form as those of C. lucidus; eighty-four on lateral line; twenty-two in a vertical row under the dorsal, of which nine are above lateral line, and eight between it and ventrals.

D. 12 or 13. P. 16. V. 12. A. 13. C. 19^{9}_{9}. Length, 13 or 14 inches.

Lake Huron, Richardson.

Salmo (Coregonus) harengus, Lake Huron Herring-Salmon, Rich., Fauna Boreal. Americ., III. p. 210, pl. 90, fig. 2.
Coregonus harengus, Dekay's Report, p. 249.

8. Coregonus Labradoricus, Rich.

Body much like that of C. quadrilateralis. Head small. Jaws toothless; four longitudinal rows of teeth on the tongue. Adipose fin corresponds with the end of the anal. Scales orbicular; seventy-eight on the lateral line; eight scales between the dorsal and lateral line, and as many between the latter and the ventrals.

D. 15. P. 15. V. 12–11. A. 15. C. 19^{9}_{9}. Length, 14 inches.

Musquaw River, Richardson.

Salmo (Coregonus) Labradoricus, Musquaw River Coregonus, Rich., Fauna Boreal. Americ., III. p. 206

GENUS V. MALLOTUS, Cuv.

With the cleft mouth of the preceding, have only even, small, and crowded teeth at the jaws, palate, and tongue. Their first dorsal and ventrals are farther back than the middle; their broad, round pectorals almost touch each other underneath.

1. Mallotus villosus, Cuv.

Back and top of head dull leek-green, with bright green and yellow reflections when moved in the light. Sides and belly covered with delicate and very bright silvery scales, which are dotted on the margins with black specks. Back covered with small smooth grains like shagreen. In the male, a prominent obtuse ridge, composed of soft, tumid, semilanceolate, acute, diaphanous processes, minutely spotted with black, and densely tiled, with three points turned towards the tail, extends along the lateral line. Six cœca of unequal length.

D. 14. P. 17. V. 8. A. 22. C. 19. Length, 6 to 7 inches.

Greenland, FABRICIUS. Newfoundland, RICHARDSON.

Called "Angmaggeuck," by the Esquimaux; "Angmagsak," "Sennersulik" (male), by the Greenlanders.

Clupea villosa, LIN., GMEL., p. 1409
" " MÜLL., Prod., p. 425.
Salmo arcticus, FABRICIUS, Fauna Groenlandica, p. 177, No. 128.
Capelan, PENNANT'S Arctic Zoöl., II. p. 111, No. 175.
Salmo Groenlandicus, BLOCH, 381.
" " Greenland Salmon, SHAW'S Gen. Zoöl., V. p. 70.
" " RICH., Franklin's Journal, p. 710.
Mallotus Groenlandicus, GRIFFITH'S CUV., X. p. 420.
Salmo (Mallotus) villosus (CUV.), Capelin, RICH., Fauna Boreal. Americ., III. p. 187.

2. Mallotus Pacificus, RICH.

Silvery white, passing on the back into a blackish tinge. Large, irregular, but generally oval spots of yellowish white, and blackish gray on the back. A bluish black spot over each orbit. Margin of lips black. Back of head grayish white. Minute black dots on the silvery bases of the cheeks. Dorsal situated more anteriorly than in the M. villosus. Teeth scarcely perceptible. Nine cœca; three shorter than the others, which are equal in length. Ascends into fresh water to spawn.

D. 11. P. 11. V. 8. A. 20. C. (?). Length, 7 to 8 inches.

Columbia River, RICHARDSON.

Indian name, "Oulachan."

Salmo (Mallotus) Pacificus, Northwest Capelin, RICH., Fauna Boreal. Americ., III. p. 226.

GENUS VI. THYMALLUS, Cuv.

Distinguished from the Trouts by the smallness of the mouth, the fineness of the teeth, the great size of the dorsal fin, and the largeness of the scales.

1. Thymallus signifer, Rich.

Back dark; sides bluish gray; belly blackish gray, with irregular whitish blotches. Five or six quadrangular prussian-blue spots on the anterior part of the body, each tinging the margin of the four adjoining scales. Head brown; a blue mark on each side of the lower jaw. Dorsal blackish-gray, with lighter blotches, and crossed by beautiful Berlin-blue spots; it is edged with light lake-red; ventrals streaked with reddish and whitish lines in the direction of their rays. Scales semioval, covered with an epidermis; eighty-seven on the lateral line, including three or four small ones on the base of the caudal, and twenty-seven in a vertical row anterior to the ventrals, of which nine are above the lateral line. Dorsal very large; its three last and longest rays exceed in height the greatest depth of the body.

D. 23. P. 15. V. 9. A. 13. C. $19\frac{2}{8}$. Length, 17 to 18 inches.

Northwestern regions, Richardson.

Called "Hewlook-powak," by the Esquimaux; "Poisson bleue," by Canadian Voyagers.

Coregonus signifer, Rich., Franklin's Journal, p. 711, pl. 26.
Salmo (Thymallus) signifer, Back's Grayling, Rich., Fauna Boreal. Americ., iii. p. 190, pl. 88.
Coregonus thymalloides, Rich., Franklin's Journal, p. 714 (young).
Salmo (Thymallus) thymalloides, Lesser's Grayling, Rich., Fauna Boreal. Americ., iii. p. 194.
Thymallus signifer, Back's Grayling, Jardine, Nat. Lib., Ichth., ii. p. 120, pl. 11.

GENUS VII. SAURUS, Cuv.

Have the muzzle short; the mouth cleft as far as behind the eyes; the edge of the upper jaw formed almost entirely by the intermaxillaries; several very pointed teeth along both jaws, the palatines, the tongue, and the pharyngeals, but none on the vomer; eight or nine, and frequently ten or fifteen, rays to the gills. The first dorsal is a little behind the ventrals, which are large; scales on the body, cheeks, and opercula; the viscera resemble those of Trouts.

1. Saurus Mexicanus, Cuv.

Almost transparent.

D. (?). P. (?). V. (?) A. (?). C. (?). Length, (?).

Mexico, Cuv.

Saurus Mexicanus (Cuv., Règne Animal), Griffith's Cuv., x. p. 431.

FAMILY XXI. CLUPEIDÆ.

No adipose fin. The upper jaw is formed as in the Trouts, at the middle by intermaxillaries, without pedicles, and on the sides by the maxillaries. Their body is always very scaly.

GENUS I. CLUPEA, Cuv.

Body compressed; scales large, thin, and deciduous; head compressed; teeth minute or wanting; a single dorsal fin; abdominal line forming a sharp, keel-like edge, which in some species is serrated; branchiostegous rays, eight.

1. Clupea elongata, Lesueur.

Body lengthened, fusiform, compressed. Above deep blue, tinged with yellow; sides silvery, with metallic reflections. Opercles yellow, oftentimes with a violet tint; beneath silvery. Abdomen carinated, the spines of which are scarcely perceptible. Scales large, silvery, nearly smooth, deciduous.

D. 18. P. 19. V. 9. A. 17. C 22. Length, 12 to 15 inches.

Massachusetts, Lesueur, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Called "English Herring," in Massachusetts.

Clupea harengus, Herring of Commerce, Mitchill, Amer. Month. Mag., ii. p. 323.
Clupea elongata, Lesueur, Journ. Acad. Nat. Sc., i. p 250.
" " Common Herring of Massachusetts, Storer's Report, p. 111.
" " Common American Herring, Dekay's Report, p. 250.

2. Clupea fasciata, Lesueur.

Body compressed; back straight; breast and abdomen forming a bow downwards as far as the tail. Seven to eight blackish blue lines at the sides of the back. A rounded notch at the bottom of the divisions of the tail, of which the lower lobe is longest.

D. 18. P. 16. V. 9. A. 18. C. $22\frac{6}{6}$. Length, 1 to 9 inches.

Massachusetts, Lesueur. Connecticut, Linsley.

Clupea fasciata, Fasciated Herring, Lesueur, Journ. Acad. Nat. Sc., i. p. 233.
Clupea pusilla, Tiny Herring, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 452 (young).
Clupea fasciata, Fasciated Herring, Storer's Report, p. 112.
" " Striped Herring, Dekay's Report, p. 251.

Dr. Dekay thinks the C. pusilla of Mitchill may be the young of this species.

3. Clupea virescens, Dekay.

Body much compressed. Back green; a longitudinal green stripe above the lateral line; A black spot behind the upper angle of the gill-openings. Dorsal and caudal fins light olive-green. Abdomen serrated, with nineteen strong spines anterior to the ventrals, and twelve between these latter and the vent. Scales large, orbicular, deciduous.

D. 16. P. 16. V. 9. A. 17. C. $19\frac{5}{5}$. Length, 6 inches.

Connecticut, Linsley. New York, Mitchill, Dekay.

Called "Greenback," and "Fall Herring."

Clupea halec, New York Herring, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 451 (var. ?).
Clupea virescens, Green Herring, DEKAY'S Report, p. 242, pl. 13, fig. 37.

Dr. Dekay considers the C. halec of Mitchill a variety of this species.

4. Clupea parvula, MITCHILL.

Delicate, semitransparent. Greenish about the head, gills, and eyes. Back of an unmixed brown, which passes through regular gradations of hue to a silvery whiteness on the sides and belly. Belly serrated. Tail forked.

D. 14. P. 14. V. 9. A. 18. C. 21. Length, 6 inches.

New York, MITCHILL.

Clupea parvula, Little Herring, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 452.
" " " " DEKAY'S Report, p. 253.

5. Clupea vittata, MITCHILL.

Large, projecting upper jaw, small lower jaw, silver-striped sides, and forked tail. Belly carinated and moderately serrated. Anal with about twenty-one rays.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 3½ inches.

New York, MITCHILL.

Clupea vittata, Satin-striped Herring, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 456.
" " " " DEKAY'S Report, p. 254.

6. Clupea cœrulea, MITCHILL.

With bluish complexion, large head, forked tail, and small pectoral and abdominal fins. Scales large. Jaws about even.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 3 inches.

New York, MITCHILL.

Clupea cœrulea, Blue Herring, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. 457.
" " " " DEKAY'S Report, p. 254.

Mitchill supposed this might be a variety of the preceding.

7. Clupea minima, PECK.

Back nearly black ; upper part of sides dark green ; sides silvery, with roseate and golden reflections ; in the younger specimens, the dorsal ridge is a black line, and the distance between it and the lateral line is of a light green, sprinkled with darker points. Abdominal ridge serrated. Lower jaw projecting. Tail forked.

D. 10. P. 15. V. 5. A. 12. C. 18. Length, 1 to 4 inches.

New Hampshire, PECK. Massachusetts, STORER.

Clupea minima, PECK, Belknap's Hist. of New Hampshire, III. p. 130; catalogued, but not described.
" " Brit, STORER'S Report, p. 113.
" " " DEKAY'S Report, p. 253.

8. Clupea harengus (?), Lin.

Back green and gold; belly and sides white, with pearly lustre and violet reflections; sides of head deeply tinged with gold-yellow. The edge of the labials is minutely toothed, and there is a cluster of minute teeth on the vomer. Scales large, thin, orbicular.

D. 19. P. 16. V. 8. A. 16. C. (?). Length, 15 inches.

Arctic Seas, Richardson.

Called "Kapiselik," by the Greenlanders.

Clupea harengus, Lin., Syst. Nat., p. 522
" " Fabricius, Fauna Groenlandica, p. 182.
" " Common Herring, Shaw's Gen. Zool., v. p. 156, fig.
" " Bloch, i. p. 49, pl. 29, fig. 1.
" " Rich., Franklin's Journal, p. 716.
" " Fleming's Brit. An., p. 182.
" " Pennant's Arct. Zoöl., viii p 335, pl. 29.
" " Rich., Fauna Boreal. Americ., iii. p. 229.
" " (?), Dekay's Report, p. 255.

It is exceedingly doubtful whether the Arctic species is the *harengus*, and I introduce it, as did Dekay into his Report, with a query.

GENUS II. ALOSA, Cuv.

Upper jaw with a deep notch in the centre; in other respects like the Clupea.

1. Alosa sapidissima, Wilson.

Body oblong, compressed. Bluish upon the top of the head and on the back; the upper portion of the sides, including the opercula, cupreous; beneath silvery. At the posterior angle of the operculum, a black blotch of considerable size, which is sometimes very indistinct. When the scales are removed from the sides, six or eight other similar spots are noticed. Upon the middle of the caudal fin are two membranous appendages on each side. Scales large, rhomboidal upon the sides, rounded on the abdomen. Abdominal ridge serrated.

D. 19. P. 16. V. 9. A. 20. C. $20\frac{2}{2}$. Length, 20 inches. Weight, 2 to 6 pounds.

Maine, Linsley. New Hampshire, Belknap. Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay. South Carolina, Virginia, Dekay.

Clupea sapidissima, Wilson, Rees's Encycloped. (American edit.); catalogued, but not described.
" " Raf., Amer. Month. Mag., ii. p. 205.
Clupea alosa, Shad, Belknap's Hist. of New Hampshire, iii. p. 130.
" " " Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 449.
Clupea indigena, Sprat Herring, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 454 (young).
Alosa vulgaris, Common Shad, Storer's Report, p. 116.
Alosa præstabilis, American Shad, Dekay's Report p. 255, pl. 15, fig. 41.
Alosa sapidissima, Shad, Wilson, Linsley's Cat. of Fishes of Connecticut, Silliman's Journal, xlvii.

2. Alosa tyrannus, LATROBE.

Body elongated, strongly compressed. Of a bluish purple-color on the back; the sides a light cupreous; beneath silvery; four or five, and sometimes even more, indistinct greenish longitudinal lines upon the sides. A deep black blotch just back of the posterior angle of the operculum. Scales very large and deciduous. Anal nearly even. Caudal deeply forked.

D. 17. P. 15. V. 9. A. 18. C. $21\frac{3}{3}$. Length, 8 to 10 inches.

New Hampshire, PECK. Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY. Chesapeake Bay, MITCHILL.

Clupea serrata, PECK, Belknap's Hist. of New Hampshire, III. p. 133.
Clupea tyrannus, Bay Alewife, LATROBE, Amer. Phil. Soc. Trans., V. p. 77, pl. I.
Clupea vernalis, Spring Herring or Alewife, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 451.
Alosa vernalis, Spring Herring or Alewive, STORER's Report, p. 114.
Alosa tyrannus, American Alewive, DEKAY's Report, p. 258, pl. 13, fig. 33.
Alosa vernalis, LINSLEY's Cat. of Fishes of Connecticut, Silliman's Journal, XLVII.

3. Alosa menhaden, MITCHILL.

Body much compressed. Abdomen serrated; serrations sharper behind the ventrals. Greenish brown upon the back, darker upon the top of the head and at the snout; roseate upon the upper part of the sides; silvery upon the abdomen; gill-covers cupreous, with a rosy tint; a more or less distinct black spot upon the shoulders. Scales large, elliptical, ciliate at edge. An accessory plate on each side of the ventrals.

D. 19. P. 15, 16, or 17. V. 6. A. 20, 21, or 22. C. $20\frac{4}{4}$. Length, 8 to 14 inches.

Maine, Massachusetts, STORER. Connecticut, AYRES, LINSLEY. New York, MITCHILL, DEKAY.

Clupea menhaden, Bony fish, Hard-heads, or Marsh-bankers of New York, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 453, pl. 5, fig. 7.
Alosa menhaden, Menhaden, Hard-head, STORER's Report, p. 117.
" " Moss-bonker, DEKAY's Report, p. 259, pl. 21, fig. 60.
" " AYRES, Bost. Journ. Nat. Hist., IV. p. 275.

4. Alosa mattowacca, MITCHILL.

Bluish green on the back; silvery, with a series of dark rounded spots, on the sides. Back regularly arched throughout. Abdomen serrated. Tongue with a band of teeth. Caudal pouches.

D. 18. P. 16. V. 9. A. 20. C. $20\frac{3}{3}$. Length, 20 inches.

Connecticut, AYRES, LINSLEY. New York, MITCHILL, DEKAY.

Called "Autumnal or Fall Herring," "Shad Herring," or "Greenback."

Clupea mattowaca, Long Island Herring, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 451, pl. 5, fig. 8.
Clupea mediocris, Staten Island Herring, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 451.
Alosa mattowacca, Autumnal Herring, DEKAY's Report, p. 260, pl. 40, fig. 127.
" " AYRES, Bost. Journ. Nat. Hist., IV. p. 275.

5. Alosa sadina, Mitchill.

Oblong, compressed. Abdomen indistinctly serrated. Greenish and blue above, with metallic reflections; sides and belly silvery; a dark, almost black spot upon the shoulder. No caudal pouches.

D. 18. P. 18. V. 7. A. 21. C. $16\frac{3}{3}$. Length, 6 to 12 inches.

Connecticut, Linsley. New York, Mitchill, Dekay.

Clupea sadina, New York Shadine, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 457.
Alosa sadina, Spotted Shadine, Dekay's Report, p. 263, pl. 40, fig. 129.

Mr. Linsley considered this species the young of the Alosa sapidissima (see Silliman's Journal, Vol. XLVII.).

6. Alosa teres, Dekay.

Body elongated, cylindrical. Ventrals behind the dorsal. Bright silvery; darker above, with a tinge of blue and yellow on the flanks. Dorsal and caudal tinged with yellow; the remaining fins transparent, feebly punctate with black.

D. 19. P. 15. V. 10. A. 12. C. $19\frac{8}{6}$. Length, 7 inches.

New York, Dekay.

Alosa teres, Slender Herring, Dekay's Report, p. 262, pl. 40, fig. 123.

GENUS III. POMOLOBUS, Raf.

Body nearly cylindrical, elongate, scaly. Vent posterior. Abdomen carinated and serrated from the head to the vent; but without plates or broad scales. Head scaleless, opercle lobed, with a rounded shield above. Jaws without teeth; upper, truncate, extensible; lower, horizontal and fixed. Abdominal fins with nine rays, and without any lateral appendage; dorsal fin opposite.

1. Pomolobus chrysochloris, Raf.

Body subcylindric, compressed on the sides; abdomen slightly carinate and serrate; back rounded. Top of the head and back bluish-purple, iridescent; the gill-covers and sides of the jaws golden and purple, sides of the body and the abdomen white.

D. 18. P. 16. V 9. A. 18. C. 34. Length, 12 to 18 inches.

Ohio River, Kirtland.

Pomolobus chrysochloris, Ohio Gold Shad, Raf., Ichth. Ohien., p. 39.
Alosa chrysochloris, Gold Shad, Gold Herring, Skipjack, Kirtland, Bost. Journ. Nat. Hist., IV. p. 307, pl. 15, fig. 3.

GENUS IV. CHATOËSSUS, Cuv.

The last ray of the dorsal is prolonged into a filament; some have the jaws equal, and the muzzle not prominent; their mouth is small and without teeth.

1. Chatoëssus oglina, LESUEUR.

Back almost straight; throat and abdomen describing an inverted arch as far as the tail, and armed with from thirty-two to thirty-three serratures, of which fourteen or fifteen are placed between the ventral and anal fins. Back blue, with three black longitudinal bands; beneath white. No teeth. Dorsal not emarginate. Anal hardly visible, almost concealed by the scales which cover its base.

D. 18. P. 19. V. 9. A. 20 to 22. C. 18. Length, 8 inches.

Newport, Rhode Island, LESUEUR.

Called "Alewife," at Newport.

Megalops oglina, LESUEUR, Journ. Acad. Nat. Sc., I. p. 359.
Chatoëssus oglina, GRIFFITH's Cuv., x. p. 439.
" " DEKAY's Report, p. 265.

2. Chatoëssus Cepedianus, LESUEUR.

Body subelliptical; back greatly elevated, almost sharp; abdomen very much arcuated, carinated, and armed with twenty-nine spines. Back grayish blue; pale silver on the sides; head of a burnt *terra de sienna,* mixed with golden; throat and abdomen white; extremity of the ventrals black; the remainder of the fins tinted with gray-blue, yellow, and green, blackish at their extremities. The extremity of the pectorals extending beyond the anterior part of the base of the ventrals, which are situated somewhat before the dorsal fin.

D. 15. P. 18. V. 8. A. 33. C. $19\frac{5}{5}$. Length, 8 to 12 inches.

Delaware and Chesapeake Bays, LESUEUR.

Megalops Cepediana, LESUEUR, Journ. Acad. Nat. Sc, I. p. 361.
Chatoëssus Cepedianus, GRIFFITH's Cuv., x. p. 439.
" " DEKAY's Report, p. 265.

3. Chatoëssus notatus, LESUEUR.

Back almost straight; thorax and abdomen arcuated, carinated. Back blue, without blackish bands, but with five blue spots; sides of a pale blue color; abdomen and head white. Anal fin narrow, equal throughout; ventrals small, truncated; dorsal fin longer than high. Scales large.

D. 18. P. (?). V. (?). A. (?). C. (?). Length, 6 to 8 inches.

Guadaloupe, LESUEUR.

Megalops notata, LESUEUR, Journ. Acad. Nat. Sc., I. p. 361.
Chatoessus notatus, GRIFFITH's Cuv., x. p. 439.

4. Chatoëssus ellipticus, KIRTLAND.

Body oval, elliptical; sides flattened, back rounded, abdomen compressed, carinate, and serrate. Back and head olive and bluish, iridescent; sides silvery; abdomen white; fins dusky brown. Dorsal triangular; caudal deeply bilobed; anal narrow, slightly falciform; pectorals do not reach the commencement of the ventrals.

D. 13. P. 15. V. (?). A. 32. C. 22. Length, 12 to 18 inches.

Ohio River and its tributaries, KIRTLAND.

Chatoëssus ellipticus, Hickory or Gizzard Shad, KIRTLAND'S Report, pp. 169, 195.
Dorosoma notata (the young), RAF., Ichth. Ohien., p. 40.
Chatoëssus ellipticus, Hickory or Gizzard Shad, KIRTLAND, Bost. Journ. Nat. Hist., IV. p. 235, pl. 10, fig. 1.
" " " " " DEKAY'S Report, p. 265.

5. Chatoëssus signifer, DEKAY.

Body compressed, elliptical. Bluish above, with a series of dark points along the sides of the back, forming four or five longitudinal lines. A round black spot behind the upper part of the branchial aperture. Pectorals, ventrals, and anal white; dorsal and caudal yellow. Abdomen serrate, with thirteen distinct rhomboidal acute scales between the ventrals and the vent, and eighteen smaller, scarcely prominent ones anterior to the ventral fins. Scales large. Dorsal subtriangular; dorsal filament equal in length to the greatest depth of the body; anal very low, but distinct.

D. 19. P. 18. V. 8. A. 21. C. $19\frac{3}{3}$. Length, 8 inches.

New York, DEKAY.

Called "Shad-Herring," "Thread-Herring," and "Thread-fish," in New York.

Chatoëssus signifer, Spotted Thread-Herring, DEKAY'S Report, p. 264, pl. 41, fig. 132.

GENUS V. HYODON, LESUEUR.

Body compressed as in the Herrings, but without abdominal serratures. Eyes very large. Teeth minute and curved on the jaws, tongue, vomer, and palatines. Branchial rays, eight or nine. Dorsal opposite the commencement of the anal. Scales large, deciduous.

1. Hyodon tergisus, LESUEUR.

Body lengthened, elevated; back almost straight, and parallel with the abdomen. Back bluish; sides silvery; fins tinted with yellow, with metallic reflections on the rays. Anal large, and rounded anteriorly, very narrow posteriorly. Lateral line nearly straight. Dorsal subquadrangular; ventrals with an accessory scale.

D. 15. P. 18. V. 7. A. 32. C. $18\frac{7}{7}$. LESUEUR. Length, 9 to 13 inches.

D. 15. P. 15. V. 7. A. 29. C. $18\frac{7}{7}$. DEKAY. " " "

New York, DEKAY. Lake Erie, Ohio River, LESUEUR.

Called "Moon-eye," "Shiner," "Lake Herring," at Buffalo; it is known also by the names of "Herring," "River Herring," and "Toothed Herring."

Hyodon tergisus, Lesueur, Journ. Acad. Nat. Sc., I. p. 366.
" " Notch-finned Hiodon, Lesueur, Rich., Fauna Boreal. Americ., III. p. 235.
" " Moon-eyed Herring, Kirtland's Report, p. 170.
" " River Moon-eye, Dekay's Report, p. 265, pl. 41, fig. 130.
Hyodon clodalus, Lesueur, Journ. Acad. Nat. Sc., I. p. 367, pl. 14.
" " Larger Herring, Kirtland's Report, pp. 170, 195.
" " Lake Moon-eye, Dekay's Report, p. 266, pl. 51, fig. 164.

Lesueur, when he described the H. tergisus and H. clodalus, was not perfectly satisfied that they were distinct species. Kirtland, in his unpublished description of the H. tergisus, which will appear in the third number of the fifth volume of the "Journal of the Boston Society of Natural History," considers it as the male of the H. clodalus. With abundant opportunities of settling this question, his authority is deserving great respect; and I have accordingly adopted his views.

2. Hyodon chrysopsis, Rich.

Body greatly compressed; thickest above the lateral line, and thinning gradually into the very acute, even edge of the belly; the back thins off more suddenly, but its ridge is less sharp than the rim of the belly. Scales large, irregularly orbicular, of a bluish slate-color at the base, with bright silvery tips. The irides and sides of the head are tinged with honey-yellow. Teeth conical, in a single row on intermaxillaries; two rows in lower jaw. Tongue furnished on its margin with hooked teeth, which are the largest of all, and its centre is occupied by a crowd of small curved ones. Caudal crescentic; its lower lobe the longer.

D. 11. P. 12. V. 7. A. 34. C. (?). Length, 16 inches.

Northern regions, Richardson.

Called "Oweepeetcheesees," by the Crees; "Gold-eye," by the fur-traders; "Naccaysh," by Voyageurs.

Hyodon clodalus, Rich., Franklin's Journal, p. 716.
Hyodon chrysopsis, Naccaysh, Rich., Fauna Boreal. Americ., III. p. 232.
" " Dekay's Report, p. 267.

GENUS VI. ELOPS, Lin.

Jaws formed like those of the Herrings. Body cylindrical. There are as many as thirty rays, or more, to the membrane of the gills. A flat spine arms the upper and the lower edge of the caudal.

1. Elops saurus, Lin.

Body elongated, cylindrical, compressed towards the tail. Bright silvery, with a greenish tinge along the back; summit of the head bronzed. All the fins more or less punctate with black. Scales moderate, orbicular. Upper jaw longer than the lower. Dorsal subtriangular, covered at its base by a thick membrane; ventrals under the anterior part of the dorsal; caudal widely forked, with six accessory rays on each side, the first somewhat produced and flattened on the upper and under edges of the tail.

D. 21. P. 15. V. 14. A. 17. C. $20\frac{6}{6}$. Length, 11 to 22 inches.

New York, MITCHILL, DEKAY.

Elops saurus, LIN., Syst. Nat. (12th edit.), p. 518.
Elops inermis, Smooth Elops, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 445.
Elops saurus, Saury, DEKAY'S Report, p. 267, pl. 41, fig. 131.

NOTE. Dr. Dekay, in his account of the above species, says, — "I find an Elops (not named) among the drawings of the fishes of Carolina by my friend Dr. Holbrook, and suppose it to be a different species."

GENUS VII. BUTIRINUS, COMMERSON.

Body elongated and rounded. Muzzle prominent. Mouth but slightly cleft; close and even teeth in the jaws. Twelve or thirteen branchial rays. Tongue, vomer, and palatines paved with rounded teeth.

1. Butirinus vulpes, LIN.

Body much elongated; depth very slight just in front of tail. Greenish blue above; sides and fins reddish brown. Snout projects beyond the lower jaw. Scales large and rounded. Dorsal upon the middle of the back; caudal deeply forked.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, about 16 inches.

Carolina, West Indies, CATESBY.

Esox vulpes, LIN., Syst. Nat., p. 516.
Vulpes Bahamensis, CATESBY'S Hist. Carol., II. p. 1, pl. 1, fig. 2.
Macabi, PARRA, p. 83, pl. 35, fig. 1
Esox vulpes, Esox Pike, SHAW'S Gen. Zool., V. p. 106.
Clupea macrocephala (LACEP.), SHAW'S Gen. Zoöl., V. p. 177.
Butirinus vulpes (CATESBY), DEKAY'S Report, p. 268.

GENUS VIII. AMIA, LIN.

Head flattened, naked, with conspicuous sutures. Twelve flat gill-rays. Small paved teeth behind the acute conical ones. A large, long buckler between the branches of the lower jaw. Dorsal long; anal short. Air-bladder cellular, like the lungs of reptiles.

1. Amia calva, LIN.

Body cylindrical anteriorly, compressed posteriorly. Back of head bluish-black; sides obscurely maculated in some specimens with olive spots; beneath white; a black spot at upper edge of caudal fin. Scales subcircular, flat, depressed somewhat in their centres.

D. 48. P. 17. V. 6. A. 9. C. 22. Length, 18 inches to 3 feet.

Lake Champlain, THOMPSON. Lake Erie, KIRTLAND. Lake Huron, RICHARDSON. Carolina, LIN.

Called the "Bowfin," at Lake Champlain.

Amia calva, LIN., Syst. Nat., p. 500.
" " Carolinian Amia, SHAW's Gen. Zool., v. p. 9.
Amia ocellicauda, Marsh-fish, RICH., Fauna Boreal. Americ., III. p. 236.
Amia calva, Dog-fish of Lake Erie, KIRTLAND, Bost. Journ. Nat. Hist., III. p. 479, pl. 29, fig. 1.
Amia occidentalis, Western Mud-fish, DEKAY's Report, p. 269, pl. 39, fig. 125.
Amia calva, DEKAY's Report, p. 270.

Mr. Zadock Thompson, the intelligent author of the "History of Vermont," writes me, that he compared his description of an Amia he took at Whitehall, Lake Champlain, with Dekay's A. occidentalis, Richardson's A. ocellicauda, and Kirtland's A. calva, and is satisfied "they all belong to one and the same species."

FAMILY XXII. SAURIDÆ.

Body covered with scales of a stony hardness, which are extended into imbricated spines upon the first rays of all the fins. In some genera, dorsal finlets, each supported by a strong spine.

GENUS I. LEPISOSTEUS, LACEP.

Muzzle formed by the union of the intermaxillaries, maxillaries, and palatines to the vomer and the ethmoid ; jaws slightly unequal ; both jaws bristling over their whole interior surface with rasp-like teeth, have along their edge a row of long and pointed teeth. Dorsal and anal fins far back, and opposite one another. Their stomach is continued as far as a slender intestine, twice folded, having many short cœca to the pylorus ; their natatory bladder is cellular, as in Amia, and occupies the length of the abdomen.

1. Lepisosteus osseus, LIN.

Body elongated, fusiform. Head more than one fourth of its total length ; base of head less in circumference than any other section of the body anterior to the dorsal fin. Snout much elongated. Back and head brown or umber-colored, sides yellow, and body white ; several circular black spots upon the caudal, a few smaller ones upon dorsal and anal fins. Scales smooth. Lateral line nearly straight.

D. 7. P. 10. V. 6. A. 6. C. 12. Length, 1 to 5 feet.

New York, MITCHILL, DEKAY. Lake Huron, RICHARDSON.

Called "Bony Pike," "Alligator," and "Alligator Gar," at Buffalo; also called "Buffalo-fish."

Green Gar-fish, CATESBY's Hist. Carol., II. p. 30, pl. 30.
Esox osseus, LIN., Syst. Nat., p. 516.
" " BLOCH, 390.
" " Bony-scaled Pike, SHAW's Gen. Zoöl., V. p. 115.
" " " " MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 441.
" " " " " Amer. Month. Mag., II. p. 321.
Lepisosteus oxyurus, Ohio Gar-fish, RAF., Ichth. Ohien., p. 73.
" " Common Gar, KIRTLAND's Report, pp 170, 196.
Lepisosteus Huronensis, Northern Mailed-fish, RICH., Fauna Boreal. Americ., III. p. 237.
Lepisosteus rostratus (CUV.), RICH., Fauna Boreal. Americ., III. p. 238.
Lepisosteus oxyurus, Ohio Gar-fish, KIRTLAND, Bost. Journ. Nat. Hist., IV. p. 16, pl. 1, fig. 1.
" " Common Bill-fish, THOMPSON's Hist. of Vermont, p. 145.
Lepisosteus bison, Buffalo Bony-Pike, DEKAY's Report, p. 271, pl. 43, fig. 139.
Lepisosteus longirostris (CUV., RICH., Fauna Boreal. Americ., III. p. 237), DEKAY's Report, p. 274.

Mr. Thompson describes and figures a species in his "History of Vermont," p. 145, under the name of L. lineatus, which he thinks may be the young of the above species; he is undoubtedly correct in this latter opinion.

2. Lepisosteus platostomus, RAF.

Body cylindrical, flattened above. Head flattened above. Jaws hard, elongated; upper jaw about as long as the head; jaws furnished with numerous sharp, prominent teeth. Head and back dusky and umber; sides yellowish; abdomen white; iris golden yellow. Dorsal, caudal, and anal fins, maculate. A series of obscure circular spots on the medial line behind anal fin.

D. 8. P. 10. V. 6. A. 9. C. 12. Length, 26 inches.

Ohio, RAF., KIRTLAND. Florida, DEKAY.

Lepisosteus platostomus, Duck-bill Gar-fish, RAF., Ichth. Ohien., p. 72.
" " " " KIRTLAND's Report, pp. 170, 196.
" " " " KIRTLAND, Bost. Journ. Nat. Hist., IV. p. 20, pl. 1, fig. 3.
Lepisosteus platyrhincus, Flat-nosed Bony-Pike, DEKAY's Report, p. 273, pl. 43, fig. 137.

Dekay's description of this species, having been drawn up from a preserved specimen, touches but slightly upon its colors; but in other respects it resembles Rafinesque's species so much, that I cannot doubt their identity.

3. Lepisosteus ferox, RAF.

Body fusiform, cylindrical, and flattened on the back. Head broad and flat above, and one fourth the whole length of the fish. Jaws nearly equal, not half the length of the head, and armed with numerous strong, prominent teeth. Scales imbricate, and sculptured on their external surface. In the prepared specimen, of a yellowish-brown color.

D. 8. P. 15. V. 6. A. 8 or 9. C. 11. Length, 4 to 6 feet.

Ohio River, KIRTLAND. Mississippi River, RAF.

Lepisosteus ferox, Alligator Gar-fish, RAF., Ichth. Ohien., p. 75.
" " " " KIRTLAND's Report, pp. 170, 196.
" " " " KIRTLAND, Bost. Journ. Nat. Hist., IV. p. 18, pl. 1, fig. 2

JUGULARES.

Ventrals attached under the pectorals, and the pelvis immediately suspended to the bones of the shoulder.

FAMILY XXIII. GADIDÆ.

Body elongated, but little compressed, covered with soft scales not very voluminous ; their head well proportioned and without scales ; all their fins soft ; their jaws and the front of the vomer are armed with pointed, irregular teeth, middling, or small sized, in several rows, forming a sort of currycomb or rasp ; their gills are large, with seven rays. Ventrals separate, jugular. Almost all have two or three fins on the back, one or two behind the anus, and a distinct caudal. Their stomach is in the form of a large and strong sac ; their cœca are very numerous, and their caudal tolerably long. They have a large air-bladder, with strong parietes, and frequently dentated in the sides.

GENUS I. MORRHUA, Cuv.

Three dorsal fins ; two anal ; ventrals pointed ; a barbel at the end of the lower jaw.

1. Morrhua Americana, Storer.

Body largest and deepest anterior to the dorsal fin. Color very variable ; generally, back ash-colored ; sides lighter ; both back and sides covered with yellowish spots, larger and more distinct upon the sides. Beneath dusky white. Lateral line lighter-colored than the body throughout its whole extent. The second dorsal and first anal with twenty-two rays.

D 15, 22, 19. P. 19. V. 6. A. 22, 19. C 40. Length, 1 to 3 feet.

Maine, Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Gadus callarias, Common Cod of New York, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 367.
Morrhua Americana, American Cod, Storer's Report, p. 120.
" " " " Dekay's Report, p. 274, pl. 41, fig. 140.

2. Morrhua æglefinus, Lin.

Body robust, large in front, tapering behind. Above the lateral line, of a dark gray color ; beneath this line, a beautiful silvery-gray, with a large, dusky, more or less circular patch on each side, on a line with the middle of the pectorals, its upper portion generally extending above the lateral line, its larger portion usually beneath it. Lateral line of a jet black color. First dorsal elevated ; caudal emarginated.

D. 16, 24, 20. P. 21. V. 6. A. 26, 21. C. 35. Length, 1 to 2 feet.

Maine, Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

Gadus æglefinus, LIN., Syst. Nat. (12th edit.), p. 435.
" " Haddock, BLOCH, II. p. 125, pl. 62.
" " " SHAW'S Gen. Zoöl., IV. p. 136.
" " " PENNANT'S Brit. Zoöl., III. p. 211.
" " " JENYNS'S Brit. Vert., p. 441.
" " " MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 370.
Morrhua æglefinus, Haddock, GRIFFITH'S Cuv., X. p. 484.
" " " YARRELL'S Brit. Fishes (1st edit.), II. p. 153, fig.; (2d edit.), II. p. 233, fig.
" " " STORER'S Report, p. 124.
" " " DEKAY'S Report, p. 279, pl. 43, fig. 138.

3. Morrhua pruinosa, MITCHILL.

Body oblong, fusiform; head small and flattened above; abdomen prominent. The color varies exceedingly; generally, it is brown, greenish, or yellowish brown, with deeper patches, spots, and blotches; beneath lighter. The first two rays of the ventrals free at their extremities, the second ray filamentous.

D. 13, 18, 19. P. 17. V. 6. A. 22, 18. C. 39. Length, 4 to 12 inches.

Maine, Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, DEKAY.

Frost Cod, and Frost-fish, PENNANT'S Arct. Zool., Supplement, p. 114.
Gadus pruinosus, Tom Cod or Frost-fish, MITCHILL'S Report in part, p. 4.
Gadus tomcodus, Tom Cod, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 368.
Morrhua tomcodus, Tom Cod, STORER'S Report, p. 126.
Morrhua pruinosa, Tom Cod, DEKAY'S Report, p. 278, pl. 44, fig. 142.
" " " AYRES, Bost. Journ. Nat. Hist., IV. p. 276.

4. Morrhua vulgaris, LIN.

Body oval, elongated, thickest behind the pectorals; somewhat tapering posteriorly. Back, head, and upper half of the sides, cinnamon-brown, obscurely spotted with yellow; lower half of the sides and abdomen white; lateral line forming a narrow white band; fins dusky; ventrals pale, approaching to white. Jaws nearly equal.

D. 12, 20, 19. P. 19. V. 6. A. 19, 17. C. 34, and several short ones. JENYNS. Length, 2 to 4 feet.

D. 10, 20, 18. P. 20. V. 6. A. 20, 16. C. 26. YARRELL. Length, 2 to 4 feet.

Greenland, FABRICIUS. Grand Bank, off Newfoundland.

Called "Saraudlirksoak," or "Ekalluarksoak," by the Greenlanders.

Gadus morrhua, LIN., Syst. Nat., I. p. 436.
" " Codfish, BLOCH, II. p. 131, pl. 64.
" " FABRICIUS, Fauna Groenlandica, p. 146.
" " Common Cod, SHAW'S Gen. Zoöl., IV. p. 131.
" " Bank Cod, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 367.
" " Common Cod, JENYNS'S Brit. Vert., p. 440.
Morrhua vulgaris, Cod, GRIFFITH'S Cuv., X. p. 483.
" " Common Cod, YARRELL'S Brit. Fishes (2d edit.), II. p. 221.
" " Bank Cod, DEKAY'S Report, p. 280.
Gadus morrhua, CAPT. J. C. ROSS, Append., p. 48.
" " Common Codfish, RICH., Fauna Boreal. Americ., III. p. 242.

5. Morrhua minuta, Lin.

Body cylindrical, fusiform. Depth one fifth of the length. First dorsal entirely before the first anal. Reddish yellow above; abdomen of a dirty white, or rather a yellowish white, covered with innumerable minute black points. Upper jaw the longer.

D. 13, 24, 20. P. 18. V. 6. A. 28, 24. C. (?). Jenyns.

D. 12, 19, 17. P. 14. V. 6. A. 25, 17. C. 18. Yarrell.

D. 12, 19, 17. P. 17. V. 6. A. 22, 17. C. 20. Storer. Length, 6 to 8 inches.

Massachusetts, Storer.

Gadus minutus, Lin., Syst. Nat., i. p. 438.
" " Poor, Bloch, ii. p. 148, pl. 67, fig. 1.
" " " Jenyns's Brit. Vert., p. 444.
" " " Shaw's Gen. Zoöl., iv. p. 141.
Morrhua minuta, Poor or Power Cod, Yarrell's Brit. Fishes (2d edit.), ii. p. 241, and plate.
" " " " Storer's Report, p. 127.
" " Power Cod, Dekay's Report, p. 277, pl. 41, fig. 141.

6. Morrhua callarias, Lin.

Body elongated, subventricose; head, back, and sides more or less spotted; lateral line white, bent; tail square; upper jaw much the longer; snout prominent, sharp; under jaw only half as long as the head, and ending on a line half way between the nose and the eye.

D. 15, 18, 20. P. 20. V. 6. A. 19, 18. C. 24. Length, 12 to 24 inches.

Greenland, Fabricius.

Gadus callarias, Lin., Syst. Nat., p. 436.
" " Bloch, ii. pl. 63.
" " Fabricius, Fauna Groenlandica, p. 144.
" " Dorse, Shaw's Gen. Zoöl., iv. p. 138.
" " Variable Codfish, Pennant's Brit. Zool., iii. p. 239.
" " Dorse, Rich., Fauna Boreal. Americ., iii. p. 244.
Morrhua callarias, Griffith's Cuv., x. p. 484.
" " Dorse, or Variable Cod, Yarrell's Brit. Fishes (2d edit.), ii. p. 231, fig.

7. Morrhua Fabricii, Rich.

The color of the back is a soiled or livid white, the sides are minutely spotted with black, and the under parts are pure white. There is a short barbel under the chin.

D. 13, 15, 23. P. 19. V. 6. A. 17, 20. C. 32. Length, 14 inches.

Greenland, Fabricius.

Gadus æglefinus, Fabricius, Fauna Groenlandica, p. 142.
Gadus Fabricii, Meesarkornak, Rich., Fauna Boreal. Americ., iii. p. 245.

8. Morrhua ogac, Rich.

Larger than the Morrhua lusca, the Whiting-pout of the British seas; no black spot at the base of the pectorals.

D. 15, 19, 16. P. 18. V. 6. A. 22, 17. C. 32. Length, 18 inches.

Greenland, Fabricius.

Called "Ogak," or "Owak" (the young, "Ogarak" or "Awarak," pl. "Ogarkaet" or "Owarkaet"), by the Greenlanders.

Gadus barbatus, FABRICIUS, Fauna Groenlandica, p. 146.
Gadus ogac, Ogak, RICH., Fauna Boreal. Americ., III. p. 246.

GENUS II. MERLUCIUS, Cuv.

The head flattened; the body elongated; the back furnished with two dorsal fins, the first short, the second long; but one anal fin, also very long; no barbels at the chin.

1. Merlucius albidus, MITCHILL.

Body elongated, somewhat compressed in front of the anus, rounded posteriorly. The top of the head and upper part of the body of a reddish-brown color when the fish is first taken, which afterwards becomes of a dull lead-color. Lower parts of the sides and abdomen white, with metallic reflections. Preopercular, maxillary, and intermaxillary bones of a beautiful, shining silver-color. Lower jaw the longer. Prominent teeth on palatine bones. A deep emargination in second dorsal fin, causing it to appear like two fins.

D. 11, 18, 20. P. 15. V. 7. A. 21, 19. C 34. MITCHILL.

D. 11, 39. P. 16. V. 7. A. 40. C. $17\frac{6}{6}$ DEKAY.

In two species I have before me, the fin rays are as follows:

D. 13, 41. P. 13. V. 7. A. 40. C. 23.

D. 13, 28. P. 13. V. 7. A. 40. C. 30. Length, from 18 to 24 inches

Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, DEKAY.

Gadus albidus, New York Whiting, MITCHILL, Journ. Acad. Nat. Sc., I. p. 409.
Gadus merlucius, Hake, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 371.
Merlucius vulgaris, Hake, STORER's Report, 132.
" " AYRES, Bost. Journ. Nat. Hist., IV. p. 276.
Merlucius albidus, American Hake, DEKAY's Report, p. 280, pl. 46, fig. 148.

GENUS III. LOTA, Cuv.

Body elongated. Two dorsal fins. A single anal fin. One or more barbels on the chin.

1. Lota maculosa, LESUEUR.

Body oblong, compressed. Ground-color of the body reddish, marbled with brown, with roundish white spots scattered throughout. Dorsal, anal, and caudal fins also spotted. The first dorsal subtriangular.

D. 10 or 12, 70 or 74. P. 16 or 18. V. (?). A. 70. C. 44 to 50. Length, 18 to 28 inches.

Every lake and river from Canada to the northern extremity of the continent, RICHARDson. Several of the small lakes in the Western District of New York, Dekay. Lake Erie, Lesueur.

Gadus lota, Pennant's Arct. Zoöl., Introd., p. 191.
" " Rich., Franklin's Journal, p. 724.
Gadus lacustris, Codfish of the Lakes, Mitchill, Amer. Month. Mag., ii. p. 244.
Gadus maculosus, Eel-pout, Dog-fish, Lesueur, Journ. Acad. Nat. Sc., i. p. 83.
Le Molve tacheté (Molva maculosa), Lesueur, Mémoires du Muséum, v. p. 159, pl. 16.
Lota maculosa, Griffith's Cuv., x. p. 487.
Gadus (Lota) maculosus (Cuv.), Methy, Rich., Fauna Boreal. Americ., iii. p. 248.
Lota maculosa, Eel-pout, Kirtland's Report, pp. 170, 196.
" " " Kirtland, Bost. Journ. Nat. Hist., iv. p. 24, pl. 3, fig. 1.
" " Ling or Methy, Thompson's Hist. of Vermont, p. 146.
" " Spotted Burbot, Dekay's Report, p. 284, pl. 52, fig. 168.

Note. Kirtland, in his observations upon this species, in the "Boston Journal of Natural History," remarks that Lesueur is incorrect in giving this species the common name of *Dog-fish;* that term is exclusively applied to the Amia calva.

2. Lota compressa, Lesueur.

Body, in front of the first dorsal, cylindrical; at extremities of pectorals, begins to be compressed; much compressed at posterior portion. Yellowish brown, variegated with darker brown spots; abdomen white. Upon the lower portion of the second dorsal, a row of dark-colored spots. Dorsal, anal, and caudal united together.

D. (?). P. (?) V (?). A. (?). C. (?). Length, 6 to 8 inches.

New Hampshire, Storer. Massachusetts, Lesueur. Connecticut, Linsley.

Gadus compressus, Lesueur, Journ. Acad. Nat. Sc., i. p. 84.
Le Molve Hunt (Molvia Huntia), Lesueur, Mémoires du Muséum, v. p. 161.
Lota compressa, Eel-pout, Storer's Report, p. 134.
" " " Thompson's Hist. of Vermont, p. 147.
" " Compressed Burbot, Dekay's Report, p. 285, pl. 78, figs. 244, 245.

3. Lota brosmiana, Storer.

Body broad in front of the dorsal; compressed upon the sides, back of first dorsal, tapering to tail. Yellowish in the recent fish, with a reddish tint upon the back, between the back of the head and the origin of the dorsal. The top of the head and opercula fuliginous, the latter with golden reflections. The second ray of the ventrals is as long again as the first, and these two rays are disconnected from each other posteriorly, leaving the first free. Dorsals of nearly equal height.

D. 10, 71. P. 16. V. 6. A. 68. C. 34. Storer. Length, 27 to 29 inches.

D. 9, 71. P. 19. V. 7. A. 63. C. 45. Dekay.

New Hampshire, Storer. New York, Dekay.

Lota brosmiana, Storer. Bost. Journ. Nat. Hist., iv. p. 58, pl. 5, fig. 1 (1839).
Lota inornata, Plain Burbot, Dekay's Report, p. 283, pl. 45, fig. 145 (1842).

Notwithstanding the difference in the radial formula of the caudal fin in Dekay's fish and mine, I cannot but believe they are identical. Dekay's specimen being a preserved one, the color had faded.

GENUS IV. MERLANGUS, Cuv.

Three dorsal and two anal fins. No barbels to the chin.

1. Merlangus carbonarius, Lin.

Body fusiform, cylindrical. All the upper part of the body and head black; beneath the lateral line, of a bluish white; abdomen lighter than the sides. Lateral line of a beautiful silvery-white color. The lower jaw the longer. Scales on the top of the head very small.

D. 13, 20, 20. P. 19. V. 6. A. 24, 21. C. 32. Storer.

D. 13, 19, 19. P. 18. V. 6. A. 24, 19. C. $22\frac{3}{8}$. Dekay. Length, 1 to 3 feet.

Davis's Straits, Sabine. Massachusetts, Storer. New York, Dekay.

Called "Pollack," and "Black Pollack," in New York and Massachusetts.

Gadus carbonarius, Lin., Syst. Nat., p. 438.
" " Coal-fish, Bloch, ii. p. 146, pl. 66.
" " " Pennant's Brit. Zoöl., iii. p. 250.
" " " Shaw's Gen. Zoöl., iv. p. 145.
Merlangus carbonarius, Coal-fish, Griffith's Cuv., x. p. 485.
" " " Jenyns's Brit. Vert., p. 446.
" " " Yarrell's Brit. Fishes (2d edit.), ii. p. 250 and fig.
Gadus (Merlangus) carbonarius, Coal-fish, Rich., Fauna Boreal. Americ., iii. p. 247.
Merlangus carbonarius, Coal-fish, Storer's Report, p. 129.
" " " Dekay's Report, p. 287, pl. 45, fig. 144.

2. Merlangus purpureus, Mitchill.

Body oblong, cylindrical, subcompressed. Upper part of head and body greenish-brown color; sides lighter; abdomen white. Lateral line grayish. Caudal deeply concave.

D. 14, 19 or 22, 18 or 21. P. 16 or 20. V. 6. A. 22 or 24, 16 or 21. C. 36 or 40. Storer.

D. 13, 21, 21. P. 20. V. 6. A. 25, 20. C. $24\frac{8}{8}$. Dekay. Length, 1 to 3 feet.

Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Gadus purpureus, New York Pollack, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 370.
Merlangus purpureus, Pollack, Storer's Report, p. 130.
" " New York Pollack, Dekay's Report, p. 286, pl. 45, fig. 147.

3. Merlangus polaris, Sabine.

Distinguished from the Gadus virens of the European seas by the third dorsal being larger than the two anterior ones; the lower jaw rather exceeds the upper one; tail slightly forked.

D. 14, 16, 19. P. 18. V. 6. A. 17, 22. C. 42. Sabine. Length, 10 inches.

D. 13, 15, 20. P. 18. V. 6. A. 17, 21. C. 42 to 48. Ross. " "

Baffin's Bay, Sabine.

Merlangus polaris, Sabine, Parry's First Voyage.
" " Ross, Append. Parry's Third Voyage, p. 110.
" " Parry's Polar Voyage, p. 199.
Gadus (Merlangus) polaris, Polar Coal-fish, Rich., Fauna Boreal. Americ., iii. p. 247.

4. Merlangus leptocephalus, Dekay.

Body compressed, subcylindric. Deep green above the lateral line ; silvery-white beneath, and minutely punctate with black. Lower jaw the shorter.

D. 12, 19, 19. P. 18. V. 6. A. 27, 20. C. $22\frac{5}{5}$. Length, 12 to 18 inches.

New York, Dekay.

Merlangus leptocephalus, Green Pollack, Dekay's Report, p. 288, pl. 45, fig. 146.

GENUS V. BROSMIUS, Cuv.

Body elongated ; a single dorsal fin extending the whole length of the back ; one barbel at the chin ; ventral fins fleshy.

1. Brosmius flavescens, Lesueur.

Body cylindrical, compressed posterior to the anus. In the larger specimens the back is brownish, the sides yellowish and sometimes a decided yellow ; occasionally, in very large specimens, the color is whitish, with brownish patches, looking as if the skin was abraded ; the immature fish is of a uniform dark-slate color, or with transverse yellow bands. Dorsal, caudal, and anal bordered with bluish black, with a white margin. Dorsal and anal fins continued to and united with the base of the tail.

D. 96 or 98. P. 23, 24, or 25. V. 5. A. 71 or 73. C. 34 or 35. Length, 2 to 3 feet.

Massachusetts, Lesueur, Storer.

Le Brosme jaune, Brosmius flavescens, Lesueur, Mémoires du Muséum, v. p. 158, pl. 16.
Gadus (Brosmius) flavescens (?), Lesueur, Yellow Tusk, Rich., Fauna Boreal. Americ., iii. p. 252.
Brosmius vulgaris (Cuv.), Cusk, Storer's Report, p. 136.
" " (?), Cusk, Dekay's Report, p. 289.

GENUS VI. PHYCIS, Artedi.

Body elongated. Two dorsal fins, first short, second long ; ventral fins with a single ray only at the base, afterward divided. Chin with one barbel.

1. Phycis Americanus, Schneider.

Body cylindrical ; sides compressed. Grayish brown above, lighter beneath. The third ray of the first dorsal is filamentous, and considerably higher than the length of the fin. Ventrals composed of two rays, which, previous to dissection, appear as one ; these fins extend to or beyond the vent.

D. 10, 54. P. 17. V. 2. A. 48. C. 20 or 21. Length, 1 to 3 feet.

Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Called "Hake," by the fishermen of Massachusetts ; "Codling," by those of New York.

Enchelyopus Americanus (SCHNEIDER), GRIFFITH'S CUV., x. p. 489.
Gadus longipes, Codling, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 372, pl. 1, fig. 4.
Phycis furcatus, STORER, Bost. Journ. Nat. Hist., I. p. 418.
Phycis Americanus, American Hake, STORER'S Report, p. 138.
" " American Codling, DEKAY'S Report, p. 291, pl. 46, fig. 150.

2. Phycis punctatus, MITCHILL.

Body cylindrical, subfusiform. Back and sides brown, or whitish with lines between the scales. Lateral line alternately black and white. A black spot on the first dorsal; caudal emarginate.

D. 9 or 10, 47. P. 13. V. 1. A. 47. C. 23. Length, 10 inches.

Nova Scotia, HAMILTON SMITH. New York, MITCHILL, DEKAY.

Gadus punctatus, Spotted Cod, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 372, pl. 1, fig. 5.
Gadus (Phycis) punctatus, Spotted Phycis, RICH., Fauna Boreal. Americ., III. p. 253, and fig.
Phycis punctatus, Spotted Codling, DEKAY'S Report, p. 292, pl. 46, fig. 149.

3. Phycis tenuis, MITCHILL.

Back and sides brown, lighter above. Fins dark brown, excepting ventrals, which are whitish. Throat internally streaked with red and purple. Convex tail.

D. 11, 54. P. 16. V. 2. A. 44. C. 25. Length, 15 inches.

New York, MITCHILL, DEKAY.

Gadus tenuis, Slender Cod, MITCHILL, Trans. Lit. and Phil Soc. of N. Y., I. p. 371.
Phycis tenuis, Slender Cod, DEKAY'S Report, p. 293.

GENUS VII. MACROURUS, BLOCH.

The entire head and whole body furnished with hard scales, bristling with small spines. Their suborbitars unite together in front, and with the nasal bones, to form a depressed muzzle, which advances beyond the mouth, and under which the latter preserves its mobility. Ventrals small and a little jugular; pectorals moderate. The first dorsal short and elevated; the second dorsal and the anal are both very long, and unite in a point at the caudal; the jaws have only very fine and very short teeth.

1. Macrourus rupestris, BLOCH.

Body oblong, thick anteriorly, slender posteriorly. Head large. Eyes large and prominent. Scales silvery, hard, and armed on the head and forepart of the body with several longitudinal serrated ridges, on the posterior parts with only one ridge. Lateral line near the back.

D. 11, 112. P. 18. V. 8. A. 112. C. (?). FABRICIUS.

D. 1-11, 124. P. 19. V. 7. A. 148. C. 272. SCHNEIDER.

Greenland, FABRICIUS.

Called "Ingmingoak," by the Greenlanders.

Coryphæna rupestris, FABRICIUS, Fauna Groenlandica, p. 154.
Macrourus rupestris (SCHNEIDER), BLOCH, XXVI. p. 103.
" " Rock Grenadier, RICH., Fauna Boreal. Americ., III. p. 254.

FAMILY XXIV. PLANIDÆ.

Body flat, compressed vertically. Upper surface dusky, and of various colors ; beneath white. Dorsal single, extending the whole length of the back. Both eyes placed on the same side of the head. No air-bladder. Branchial rays six.

GENUS I. HIPPOGLOSSUS, Cuv.

Both eyes and the color on the right side, and the fins are similar to those of the species of the following genus ; the jaws and the pharynx are armed with teeth that are sharper and stronger, and the form of the body is more elongated.

1. Hippoglossus vulgaris, Cuv.

Body oblong, very large, smooth. Of a dark-brown color on the right side, left side white. Lateral line arched above the pectorals.

D. 99. P. 17. V. 6. A. 73. C. 18. Length, from 3 to 6 feet.

Greenland, FABRICIUS. Maine and Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

Pleuronectes Hippoglossus, LIN., Syst. Nat., p. 456.
" " Holybut, BLOCH, II. p. 44, pl. 47.
" " FABRICIUS, Fauna Groenlandica, p 161.
" " Holibut, SHAW's Gen. Zoöl., IV. p. 295.
" " " PENNANT's Brit. Zoöl., III. p. 302.
" " Halibut, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 386.
Hippoglossus vulgaris, Holibut, JENYNS's Brit. Vert., p. 460.
" " GRIFFITH's Cuv., X. p. 494.
" " Holibut, YARRELL's Brit. Fishes (1st edit.), II. p. 230 ; (2d edit.), II. p. 321.
" " Halibut, STORER's Report, p. 145.
" " " DEKAY's Report, p. 294, pl. 49, fig. 157.

GENUS II. PLATESSA, Cuv.

Body rhomboidal, depressed ; both eyes generally on the right side of the head, one above the other ; a row of teeth in each jaw, with others on the pharyngeal bones ; dorsal fin commencing over the upper eye, that fin and the anal extending nearly the whole length of the body; but neither of them joined to the tail; branchiostegous rays six.

Eyes on the Right Side of the Head.

1. Platessa plana, MITCHILL.

Form elliptical. The smaller and middling-sized specimens, when first taken from the water, are of a greenish-brown tinge, more or less spotted and blotched with rusty brown. The larger individuals are of a general rusty-brownish color, or a dark blackish-brown, or a dull slate-color, scarcely exhibiting any spots. White on left side. A spine at anus, nearly concealed. Lateral line makes a very slight curve only over the pectorals. The half of the jaw next to the colored portion, edentate. The fin rays vary somewhat.

D. 62. P. 9. V. 6. A. 46. C. 17. MITCHILL.

D. 65. P. 10. V. 6. A. 48. C. 17. STORER.

D. 61. P. 10. V. 6. A. 46. C. 17. "

D. 67. P. 10. V. 6. A. 46. C. 17$\frac{3}{2}$. DEKAY.

Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, DEKAY.

Pleuronectes planus, New York Flat-fish, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 387.
Platessa plana, Flounder of Massachusetts, STORER'S Report, p. 140.
" " New York Flat-fish, DEKAY'S Report, p. 295, pl. 48, fig. 154, and pl. 49, fig. 158.
" " AYRES, Bost. Journ. Nat. Hist., IV. p. 276.

2. Platessa dentata, MITCHILL.

Body elliptical. All the right side of the body and the fins of a uniform reddish-brown color. Mouth very large. The lower jaw has a blunt spine at the chin. Jaws furnished with a single row of prominent, sharp teeth, separated from each other.

D. 91. P. 11. V. 6. A. 70. C. 18. Length, 2 inches.

Massachusetts, STORER. New York, DEKAY, STORER.

Pleuronectes dentatus, Flounder of New York, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 390.
Platessa dentata, Flounder of New York, STORER'S Report, p. 143.
" " " " DEKAY'S Report, p. 298.

3. Platessa ferruginea, STORER.

Body elliptical. Of a reddish slate-color, with a tinge of green, covered with numerous large, irregularly-formed ferruginous spots. The left side a clear white, except the posterior portion in front of the caudal fin, the caudal fin, and the margin of the dorsal and anal, which are of a lemon-yellow. Mouth small, lips tumid. Lateral line curves over the pectorals. Teeth in the jaws very small.

D. 84. P. 10. V. 6. A. 65. C. 16. STORER. Length, 12 to 20 inches.

D. 81. P. 10. V. 6. A. 59. C. 14$\frac{3}{2}$. DEKAY.

Massachusetts, STORER. New York, DEKAY.

Platessa ferruginea, Rusty Dab, STORER's Report, p. 141.
" " Rusty Flat-fish, DEKAY's Report, p. 297.

4. Platessa pusilla, DEKAY.

Body more elongated than that of the P. plana. Nearly uniform olive-brown, with indistinct darker blotches towards the dorsal and anal fins. No anal spine. Jaws armed with minute conic teeth. Lateral line but very slightly curved over pectorals.

D. 67-69. P. 11. V. 6. A. 50. C. $15\frac{3}{3}$. Length, 5 inches.

New York, DEKAY.

Platessa pusilla, Pigmy Flat-fish, DEKAY's Report, p. 296, pl. 47, fig. 153.

5. Platessa glabra, STORER.

Body elliptical, perfectly smooth. Above grayish, mottled with dark brown. Dorsal, anal, and caudal fins, reddish yellow, with well marked, nearly black spots, more or less oval, differing in their size. A smooth ridge between the eyes. Lateral line scarcely deviates from the straight course over the pectorals. Teeth cylindrical, slightly conical at their points. Numerous blunt teeth upon the hyoid bone. The extremities of the ventrals do not reach the anal fin.

D. 54-62. P. 9. V. 6. A. 39-41. C. 16. Length, 8 inches.

Massachusetts, STORER.

Platessa glabra, STORER, Proceed. Bost. Soc. Nat. Hist., I. p. 131.

Eyes on the Left Side.

6. Platessa oblonga, MITCHILL.

Body oblong, smooth. Of a reddish-gray color, with more or less numerous circular, oval, or oblong blotches of a darker color, surrounded with a lighter margin, and also numerous white spots, which are distributed more copiously at the bases of and upon the fins. Right side white, without spots. A prominence at chin. Jaws with a single row of separated, quite large, sharp teeth; the front ones much the largest. The external and central rays of caudal longest; when unexpanded, the caudal appears roundish.

D. 73. P. 11. V. 6. A. 59. C. 17. MITCHILL.
D. 89. P. 12. V. 6. A. 68. C. 16. STORER. Length, 15 to 30 inches.
D. 89. P. 12. V. 6. A. 74. C. 16. "
D. 88. P. 12. V. 6. A. 66. C. 17. DEKAY.
D. 95. P. 12. V. 6. A. 72. C. $16\frac{2}{2}$. "

Massachusetts, STORER. New York, MITCHILL, DEKAY.

Pleuronectes oblongus, Spotted Flounder, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 391.
Rhombus aquosus, Watery Flounder, STORER, Bost. Journ. Nat. Hist., I. p. 351.
" " " " STORER's Report, p. 146.
Platessa oblonga, Oblong Flounder, DEKAY's Report, p. 299, pl. 48, fig. 156.
Platessa ocellaris, Long-toothed Flounder, DEKAY's Report, p. 300, pl. 47, fig. 152.

I cannot but believe the species described and figured in Dekay's Report as the P. oblonga and P. ocellaris are identical. The following are Dekay's characteristics of the P. oblonga: —"Oblong, smooth. Nearly uniform brown; occasionally with spots. Caudal fin angulated. Length, fifteen to twenty inches." While the P. ocellaris is thus described: —"Dorsal fin with more than ninety rays. Chin prominent. Teeth long. Upper surface with ocellated and other spots. Tail rounded. Length, twelve to eighteen inches."

A specimen lies before me, while writing this, with ocellated spots upon its surface, an angulated caudal fin, a prominence at the chin, and less than ninety dorsal rays.

The ocellated spots upon its surface and prominent chin would mark it as the P. ocellaris of Dekay; but that species, according to Dekay, has a "rounded tail," and a "dorsal with more than ninety rays."

The angulated caudal fin and number of dorsal rays (less than ninety) would point it out as the P. oblonga of Mitchill. But Dr. Dekay would lead us to infer that it is without *ocelli.* He says this species is "nearly uniform brown, occasionally with spots."

I have, during the last season (1844), seen a large number of this species in the market at the same time, and they presented the following characteristics. *Some had distinct ocelli distributed over the greater portion of the body, while in others they were so dim as scarcely to be seen. They all had the chin prominent.* It will be observed, by examining the descriptions of the P. oblonga and P. ocellaris, by Dekay, he says of the former, "lower jaw prominent"; this is shown in his figure, but omitted in his *characteristics!* Of the latter species, he remarks, "*chin prominent*"; this character does not appear in the figure. *They all have an angular tail when unexpanded*, which is more rounded when fully expanded. I have counted eighty-eight, eighty-nine, ninety, and ninety-one rays in the first dorsal fin.

I cannot, with these facts before me, consider the two species as distinct from each other.

7. Platessa stellata, PALLAS.

Profile of the body broadly elliptical, terminated by a strap-shaped tail and a caudal fin scolloped between the rays. The dorsal and anal fins of the same form, and terminate opposite; these two fins conjointly give a rhomboidal outline to the fish. Color of the upper side liver-brown, without spots; of the under side white, tinged with red towards the tail. Fins reddish, with broad, vertical black stripes. Both sides of the body studded with stellated, bony tubercles. Under jaw the longer.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 1 foot.

Arctic Sea, RICHARDSON.

Pleuronectes (Platessa) stellatus, Stellated Flounder, PALLAS, RICH., Fauna Boreal. Americ., III. p. 257.
Platessa stellata, DEKAY's Report, p. 301.

GENUS III. PLEURONECTES, DEKAY. (RHOMBUS, CUV.)

With the jaws and pharynx of Hippoglossus, they have some close or even teeth, or pectiniform; but their dorsal advances towards the edge of the upper jaw, and extends, as well as the anal, very nearly to the caudal. The majority have the eyes to the left.

1. Pleuronectes argus, BLOCH.

Oblong. Of a pale brown color, with scattered blue, half-ocellate spots. Tail lunate.

D. 85. P. 16. V. 6. A. 79. C. 17. Length, 10 inches.

Precise locality not mentioned by CATESBY.

Pleuronectes argus, BLOCH, 48.
" " LIN., Syst. Nat., GMEL., p. 1239.
Solea lunata et punctata, Sole, CATESBY'S Hist. Carol., II. p. 27.
Pleuronectes argus, Argus Flounder, SHAW'S Gen. Zoöl., IV. pp. 319, 320, fig. 45.
Pleuronectes argus et lunulatus, TURTON'S LINNÆUS, I. pp. 767, 768.
Rhombus argus, GRIFFITH'S CUV., X. p. 497.

2. Pleuronectes maculatus, MITCHILL.

Orbicular. Body and fins pellucid, with numerous black spots. The anterior rays of the dorsal with membranous slips. Chin with a slight protuberance.. Lateral line arched above the pectorals.

D. 68. P. 12. V. 6. A. 56. C. $15\frac{3}{2}$. Length, 12 to 18 inches.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

Pleuronectes maculatus, New York Plaice, MITCHILL, Report in part, p. 9.
Pleuronectes aquosus, Plaice of New York, MITCHILL, Trans. Lit. and Phil. Soc. of New York, I. p. 389, pl. 2, fig. 3.
Pleuronectes maculatus, Spotted Turbot, DEKAY'S Report, p. 301, pl. 47, fig. 151.

3. Pleuronectes glacialis, PALLAS.

Ovate. Color a mixture of yellowish-gray and dull greenish-gray, somewhat clouded, but without defined spots; belly bluish white; caudal fin irregularly spotted with red. Caudal cuneiform, entire. Scales small, rough on left side of the body. Lateral line straight.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Arctic Sea, RICHARDSON.

Pleuronectes (Rhombus) glacialis (PALLAS), Arctic Turbot, RICH., Fauna Boreal. Americ., III. p. 258.
Pleuronectes glacialis, DEKAY'S Report, p. 302.

GENUS IV. ACHIRUS, LACEPEDE.

Destitute of pectoral fins. Both eyes and color on the right side. Mouth distorted to the side opposite the eyes. Dorsal and anal extend to the tail, but are not united with it.

1. Achirus mollis, Mitchill.

Form oval. Dark brown, marked transversely with irregular black bands ; left side white, with circular dark-brown blotches scattered over its entire surface ; also, in a less marked manner, upon the fins. Scales small. A small, compressed spine, almost concealed, directly in front of the upper eye, just back of the commencement of the dorsal fin.

D. 52. V. 4. A. 40. C. 16. Length, 6 inches.

Massachusetts, north of Cape Cod, Storer. Nantucket to Carolina, Dekay.

Pleuronectes mollis, New York Sole, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 388, pl. 2, fig. 4.
Achirus mollis, Griffith's Cuv., x. p. 499.
" " New York Sole, Storer's Report, p. 149.
" " " " Dekay's Report, p. 303, pl. 49, fig. 159.

2. Achirus apoda, Mitchill.

Body nearly circular. With about twenty transverse black stripes and as many pale ones, and each pale one is divided by a narrow brown stripe, giving the upper side the appearance of variegated black, pale, and brown cross-bars. Beneath white ; many soft caruncles or papillæ beneath, on both sides of the mouth.

D. (?). V. (?). A. (?). C. (?). Length (exclusive of caudal fin), 4 inches.

Straits of Bahama, Mitchill.

Pleuronectes apoda, Apodal Sole, Mitchill, American Monthly Review, ii. p. 244.

Dr. Dekay, in his "Report on the Fishes of New York," considers this species, as described by Mitchill, a Monochirus. But as Mitchill distinctly remarks, "*there are no pectoral fins*," we must, until it is controverted by a recent specimen, consider it an Achirus.

GENUS V. PLAGUSIA, Cuv.

No pectoral fins. Dorsal, caudal, and anal fins united.

1. Plagusia fasciata, Holbrook.

Body elongated, terminating in a point, with seven broad, transverse dusky bands.

D. (?). V. (?). A. (?) C. (?) Length, (?).

South Carolina, Holbrook.

Plagusia fasciata (Holbrook's Illustrations), Dekay's Report, p. 304.

FAMILY XXV. CYCLOPTERIDÆ.

Ventrals suspended all around the pelvis, and united by a single membrane, forming an oval and concave disk, which the fish employs as a sucker to fix itself to the rocks. Mouth broad, furnished at the jaws and pharyngeals with small pointed teeth; opercula small. Branchial rays, six. Pectorals very ample, and almost uniting under the throat, as it were to embrace the disk of the ventrals.

GENUS I. LUMPUS, Cuv.

Two dorsal fins; the first dorsal fin so enveloped by a thick and tubercular skin, that, externally, it might be taken for a simple hump of the back; second dorsal with branched rays, opposite the anal. Body deep and rough, with conical horny tubercles.

1. Lumpus anglorum, Willoughby.

Body suborbicular. All the upper part of the body of a bluish slate-color; beneath yellowish. The disk of a bright yellow color. The young fish is blue above, and almost entirely white beneath. The whole surface of the body covered with an immense number of small stellated tubercles, studding even the fin rays. Three rows of tubercles project from each side, and another row projects from the dorsal ridge.

D. —, 11. P. 20. A. 10. C. 12. Length, 8 to 20 inches. Weight, 1 to 18 pounds.

Greenland, Fabricius. Maine, Massachusetts, Storer. New York, Mitchill, Dekay.

Called "Neepeesa," "Angusedlok" (male), "Arnardlok" (female), by Greenlanders.

Cyclopterus lumpus, Lin., Syst. Nat., i. p. 414.
" " Lump, Bloch, iii. p. 92, pl. 90.
Lumpus anglorum, Will., p. 208, No. 11.
Cyclopterus lumpus, Lump-Sucker, Pennant's Brit. Zoöl., iii. p. 176, pl. 24.
" " " " Shaw's Gen. Zoöl., v. p. 388, pl. 166.
" " Common Lump-fish, Jenyns's Brit. Vert., p. 471.
" " Lump, Rich., Fauna Boreal. Americ., iii. p. 260.
" " Fabricius, Fauna Groenlandica, p. 131.
" " Lump-Sucker, Yarrell's Brit. Fishes (2d edit.), ii. p. 365, fig.
Cyclopterus cœruleus, Blue Lump-fish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 480, pl. 2, fig. 7.
Lumpus vulgaris, Cuv., Règne Animal, ii.
" " Lump-Sucker, Storer's Report, p. 151.
Lumpus anglorum, Lump-Sucker, Dekay's Report, p. 305.

2. Lumpus minutus, Pallas.

Body compressed, naked. Two white, unequal bony tubercles on each side. Snout marked, above the mouth, by three tubercles. Tail even. Color whitish.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 1 inch.

Greenland, Fabricius.

Called "Nepeesardlooarksook," by the Greenlanders.

Cyclopterus minutus, Lin., Gmel.
" " (Pallas), Fabricius, Fauna Groenlandica, p. 135.
" " Ross, Appendix, p. xlvi.
" " Small Sucker, Shaw's Gen. Zoöl., v. p. 396.
" " Diminutive Lump, Rich., Fauna Boreal. Americ., iii. p. 262.

3. Lumpus spinosus, Fab.

Tubercles of the skin not arranged in rows, as in the L. anglorum; their bases are rough, and they rise into a longish spine in the centre, the largest being upon the upper parts, while the belly is smooth. The first dorsal neither so high nor so thick as in the L. anglorum, and its edge not armed with tubercles, but its soft rays sufficiently evident. The hue of the fish is blackish, the belly whitish, and the first twelve rays of the pectorals quite white.

D. 6, 11. P. 23. V. 6. A. 10. C. 10. Length, (?).

Greenland, Fabricius.

Called "Nepeesardlook," by the Greenlanders.

Cyclopterus spinosus, Fabricius, Fauna Groenlandica, p. 134.
" " Spiny Lump, Rich., Fauna Boreal. Americ., iii. p. 263.

4. Lumpus ventricosus, Pallas.

Body naked; skin covered with livid mucus; abdomen ventricose; head thick, blunt, flattish above; eyes lateral, on the upper part of the head; dorsal fin whitish yellow, with black rays, of which the sixth is longer than the rest; pectoral fins wide; tail suddenly attenuated beyond the vent; disk orbicular.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 1 foot.

Seas between America and Kamtschatka, Pallas.

Cyclopterus ventricosus (Pallas), Lin., Gmel.
" " Ventricose Sucker, Shaw's Gen. Zoöl., v. p. 394.
" " Bellying Lump, Rich., Fauna Boreal. Americ., iii. p. 263.

GENUS II. LIPARIS, Artedi.

Body smooth, elongated, and compressed behind. A single dorsal, laterally long, as well as the anal.

1. Liparis communis, Artedi.

Body compressed, lengthened, soft, unctuous, subtransparent. Brownish above, with darker stripes; beneath white, with a cast of yellow on the head and sides. Head large, thick, and rounded; fins brown; eyes small; tail short and rounded. Disk bluish, marked with twelve radial spots.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, from 5 to 16 or 18 inches.

Northern Seas, Richardson.

Called "Abapokeetsok," by the Greenlanders; "Sea-Snail," by the Yorkshire fishermen.

Cyclopterus liparis, Artedi.
" " Lin., Syst. Nat., i. p. 414.
" " Fabricius, Fauna Groenlandica, p. 135.
" " Snail-Sucker, Shaw's Gen. Zoöl., v. p. 394.
" " Bloch, iv. pl. 123, figs. 3, 4.

Cyclopterus liparis, Ross, Append. Parry's Polar Voyage, p. 199.
" " Unctuous Sucker, Pennant's Brit. Zoöl., III. p. 179, pl. 24.
" " Common Sea-Snail, Jenyns's Brit. Vert., p. 472.
Liparis communis, Sabine, Append. Parry's First Voyage, p. ccxii.
" " Ross, Append., p. xlvii.
Cyclopterus (Liparis) communis (Artedi), Rich., Fauna Boreal. Americ., III. p. 263.

2. Liparis gelatinosus, Pallas.

Body slender, oblong, compressed, thicker towards the head, gradually tapering to the tail. Color whitish, with a rosy tinge. Skin smooth; flesh very soft, trembling like jelly when touched. Dorsal and anal fins dark violet; pectoral fins flaccid and rounded.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 18 inches.

Seas between America and Kamtschatka, Pallas.

Cyclopterus gelatinosus (Pallas), Lin., Gmel.
" " Gelatinous Sucker, Shaw's Gen. Zoöl., v. p. 393.

FAMILY XXVI. ECHENEIDÆ.

With a flattened disk upon the top of the head, composed of numerous cartilaginous transverse plates, directed obliquely backwards, dentated or spinous at their posterior edge, and movable, by means of which they are enabled to attach themselves to other substances.

GENUS I. ECHENEIS, Lin.

Body elongated, covered with very small scales. A single dorsal fin, placed opposite the anal. Head very flat, covered with a disk; mouth wide, with numerous small, recurved teeth on both jaws, tongue, and vomer.

1. Echeneis albicauda, Mitchill.

Body cylindrical, elongated. Above of a grayish slate-color; lighter upon the sides, with a dark band, which, commencing at the tip of the lower jaw, as a small black point, runs along its margin to the angle of the jaw, then, assuming a band, passes to the tail, interrupted only by the eyes. All the fins margined with white. Disk upon head, with twenty-one transverse plates, divided by a fleshy median line.

D. 29. P. 18. V. 5. A. 30. C. 18. Storer. Length, 12 to 20 inches.

D. 33. P. 18. V. 7. A. 30. C. 18. Dekay.

Massachusetts, Storer. New York, Mitchill, Dekay.

Echeneis albicauda, White-tailed Remora, Mitchill, Amer. Month. Mag., II. p. 244.
Echeneis naucrates, Indian Remora, Storer's Report, p. 153.
Echeneis albicauda, White-tailed Remora, Dekay's Report, p. 307, pl. 54, fig. 177.
" " " " Storer, Bost. Journ. Nat. Hist., IV. p. 183.

2. Echeneis naucrates, Lin.

Olive-brown, without stripes. A whitish longitudinal cloud on each side, near the belly. Disk elliptical, inclining to oval, with twenty-two to twenty-four plates.

D. 34. P. 19. V. 5. A. 34. C. 21. Length, 31 inches.

Newfoundland, Audubon. New York, Mitchill.

Echeneis naucrates, Lin., Syst. Nat., p. 446.
" " Bloch, v. p. 106, pl. 171.
" " Indian Remora, Shaw's Gen. Zoöl., iv. p. 209, pl. 31.
" " Big Oceanic-Sucker, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 377.
" " Ship-master Echeneis, Rich., Fauna Boreal. Americ., iii. p. 266.
" " Indian Remora, Dekay's Report, p. 308.

3. Echeneis remora, Lin.

Body elongated. Dusky brown above; lighter beneath. Fins darker than the rest of the body. Disk with seventeen or eighteen plates. Caudal crescent-shaped.

D. 21. P. 22. V. 4. A. 20. C. 20. Length, 12 to 18 inches.

New York, Mitchill.

Echeneis remora, Lin., Syst. Nat., i. p. 446.
" " Sucking-fish, Bloch, v. p. 109, pl. 172.
" " Mediterranean Remora, Shaw's Gen. Zoöl., iv. p. 201, pl. 31.
" " " " Pennant's Brit. Zoöl., iii. Append., p. 524.
" " Small Oceanic-Sucker, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 378.
" " Common Remora, Jenyns's Brit. Vert., p. 473.
" " " " Yarrell's Brit. Fishes (2d edit.), ii. p. 377, fig.
" " " " Dekay's Report, p. 309.

4. Echeneis quatuordecemlaminatus, Storer.

Of a light reddish-brown color, rather darker beneath. Disk with fourteen plates. Caudal not emarginated.

D. 32. P. 14. V. 4. A. 30. C. 18. Length, 5½ inches.

Massachusetts, Storer.

Echeneis quatuordecemlaminatus, Fourteen-plated Remora, Storer's Report, p. 155.
" " (Storer), an juv.? Dekay's Report, p. 309.

APODES.

No ventral fins.

FAMILY XXVII. ANGUILLIDÆ.

Body very much elongated and cylindrical, for the most part of a serpentine figure. Scales scarcely apparent, being imbedded in a soft and thick skin. Air-bladder of various singular forms. No cœcal appendages.

GENUS I. ANGUILLA, Cuv.

The dorsal commencing considerably behind the pectorals, and uniting with the anal to form the caudal. Lower jaw the longer. Mouth with a row of teeth in each jaw, and a few on the anterior part of the vomer.

1. Anguilla Bostoniensis, Lesueur.

Body cylindrical, compressed posteriorly. Head equal to about one tenth the length of the body. Lower jaw slightly projecting. Pectorals short and subovate. Greenish or olive-brown above; yellowish or yellowish white beneath, frequently having a reddish tinge along the margin of the anal fin; in the smaller specimens, the opercula, throat, and abdomen, anterior to the vent, are of a bluish slate-color, with scarcely a tint of yellow.

D. (?). P. (?). A. (?). C. (?). Length, 24 inches.

Massachusetts, Lesueur, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Anguilla vulgaris, Common Eel, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 360.
" " Fresh-water Eel, Mitchill, Amer. Month. Mag., II. p. 241.
Muræna Bostoniensis, Lesueur, Journ. Acad. Nat. Sc., I. p. 81.
" " Common Eel of Massachusetts, Storer's Report, p. 158.
Anguilla tenuirostris, Common New York Eel, Dekay's Report, p. 310, pl. 53, fig. 173.
Anguilla Bostoniensis (Lesueur), Dekay's Report, p. 313.
" " " Ayres, Bost. Journ. Nat. Hist., IV. p. 279.

2. Anguilla argentea, Lesueur.

Body much compressed. Pectorals very near the head. General color a silvery gray; darker upon its upper portion, with a clear satiny-white abdomen. Lateral line exceedingly distinct, appearing to divide equally the darker-colored back from the beautiful lighter abdomen.

D. (?). P. (?). A. (?). C. (?). Length, 12 to 24 inches.

Massachusetts, Lesueur, Storer. Connecticut, Linsley.

Muræna argentea, Lesueur, Journ. Acad. Nat. Sc., I. p. 82.
" " " Silver Eel, Storer's Report, p. 158.
Anguilla argentea, Dekay's Report, p. 313.

3. Anguilla rostrata, Lesueur.

Body tumid in the centre, and narrowed to a point at both extremities. Snout elongated, pointed, and straight. Upper parts varied with gray and olive, sometimes of a slate-blue, lower parts white; dorsal and anal fins reddish, which color deepens as it approaches the tail; pectoral fins small, acute, and bluish.

D. (?). P. (?). A. (?). C. (?). Length, from 18 to 24 inches.

Lakes Cayuga and Geneva, Lesueur.

Muræna rostrata, Lesueur, Journ. Acad. Nat. Sc., I. p. 81.
" " Beaked Eel, Rich., Fauna Boreal. Americ., III. p. 267.
Anguilla rostrata, Beaked Eel, Dekay's Report, p. 312.

4. Anguilla serpentina, Lesueur.

Anterior part of body larger than the posterior. Pectorals very large. Head large, snout short. Color a dark copper-brown, which is lighter on the sides and belly; the fins of the color of the body, though paler; the dorsal fin arises nearer the pectorals than that of the A. argentea.

D. (?). P. (?). A. (?). C. (?). Length, (?).

Rhode Island, Lesueur.

Muræna serpentina, Snake-Eel, Lesueur, Journ. Acad. Nat. Sc., i. p. 81.

5. Anguilla macrocephala, Lesueur.

Head very large and elevated. Snout short. Eyes large and prominent. Olivaceous-yellow above; from the angle of the mouth a golden band extends beyond the pectoral fins; beneath pure white.

D. (?). P. (?). A. (?). C. (?). Length, (?).

Saratoga Lake, New York, Lesueur.

Muræna macrocephala, Bull-head Eel, Lesueur, Journ. Acad. Nat. Sc., i. p. 82.
Anguilla macrocephala, Bull-head Eel, Dekay's Report, p. 313.

6. Anguilla oceanica, Mitchill.

Jaws equal. Tail pointed. Above brown; on the sides pale; belly smutty. A dark or somewhat bluish border on the vertical fins.

D. (?). P. (?). A. (?). C. (?). Length, 4 feet.

New York, Mitchill.

Anguilla oceanica, Sea-Eel, Mitchill, Journ. Acad. Nat. Sc., i. p. 407.
" " " " Dekay's Report, p. 312.

As intimated by Dekay, in his Report, this will probably prove to be, upon further investigation, a species of Conger.

7. Anguilla lutea, Raf.

Head flattened above, abruptly elevated behind the eyes, ventricose beneath the throat. Lower jaw projecting. Tail carinate at its extremity. Yellowish-brown on its sides and back, and whitish on the belly; the two colors meeting abruptly on the sides of the abdomen.

D. (?). P. (?). A. (?). C. (?). Length, 2 to 3 feet.

Ohio, Kirtland.

Anguilla lutea, Yellow Eel, Raf., Ichth. Ohien., p. 78.
" " " " Kirtland, Bost. Journ. Nat. Hist., iv. p. 234, pl. 11, fig. 2.
Anguilla laticauda (?), Broad-tailed Eel, Raf., Ichth. Ohien., p. 77.

GENUS II. CONGER, Cuv.

The dorsal fin commencing close to the pectorals or on them, and in some species even before the pectorals, or at least at their base. The upper jaw is longest in all the known species.

1. Conger occidentalis, Dekay.

Dark olive-brown ; chin, space behind the pectorals, and all beneath, soiled white. Dorsal and anal of a deep black hue along their margins. Dorsal arising two inches behind the base of the pectorals. Jaws with a single series of contiguous, equal teeth. Lateral line distinct, with a series of white dots.

P. 17. D., C., and A. 539. Length, 3 to 5 feet.

New York, Mitchill, Dekay.

Anguilla conger, Conger Eel, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 360.
Conger occidentalis, American Conger, Dekay's Report, p. 314, pl. 53, fig. 172.

GENUS III. MURÆNA, Thunb.

Have no vestige of pectorals ; their branchiæ open on each side by a small hole ; their opercula are so thin, and their branchiostegal rays so slender and concealed under the skin, that their existence has been denied. The stomach is a short sac, and the natatory bladder small, oval, and placed near the upper part of the abdomen.

1. Muræna moringa, Cuv.

Black or green, sprinkled over its whole surface with innumerable black dots.

D. (?). A. (?). C. (?). Length, 4 feet.

Bahama Islands, Catesby.

Muræna maculata nigra et viridis, Muray, Catesby's Hist. Carol., II. p. 20.
Muræna maculata nigra, Black Muray, Catesby's Hist. Carol., II. p. 21.
Muræna moringa, Griffith's Cuv., X. p. 527.

GENUS IV. OPHIDIUM, Cuv.

Head smooth. Body elongated, compressed ; teeth in both jaws, the palate, and pharynx. Dorsal, caudal, and anal united. Gill-apertures rather large. Two pairs of small barbels adhering to the point of the hyoid bone.

1. Ophidium marginatum, Dekay.

Body elongated, much compressed, tapering to an acute point. Gray, with three dusky stripes along the body. Dorsal, caudal, and posterior portion of anal, edged with black on their margins. Pectorals yellow.

D. 120. P. 22. A. 75. C. 17. Length, 9 inches.

New York, MITCHILL, DEKAY.

Called "Little Cusk," by the fishermen.

Ophidium barbatum, Cirrhous Ophidium, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 362, pl. 1, fig. 2.
Ophidium marginatum, New York Ophidium, DEKAY's Report, p. 315, pl. 52, fig. 169.

2. Ophidium stigma, BENNETT.

Dilute brown, spotted, and with a purplish spot near the beginning of the dorsal fin. Snout obtuse, chin with a large gibbosity, teeth small.

D. (?). P. (?). A. (?). C. (?). Length, 5 inches.

Behring's Straits, BENNETT.

Ophidium stigma, Branded Ophidium (BENNETT, Append. Beechey's Voyage), RICH., Fauna Boreal. Americ., III. p. 273.

GENUS V. FIERASFER, CUV.

No barbels. Dorsal so thin as to resemble a simple fold of the skin. Their natatory bladder is supported by only two osselets ; that of the middle is wanting.

1. Fierasfer borealis (?), DEKAY.

Body oblong, nearly round ; the color of the body is nearly that of the human skin, with scattered blotches of a pale rust-color. Dorsal of a uniform color; caudal fin rounded, and marked with numerous black dots.

D. 76. P. 14. A. 49. C. 22. Length, 19 inches.

New Hampshire, PECK.

Ophidium (imberbe) maxillis imberbibus, cauda rotundata, pinna dorsi unicolore, PECK, Mem. Amer. Acad., II., part ii., p. 46, pl. 2, fig. 1.
Fierasfer borealis (?), DEKAY's Report, p. 316.

With much doubt, I follow Dekay in locating this species in the genus Fierasfer.

2. Fierasfer Parrii, Ross.

Greenish brown above. Pectoral fins large, with thirty-seven rays, and extending beyond the vent. Neck much arched.

D. (?). P. (?). A. (?). C. (?). Length, 4 to 8 inches.

Northern Seas, Ross.

Ophidium Parrii, CAPT. J. C. Ross, Append. Parry's Third Voyage, p. 109, and Polar Voyage, p. 199.
" " Append. Ross's Second Voyage, p. xlvii.
" " Parry's Ophidium, RICH., Fauna Boreal. Americ., III. p. 274.
Fierasfer Parrii, DEKAY's Report, p 316.

GENUS VI. SACCOPHARYNX, Mitchill.

The trunk, susceptible of being inflated like a thick tube, is terminated by a very slender and very long tail, along which proceed a very low dorsal and anal, and unite at its point. The mouth, armed with sharp teeth, opens far behind the eyes, which are quite near the very sharp point of the muzzle. Its gills open by a hole below the pectorals, which are very small.

1. Saccopharynx chordatus, Mitchill.

Skin smooth and scaleless. Of a dusky brown color; a whitish line on each side of the back; interior of mouth black. Lower jaw without teeth; upper jaw, for about an inch and a half, furnished with a row of bony, hooked teeth. Head small; eyes small. Dorsal fin appearing like a narrow riband, and reaching to the tail; dorsal, caudal, and anal united. Filiform excrescences on each side of the whitish stripe all the way from the head down the back to the tail. Tail flexible enough to be tied into knots.

D. (?). P. (?). A. (?). C. (?). Length, 6 feet.

Lat. 52° N, Long. 30° W., Mitchill.

Saccopharynx chordatus, Mitchill, Annals of Lyc. Nat. Hist. of N. York, I. p. 82.
Ophiognathus ampullaceus, Harwood, Phil. Trans., an. 1827, p. 49, pl. 7.
Saccopharynx flagellum, Griffith's Cuv., x. p. 531.

GENUS VII. AMMODYTES, Lin.

Head and body elongated; gill-openings large; dorsal fin extending nearly the whole length of the back; anal fin of considerable length; dorsal and anal fins separated from the caudal fin. Lower jaw longest. Their stomach is pointed and fleshy; they have neither cœca nor natatory bladder.

1. Ammodytes Americanus, Dekay.

Body elongated, slightly compressed. Back of a dirty yellowish-brown color. Top of the head, and upper part of the opercula, slate-colored; this slate or silvery-blue color passes down over the opercula in a broad band to the tail, giving the fish a beautifully brilliant appearance; beneath this, the sides and abdomen are silvery. The dorsal fin commences over the extremities of the pectorals. The anal fin is just one third the entire length of the fish. Without the strong forked teeth on the vomer, which exist in the Tobianus.

D. 61. P. 13. A. 28. C. 14. Length, 6 to 12 inches.

Massachusetts, Storer. Connecticut, Ayres, Linsley. New York, Mitchill, Dekay.

Ammodytes tobianus, Sand-Launce, BLOCH, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 363.
" " Sand-Eel, STORER's Report, p. 159.
Ammodytes Americanus, American Sand-Launce, DEKAY's Report, p. 317, pl. 52, fig. 167.
Ammodytes lancea, AYRES, Bost. Journ. Nat. Hist., IV. p. 280.
Ammodytes tobianus, Little Sand-Eel, LINSLEY's Cat. of Fishes of Connecticut.
Ammodytes lancea, Banded Sand-Launce, " " "

Specimens of this Ammodytes, which in my Report I considered the A. tobianus, were sent to Mr. Yarrell, who writes me, — "I feel quite satisfied that it is distinct from both the *tobianus* and *lancea.*" Never having seen the foreign species, I cheerfully prefix Dr. Dekay's specific name, after this careful comparison by the distinguished British ichthyologist.

2. Ammodytes vittatus, DEKAY.

Body oblong, subcompressed, slender. Greenish olive above, with a broad silvery band along the sides, which is margined above with blackish; belly white. Seven projecting spinous processes before the dorsal fin.

D. 7, 54. P. 15. A. 28. C. $19\frac{3}{8}$. Length, 4 to 6 inches.

New York, DEKAY.

Ammodytes vittatus, Banded Sand-Launce, DEKAY's Report, p. 318, pl. 60, fig. 197.

LOPHOBRANCHII.

Gills, instead of being, as usual, pectiniform, are divided into little round tufts, dispersed in pairs along the branchial arches.

FAMILY XXVIII. SYNGNATHIDÆ.

Body mailed with transverse angular plates. Opercle large; branchial opening very small, and formed by a membrane which only exhibits vestiges of rays. Dorsal single. No cœca; with an air-bladder.

GENUS I. SYNGNATHUS, LIN.

Body elongated, slender, covered with a series of indurated plates, arranged in parallel lines; head long; both jaws produced, united, tubular; no ventral fins. Males with a pouch for the reception of the female roe.

1. Syngnathus Peckianus, STORER.

Olive-brown, with darker-colored blotches or bars. The posterior portion of the body is darker than the anterior. Beneath, anterior to the vent, of a beautiful golden-yellow; portion back of vent nearly white. Body, anterior to vent, heptangular; in front of posterior extremity of the dorsal fin, hexangular; posteriorly quadrangular. Nineteen transverse plates in front of anus; forty plates between the anus and the caudal fin.

D. 45. P. 14. A. 3. C. 12. Length, 6 to 12 inches.

Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Syngnathus typhle, Smaller Pipe-fish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 475.
Syngnathus Peckianus, Peck's Pipe-fish, Storer's Report, p. 163.
Syngnathus fuscus, Brown Pipe-fish, Storer's Report, p. 162.
Syngnathus fasciatus, Banded Pipe-fish, Dekay's Report, p. 319, pl. 54, fig. 174.
Syngnathus viridescens, Green Pipe-fish, Dekay's Report, p. 321, pl. 54, fig. 176.
Syngnathus fuscus (Storer), Dekay's Report, p. 321.
Syngnathus Peckianus (Storer), Dekay's Report, p. 321.
" " " Ayres, Bost. Journ. Nat. Hist., iv. p. 282.

GENUS II. HIPPOCAMPUS, Cuv.

The jaws united and tubular, like those of the Syngnathi ; mouth placed at the end ; body compressed, short and deep ; the whole length of the body and tail divided by longitudinal and transverse ridges, with tubercular points at the angles of intersection ; pectoral and dorsal fins ; no ventral nor caudal fins ; the females only have an anal.

1. Hippocampus Hudsonius, Dekay.

Yellowish brown. Body heptangular, composed of twelve segments, banded by horny spines ; tail tapering to a point made up of thirty-six segments. Tubular jaws more than half the length of the head. A spine at the base of the snout, anterior to the eyes. A bony protuberance on top of head, terminating in five points.

D. 18 to 20. P. 14 or 15. A. 3. Length, 3 to 6 inches.

Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Syngnathus hippocampus, Sea-Horse Pipe-fish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 475
Hippocampus brevirostris, Short-nosed Sea-Horse, Storer's Report, p. 167.
Hippocampus Hudsonius, Hudson River Sea-Horse, Dekay's Report, p. 322, pl. 53, fig. 171.
Hippocampus brevirostris, Linsley's Cat. of Fishes of Connecticut.

PLECTOGNATHI.

The maxillary bone soldered or fixedly attached on the side of the intermaxillary, which alone forms the jaw, and to which the palatine arch is dovetailed by a suture within the cranium, and consequently has no power of motion. Opercula and the rays are concealed under a thick skin, which only permits a small branchial cleft to be visible externally.

FAMILY XXIX. GYMNODONTIDÆ.

Instead of apparent teeth, the jaws are furnished with an ivory substance, divided internally into laminæ, the general appearance of which somewhat resembles the bill of a parrot, and which is essentially composed of true teeth united together, and succeeding one another in proportion as there are any worn out by trituration. Opercula small; their rays five in number.

GENUS I. DIODON, Lin.

Jaws undivided, presenting but one piece above and below. Behind the trenchant edge of each is a round part, furrowed crosswise, which forms a powerful instrument of mastication. No ventral fins. Skin armed with slender prickles or stout spines.

1. Diodon maculato-striatus, Mitchill.

Body subcubical. Greenish, with numerous meandering, olive-brown stripes, and a few dark-colored, large blotches, margined with green. The whole surface, except the chin and tail, covered with sharp, recurved, triangular, compressed spines, each with a trifid base. Tail even.

D. 13. P. 24. A. 12. C. 9. Length, 5 to 7 inches.

Connecticut, Linsley, Ayres. New York, Mitchill, Dekay.

Diodon maculato-striatus, Spot-striped Diodon, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 470, pl. 6, fig. 3.
Diodon rivulatus, Cuv., Mémoires du Muséum d'Hist. Nat., iv. p. 129, pl. 6.
Diodon maculato-striatus, Spot-striped Balloon-fish, Dekay's Report, p. 323, pl. 56, fig. 185.
" " (Mitchill), Ayres, Bost. Journ. Nat. Hist., iv. p. 284.
" " Linsley's Cat. of Fishes of Connecticut.
Diodon fuliginosus, Unspotted Balloon-fish, Dekay's Report, p. 324, pl. 55, fig. 181 (young).

2. Diodon pilosus, Mitchill.

Body oblong, cuboidal. Brownish above; ashy-white beneath; on the back and along the sides, several oblong, distant, blackish-brown spots. Every part of the body except a small space round the mouth and eyes, and another including the base of the caudal fin, furnished with soft, flexible bristles, of a metallic golden color. Caudal lanceolate.

D. 12. P. 20. A. 14. C. 9. Length, 2 to 4 inches.

New York, Mitchill, Dekay.

Diodon pilosus, Hairy Diodon, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 471, pl. 6, fig. 4.
Diodon asper, Cuv., Mémoires du Muséum d'Hist. Nat., iv. p. 138.
Diodon pilosus, Griffith's Cuv., x. p. 567.
" " Hairy Balloon-fish, Dekay's Report, p. 326, pl. 55, fig. 180.

3. Diodon verrucosus, Mitchill.

Body cuboidal, oblong, small. Cinereous-brown above; yellowish white beneath. With rounded areolæ, from which arise soft, flexible spines. Caudal long, emarginate.

D. 11. P. 22. A. 10. C. 10. Length, 1 to 4 inches.

New York, MITCHILL.

Diodon verrucosus, Warty Balloon-fish (MITCHILL), DEKAY'S Report, p. 325, pl. 56, fig. 184.

GENUS II. TETRAODON, LIN.

Jaws divided in the middle by a suture, presenting the appearance of four teeth in front, two above and two below. The skin over a portion or its whole extent covered with prickles.

1. Tetraodon lagocephalus, LIN.

Body orbicular. Yellowish brown above; whitish, with a silvery cast, beneath. Several short black or dark-brown bars of different sizes upon the back; many round blackish spots upon the sides; sides and abdomen beset with numerous short, radiated spines. Transverse brown bands upon the dorsal, anal, and caudal fins.

D. 10. P. 18. A. 8. C. 10. Length, 12 inches.

Virginia, CATESBY.

Tetraodon lagocephalus, LIN., Syst. Nat., TURTON'S Translat., I. p. 890.
" " Starry Globe-fish, BLOCH, IV. p. 127, pl. 140.
" " Hare Tetraodon, SHAW'S Gen. Zoöl., V. p. 441, pl. 177.
Orbis lævis variegatus, Globe-fish, CATESBY'S Hist. Carol., II. p. 28, pl. 28.
Tetraodon geometricus, GRIFFITH'S CUV., X. p. 568.

2. Tetraodon lævigatus, LIN.

Body elongated, cylindrical, tumid in front, gradually tapering behind. Abdomen pendulous. Olive-green above. Belly only furnished with sharp prickles. The upper part of the body with series of mucous pores, forming numerous lines.

D. 14. P. 17. A. 12, 13. C. 11, 13. Length, 1 to 2 feet.

Massachusetts, STORER. New York, MITCHILL, DEKAY. South Carolina, LIN. Gulf of Mexico, PARRA.

Tetraodon lævigatus, LIN., Syst. Nat., p. 411.
" " SHAW'S Gen. Zool., V. p. 446.
Tamboril, PARRA, p. 37, pl. 19.
Tetraodon lævigatus, Brown Globe-fish, MITCHILL, Report on the Fishes of New York, p. 28.
Tetraodon mathematicus, Mathematical Tetraodon, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 474, pl. 6, fig. 6.
Tetraodon mathematicus, Mathematical Tetraodon, STORER'S Supplement to Report, Bost. Journ. Nat. Hist., IV. p. 183.
Tetraodon lævigatus, Lineated Puffer, DEKAY'S Report, p. 329, pl. 56, fig. 182.

3. Tetraodon turgidus, MITCHILL.

Body oblong, cylindrical; when inflated, nearly globular. Olive-green above, beneath white. Several undefined black blotches on the back, which, as they approach the belly, assume the appearance of bars, six to eight of which are noticeable. The whole surface of the body, save the space between the dorsal and caudal fins, and the anal and caudal fins, roughened by innumerable small spines. Caudal rounded.

D. 6. P. 15. A. 6, 7, 8. C. 7. Length, 6 to 14 inches.

Massachusetts, STORER. Connecticut, LINSLEY, AYRES. New York, MITCHILL, DEKAY.

Tetraodon turgidus, Puffer, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 473, pl. 6, fig. 5.
" " Swell-fish, Puffer, STORER'S Report, p. 169.
" " Common Puffer, DEKAY'S Report, p. 327, pl. 55, fig. 178.
" " AYRES, Bost. Journ. Nat. Hist., IV. p. 285.

4. Tetraodon curvus, MITCHILL.

Back considerably arched and smooth. Dark brown above, variegated with faint bars across; beneath dull yellow, and roughened by short, sharp spines, disposed in quincunx. A smooth brass-colored stripe or riband on the side from the head to the tail. General complexion brassy. Tail tapering.

D. 13. P. 16. A. 13. C. 15. Length, 2½ inches.

New York, MITCHILL.

Tetraodon curvus, Curved Tetraodon, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 472.
" " Curved Puffer (MITCHILL), DEKAY'S Report, p. 328.

GENUS III. ACANTHOSOMA, DEKAY.

Body globular, armed with spines, and susceptible of inflation. Dorsal, caudal, and anal united. Teeth as in Diodon.

1. Acanthosoma carinatum, MITCHILL.

Body vertically oval, small. Olive-brown above; silvery on the sides and beneath. Spines pointed, distant, and striated on their sides, with a dilated, rounded base. Eyes large, nostrils small, slightly before the eyes.

D. (?). P. (?). A. (?). C. (?). Length, (?).

New York, MITCHILL, DEKAY.

Diodon carinatus, MITCHILL, Ann. Lyc. of Nat. Hist. of New York, II. p. 264, pl. 5, fig. 1.
Acanthosoma carinatum, Small Globe-fish, DEKAY'S Report, p. 330, pl. 55, fig. 179.

GENUS IV. ORTHAGORISCUS, SCHN.

Jaws undivided, forming a cutting edge. Body compressed, without spines, not susceptible of inflation, and whose tail is so short, and so high, vertically, that they have the appearance of fishes from which the posterior part has been cut away. Dorsal and anal, each high and pointed, are united to the caudal. No natatory bladder ; stomach small, and immediately receiving the biliary canal.

1. Orthagoriscus mola, Lin.

Form oblong, elliptical, compressed, subtruncated behind. Depth two thirds of its length. Back dark gray ; sides of a dusky white ; abdomen nearly white ; a broad black band at base of tail, running from origin of dorsal to origin of anal. Cuticle granulated, covered with a thick adhesive mucus. Dorsal and anal not united to caudal fin. Caudal formed of several digitations, varying in their height. Eyes moderate, convex ; snout prominent.

D. 13. P. 12 or 13. A. 13 to 15. C. 9. Weight, 200 to 400 pounds.

Massachusetts, Storer. New York, Mitchill, Dekay.

Tetraodon mola, Lin., Syst. Nat., p. 412.
" " Short Tetraodon, Pennant's Brit. Zoöl., III. p. 172, pl. 22.
Diodon mola, Bloch, pl. 128.
Cephalus brevis, Short Sun-fish, Shaw's Gen. Zoöl., V. p. 437, pl. 175.
" " Mitchill, Trans. Lit. and Phil. Soc. of N. Y., I. p. 471.
Orthagoriscus mola, Short Sun-fish (Schneider), Jenyns's Brit. Vert., p. 490.
" " Griffith's Cuv., X. p. 569.
" " Short Sun-fish, Yarrell's Brit. Fishes (2d edit.), II. p. 462 and fig.
" " " " Storer's Report, p. 170, pl. 3, fig. 1.
" " Short Head-fish, Dekay's Report, p. 331, pl. 59, fig. 193.

FAMILY XXX. BALISTIDÆ.

Body compressed. Snout prolonged from the eyes. Mouth small, with a few distinct teeth in each jaw. Skin roughened with prickles or scales. Dorsals, two ; the anterior sometimes represented by a single spine. Ventrals often wanting or indistinct. Pelvic bone prominent.

GENUS I. BALISTES, Cuv.

Entire body covered with large scales, very hard and rhomboidal, not imbricated. The first dorsal with three prickles or spines, the first of which is much the largest, the third very small, and separated, further back. The extremity of their pelvis is always salient and prickly, and behind it are some spines engaged in the skin, which, in the long species, have been considered as rays of the ventrals.

1. Balistes fuliginosus, Dekay.

Body oblong, elliptical. Dusky brown, unspotted. Caudal fin doubly emarginated ; a single spine between the first and second dorsals ; first dorsal spine is roughened with asperities upon its anterior edge, and broadly channelled behind.

D. 2, 1, 28. P. 14. V. 7. A. 26. C. 12. Length, 12 inches.

New York, DEKAY.

Balistes fuliginosus, Dusky Balistes, DEKAY's Report, p. 339, pl. 57, fig. 188.

GENUS II. MONACANTHUS, CUV.

Body covered with very small scales, bristling with stiff excrescences, and extremely crowded. The extremity of their pelvis projecting and spiny, as in the Balistes, but they have only one large dentated spine to their first dorsal, or at least the second is almost imperceptible.

1. Monacanthus aurantiacus, MITCHILL.

Oval. Of an orange-yellow, except the chin, lips, and belly, which are bluish-white. Dorsal and anal tinged with dusky. Tail doubly emarginate. Abdomen tumid. Lower jaw largest, with eight thin, flattened teeth, of which those in front are long and large, with emarginated edges; upper jaw with smaller flat and lanceolate teeth. A rounded prominence anterior to second dorsal fin; anal extends further back than dorsal fin.

D. 1, 36. P. 12. V. 0. A. 39. C. 12. Length, 1 to 2 feet.

Maine, Massachusetts, STORER. Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

Balistes aurantiacus, Orange File-fish, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 468, pl. 6, fig. 1.
Monacanthus aurantiacus (?), Orange File-fish (MITCHILL), DEKAY's Report, p. 333, pl. 57, fig. 186.
" " STORER, Proceed. Bost. Soc. Nat. Hist., II. p. 72.

2. Monacanthus broccus, MITCHILL.

Body subovate. Uniform brown. Covered with asperities. Dorsal fin with an equal, convex margin. Mouth prominent, projecting; six to eight sharp incisorial teeth in both jaws. Anal not as high as the dorsal; caudal long and rounded.

D. 1, 32. P. 13. V. 0. A. 32. C. 13. Length, 8 inches.

Connecticut, LINSLEY. New York, MITCHILL, DEKAY.

Balistes broccus, Tut-mouthed File-fish, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 467.
Monacanthus broccus, Long-finned File-fish, DEKAY's Report, p. 335, pl. 56, fig. 183.

3. Monacanthus Massachusettensis, STORER.

Body elliptical, much compressed. Yellowish brown, variegated over its entire extent with brownish markings and blotches, which are less obvious beneath. Anal and dorsal yellowish green; caudal light olive-green; pectorals light reddish. Faint, abbreviated, dark oblong streaks along the sides. Surface rough, with numerous minute cilia suspended from its sides. Dorsal emarginated posteriorly; ventral fold roughened by sharp stellated spines.

D. 1, 34. P. 12 to 15. V. (?). A. 30 to 34. C. 13. Length, 3 to 4 inches.

Massachusetts, STORER. Connecticut, LINSLEY. New York, DEKAY.

Monacanthus Massachusettensis, Massachusetts File-fish, STORER's Report, p. 174.
" " " " DEKAY's Report, p. 336, pl. 57, fig. 187.

4. Monacanthus signifer, STORER.

Body elongated. Of a reddish-brown color, with greenish reflections. The second dorsal ray very much elongated. The whole surface minutely granulated, with the exception of the fleshy portion of the tail and a very small space anterior to it, which are studded with stiff setæ looking and feeling like the teeth of a card; the points of these setæ incline forwards.

D. 1, 32. P. 13 to 16. A. 32 or 33. C. 10 or 13. Length, 5 to 7 inches.

Massachusetts, STORER. New York, DEKAY.

Monacanthus setifer, DEKAY's Report, p. 337, pl. 59, fig. 194.

I supposed, previous to the appearance of Dr. Dekay's Report, this species to be Mitchill's M. broccus, and thus I called it in the "Proceedings of the Boston Society of Natural History," p. 84 (Sept. 1842). Dr. Dekay's specific name has been previously applied to another species of the genus by Bennett (Proceed. Zoöl. Soc. of London, Pt. I., p. 112, 1830).

GENUS III. ALUTERES, CUV.

An elongated body, covered with small and scarcely visible granules; a single spine in the first dorsal; the chief character is in the pelvis, which is completely hidden under the skin, and is without that spinous projection observed in the other Balistes.

1. Aluteres monoceros, LIN.

Elongated. Olive-brown, with many irregularly distributed bluish lines, between which are sprinkled numerous black dots.

D. 1, 46. P. 14. A. 50. C. 12. Length, 3 feet.

Bahama Islands, CATESBY.

Unicornis piscis Bahamensis, Bahama Unicorn-fish, CATESBY's Hist. Carol., II. p. 19.
Balistes monoceros, TURTON's LINNÆUS, I. p. 898.
" " Unicorn File-fish, SHAW's Gen. Zoöl., V. p. 399, pl. 168.
Aluteres monoceros, GRIFFITH's CUV., X. p. 575.

2. Aluteres cuspicauda, MITCHILL.

Elongated; yellowish brown, mottled by a darker brown. Tail lancet-shaped, nearly half the length of the body.

D. 1, 38. P. 13. A. 42. C. 12. Length, 8 inches.

Massachusetts, STORER. New York, MITCHILL, DEKAY.

Balistes cuspicauda, Sharp-tailed File-fish, MITCHILL, Amer. Month. Mag., II. p. 326.
Aluteres monoceros, Unicorn File-fish (SHAW), STORER's Report, p. 175.
Aluteres cuspicauda, Long-tailed Unicorn-fish, DEKAY's Report, p. 338, pl. 59, fig. 192.

3. Aluteres angusticauda, Mitchill.

Shades of brown over entire surface. Gibbous before the eyes; belly prominent and flabby; snout projecting; mouth small. Tail isthmus-shaped, narrow immediately behind the anal and dorsal fins, and wider towards the origin of the caudal fin.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Balistes angusticauda, Narrow-tailed File-fish, Mitchill, Amer. Month. Mag., II. p. 327.
Aluteres angusticauda, Narrow-tailed File-fish, Dekay's Report, p. 339.

FAMILY XXXI. OSTRACIONIDÆ.

Body triangular or four-sided, enveloped in a hard, bony case, composed of numerous plates, soldered together in such a manner that only the mouth and fins are movable. No ventral fins; a single dorsal.

GENUS I. LACTOPHRYS, Dekay.

Body triangular; with strong spines directed backwards before the anal fin. Orbits usually spinous.*

1. Lactophrys sex-cornutus, Mitchill.

With six spines; two in front of the eyes, two on the sides of the abdomen, and two at the extremity of their bony corselet, one above and one below the tail. Skin somewhat clouded or streaked lengthwise. Beneath white.

D. (?). P. (?). A. (?). C. (?). Length, 7 inches.

Gulf of Mexico, Mitchill.

Ostracion sex-cornutus, Six-horned Trunk-fish, Mitchill, Amer. Month. Mag., II. p. 328.
Lactophrys sex-cornutus, Six-horned Trunk-fish, Dekay's Report, p. 343.

2. Lactophrys Yalei, Storer.

Back convex; no spines upon the orbits; two abdominal spines. Of a uniform light, lurid color above; back of dorsal fin darker-colored; body beneath much lighter.

D. 10. P. 12. A. 10. C. 10. Length, 14 inches.

Massachusetts, Storer.

Ostracion Yalei, Storer, Bost. Journ. Nat. Hist., I. p. 353, pl. 8.
" " Yale's Trunk-fish, Storer's Report, p. 176.
Lactophrys Yalei, Yale's Trunk-fish, Dekay's Report, p. 342.

* Although I have not seen the necessity of this genus, I am not disposed to reject it on that account only.

3. Lactophrys camelinus, DEKAY.

Back elevated into a spine. Eight spines along the sides, over the orbits and tail. Ashen-gray, with irregular black blotches on the dorsal hump and the sides. Abdomen soiled yellowish-white.

D. 9. P. 10. A. 10. C. 6. Length, 3½ inches.

New York, DEKAY.

Lactophrys camelinus, Dromedary Trunk-fish, DEKAY's Report, p. 341, pl. 58, fig. 190.

CLASS II. CARTILAGINOUS FISHES.

Skeleton cartilaginous. Cranium divided by indistinct sutures. Gills generally fixed ; the membrane without rays. Maxillary and intermaxillary bones either wanting or rudimentary, the palatines or vomer alone supplying their place.

ORDER I. ELEUTHEROPOMI.

Gills pectinated, free, as in ordinary fishes, with one large external aperture on each side, furnished with a strong opercle ; without rays. Upper jaw formed by the palatine bone, firmly united to the maxillary ; intermaxillary rudimentary.

FAMILY XXXII. STURIONIDÆ.

The genera of this family approach to ordinary fishes, by their gills being attached only at one extremity. They have but one branchial aperture, which is very open ; they have but one operculum, and are without rays to the membrane of the gills.

GENUS I. ACIPENSER, LIN.

Body elongated and angular, defended by indurated plates and spines, arranged in longitudinal rows ; snout pointed, conical ; mouth placed on the under side of the head, tubular, and without teeth.

1. Acipenser oxyrinchus, MITCHILL.

Body pentagonal. Of a grayish-brown color above ; inferior portion of sides silvery ; beneath white. Snout elongated, rounded at tip, covered with bony shields. Dorsal series of plates, ten to twelve; lateral series, twenty-eight; abdominal series, eight plates.

D. 38. P. 28. V. 24. A. 23. C. 125. Length, 3 to 7 feet.

Massachusetts, STORER. Connecticut, AYRES, LINSLEY. New York, MITCHILL, DEKAY.

Acipenser oxyrinchus, Sharp-nosed Sturgeon, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 462.
" " LESUEUR, Trans. Amer. Phil. Soc. (New Series), I. p. 391.
" " Sharp-nosed Sturgeon, STORER'S Report, p. 173.
" " " " DEKAY'S Report, p. 346, pl. 58, fig. 189.
" " AYRES, Fishes of Brookhaven, L. I., Bost. Journ. Nat. Hist., IV. p. 287.
" " Sharp-nosed Sturgeon, LINSLEY'S Fishes of Conn., Amer. Journ. Sc., XLVII., No. 1.

2. Acipenser rubicundus, LESUEUR.

Body convex at origin of dorsal plates. Forehead broad and flat between the eyes. Head and body olive-brown above, white beneath. Fins reddish. Younger specimens maculated on the body and sides. Dorsal plates, from nine to fifteen; lateral plates, thirty-five to thirty-nine; abdominal plates, nine.

D. 40 to 42. P. 50. V. 28. A. 22. C. (?). Length, 4 feet.

Lakes Ontario, Erie, Huron, Michigan, LESUEUR. Lake Erie, Ohio River, KIRTLAND.

Acipenser rubicundus, LESUEUR, Trans. Amer. Phil. Soc. (New Series), I. p. 388, pl. 12.
Acipenser maculosus, LESUEUR, Trans. Amer. Phil. Soc. (New Series), I. p. 393.
Acipenser Ohiensis, RAF., Ichth. Ohien., p. 81.
Acipenser scrotinus, RAF., Ichth. Ohien., p. 80.
Acipenser macrostomus, RAF., Ichth. Ohien., p. 81.
Acipenser rubicundus, Ruddy Sturgeon, RICH., Fauna Boreal. Americ., III. p. 284.
" " KIRTLAND'S Report, p. 196.
Acipenser maculosus, KIRTLAND'S Report, p. 196.
Acipenser Ohiensis, KIRTLAND'S Report, p. 196.
Acipenser nudus, KIRTLAND'S Manuscript.
Acipenser rubicundus, Lake Sturgeon, DEKAY'S Report, p. 344, pl. 58, fig. 191.
Acipenser maculosus, Lake Sturgeon, DEKAY'S Report, p. 347.
" " " " KIRTLAND, Bost. Journ. Nat. Hist., IV. p. 303, pl. 14, fig. 1.

3. Acipenser brevirostris, LESUEUR.

Head large and convex. Snout short and blunt. Dusky above, with faint traces of oblique bands; beneath white. Dorsal series of tubercles, nine to twelve; lateral series, twenty-three to twenty-nine.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 2 to 5 feet.

New York, MITCHILL, DEKAY.

Acipenser sturio, Round-nosed Sturgeon, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 461.
Acipenser brevirostrum, LESUEUR, Trans. Amer. Phil. Soc. (New Series), I. p. 390.
Acipenser brevirostris, Short-nosed Sturgeon, DEKAY'S Report, p. 345.

4. Acipenser transmontanus, RICH.

Top of the head slightly convex, both longitudinally and transversely, with a shallow depression extending from between the orbits backwards on the mesial line; the profile shelves off suddenly before the nostrils into the greatly depressed snout, which, when seen from above, is semilanceolate; its breadth at the nostrils being equal to its length anterior to these openings; in profile, the snout appears thin and horizontal, but its flexible point is readily turned up a little. Body and top of head of a hue intermediate between yellowish and bluish, partially iridescent; shields ash-gray, giving a spotted appearance to the back. Sides silver-white, with faint vertical bluish-gray bands; belly white. Dorsal row of plates, fifteen. Lateral plates, forty-two to forty-seven.

D. 52. P. 43. V. 34. A. 33. C. 27-86. Length, 11 feet. Weight, 600 pounds.

Columbia River, RICHARDSON.

Acipenser transmontanus, Columbia River Sturgeon, RICH., Fauna Boreal. Americ., III. p. 278, pl. 97.
" " DEKAY's Report, p. 347.

5. Acipenser Rupertianus, RICH.

Snout slender, but not acute; its sides are flattened and have a vertical height equal to half the transverse breadth. Dorsal plates, fourteen in number; lateral shields, thirty-five in number; abdominal shields, nine or ten, smooth, and indented rather than spined at tip.

D. 40. P. 40. V. 30. A. 25. C. 28-84. Length, 26 inches.

Northern Regions, RICHARDSON.

Acipenser Rupertianus, Rupert Land-Sturgeon, RICH., Fauna Boreal. Americ., III. p. 311.
" " DEKAY's Report, p. 347.

6. Acipenser platorynchus, RAF.

Head one fifth its total length; slightly convex above, entirely flat beneath. Head and body above brownish, beneath pure white. Dorsal plates, fifteen; lateral plates, forty; abdominal plates, eleven.

D. 25. P. 45. V. 20. A. 14. C. 18-60=78. Length, 1 to 2 feet.

Ohio River, KIRTLAND.

Acipenser platorynchus, Shovel-fish Sturgeon, Spade-fish, Shovel-head, Flat-head, RAF., Ichth. Ohien., p. 80.
" " Shovel-nose Sturgeon, KIRTLAND's Report, p. 196.
" " " " KIRTLAND, Bost. Journ. Nat. Hist., v. p. 25, pl. 8, fig. 1.

GENUS II. POLYODON, LACEP.

Snout enormously prolonged, with a dilated middle, resembling a leaf. Their general form, and the position of the gills, similar to those of the Sturgeon; but their gills are still more open, and their operculum is prolonged into a membranous point, which is extended as far as the middle of the body. Their mouth is very much cleft, and furnished with many small teeth. The upper jaw is formed by the union of the two palatines to the maxillaries.

1. Polyodon folium, LACEP.

Body subcylindric, flattened laterally. Head gibbous at its union with the body. The head, including the operculum and snout, is longer than one half the total length of the fish, and the snout exceeds the united length of the head and operculum. Above, of a beautiful steel-blue; throat and abdomen white, and the gill-covers maculated by stellate impressions. Caudal fin bilobed; the lower lobe shorter, broader, and less oblique than the upper, which is serrated on its superior edge.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 1 to 5 feet.

Ohio River and its tributaries, Hildreth, Clemens, Kirtland.

Polyodon feuille (Lacepède), Griffith's Cuv., x. p. 591.
Spatularia reticulata, Reticulated Spatularia, Shaw's Gen. Zoöl., v. p. 362, pl. 156.
Polyodon folium, Western Spade-fish, Raf., Ichth. Ohien., p. 82.
" " Wilson, Encyclop. Brit., Art. Ichth. (7th edit), p. 230.
" " Spoon-bill Sturgeon, Paddle-fish, Mitchill, Hildreth, Clemens, Silliman's Journal, xii. p. 201, plate.
" " " " Kirtland, Bost. Journ. Nat. Hist., iv. p. 21, pl. 2, fig. 1.

GENUS III. PLATIROSTRA, Lesueur.

Jaws, tongue, and throat destitute of teeth. Snout flattened, elongated, and spatuliform. Fins and body closely resembling those of the Sturgeon, but without plates. The tail only is covered on each side by small bony plates, as in that genus.

1. Platirostra edentula, Lesueur.

Snout not so long as one third of the body, dilated and rounded at the end. The skin supporting the gill-covers expanding and attenuating to a point posteriorly almost to the end of the pectoral fin. Tail large, notched with pointed lobes. Livid brown above, with small blackish spots upon the head; beneath white, with a few spots.

D. 58. P. 26. V. 40 to 50. A. 56. C. 15. Length, 4 to 5 feet.

Ohio River, Lesueur, Kirtland. Mississippi River, Kirtland.

Platirostra edentula, Lesueur, Journ. Acad. Nat. Sc., i. p. 223.
" " " Say's Append. Long's Expedition.
" " " Kirtland's Report, p. 197.
" " " Dekay's Report, p. 347.
" " Toothless Spoon-bill, Kirtland, Bost. Journ. Nat. Hist., v. p. 22, pl. 7, fig. 2.

ORDER II. PLAGIOSTOMI.

Gills fixed by their external edges, with five small external openings on each side. No opercle. Jaws represented by the palatine and postmandibulary bones, which alone are armed with teeth. Pectorals and ventrals always present; the latter (in the male) furnished on their internal margins with long appendages.

FAMILY XXXIII. SQUALIDÆ.

Body elongated, cylindrical. Tail thick and muscular. Eyes lateral. Branchial openings on each side, never underneath.

GENUS I. CARCHARIAS, Cuv.

One anal and two dorsal fins, the first dorsal placed over the space between the pectoral and abdominal fins. Jaws and head depressed. Teeth flat, pointed, and cutting ; serrated in the upper jaw, sometimes in both jaws. No temporal orifices in adults, but rudiments may be observed in the fœtus of some of the species.

1. Carcharias ceruleus, Mitchill.

Small, body cylindrical. Teeth in several series, small, triangular, serrated. Pectorals broad ; anal deeply notched. Slate-blue above ; beneath whitish.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 2 to 6 feet.

New York, Mitchill, Dekay.

Carcharias ceruleus, Small Blue Shark, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 487.
" " " " " Dekay's Report, p. 349, pl. 61, fig. 200.

2. Carcharias obscurus, Lesueur.

Head flat and broad. Snout rounded. A single row of triangular, serrate teeth in the upper jaw ; two rows of similarly formed, but smaller, teeth in the lower jaw. Pectorals long, narrow, and falciform ; ventrals subquadrangular, with no pointed process behind. Dark brown above, rather lighter than the Lamna punctata ; beneath of a dirty white.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 9 to 10 feet.

Massachusetts, Storer.

Carcharias obscurus, Dusky Shark, Lesueur, Journ. Acad. Nat. Sc., i. p. 223, pl. 9.
" " " " Storer's Report, p. 184.
" " " " Storer, Bost. Journ. Nat. Hist., i. pp. 533, 558.
" " " " Dekay's Report, p. 350, pl. 61, fig. 201.

3. Carcharias littoralis, Mitchill.

Body short, thick, wider towards abdomen. Fins large, not prolonged backwards. The second dorsal before the anal. Snout acute. Reddish ash-gray above, white beneath.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 3 to 8 feet.

New York, Mitchill, Lesueur, Dekay.

Squalus littoralis, Ground Shark, Mitchill, Amer. Month. Mag., ii. p. 328.
" " Ash-colored Shark, Lesueur, Journ. Acad. Nat. Sc., i. p. 224.
Carcharias littoralis, Ground Shark, Dekay's Report, p. 351.

4. Carcharias griseus, Ayres.

Above of a light bluish-gray color, sides lighter, beneath white. Back convex in front of the first dorsal fin. Numerous long, pointed teeth in jaws, in some instances with a small projection on each side near the base; edges of teeth smooth. Pectorals large; second dorsal arises just posterior to the origin of the anal fin.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 3 to 7 feet.

Brookhaven, Long Island, Ayres.

Carcharias griseus, Ayres, Bost. Journ. Nat. Hist., iv. p. 293, pl. 12, fig. 4.

GENUS II. LAMNA, Cuv.

Muzzle pyramidal, under the base of which are the nostrils. Branchial apertures all in front of the pectorals.

1. Lamna punctata, Mitchill.

Body cylindrical, fusiform. Above greenish, becoming of a slate-color after death; lighter upon the sides; white beneath. Snout blunt. Each jaw is furnished with three rows of small, sharp, triangular teeth, smooth at their edges; the first two rows are straight; the back row recurved; the three teeth on each side of the middle of the lower jaw the largest. Anal fin opposite to the second dorsal. Caudal keeled on its sides; the upper lobe of the caudal considerably larger than the lower lobe. Head and sides of body punctured by series of mucous pores.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 3 to 10 feet.

Massachusetts, Storer. New York, Mitchill, Dekay.

Squalus punctatus, Green-backed Shark, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 483.
Lamna punctata, Mackerel Shark, Storer's Report, p. 185, pl. 3, fig. 2.
" " " " Storer, Bost. Journ. Nat. Hist., ii. 534.
" " Mackerel Porbeagle, Dekay's Report, p. 352, pl. 63, figs. 206, 207.

2. Lamna terræ-novæ, Rich.

Body more elongated and cylindrical than in the L. punctata. Upper caudal lobe much elongated, and furnished with an accessory lobe at the tip. Teeth triangular, serrated. No caudal carina. Snout pointed, thin, and broad. Uniform dusky brown above, tinged with bluish; white beneath.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 7 feet.

Newfoundland, Richardson. Rhode Island, Dekay.

Squalus (Carcharias) terræ-novæ, Newfoundland Shark, Rich., Fauna Boreal. Americ., iii. p. 289.
Lamna caudata, Long-tailed Porbeagle, Dekay's Report, p. 354, pl. 62, fig. 205.

GENUS III. ALOPIAS, Bonap.

Head, dorsal and anal fins, and spiracles, as in the genus Lamna; upper lobe of the tail very long, with a depression at the base. Teeth triangular, flat, with smooth cutting edges in both jaws, curving outwards on each side from the centre. Branchial openings small, the last over the pectoral fins.

1. Alopias vulpes, Gmel.

Body fusiform. The upper lobe of the tail nearly as long as the body. Teeth triangular, pointed, smooth upon their edges. A dark bluish lead-color above; beneath white, with light bluish blotches upon the outer edges of the abdomen.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 12 to 15 feet.

Massachusetts, Storer. New York, Mitchill, Dekay.

Squalus vulpes, Gmel., Lin., Syst. Nat., i. pt. 3, p. 1496.
Long-tailed Shark, Pennant's Brit. Zoöl., iii. p. 110, pl. 14.
Squalus vulpes, Fox-Shark, Shaw's Gen. Zoöl., v. p. 333.
Thresher, Mitchill, Medical Repository, viii. p. 77.
Squalus vulpes, Thresher or Long-tailed Shark, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 482.
Carcharias vulpes, Fox-Shark or Thresher, Griffith's Cuv., x. p. 599.
Squalus vulpes, Sea-Fox or Thresher, Jenyns's Brit. Vert., p. 498.
Carcharias vulpes, Fox-Shark or Thresher, Storer's Report, p. 182.
Alopias vulpes, Sea-Fox, Thresher, Sea-Ape, Yarrell's Brit. Fishes (2d edit.), ii. p. 523, fig.
Carcharias vulpes, Thresher or Fox-Shark, Linsley's Cat. Fishes of Connecticut.
" " Thresher Shark, Dekay's Report, p. 348, pl. 61, fig. 199.

GENUS IV. MUSTELUS, Cuv.

Teeth blunt, forming a closely compacted pavement in each jaw; with temporal orifices. First dorsal in advance of the ventrals. Lower lobe of the caudal short. No spines.

1. Mustelus canis, Mitchill.

Body cylindrical, tapering, elongated. Back and sides of a uniform slate-color; abdomen a dusky white. Body rough, when the finger is passed towards the head. Head flat between the eyes.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 2 to 4 feet.

Massachusetts, Storer. New York, Mitchill, Dekay.

Called "Dog-fish Shark," by the fishermen of Massachusetts Bay.

Squalus canis, Dog-fish, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. 486, pl. 64, fig. 209.
Mustelus canis, American Hound-fish, Dekay's Report, p. 355, pl. 64, fig. 209.

GENUS V. SELACHUS, Cuv.

Two dorsal fins, the first placed but little behind the line of the pectorals, the second over the interval between the ventral and anal fins. The skin rough. Snout short and blunt. Temporal orifices very small. Teeth very small, numerous, conical, edges smooth, no lateral denticles. Branchial openings large, nearly encircling the neck.

1. Selachus maximus, LIN.

Body cylindrical, fusiform. Above of a dark slate-color, lighter beneath. Snout blunt. Eyes very small. Jaws furnished with a great number of small, conical, recurved teeth. In a specimen I examined a few years since, fourteen hundred teeth were counted in the lower jaw. A carina on each side of tail.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 30 feet.

Greenland, FABRICIUS. Massachusetts, STORER. New York, MITCHILL, DEKAY. New Jersey, LESUEUR.

Squalus maximus, LIN., Syst. Nat., I. p. 400.
" " Basking Shark, PENNANT'S Brit. Zoöl., III. p. 134, pl. 16.
" " " " SHAW'S Gen. Zoöl., V. p. 327, pl. 149.
" " FABRICIUS, Fauna Groenlandica, p. 130.
" " Basking Shark, JENYNS'S Brit. Vert., p. 503, sp. 193.
Squalus peregrinus, BLAINVILLE, Ann. du Mus., XVIII. pl. 6, fig. 1.
Squalus maximus, Basking Shark, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 486.
Squalus elephas, LESUEUR, Journ. Acad. Nat. Sc., II. p. 343, pl.
Squalus (Selache) maximus (CUV.), Basking Shark, RICH., Fauna Boreal. Americ., III. p. 291.
Selachus maximus, Basking Shark, Sun-fish, Sail-fish, YARRELL'S Brit. Fishes (2d edit.), II. p. 518, fig.
" " " " GRIFFITH'S CUV., X. p. 603.
Squalus elephas (LESUEUR), STORER'S Report, p. 407.
Selachus maximus, Basking Shark, DEKAY'S Report, p. 357, pl. 63, fig. 208.

GENUS VI. ACANTHIAS, RISSO.

Two dorsal fins, with a spine before each; first dorsal behind the line of the pectorals; the second dorsal over the space between the ventral and caudal fins; no anal fin. Skin rough in one direction; the scales heart-shaped, with a central spine directed backwards. Temporal spiracles large. Several rows of teeth in both jaws, cutting and sharp, the points directed outwards and backwards.

1. Acanthias Americanus, STORER.

All the upper part of the body is of a slate color, which is deeper upon the head and lighter below the lateral line; beneath white. A row of circular white spots are situated just under the anterior portion of the lateral line, and a few similar spots are irregularly distributed upon the back. The first dorsal fin commences posterior to the anterior third of the body; the second dorsal is nearer to the first dorsal fin than it is to the extremity of the tail. Upper lobe of the caudal broad, and as long again as the lower portion.

D. (?). P. (?). V. (?). C. (?). Length, 1 to 3 feet.

Northerly, beyond the coast of Labrador, DEKAY. Massachusetts, STORER. Connecticut, AYRES. New York, DEKAY.

Spinax acanthias, Picked Dog-fish, STORER's Report, p. 187.
" " (?), Spinous Dog-fish, DEKAY's Report, p. 359, pl. 64, fig. 187.
" " Dog-fish, AYRES, Bost. Journ. Nat. Hist., IV. p. 289.

GENUS VII. SCYMNUS, Cuv.

All the fins small; two dorsal fins, the first but little before, and the second but little behind, the line of the ventrals; no anal fin. Skin rough. Temporal orifices or spiracles large, placed rather high up on the head, above as well as behind the eyes. Teeth in the lower jaw crooked at the point, equilateral at the base; in the upper jaw, lancet-shaped, but little curved; the points in both jaws diverging from the centre. Gill-openings small.

1. Scymnus brevipinna, LESUEUR.

Body elongated, very narrow at base of tail. Lateral line black, undulating at the head, and marked in its whole length with small transverse lines. Tail wide, emarginate.

D. (?). P. (?). V. (?). C. (?). Length, 6 feet 5 inches.

Massachusetts, LESUEUR.

Somniosus brevipinna, Nurse or Sleeper, LESUEUR, Journ. Acad. Nat. Sc., I. p. 222, pl.
" " " " STORER's Report, p. 189.
Scymnus brevipinna, Nurse, DEKAY's Report, p. 361, pl. 61, fig. 202.

Lesueur does not refer to the *teeth*, in his account of this species, and hence it is impossible to fix with certainty its *generic locality*. His general description, however, leads us to suppose that it is probably a Scymnus, and we therefore follow the opinion of Dekay, and place it in that genus, in preference to leaving it in Lesueur's "illy-constructed genus Somniosus," as is well remarked by Dekay.

GENUS VIII. ZYGÆNA, Cuv.

Head depressed, more or less truncated in front; the sides extend horizontally to a considerable length, with the eyes at the external lateral extremity. Teeth of the same shape in the upper and lower jaw, namely, the points directed towards the corner of the mouth, with a smooth edge when young, but distinctly serrated in adult specimens. Branchial openings, five. Two dorsal fins; the first in a line close behind the pectorals; the second over the anal fin.

1. Zygæna malleus, VAL.

Body cylindrical, elongated. Head one third as long as broad. Grayish brown above, whitish beneath. Second dorsal arises slightly in front of the anal fin. Branchial openings all before the base of the pectorals.

D (?). P. (?). V. (?). A. (?). C. (?). Length, 2 to 12 feet.

Massachusetts, STORER. New York, MITCHILL, DEKAY. Caribbean Sea, BANCROFT. "From Nantucket to Brazil," DEKAY.

Squalus zygæna, LIN., Syst. Nat., I. p. 399.
" " Hammer-headed Shark, SHAW's Gen. Zoöl., v. p. 351, pl. 151.
" " " " MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 482.
Zygæna malleus, Hammer-head, VAL., Mémoires du Muséum d'Hist. Nat., IX. p. 422, pl. 11, fig. 1.
" " " JENYNS's Brit. Vert., p. 507, sp. 196.
" " " YARRELL's Brit. Fishes (2d edit.), II. p. 504, fig.
" " " STORER, Supplement to Report, Bost. Journ. Nat. Hist., IV. p. 185.
" " " DEKAY's Report, p. 362, pl. 62, fig. 204.

GENUS IX. SQUATINA, DUMERIL.

Body very much depressed ; head flat, rounded anteriorly ; both eyes on the upper surface ; temporal orifices large, behind the eyes ; mouth at the end of the snout ; pectoral fins large, attached anteriorly to the head, the posterior edge free ; two dorsal fins, both behind the ventrals ; no anal fin.

1. Squatina Dumerili, LESUEUR.

Head bordered on each side by a white membrane ; head and fins a bluish ash-gray, with reddish tints upon the head and margin of the fins ; abdomen, throat, and pectoral and anal fins, marked by large red spots ; nostrils with a broad, ciliated skin on each side, as in the Barbel. Teeth lanceolate, rather gibbous in front ; there are six or seven distinct rows, having each five teeth.

D. (?). P. (?). V. (?). C. (?). Length, 3 to 4 feet.

Dekay supposes Lesueur's specimen was from Florida, and thinks it is found on the coast of New York.

Squatina Dumeril, LESUEUR, Journ. Acad. Nat. Sc., I. p. 225, pl. 10.
Squatina Dumerili, American Angel-fish, DEKAY's Report, p. 363, pl. 62, fig. 203.

GENUS X. PRISTIS, LATHAM.

They unite to the elongated form of the Squali, in general, a body flat in front, and gills pierced beneath, as in the rays. But their proper character consists in a very long, depressed muzzle, in the form of the blade of a sword ; armed on each side with strong osseous spines, pointed and trenchant, and implanted like teeth. The true teeth in the jaws are small and rounded, as in Mustelus.

1. Pristis antiquorum, Lath.

Dusky above; pale gray beneath. Elongated beak, with twenty-four teeth on each side. Skin fine shagreen.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 12 to 15 feet.

New York, Schoepff.

Squalus pristis, Lin., Syst. Nat.
" " Pennant's Arct. Zoöl., Supplement, p. 105.
" " Fabricius, Fauna Groenlandica, p. 130.
" " Saw-snouted Shark, Shaw's Gen. Zoöl., v. p. 357.
Pez de Espada (?), Parra, p. 75, pl. 33.
Pristis antiquorum, Saw-fish, Griffith's Cuv., x. p. 408.
" " Common Saw-fish, Dekay's Report, p. 365.

Besides the Squalidæ above referred to, Mitchill, in his paper on the "Fishes of New York," very concisely speaks of a species which he calls "Squalus Americanus, — short, with oblong, sharp teeth, each of which has a little one each side at its base." He remarks, that "both jaws have five rows of teeth in front, nearly an inch long, and not jagged at the sides." Subsequently, he considered it a new species, and in his Supplement, published, in 1818, in the "American Monthly Magazine," p. 328, has called it Squalus macrodus, or Long-toothed Shark. What this species is must be determined by further research. In a supplement to my "Report on the Fishes of Massachusetts," published in the "Boston Journal of Natural History," Vol. IV., p. 188, I spoke as follows of a fragment of a Shark's jaw, which either belonged to this or an undescribed species. "The portion of the jaw before me is six inches in length, and two inches wide at its tip. From the tip of the jaw to the posterior angle on each side are situated seven teeth; the two on each side of the chin are longer, narrower, and straighter than those exterior to them. Dr. Prescott observed, in his letter to me, that when taken 'it exhibited three, and in some places four, rows of long, narrow teeth.' Now that the soft parts are removed, the two teeth next the chin are seen continued back into the mouth seven rows deep; in the first row, the two exterior teeth are shorter than the third within them; this third tooth, with the two still within it, are about the same size; the outer tooth of the second row is of the same height as the third of the first row, and in this row they pass backwards, decreasing as in the first row. The teeth of the other five rows differ very much from those spoken of, in their form; they are shorter, wider, and less stout, curving towards the angle of the jaw; those of the sixth and seventh rows being shorter than those of the previous three rows."

FAMILY XXXIV. RAIIDÆ.

Body very much flattened out, resembling a disk. Pectorals very large, uniting in front with the snout, and extending backwards to near the base of the ventrals. Tail more or less long and slender. Mouth, nostrils, and branchial openings beneath. Eyes and temporal orifices above. Dorsals (when present) almost always on the tail.

GENUS I. RAIA, Lin.

Disk rhomboidal. Tail slender; with two small dorsals near the tip, and sometimes the vestige of a caudal fin. Teeth slender, close set, arranged in quincunx.

1. Raia diaphanes, Mitchill.

Body rhomboidal. Of a light brown color, thickly sprinkled, over its entire surface, with more or less circular black spots or blotches. Sides, anterior to pectorals, concave. Snout slightly projecting. The space between the anterior orbitar ridges and the snout is diaphanous. In the male, two rows of prominent sharp spines, pointed inwards, about a dozen in each row, towards the outer portion of the pectorals. Two rows of spines on each side of the tail above; between the two central rows a naked groove.

Length, 2 to 3 feet.

Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Raia diaphanes, Clear-nosed Ray, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 478.
" " " " Dekay's Report, p. 366, pl. 77, fig. 218.
" " " " Linsley's Cat. of Fishes of Connecticut.

2. Raia ocellata, Mitchill.

Body rhomboidal, depressed, with the anterior margin of the pectorals slightly sinuous; the posterior margin undulated, rounded behind, and much attenuated at its junction with the body. Patches of spines on the nose, over the eyes, and near the centre of the pectorals. A series of minute spines upon the dorsum, and on each side of the tail. Snout prominent. Chocolate-brown above, with numerous ocellated dusky or black spots, which are sometimes confluent, surrounded by lighter margins; beneath dusky white, with light brown in the centre, and faint pink on the edges.

Length, 2 to 3 feet.

Connecticut, Linsley. New York, Mitchill, Dekay.

Raia ocellata, Ocellated Ray, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 477.
" " Spotted Ray, Dekay's Report, p. 369, pl. 65, fig. 212.
" " Ocellated Ray, Linsley's Cat. of Fishes of Connecticut.

Dekay considers this and Lesueur's R. Chantenay synonymous. But the coloring of the two species is very different. Lesueur, also, in his account of his R. Chantenay, speaks of the tail being "terminated by three rounded fins," and his figure exhibits them. Dekay, in his account of the above (ocellata), describes only "two small dorsals on the tail, near its extremity."

3. Raia erinacea, Mitchill.

Form rounded; diaphanous. Pale brown, with dark-brown spots. Two dorsal fins, with the vestige of a third. Two series of prickles on the tail; a patch of about twenty erectile spines on the pectorals. Prickles upon the cheeks. Snout pointed.

Length, 17 inches.

New Jersey, Mitchill.

Raia erinaceus, Hedge-hog Ray, Mitchill, Amer. Journ. Sc., IX. p. 290, pl. 6.
" " " " Dekay's Report, p. 372, pl. 78, fig. 246.

4. Raia lævis, Mitchill.

Body rhomboidal. Small spines on the orbits, and anterior margins of the pectoral fins; the rest of the body smooth. Three rows of spines on the tail. Snout blunted. In the *male*, the under surface of the snout and exterior to the nostrils to the angle of the jaws, roughened by innumerable minute tubercles. *Male* of a uniform light-brown color. *Female* with blackish ocelli.

Length, 2 to 5 feet.

Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Raia lævis, Smooth-backed Skate, Mitchill, Amer. Month. Mag., II. p. 327.
Raia batis, Skate, Storer's Report, p. 193.
Raia lævis, Smooth Skate, Dekay's Report, p. 370.
Raia batis, Skate, Linsley's Cat. of Fishes of Connecticut.

When my Report was written, the supplement of Dr. Mitchill to his "Fishes of New York," contained in the "American Monthly Magazine and Critical Review," was unknown to me. Dr. Dekay is probably correct in supposing my *Skate* to be the R. lævis of Mitchill, and I cheerfully acknowledge it above.

5. Raia Desmarestia, Lesueur.

Body subrhomboidal. Brownish above, whitish beneath. Snout prominent, rounded at tip, slightly emarginated each side. Many ranges of long, curved points exterior to the eyes, and upon the pectoral fins; a range of spines upon the dorsal line; three ranges on the tail, and a spine at each extremity of the dorsal disk; two approximate fins on the superior extremity of the tail; teeth discoidal, surmounted by a point.

Length, 18 to 19 inches. Breadth, 12½ inches.

Florida, Lesueur.

Raia Desmarestia, Lesueur, Journ. Acad. Nat. Sc., IV. p. 100, pl. 4.
" " Dekay's Report, p. 372.

6. Raia eglantiera, Bosc.

Body flat, semiorbicular behind, with a wide, rounded emargination each side before, near the spiracles, anterior to which the edge is dilated opposite to the eyes, and then is contracted so as to form a short, rounded rostrum. Above reddish, sprinkled with small spots; beneath whitish, with reddish tints. A longitudinal series of from nine to twelve simple spines on each side upon the pectorals; tail longer than the body, with two fins at its tip.

Length, 19 inches. Width, 10 inches.

Delaware Bay and Southern coasts, Bosc, Lesueur.

Raia eglantiera, Lacep., Hist. des Poissons, II. p. 105, pl. 4, fig. 1.
" " Lesueur, Journ. Acad. Nat. Sc., IV. p. 103.
" " Dekay's Report, p. 373.

7. Raia Chantenay, Lesueur.

Body flat, subrhomboidal, about one fifth broader than long. Above glabrous, excepting on the anterior margin of the pectoral fins, between the eyes, and on the extremity of the rostrum, which are rough to the touch; scattered reddish-brown spots of various sizes and forms, and a transversely-oblong subocellated spot each side of the middle; beneath whitish, slightly tinted with rosaceous; towards the anterior part of each side of the anus are six small black lines or spots. Three fins at the extremity of the tail; tail armed laterally with points.

Breadth, 2½ feet.

Delaware Bay, (?).

Raia Chantenay, Lesueur, Journ. Acad. Nat. Sc., IV. p. 106, pl. 5.

Lesueur's description was made out from a dried specimen in the Philadelphia Museum.

8. Raia Americana, Dekay.

Body rhomboidal. Uniform brown, unspotted. Snout elongated. Pointed groups of prickles on the upper surface; a vertebral series, and three series along the tail.

Length, 1 to 2 feet.

New York, Dekay.

Raia Americana, Prickly Ray, Dekay's Report, p. 368, pl. 66, fig. 215.

GENUS II. TRYGON, Adanson.

Head inclosed laterally by the pectorals; posterior portion of the disk of the body somewhat rounded; tail armed near its origin with a long and sharp flattened spine, serrated on both edges ; the rest of the tail slender, without fins, and ending in a point ; teeth small.

1. Trygon hastata, DEKAY.

Body quadrilateral, rounded on the pectoral angles. Uniform olive-brown above; white beneath. Upper surface partially smooth. Tail longer than the body, and armed with two or more spines.

Width, 3 feet. Entire length, 5 to 8 feet.

Rhode Island, DEKAY. Connecticut, LINSLEY.

Raia centroura (?), Prickly-tailed Sting-Ray, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 479.
Pastinaca hastata, Whip Sting-Ray, DEKAY'S Report, p. 373, pl. 65, fig. 214.
Trygon centroura, Whip-tailed Sting-Ray, LINSLEY'S Cat. of Fishes of Connecticut.

2. Trygon Maclura, LESUEUR.

Body oval, elliptical, broader than long. Tail short, one third of the length of the body. Above greenish blue, with small black vermicular, interrupted lines, and larger distant, pale spots; beneath, pale red.

Length, 15 to 18 feet.

Rhode Island, LESUEUR. Connecticut, LINSLEY.

Raia Maclura, LESUEUR, Journ. Acad. Nat. Sc., I. p. 41, plate.
Pastinaca Maclura, Broad Sting-Ray, DEKAY'S Report, p. 375, pl. 65, fig. 213.
" " " " LINSLEY'S Cat. of Fishes of Connecticut.

3. Trygon sabina, LESUEUR.

Body orbicular; tail more than twice as long as the body; ventral fins long, pointed; a range of spines upon the back and the origin of the tail; two spines on each side of the back. Upper part of the head rough; appendices in the male slender, distinct, as long as the ventrals.

Length, (?).

Florida, LESUEUR.

Trygon sabina, LESUEUR, Journ. Acad. Nat. Sc., IV. p. 109.
Pastinaca sabina, DEKAY'S Report, p. 375.

Cuvier, not having assigned any reason why he has substituted the genus "Pastinaca" for Adanson's "Trygon," I have followed Yarrell in retaining the latter.

GENUS III. MYLIOBATIS, DUM.

Head projecting from the pectorals, and the latter more broad transversely than in the other Rays, which gives them somewhat the appearance of a bird of prey with the wings extended, and has caused them to be compared to the eagle. Their jaws are furnished with broad, flat teeth, arranged like the squares of a pavement, and of different proportions, according to the species; their tail, extremely long, is terminated in a point, and is armed, like that of Trygon, with a strong spine, serrated on both sides, and has above, towards its base, in front of the spine, a small dorsal. Sometimes there are two or more spines.

1. Myliobatis Freminvillii, Lesueur.

Body rhomboidal. Above olivaceous, more or less deep in different specimens, paler on the margins, and sprinkled with distinct rounded spots; beneath white. Orbit salient, surmounted by an eminence. Ventrals rounded. Tail very long, filiform, triangular.

Length, 2 feet. Width, 2 to 3 feet.

Rhode Island, Lesueur.

Myliobatis Freminvillii, Lesueur, Journ. Acad. Nat. Sc., iv. p. 111.
" " Dekay's Report, p. 366.

2. Myliobatis Say, Lesueur.

Suborbicular. Olivaceous red above. Teeth dilated, and rhomboidal at the base. Two elongated vertical opposite fins on the tail, behind the spine.

Length, (?). Width, 17 inches.

New Jersey, Lesueur.

Myliobatis Say, Lesueur, Journ. Acad. Nat. Sc., i. p 42, pl.
" " Dekay's Report, p. 376.

3. Myliobatis acuta, Ayres.

Head rounded anteriorly, and extending backwards, widening but little for several inches, until opposite the eyes, where it joins the body. Body above smooth, entirely destitute of spines. Whole body and head above reddish brown; tail lighter at the base, but nearly black towards the tip; beneath whitish. Tail very slender, smooth to the tip, bearing two reversely serrated spines.

Length, 3 feet, 11 inches.

Massachusetts, Storer. Connecticut, Ayres.

Myliobatis bispinosus, Storer, Proceed. Bost Soc. Nat. Hist., p. 53.
" " " Bost. Journ. Nat. Hist., iv. p. 187.
Myliobatis acuta, Ayres, Proceed. Bost. Soc. Nat. Hist., p. 65.
Myliobatis bispinosus (Storer), Ayres, Bost. Journ. Nat. Hist., iv. p. 290, pl. 13, fig. 1.
Myliobatis acuta (Ayres), Linsley's Cat. of Fishes of Connecticut, Silliman's Journal.

In the year 1840, Dr. Yale sent me the tail and a portion of a jaw of this species, and from these I named it M. bispinosus in the fourth volume of the "Boston Journal of Natural

History." Mr. Ayres afterwards found an entire specimen at Brookhaven, Long Island, and called it M. acuta; this name, however, he withdrew, and allowed mine the priority. As, however, he has fully described from a recent specimen what I merely named from fragments of one, I feel that his name should be retained, and mine erased from the list. The remarks of my lamented friend, Rev. Mr. Linsley, of Connecticut, contained in his "Catalogue of the Fishes of Connecticut," upon the impropriety of considering the number of caudal spines as specific characters, are very just, and conclusively show the impropriety of my specific name.

GENUS IV. AËTOBATIS, Müller.

Have no marginal teeth; the jaws support only a single row of broad dental plates. In the upper jaw, these plates are arched, with the convexity turned forwards; in the lower jaw, they pass straight across, with the extremities only a little bent backwards. The upper jaw is shorter and more curved than the lower one, the anterior extremity of which projects beyond the upper jaw, and can be used like a spade in digging out shell-fish, &c., from the sandy bottoms frequented by these Rays.

1. Aētobatis guttata, Shaw.

Subrhomboidal. Snout spatuliform. Above light brown, with regularly distributed, numerous yellowish-white ocelli; beneath white. The tail, which is nearly four times as long as the body, is small at its origin, and terminates in a mere thread. In the dried specimen, a deep concavity upon the top of the head, between and back of the eyes, dilated anteriorly. Adult very large.

Length of body, 17 inches; of tail, posterior to dorsal fin, 45 inches. Greatest width of body, across pectorals, 20 inches.

Porto Rico, Storer.

Raia guttata, Shaw's Gen. Zoöl., v. p. 285, pl. 142.

GENUS V. RHINOPTERA, Kuhl.

Have the muzzle divided into two short lobes, under which are two similar ones.

1. Rhinoptera quadriloba, Lesueur.

Body rhomboidal, elevated along the dorsal line. Olive-brown above, beneath white. Pectorals acute. Tail slender, longer than the body.

Length, 3 feet. Width, 2 feet.

Connecticut, LINSLEY. New York, MITCHILL, DEKAY. New Jersey, LESUEUR.

Raia bonasus, Cow-nosed Ray, MITCHILL, Trans. Lit. and Phil. Soc. of N. Y., I. p. 479.
Raia quadriloba, LESUEUR, Journ. Acad. Nat. Sc., I. p. 44, pl.
Rhinoptera quadriloba, GRIFFITH'S CUV., X. p. 616.
" " Cow-nosed Ray, DEKAY'S Report, p. 375, pl. 66, fig. 217.
" " " " LINSLEY'S Cat. of Fishes of Connecticut.

GENUS VI. CEPHALOPTERA, DUMERIL.

The head truncated in front, and the pectorals, instead of embracing it, prolong each of them their anterior extremity into a salient point, which gives to the fish the appearance of having two horns. Teeth slender, slightly dentated. The slender tail, the spine, and the little dorsal, as in Myliobatis.

1. Cephaloptera vampyrus, MITCHILL.

Body dark brown above; beneath black, calicoed with milk-white. Skin rough. Tail longer than the body, and armed with one or more spines. Dorsal between the ventrals. Anterior margin of the pectorals convex; posterior concave.

Length, 17 feet, 3 inches. Width, 16 to 18 feet.

Delaware Bay, MITCHILL. South Carolina, CATESBY. Georgia, LESUEUR.

Cephalopterus vampyrus, Oceanic Vampyre, MITCHILL, Annals of Lyc. Nat. Hist. of N. York, I. p. 23, pl. 11, fig. 1.
Cephaloptera giorna (LACEP.), LESUEUR, Journ. Acad. Nat. Sc., IV. p. 115, pl. 6, fig. 1.
Cephaloptera vampyrus, Sea-Devil, DEKAY'S Report, p. 377, pl. 67, fig. 219.
Cephalopterus manta, BANCROFT, Sowerby's Zoölogical Journal, IV. p. 453.

GENUS VII. TORPEDO, DUMERIL.

The disk of the body nearly circular; pectoral fins large; two dorsal fins placed so far back as to be on the tail; surface of the body smooth; tail short and rather thick; teeth small and sharp.

1. Torpedo occidentalis, STORER.

Whole upper surface dark brown, with a few almost black dots distributed over it; beneath white. Very broad across the pectorals; length of pectorals rather less than half the entire length. Caudal fin is nearly triangular, straight at its posterior margin. Eyes very small. Spiracles oval, directed outwards and a little forwards.

Length, 4 feet, 2 inches. Width, 3 feet.

Massachusetts, STORER.

Torpedo occidentalis, STORER, American Journal of Arts and Sciences, XLV. p. 165, pl. 3.

ORDER III. CYCLOSTOMI.

Gills purse-shaped, fixed, opening outwards by several apertures. Jaws represented by an immovable cartilaginous ring, formed by the union of the palatine and mandibular bones. Intestinal canal straight and narrow.

FAMILY XXXV. PETROMYZONIDÆ.

Body elongated, cylindrical, eel-shaped. No pectorals nor ventrals. Fins without rays.

GENUS I. PETROMYZON, Lin.

Seven branchial apertures on each side of the neck. Maxillary ring armed with strong teeth. Mouth beneath.

1. Petromyzon Americanus, Lesueur.

Body cylindrical anteriorly, compressed posteriorly, and terminating in an acute tip. A slight keel upon the back. Above olive-brown, mottled with dark-brown, almost black, confluent patches; beneath of a uniform dull brown. Three large teeth in the throat.

Length, 20 to 30 inches.

Massachusetts, Storer. Connecticut, Linsley. New York, Mitchill, Dekay.

Petromyzon marinus, Great Lamprey, Mitchill, Trans. Lit. and Phil. Soc. of N. Y., i. p. 461.
Petromyzon Americanus, Lesueur, Trans. Amer. Phil. Soc. (New Series), i. p. 382.
" " " Hist. N. A. Fishes, ined., plate.
" " American Lamprey, Storer's Report, p. 195.
" " American Sea-Lamprey, Dekay's Report, p. 379, pl. 66, fig. 216.

2. Petromyzon nigricans, Lesueur.

Body above of a deep blue color; beneath bluish white. Mouth with numerous incurved teeth, or bony spines, projecting from widened bases, resembling the spines with which the Raiæ are armed. Dorsals white. Caudal triangular at its termination.

Length, 6 to 7 inches.

Massachusetts, Lesueur, Storer. Connecticut, Linsley.

Petromyzon nigricans, Lesueur, Trans. Amer. Phil. Soc. (New Series), i. p. 385.
" " Bluish Lamprey, Storer's Report, p. 197.
" " Bluish Sea-Lamprey, Dekay's Report, p. 381, pl. 79, fig. 247.

3. Petromyzon Lamottenii, Lesueur.

Yellowish on the sides, with irregular patches of dark brown above; white beneath. The mouth pectinated on its margin. Dorsals continuous.

Length, (?).

Petromyzon Lamottenii, Lesueur, Hist. N. A. Fishes, ined., plate.
" " " Dekay's Report, p. 382.

4. Petromyzon tridentatus, Gairdner.

Back and sides bluish gray, with irregularly scattered yellowish patches; belly yellowish white. Three conspicuous and contiguous teeth on the upper side of the maxillary ring. Dorsals distinct.

Length, 21 inches, 6 lines.

Columbia River, Richardson.

Called "Squaqual," by the Indians on the banks of the Wallamet.

Petromyzon tridentatus, Tridentate Lamprey, Gairdner, Rich., Fauna Boreal. Americ., III. p. 293.
" " Dekay's Report, p. 382.

5. Petromyzon argenteus, Kirtland.

Body cylindrical, compressed towards the back. Back ash-gray; sides and beneath silvery-gray, maculated with irregular rows of black dots. A black dot over each branchial opening. Dorsals continuous.

Length, 11 inches.

Big Miami River, Ohio, Kirtland.

Petromyzon argenteus, Kirtland's Report, pp. 170, 197.
" " Lamprey, Kirtland, Bost. Journ. Nat. Hist., III. p. 342, pl. 4, fig. 3.
" " Dekay's Report, p. 382.

6. Petromyzon appendix, Dekay.

Dorsals continuous, yellow. Anal fin with a thread-like appendix on its anterior portion.

Length, 4 to 6 inches.

Rhode Island, New York, Dekay.

Petromyzon appendix, Small Lamprey, Dekay's Report, p. 381, pl. 64, fig. 211.

7. Petromyzon fluvialis, Lin.

Richardson, in his "Fauna Boreali Americana," says,—"A Lamprey, having teeth like P. fluvialis, was found in Great Slave Lake, adhering to an Inconnu (Salmo Mackenzii). It was very like Bloch's figure of the P. argenteus, which Cuvier thinks is not different from fluvialis."

GENUS II. AMMOCŒTES, Dumeril.

Form of the body, the branchial apertures, and fins, like those of the Lampreys; upper lip semicircular, with a straight, transverse under lip; mouth without teeth, but furnished with numerous short membranous cirrhi.

1. Ammocœtes bicolor, Lesueur.

Back and sides reddish; abdomen white; the color separated by an undulating line. Nape of the neck elevated. Dorsal fins low, separated. On the inside of the upper lip are small granules, and at the opening of the throat, small ramified papillæ.

Length, (?).

Connecticut River, Lesueur.

Ammocœtes bicolor, Lesueur, Trans. Amer. Phil. Soc. (New Series), i. p. 386.
" " Mud-Lamprey, Storer's Report, p. 198.
" " Colored Mud-Lamprey, Dekay's Report, p. 383, pl. 79, fig. 248.

2. Ammocœtes concolor, Kirtland.

Body subcylindric, more compressed laterally behind the vent; transversely marked with numerous curved sulcations. Back and sides uniformly of a light olive, or sometimes a leaden hue; the belly and throat of a yellowish white; the fins pale and diaphanous. Irregular series of dark brown dots are imprinted on the whole length of the sides of the body, and more faintly above the branchial openings. Body convex above the branchial openings. Dorsal single, commencing over the middle of the body. Mouth semicircular, elongate; lower lip transverse; nose terminates in a short snout, projecting over the mouth.

Length, 4 to 5 inches.

Mahoning and Scioto Rivers, Kirtland.

Ammocœtes concolor, Mud-Eel, Blind Eel, Kirtland, Bost. Journ. Nat. Hist., iv. p. 473, pl. 27, fig. 1.

3. Ammocœtes unicolor, Dekay.

Color nearly uniform throughout. Dorsal single. Opening to the throat very large, but accurately closed by six irregular and ragged subcartilaginous processes, which meet in the centre.

Length, 3 to 5 inches.

Vermont, Thompson. New York, Dekay.

Ammocœtes unicolor, Plain Mud-Lamprey, Dekay's Report, p. 383, pl. 79, fig. 250.

The seven following species are added from Sowerby's "Zoological Journal."

GENUS HÆMULON, Cuv.

13. Hæmulon obliquatum, Bennett.

Yellowish, with twelve bluish bands upon the head, and numerous oblique bluish lines upon the body.

D. 12 – 16. P. 15. V. 1 – 6. A. 3 – 12. C. 16. Length, (?).

Caribbean Sea, Bancroft.

Diabasis obliquatus, Bennett, Sowerby's Zoölogical Journal, v. p. 90.

GENUS CHROMIS, Cuv.

The lips, protractile intermaxillaries, pharyngeals, dorsal filaments, and general appearance of a Labrus ; but the teeth of the pharynx and jaws resemble those of a card, and there is a range of conical ones in front. The vertical fins are filamentous, those of the belly being even frequently extended into long threads. The lateral line is interrupted ; the stomach forms a *cul-de-sac*, but has no cœca.

1. Chromis tænia, Bennett.

Blackish brown ; fins blackish ; tail rounded, banded with black dots ; a round black spot beneath the eye, another at the base of the caudal beneath, and a band continued from the eye along the middle of the side to the tail.

D. 15 – 11. P. 13. V. (?). A. 4 – 9. C. 16. Length, (?).

Caribbean Sea, Bennett.

Chromis tænia, Bennett, Proceedings of Zoölogical Society of London, i. 1830, p. 112.

GENUS HEMIRAMPHUS, Cuv.

3. Hemiramphus apicalis, Bennett.

Body four times the length of the lower mandible. Dorsal and anal fins of equal length. A silver stripe extends horizontally along the middle of the body, from the operculum to the tail. Apex of the lower jaw of a bright flame color. Pectoral fins equal in length to one half of the length of the lower jaw. Upper mandible scarcely exceeding one half of the diameter of the eye in length.

D. 15. P. (?). V. (?). A. 16. C. (?). Length, (?)

Caribbean Sea, BANCROFT.

Hemiramphus apicalis, BENNETT, Sowerby's Zoölogical Journal, v. pp. 84, 89.

GENUS ECHENEIS, LIN.

5. Echeneis lunata, BENNETT.

Body elongated, scaly. Twenty-two to twenty-five bars on the disk; caudal fin lunate; pectorals acute. Black on the upper and more anterior portion of the back; of a dark gray over the remainder of the body, with a lighter gray stripe from near the eye to near the vent. All the fins of a dark gray.

D. 30 or 32. P. 21. V. 6. A. 30 or 33. C. 16. Length, 34 inches.

Caribbean Sea, BANCROFT.

Echeneis lunata, BENNETT, Proceedings of Zoölogical Society of London, I. 1830, 1831, p. 134.
" " " Sowerby's Zoölogical Journal, v. p. 412, pl. 18.

GENUS CONGER, CUV.

2. Conger Savanna (?), CUV.

Dorsal fin arises before the origin of the pectorals. Anterior teeth conical; the side teeth disposed in many series, those of the middle series the greater, parallelopiped, wedge-shaped, those of the outer and inner series the smaller, granulated, rounded, and closely arranged; the middle series of those on the vomer the larger, triangular, somewhat recurved, compressed; those on the sides granulated.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, (?).

Caribbean Sea, BANCROFT.

Called "Conger or Sea Eel," at Jamaica.

Conger Savanna (CUV.), BENNETT, Proceedings of Zoölogical Society of London, I. 1830, 1831, p. 185.
" " " Sowerby's Zoölogical Journal, v. p. 416.

GENUS SCYLLIUM, CUV.

An anal and two dorsal fins; the first dorsal fin placed behind or opposite, but never before, the abdominal fins. Head short and blunt; nostrils pierced near the mouth, and continued by a fissure in the upper lip, forming valves. Teeth small, triangular, pointed, with one or more lateral denticles at the base on each side. Eyelids wanting. Spiracles distinct. Branchial openings, five, partly over the pectoral fins.

1. Scyllium cirratum, Gmel.

Rufous. The young brownish above, and somewhat fawn-colored beneath, marked on both surfaces, over the whole of the body and the fins, by small black, rounded spots, not closely set, and somewhat regular in their distribution. Spiracles small, just behind the eyes. It generally has ten rows of teeth.

D. (?). P. (?). V. (?). A. (?). C. (?). Length, 1 to 15 feet.

Caribbean Sea, Bancroft.

Called "Nurse," at Jamaica; "Gata," at Havana.

Squalus cirratus, Lin., Gmel.
" " Cirrated Shark, Shaw's Gen. Zoöl., v. p. 344.
Scyllium cirratum (Gmel.), Bancroft, Sowerby's Zoölogical Journal, v. pp. 82, 86, 415.

GENUS CEPHALOPTERA, Dumeril.

2. Cephaloptera hypostoma, Bennett.

Smooth; mouth beneath; the anterior edge of the pectoral fins declivous. Spiracles situated in a groove at the anterior base of the pectorals.

Length to ventrals, 17 inches; length of tail, 21 inches. Extreme breadth of body, 28 inches.

Caribbean Sea, Bancroft.

Cephalopterus hypostomus, Bennett, Proceedings of Zoölogical Society of London, i. 1830, 1831, p. 134.
" " " Sowerby's Zoölogical Journal, v. p. 411, pl. 50.

Since this paper was prepared for publication, the following species have been discovered, and are described in the "Proceedings of the Boston Society of Natural History."

GENUS PRIONOTUS, Cuv.

5. Prionotus pilatus, Storer.

Above of a reddish brown, beneath yellowish white. The first dorsal fin is crossed by two oblique white lines, with a black blotch upon the connecting membrane, between the fourth and fifth rays, above the upper oblique line. The entire head is roughened by elevated striæ. The lateral projections of the snout are prominent, and margined with very strong crenulations, which are longer than in either of the species contained in Cuvier's "Histoire Naturelle des Poissons." Two distinct spines at the anterior superior angle of the eye. Opercular spine of moderate size, not elevated at its base above the opercular plate. Preopercular spine large, naked at its posterior extremity, raised and crenulated along its whole outer edge. Length of the head equal to one fourth the length of the body. Length of the pectoral fins equal to nearly one third the length of the head. The caudal fin is quite deeply emarginated; the outermost rays projecting.

D. 10-13. P. 13. V. 6. A. 12. C. $12\frac{4}{4}$. Length, 12 inches.

Massachusetts Bay, STORER.

Prionotus pilatus, STORER, Proceed. Bost. Soc. Nat. Hist., II p. 77.

GENUS ARGYREIOSUS, LACEP.

3. Argyreiosus unimaculatus, BATCHELDER.

Body nearly circular, much compressed, being less than one tenth of an inch in thickness. Breadth, one and one tenth inches. Profile nearly vertical. Lower jaw the longer, and hooked. Eyes one tenth of an inch in diameter. A filament, half an inch in length, arises on the back in a vertical plane with the origin of the pectoral fin; three tenths of an inch back of this are three very minute spines. Several finlets upon the back and abdomen. Pectoral fins three-tenths of an inch long; caudal fin deeply forked.

Preserved in spirit, above the lateral line the color is dark; below it, silvery. Upon the lateral line, which passes in nearly a right line from the superior angle of the gill-covers to the base of the caudal rays, is a nearly circular black spot, the anterior edge of which is just touched by the pectoral fin when depressed.

D. (?). P. 16. V. (?). A. (?). C. 14. Length, $1\frac{3}{10}$ inches to the base of the caudal fin.

Maine, BATCHELDER.

Argyreiosus unimaculatus, BATCHELDER, Proceed. Bost. Soc. Nat. Hist., II. p. 78.

GENUS LEPTOCEPHALUS, PENNANT.

Have the cleft of the gills open in front of the pectorals, and the body compressed like a riband. Their head is extremely small, with a short and rather pointed muzzle, the pectorals almost imperceptible or actually wanting; the dorsal and anal in like manner scarcely visible, united together at the point of the tail; the intestines occupy only an extremely narrow line along the inferior edge.

1. Leptocephalus gracilis, Storer.

Body elongated, tapering posteriorly to a point, very much compressed. Translucent, the vertebral column and ribs distinctly visible through the skin. Length of the head equal to one seventeenth of the entire length of the fish; the greatest depth of the body slightly exceeds the length of the head. Snout pointed. Eyes circular. No pectoral fins; the dorsal and anal fins exceedingly small, and by their union forming the tail. In spirits, of a reddish-brown color. Small black points are noticed, by means of the glass, upon the margins of the dorsal and anal fins, and also along the lateral line.

D. (?). V. (?). A. (?). C. (?). Length, 4½ inches.

Maine, Wheatland.

Leptocephalus gracilis, Storer, Proceed. Bost. Soc. Nat. Hist., II. p. 76.

GENUS SYNGNATHUS, Lin.

2. Syngnathus Californiensis, Storer.

Reddish brown, lighter beneath; the lower portion of the sides irregularly dashed with white. Nineteen transverse plates anterior to the vent, and forty-seven plates posterior to it. From the tip of the tubular mouth to the posterior edge of the operculum, the length is rather more than one seventh the length of the fish. The greatest depth of the jaws is rather less than one half the depth of the head. The dorsal fin commences on the anterior third of the body, and the height of its rays is less than one third the depth of the body.

D. 42. P. 13. A. 3. C. 10. Length, 14 inches.

California, Storer.

Syngnathus Californiensis, Storer, Proceed. Bost. Soc. Nat. Hist., II. p. 73.

Making a total of, —

Families, ...	35
Genera, ...	221
Species, ...	739

ADDITIONS AND CORRECTIONS.

In consequence of having added several genera to the preceding paper after the first eight pages were printed, I find it necessary to make the following additions and corrections.

In the tables of Geographical Distribution of Genera, add to the family Scombridæ the genera Palinurus and Notacanthus, as peculiar to America.

To the family Labridæ, add the genus Chromis, as being found both in Europe and North America.

To the family Cyprinidæ, add the genera Pimephales and Fundulus, as peculiar to America.

To the family Salmonidæ, add the genera Thymallus and Saurus, as being found both in Europe and North America.

To the family Clupeidæ, add the genus Pomolobus, as peculiar to America.

To the family Anguillidæ, add the genera Muræna and Leptocephalus, as being found both in Europe and North America; and the genus Saccopharynx, as found in North America but not peculiar to it.

To the family Squalidæ, add the genera Alopias and Scyllium, as being found both in Europe and North America.

To the family Raiidæ, add the genera Rhinoptera, Cephaloptera, and Torpedo, as being found both in Europe and North America.

Add the two following species from Fabricius.

Genus Anarrhicas, A. minor, Olafsen, Fabr., Fauna Groenl., p. 139; Rich., Fauna Boreal. Americ., p. 96.

Genus Squalus, S. Gunneri, Rich., Fauna Boreal. Americ., p. 313; S. Carcharias, Fabr., Fauna Groenl., p. 127.

To the catalogue of works consulted, add the following.

Bost. Journ. Nat. Hist. Boston Journal of Natural History. 8vo. Boston. 1834 *et seq.*

Proceedings of Boston Society of Natural History. 8vo. Boston. 1841 *et seq.*

Zoöl. Journal. Sowerby's Zoölogical Journal. 8vo. London.

Proceedings of Zoölogical Society of London. 8vo. London. 1830 *et seq.*

ERRATA.

Page	256,	*line*	6,	*for* Percina,	*read*	Etheostoma.
"	257,	"	26,	" Zoarcus,	"	Zoarces.
"	258,	"	9,	" Hypsocidæ,	"	Hypsæidæ.
"	261,	"	7,	" Percina,	"	Etheostoma.
"	263,	"	6,	" Zoarcus,	"	Zoarces.
"	263,	"	22,	" Hypsocidæ,	"	Hypsæidæ.
"	269,	"	19,	*for* VII.,	"	II.
"	283,	"	14,	*after* Mesoprion,	"	Cuv.
"	283,	*line*	26,	*for* Lane,	"	Lone.
"	290,	"	6,	" p. 116,	"	p. 216.
"	293,	"	1,	" Ravenelii,	"	Raveneli.
"	293,	"	7,	" "	"	"
"	293,	"	9,	" Holbrookii,	"	Holbrooki.
"	293,	"	11,	" "	"	"

" 294, *to the synonymes of* Pomotis appendix, *add* Pomotis rubricauda. Red-tailed Pomotis, STORER, Bost. Journ. Nat. Hist., IV. p. 177.

"	306,	*line*	16,	*for* 3,	*read*	5.
"	314,	"	24,	*after* Gasterosteus,	"	aculeatus.
"	365,	"	26,	*for* three tenths,	"	one eleventh.
"	376,	"	10,	" C. 161,	"	C. 16.
"	381,	"	8,	" Platescephalus,	"	Platycephalus.
"	382,	"	5,	" card-teeth,	"	card-like teeth.
"	454,	"	11,	" three,	"	the.
"	455,	"	17,	" Lesser's,	"	lesser.
"	476,	"	25,	" Length, 2 inches.	"	Length, 21 inches.

INDEX OF POPULAR NAMES.

INDEX OF SCIENTIFIC NAMES.

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J. INGERSOLL BOWDITCH, *Treasurer.*
AUG. A. GOULD, M. D., *Librarian and Cabinet-keeper.*

* John Pickering, LL. D. Jacob Bigelow, M. D. Daniel Treadwell, A. M. John Ware, M. D. Benjamin Peirce, A. M.	*Rumford Committee.*
George B. Emerson, A. M. Amos Binney, M. D. Francis Bowen, A. M.	*Committee of Publications.*
Augustus A. Gould, M. D. D. Humphreys Storer, M. D. Benjamin Peirce, A. M.	*Committee on the Library.*
Benjamin Peirce, A. M. C. C. Felton, A. M. Morrill Wyman, M. D.	*Committee on Reports.*

STATUTES

OF THE

AMERICAN ACADEMY OF ARTS AND SCIENCES.

CHAPTER I.

Of Officers.

1. There shall be a President, a Vice-President, a Corresponding Secretary, a Recording Secretary, a Treasurer, and a Librarian, which officers shall be annually elected by written votes, the day next preceding the last Wednesday in May.

2. If either of the Secretaries, the Treasurer, or the Keeper of the Library die, resign, or be removed during the year, the vacant office or offices shall, at the next meeting of the Academy, be filled by written votes for the remainder of the year.

CHAPTER II.

Of the President.

1. It shall be the duty of the President, and, in his absence, of the Vice-President or next officer in order, as above enumerated, to preside at the meetings of the Academy; to summon extraordinary meetings of the Academy, upon any urgent occasion; and to execute or see to the execution of the statutes of the Academy.

2. The President, or in his absence the next officer as above enumerated, is empowered to draw upon the Treasurer for such sums of money as the Academy shall direct. Bills presented on account of the Library or the publications of the Academy must be previously approved by the respective committees on these departments.

3. Any deed or writing, to which the common seal is to be affixed, shall be signed and sealed by the President, when thereto authorized by the Academy.

CHAPTER III.

Of the Secretaries.

1. The Corresponding Secretary shall keep the letter-book, shall record all letters written in the name of the Academy, and preserve on file all letters which are received ; and, at each meeting, he shall read such letters as have been addressed to the Academy since the last meeting. With the advice and consent of the President, he may propose and make exchanges with such other scientific associations as he shall deem proper, and may give copies of the Transactions of the Academy for this purpose.

2. The Recording Secretary shall have charge of the charter and statute-book, journals, and all literary papers belonging to the Academy. He shall keep a record of the proceedings of the Academy at its meetings, and after each meeting is duly opened by the presiding officer, he shall read the proceedings of the last meeting. He shall post up in the hall a list of the persons nominated for election into the Academy, which list shall remain there at least during the interval between two successive quarterly meetings ; and when any individual is chosen, he shall insert in the records the names of the Fellows by whom he was nominated.

3. The Corresponding and Recording Secretaries shall have authority to publish in an octavo form such of the proceedings of the Academy as may seem to them calculated to advance the interests of science.

4. Until the further order of the Academy, it shall be the duty of the Corresponding Secretary to transmit to every Fellow thereof residing in

foreign countries one copy of each volume of Memoirs hereafter published, as soon as convenient.

5. Any Fellow of the Academy shall be entitled to receive one copy o each volume hereafter published, by applying personally, or by written order, for the same within two years after such publication.

CHAPTER IV.

Of the Treasurer.

1. The Treasurer shall give such security as the Academy may require, for the trust reposed in him.

2. The Treasurer shall receive officially all moneys or sums of money due or payable, and all bequests or donations made, to the Academy; and, by order of the President or presiding officer, shall pay such sums as the Academy shall direct; and shall keep an account of all receipts and expenditures.

3. All moneys or sums of money, which there shall not be present occasion to expend, shall be put out at interest on such securities, or otherwise disposed of, as the Academy shall direct.

4. The Treasurer shall keep a separate account of the income and appropriation of the Rumford fund, and report the same annually.

5. The Treasurer's accounts shall be annually audited by a committee appointed by the Academy for the purpose.

CHAPTER V.

Of the Library and Cabinet.

1. It shall be the duty of the Librarian to take charge of the books, to keep a correct catalogue of the same, and to provide for the delivery of books from the Library.

2. Any Fellow of the Academy may have at any one time three volumes from the Library.

3. Books may be kept out three calendar months, and no longer; and every person shall be subjected to a fine of twenty cents a week for every volume retained beyond that time.

4. Every person, who takes a book from the Library, shall give a receipt for the same to the Librarian or his assistant.

5. Every book shall be returned in good order, regard being had to the necessary wear of the book with good usage. And if any book shall be lost or injured, the person to whom it stands charged shall replace it by a new volume or set, if it belong to a set, or pay the current price of the volume or set to the Librarian; and thereupon the remainder of the set, if the volume belonged to a set, shall be delivered to the person so paying for the same.

6. All books shall be returned to the Library for examination, at least one week before the annual meeting. And every person then having one or more books and neglecting to return the same, as herein required, shall forfeit and pay a fine of one dollar.

7. A committee on the Library, to consist of three persons, of whom the Librarian shall be one, shall be chosen at the annual meeting in May. This committee shall examine the Library, and make report of its condition at the next annual meeting. They shall have authority to purchase such books, from time to time, as they may deem expedient; to make rules and regulations concerning the circulation, return, and safe keeping of the books; and to appoint such agents for these purposes as they may think necessary. And for all these objects there shall annually be appropriated a proper sum, to be expended under their direction, and the charges to be made either to the Rumford fund, or to that of the Academy, as the committee may direct.

CHAPTER VI.

Of Meetings.

1. There shall be annually four stated meetings of the Academy, namely, on the last Wednesday in January, the day next preceding the last Wednesday in May, the second Wednesday in August, and the second Wednesday in November, to be held at the Hall of the Academy in Boston.

2. The President shall have power to call extraordinary meetings of the Academy, at such time and place as he shall see fit.

3. Seven Fellows shall constitute a quorum for the transaction of business of every description, which may come before the Academy.

4. The Recording Secretary shall notify the meetings of the Academy to the Fellows residing in Boston and the vicinity, and shall also cause the meetings to be advertised in the public papers, whenever he deems such further notice to be necessary.

CHAPTER VII.

Of Fellows.

1. No person shall be elected a Fellow of the Academy, unless proposed and recommended by one or more Fellows, who shall subscribe their names to the recommendation upon the nomination list. The name shall stand on the nomination list at least during the interval between two statute meetings previous to the election. Three fourths of the votes given shall be necessary to constitute a majority for the admission of a member ; and when three fourths shall amount to less than seven, then seven votes shall be necessary. Should any person, on balloting, not be admitted, his name shall be removed from the nomination list ; but may at any future period be placed upon it again for a new nomination.

2. Each Fellow residing in the State of Massachusetts shall pay annually two dollars to the Academy, and such additional sum, not exceeding three dollars, as the Academy at its annual meeting shall require.

CHAPTER VIII.

On Literary Performances.

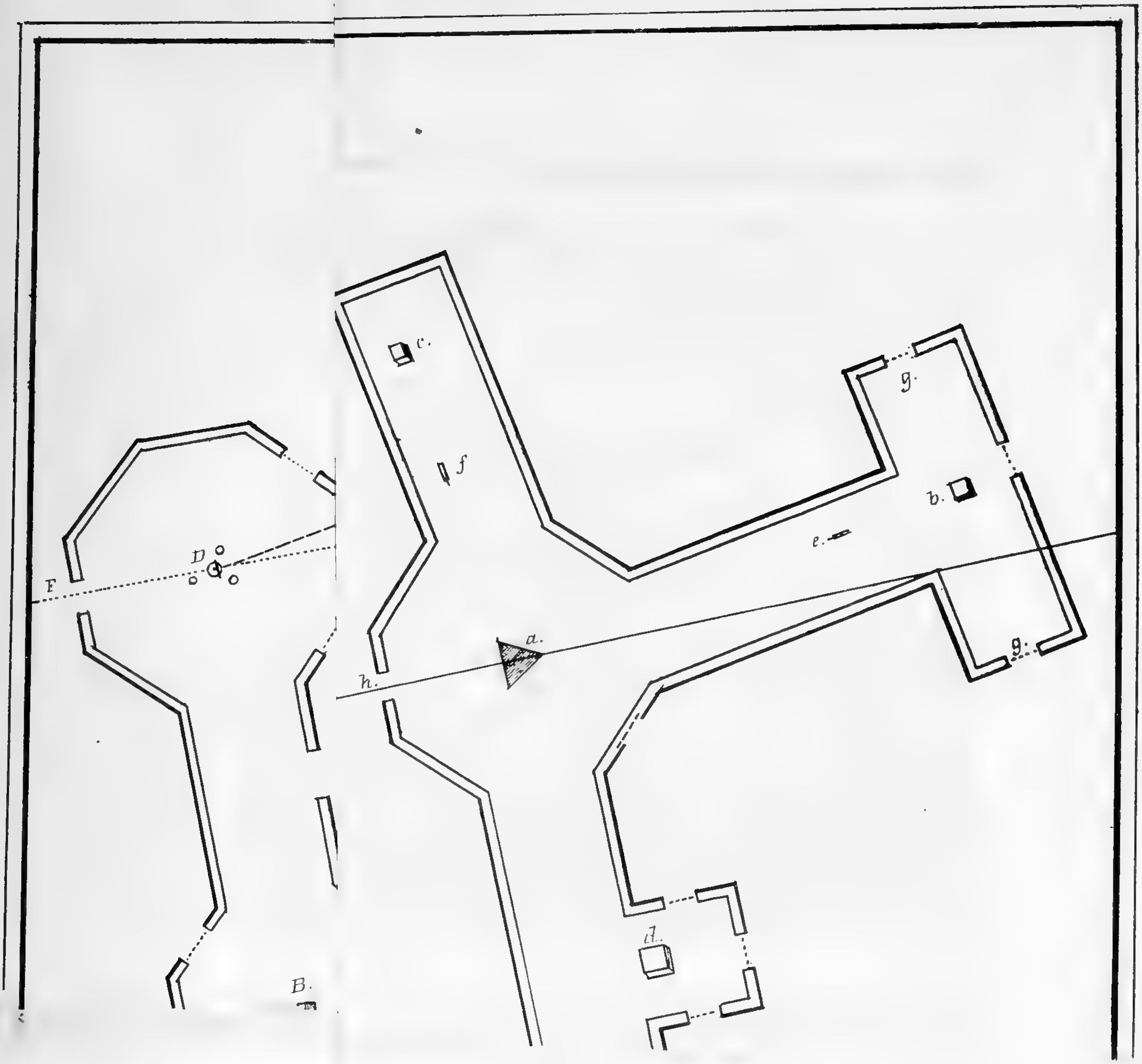
1. The Academy will never express its judgment on literary or scientific memoirs or performances submitted to it, or included in its printed transactions.

2. A committee of three persons, to be called the Committee on Publications, shall be chosen at each annual meeting, and to them all memoirs submitted to the Academy shall be referred.

RUMFORD PREMIUM.

In conformity with the last will of Benjamin Count Rumford, granting a certain fund to the American Academy of Arts and Sciences, and of a decree of the Supreme Judicial Court for carrying into effect the general charitable intent and purpose of Count Rumford, as expressed in his said will, the Academy is empowered to make from the income of said fund, as it now exists, at any annual meeting, award of a gold and silver medal, being together of the intrinsic value of three hundred dollars, as a premium, to the author of any important discovery or useful improvement on light or on heat, which shall have been made and published by printing, or in any way made known to the public, in any part of the continent of America, or any of the American islands ; preference being always given to such discoveries as shall, in the opinion of the Academy, tend most to promote the good of mankind ; and to add to such medals, as a further premium for such discovery and improvement, if the Academy see fit so to do, a sum of money not exceeding three hundred dollars.

For this purpose, a standing committee is appointed annually by the Academy, in May, to consider and report on all applications for the Rumford Premium.



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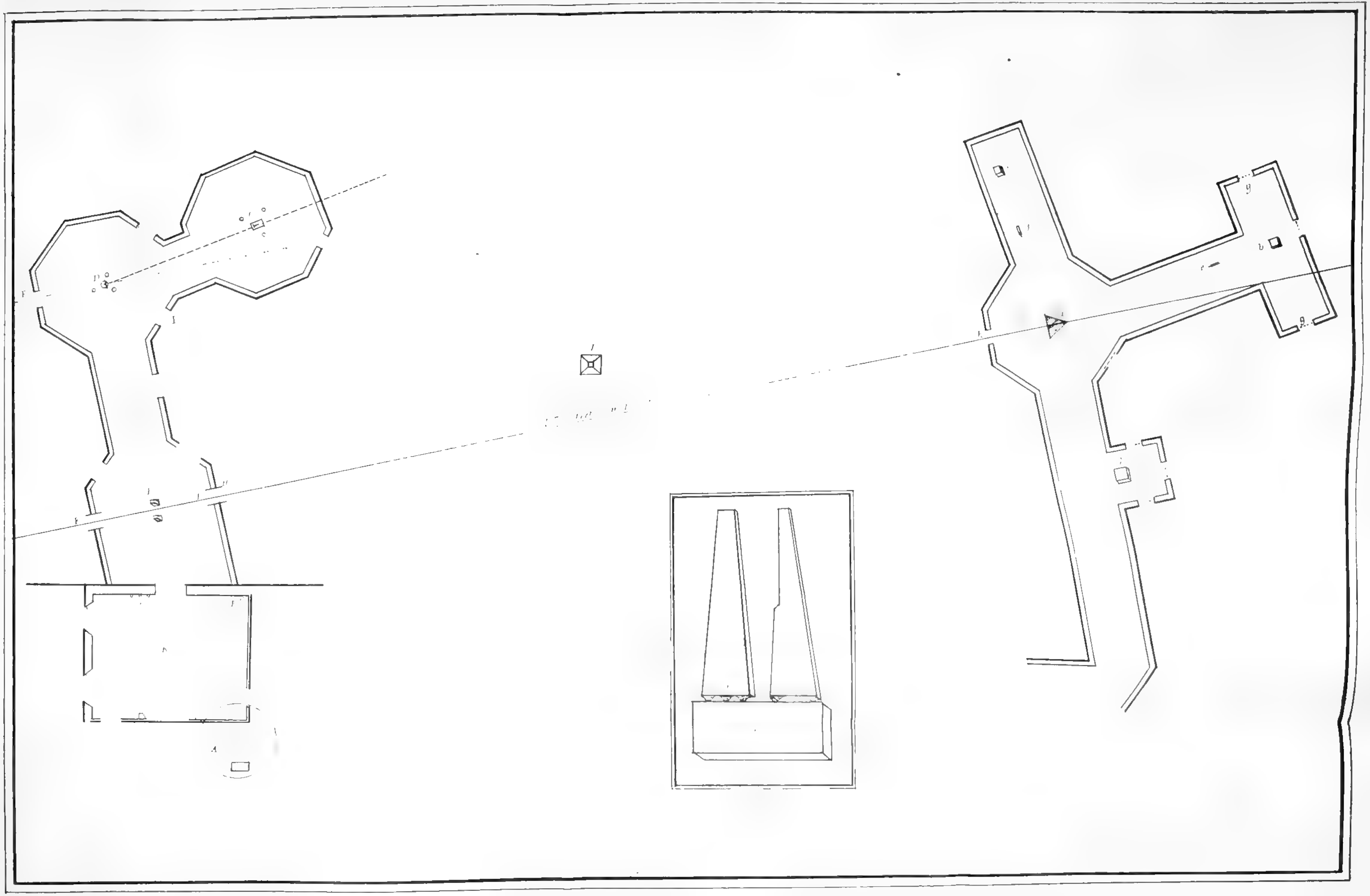
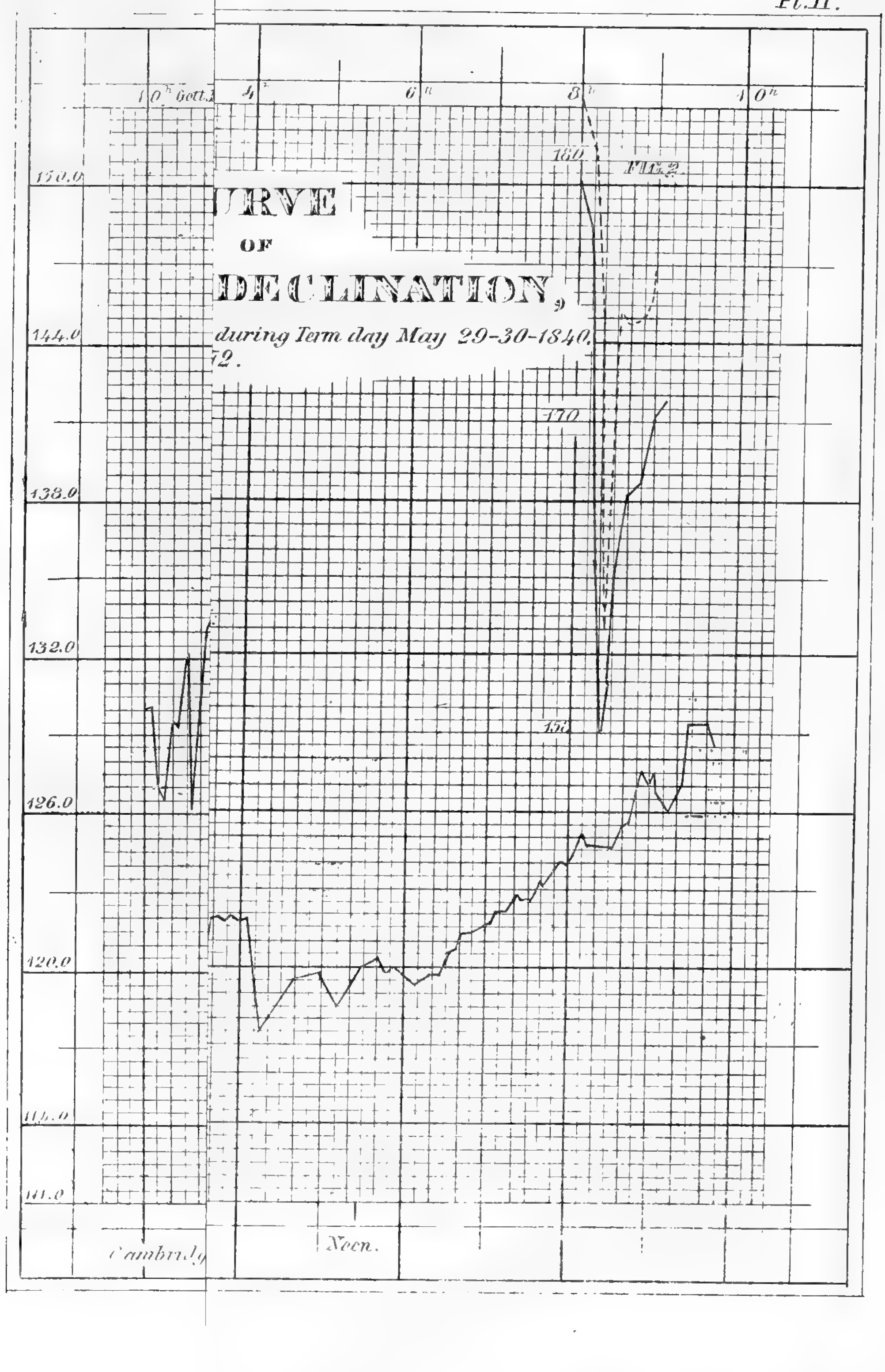
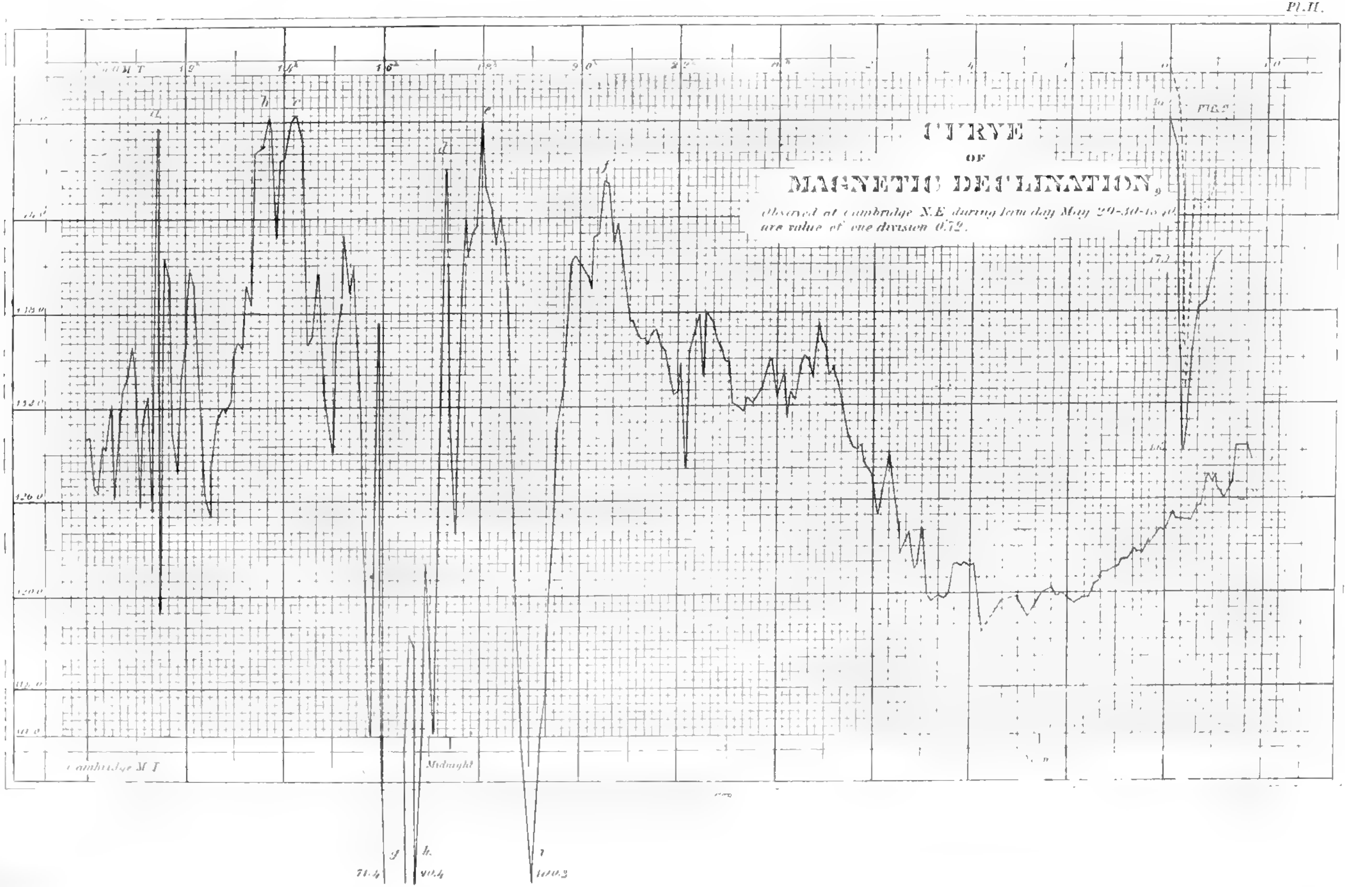
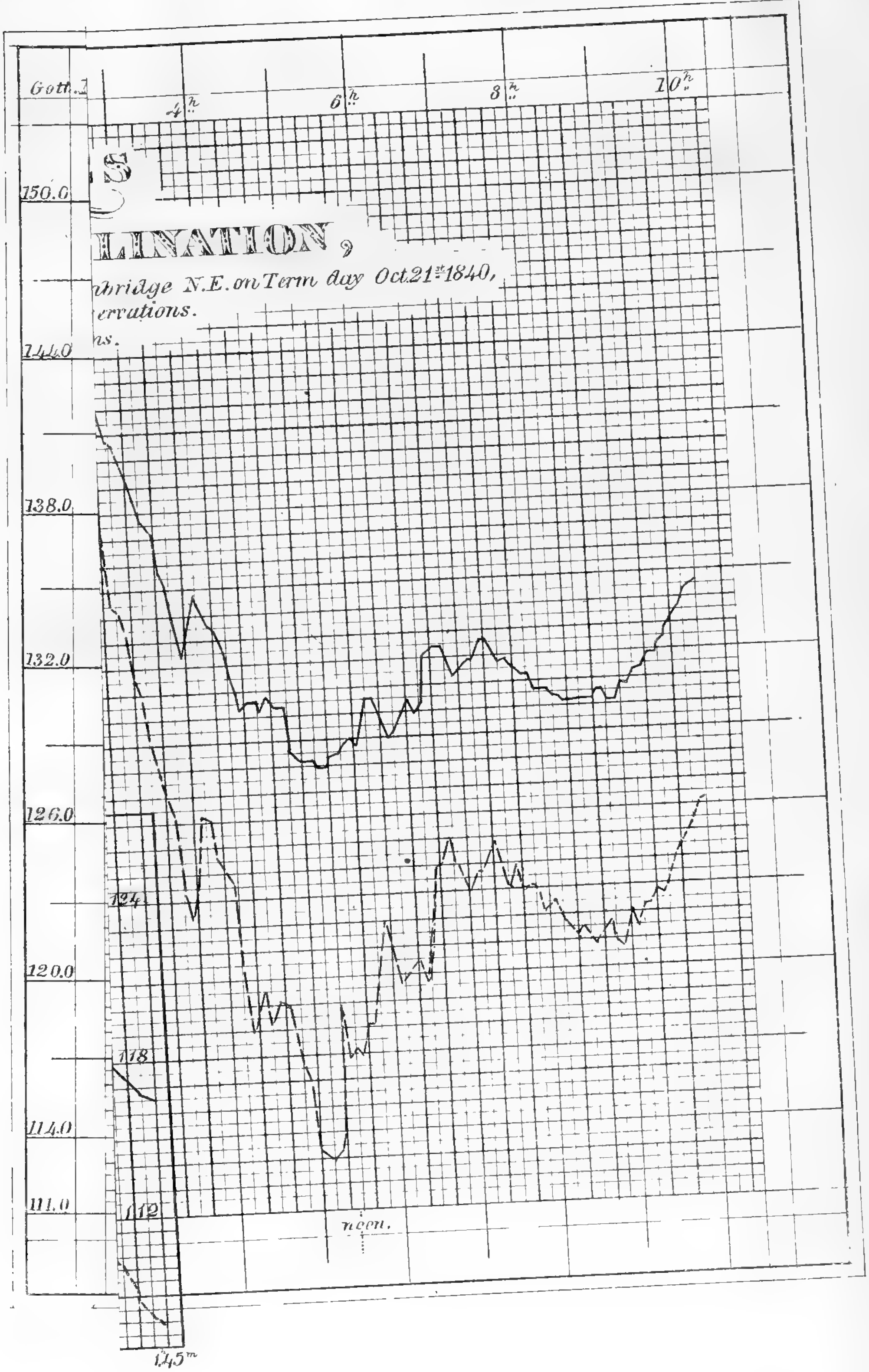



10h Gott.
4h
6h
8h
10h
180.
Fig. 2.
150.0
URVE
OF
DECLINATION,
during Term day May 29-30-1840,
72.
144.0
170
138.0
132.0
155
126.0
120.0
Cambridg
Noon.

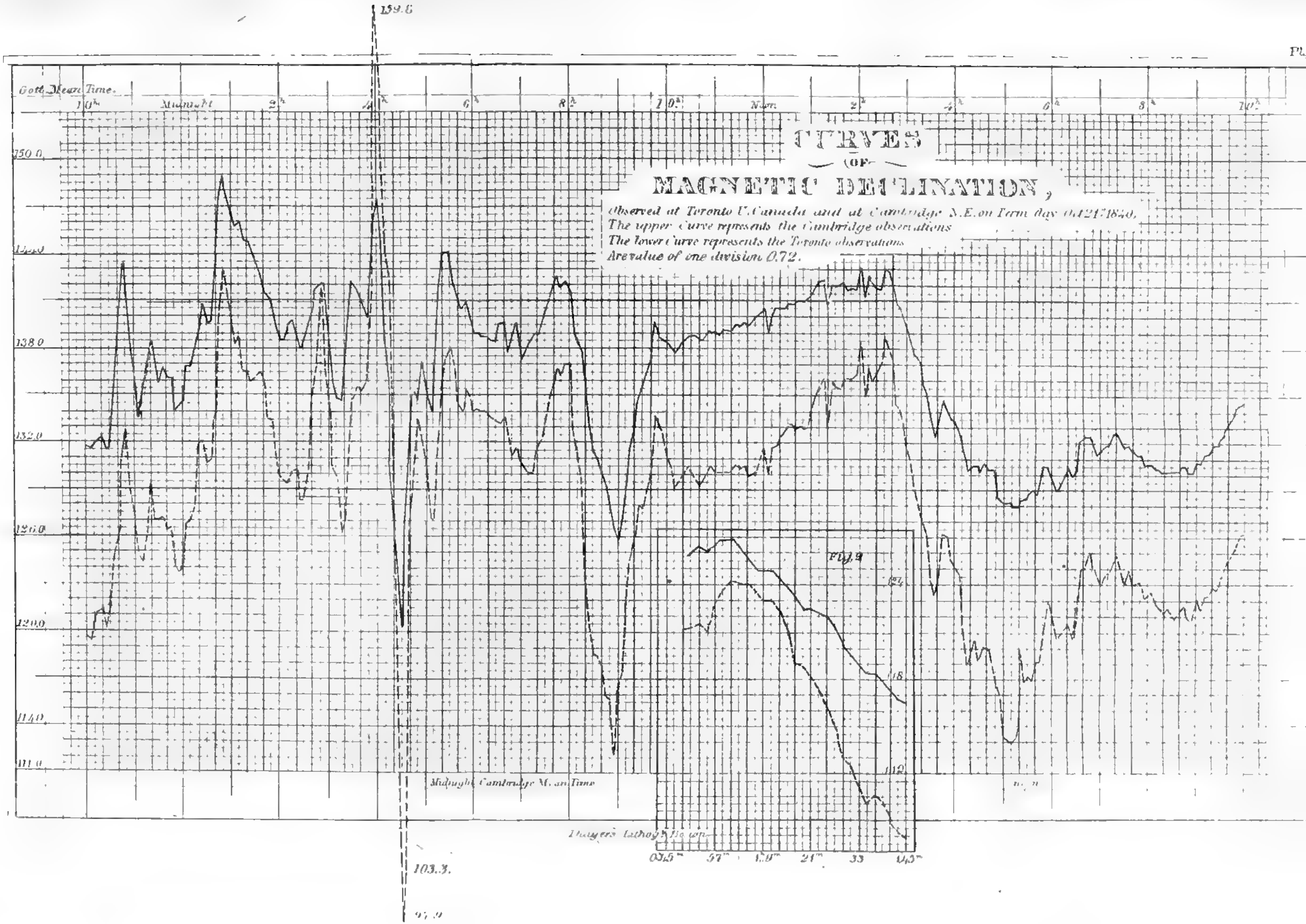
Pl. II.

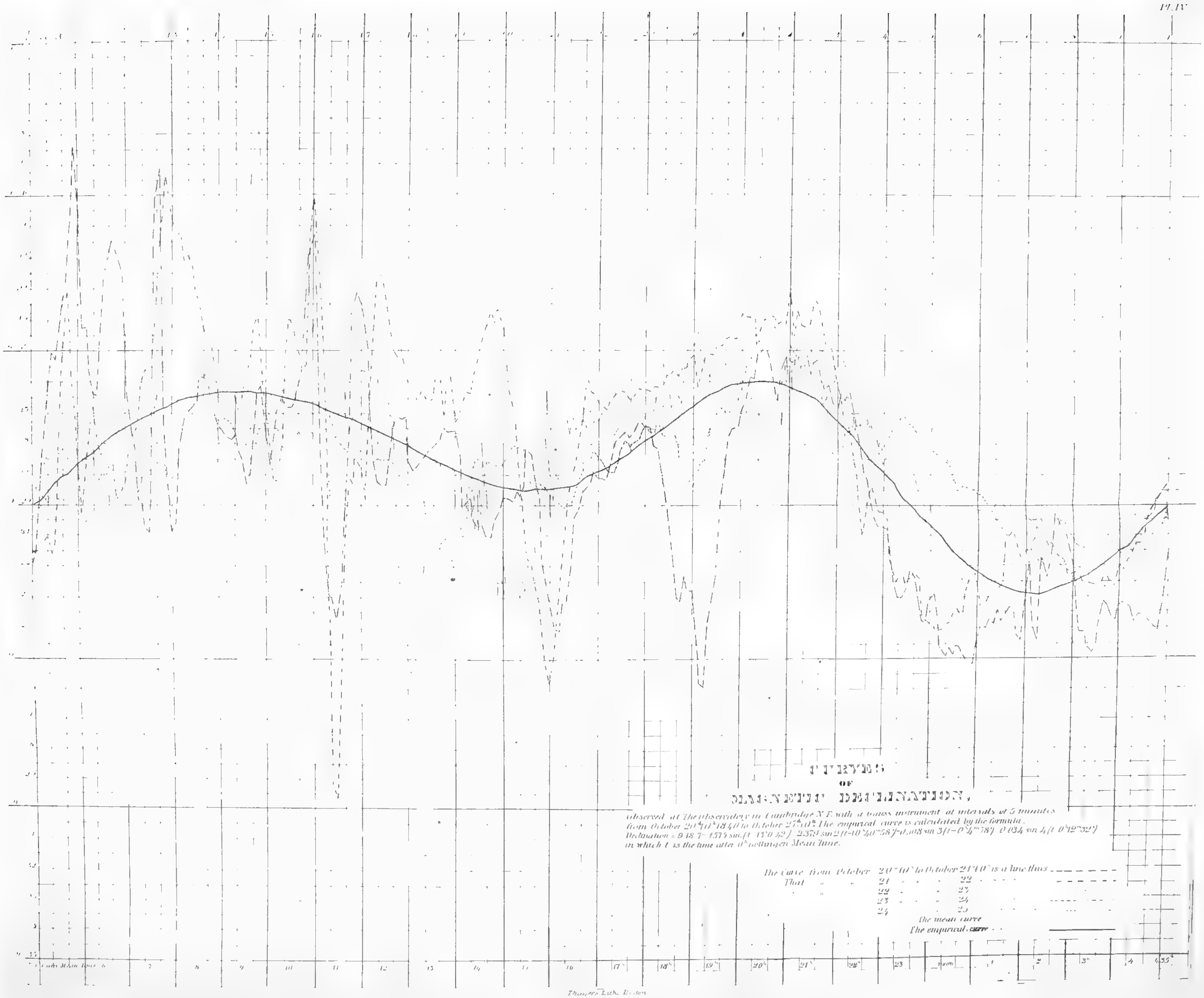


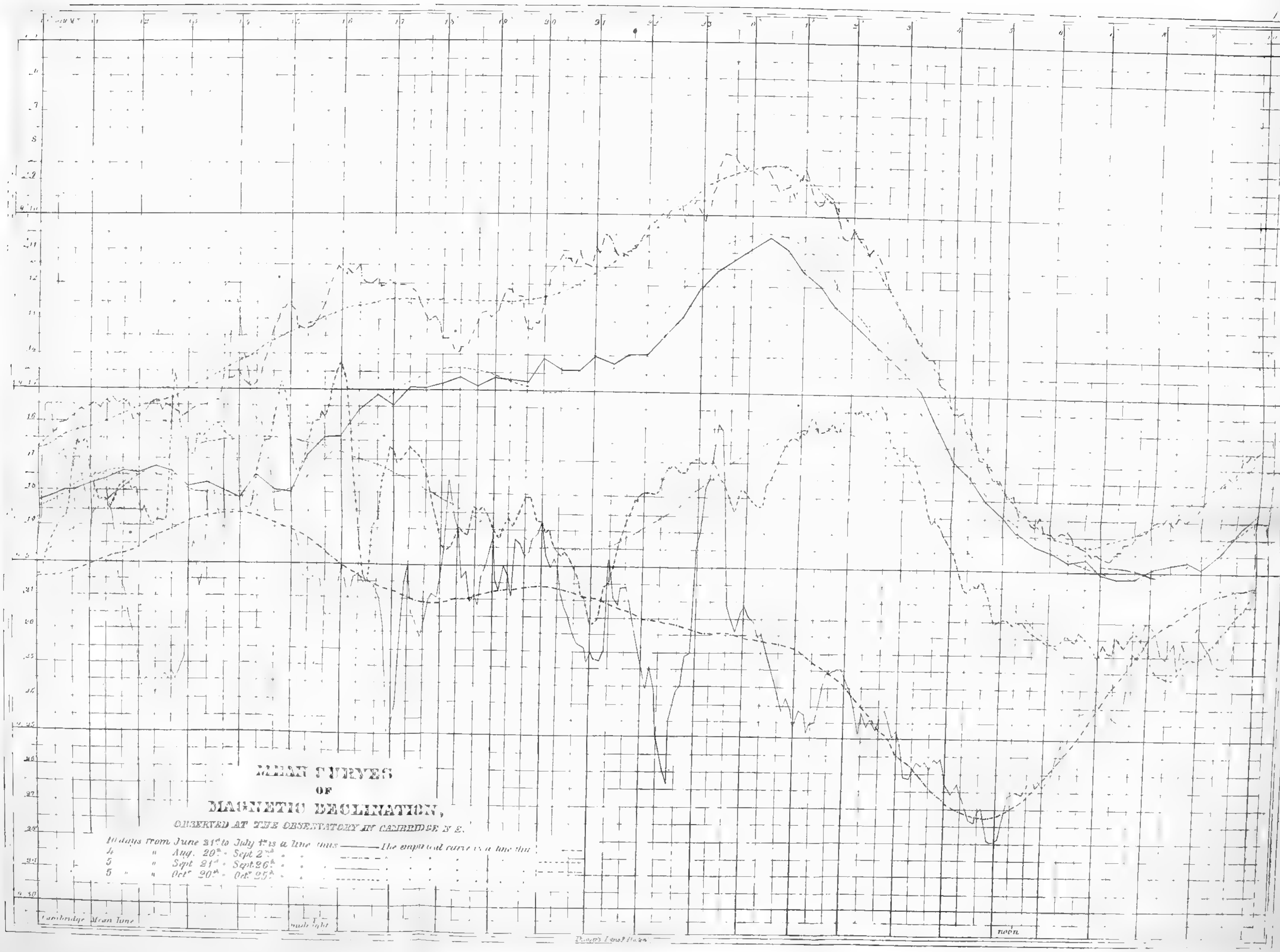
Pl.III.



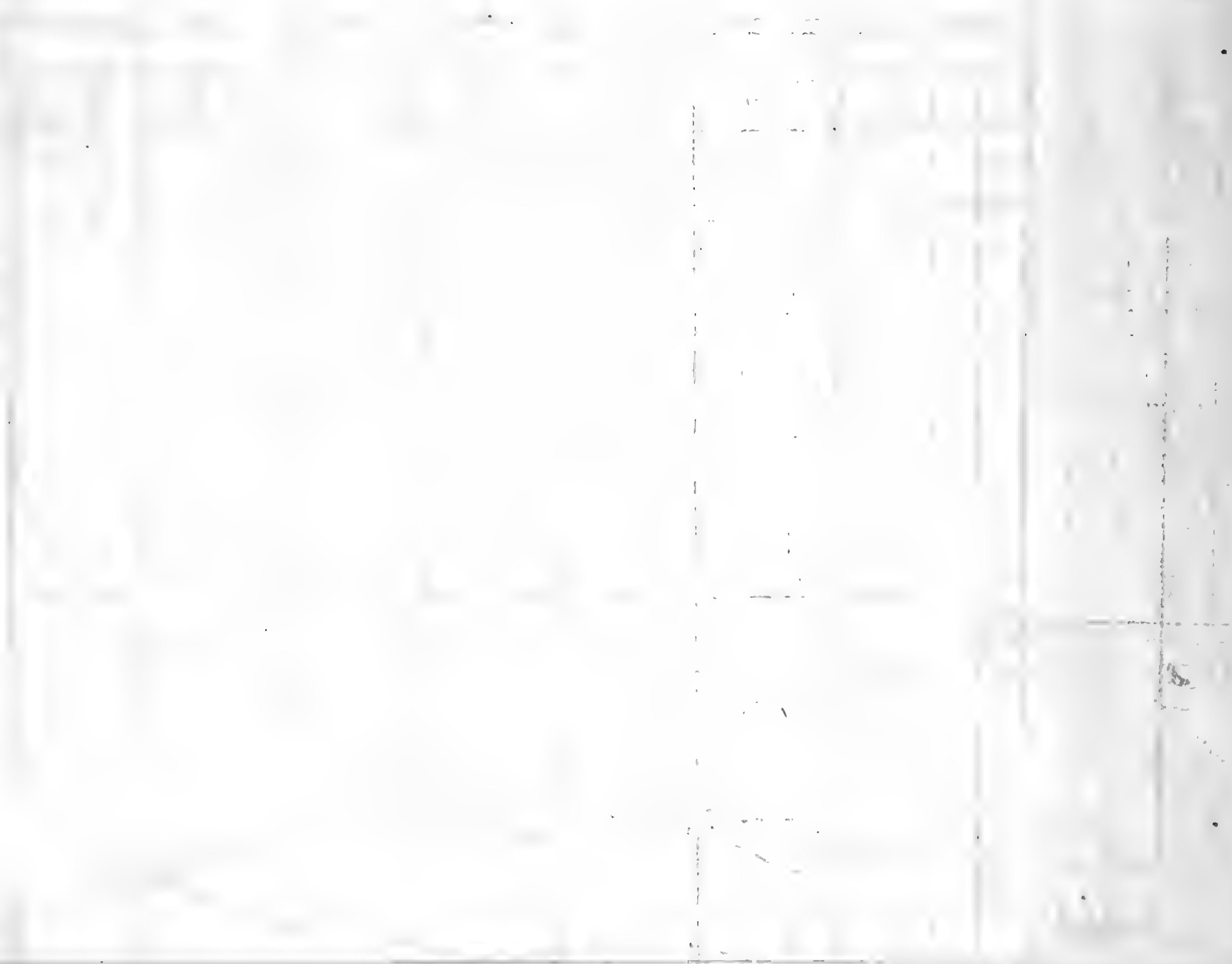
S
LINATION,
nbridge N.E. on Term day Oct. 21st 1840,
ervations.
ns.
Gott. 1
4h
6h
8h
10h
150.0
144.0
138.0
132.0
126.0
124
120.0
118
114.0
111.0
112
noon.
1.45m

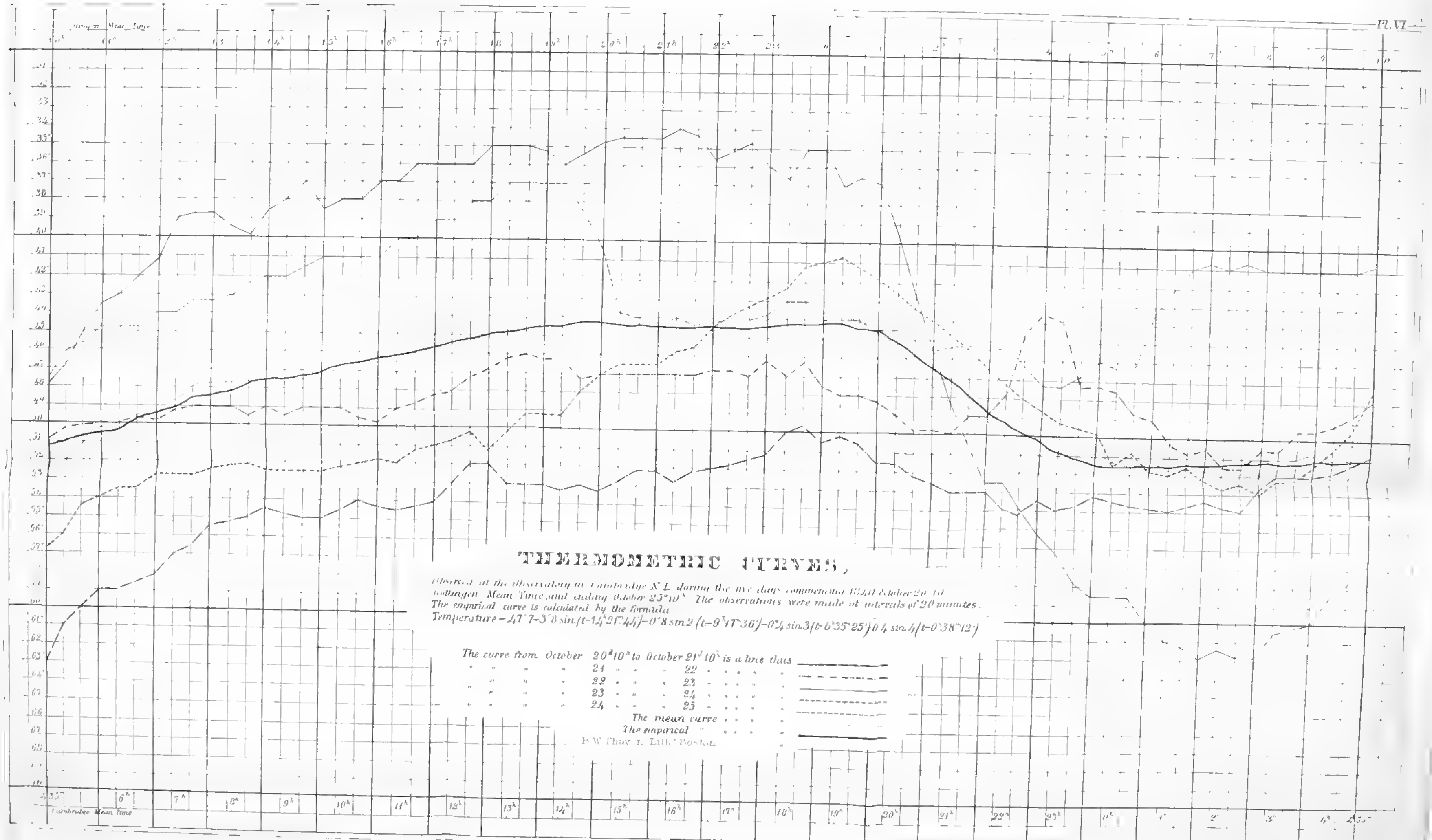

CURVES OF MAGNETIC DECLINATION,
Observed at Toronto U. Canada and at Cambridge N.E. on Term day Oct. 21st 1840.
The upper Curve represents the Cambridge observations
The lower Curve represents the Toronto observations
Arc value of one division 0.72.
Gott. Mean Time.
Midnight
Noon
150.0
138.0
132.0
126.0
120.0
114.0
159.6
103.3.
Fig. 2
Midnight Cambridge Mean Time
Thayer's Lithog. Boston


Pl. IV
CURVES
OF
MAGNETIC DECLINATION,
The mean curve
The empirical curve



MEAN CURVES
OF
MAGNETIC DECLINATION,
OBSERVED AT THE OBSERVATORY IN CAMBRIDGE N. E.
10 days from June 21st to July 1st is a line thus
4 " Aug. 20th - Sept 2nd
5 " Sept 21st - Sept. 26th
5 " " Oct. 20th - Oct. 25th
Cambridge Mean Time
midnight
noon




Pl. VI.
THERMOMETRIC CURVES,
The observations were made at intervals of 20 minutes.
The empirical curve is calculated by the formula
Temperature = 47°7 − 3°8 sin.(t − 14h 21m 44s) − 0°8 sin.2 (t − 9h 1m 36s) − 0°4 sin.3 (t − 6h 35m 25s) 0°4 sin.4 (t − 0h 38m 12s)
The curve from October 20d 10h to October 21d 10h is a line thus
" " " " 21 " " " 22 " " " "
" " " " 22 " " " 23 " " " "
" " " " 23 " " " 24 " " " "
" " " " 24 " " " 25 " " " "
The mean curve " " " "
The empirical " " " " "
Cambridge Mean Time.