REPORTS

OF THE

COMMISSIONERS

ON THE

ZOOLOGICAL SURVEY

OF THE STATE.

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DUTTON AND WENTWORTH, STATE PRINTERS.
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To the Senate and House of Representatives:

I transmit to the House of Representatives, for the information of the Legislature, a Report on Quadrupeds, by Professor Emmons, of Williams' College; a Report on Birds, by Rev. W. O. B. Peabody, of Springfield; and a Report on Fishes, by D. Humphreys Storer, M. D., of Boston: Commissioners appointed to survey the Zoology of the State, under a Resolve of April 12th, 1837.

EDWARD EVERETT.

Council Chamber,
6th April, 1838.

DR. EMMONS' REPORT.

To His Excellency,

EDWARD EVERETT,

Governor of the State of Massachusetts:

SIR,—The subscriber in fulfilment of the trust committed to him by the Executive, to make farther investigations in relation to the animals of this State, offers the following Report:

In the first place, I deem it proper to state the difficulty I met with in satisfying myself as to the manner in which the work ought to be performed. The difficulty arose not from a deficiency of interest, nor a want of importance to a *scientific* public, but from a doubt how the work could be made of practical importance to the community at large; the requirement that it should possess this character, being distinctly set forth in the commission.

After some reflection on the subject, and consultation with the gentlemen associated in the enterprize, it was considered expedient to confine my investigations, in part at least, to the domestic animals. Though this field has been occupied more or less by members of our excellent Agricultural Societies, still, many facts, it was supposed, might be gleaned, highly useful to the public.

In addition to the above, as well as to what has been made public, concerning the animals of the state, in the preceding reports, I determined to figure and describe some of the rarer animals which had come under my particular notice. This part of the work seemed to be left discretionary, as no adequate provision had been made for its execution; but no doubt could be entertained of its acceptability, if correctly performed. Another consideration which has induced me to undertake this difficult task, is the fact, that many of our animals are incorrectly described and badly figured. This is said without imputing to any one of our naturalists, inattention or incompetency. The subject has inherent difficulties, and it cannot be expected that any individual can give a full and correct account even of the animals

of a small district, without the labor of years; and this is emphatically true, when a naturalist attempts to describe all the native animals of this country. In the first settlement of a country, where almost every thing is new, and all is to be learned, it cannot be expected, that correct descriptions of natural objects will be made immediately.

Much time must necessarily be consumed in the collection of materials, and their accumulation is slow; and besides, it requires a certain degree of advancement towards affluence, or at least to be above want, before a community will turn its attention to subjects not recognized as being of immediate utility.

The ultimate end however, of the study of zoology, is the discovery of facts which shall be beneficial to mankind. One reason why this result is questioned by any, is, that *utility* is confined by them within too narrow bounds. Another is, that the true method of study is not understood, and as it is not known that many things are to be learned which cannot be shown to be useful, unless they are links which will lead to the discovery of other important truths, so this class of facts, or this kind of knowledge may be set down for nothing. Every one admits the value of method in all pursuits, the value of a discriminating mind, or in other words, of a correct and sound judgment, and also, what must precede these, a talent and a habit for observation. Whatever therefore, serves to develope this talent and form this habit, and secure the possession of a sound and correct judgment, or in other words, increase the accuracy of the power by exercise, will not fail to be appreciated in those studies and investigations which are acknowledged to produce these effects.

These effects follow almost necessarily from investigation in natural history; it is, in fact, impossible to advance a step without the adoption of method, or, which is much the same, without science; for we cannot consider a subject according to a method, without also availing ourselves of some of the important principles of science. Nature, in conferring characters on the individuals of her works, has made such a subordination of them, that they may be included in certain groups or families, under a few common characters, and in the possession of these characters, there is a common resemblance which is confined to that group or family, and which is also exclusive of all others. The discrimination of character therefore, leads to the ex-

ercise of the same powers as are employed in the detection of counterfeit bills, in estimating correctly the difference of value between two horses, or two farms, or of the degrees of guilt in two criminals arraigned at the bar of justice, or the shade of difference in the meaning of two words. The method of nature has another advantage over any other, in this, that though we may be obliged to stop in our inquiries at a certain point, and though we cannot now see that they bear on the arts of life, or the good of the world, yet hereafter they may be taken up and pursued from the point at which we leave them, without having to go over the previous ground ; they may subsequently be carried out, after light has been shed on the path by some kindred science, to a most valuable purpose in civilized life.

To pursue the preceding views a step farther, we may refer to the advantage of a scientific catalogue of animals, over one arranged alphabetically. If, in the former, the principle of resemblance has been employed to a legitimate extent, then the several groups contain individuals whose external as well as internal configurations are similar in some of their most important features ; again, those groups or families, under some distinguishing name, will follow each other in some regular order, each family will be adjacent to those which it most resembles, while those whose resemblance is remote, will occupy a remote station. A system is thus formed of the series, easy of reference, and in which we may see at a glance the affinities of a whole kingdom. In the latter case it is easy to see, that the alphabetic arrangement is entirely deficient in information and value, except so far as names are concerned. It may be employed like a dictionary of words, and therefore may be employed occasionally for reference, but ought never to supersede the systematic arrangement.

I shall now pass from these general and somewhat desultory remarks, to the consideration of the subjects of this report. Of the domestic animals I have selected the ox as the first for description. The points on which I shall dwell at some length are, his natural history and anatomical structure, his diseases and mode of cure. The zoological characters of the class Mammalia, (the class of animals on which I am directed to report,) are the following, " Animals having mammæ or teats, or which suckle their young." In this class

and in the order ruminantia, or animals which chew the cud, or chew their food a second time, is placed the ox." He belongs to the tribe *bovidæ* and genus *bos*; characterized by the horns occupying the crest, and projecting sideways at first, and being cellular within. The domestic ox belongs to a sub genus, or *bos taurus*. As an individual of this sub genus, he furnishes the following distinguishing marks or characters: whole number of teeth, 30; incisors or cutting teeth six in the under jaw, none in the upper; canine or tusks, none; molars or grinders, twelve in each jaw. The whole is expressed more concisely as follows, incisors $\frac{0}{6}$, canines $\frac{0}{0}$, molars $\frac{6\ 6}{6\ 6}$ total 30.

The native country of the ox is not certainly known, but he was probably domesticated very soon after the flood, and perhaps before, as we have this passage in the 4th chapter of Genesis, "Jabal was the father of such as dwell in tents, and of such as have cattle." The time therefore of his reclamation from the wilds of the forest, as well as his native country, is veiled in obscurity. The effect of domestication in this, as in all other instances, has been to diminish the size of the animal, and extinguish to a great extent the natural ferocity.

According to tradition, the wild oxen of Britain belonged to a very large race, and were very ferocious. Besides this traditionary evidence, there are found, in almost every country of Europe, the skull bones of oxen much larger than those of any of the living races. There is some doubt whether the animals to which these fossil bones belonged, were the parents of the present domestic ox. In this country, also, we have indications of the former existence on this continent of at least two, if not three species which have become extinct. We have also two living species, viz., the bos Americanus, or bison, and the bos moschiferus or musk ox. The former is now driven far westward, but once inhabited the states bordering on the Atlantic; and the latter is now confined to the Arctic Circle, but is supposed to have existed as low as 40° of latitude. Of the extinct species one has been named bos Pallasii by Dr. De Kay. Its skull was thrown out of the earth at the time of the eruption at New Madrid in 1812.

Dr. Harlan has described two other skulls, supposed to belong to two distinct species. One, the bos bombifrons, the other, bos

latifrons or broad-headed ox. The horns of the latter measured twenty-eight inches in circumference at the base. Skulls, and other bones of cattle are abundant at the Big-bone licks in Kentucky, in common and associated with, those of the mastodon. It appears, therefore, that these cattle were contemporary with this latter wonderful animal, and also perished with it, in the same general catastrophe. Without doubt these records of ancient days have a date more distant than the historical era. Such are some of the facts connected with the history of the genus to which the domestic ox belongs.

The effect of domestication in reducing the size of animals is not a necessary one, but is probably the result of severe and cruel treatment, and neglect in furnishing the confined animal with a sufficiency of food: for it is found that, since agriculturists have turned their attention to the improvement of certain varieties, they have increased in stature. But all changes which operate on races, whether they are for the better or worse, must take place slowly. There is, here and there, an individual, which exceeds the ordinary size, but this is usually to be ascribed to more than ordinary attention, and its progeny would not have, without good attention also, the qualities of its parent. This may not be true however, except in cases where the race had deteriorated generally, and the low standard was fixed by time. The size of an animal, therefore, diminishes to a certain standard, when it is neglected or only partly provided for, which in time becomes an established standard of growth. In raising the standard of size or of value, we are obliged to contend with a law of nature, which operates on the progeny even of improved individuals, in order to preserve them of about the same measure and weight as preceding generations. As they come down to a certain point, so they must go up, though, if any thing, more slowly, for a retrograde course is always the most rapid.

These remarks are intended to show the necessity of sustaining the efforts at improvement in cattle, till they attain their ancient stature, or the original cast of the parent stock. Beyond this, it is in vain to attempt to carry improvement; for we are met again by a law which limits the size and dimensions of all the families of animals. What is gained in size, beyond the limits of the species, is lost in

activity. The proportion of food, also, necessary to sustain large corporate powers, is disproportioned to the final value of its parts.

All species of animals have a certain stature to which they usually attain. If they increase much beyond its limits, a loss of power is the consequence; it is the result of disease, rather than healthy action; of morbid growth, rather than the natural deposition of healthy organic matter. If, again, on the other hand, they fall greatly under the natural size, the loss of power and value is no less than in the former case. Disease and an early death are the consequence in each case. The point to be attained or sought for then, is, that size or bulk which belongs to the original conformation. Nature has limited improvements beyond this, and to attempt to pass over these bounds will defeat our own intentions. While on the subject of domestication, it may be interesting to inquire, what are the animals which were designed for this state? To this we may answer generally, that they are those which are social, or which live in families, or seek their prey or obtain their sustenance by concerted movements. Observation goes far to establish this position, and besides these, are reasons drawn from the laws of their minds, if the expression may be allowed.

In a state of nature, all those who associate in this way, acknowledge a head or chieftain; their movements are governed by his, and his wishes they understand. There is a mutual compact for the time being: but the leader or chieftain maintains his place and authority by physical strength, and the class or family is ready to obey a new master, when the former is conquered in combat. This prepares the way for adopting man as his master, when he finds himself in his power, and is able to reward his obedience or punish his transgressions.

In domestication, therefore, there is but a change of masters. There is no infraction of a law of nature in the process, but rather a conformity to one in force in the wilds of the forest. These remarks are applicable to the elephant, dog, horse and ox: they have become the companions of man, and give to his commands implicit obedience. They are truly social animals.

Animals, like man, are also the creatures of habit. Circumstances modify their physical frame and constitution; climate produces a

controlling influence, and changes especially the color of the external integuments, though the flexibility or accommodating powers of their constitutions, is probably much less than that of man. The flexibility of the constitution of the whole genus *bos*, is by no means small. By the fostering care of man, the domestic ox can accommodate himself to any climate. Without this care, the Bos Urus, the Aurochs of France and Germany, the Bison of the ancients, has been an inhabitant of nearly the whole of Europe. It is now to be found in the Caucasus, where are still the royal tiger and the panther ; in Poland, in the forest of Bialowicza, with the wolverine, the Ursus gulo of Lin. and on the coast of Tenasserim, having for its companions the elephant and rhinoceros.

In a domestic state, *treatment* does much either to improve or injure the condition of an individual. Its influence may be seen in the body and disposition, independently of the amount of food it receives. One that has kind treatment, and is caressed by its owner, hardly ever fails of being in a good condition, while, on the other hand, one that is beaten and fears its owner, and flies from his presence, is, most generally, in a bad condition, and is not of half the value of the former.

Hence, in addition to the dictates of humanity, interest should compel us to treat the ox and other domestic animals with kindness, as, without this, a farmer must necessarily fail in all attempts at the improvement of his stock.

When first brought under the dominion of man, and subjugated to the yoke, something like harshness is necessary, till the individual is subdued. This, if followed by kindness, will make obedience more certain ; it will secure a good understanding between the parties. The subjugation will be considered, in the first place, as a matter of right by the weaker party ; it meets with the same trials in a state of nature, and is therefore no infraction of a law of nature, or trespass on the bounds of justice, for experience has taught it harsher lessons, while roaming its native plains and woodlands. When, however, it has submitted to the yoke of servitude, acts of kindness only can secure a devotion to our interest ; if our treatment is marked with cruelty, it rouses a spirit of revenge, or breaks it down to a state of

stupid indifference, and creates, in the room of a faithful servant, a sullen ill-tempered dependant.

The intellect of the ox, though less than that of the horse, is yet of a high character, when compared with a majority of animals. That he is capable of filling the sphere in which he was destined to move, before his reclamation from the forest, is saying no more than can be said of all other animals. His intellect, under a course of education, will advance him higher than what we should expect from his ordinary appearance in a state of servitude.

Under some circumstances, he even exhibits the sagacity of the dog. In South Africa, the Hottentots train their oxen not only to guard themselves but their flocks. In case of war with neighboring tribes, he is sent forward on the battle field, and the herd, moving in concert, overthrow every opposing obstacle, and thus prepare the way for an easy conquest of the enemy. They in fact are both the protectors and servants of the Caffre. What the character of the Caffre ox is, so probably was our domestic ox previous to his galling servitude to the European. He is equally susceptible of improvement under the hand of culture, and equally capable of increasing his amount of service and of value. His fidelity and usefulness may yet be increased during his life, and when put to the stall for slaughter, he may yield a two-fold value to the proprietor.

The ox, in the domesticated state, seems more liable to disease than those species which yet remain unreclaimed from the forest. On this point, however, mistakes may arise from our not being able to observe the condition of the latter. It is rare to meet with any of the wild animals under disease. In original structure and bottom, the ox is firm and sound. The bones of the skeleton are hard and strong, and its general resemblance to that of man is quite striking. The greatest deviation of form in any single bone, is in that of the lower jaw. In man it is short and square; in the ox and all other quadrupeds, except the elephant, it is long and tapering. He differs from man also in the number and form of the metatarsal and metacarpal bones. His apparatus too, for digestion and assimilation, is larger even in proportion to size, and more complicated. In these particulars, and others which might be noticed, the changes are specially adapted to fit his organization to this condition. This is true of all the species of the

animal kingdom. The physical condition of the world once established, all organized bodies are fitted with reference to those conditions. No exception to the law is yet discovered.

In speaking of the diseases of the ox, and their mode of treatment, I shall confine myself to the statement of general principles. I take it for granted, that there is such a resemblance in the anatomical structure of the ox to that of man, that many of the principles which are established in the nature and treatment of disease, apply equally to each. To support this, there may be an appeal to facts. A few will suffice. 1. Our domestic animals are affected by many of the contagious diseases to which man is also subject. 2. The organs and forces which belong to organic life, present the same general phenomena. 3. Disease, involving structural derangement, presents the same morbid appearances. 4. Vital forces are the same in all mammiferous animals. 5. Exposure to atmospheric changes produces the same train of diseases as in the human family, as coughs, colds and consumptions. 6. Medicinal agents act on the same organs in each, and are followed by like effects. 7. Differences in the organs are differences in form, and are not *radical* differences, and amount only to certain modifications which are limited on all sides, the deviation never extending so far as to destroy the unity of the plan of construction. 8. The primary elements which enter into this construction, considered as mere machines, are the same. It is necessary to state here distinctly that we are speaking only of certain general principles, and it is not contended that there are not some differences, but the deviations from one plan cannot be very wide, since both families are fitted for the same physical conditions. When, therefore, so many principles are found to apply or belong to both families, in health and disease, may we not also farther infer that those practices in disease, which are established in particular cases in one, may be extended to the other? May not the experience in one, aid us in the other, or be used as a guide in the application of remedial agents? It is not necessary, however, to theorize, when there are so many facts of the specific action of medicines almost identical in man and beast. In each, opium relieves pain; aloes, senna, jalap, calomel, &c., act on the intestinal canal; nitre on the kidneys; camphor, opium, and nitre on the skin; alcohol on the brain; ginger, columbo, gentian,

and boneset act as tonics. The effect of bloodletting, in subduing and arresting inflammatory diseases, is another instance of the unity of effect in the cases already spoken of, and it may be employed so generally in the diseases of cattle that we never ought to lose sight of it. Too much importance cannot be attached to the employment of this remedy, for nine-tenths of the diseases in cattle, are those of increased action, or of an inflammatory action, and it makes no difference what the organ diseased is, or what function it performs in the system, if it is one of an inflammatory nature. Though each organ performs a distinct office in the system, and though the structures are different, yet inflammation, in its nature and effects, is the same, and is to be combatted by the same general remedies : and at the head of these remedies, in all cases, is bloodletting. Diseases in cattle are well known to be more simple than in man. The simplicity of their diet, and freedom from exciting passions, are the two causes most influential in preserving them from complicated structural derangements, and securing the healthy and regular operation of all their organs. Nature has pointed out their proper food, both in the instinctive choice of that which is congenial, and the instinctive rejection of that which would be injurious, and it is very difficult to compel them to change their natural aliments for those which are artificial.

For the successful treatment of inflammatory diseases, it is not necessary that we should understand the precise change which the organ so affected undergoes ; whether, in the first onset of it, the circulation of the part is less vigorous, or less rapid ; whether the quantity of blood in the capillaries is increased and accumulates in them, in consequence of debility, or not. We know that there is an accumulation, that there are increased heat and pain. We know that abstracting blood, and cold applications are the first natural remedies ; we know that withdrawing from the circulation a quantity of the fluids which act on the excitability of the heart, diminishes its force and thus gives an opportunity for the equalization of the powers of the system and of restoring it to its natural state. It is taking fuel from the fire. Perhaps this is not well expressed. It is difficult to explain some points without conveying erroneous views, and it is as much the case when we speak of diseased action, and the rationale

of remedial agents, as when we attempt to explain the operations of mind, will, free agency and the like.

Of diseases of the inflammatory character, there is probably none so fatal as *murrain*. However it may commence, whatever part it may attack, still it tends to a speedy and fatal termination. This is unquestionably an inflammatory disease, and its seat in the foot, in the fore quarter, side or hind quarter, does not alter its character. When it prevails as an epidemic, it is like all epidemics which attack man, more rapid in its course, and more certainly fatal in its termination. It hurries through its regular stages without giving the sufferer even temporary repose or intervals of abatement. As it commonly prevails in New England, it occurs in sporadic cases, and confines its attacks mostly to the young and thrifty cattle which have been turned into a rich pasture in the spring. The first intimation to the owner of a thriving herd of yearlings, that they are becoming too plethoric, is the finding already dead, one of the finest of the herd. When this is the case, it should lead to a careful examination of the remainder, to ascertain whether there are among them any that are lame or ill, or apparently of too full habit. If one or more be ailing, the first remedy to be applied is blood-letting. The vein in the neck is to be freely opened, that the blood may flow in a full stream. The quantity to be taken depends on the circumstances of the case, or the progress which the disease has made, and it is safer to let it flow till the animal staggers and his pulse flutters under the finger. This is to be followed by a pound and a half of epsom salts dissolved in thin gruel or warm water. If all appear in a healthy state, a safe and prudent course will be to turn them all into short feed for one or two weeks, and, during that time, mix with their salt a quantity of sulphate of magnesia. Such a course will remove a predisposition to the disease, if one exists. The latter course may be pursued even when no disease has appeared. A short dry pasture reserved for this purpose, where they can be exercised, (for cattle do become indolent,) will be of great value to the cultivator of this kind of stock, and save yearly one or more from falling victims to this disease.

To return again to the treatment of this malady, I remark that not only reducing remedies are to be relied upon, but those that heat the system or act as tonics, are to be withheld. The latter would de-

feat the good operation of the former, and render abortive the best of treatment.

The pulse may be examined on the side of the temple, on the lower jaw, or, better, on the left side, just at the point of the elbow. At the latter place we may ascertain the action of the heart. The average number of pulsations in a minute is forty.

The points to be determined in the examination of the pulse are, its frequency, its qualities, whether hard, soft, full or bounding. The strength of the pulse is estimated by the force required to suppress it under the finger.

A very important exercise of the judgment is not unfrequently required in violent and dangerous diseases, for the pulse may be of a deceptive character, not only in the commencement of the disease, but through its whole course, if the termination is fatal. The pulse in these cases will be found rather slow and small, that is, the artery feels smaller under the finger, but is not decidedly hard and wiry; it is rather weak and its motion sluggish, and the first impression would probably be, that the patient was already in a debilitated state. But in the early stage of severe diseases, we must not thus reason or thus decide, without a careful examination of all the symptoms of the case. The heart, which is the centre of the circulatory system, may be obstructed in its movements by an engorgement of blood in its cavities and the large vessels near it, and its free contraction and dilatation may be restrained. It may be drowned like a mill-wheel flooded with back water.

The concomitant symptoms of such a state are, a blood-shot eye, coldness of the ear, horn and extremities, panting for breath, and protrusion of the tongue. The neck will be outstretched, to assist in the efforts of breathing, with a heaving of the flanks. Cases answering to this description would be ranked among the extremes, but they are not hopeless, if suitable measures of relief are adopted and pursued promptly and vigorously.

Here I remark again, that bleeding is the first remedy and the only remedy which will be effectual, as without it, other remedies will not act with sufficient promptitude to save the patient. Bleeding prepares the way for the use of other means, which, without it, would not only afford no relief, but might increase the oppression. Bleeding,

arrests, for a time, the progress of the disease, removes a hindrance to the free circulation of the fluids, brings a temporary respite or mitigation; it does not cure, but opens a prospect of curing, and the final termination will depend much on the course pursued during the interval of relaxation. The next step is the administration of a pound and a half of Epsom salts in warm gruel, to which may be added from 10 to 15 grains of tartar emetic. To secure its operation, it is necessary that it should be given carefully, that is, it should not be poured down the throat hastily and at once, as it will be very likely to fall into the first stomach or paunch, where it will remain inactive, or in a great measure inert. If, on the other hand, it is given slowly, it will be more likely to pass over the opening into this, and pass on to the fourth stomach.

To those who do not understand the effect of bleeding, or other remedies, or who do not know what changes to expect from their operation, either singly or combined, I state farther.—There are two kinds of changes which follow bloodletting, both of which are favorable; they depend on the previous state of the circulatory system. If it is oppressed from engorgement; bleeding, (if its effects are favorable,) will produce a more frequent, fuller, and rounder pulse, or the artery will be more expanded, seem larger in circumference; but, if the pulse, previous to bleeding, is bounding, frequent, or hard, it will be less bounding, less frequent, and softer. The system, in the first case, will be relieved of a load, under which it could not freely act; in the last, there are abstracted from the circulation, fluids, which, by their over-stimulating effects, tend rapidly to the extinction of the vital principle, or the destruction of some vital organ. The first state, is one *preceding* reaction, and in which nature requires assistance to develope; the latter is *one of reaction*, and requires moderating, before any of the vital organs suffer from structural derangement. The first state is one, much like that which follows a blow on the head, the whole system is laboring under a depression, and this may be so great, that the circulation in the capillaries is wholly impeded. The appearances after death in such a case, are black extravasations in the diseased part, or decided mortification. The last is more like the excitation from stimulating liquids, and ends in the suppuration of some part, on which the disease falls. Sometimes some organs are

found in a state of mortification, and others in suppuration, or both states are found in the same organ. It may be well to remark here, that the same train of symptoms does not always follow a state of inflammation, or, in other words, the train of symptoms depends somewhat on the part affected, or on the office the diseased organ sustains in the system. This difference is partly in degree, partly in the rapidity by which a termination is produced. Each organ is to be considered as a part of the whole, and connected with the general system by peculiar sympathies, and each organ in itself as the centre of this train. Now an organ being diseased, its functions are not only deranged, but the functions of some other part are deranged also. Knowing, therefore, the functions of a part, we may know generally whether those functions are deranged; but it is not so easy to determine whether the derangement is primary or secondary, primary or sympathetic. But the course to be pursued, is not so obscure; for the nature of inflammation is the same in all organs, and its results the same; and it is an established rule that the general treatment is the same. The simplification of treatment, in this way, is of great importance, and is particularly well adapted to the simplicity of the diseases of cattle. We have not to be on the lookout for particular remedies in each case, so long as we are in possession of general principles to guide us. A milder state of inflammation than what has been described already, is characterized by dulness, dryness of the muzzle, ceasing to graze or ruminate; increase of heat at the root of the horn, and increase of the number of pulsations in the artery, which will vary from 40 to 80 in a minute, according to the severity of the disease. We are to estimate the immediate danger, by the departure from a healthy state; by this we are to proportion or graduate the activity of the means of cure. In cattle, as in man, after the active stage of the disease is past, tonics may occasionally be useful to restore the stomach to a proper standard of action. But this class of remedies is much less useful than is generally supposed, and in the milder forms of disease, if the first treatment has been proper, they will not be needed. Those of the most value, both as it regards safety and restorative qualities are the cold infusions of columbo, gentian, eupatorium, or boneset, to which may be added ginger, if

an aromatic is wanted. The vegetable class of tonics are, in their nature, adapted to the constitutions of all ruminant animals.

The preceding views contain some of the leading general principles of the nature and cure of inflammatory diseases. More might be said, but it is thought best to leave the subject here for the present. The great object has been to put the farmer in possession of a few established points, that they may supply the place of the irrational and empirical modes of practice which have hitherto exclusively prevailed in this country.

Many of the articles in use by the cow doctor, are not only inert, but filthy in the extreme. Some prescriptions recommend themselves to the farmer because they contain a host of articles; it is therefore thought that some one of them, or all taken together, must certainly cure. But let it be remembered, the more simple the prescription, the better.

The varieties of cattle in New England are evidently numerous. The red cattle bear the marks of the Devonshire breed, and probably differ as little from them as possible, under the climate and mode of treatment they have met with. It is not supposed that any are of a pure blood, except those recently imported. Where care has been taken of young stock, i.e., the ordinary care of a good husbandman, it is believed that the cattle in this state have as much power and as much speed at the plough, as any in the world, even as the best of the Devonshire in their own country. It remains to be shown by experiment, how much the present race may be improved by extra care, or what advantages are to accrue from crossing with the best English stocks. It is the opinion of the writer, that the most feasible course for the New England farmer, is to improve the present mixed race. This race is inured to the climate, is not very deficient in good points, attains a good size; the males are good workers, and the females not deficient in milk. They are a race, like the New England people, who, though descended from the English, retain but few of their characteristics, and having acquired some new ones, are, on the whole, not inferior to the original stock. A fine field is opened to the husbandman, for the improvement of the stock now on his farm, not by expensive, uncertain importation of cattle from a climate essentially different from ours, but by selecting the best of his

present stock for breeders. Much has been said on the best mode of breeding cattle, and undoubtedly on this, as on all obscure subjects, there has been a mixture of truth and error.

In a state of nature, there are few changes for the better or worse. The species attains a certain size, has similar marks from age to age, when living under the same circumstances. But changes in size, color, &c., do occur even in a wild state, yet more limited than in a state of domestication. How many varieties may spring from a single stock, it is impossible to tell. The variation is so great in some cases, that the individuals are considered for a time as distinct species. The practice of breeding in and in, as it is termed, although advocated by eminent men, cannot raise a variety to the highest perfection of which the species is susceptible. For it is evident, that on the principle on which this is advocated, viz.: "that like will produce its like," if the variety has any defects, they too must find a place in the progeny, as well as its perfections.

Besides, the practice of breeding in and in, has another more serious objection, the stock will not hold its own for many generations, but it will finally depreciate till it has become worthless. This rests on a law of the animal and vegetable kingdom. Another question has been discussed in relation to mutual influence of parents on their offspring. Linneus, who was one of the most accurate observers of nature, has satisfactorily elucidated this point. According to him, the male imparts the *external* characters, and the female the *internal.*

The breeding of the jack with the mare, produces a mule,—having the ears, head, skin and tail of the former. The common goat, whose hair is always coarse and useless, crossing with a fine fleeced Angora goat, produces, like the male parent, an offspring, whose coat is also coarse and worthless, but change the order, in the latter case, and the coating is improved. These facts have an important bearing on the improvement of both cattle and sheep. It is hardly necessary to make the application to either of this species of stock; it is sufficient to say, that we need not expect fine wool from a coarse woolled buck, nor a large quantity of milk from a mother whose milk is deficient in this respect; and the principle holds true in relation to quality. The character of the most importance in cows, then, is their milk. It is true, beef may be made of a cow not re-

markable for milk; it is, however, but reasonable to infer, that a good milker will also make beef *easily*, and of a good quality, when she is dried, for the matter for the secretion of milk, will then be converted into meat. The value of a cow does not depend on the number of quarts of milk she gives, but on the quantity of cream. The best method of determining the quantity of cream, is to divide a tall glass into equal parts, or inches, and let the last inch be divided into quarters or tenths, according to the point of accuracy it is wished to observe; let this glass be filled with milk and set aside, the proportion of cream to the milk may then be known by the proportion of the parts it occupies.

To improve the husbandry of this state, it is not necessary to copy the system of husbandry of foreign countries. A successful system in one country is not certainly successful in another. Considerations of climate, soil, exposure, general features, &c., are to be taken into consideration, when a new system is proposed. Besides, the distance from market is by no means to be lost sight of. For instance, the farms of two individuals, equally good as to quality, but located differently as regards a market, would not be equally profitable to the owners by the same course of husbandry. The farm, in one instance, might be turned to the raising of wheat, and, in the other, to the making of cheese. It is evident, that cheese will bear a more distant transportation than wheat; for $1000 worth of cheese may be transported to market with much less expense than the same value of wheat. A gentleman in the vicinity of the metropolis, may turn his whole farm to garden sauce, to great profit; he will, of course, adopt the drill husbandry, but a distance of 20, 30, and 40 miles will prevent the successful adoption of this kind of crop, and this system of husbandry.

I shall conclude this part of my report with remarks on some of the animal secretions.

1. *Fat.* The beauty and roundness of form depends on the accumulation of fat. It is to be considered as a secretion, deposited in the cellular system for certain purposes. It never accumulates, except the animal has more than a supply of food for the immediate wants of the system. Its use in the animal economy is plain, viz., to furnish nourishment when other supplies fail. It is an internal store-house, from which the system draws nourishment in time of

outward famine. Were it not for this, few could survive a protracted illness, and in the winter many wild animals would perish. Accumulating in a season of plenty, and being of the most nourishing substance known, and as it is already animalized or assimilated to the system, it is in a state fit for immediate use, without a laborious change in the digestive apparatus. Thus in sickness, when the animal powers are greatly weakened and unfit for labor, the fat becomes an important store-house; or when food is beyond the reach, it supplies strength till its prey is found, and the calls of nature satisfied.

The consistence of fat is known to vary with the food from which it is formed. It is in itself unorganized, being in this respect like an excretion. It is no more organized than bile or saliva. It is deposited in little cells, in a state as pure as after it is expressed. In the economy of animals, its presence is an illustration of the foresight of the wants of a created being, and such an exhibition of wisdom in meeting those wants, as is worthy of admiration.

The fatty principles derived from animals are very analogous to the fixed oils of vegetables; they are also composed of the same elements, viz., carbon, hydrogen and oxygen. A substance similar to fat has been prepared artificially, by several distinguished chemists. The proportion of the above elements in the fat of animals, is 78 carbon, 11.44 hydrogen, 9.98 oxygen. The composition of olive oil is 77.21 carbon, 13.36 hydrogen, 9.42 oxygen; and of alcohol, 52.17 carbon, 13.04 hydrogen, 34.79 oxygen. Thus nature, from two or three elements, elaborates a multitude of homogeneous or apparently simple bodies. Of this multitude we have no conception, till we sit down and enumerate, one by one, the products of the animal and vegetable kingdoms, all of which are composed, with trifling exceptions, of those simple elements combined in different proportions.

Milk. This well known fluid consists of three distinct substances or parts,—cream, curd and whey,—into which it separates spontaneously by repose. Cream has a specific gravity of 1.0244, according to Berzelius, and consists, in 100 parts, of butter 4.5, caseous matter 3.5, and whey 92. During the ordinary process of churning, it is said that there is an elevation of temperature amounting to three or four degrees; at the same time oxygen is absorbed, and

an acid is generated. But the formation of butter, or its separation from the other elements of cream, does not depend on the absorption of oxygen gas, as it can be obtained when the atmosphere is entirely excluded. The curd which is formed, soon after the separation of the cream, becomes a sort of coagulum, by the action of a free acid, or by rennet. It is considered as pure caseous matter, or the basis of cheese. The action of rennet, in separating the caseous matter, is not well understood, but it is generally supposed to act in consequence of the presence of gastric juice, which is always more or less acid.

Caseous matter yields, on analysis, carbon 59.78, hydrogen 7.42, oxygen 11.40, nitrogen 21.38. When burnt, it yields an ash which amounts to 6.5 of its weight, the greater part of which is phosphate of lime. This substance makes the caseous matter so valuable as an article of food to young animals. It is during this period that the bones require the deposition of this solid earthy matter to give them strength and consistence. Milk, when deprived of cream, has a specific gravity of 1.03, and yields, in the 1000 parts, water 928.75, caseous matter 28, sugar of milk 35, muriate and phosphate of potassa 1.95, with traces of a few other unimportant elements.

The following concise description of a few of the rarer animals of this state, is offered in the room of a general catalogue. This course appeared the most expedient, as two editions of the Geological Reports have been distributed in all the towns in the state, containing catalogues of the animals nearly complete, and in which very few additions or alterations can be made at the present time.

1. Hystrix.

Generic Characters. Teeth. Incisors $\frac{2}{2}$, canines $\frac{0}{0}$, molars $\frac{8}{8}$. Total 20.

H. dorsata, Gmelin. Porcupine. Color black. Feet armed with long and moderately curved nails, 4 on the anterior, and 5 on the posterior feet. Body and extremities covered with coarse hair,

more or less black, inclining sometimes to dark brown, and intermixed with spines, with black tips and white shafts. Tail thick, and 7 or 8 inches in length, and prehensile and ancipitate, or two edged. Herbivorous, living on fruits, grains, barks and roots of trees. Dwells in hollow trees and in dens. The porcupine passes much of its time in sleep, is sluggish in its habits, and clumsy in its form and motions, yet moves with security among the tops of trees. The length of the longest spines is about two inches and a half. These are a formidable means of defence against the attack of wolves, dogs and foxes. When assailed, it immediately throws its head between its fore legs, and erects the spines on its back, and at the same time elevates its posterior parts and tail. If the assailant is within reach, it gives it a smart blow with its tail, leaving the part struck covered with detached spines. Its tail is therefore its weapon most employed in its defence.

Whole length of the animal 26 inches. Highest part of the back about 14 inches. Flesh red and unpleasant, but relished by the Indians. Voice, a plaintive mew, which it utters on being disturbed with a stick or other instrument.

It is quite common on the mountains surrounding Williamstown. Sometimes an Albino of this species is met with.

2. MUSTELA.

Gen. Char. Teeth 34 or 38, $\frac{16}{18}$, or $\frac{18}{20}$, $\frac{6}{6}$, $\frac{2}{2}$, $\frac{8—10}{10—12}$.

Mustela Canadensis Lin. var. Pennanti.

Pekan Weasel, or Fisher Weasel. Fisher. Color mostly black; nose, rump, tail and extremities black, covered with fur and hair; the former, some shade of brown, more or less pale, or inclining to a yellowish; the latter is terminated with black and pale below. In the winter, it is long, and the animal is blacker than in summer. The animal approaches a brownish gray about the face and sides. White spots between its anterior and posterior legs, and a small one on the throat. Whole length 37 inches; tail 13 inches; height at the anterior legs $8\frac{1}{2}$ inches, at the posterior $9\frac{1}{2}$; from the nose to the base of the ear 3 inches. Dwells mostly in

hollow trees: rarely seen on account of its nocturnal habits. Lives on squirrels and other small animals. Is very troublesome on sable lines by robbing the traps of the sable. It is found occasionally on the mountains in the neighborhood of Williamstown.

Mustela *Martes*. Lin. Pine Marten.

Color yellowish brown. Head and margin of the ear whitish. Legs and extremity of the tail black. Long yellow stripe under the neck, and reaching along the space between the legs. Toes 5, armed with slender nails, almost concealed in the thick hair. Whole length 1 foot 11 inches. Length of the body 1 foot 2 inches. Height, at the anterior legs, 4½ inches. This animal lives wholly in trees, and subsists on squirrels and other small quadrupeds. It is rarely seen on account of its nocturnal habits. Is found in the vicinity of Williamstown. The fur is beautiful and much esteemed.

3. LUTRA.

Gen. Char. Teeth, $\frac{6}{6}, \frac{2}{2}, \frac{10}{10}$: total, 36.

Lutra *Canadensis*, *Braziliensis* of Harlan. American Otter.

Color dark glossy brown; pale or whitish about the throat and face. Feet with 5 toes on the anterior legs, and 4, with the rudiment of a fifth, on the posterior. Webbed, short and strong. Body long and cylindrical. Tail depressed at the base. Whole length 4 feet, tail 1 foot 5 inches. Height 10 inches, length of the head 4½. Circumference at the middle of the back, 1 foot 7 inches. Measurements taken from a fine male caught in the Hudson, near Albany. One about the same size was taken in the Hoosic, in Williamstown. Lives in holes on the banks of streams; its principal food, fish, which it takes very expertly. Capable of being domesticated and becoming somewhat familiar. Skin very tough, and covered with the most valuable fur. Value of the skin, about $8.

Note. Length of another individual, 3 feet, 5 inches. From the nose to the root of the tail, 2 feet 3 inches. Height at the fore legs, 8 inches. Length of the skull 4 inches and 3 tenths. Height 1½ inches, breadth of the base, from one meatus to the other, 2 inches, measured on the outside. Greatest width of the zygomatic arches,

2½ inches. Narrowest part of the skull, just anterior to the line of greatest width, 8 tenths of an inch.

4. CANIS.

Gen. Char. Teeth, $\frac{6}{6}$, $\frac{2}{2}$; $\frac{12}{12}$: total, 40.

Canis *lupus*. Wolf. Color reddish yellow in the summer, black along the back in winter, and obscurely striped with black along the sides. Large patch of white beneath the lower jaw, and between the fore legs. Hair short in summer, and long in winter, and in northerly regions it often becomes white. Whole length about 3 feet. Height 2 feet 5 inches, tail, 12 inches. Head 10, ears from 2½ to 3. Length of the skull, from the base of the incisors to the middle of the meatus auditorius, 8 inches. Breadth at the base of the zygomatic process, three inches and a half. Greatest breadth of the zygomatic arches, 5 inches. Breadth of the cerebral mass, over the meatus, 2 inches and 3 tenths. Height over the same line, 2 inches and one tenth. The head is thick, but the snout long and slender, tail tufted with black and white, and never recurved like that of the dog. Anterior legs black in front. Voice a howl. Snaps when it bites, without retaining its hold. Hunts in packs when necessary, apparently with preconcerted movements. Female brings forth 4 or 5 young at a time, which are blind. The wolf acquires its full size in three years. It is capable of domestication, of becoming attached to its captor by kind treatment, yet, like the greyhound, is more forgetful than some other breeds of dogs, and cannot be made watchful of the premises of its master. Length of the individual from which the drawing was taken, 5 feet, measuring from the nose to the end of the shaft of the tail. Length of the shaft of the tail, 14 inches. Length of the tuft at the end of the tail, 3 inches. Height at the fore legs, 2 feet 1 inch; at the posterior, 2 feet 4 inches. From the nose to the base of the ear, 7½ inches, measured over the eye. Length of the ear 3 inches. Circumference, just behind the fore legs, 1 foot 9 inches.

Whole length of the skin of a *black* wolf, 4 feet 4 inches. Tail 12 inches. From the end of the foot to the centre of the back ante-

riorly, 1 foot 5 inches. Height posteriorly, 1 foot 8 inches. From the nose to the base of the ear, 7 inches. Length of the ear, 2 inches, and narrower than in the canis lupus, and the whole measurement shows it to be lower in proportion than the preceding.

5. FELIS.

Gen. Char. Teeth, $\frac{6}{6}, \frac{2}{2}$.

Felis. *Canadensis.* Lin. Lynx.

Color gray, silver gray, with a yellowish tint beneath. Extremity of the hairs generally white, then yellowish brown, and the white extending to the base. Ears terminated with black pencils or tufts, one inch and a half in length ; black at the tips, with a black border on the posterior side. Anterior border yellowish. Base of the jaws surrounded by a fringe of long hair, intermixed with gray, black, and white. Brownish around the mouth, white beneath. Whiskers black and white. Tail terminated with black ; blackish along the back. Legs yellowish. Toes and nails concealed in long silky fur or hair. Whole length, 3 feet 6 inches ; tail, 3 inches. Height at the posterior legs, 1 foot 11 inches ; at the anterior, 1 foot 6 inches. Length of the ear, 1½ inches. The above measurements were taken from a fine male taken in the winter, in the state of Maine. A few years since, there was one killed in Chester, or in the neighborhood of Chester village. It is valuable on account of its soft long hair and fur. It destroys sheep, pigs and other small quadrupeds. Never attacks man.

Felis *rufa.* Bay Lynx. Wild Cat.

Color yellowish, or reddish brown, mingled with darker spots of brown. Inferior parts of the throat and body, white or whitish. Eyes encircled with a whitish band. Front and portions about the upper lip striped with darkish. Irides yellow. Ears short, tufted with black hair, springing from the back of the ear near the tip. Inside of the legs spotted with brown. Tail terminated with dark brown, and obscurely banded. Fringe of hair, longer than the common peleage, near the base of the jaw. Ear surrounded posteriorly with a black border, within which is a triangular patch of yellowish

white. Whole length, 2 feet; tail, 4 inches. Circumference, 14. Three times the size of the domestic cat.

The wild cat stands high upon its legs, has a short tail curved upwards, which makes the animal appear somewhat disproportioned. It resembles, in general appearance, the common cat. It resides in wooded and rocky districts, lives on squirrels, birds, &c., which it takes by surprise. It is very destructive to lambs. It is still found in the mountainous towns in the state, though not in numbers. There is probably but one species of wild cat. The difference of individuals is occasioned by season and food.

Note. Length of another individual, 2 feet 9 inches. Height at the anterior legs, 1 foot 4 inches. Height behind, 1. 5. Length of the tail, 4½ inches. From the nose to the base of the ear, 3 inches. Length of the ear, 1 inch: ear pointed. The number of teeth in this specimen, and it appeared full grown and mature, is, incisors $\frac{6}{6}$, canine $\frac{2}{2}$, molars $\frac{2}{3} = 21$. Last molar in each jaw, very large.

6. CERVUS.

Gen. Char. Teeth, $\frac{0}{6}$, $\frac{0}{0}$, $\frac{12}{12}$: total, 30.

Cervus *alces*. Moose, Moose deer. Black or blackish brown, intermixed with gray. Neck surmounted with a short mane. Head large, and terminating with a large, thick, curved nose; at the extremity is a small muzzle. Nostrils long, slouched and narrow. Neck short, and furnished with a hairy appendage. Head of the male adorned with broad palmated horns. Length, 6 feet 10 inches; tail, 1½ inch. Height, 5 feet 4 inches. Length of the head, 1 foot 11 inches. Ears, 10 inches. Length of the neck, 18 inches. Female is destitute of horns. The moose, which, in the Indian language, means *wood eater*, comes to maturity in five years. The female brings forth two calves in the spring. The rutting season is in October. In the summer, this animal frequents the swamps and marshy grounds in the vicinity of lakes and ponds. It feeds conveniently on the tall coarse grass on the margin of ponds and rivers. Its neck is so short that it cannot feed on the common grass, unless it spreads its legs wide asunder.

It is not at present found in the limits of Massachusetts. It herds together in the winter, eight or ten individuals occupying a common pen or enclosure during the whole season, unless disturbed by the hunters. Its meat is excellent, being tender and well flavored, and tasting more like beef than any other meat. The gait of the moose is a long shambling trot; at every step its hoofs spread apart, but the moment the foot is raised, they are brought together with a crack which may be heard at a distance.

This animal has been domesticated and broken to the harness. Under some circumstances it might be used to advantage. It is desirable that so noble an animal should not be suffered to become extinct. It is, however, difficult to enforce laws enacted for their preservation, so that it is probable, that in a few years not an individual will remain, unless, indeed, enterprising persons should anticipate a profit from domesticating a pair, and raising them for the value of their meat.

The following measurements I have taken from the skulls in my possession:

Length of the skull, from the occiput to the end of the maxillary bones, 2 feet 2 inches. Breadth over the centre of the orbits, 7 inches. From the crest of the occiput to the eye, 8. Height of the upper jaw, over the nasal and maxillary bones, 7¼. From the foramen magnum to the anterior portion of the maxillary bone, 1 foot 9 inches. Breadth of the jaw over the palatine bones and teeth, 5 inches; over processes of the ossa malorum, 7¾ inches. Length of the lower jaw, along the base, 1 foot 6½ inches. Distance from the occipital crest to a prominence between the horns, 4½ inches. From the prominence to depression in the os frontis, 2 inches. Amount of depression in the os frontis, measured from a line drawn from the prominence to the anterior portion of the nasal bones, 1½ inch. From the prominence to the lower end of the nasal bones, 9 inches. From the lower end of the nasal bones, to the extreme of the maxillary, 10½ inches. From the centre of the horn to the centre of the orbit of the eye, 3½ inches. From the tip of one horn to the other, 2 feet 8 inches. Number of prongs, 8. Length of the horn, 2 feet 4 inches.

In conclusion, the undersigned begs leave to say, that most of the

foregoing statements in relation to the animals, were made, as well as the drawings, from the animals before him. That the descriptions will apply to every individual met with, is not expected ; for, on examination, I have found a greater diversity in the coloring than I had previously supposed. But the characters, in the main, together with the measurement, I have no doubt will be found accurate, and applicable to the species.

EBENEZER EMMONS.

Williamstown, Jan. 1st, 1838.

REV. W. O. B. PEABODY'S REPORT.

To G. B. Emerson, Esq.

Sir:—To ascertain the names and habits of our common birds, and to collect the information concerning them required by the present survey, would be a work of no great labor or time. But the great proportion of our birds are visiters; some regular, some occasional, and others accidental. To distinguish accurately between these classes, especially to ascertain which belong to the last, requires more than a single season: and as the purpose of those engaged in the survey, is to give authorities for their statements, it seems obvious that the duty assigned them cannot be well performed within the limits of a single year.

An acquaintance with the birds of our State is desirable on many accounts. The object of science is, not merely to satisfy curiosity, but to serve the wants and comfort of men.

One object of this survey should relate to the preservation of game, if it be an object to preserve it within our bounds. But in this particular, it will not be easy to contend with the order of nature, which is constantly reducing their numbers. When these regions were first visited by civilized men, this kind of food was abundant, being evidently intended to afford resourses for subsistence until the the earth should yield her increase. But, as soon as the earth was subdued, and these resources became less necessary, they began to diminish in numbers, leaving our woods and plains for others where they were needed more; and now, when they would be rather an injury than a blessing, by encouraging habits of idleness in the community, they are almost gone, and legislation will not be able, even were it worth while, to preserve them.

To say that they are almost gone, is speaking comparatively: for, though their present numbers are nothing compared with former times, many are yet to be found. The water birds, which can retreat from persecution, are less wasted than the rest. The land birds are emigrating fast to securer regions. But the wild turkey, thought by many to be extinct in the Atlantic states, is found every year on the Holyoke range near Connecticut river, and other mountains at the west. The Pinuated grous, formerly so common that domestics stipulated not to be fed with it too often, is met with in small numbers in Martha's Vineyard. The ruffed grous, one of the greatest luxuries of the table, is sold in all our markets; and the quail is abundant in our woods.

Still the time is not distant when they must yield to the law of nature. The only chance to preserve them is, to change their habits by domestication, which in some instances is done with success. The Canada goose, the mallard, and some other birds of passage, have been tamed without difficulty; and many others, like the beautiful summer duck, which it has not been thought worth while to tame, will doubtless become dependent on human care. The quail and grous are perhaps too vagrant in their habits; but careful and persevering effort may succeed, even where many attempts have been made in vain.

But a more important object of the survey is to ascertain, with respect to many birds which man pursues with unrelenting vengeance, whether they are really as injurious as is commonly supposed. The crow, the grakles, and other birds of that description, do certainly make havoc with the corn. The cedar birds, robins, cat-birds, and others make large demands upon the garden; but it is certain that the grubs which they devour, would, if suffered to live, destroy all the promise of the year; and while we have nothing but the birds to protect us from these destroyers, there are some means already known, and many others will be discovered, to prevent the birds from taking more than their share.

If any one will consider the subject, he will see, that insects are by far the most formidable enemy man has to contend with. The moscheto, for example, occasions far more suffering, and is actually more feared than the lion. Other enemies, equally contempti-

ble, are busy throughout the summer torturing our beasts to madness, and destroying the comfort of man. The birds are the instruments commissioned to keep down their numbers, and if they are exterminated, how is this work to be done? It may be said, that, if the injurious birds are destroyed, harmless ones will still labor in that vocation; but the misfortune is that all together are not sufficient for the purpose, and if any are exterminated, the evil will grow.

It is well known, that the cultivation of fruit is regarded as hopeless by many, and found discouraging by all who attempt it. And the reason is, not that the birds plunder the trees, but that insects destroy them. The insects then, and not the birds, are the proper subjects of extermination. Means may be found to prevent the birds from taking more than their portion of the fruit, but it is not probable that human agency can contend with the millions of the insect race. If so, we are taking the part of our enemies against our friends; and it may be our persecution of the birds, which has caused the insects to increase in numbers to such an extent, that many doubt, whether, under present circumstances, the more delicate kinds of fruit are worth the trouble and expense of cultivation.

Such are one or two of the practical objects of the survey, which deserve and will receive attention. Many intelligent observers are constantly engaged in this study, and every month adds something to the amount of our information on the subject; so that enough will be gained in point of accuracy and completeness, to compensate for any loss of time.

DR. D. H. STORER'S REPORT.

To His Excellency,

EDWARD EVERETT, ESQ.,

Governor of Massachusetts:

Having been appointed, with several other gentlemen, "to make a further and thorough Geological, Mineralogical, Botanical, and Zoological Survey of this Commonwealth," the departments of Ichthyology and Herpetology were entrusted to me. I was expected to make as faithful and accurate a catalogue of our Fishes and Reptiles, together with a general notice of each species, as our present knowledge would allow. With alacrity, the duty was entered upon,—and, by being enabled to interest some of our fishermen, and several professional friends in various parts of the state, no small advance has been made in the work. In connection with this, a collection of species has been commenced, and presented to the Boston Society of Natural History. So little attention has been paid by scientific men, to say nothing of the community at large, to the branches referred to, that my means of acquiring the necessary information are extremely limited; and my progress, compared with the gentlemen who have undertaken to report upon the other branches of our Natural History, is very slow. Much time and labor are requisite to ascertain and determine species with accuracy, as well as to remove existing errors. The season had so far advanced, when the appointment was made, that many species could not be examined, the common names of which, are familiar to all. In different parts of New England, and even of this state, different species have oftentimes the same name applied to them; and it is absolutely necessary to receive specimens of each, to settle the species. Thus we are able to learn

that the most unpardonable mistakes are sometimes committed, and that the specimens prove to belong not only to distinct species, but frequently different genera.

A pretty little species of the genus *Leuciscus*, and another of the genus *Clupea*, may both be purchased in our markets in the spring and autumn, as the "*Shiner.*" The *Sargus ovis*, a very excellent, and in many markets a highly valued fish, sometimes weighing as much as 15 pounds; and the *Peprilus cryptosus*, a little species, about 8 inches in length, and although by Mitchell, in his "Fishes of New York," called "a delicate fish to eat," used in this State only as manure, are each called "Sheep's-head." The *Squatina angelus* and *Lophius piscatorius*, are both known by our fishermen, as the "*Monk fish.*" The *Pimelodus nebulosus*, and *Anarrhicas lupus*, are each designated "*Cat fish.*" The *Pomotis vulgaris* and *Cephalus brevis*, the one a beautiful little pond fish, a few inches in length, the other a marine species, oftentimes weighing several hundred pounds, are both called "*Sun-fish.*" The most common Sucker in our market, *Catostomus Bostoniensis*, is yearly sold in large quantities as the "*Mullet,*" while as yet, I have not been able to ascertain with certainty, that the *Mugil cephalus* itself, was ever found in Massachusetts.

Many other instances might be adduced to show the necessity of the most careful attention in observing species before attempting to catalogue them. The brief time allowed me for the performance of this duty, has been utterly insufficient for its accomplishment. Anxious to present a *faithful report*, I have made every effort—improved every opportunity, to complete it. Were I fully to rely upon the testimony of others—to consider as scientific authority, the exaggerated accounts ever so freely offered by the well disposed, but credulous; or to infer, because certain species were supposed to have been found upon the American coast, that they would probably exist in the waters of this state, I might readily throw together a large mass of incongruous materials, and with comparatively little labor terminate my task. But to perform accurately and thoroughly the duty expected of me—to answer the demands of those, by whose partiality I have been selected, and to serve whom I am proud—I would rely in the investigation of species, so far as practicable to obtain them, upon the evidences alone of my own senses;—I would com-

pare all which are doubtful, with those with which they may be confounded ;—I would never admit a single species into the State's catalogue, which could be at a future day disproved, or even doubted ;—preferring, that further investigation should add hundreds to the list, rather than that *one* should ever be erased from it.

Trusting, that the reasons I have offered, may be considered sufficient for my catalogue not being prepared—and that another season will be allowed me to collect the needed materials, I would present the following general observations upon the subjects submitted to my attention.

No branch of Natural History has been more neglected in this country than Ichthyology—nor is this surprising. The beauty or facilities of acquiring the different species of Birds and Insects, and Shells, and Plants, and Minerals, have ever rendered *them* objects of study. While the disgusting appearance of several species ; the difficulty of procuring many, and of preserving even our most common Fishes, have caused them to remain almost entirely unnoticed. When the importance of the subject, however, is considered—the universal distribution of this class of animals is recalled—in some countries, being an important article of commerce ; in others, the principal subsistence of a great portion of the people—it deserves equally the attention of the scientific naturalist and enlightened economist.

Innumerable instances might be adduced to show, that immense sums had been in former times, expended for certain species,—that sea and land have been compassed to gratify depraved appetites, and pamper the insatiable epicure. That a Prince should ever have been such a glutton as to have expended 300 rubles for a *Sturgeon soup*—or, a German Countess, so regardless of the necessities of those around her as to lavish the larger portion of her income in the purchase of *Turbot's liver*—or, that a single Mullet, should ever have been considered worth between 60 and 70 pounds sterling—that such, and many other similar examples of prodigality which might be adduced, serve only to point out instances of uncommon extravagance, and do not awaken the slightest interest with regard to the real utility of the subject, is obvious. I shall, therefore,—avoiding all reference to whatever is extraneous to my subject,—take a glance at those Fishes found

in our waters, which are of value to this people, and which may be made more important, than they now are.

This class of animals is divided by Naturalists into two series—dependant upon their anatomical structure. These series are subdivided into orders—and these again into natural families, which include numerous genera and species.

The family Percoides—Perches—contains but few species which are in common use among us.

The *Perca flavescens—yellow perch*, is found in most of the ponds of the State, and is a good edible fish.

Two species of *Bass* are useful—*Labrax mucronatus—white perch*—is taken in Spring and Autumn in the ponds to which the sea has access, and is readily sold in the market.

Labrax lineatus—striped bass—at some seasons is brought into market in considerable quantities, and sold in the fresh state ; and in 1836, a small number of barrels (sixty-seven,) were packed and inspected.

The *Pomotis vulgaris—pond perch*—is seldom seen in the market, but is nevertheless a very good fish.

Few as are the species among us, of utility, I might point to almost every one of the more than fifty genera which compose this family, as furnishing species important to the inhabitants of the countries in whose waters they are found.

In the 2d family—*Buccae loricatae*—not a single species of the numerous genera is employed ; while the *Sebastes Norvegicus—Norway haddock*—and the *Cottus Groenlandicus—father lasher*,—or, as it is more generally called, *sculpin*—are considered, the one in the North Europe, and the other in Greenland, very palatable food.

The family Sparoides, furnishes the *Sargus ovis—sheep's head*—every where considered an excellent eating fish,—and the *Pagrus argyrops — scapaug* — a very common and useful species in the south-eastern markets of the State.

Passing to the family Scomberoides, we find many genera of fishes, of infinite importance in an economical and commercial point of view. To the seaman, the *Pelamys sarda*, improperly called here *Bonito*, is a very acceptable meal. Not only is the *Xiphias gladius—sword-fish*, salted and eaten by the Sicilians, but is be-

coming an article of commerce with us. About 200 barrels are annually taken at Martha's Vineyard, which are either sold fresh, or cut into slices and pickled or salted, and kept for sale in that state, throughout the year. The *Temnodon saltator—blue fish*—is taken at Nantucket in large numbers, and is highly esteemed by the inhabitants of that island. But the genus *Scomber—Mackerel*—is of infinitely more importance, than any other of the family. Two species are found upon our coast in immense quantities—the *grex* and *vernalis*—occasionally two or three other species are also taken, they are however all known under the common name of *mackerel.*

In the Mackerel fishery, so large an amount of capital is invested ; so many are immediately interested ; so great, in a word, is its importance, that I feel the following data will not be considered useless. I had hoped to have presented an accurate list of the number of vessels engaged in this fishery, in every town in the state—the number of men employed—the capital expended—the quantities of fish taken—and the gross proceeds ; but disappointed and chagrined in my means of obtaining information, I have been unable to collect perfect materials, and can only offer the annexed statement, which may serve to direct public attention to its importance.

Although as *fresh fish*, mackerel are sold in the markets along our whole coast, for several months in the year, and are considered by *all*, excellent food, (from 6 to 8000 barrels being sold annually in Boston market alone,) their great value to this people, arises from the means of employment afforded to an immense number, by the process of salting and packing.

Those packed in 1836, were furnished by the following towns :

Boston,	40,559	barrels.
Gloucester and Manchester,	43,937	
Newburyport and Newbury,	21,463	
Welfleet,	17,500	
Provincetown,	14,139	
Hingham,	13,882	
Cohasset,	11,700	
Barnstable,	4,115	
Scituate,	3,782	

Yarmouth,	2,446 barrels.
Salem and Beverly,	2,394
Plymouth,	1,477
Lynn,	1,400
Duxbury,	1,000
Charlestown,	822

At the prices these fish were worth in November, 1836, the value of the year's fishing, amounts to 1,264,012 dollars.

The whole number of barrels of mackerel, inspected in Massachusetts for the five last years, are as follows :

1832, 224,000 barrels : 1833, 225,000 : 1834, 253,000 : 1835, 197,000 : 1836, 180,616.

Although it would seem, from the above table, that a smaller quantity of mackerel had been packed in 1836, than the several years immediately preceding it, yet it cannot be inferred, from this circumstance, that fewer vessels were engaged, or that the business was considered less important than before. In some years, immense shoals of these fishes are readily met with, and the vessels return in a few weeks, with full cargoes ; while the same localities may be visited at other seasons, and the efforts of the fisherman prove fruitless, and his fare meagre indeed.

So peculiar are the habits of this Genus, that oftentimes weeks may pass, the fishing-smacks be surrounded by millions sporting upon the surface of the ocean, and scarce one allow itself to be taken, while again, the success of a few days will relieve the disappointments of nearly a season.

Thus, a fisherman informs me, that the last season, (1837,) having been to the bay of Chaleur, and taken but few fish, the vessel to which he belonged, was returning home, when, off Cape Cod, the fish were so numerous and voracious, that the crew, consisting of 10 men, captured in 2 hours, nearly 30 barrels of them. At this time about 200 smacks were together, and they were all equally successful, some of them, taking even 40 barrels of fish.

After being carefully inspected, these fish find a ready market in Philadelphia, New York, Baltimore and New Orleans, and from

this last port, they are sent over the entire western country. The inferior quality are shipped to the West India islands.

I have not been able to learn with accuracy the number of vessels engaged exclusively in this fishery; in many towns, the same vessels are used at different seasons of the year for the Cod as well as the Mackerel fishery. I have ascertained however, that there were 202 vessels employed in this fishery in 1836, in the county of Barnstable, and that of this number, 98 belonged to Provincetown, which were valued at $147,000.

In the family Gobioides, the *Anarrhicas lupus—Sea-wolf*, is not only eaten by the inhabitants of several countries of the north of Europe, and considered by *them* excellent food, but is even *here* esteemed by many, and thought inferior to but very few of our fishes.

In the family *Labroides*, the *Labrus Americanus—Tautog*, is taken in considerable quantities upon some portions of the coast, and in its *fresh* state finds a ready sale in the larger markets. I am informed that in 1836, *three* smacks were constantly employed in the harbor of South Wellfleet, in the Tautog fishery, from April to November, and that it was a profitable occupation to those engaged in it.

At New Bedford, 300 pounds of *fresh tautog* have been sold by a single market boat in a day. This fish is also pickled at the last place, and may be kept in a weak brine for a long time—in this state, they are considered by epicures, a great delicacy. The *Crenilabrus burgall* too—*Marine perch*—or, as it is most commonly called, "*Cunner*," is for several months in the year, taken along our whole *sea-board*,—not only by the fishermen's nets in myriads, but by the needy and destitute, from our wharves and bridges, and is one of the most common, as well as excellent species found in our waters.

The family *Cyprinidæ* includes many of our fresh water fishes, which, although not extensively used, are very good food.

Thus several species of the genus *Catastomus—Suckers*—are frequently found in our market in considerable numbers: so also of the genera *Cyprinus* and *Leuciscus*, the species of which being equally palatable, and somewhat similar in their appearance to the

European species, have received their names of *Carp*, and *Bream*, and *Roach*, and *Dace*, and *Chub*.

But few genera of the family *Esoses*, are found in our State. These, however, are far from being valueless. The *Esox reticulatus—pickerel*—a very common species, is by many considered a great treat. A species of *Scomberesox—bill-fish*—is collected by the inhabitants of the towns upon Cape Cod in large quantities in the autumn, at the appearance of the first frost, and thought very nutritious and grateful food. And the *Exocetus volitans—Flying-fish*—is no unpalatable meal.

The family *Salmonides* includes several genera of fishes, which for delicacy and richness are not surpassed. Previous to the separation of Maine from this state, large quantities of the *Salmo salar —salmon*—were packed—thus, in the year 1818, 2,381 barrels were inspected. Since that time *none* have been inspected. The building of dams and manufacturing establishments, by preventing the fishes from going up the rivers to deposit their spawn, has almost entirely annihilated them in this Commonwealth. About 17 years since, two waggons, each bringing from 30 to 40 fine salmon from the Merrimack river, supplied the Boston market every week during the season of the fish :—now, the few specimens taken are looked upon as rarities, and our market is enriched by the fishery of the Kennebec.

The *Salmo trutta*(?)—*Salmon trout*(?)—exists in considerable quantities at Sandwich, where not less than 1000 pounds are yearly taken.

The *Salmo fortinalis—Brook-trout*—often acquires considerable size, and when brought to market, meets with a ready sale. The *Osmerus viridescens—Smelt*—which is an universal favorite, is taken in great numbers in the spring and autumn, and through a great portion of the winter. In *Watertown* alone, about 750,000 dozen are taken annually in scoop-nets from the *first of March* to *the first of June*—and sent to Boston market.

The family *Clupeæ*, are among our most valuable fishes. The *Clupea vernalis—alewife*—is taken in immense quantities still, in several parts of the state, although in several places where they have heretofore been most abundant, the various encroachments of man have sensibly diminished them. A larger quantity of *alewives* are

packed, than of any other species of this family. In 1832, 1730 barrels were inspected : 1833, 2,266 : 1834, 4,320 : 1835, 5,600 : 1836, 5,000.

At *Watertown*, the average quantity of alewives for the last ten years, is 700 barrels. They are first pickled, then salted and barrelled, and sent to the West India Islands. They sell for $1.50 to $2.00 per barrel. At *Taunton*, which for years was so celebrated for its fishery, the alewives are gradually lessening. There are two or more dams across the Taunton "Great River," so called, which impedes their progress very much; and on the "Little River," where many dams and factories have been erected; and where, twenty years ago thousands were taken, not one is to be seen. Twenty-five years since they were taken in such abundance, that they sold for 20 cents per hundred, and a great business was carried on by barrelling and shipping them to the West India market.

The *Alosa menhaden — Pauhagen — Hardhead* or *Menhaden*, is also a very useful fish. In the summer season, it is taken in large quantities upon our coast, and used for *mackerel bait*, *manure*, and is also becoming an *article of commerce*. For the former purpose, it is worth from $2 to $4 per barrel, in proportion to the demand. At Lynn, in 1836, 1500 barrels were used for bait for other fishes, and as many more were thrown upon the land. At Provincetown, they are used only for mackerel bait. At Sandwich, where they are very abundant, the inhabitants strew them upon their lands by the cart-load; and thus for miles, immense quantities enrich the soil. It is computed that a single menhaden of ordinary size is equal in richness to a shovel-full of barn-yard manure. It is getting likewise to be thought worthy of preservation as an article of food. In 1832, 300 bbls. were inspected; in 1833, 480; 1834, 1008; 1835, 1443; 1836, 1488.

The *Clupea harengus*(?)—*common herring*(?)—is in some seasons taken in great numbers. The quantities of herring packed and inspected according to tables kept at the General Inspection office for the last five years, are as follows: 1832, 52 bbls.; 1833, 36; 1834, 518; 1835, 963; 1836, 77. That a small quantity only of the *herring* taken, are packed, is obvious, from the fact, that in 1836,

500 bbls. were taken at Falmouth; 400 bbls. at Duxbury, and 3000 at Martha's Vineyard.

Upon some portions of our coast, *herring* have been limited in quantity for the few last years, and during the last *two years* very few, comparatively speaking, have been taken. Their scarcity has been attributed by the fishermen to *torching* them at night, by which the shoals are broken, and the fish frightened away.

The *Alosa vulgaris—shad*—is taken in several of our rivers in large quantities, at some seasons of the year, and quite a number of them are packed. In 1832, 100 bbls. were inspected; 1833, 321; 1834, 3; 1835, 310; 1836, 527. The quantities taken in Charles river at Watertown, for the five last years, have averaged about 6000 per annum: from 3000 to 4000 are yearly caught at Taunton. Those taken at the former place, are usually sent to Boston market, and sold at 25 cents each. Those caught at the latter locality are for the most part disposed of at the seines (fresh) and cured by the purchasers. When first taken, they sell for 100 cents per hundred—and as the season advances, diminish gradually in price to 50 cents.

No family of fishes, however, found in the state, presents a greater number of species of real utility, than that of the Gadites; and no species in the whole catalogue of our Ichthyology, is of greater importance than the *morrhua vulgaris—common Cod;* supplying our markets with an excellent food throughout the year, and giving employment to thousands. In some portions of the State, this fishery is entirely superseded by the taking of *whales.* Thus, while every town in the county of Barnstable, is more or less engaged in this business, and collectively exhibit an aggregate of 212 vessels, but a single fishing-smack was licensed in Dukes' County, in 1836, —and *not one* in the county of Nantucket—the attention of the inhabitants of the last two counties, being entirely engrossed in whaling.

Imperfect as are the following data, they may not be thought valueless. I have been able to ascertain that, in 1836, there were engaged in the cod fishery, from Gloucester, Marblehead, Provincetown, South Wellfleet, Cohasset, Duxbury, Plymouth, Manchester, Salem and Beverly, being *ten* towns, 561 vessels, having crews of 3816 men—and that by these vessels there were taken 263,454

quintals of fish. To these may be added the towns of Newburyport, Lynn Falmouth, Holmes Hole, and Sandwich, (in which I have not been able to learn the number of vessels exclusively employed in this fishery,) which furnished in 1836, 16,265 quintals. Thus exhibiting 279,718 quintals of cod fish, taken by the enterprise of the citizens of 15 towns. When it is observed, that about 3500 of the cod fish from the Grand Bank, (which are generally much larger than those from the Straits of Bellisle,) constitute a hundred ~~single~~ quintals, some conception may be formed of the immense number taken. At the usual price of these prepared fish, the above mentioned number of quintals would sell for $839,154.

Besides these *fishing vessels*, a great number of *boats* are constantly employed in supplying the markets with *fresh fish*. Thus, at Duxbury in 1836, there were 10 market boats, having 40 men on board, which took from 38,000 to 40,000 fish. At Provincetown, there were *ten boats* thus engaged. Boston market is supplied with cod fish by about 15 or 20 small schooners, and a large number of boats. By the kindness of Capt. Nathaniel Blanchard of Lynn, master of one of these smacks, I am enabled to furnish the following table, by which some idea may be formed of the amount of *fresh cod fish*, brought to our market. He has presented me the result of his labors with a vessel of 25 tons, and a crew of 6 men, for nearly 5 months, commencing October 24, 1836, and terminating March 20, 1837. His account exhibits the number of fish taken, and the price obtained for the same for each day during that period. From this minute statement, I am able to ascertain, that the *largest quantity* taken any one day, was 7124 pounds—December 13th—which sold for 5 shillings per hundred=$59.39.

The *smallest quantity* taken any one day, was 337 pounds—January 16th—which sold for 12 shillings=$6.67.

The *smallest receipts* were March 20th, when 359 pounds taken, sold for 10 shillings 6 pence=$5.92.

The whole number of pounds taken during the period mentioned, were 194,125.

The entire receipts for the same, were $3,026.14.

Besides the value of the fishes themselves in a fresh and dried

state, large quantities of *oil* are extracted from their *livers*, which is sold for about $15 per barrel.

Immense shoals of the *Morrhua aeglefinus*—*Haddock*—are found on our coast in spring, and continue through the season until autumn. Large numbers are sold in the market—and during the entire summer it is generally eaten by the poorer classes, who are often able to obtain a fine fish weighing several pounds, for one or two cents. When taken in larger quantities than can be disposed of in market, they are frequently strewed over the earth for manure.

Until within a few years, the *Merlangus pollachius*—*Pollack*—was but slightly prized,—and the fishermen had so little demand for it, that they not unfrequently gave it away from their boats. Its useful qualities are beginning to be known and valued—and in several of the interior towns of the state, it is now as readily sold as any other fish. When salted, it was formerly the habit to throw them at once into old brine to increase their weight, which it did at the expense of their goodness. It is ascertained, that, when prepared in the same way as the cod, when intended for *dun-fish*, with proper care and good salt, this is really an excellent fish—and its value is increased from 9 shillings to from 3 to 4 dollars per quintal. Immense numbers of this species are found in our waters, in spring and autumn. To Jeffries' ledge, a fleet of 20 or 30 boats frequently go off in the fall of the year, and having fastened their craft together, and thrown over-board a quantity of bait to entice the fish, capture in a single night from 30 to 40 quintals of *pollack* to a boat.

The *Phycis longipes*—*Codling*—known by the name of *Hake*, along our entire coast, is taken in considerable quantities, and when salted, is exported to the West India markets.

The *Brosmius vulgaris*—*Cusk*—and *Merlangus vulgaris*—*Whiting*—are also excellent fishes—but are not found in our markets in great quantities.

The little *Morrhua tomcodus*—*Tomcod*—is by no means valueless. The amount of *Tomcod* taken at Watertown alone, is estimated at 2,000 bushels annually—they are sent to Boston market, and readily disposed of there.

Several valuable species are furnished us by the family, *Plani*—the most important, however, is the *Hippoglossus vulgaris*—*Hali-*

but. The flesh of this fish is rather coarse and dry, but is by many highly esteemed. An unusual number of this species were brought to Boston market in the early part of 1837, and were all sold at considerable profit. Eighty large schooners of from 60 to 80 tons burthen, belonging to Cape Ann were thus employed. *Smoked*, this fish is quite a delicacy : and when *dried*, as is the usual habit with the Greenlanders, it is, I can affirm, far from uninviting.

Among the *Anguilliformes*—the *Muraena Bostoniensis*—common eel—is taken along our whole coast, as well as in the rivers and ponds of the state. In winter, great quantities are *speared* through the ice :—those taken at this season, however, are not as large, nor is their flesh as rich, as those which are captured in summer.

The markets are usually supplied from the rivers, where they are taken in nets. At Medford, nets are stretched across the river, having in their middle a large bag, capable of containing from 15 to 20 bushels : as the eels are going up or down the river, they are thus caught ; and are kept alive for the supply of the market in large ditches excavated near the river, which are supplied by the tide with water. About 3,000 pounds are yearly taken at Watertown.

Although many *species* and even *genera* belonging to the second great division—*Chondrop terygii*—*Cartilaginous fishes*—are made useful in other countries—they are almost entirely neglected with us. The *Acipensor sturio*—*common sturgeon*—in the north of Europe, not only furnishes, by its flesh, an acceptable food ; but its *air-bladder* is converted into *isinglass*, and its *roe* into caviar.

The *Raia clavata*—*Thornback*—when salted, is eaten by great numbers of the poor in many parts of Great Britain. And the *Petromyzon marinus*—*Sea lamprey*—is highly esteemed there, as an article of food. I am not aware that any species are taken for *use* by our fishermen, save the *Carcharias glaucus*—*Blue Shark*—and the *Spinax acanthias*—*Picked dog-fish*—and these only, occasionally ; although both, at some seasons of the year might be taken in large quantities, and would prove of no inconsiderable value. The *liver* of the former furnishes a *valuable oil. Seven gallons of oil* are not unfrequently extracted from the liver of a single fish. And although it is generally used only by the *curriers*, yet, when carefully prepared by boiling the *fresh liver*, it is as good as *whale oil*,

to burn. The *Dog-fish* is a very useful scavenger to the fishermen, by cleaning the bottoms upon which they have thrown their offal, when preparing their fish for market. Its liver is boiled for the oil it contains—and its skin is considerably used for polishing by the mechanic.

Some idea of the immense quantities of fishes taken by the fishermen of several of our towns, may be learned from the following extract from a letter of my old friend, Capt. Blanchard, of whom I have already spoken—one of our oldest, most experienced, most worthy fishermen. He says, "I have made an estimate of the fish caught by the fishermen of this place (Lynn), and I find, that there are four millions, six hundred and eighty thousand pounds caught in one year :—which is a little more than a quarter of a pound, to each inhabitant of the United States of America. (This quantity of fish consists of cod, haddock and halibut.) There are nearly three hundred and twelve thousand *pohegans* used for bait—and nearly as many thrown away, and strewed on the land for manure."

Thus have I taken a general survey of those species of fishes, which are in most common use among us. These observations might have been much more extended—but, desirous of awakening attention to this branch at this time only in its commercial bearing, I have endeavored to confine myself strictly to the *uses*—the *immediate importance* of its subjects :—intentionally avoiding many points, which might be highly interesting to the naturalist.

Note. In collecting the facts herein embodied, I have received from many gentlemen, essential aid—and it affords me great pleasure to extend my acknowledgments to the following :—Hon. Hezekiah Barnard, Nantucket—Henry Blood, Esq., New Bedford—James C. Doane, Esq , Cohasset—C. R. Vickery, Esq., Taunton—Solomon Lincoln, Esq., Hingham—L. J. Presson, Esq., Gloucester—Thos. Kidder, Esq., of the General Inspection office, Boston—Mr. Jonathan Johnson, Nahant—and Drs. Chandler Flagg, Marblehead—Henry Tuck, Barnstable—H. Willard, Provincetown—D. Davis, South Wellfleet—Charles. O. Barker, Lynn—H. C. Perkins, Newburyport—Leroy M. Yale, Holmes Hole—Hiram Hosmer, Watertown—A. Cornish, Falmouth—Horatio Robinson, Salem—E. H. Bartlett, Duxbury—W. Warren, Plymouth—John Appleton, Gloucester,—J. B. Forsyth, Sandwich :—to no individual, however, am I so deeply indebted, as to Capt. Nathaniel Blanchard, of Lynn, who has not only freely and promptly answered my numerous queries, but throughout the season has exerted himself to procure for me such fishes as he knew I wished to examine.

HERPETOLOGY.

Less than forty species of Reptiles have as yet been found in Massachusetts—and these are scarcely known even by our Naturalists. Unattractive for the most part, in their appearance—their habitats not easily ascertained ;—their importance not considered ;—they are generally neglected, as objects unworthy attention, or to be avoided for their imagined detriment.

Investigated, we find almost every species of more or less utility, and *one* only possessed of any noxious power.

The order *Chelonia* comprises our Tortoises. Of these, the *clausa*, *picta*, *punctata*, and *serpentina* are each used as articles of food ;—the last of these, being the largest species, is more generally eaten, and considered quite a delicacy when made into a soup. The *oil* obtained from this species is carefully preserved in many portions of the interior of the state, for its supposed virtues in bruises, sprains, &c., when externally applied.

The order *Ophidia*,—*Serpents*,—has ever been looked upon with superstition and terror. And, I believe, that at the present moment, it is almost universally supposed, that several species of venomous *Snakes* inhabit Massachusetts. Who has not heard of hair-breadth escapes from "*monstrous black snakes*" and "great water *adders* ? The beautiful *garter* and *ribbon*, and *green* snake even, are avoided with consternation by not a few. A *venomous coluber* does not exist among us. Perfectly innocuous and inoffensive, they should be looked upon with interest, as they undoubtedly destroy many animals which might be injurious. So great, however, is the prejudice against this genus, that if instances could really be produced of their importance with us, they would still be exterminated, as is the *erythrogrammus* of the southern states ; although it is well known, that

by this last species, thousands of rats are destroyed, which otherwise would have seriously injured the crops of *rice*.

The *Crotalus durissus*,—*Banded rattlesnake*,—*is* occasionally met with—but very seldom are accidents produced by its bite; proving its unwillingness to be the aggressor, and that the fangs are used only as weapons of defence, after sufficient warning has been given of its presence by the *rattles*. A few years since, a surgeon in a neighboring town became quite celebrated for a liniment he often prescribed, the *basis* of which, if not the *entire substance*, was the *oil* procured from this species.

Great errors also exist with regard to the order *Batrachia*. The acrid secretion found upon the skin of the *Hyla versicolor*, the *toad*, *Tree* and several species of efts or newts, has caused them to be considered venomous,—which is incorrect. Every species of this order is inoffensive, and, when better known, will undoubtedly be found beneficial to man.

In some countries, the flesh of the different *Ranae*, *Frogs*, is an article of food. With us, the habits of the *Bufo Americanus*, *Common Toad*, are becoming better understood, and the Horticulturalist, instead of destroying, carefully preserves it on his grounds, for the benefit it affords him, by feeding upon noxious insects. In the same way are our springs and wells rendered the purer, by the presence of the carnivorous salamander.

No little confusion exists in the catalogue of our Reptiles. Each of the orders require, corrections, more or less important. It shall be my effort, to make the list as accurate as my means will allow.

All which is most respectfully submitted, by

Your Excellency's ob't. servant,

D. HUMPHREYS STORER.

To the Senate and House of Representatives:

I transmit to the House of Representatives, for the information of the Legislature, Reports from George B. Emerson, Esq., Chairman of the Commission for the Botanical and Zoological Survey, from Dr. Harris, on the Habits of Insects injurious to Vegetation, in Massachusetts, and from Dr. Gould, on Molluscous, and the other Lower Animals.

EDWARD EVERETT.

Council Chamber,
19th April, 1838.

MR. EMERSON'S REPORT.

To His Excellency, GOVERNOR EVERETT:

SIR:—I transmit a Report from Dr. Harris, upon the habits of some insects injurious to vegetation, in Massachusetts, and a Report from Dr. Gould upon the Molluscous and other inferior animals. These, with the reports I have already had the honor to transmit to your Excellency, although confessedly incomplete, are all that the Commissioners for the Botanical and Zoological Survey will be able to present, during the present season. Those upon the Botanical Survey are necessarily deferred, a single full year not having elapsed since the date of our commission.

Immediately after receiving from your Excellency that commission, which bore date June 10th, 1837, and by which Drs. Emmons, Gould, Harris, and Storer, and Messrs. Dewey, and Peabody, and myself were appointed upon the Botanical and Zoological Survey of the State, authorized by a resolve of April 12th, I made known to the other gentlemen the fact of their appointment, and laid before them the letter of instructions received from your Excellency. The great distance from the metropolis at which three of the gentlemen resided, making it inconvenient to have a full meeting, as would have been desirable, and as was recommended by your Excellency, I conferred with those gentlemen of the commission who resided in the immediate vicinity, and communicated with the others by letter, and thus arranged with them, by mutual agreement, an assignment of the separate portions of the work which should be undertaken by each.

In this arrangement, Dr. Emmons undertook to report upon the Mammalia of the State; Dr. Storer, upon the Fishes and Reptiles; Mr. Peabody, upon the Birds; Dr. Harris, upon the Insects; Dr. Gould, upon the animals of the lower orders; Professor Dewey,

upon the herbaceous Plants; leaving to me the Trees and larger Shrubs.

This arrangement having necessarily occupied considerable time, and made it somewhat late in the summer before any one could enter upon the survey of his department, the gentlemen of the commission soon came to the conclusion that it would be impossible for them to make a full and final report within the year, but hoped to make such progress as to satisfy your Excellency of the earnestness with which they entered upon the work.

We trust that the reports presented, however incomplete, will be satisfactory upon that point. It has been the aim of all the commissioners, to comply with the spirit of the resolve authorizing the survey, in having especial reference to the practical utility of their investigations. With this view, the commissioner on the Mammalia, aware that most of the native quadrupeds are objects of scientific rather than economical interest, has thought it within the scope of his commmission, to give his chief attention to our domestic animals. He has also given accurate descriptions, accompanied by highly characteristic figures, of some of the least known and most interesting native quadrupeds.

The great importance of the Fisheries to the Commonwealth, and the fact that most of our fishes have been very imperfectly described, have led the commissioner upon that department, to give unwearied attention to his work, in the purpose of presenting an accurate scientific description of every fish, and making its history accessible to our fellow citizens. With that view he will continue his work, in the same spirit, if the Legislature authorize the continuation, until it shall be complete.

The commissioner on Ornithology has himself so fully shown the importance of an acquaintance with our native birds, to the agricultural interests of the State, as to render it unnecessary for me to say any thing. He hopes that farther time will be allowed him to complete his report.

The commissioner upon Insects, from his great stores of observation upon animals of this class, for many years, has presented only such as will at once be recognized as of obvious practical utility, in their bearing upon the culture of the trees, cereal plants and culinary

vegetables of most importance in the Commonwealth. He also is obliged to leave his report incomplete, and asks for further time.

The commissioner on the survey of the lower animals, has not been able to offer a full report. Those who are acquainted with science, in this vicinity, will bear testimony to the untiring zeal with which he constantly pursues the objects of his survey;—and the great number of names of new animals, added to the catalogue within two years, give, evidence of success.

All which is respectfully reported by

Your Excellency's obedient servant,

GEORGE B. EMERSON.

Boston, April 19, 1838.

DR. HARRIS'S REPORT.

To George B. Emerson, Esq. :

Sir :—In compliance with your request, I now send you the first part of my report on the insects of Massachusetts.

The benefits which we derive from insects, though not few in number, nor inconsiderable in amount, are, if we except those of the silk-worm, the bee, and the cochenille, not very obvious, and are wholly beyond our influence. On the contrary, the injuries that we suffer from them are becoming yearly more apparent, and are more or less within our control. Before suitable remedies can be discovered, and effectually applied, it is necessary that our insect enemies should be recognized and their habits generally known. The instructions of His Excellency the Governor seemed to point to the economical advantages to be derived from natural history, as the most proper objects of our consideration. These instructions, together with the nature and extent of the branch of natural history assigned to me have led me to think that some account of the insects injurious to vegetation in Massachusetts would be acceptable and satisfactory to the governor, and to the people of this Commonwealth.

I have endeavored to treat the subject in a plain and familiar way, and have introduced no more of the science and language of entomology, than was absolutely necessary to define and discriminate the different insects whose transformations are described.

This portion of my report is wholly confined to the insects belonging to the order *coleoptera*, which, in the adult state, are commonly called beetles.

Habits of some of the Insects injurious to Vegetation in Massachusetts.

Insects are divided by popular writers into those which are injurious, and those which are beneficial to mankind. The former are appropriated to man and animals, or derive their sustenance from vegetables; the latter are destined to balance the account by keeping in check the noxious insects, or by contributing directly to man's convenience.

The science of Entomology is of great importance in enabling us to detect our enemies, and discriminate our friends of the insect race.

In this portion of the Report, it is proposed to give an account of a few insects injurious to vegetation in this vicinity. It will be proper, however, first to explain some of the terms that must necessarily be used.

Insect, in Latin *insectum*, is an abbreviation of *intersectum*; the body of insects being intersected or divided into segments. An insect is an animal with a double, knotted, medullary chord; a body divided transversely into segments; with no vertebræ nor internal bony skeleton; without organs of circulation; respiring by lateral pores or spiracles and tracheæ; undergoing a metamorphosis of three stages before arriving at the perfect state; and in that state having six legs only, a distinct head, immovable compound eyes, a pair of antennæ, and (with few exceptions) furnished with organs of flight. You probably know, that in man and quadrupeds the nervous system consists of a brain, spinal marrow, and the nerves which branch from them. In insects the brain is minute, but, to compensate for this, there issues from it a double medullary cord, dilating at intervals (usually corresponding with the segments) into knots or ganglions which give origin to the nerves.

In man and quadrupeds the spinal marrow is enclosed in a bony case, composed of several joints, which, united, form the back-bone or spine, and the whole body is built upon an osseous frame or skeleton. Insects have no bones, their external skin being sufficiently hard to give firmness and support to their bodies.

Insects have not an uninterrupted circulation of blood from a heart through arteries and veins. A longitudinal vessel, situated under the

skin of the back, represents the heart, and contains a pale-colored blood, which flows, with a wavy motion, from the tail to the head, and thence penetrates into the various crevices within the body.

Insects do not breathe through their mouths, and have no lungs; they imbibe the air by means of several lateral pores called spiracles, from which it is distributed to every part of the body through certain tubes called tracheæ and bronchiæ, which thus perform the office of lungs.

These constitute the principal peculiarities of their internal structure. But the most wonderful characteristic of insects is this. In order to arrive at the full and complete possession of their powers, they must pass through three successive stages, in which they exhibit a greater or less change of forms. This change of form is called *metamorphosis*, which signifies transformation. The caterpillar, or grub, after feeding a certain time, casts off its skin and assumes a different shape, in which it remains at rest and takes no food; sooner or later this second state is succeeded by another: the insect throws off its sluggish habit, emerges from the case or bandages in which, like a mummy, it was enveloped, and appears a renovated or resuscitated, volatile being, endued with new organs, and feeling the impulses of unknown passions. This is the perfect state, in which only it is capable of providing for a continuation of the species.

All insects, however, do not exhibit so great a dissimilarity in their three stages, and some, in the second, are capable of moving about, and even take food. The first state, in which an insect appears at its birth, is called the *larva;* when it changes from this, it becomes a chrysalis or *pupa;* the last metamorphosis produces the insect in its perfect state, the *imago*, image, or correct representation of the species.

The perfect insect has only six legs; its head is distinct; its eyes are compound, or composed of a great number of single eyes closely united together, and incapable of being rolled in their sockets. It has a pair of organs, situated near the eyes, called *antennæ*, which are the external recipients of some of their senses. The body is divided into three principal parts called, *head*, *thorax*, and *abdomen*. The situation of the head is obvious; the thorax is placed immediately behind it; the abdomen constitutes the posterior and

principal part of the body, and is covered above by the wings, which are two or four in number, and of various consistence.

An English Entomologist has stated, that, on an average, there are six distinct insects to one plant. This proportion is probably too great for our country, where vast tracts are covered with forests, and the other original vegetable races still hold possession of the soil. There are above 1200 flowering plants in Massachusetts, and it will be within bounds to estimate the species of insects at 4800, or in the proportion of four to one plant. To facilitate the study of such an immense number, some kind of classification is necessary; it will be useful to adopt one, even in describing the few species now before us. The basis of this classification is founded upon the number and nature of the organs of flight, and the first great divisions are called orders.

In the order *Coleoptera*, the upper wings, more generally named *elytra* or wing cases, are coriaceous (leathery) or corneous, (horny): the under wings are membranous, and are transversely folded. The first noxious insects belonging to this order which I shall describe, are named *Buprestes*.

Many of these, in their perfect state, are of brilliant or metallic colors. Their bodies are compact, firm, hard, of an elliptical form, obtuse before, tapering behind, broader than thick, so that, when cut in two transversely, the section is oval. Their heads are immersed to the eyes in the thorax, their antennæ are short and serrated on one side or notched like the teeth of a saw. Their feet are formed for standing firmly, rather than for rapid motion; the soles being composed of four dilated joints covered with little spongy cushions beneath, and terminated by a fifth joint which is armed with two claws. They are frequently seen on the trunks and limbs of trees basking in the sun. They walk slowly, and at the approach of danger contract their feet and fall from their situation. Being furnished with ample wings, their flight is swift and attended with a whizzing noise. They are not nocturnal insects, and are in motion only during the day.

The larvæ are wood-eaters or borers. Our forests and orchards are more or less subject to their attacks, especially after the trees have passed their prime. Their metamorphoses take place in the

bodies of trees. The larvæ that are known to me have a close resemblance to each other; a general idea of them can be formed from a description of that which attacks the pig-nut tree. It is of a yellowish white color, elongated and depressed in form, and abruptly dilated near the anterior extremity. The head is brownish, small, and merged in the next segment; the jaws are tridentate at the points, and of a black color; and the antennae are very short. The segment which receives the head (collar,) is short and transverse; next to it is a large, oval segment, broader than long, depressed or flattened above and beneath; it forms the thoracic portion of the body. Behind this, the segments are very much narrowed and, from transverse, become gradually quadrate, but are still flattened, to the last, which is terminated by a rounded tubercle. There are no legs, nor any apparatus which can serve as such, except two small tubercles on the under side of the second segment from the thorax. The motion of the larva appears to be affected by the alternate contractions and elongations of the segments, aided, perhaps, by the tubercular extremity of the body, and by seizing hold, with the mandibles or jaws, upon the sides of its burrow. These larvæ are found under the bark and in the solid wood of trees, and sometimes in great numbers. It is not uncommon for them to bend the body sideways, so that the head and tail are approximated. This posture those found under bark usually assume. They appeared to pass more than one year in the larva state.

The pupa bears a near resemblance to the perfect insect, but is entirely white, until near the time of its last transformation. Its situation is immediately under the bark, the head being directed outwards, so that when the pupa coat is cast off, the perfect insect has merely a thin covering of bark to perforate, before making its escape from the tree. The form of this perforation is oval, as is also a transverse section of the burrow, that shape being best adapted to the form, motions and egress of the insect. *Buprestis Virginica* is probably our largest species. It inhabits the trunks of the *Pinus rigida* or pitch-pine tree. *Buprestis divaricata* is exceedingly injurious to the *Prunus Virginiensis* or wild cherry-tree, and sometimes attacks the peach tree. The perfect insect appears on the limbs of these trees in June, July, and August.

Buprestis obscura is appropriated to the *Carya porcina* or pig-nut-tree. *Buprestis fulvo-guttata* inhabits the *Pinus strobus*, or white pine. There is another species which attacks the small limbs of this tree. *Buprestis femorata* has frequently been taken from the peach tree. It also attacks the white oak. The perfect insect appears in June and July. *Buprestis characteristica* also inhabits the oak.

The situation of the larvæ in the solid bodies of trees renders unavailing our attempts to dislodge them. The only remedy that can be suggested, is, to commit to the flames, as soon as possible, any fruit trees which may be much infested or destroyed by them. In this way many larvæ may be prevented from going into the perfect state, and thus continue their species. Although these larvæ are beyond the reach of man, they do not escape the researches of the woodpecker, by whom they are sedulously and successfully sought and extracted from their retreats.

Closely related to these insects are the *Elaters* or snapping beetles, which are well known by the faculty they have of throwing themselves upwards with a jerk, when laid on their backs. On the under side of the breast, between the bases of the first pair of legs, is a short blunt spine, pointing backwards, and usually concealed in a corresponding cavity behind it. When the insect, by any accident, falls upon its back, its legs are so short that it is unable to turn itself over. It then draws the legs close to the body, bends back the head and thorax, and thus unsheaths its pectoral spine : then suddenly resuming its former position, the point of the spine strikes with force the edge of its sheath, which gives it the power of a spring, and reacts on the body of the insect, so as to elevate it perpendicularly into the air. When it again falls, if it does not come down upon its feet, which is usually the case, it repeats its exertions until its object is effected.

The larvæ are more or less injurious to vegetation. Some are confined to decaying trees, in the trunks and roots of which they reside. Others feed upon the roots of annual, perennial and herbaceous plants. These larvæ, in England, from their slender form and uncommon hardness, are called wire-worms.

They are not to be confounded with the wire-worm of America,

a species *Iulus*, which is not a true insect, but belongs to the class Myriapoda, a name derived from the great number of feet with which most of the animals included in it are furnished; whereas, the English wire-worm has only six feet. The European wire-worm is said to live, in its feeding or larva state, not less than five years; during the greatest part of which time, it is supported by devouring the roots of wheat, rye, oats and grass,—annually causing a large diminution of the produce, and sometimes destroying whole crops. It is particularly destructive in gardens recently converted from pasture lands.

We have several species allied to this destructive insect; the larvæ of which are quite common in newly broken up lands, but fortunately, as yet, their ravages are inconsiderable. We may expect these to increase in proportion as we disturb them and deprive them of their usual articles of food, and may then have to resort to the ingenious method adopted by Europeans for alluring and capturing the larvæ. This method consists in strewing sliced potatoes or turnips in rows through the garden or field; women and boys are employed to examine the slices the next morning, and collect the insects which are enticed to feed upon these substances.

The body in our species of wire-worm is elongated, linear, nearly cylindrical, or slightly flattened above and below. There are 12 segments besides the head. The jaws are strong, pointed and curved at the tips, without lateral teeth. There is no thoracic shield. The last segment is longer than the preceding one, and terminates in a small acute spine, on each side of the base of which is a deep cavity. Beneath this segment, is a minute retractile tubercle, or proleg, as it is called, which, when the animal walks, is thrust out, and serves the purpose of a foot, to support the posterior part of the body, and prevent it from trailing on the ground. There are six feet, one pair to each of the three anterior segments. The color of the body is pale brown or buff, the head and last segment being somewhat darker. The larvæ of our large species, which live upon decayed wood, are somewhat different. Their bodies are proportionally much broader and more depressed. The eyes, though small, are distinctly visible; are two in number and simple; one situated at the base of each of the antennæ. The last segment is somewhat mitre-shaped, the

margin above armed with the teeth, and the apex with a pair of forked, recurved horns or hooks. Beneath this is situated the anal proleg, which is retractile, and (at least in one species, *E. oculatus*,) furnished behind with two small incurved hooks, and spined at the sides. The true legs are six, each armed at tip with a single claw. The total length of the largest larva found here is $2\frac{1}{2}$ inches.

The pupæ of Elaters, like those of most coleoptera, bear a near resemblance to the perfect insect. After their last metamorphosis, Elaters make their appearance upon trees and fences, and some are found upon flowers. They fly both by day and night. Their food, in the perfect state, appears to be chiefly derived from flowers, though many species do not probably take any in this state. Whenever discovered, they should be immediately destroyed. The larva of *Elater noctilucus* resides in the interior of the sugar cane. The perfect insect is remarkable for its luminous properties. *Elater oculatus* I have found in the decayed stumps of apple trees, both in the larva and perfect state. We have a great many small species which appear to live upon the roots of the grasses. These will probably in time become serious assailants of vegetation. There are a few, which, in the perfect state, are found upon flowers, and which have their nails pectinated or divided, like the teeth of a comb.

Our attention is next attracted to that great family of insects comprehended in the Linnean genus Scarabæus. These insects are easily recognized by their antennæ, terminating in several leaf-like joints, and by their legs, particularly the first pair, which are furnished with several strong projecting teeth. Among these are the insects included by Fabricius in his genus *Melonontha*, a word used by the Greeks to distinguish these same insects. More than 400 years before the Christian era, Aristophanes alludes to a custom which his commentator says was common to the children at that time, of fastening a string to the leg of a Melolontha, and then allowing it to fly in the air. His words may be translated,

> —"To winds thy cares commit
> Like Melolontha string-bound by the feet."
> *(Aristophanes' Clouds.)*

It is not a little remarkable, that this kind of sport should still exist. De Geer says, that, in the Netherlands, the children amuse themselves

by attaching a long thread to one of the hind legs of the common Melolontha, and then leave it to fly, without suffering it to escape. Being thus restrained, its motions are confined to a circle, and these gyrations afford much pleasure to the little tormentors. De Geer further tells us, that the country children carry on a trade in these insects with the children of cities, and that he himself, when a boy, had purchased many of them. The same custom exists in the vicinity of Paris, and the children accompany the gyrations of the Melolontha, by the French called *Hanneton*, with a song or incantation, the burthen of which is "*Hanneton! volé, volé, volé*"—"Hanneton! fly away, fly away, fly away." Those who have read the popular novel called Torhill, may remember that these were the words frequently sung by the volatile French servant. Thus are we led to observe a curious coincidence in the puerile sports among remote nations, while tracing the antiquity of a name.

The Melolonthæ are known in England by the names of *dorrs* or *chaffers*, and in this country, by those of *dorr-bugs* and *may-beetles*. They are characterized by having the body oblong, oval, and convex, the mouth covered above by a thin plate, beneath which, are situated the antennæ, consisting of ten joints, the terminal ones united by the end to a common centre, and expanding like the leaves of a book; the thorax more or less transversely quadrate or trapezoidal; the elytra convex above, not embracing the sides of the body, and leaving the posterior extremity exposed. The middle part of the fore legs is armed with 2 or 3 lateral teeth; and each foot, consisting of five small joints, is terminated by two strong claws or nails, furnished beneath with a small tooth or double point. The powerful and corneous jaws are admirably adapted for tearing and bruising the leaves of vegetables on which these insects live in their perfect state; their double or toothed claws support them securely upon the foliage; and their strong and dentated legs, being constructed for digging in the ground, indicate the place of their metamorphoses.

The general habits and transformations of the common cock-chaffer of Europe, will elucidate those of the whole genus, which are nearly the same.

This insect devours the leaves of trees and shrubs. Its duration

in the perfect state is very short, each individual living only about a week, and the species entirely disappearing in the course of a month. After the sexes have paired, the males perish, and the females enter the earth to the depth of six inches or more, making their way by means of the strong teeth which arm the fore legs; here they deposit their eggs, amounting, according to some writers, to nearly 100, or, as others assert, to 200 from each female, which are abandoned by the parent, who generally ascends again to the surface, and perishes in a short time.

From the eggs are hatched, by the warmth of the earth, little whitish grubs, each provided with six legs near the head, and a mouth furnished with strong jaws. When in a state of rest, these grubs usually curl themselves in the shape of a crescent. They subsist on the roots of trees and other plants, found in the ground, committing ravages among these vegetable substances, on some occasions of the most deplorable kind, so as totally to disappoint the best founded hopes of the agriculturalist. During the summer they live under the thin coat of vegetable mould near the surface, but, as winter approaches, they descend below the reach of frost, and remain torpid until the succeeding spring, at which time they change their skins and reascend to the surface for food. At the close of their third summer (or, as some say, of the fourth or fifth,) they cease eating, and penetrate about two feet deep into the earth; there, by its motions from side to side, the grub forms an oval cavity, which is lined by some glutinous substance, in which it is changed to a pupa by casting its last larva skin. In this state, the legs, antennæ, and wing cases are visible through the transparent skin which envelopes them, but appear of a yellowish white color; and thus it remains until the approach of the vernal season, when the thin film which encloses the body is rent, and the perfect insect digs its way to the surface, from which it finally emerges during the night. According to Kirby and Spence, the grubs of the cock-chaffer sometimes destroy whole acres of grass by feeding on its roots. They undermine the richest meadows, and so loosen the turf that it will roll up as if cut by a turfing spade. They do not confine themselves to grass, but eat also the roots of wheat and of other grains. About seventy years ago, a farmer near Norwich, in England, suffered much by them, and, with his man,

gathered 80 bushels of the beetles. In the year 1785 many provinces in France were so ravaged by them, that a premium was offered by government for the best mode of destroying them. The Society of Arts in London, during many years, held forth a premium for the best account of this insect, and the means of checking its ravages, but without having produced one successful claimant. In their perfect state, these, with several other species, act as conspicuous a part in injuring the trees, as the grubs do in destroying the herbage. Besides the leaves of fruit trees, they devour those of various forest-trees and shrubs, with an avidity not much less than that of the locust, so that, in certain seasons, and in particular districts, they become an oppressive scourge, and the source of much misery to the inhabitants.

Mouffet relates that, in the year 1574, such a number of them fell into the river Severn, as to stop the wheels of the water-mills ; and, in the Philosophical Transactions, it is stated, that in the year 1688 they filled the hedges and trees of Galway, in such infinite numbers as to cling to each other like bees when swarming ; and, when on the wing, darkened the air, annoyed travellers, and produced a sound like distant drums. In a short time, the leaves of all the trees, for some miles round, were so totally consumed by them, that at midsummer the country wore the aspect of the depth of winter.

Another chaffer, *Melolontha vitis. F.* is sometimes exceedingly injurious to the vine. It prevails in certain provinces of France, where it strips the vines of their leaves, and also devours those of the willow, poplar and fruit trees. The animals and birds appointed to check the ravages of these insects, are, according to Latreille, the badger, weasel, martin, bats, rats, the common dung-hill fowl, and the goat-sucker or night-hawk. To this list may be added the common crow, which devours not only the perfect insects, but their larvæ, for which purpose it is often observed to follow the plough. In "Anderson's Recreations," it is stated that "a cautious observer, having found a nest of five young jays, remarked, that each of these birds, while yet very young, consumed at least 15 of these full sized grubs in one day, and of course would require many more of a smaller size. Say that, on an average of sizes, they consumed 20 a piece, these for the 5 make 100. Each of the parents consume say 50 ; so that the pair and family devour 200 every day. This in 3 months,

amounts to 20,000 in one season. But as the grub continues in that state 4 seasons, this single pair, with their family alone, without reckoning their descendants after the first year, would destroy 80,000 grubs. Let us suppose that the half, viz. 40,000, are females, and it is known that they usually lay about 200 eggs each, it will appear, that no less than 8 milions have been destroyed or prevented from being hatched by the labors of a single family of jays. It is by reasoning in this way, that we learn to know of what importance it is to attend to the economy of nature, and to be cautious how we derange it by our short-sighted and futile operations." Our own country abounds in insectivorous beasts and birds, and without doubt the more than abundant Melolonthæ form a portion of their nourishment.

In the year 1817, the Fabrician genus *Melolontha* contained 305 known species, 226 of which still retained that name, and 79 were separated into 5 distinct genera. A great number of new species have since been added to this list, which it has become necessary still further to subdivide. Having myself, in a paper on the noxious insects of this genus, published in 1827, indicated some new genera, and pointed out their types, I would, in my own justification, observe, that, (as I have since ascertained,) about the same time, there were established by European entomologists, similar genera, from a consideration of *the same* types.

We have several allied species of *Melolontha* whose injuries in the perfect and grub state approach to those of the European cock-chaffer. *Melolontha quercina* of Knoch is our common species. In its perfect state it feeds on the leaves of trees, particularly of the cherry-tree. It flies with a humming noise in the night, from the middle of May to the end of June, and frequently enters houses, attracted by the light. In the course of the spring, these beetles are often thrown from the earth by the spade and plough, in various states of maturity, some being soft and nearly white, their superabundant juices not having been exhaled; others exhibit the true color and texture of the perfect insect. The grubs devour the roots of grass and other vegetables: in many places the turf may be turned up like a carpet in consequence of the destruction of the roots. The grub is a white worm with a brownish head, and, when fully grown, nearly as thick as the little finger. It is eaten with avidity by crows and

fowls. The perfect insect is devoured by some nocturnal animal, which frequents our gardens for that purpose, and whose beneficial foraging is detected by its abundant excrement filled with the wing-cases of the Melolontha. A writer in the "New York Evening Post" says, that the beetles, which frequently commit serious ravages on the fruit trees, may be effectually exterminated by shaking them from the tree every evening. In this way two pails full of beetles were collected on the first experiment; the number caught regularly decreased until the fifth evening, when only two beetles were to be found.

M. hirsuta is also found occasionally in gardens.

M. balia is more common in forests.

M. pilosicollis is quite common in gardens.

M. variolosa is one of our finest species as regards beauty and size. It is not common. An individual was captured near the mall in Boston, some years ago.

M. vespertina and *M. sericea* are destructive to the naturalized sweet-briar, on which the perfect insects may be found in profusion in the night, about the last of June.

All these species are nocturnal insects, never appearing except by accident in the day, during which they remain under shelter of the foliage of trees, or concealed in the grass. Others are truly day-fliers, committing their ravages by the light of the sun, and are always present to our observation. One of them appears about the middle of May, and may be found till the end of June.

It eats the tender leaves of the pear-tree, and feeds also on those of the poplar and oak. It is a large insect, and was described by Linnæus as the *Scarabœus lanigerus*. It is not constant in its appearance; in some seasons being found in great profusion, when, by shaking the young pear-trees, any number of them may be obtained. *Melolontha punctata* is also a large species which is frequent on the grape vine in July and August. *M. varians*, a smaller species, appropriated to the cultivated and wild grape vine, is closely allied to the vine-chaffer of France, but fortunately, its ravages are not as yet so extensive as those of the latter. On these vines, and still more profusely on the Sumach, (*Rhus Typhinum*), it feeds during the months of June and July. The rose-chaffer or rose-bug, as it is

commonly called, is also a diurnal Melolontha. It is exclusively an American insect, and presenting peculiarities in its structure and form widely distinct from other species of the genus, has very properly been referred to a sub-genus,* of which, till lately, it was supposed to be the only species. The rose-chaffer is the *Melolontha subspinosa*, of Fabricius, by whom it was first described in the year 1781. The meaning of the specific name given by Fabricius is, *somewhat spinous*, because the thorax of the insect presents that appearance, in consequence of the blunt spine or tubercle which arms each side. It has since received several other names; but that given by the first describer, having the priority, must be retained. From my communications to the Massachusetts Agricultural Society, in 1826, and from the remarks of Dr. Greene, published in the New England Farmer, and since confirmed by my own observations, I shall be able to present a complete summary of the most important facts relative to the economy of this insect. The most remarkable of its habits are its voracity and its salaciousness. It attacks, without much discrimination, almost every tree, shrub, and plant, such as the oak, elm, cherry, and apple trees, the rose, sumach, and elder bushes, the grape-vine, and even herbaceous plants, particularly the common white weed, *Chrysanthemum leucanthemum*. Generally, during the day time, we find these insects paired, the male holding the female closely embraced, even when not *in coitu*. The male is readily distinguished by the greater length of the legs, and the elongated, pointed extremity of the body. The rose-chaffers make their appearance during the second week of June, or about the time of the blossoming of the damask rose. They do not attack the cinnamon rose, and are often seen on the elm and oak, before they appear on the garden or wild rose. Their numbers are rapidly augmented for several days, and, as different individuals appear in succession, the whole duration of the species is found to extend even to 30 or 40 days. In three weeks, the eggs of the female becoming mature, she enters the earth and deposits them at the depth of from one to four or more inches, according to the nature of the soil. The males and females then die, the former above, and the latter either beneath or above the surface of

**Macrodactylus*, Latr., *Stenothorax*, mihi. There is a much larger species quite common in Carolina.

the earth. The number of eggs, in each individual, is stated by Dr. Green, never to exceed 30, being generally below 20. They are nearly globular, whitish, and about one thirtieth of an inch in diameter. In the space of 20 days after being deposited, they are hatched, and the young larvæ soon begin feeding on such vegetable substances as are within their reach. Like others of the genus, when not eating, they lie upon the side, with the body curved, so that the head and tail are nearly in contact. I have never been able to rear these insects in pots, so as to trace the *same individuals* from birth, through all their changes; and Dr. Green informs me, that he has been equally unsuccessful. However, by replenishing the pots, from time to time, with fresh larvæ from the ground, he has come to the conclusion, that they arrive at their full growth about the last of October. During the winter, they remain torpid, and at such depth in the soil, as to escape the effects of frost. At the approach of spring, they ascend near the surface, and prepare to take the pupa form. They are then about half an inch long, and over one line in diameter. The body of the grub is soft, whitish, with a bluish tinge near the tail, and slightly hairy. The head is covered with a corneous shell of a pale rust color, the jaws are rather darker. There are six legs near the head, namely, one pair to each of the first three segments of the body. About the first of May, the grub, by moving its body round and round, forms a little cavity or cell, in which, after a few days, it becomes a pupa. This change is effected by the alternate contractions and dilatations of the grub, during which, the skin near the head bursts and is gradually pushed down, (like a stocking from the leg,) until the pupa is entirely liberated. The pupa is of a yellowish white color at first, but gradually becomes darker, as it approaches the perfect state. The rudiments of the future wings, antennæ, and legs, are distinctly visible, folded under the body, and enclosed in a thin membrane, which wraps each part separately: the eyes appear as two blue spots; the dorsal segments of the body are prominent in ridges; the tail is acuminated, and retains upon it the exuviæ or cast-skin of the larva, until a few days before it throws off its last covering, and emerges from the earth a perfect insect. This last and important change is not effected but by the greatest efforts, during which the pupa appears to writhe in agony, until, by its continued exertions, it

bursts its membranous shroud, and crawls to the surface, where it becomes, from a grovelling worm of the earth, an animated tenant of the air. Thus the various changes, from the egg to the full development of the perfect insect, are consummated in the space of one year.

Our insectivorous birds undoubtedly consume many of the rose-bugs in the perfect and larva state, and deserve to be cherished and protected for their useful habits. The perfect insects are eaten greedily by domesticated fowls, and, when exhausted and fallen on the ground, become food for other animals and insects, particularly ants. Dr. Green informs us that a species of dragon-fly, or devil's-needle, (Libellula,) also destroys them. In France, a large insect, called *vinaigrier*, (Carabus *auratas*, *L.*) devours the female *Melolontha vulgaris* at the moment when she is about to deposit her eggs. I have taken one specimen of this fine *Carabus* in Massachusetts, and we have several other species which are equally predaceous, and which probably contribute to check the increase of our native species of *Melolontha*. According to Dr. Green, the insect, which he calls the enemy of the cut-worm, prays also upon the grubs of the Melolontha. This predaceous insect is the larva of a species of *Carabus*.

Various remedies for protecting vegetation from the ravages of the melolontha have been suggested. The most useful are to strew air-slacked lime on the plants exposed to their attacks, or to cover them with millinet. Great numbers may be collected and destroyed by hand, and, were this made a general pursuit, it would be productive of considerable benefit. "Eighty-six of these spoilers," says Dr. Green, "were known to infest a single rose-bud, and were crushed with one grasp of the hand." Suppose, as was probably the case, one half of them were females; by this destruction about 800 eggs were prevented from becoming matured. The rose-bugs may be shaken or brushed from plants into tin vessels containing a little water, and afterwards committed to the flames, or killed by scalding water. The causes that contribute to the natural increase and diminution of these and other insects, are not sufficiently understood. Of the fact we are assured, that various destructive insects occasionally diminish in numbers, and nearly disappear. This has been the case with rose-bugs, which have sensibly decreased during several years past;—now, then, is the time when our efforts for their extermination would

be most successful, and which, as before said, consist in making a general pursuit and destruction of the insects in their perfect state. Those within reach of the hand may be gathered into suitable vessels, others may be shaken from small trees into cloths spread beneath them. It may even be worth the trouble to mow down rapidly the white weed in arid pastures, and consume it, with the sluggish rose-bugs upon it, on the spot.

Belonging to the great family of Scarabæidæ, and included in De Geer's division of flower-beetles, is one insect which has become injurious to fruit trees. It is the *Trichius scaber*, of Palissot de Beauvois. In *Trichius* the body is thick, short, flattened above. The plate (clypeus) above the mouth oblong square; the antennæ, like those of Melolontha, are terminated by a three-leaved club; the thorax is nearly orbicular, buckler-shaped, or hexagonal, usually longer than broad, and narrower than the abdomen; the elytra, taken together, are perfectly quadrate, with the posterior margin straight; the posterior extremity of the body is more exposed than in Melolontha; the nails are neither toothed or bifid. The larvæ live in the trunks of trees, and most of the perfect insects are clothed with hairs, whence their name *Trichius*, signifying hairy. The species under consideration, with two or three others, are entirely destitute of hairs, and offer other minute characters distinct from the hairy *Trichii*, whence they have been denominated *Gymnodi*, or naked.

The larva of *Trichius* (or more properly *Gymnodus*) *scaber* closely resembles that of Melolontha. It lives in the trunks of old cherry trees, whose decay it accelerates. In the autumn it forms a cell or cocoon of the debris or woody fibres of the tree, which is strongly cemented within; the perfect insect is developed in July. It flies abroad only in the night, and conceals itself during the day in the crevices of trees. It betrays its retreat by the powerful odor which it exhales, and which is perceptible at the distance of several feet.

The habits of the insects which belong to the genus *Lucanus* are similar to those of the insect just described. The larvæ have a general resemblance to those of the Scarabæi, and live in the trunks of old trees. The perfect insect is readily distinguished by the oblong form of its body which is rounded behind, and slightly flattened

above. The head is broad, the thorax short, transverse, and as broad as the elytra; the antennæ are ten-jointed, the first joint being very long, and the four last projecting at the sides like the teeth of a comb. But the mandibles, or upper jaws, of great size, extending like the horns of cattle, or branched like those of the stag, form the most conspicuous character. These insects fly abroad during the night, and frequently enter houses. They are vulgarly called horn-bugs, and are dreaded for their formidable aspect, but are perfectly harmless. The larvæ are common in all decaying trees, and are frequently found in the trunks of apple-trees.

The preceding insects have five joints to all their feet. There are others which injure vegetation, and which have only four joints to the posterior pair of feet.

In *Tenebrio*, the body is elongated, hard, flattened, and entirely covered above; the antennæ are moniliform, or composed of grains like the beads of a necklace, and gradually enlarge towards the tips; the thorax is square; the elytra are not united at their junction; and the legs are curved. The larva is long, slender, nearly cylindrical, very smooth, and of a pale rust or dirty yellow color. The first segment behind the head is larger than either of the others; this, as well as each of the two following segments, is furnished beneath with one pair of legs; the tail is acuminated, the tip in some species furnished with two minute vertical spines; under the tail, at the junction of the two last segments, is a membranous space in which is concealed a retractile fleshy tubercle, from which issue, when the animal walks, two horny movable parts which perform the office of legs. The larva state continues during two or more years. The perfect insects are nocturnal, as the name indicates.

Tenebrio granarius. The larva lives in stables and granaries, subsisting upon corn and meal. It has considerable resemblance to that of the small species of *Elater*. The pupa is found in June in places inhabited by the larva. The perfect insect is developed about the middle of June.

A remarkable case of the introduction of this insect into the human body is recorded by the late Dr. Coffin of Boston, exhibiting a great change in the ordinary habits of the insect, showing the necessity of great attention to cleanliness in cases of sickness, and fur-

nishing a caution against the careless use of articles containing eggs or larvæ of insects. In the year 1812, a woman in Biddeford, Maine, had an issue of long standing in the back of her neck. At this period she was confined to a dark and dirty apartment. At length the issue healed, soon after which a tumor rose at the part, burst, and discharged a great number of larvæ, a tea cup full as was said. For several months these vermin seemed to be confined to the part, occasionally crawling out ; but when the abscess healed, the patient felt them to spread to the head, producing in their course severe pains, described by her as itching, biting, and gnawing sensations. Some time after these sufferings, larvæ were discharged from the ears, eyes, nose, and mouth, varying in number and size, sometimes one hundred in twenty-four hours, some as small as a hair, others almost as large as a pipe-stem, and two-thirds of an inch long. The woman continued to be troubled with these vermin four years. Some of them were sent to Boston, from one of which Prof. Peck obtained the perfect insect. It proved to be the *Tenebrio* just described. It is probable they were introduced in the egg state, either by the parent insect gaining admission to the sore, or what is more likely, that poultices, composed of meal containing eggs or larvæ, were applied to the sore, and proper attention to cleanliness not having been given, the larvæ established themselves unnoticed in the part.

Tenebrio punctulatus, *badius*, *lævis*, and several other species, are found in the decayed trunks of trees, upon the debris of which the larvæ subsist, and resemble those of the meal tenebrio.

The habits of the genus *Cistela* are similar to those of Tenebrio, but their injuries to trees are greater, for they subsist upon wood less advanced to decay than do the former. The body is oblong oval ; The antennæ are long, tapering towards the extremity, and slightly serrated on one side ; the thorax is short and semicircular ; the eyes are crescent-shaped ; the nails pectinated like the teeth of a comb. This structure of the nails is peculiar to some insects, which, in their perfect state, frequent flowers.

The larvæ are somewhat like those of tenebrio, but are much more flattened, and the apex of the body terminates in three minute spines, the central one of which is the most prominent. The anal

proleg, or part which performs the office of a posterior foot, is situated in a semicircular space at the base of the last segment. They are found under the bark of trees; the perfect insects, in June and July, in the same situation, and also upon flowers.

In the Coleopterous insects which follow, all the feet have but four articulations.

The genus *Bruchus*, appears to be chiefly appropriated to the Leguminous or Pea-flowering plants. The form of the body in this genus is short and convex; the head is produced or elongated before into a broad snout, and is suspended vertically below the thorax; the antennæ are composed of eleven nearly cylindrical joints, which gradually increase in size to the last; the elytra are short, and do not cover the posterior extremity, which is pointed; the posterior thighs are thick. The perfect insects deposit their eggs upon the pods of plants, the pulse of which affords nourishment to the larvæ. These are little whitish grubs, without feet, and one only is to be found within a single seed, the interior of which is perforated by a hole, which is covered only by the thin hull, on the outside, and through which the perfect insect gnaws a passage sometime before it makes its escape. This is not effected until about the time of the germination of the seed, so that the existence of the insect is extended through one year, during the winter months of which it remains, concealed in the seed, in a state of torpidity.

These insects are far more common than has generally been imagined. The Gleditsia, Robinia, Mimosa, Cassia, and various other native legumes have their distinct species. But the most remarkable is the *Bruchus pisi*, or pea-bug of North America. This insect has been introduced with American pease into England, and a part of Europe, but is not known in the North of Europe. Kalm, the Swedish traveller, tells us that he was greatly agitated on discovering some of these insects in a parcel of pease brought by him from America, lest he should be the instrument of introducing so fatal an evil into his beloved country. Nor was his agitation unfounded; for this noxious insect was at one time so destructive to the pea in our country as to put an end to its cultivation in many places. The pea-bug must originally have fed upon some of our indigenous vegetables allied to the garden pea, which, however, it has deserted in

preference for this more prolific and abundant foreigner. The female pea-bug deposits her eggs beneath the epidermis, or thin skin, which covers the pod of the pea, one egg, only, being left opposite to a single pea. This is effected during the night, or in cloudy weather, and the pods are attacked only when young, and when the pease are just beginning to swell.

The larva or grub, as soon as hatched, perforates the pod and pea by a very fine hole, which is soon closed, and is only to be discovered when the pea is fully grown by a small reddish spot on the pod, corresponding with a similar one on the pea. If this spot be carefully opened at this time a minute whitish grub or maggot, destitute of feet, will be found in the pea. The growth of the grub is rapid, and is completed by the time the pea becomes dry. It then bores a round hole in the pea, quite to the hull, which, however, is left untouched, as is also the rostellum or future sprout. In this hole it becomes a pupa and subsequently a perfect insect, when it has only to gnaw through the thin hull before it makes its exit.

It is a singular fact, and evinces the wisdom of Providence, that the germinating principle of pease is permitted to escape the insect destroyer, whereby abundant provision is made for a future supply of one of the finest of esculent vegetables. This insect is also limited to a certain period for depositing its eggs; late sown pease therefore escape its attacks. According to observations made by the late Col. Pickering, pease sown as late as the 20th May, in lat. 41° 13′ N., were entirely free from bugs. Deane recommends to keep buggy pease over one year before sowing them. This method would answer if generally adopted, but the pease themselves should be so secured that the bugs could not escape. Probably keeping them in boxes with a quantity of camphor, would destroy the bugs without injuring the pease. Latreille suggests submitting the pease to the heat of water at 30° Reaumer, or 90° of Farenheit, by which probably the same results might be obtained. A writer in the New England Farmer has adopted the following plan:—Immediately before being planted, the pease are put into a tub; very hot water (he does not state specifically how hot,) is poured on them, they are constantly stirred in this for two minutes, and then cold water is added, in such quantity as to render the mixture blood warm, and to cover the pease

one or two inches. In this they are allowed to stand an hour or two, when all the bugs will be found dead and floating, and the pease will be in a state for immediate planting. The Baltimore Oriole or hang-bird, is appointed to check the increase of this insect, by picking from the green pea the larva on which it feeds.

In the genus *Anthribus*, the head is elongated into a broad snout or rostrum. The body is short, thick, and obtuse, or truncated behind; the antennæ are straight, abruptly thickened at tip into a three-jointed mass or club; the thorax is transverse, broadest behind, and lobed; the posterior extremity is covered by the elytra.

Anthribus marmoreus lives in the larva state in the solid wood of the oak, where also it undergoes its metamorphoses.

The succeeding insects, which are furnished with snouts or rostra, belong to the family *Curculionidæ*, so named from a genus of Linnæus in which they were included. They are popularly named weevils, and are widely spread through vegetation; almost every grain and seed having its peculiar species, and the trunks and leaves of a great number of plants are also infested by them. The larvæ are more or less oval or approach to a conical form. They are destitute of legs, unless we may call by that name certain fleshy tubercles at the sides of the body, besmeared in some species with a tenacious slime, which assist them in their motions. These motions are effected by the alternate contraction and extension of the segments of the body. They have a horny head, by which they are distinguished from the maggots of flies. The pupæ do not differ greatly from those of other coleopterous insects, exhibiting the rudiments of feet and wings through the thin pellicle which envelopes every part.

According to Kirby and Spence, several species of *Harpalus* (insects belonging to the *Carabidæ*) prey upon the perfect insects. The larvæ fall victims to several Ichneumon flies, to woodpeckers, and to other birds.

The habits of the genus *Brenthus* have not hitherto been described. Their characters are these. Antennæ straight, not tapering at the ends; body hard, elongated, somewhat cylindrical; head, rostrum or beak straight and porrected, in the female very slender and long, in the male short, robust, dilated at the end, and with large and dis-

tinct mandibles or jaws ; last joint but one of the feet divided into two lobes.

Brenthus septentrionis passes though all its metamorphoses in the trunks of trees, under the bark of which the perfect insect is, in summer, frequently found. The female perforates the bark with her slender beak, and deposits an egg in the hole thus made. The larvæ penetrate into the solid wood forming cylindrical passages, which they keep clear by constantly thrusting behind them and out of the hole their castings, as fine as saw-dust. A full grown larva measures above an inch in length. It is of a whitish color, and is very much elongated and cylindrical ; each of the first three segments is furnished beneath with a pair of legs, and there is a fleshy prop or proleg beneath the hinder extremity of the body ; the last segment is dark chestnut colored, of a horny consistence, and hollowed above so as to form a kind of gouge or scoop, the edges of which are furnished with little notches or teeth. It is by means of this singular scoop that the larva shovels the minute grains of wood or castings out of the orifice of its burrow. On the dorsal segments of the pupa are transverse rows of minute spines or teeth, and the tail is surmounted by two distinct spines much larger than the others ; the beak is inflexed under the breast.

In the genus *Curculio* the antennæ are geniculated or bent at right angles in the middle, the first joint being very long, inserted near the mouth, and usually received into a groove at the side of the rostrum, which is short and thick ; the body is ovate, convex, narrower before, and in most species ornamented with minute scales ; the antennæ are situated near the extremity of the rostrum, and are composed of eleven joints, the three last of which are united into a mass or club.—The weevil tribes use their snouts for preparing the holes in vegetable substances and fruits in which their eggs are deposited..

Curculio hilaris lives in the solid wood of the oak. The perfect insect is developed in May, and may then be found on the trunks of trees *sub copula.*

The antennæ in the genus *Rhynchænus* resemble those of curculio, are eleven-jointed, but inserted near the middle of the rostrum, which is long and slender ; the body is more elongated than in *curculio.*

Rhynchænus pales inhabits the trunks of the pitch and perhaps other pines. The perfect insect is very common on palings, the trunks of pines, the sides of houses, &c. in May and June.

Rhynchænus Strobi was first described by the late Prof. Peck. It attacks the leading shoot of the *Pinus strobus*, or white pine. "The lofty stature of this tree depends upon the constant health of its leading shoot, for a long succession of years." If the leading shoot be destroyed, the tree becomes deformed, and the trunk rises no higher, until some one of the topmost branches assumes an ascending direction, and becomes an irregular kind of leading shoot. This accident is not uncommon, and is effected by this insect. Its eggs are deposited on the leading shoot, probably immediately under the epidermis. The larvæ, when hatched, immediately commence feeding on the wood. "It is probable," says Prof. Peck, "that they remain in the wood more than one year, and the shoot dies the second year after the eggs are placed in it. The larva is a soft white grub, with only the head shelly, and armed with strong mandibles." "When the feeding state is passed, and before the pupa state comes on, it prepares an exit for itself by opening a passage outwards, but leaves the exterior skin of the bark untouched, so that it is perfectly secured from any injury by rain. The pupa remains quiet for a time, and the perfect insect has only to cut away the epidermis to escape. The perfect insects begin to come out early in September, and continue to leave the wood through that month and a part of October. The shoot at that time is pierced on all sides with small round holes; sometimes thirty or forty may be counted in one shoot." "But an unlimited increase is not permitted to this destructive insect; if it were, our forests would scarce produce a single mast." One of the means appointed to restrain the increase of the white-pine weevil, is a species of ichneumon fly endued with sagacity to discover the retreat of the larva, the body of which it perforates with its sting, and therein deposits an egg. From the egg of the Ichneumon is hatched a grub which devours the larva of the weevil, and then transforms to a perfect insect in its habitation. The most effectual remedy against the increase of these weevils is to cut off the shoot in August, or as soon as it is perceived to be dead, and commit it with its inhabitants to the fire. Such is

the substance of Prof. Peck's communication respecting this insect. I would observe that these insects are very abundant in the perfect state during the months of April and May, from which it is to be inferred that they secrete themselves somewhere during the winter, and deposit their eggs in the spring, or perhaps do not usually leave the trees before spring.

Rhynchænus Nenuphar, was scientifically described and figured by Herbst in the year 1797. Its history has been investigated by several American writers, particularly by Prof. Peck, who called it *R. cerasi*. The plum and cherry trees have, for a long time, been annually disfigured by irregular swellings on the young branches. These swellings or warts are diseases of the bark, caused by the punctures of the weevil and the residence of the grubs. The sap-vessels being wounded and irritated by the insects, throw out an increased quantity of fluid, this is re-absorbed by the bark, which is consequently swollen and thickened in substance ; the over-stretched cuticle bursts, and the swelling becomes irregular, granulated, and full of fissures. The local exhaustion of sap, and the pressure of the tumors, compress the wood, and the limb gradually perishes above the seat of the disease. From one of the warts of the cherry tree Prof. Peck obtained the weevils in their perfect state, which proved to be the same insects whose larvæ were known to cause the premature ripening and fall of peaches, apricots, and plums. From the latter fruit I bred the same insect, differing in no respect from that described by Prof. Peck. A paper by Mr. Tilton on this insect was published by Dr. Mease, in his Domestic Encyclopedia, from which it has been repeatedly republished in the various horticultural treatises of this country.

Melsheimer, in his catalogue, observes, that the larva lives under the bark of the peach-tree. We have Prof. Peck's authority for the fact that it is the cause of the excrescences on the cherry-tree, and further observation has proved that the same insect deforms the limbs of the plum-tree. According to several memoranda the perfect insect is found during most of the spring and summer months. Its first appearance is in May, when it begins puncturing the small fruit with its rostrum, and deposits in the puncture thus made an egg, which in a short time becomes a larva or maggot. This worm eats into

the kernel before the fruit is half grown; and thus causes it to fall prematurely. The maggot then easily escapes into the earth, becomes a pupa, and returns to the surface in about three weeks. In order to account for the occurrence of these insects in the limbs of the trees, I will venture to give the following explanation, although, at present, it rests only upon hypothesis. The final transformation of the grubs, living in the fruit, appears to take place at various times during the last of summer and the beginning of autumn, when the weevil, finding no young fruit, is probably obliged to lay its eggs in the small branches. The larvæ live in the branches during winter and are not perfected till near the last of the ensuing June. Should the fall of the fruit occur late in autumn the development of the perfect insects will be retarded till the next spring; and this I *suppose* to be the origin of the brood which oviposits in fruit. It is a singular circumstance in the history of this insect, and one of which, hitherto, no explanation has been offered, that some broods should attack the limbs and others the fruit. In this is manifest the wisdom of the Author of nature in providing for a continuation of the species in various contingencies. By this wonderful compensating contrivance in its economy, this little entity is secure of an appropriate nidus for its future progeny in sterile regions and unfruitful seasons.

Such, in brief, are the habits of this insect, and these being known, the way for successful experiment is opened. Not having made any myself, it must be left to the ingenuity of others to devise and point out a remedy against the injuries of this depredator. The following, among others which have been suggested, may succeed.

1. The diseased excrescences should be extirpated before the last of June and be burned.

2. All immature or wormy stone fruit should be collected as soon as it falls, and should be boiled or steamed to kill the enclosed larvæ, after which they may be given to swine.

The moose plum-tree, which grows wild in Maine, is never attacked by this insect, even when in the immediate vicinity of diseased foreign trees. It, therefore, would be the best of stocks for budding or engrafting upon. The fruit can be easily obtained from Maine, and the trees grow rapidly from the stones.

From the genus Rhynchænus have been separated those insects

which have the rostrum or snout as long as the body, very slender, and curved ; the antennæ are also long and slender, and are inserted rather beyond the middle of the rostrum. The name of this subgenus is *Balaninus*, which signifies inhabiting a nut, (βαλανος, *a nut*, and ενειμι, *I am in*,) and the insects are called *nut-weevils*. The European *Balaninus nucum* inhabits the hazel-nut. The female, with her long rostrum, pierces the nut when young and soft, and then deposits in the hole an egg, from whence is hatched a small maggot that preys upon the kernel. The nut, not apparently injured by the slight perforation, continues to increase in size, and thus furnishes an abundant supply for its inhabitant. When this has finished eating, it forms in the shell with its teeth a regular, circular orifice, through which to make its exit. The fruit itself, as if aware of the necessities of the insect, now falls to the earth ; the grub quits " the dark chambers of the caverned nut," enters the soil, is transformed to a pupa, and remains at rest till the succeeding summer, when it emerges from its case to provide for the continuation of its species. Our most common nut-weevil, *Balaninus rectus*, is found from July to October. I have one specimen which was captured in a chestnut grove; but I have usually found this species in the vicinity of hazel-bushes, and believe that it inhabits the nut of that shrub, though I have never witnessed its metamorphoses.

The most pernicious of the weevil tribes are those insects which belong to the genus *Calandra*. The antennæ are inserted at the base of the rostrum, are geniculated, apparently eight-jointed, the last or eighth joint forms the club, and contains at its apex a minute, spongy, retractile mass which really constitutes another joint ; the body is oblong, plane or flat above, and the tip is naked or not covered by the elytra. By these characters it is easy to recognize these insects.

With the exception of a few large species, the genus *Calandra* is appropriated to the farinaceous grains, such as wheat, maize, rice, and various other cereal productions. There are several insects called weevils, some of which do not belong to the order *Coleoptera*, but the *Calandræ* are the only true corn or grain weevils of scientific writers.

Calandra oryzæ, the rice weevil, is very injurious to this useful grain, consuming its nutritious parts, and materially lessening its

weight. It is not confined to rice, but also attacks maize. I have seen stored maize literally alive with them; and should the evil be propagated and extended in this section of our country, it will prove a serious injury to one of our most valuable staple productions.

The insect inserts only a single egg in each grain, but, as she is very prolific, one female may produce a numerous progeny. The eggs are deposited when the grain begins to swell, and while it is yet very tender. The maggot lives securely and unsuspected in the centre of the rice; when it has attained its full size it has formed a cavity from which it gnaws a small passage through one end, which it stops up with some of the flour or particles of the rice, and then becomes a pupa, and subsequently a perfect insect before leaving its habitation, which takes place in the spring. This weevil does not, to my knowledge, attack rice or maize after it has become dried and is stored for consumption. The wheat weevil of this country is unknown to me. I have a large species of *Calandra* which I am informed was found in southern maize, and which has continued to be propagated in the corn-house where it was first introduced.

The family of wood-eaters or Xylophages, called also *Bostricidæ*, includes the notorious *Scolytus Pyri*, and many other insects which feed upon wood. When these abound, they are productive of much mischief, particularly in forests, which are often greatly injured by them, and the wood rendered unfit for the purposes of art. In the year 1780, an insect of this family made its appearance in the pine trees of one of the mining districts of Germany. Three years afterwards whole forests had disappeared, and for want of fuel, an end was nearly put to the working of the extensive mines in this range of country.

A distinguished British naturalist, in the year 1824, was requested to investigate the cause of an alarming decay of the noble elms which ornament St. James' and Hyde Parks. He discovered that they were infested by numerous insects belonging to the genus *Scolytus*, whose ravages had loosened the bark of many of the trees, causing it to fall off in large flakes, and threatening their total destruction. An abstract of the account given by Mr. Macleay, the naturalist just mentioned, and some additional information on destructive insects, was published, with the signature of Indagator, in the fifth volume of the New Eng-

land Farmer. Its perusal is earnestly recommended to all who take an interest in the history of the contagious diseases of plants.

The insects of this family have the body cylindrical or globose; the antennæ with not more than ten distinct joints, terminated by a thickened, solid, or perfoliate mass, composed of two or three joints; the joints of the tarsi or feet are not spongy beneath, and the anterior legs are dentated or toothed.

Their larvæ are small, short, white grubs with horny heads, and six small feet attached to the three anterior segments. Their jaws are very hard, and formed for cutting woody substances, which they reduce to fine powder. They remain one or two years in the larva state, and do not quit the trees which they inhabit until they have become perfect insects. The places of their exit are perfectly cylindrical holes.

In *Hylurgus*, the body is cylindrical and is obtuse behind; the antennæ are short, composed of ten joints, the three last forming a rounded mass. The last joint but one of the feet is divided into two lobes.

Hylurgus terebrans, is a large insect, apparently capable of doing much mischief. It is very common during the months of April, May and June, on newly made board-fences, and on lumber wharves; but I have not been able to ascertain upon what tree it resides; though probably it inhabits some of the pines, hemlocks, or cedars employed as lumber.

Hylurgus dentatus is found in October, on the trunks and under the bark of the red cedar. The bark of this tree is perforated by thousands of small holes, from which have escaped these little beetles. The female forms a cylindrical passage beneath the bark, where she deposites her eggs. The larvæ proceed from this path, in feeding, at right angles, forming on each side numerous parallel furrows, smaller than the central tube of the female. The larvæ live between the bark and the wood, and by their ravages loosen the former, and arrest the formation of new wood.

In the insects, referred by Prof. Peck to the genus *Scolytus*, the body is short and cylindrical; the thorax is arched so that the head is situated beneath its anterior part; the antennæ are ten-jointed, the first joint is long, and thickened at the end, the second cup-shaped, the third to the seventh, inclusive, are minute, but gradually increase in size,

the eighth, ninth and tenth are united into a knob ; the palpi or feelers are conical. These insects cannot be retained in the genus *Scolytus*, as now defined, because in this genus the antennæ have the club composed of only two joints. Not having seen these insects in a living and entire state, I cannot certainly determine from my specimens, or from Prof. Peck's description and figures of them, to which of the modern genera they belong.

For many years past the pear-tree has been found to be subject to a peculiar malady, which shows itself during midsummer by the sudden withering of the leaves and fruit, and the discoloration of the bark of one or more of the limbs, followed by the immediate death of the part affected. In June, 1816, the Hon. John Lowell, of Roxbury, discovered a minute insect in one of the affected limbs of a pear-tree ; since that time he has repeatedly detected the same insects in blasted limbs, and his discoveries have been confirmed by Mr. Henry Wheeler and the late Dr. Oliver Fiske, of Worcester. Mr. Lowell submitted the limb and the insect contained in it to the examination of Prof. Peck, who gave an account and figure of the latter, in the fourth volume of the Massachusetts Agricultural Repository and Journal. From this account, and from a subsequent communication by Mr. Lowell, in the fifth volume of the New England Farmer, it appears that the grub or larva of the insect eats its way inward through the alburnum or sap-wood into the hardest part of the wood, beginning at the root of a bud, behind which probably the egg was deposited, following the course of the eye of the bud towards the pith, around which it passes, and part of which it also consumes ; thus forming, after penetrating through the alburnum, a circular burrow or passage in the heart-wood, contiguous to the pith which it surrounds. By this means the central vessels, or those which convey the ascending sap, are divided, and the circulation is cut off. This takes place when the increasing heat of the atmosphere, producing a greater transpiration from the leaves, renders a large and continued flow of sap necessary to supply the evaporation. For the want of this, or from some other unexplained cause, the whole of the limb above the seat of the insect's operations suddenly withers, and perishes during the intense heat of midsummer. The larva is changed to a pupa, and subsequently to a little beetle in the

bottom of its burrow, makes its escape from the tree in the latter part of June, or beginning of July, and probably deposites its eggs before August has passed. This little beetle, which is only one-tenth of an inch in length, was named *Scolytus Pyri*, by Prof. Peck; it is of a deep brown color, with the antennæ and legs rather paler, or of the color of iron-rust. The minuteness of the insect, the difficulty attending the discovery of the precise seat of its operations before it has left the tree, and the small size of the aperture through which it makes its escape from the limb, are probably the reasons why it has eluded the researches of those persons who disbelieve in its existence as the cause of the blasting of the limbs of the pear-tree. It is to be sought for at or near the lowest part of the diseased limbs, and in the immediate vicinity of the buds situated about that part. The remedy, suggested by Mr. Lowell and Prof. Peck, to prevent other limbs and trees from being subsequently attacked in the same way, consists in cutting off the blasted limb *below* the seat of injury, and burning it *before* the *perfect* insect has made its escape. It will therefore be necessary, carefully to examine our pear-trees daily, during the month of June, and watch for the first indication of disease, or the remedy may be applied too late to prevent the dispersion of the insects among other trees

In examining the leading shoot of the white pine, Prof. Peck found another insect which he called *Scolytus strobi*. Half a dozen were obtained from the terminal bud. This insect is exceedingly minute, being only six hundredths of an inch in length, and two hundredths of an inch in diameter. It is black and polished, the feet are pale brown, and the antennæ dusky. The wing-cases have longitudinal rows of short bristles, the thorax is densely covered with shorter ones, and is rough in front with minute tubercles.

In the genus *Bostrichus*, the body is cylindrical, the thorax globose, generally rough with tubercles, the elytra or wing-cases are arched so as to cover nearly two-thirds of the body, are often obliquely truncated or cut off behind, and armed with teeth at the apex; the antennæ are terminated by a pectinated or serrated club.

Bostrichus basillaris, is appropriated to the shagbark tree. Its larvæ frequently abound in the trunk, the solid wood of which is per-

forated diametrically through with their cylindrical passages. Mr. Say has described three insects of this family which are very injurious to the pines.

Among the insects which facilitate the destruction of old trees are those belonging to the family *Cucujiadæ*. They are found beneath the bark, and in the bodies of trees upon the wood of which their larvæ subsist. They are of an oblong form, the body is more or less flattened, the thorax is square, the antennæ are eleven-jointed, of moderate length, and often taper at the end ; the feet are not spongy beneath, and the joints are entire.

In *Parandra*, a genus peculiar to America, the antennæ are moniliform, or bead-like, and shorter than the body ; the feet are of moderate length ; the jaws (mandibles) are strong, prominent, and toothed ; the body is more convex than in the other genera of the family. *Parandra brunnea* is not uncommon in decayed trees. It flies abroad in the night. This insect might readily be mistaken for a small *Lucanus*, and its habits are similar.

In *Cucujus*, the body is quite flat, the head is broad behind the eyes; the triangular plate, covering the mouth and extending forwards, with the prominent jaws, give to the mouth the appearance of a short beak. The antennae are short, and granulated or moniliform.

Cucujus clavipes is our largest and most beautiful species. The larva feeds under the bark of trees. When fully grown it measures about three quarters of an inch in length, and seventeen hundredths of an inch at its broadest part. It is very much flattened ; the head resembles that of the perfect insect in shape ; the antennæ are three-jointed and longer than the head ; the first three segments of the body are each furnished with a pair of robust feet ; there is no thoracic shield, and no anal proleg ; the posterior margin of the eleventh segment is armed with four teeth, a small one on each side, and two larger ones beneath ; the last segment merely constitutes a small base to support an anal recurved fork ; each tyne of this fork has a small spine just above its base. When the insect becomes a pupa, the skin of the larva is left entire, except a small longitudinal fissure on the back of the first three segments. The perfect insect is developed about the middle of May.

The next insects to be described belong to the family of *Ceram-*

bycidæ, or capricorn beetles. The larvæ, in common language called *borers*, are eminently wood-eaters, and exceedingly injurious to vegetation. These insects, which are very numerous, are distinguished by their long and tapering antennæ inserted into a notch of the eyes, which are kidney-shaped; the body is elongated; the thorax cylindrical or quadrate; the feet are formed for standing securely; the first three joints dilated, and covered with spongy cushions beneath, the third being also divided into two lobes, between which issues the fourth joint, which is terminated by two strong, curved and simple claws. They fly well, and usually by night. During the day they remain in concealment. When annoyed or taken into the hands, they make a querulous noise. By nodding its head, the insect causes the base of the thorax to rub against the base of the abdomen, and these parts being corneous emit a squeaking sound, whence one of these insects is, in Germany, called the fiddler. The antennæ of the females are usually shorter than those of the males; many of the former also have a tubular, jointed, retractile apparatus at the posterior extremity, which is capable of being drawn out like the joints of a telescope, and which serves to conduct the eggs into the place where they are to be deposited. The larvæ constitute the principal nourishment of wood-peckers.

In *Prionus* the body is flattened, and the thorax is broad, square, and toothed at the sides. The female lays her eggs in crevices of old trees. The eggs are oblong and many in number. The larvæ have the body divided into twelve segments, and are white, except the head, which is horny and yellowish; the diameter of this part also is somewhat greater than that of the body. They have three pair of minute feet near the head; but the motions are principally effected by the contractions and dilatations of the body, aided by the little projections or tubercles which cover the seven terminal segments. The metamorphoses of the insects of this genus, as well as of all the other *Cerambycidæ*, occur in the places where the larvæ reside.

Prionus brevicornis is found in the perfect state during the month of July. Its larva feeds upon the trunks of the Lombardy poplar, the balsam poplar, or balm of Gilead, and probably upon other species of poplar.

Prionus cylindricus inhabits the pine. The perfect insect fre-

quently enters houses at night, from the middle of July to September.

In *Lamia*, the head is vertical, or forms a right angle with the thorax; the antennæ are longer than the body; the thorax is generally cylindrical, and tuberculated or spined at the sides; the last joint of the palpi or feelers is not much thickened, or is nearly cylindrical.

The larvæ are white and elongated; their bodies are composed of thirteen segments, each of which is distinct and swollen; the head is horny; and they have six small feet. They remain two or three years before becoming pupæ.

Lamia titillator is one of our largest species; the habitat of the larva is unknown to me; the perfect insect occurs in woods.

The genus *Saperda* has the head and antennæ like those of Lamia, but the thorax is smooth, perfectly cylindrical, and destitute of spines or tubercles.

Saperda calcarata inhabits the poplar, and greatly resembles, in size, form and color, a European species, appropriated to that tree. This insect, together with *Prionis brevicornis*, has almost destroyed the Lombardy poplar of this vicinity, which is perforated in various directions by their larvæ. The perfect insect is disclosed in August.

The full-grown larva measures nearly two inches in length, and is of a yellowish white color, except the upper part of the first segment which is of a deep buff. Its body is nearly cylindrical, rather thicker before than behind, and consists of twelve segments, separated from each other by deep transverse furrows; the first segment is covered above by a broad buff-colored plate or thoracic shield; the second segment is very narrow; on the upper and under sides of each of the following segments, from the third to the tenth inclusive, is a transverse space, rendered rough like a rasp by minute projections. These rasps, on the upper and under sides of the body, serve instead of legs, which are entirely wanting.

The most notoriously noxious insect of this genus, is the *Saperda bivittata*, the parent of the apple-tree borer. The trees and shrubs principally attacked by this borer, are the apple-tree, the quince, mountain ash, hawthorn, medlar, and several species of *Aronia*. Indigenous plants of this genus, called *June-berry* and *choke-berry*

bushes, seem to be its natural food; and the perfect insects are frequently found on the leaves of these plants during the months of June and July. It is at this time that the eggs are deposited, being laid upon the bark near the root. The larva is elongated, nearly cylindrical, rather larger towards the head, and is destitute of feet. It cuts, with its strong jaws, a passage through the bark into the wood, and the place of its operations is known by the castings which it thrusts backwards out of the hole. The larva state continues two or three years, at the expiration of which time the insect has extended the channel several inches in length up the trunk of the tree, at its termination approaching the bark and covered only by it. In this channel its final transformation takes place. The pupa does not differ greatly from other pupæ of the Coleoptera; but it has the tail armed with short spines, and a transverse series on each of the dorsal segments. These spines probably assist the insect in its movements when the pupa coat is to be cast off. This occurs about the first of June; the perfect insect penetrates the thin covering of bark which was left over the upper extremity of its channel, and emerges from its place of confinement during the night.

Various means have been tried for destroying the borers in the apple tree. An ingenious mechanic, Mr. Hersey, was very successful in cutting them out with a gouge; he then covered the wounds with composition, and, in vigorous trees, the bark soon closed over them. Where great numbers of borers infest one tree this method is injudicious; such an extensive removal of the bark, as nearly to girdle the tree, interrupts materially its healthy functions. Instead, therefore, of a free use of the gouge and knife, it will be more prudent to introduce a wire so as to destroy the larvæ in their holes. Plugging the external orifice has been practised by some persons, and, as they assert, with success. Others have recommended putting camphor in the hole and then plugging it. The latter promises to be more effectual, but experiments are wanting to confirm its expediency.

There are several small species of *Saperda* in this State, distinguished by the extreme slenderness of the body, which is almost or quite cylindrical. Such are the insects named *Saperda plumbea* and *tripunctata*. The larvæ of these species are not, strictly speaking, wood-eaters, for they consume the pith only of plants. They are

much more slender than the other larvæ of this genus, and are found in the stems of the tall blackberry and other species of *Rubus*. Roesel has described and represented the transformations of an European insect closely resembling these, which also lives in the interior of the stems of some kind of bramble.

In *Stenocorus* the body is slender, the head nutant, or forming an oblique angle forwards; the antennæ are long and spiny; the thorax approaches to an orbicular form, and is frequently armed at the sides with spines or tubercles; the apex of the elytra is emarginated or notched, and toothed or terminated with spines.

Stenocorus cinctus, our largest species, is said to inhabit the hickory, in which the larva perforates long galleries in the direction of the fibres.

Stenocorus putator, or the oak-pruner, so named by Prof. Peck, inhabits the white and black oaks. The egg is laid at the origin of a bud or small twig, near the extremity of a branch; the larva penetrates at that spot to the pith, and then continues its course towards the body of the tree, thus forming a cylindrical perforation several inches in length in the centre of the branch. Having reached its full size, which it does towards the close of summer, it divides the branch at the end of its burrow, nearest the body of the tree, by eating it off transversely from within, leaving only the ring of bark untouched. It then retires backward, stops the end of its hole near the transverse section with fibres of the wood, and awaits the fall of the branch, which is usually broken off and precipitated to the ground by the autumnal winds. The leaves of the oak are rarely shed before the branch falls, and thus serve to break the shock. The pupa state takes place in the branch, and the perfect insect is disclosed from the middle of May to the first of July. These insects are nocturnal, like most of the capricorn beetles, and frequently enter houses in the evening. I have repeatedly seen branches lopped by the larvæ, which were nearly an inch in diameter, and five or six feet in length, the transverse section being almost as regular as if made by a saw. It is evident that this kind of pruning must be injurious to the trees, and should be guarded against if possible. By collecting the fallen branches in autumn, and consuming them before spring, we prevent the development of the perfect insect, while we derive some benefit from the branches as fuel.

From the regularity of its form and noble size, the sugar maple is accounted one of the most beautiful, while, from its many useful properties, it is esteemed one of the most valuable of our forest trees. This fine tree suffers much by the attacks of a borer belonging to the genus *Clytus*, which in some cases produces its entire destruction.

The genus *Clytus* is characterized by having the head nutant; the body flattened; the thorax globose, or orbicular, and convex, without spines or tubercles; the antennæ usually shorter than the body; and the palpi or feelers terminated by a triangular joint.

The species which has been discovered in the sugar maple, is the *Clytus speciosus*, scientifically described by Mr. Say, and accurately represented by the pencil of Lesueur, in the American Entomology. But for its habits we are indebted to the investigations of the Rev. L. W. Leonard, of Dublin, N. H. In the summer of 1828, he discovered the perfect insect under the loosened bark of some young maples in Keene, and traced the recent track of the larva three inches into the solid wood. These trees, on the cultivation of which much care had been bestowed, were nearly destroyed by this large insect. Specimens of the perfect insect have been repeatedly captured in the vicinity of Boston, which were undoubtedly brought here in maple logs from the State of Maine. They have been taken in the month of July.

Many species of *Clytus* are found during the day upon flowers, and do not therefore seem to be nocturnal insects. During the month of September, *Clytus pictus* is often seen in abundance, feeding upon the blossoms of the golden-rod. If the trunks of our common locust tree, *Robinia pseud-acacia*, are examined at this time, a still greater number of these insects will be found upon them, and most often paired. The habits of this insect seem to have been known, as long ago as the year 1771, to Dr. John Reinholdt Forster, who then described it under the name of *Leptura Robiniæ*, the latter being derived from the tree which it inhabits. Drury, however, had previously described and figured it under the specific name which I have adopted, and which, having the priority, in point of time, over all the others which have subsequently been imposed, must be retained. The female deposits her eggs in the crevices of the

bark, the larvæ bury themselves beneath it before winter, and in the spring attack the solid wood, which they perforate deeply in various ways, but most usually in the direction of the fibres. The places of their operations are known by the oozing of the sap intermixed with the castings of wood, which are every now and then thrust backwards by the insects out of the external apertures. According to the observations of Gen. Dearborn, who has given an excellent account of this insect, the larvæ attain their full size by the 20th July, soon become pupæ, and appear in the perfect state early in September. Thus the existence of this species is limited to one year.

White-washing, and covering the trunks of the trees with grafting composition, may prevent the female from depositing her eggs on them; but this practice cannot be employed to any extent. Perhaps it will be useful to head down young trees to the ground, with the view of destroying the larvæ contained in them, as well as to promote a more vigorous growth. In nurseries and plantations, much evil might be prevented, by employing children to collect the perfect insects while in the act of providing for the continuation of their species. A common black bottle, containing a little water, would be a suitable receptacle for them, and should be emptied into the fire in order effectually to destroy the insects. The gathering should be commenced as soon as the insects first appear, should be continued daily as long as any are found on the trees, and furthermore should be made a general business for several years in succession. I have no doubt, should this be done, that, by devoting one hour every day to this object, we may in time rid ourselves of this noxious insect.

The genus *Callidium* is nearly allied to that of *Clytus*. The head nods forwards; the body is flattened; the antennæ are proportionally longer than in Clytus; the thorax is orbicular, not convex above, and is depressed or indented on the disc, and the thighs are much more swelled in the middle. I have never found any species upon flowers, though they are not uncommon in the day-time upon wooden buildings and fences. The larvæ do not differ much from other borers of this family; they live in the trunks of trees, and in timber; their passages are more or less tortuous, and are filled with castings of the wood as fast as the insects advance. The larva state is said to continue two years.

Two species are common both to this country and to Europe. One of them is *Callidium bajulum*. It appears to inhabit pine wood and timber, whence it is frequently met with on buildings in the months of July and August. We are informed by Kirby and Spence, that the larva sometimes does material injury to the woodwork of houses in London, piercing in every direction the rafters of the roofs, and, when arrived at its perfect state, even penetrating through sheets of lead which happen to cover the place of its exit. One piece of lead, only eight inches long and four broad, exhibited twelve oval perforations made by these insects; and lead was discovered in the stomachs of the larvæ.

The other species is *Callidium violaceum*, which Prof. Peck said he believed to have been introduced into Europe in timber exported from this country. It is exceedingly injurious to the sapling pines of Maine. The perfect insect makes its appearance about the last of May or the first of June.

Nearly allied to the family of capricorn beetles, is another which is called *Lepturiadæ*. The insects contained in it were included formerly in the genus *Cerambyx*, and many, if not all of their larvæ, are wood-eaters. In this family the antennæ are of variable length, and inserted between the eyes, which are not kidney-shaped, but are nearly round; the body is elongated, and more or less attenuated behind; the thorax is trapezoidal or contracted before, and resembles a truncated cone; the feet are like those of the capricorn beetles.

The only genus in this family to be noticed is called *Rhagium*, in which the antennæ are short, the eyes large and prominent, and the thorax has a large spine on each side.

The bark of the *Pinus rigida*, or pitch-pine, is often extensively loosened by larvæ at work beneath it, so that it falls off in large flakes, and the tree perishes. These larvæ feed between the bark and wood, and when they are about to become pupæ surround their bodies with a ring of woody fibres, and in this little cavity pass through their transformations. The perfect insect is fully formed before winter, and eats a passage through the bark in the ensuing spring. It is the *Rhagium lineatum*, of Olivier, which was thought by Mr. Say to be the only American species of the genus. There

is another species, however, closely allied to *Rhagium salicis* of Europe, and which was obtained by Mr. Leonard from the sill of an old door. This species does not appear to have been described, and I, therefore, would call it *R. decoloratum*, the elytra appearing as if their original color had faded away. It is highly probable that the other sex may have elytra of a blue color.

The *Crioceridæ* have some resemblance to the capricorn beetles. Besides some minute differences, they are distinguished by their short antennæ, composed of cylindrical or globose joints, which are of the same size or even larger towards the extremity; the eyes do not surround the base of the antennæ; the thorax is cylindrical; and the body is of an oblong quadrate form; the feet are shorter, but are furnished, like those of the cerambyx family, with cushions beneath.

In the genus *Crioceris*, the eyes are prominent, globose, with a minute notch in the anterior margin; the joints of the antennæ are very short; and the thorax is abruptly contracted in the middle. When held between the fingers, they make a sound like that of the capricorn beetles. They deposit their eggs in parcels of eight or ten together, on the leaves of plants. The larvæ are hatched upon these leaves. Their bodies are short and cylindrical; their heads are horny; and they have six feet. The vent is situated at the upper part of the posterior extremity, so that their excrement falls on the back, and, by the contraction and dilatation of the segments, is pushed forwards towards the head; this process is repeated until the back is entirely coated with it. This covering shields their soft and tender bodies from the heat of the sun, and probably serves to secure them from the attacks of their enemies. When the mass accumulated becomes too heavy or too dry, the insect throws it off, but replaces it again in the course of two or three hours. In eating, the larvæ move backwards, never devouring the portion of leaf immediately before the head, but that which lies under it. In about a fortnight the larva attains its full size, crawls from the plant, enters the earth, and forms a little cell of grains of earth which are cemented and lined by a glutinous fluid emitted from the mouth. Fifteen days afterwards the perfect insect throws off its pupa skin, ruptures its cocoon, and ascends from the earth. The pupæ of the

second brood, which appears towards the end of summer, remain without change, till the ensuing spring, and then become perfect insects. Thus, in every year, there are two broods, the larvæ from which, when numerous, often do considerable injury to vegetation.

Crioceris trilineata is found on the leaves of the potato-vine. The parent insects, which have survived the winter in the pupa state, make their appearance early in June. The eggs are oblong oval, and of a yellow color, and are fixed on the leaves by a glutinous substance, which cements them securely in packets of six or eight in number. The larvæ soon appear, and begin their depredations. Their numbers are sometimes immense, and the leaves are then covered and nearly consumed by these filthy grubs. After they have passed through their metamorphoses, which are such as were stated in the account of the genus, the perfect insects again appear. This occurs during the month of July, and the eggs for the second brood are then deposited, from which a continuation of the species in the following year, is secured, the larvæ entering the earth before autumn, and the pupæ remaining quiescent till spring.

The insects belonging to the family of *Cassidadæ* have the feet spongy beneath as in the three preceding families ; but the eyes are oval ; the antennæ are short, and situated near each other at a distance from the mouth, or between the eyes ; the nails are simple at the points, and not much curved.

In the genus *Hispa*, the antennæ are very short, and are thickened towards the ends ; the thorax is trapezoidal, its anterior edge being the shortest ; and the body is rough or spinous. The habits of this genus are very peculiar, and no account has as yet been given of them by any European naturalist. The perfect insect is found in the spring on the leaves of trees. It deposits from one to four or five eggs on the upper surface of the leaf. The larva, when hatched, penetrates under the cuticle and devours the parenchyma or pulpy part of the leaf, so that the cuticle over its retreat turns brown and dies. The larvæ of those species which are known to me are about one-fifth of an inch in length, when fully grown. The body is oblong, flattened very much, rather broader before than behind, of a whitish color, except the head and first segment, which are of a darker color and horny consistence. It has three pairs of feet, and the segments

of the body project at the sides, being there surmounted with minute tubercles. The pupa state takes place in the leaf, and continues about one week, when the perfect insect bursts from its confinement and escapes into the air.

Hispa rosea devours the tender leaves of the apple tree, and its larvæ are found also in the leaves of that tree in July. *Hispa suturalis* attacks the leaves of the *Robinia pseudacacia*, or locust.

The genus *Cassida* is distinguished for its shield-shaped body, whence it derives its name. The head is covered by the semicircular thorax ; the antennæ are about the length of the thorax ; the body is convex above and flat beneath. The larvæ live on the leaves of plants. They have three pairs of legs ; their body is oval, and flattened, or but slightly convex above, and armed at the sides with spines, and the tail is terminated by two considerably longer than the rest, forming a kind of fork. This fork serves to retain the excrement when voided, and a mass is often thus accumulated which equals half the body in magnitude. The tail, with the loaded fork, is recurved over the back, and thus protects the insect from the sun, and probably also from its enemies. When the pupa state approaches, the larva fixes the hinder part of its body firmly to the leaf, the skin over the anterior extremity is longitudinally rent, and is gradually slipped backwards. The pupa has some spines near the tail which secure it to the cast-skin ; its body also is furnished with four long teeth-like projections on each side. The pupa state continues only a few days.

Cassida aurichalcea appears to be appropriated to different species of *Convolvulus*, though it is occasionally found on *Solanum dulcamara ;* it occurs in great abundance on the *Convolvulus sepium*, and on the sweet potato-vine. The leaves of these plants are devoured both by the larvæ and perfect insects. The latter appear first during the months of May and June, having probably survived the winter in the perfect state, in some place of concealment. The first brood of larvæ arrive at their growth and are metamorphosed into pupæ, and subsequently into perfect insects, early in July, when a second brood is produced, from which proceed the insects found in spring. In June, 1824, Mr. Lowell sent me specimens of this little beetle, which he found to be injurious to the sweet potato-vine,

by eating holes through the leaves. When living it has the power of changing its hues, at one time appearing only of a dull yellow color, and at other times shining with the refulgence of polished gold. To ascertain the immediate source of this voluntary and evanescent brilliancy, we must examine the structure of the insect. The elytra or wing-cases, the parts which exhibit the phenomenon, are lined beneath with an orange-colored paint, which seems to be an organized substance. On examining it with a microscope, several large vessels may be perceived running to the tip from the base of the elytra, where they appear to communicate with the abdomen. These vessels ramify in the orange-colored substance, and seem finally to terminate in numerous points with which the elytra are studded. It may be remarked, that the external margins of the elytra never exhibit any change of color; they are, in fact, destitute of the paint, and are nearly transparent. The disc of the elytra appears also quite diaphanous when this colored substance is removed by a knife. And further, the color of the paint is most vivid when the insect is most effulgent, more faint when the lustre is temporarily withdrawn, and quite dull when the insect is dead. This organized substance, then, is the immediate source and seat of the corruscation. Those insects which shine in the night are provided with a set of organs which secrete a luminous fluid. This insect, however, is brilliant during the day, and its internal structure is so delicate as to defeat any attempt to investigate it. The remote cause, therefore, is at present obscure. It may, perhaps, be referred to a secreted fluid, which the insect at will propels into the vessels that ramify in the pigment, which, when thus injected, would become more opaque, and would produce a different reflection of light. If such a fluid really exists, which is very probable, it must have its appropriate glands or secreting organs within the abdomen. How extremely minute and how wonderful then must be their organization, since it is not perceptible by the microscope, and is known only by its beautiful effects. These undoubtedly answer some important end, as they are closely connected with the existence of the insect, and evidently appertain to the functions of vitality.

The last family of Coleopterous insects which will be examined may be called *Galeruciadæ*. It is characterized by having the feet

spongy beneath ; the eyes oval or globose ; the antennæ of moderate length, approximated at their base, and inserted before the middle of the face, near the mouth ; the thorax transversely quadrate, or but slightly narrowed in front ; and the nails divided at their points, or toothed beneath.

In the genus *Galeruca*, the antennæ are rather shorter than the body, and composed of obconical joints ; the posterior thighs are not formed for leaping ; the nails are bifid at their points ; the body is oblong quadrate, and slightly flattened above : and the thorax is most often uneven or indented. Many of these insects, both in the larva and perfect states, devour the leaves of plants. They often occur in great numbers, and then commit devastations as extensive and injurious as those of any other noxious insects. Some of the species are known to metamorphose on the plants which they inhabit; others become pupæ in the earth.

The cucumber-bug belongs to this genus. It is called *Galeruca vittata*. At first sight it appears much like the potato-insect (*Crioceris trilineata*,) being nearly of the same shape and size, with the stripes similarly disposed. On examination, however, it will be seen that it is of a paler color, and that the thorax is differently formed. This bug, or more properly beetle, makes it first appearance on the cucumber, squash, and melon vines, about the last of May and first of June, or as soon as the leaves begin to expand. Its injuries are often very great, and various means have been tried to prevent its attacks. Dr. Barton recommended sprinkling the vines with a mixture of tobacco and red pepper, which he says is more beneficial than any other method. Others have advised watering the vines with a solution of one ounce of Glauber salts, in a quart of water. Mr. Gourgas, of Weston, has found no application so useful as ground plaster ; and a writer in the American Farmer extols the use of charcoal dust. The Rev. Dr. Harris, some years since, advised making fires in the night in gardens and orchards for the purpose of attracting and consuming noxious insects, and this plan has proved successful in destroying the cucumber-bug. The staves of old tar-barrels, or pitch-pine knots, split into small pieces, are the best materials for making these fires. Many cover the vines with millinet, stretched on small frames. Such an exterminating war has been

waged with these insects, that I have had no opportunity of learning their history or metamorphosis. The eggs and larvæ, although frequently sought for, have escaped my researches. But the habits are presumed to be similar to those of *G. puncticollis*, which is found in profusion on the common *Salsola*. The larvæ of this species live in the earth, and feed on the roots of the Salsola, and do not leave the earth until they become perfect insects.

In the genus *Haltica*, the antennæ are about half the length of the body; the posterior thighs are thickened and very robust, being formed for leaping; the nails are very much curved at their points, with a strong blunt tooth extending from beneath the base to the middle; the body is oval and convex. These insects infest the olera-ceous plants, perforating their leaves with innumerable small holes. At the approach of the finger they leap with surprising agility. Many of them are minute.

Their eggs are deposited on plants on which the larvæ are destined to feed. The larvæ are elongated and furnished with six feet. When about to become pupæ they fix themselves upon the leaves by means of a tubercle at the posterior extremity. The larva-skin is then thrown off, and remains in a mass beneath the tail of the pupa; and in about fifteen or twenty days more the last metamorphosis takes place, and the perfect insect makes its appearance. It conceals itself during the winter in some secure place, and survives the cold.

The most destructive species in this vicinity is that which attacks the cucumber as soon as it comes from the ground. Supposing this to be an undescribed insect, I formerly named it *Haltica cucumeris;* but Mr. Say subsequently informed me that it was the *pubescens* of Illiger.

Another species, *Haltica striolata*, is found on cruciferous plants, such as the cress, the horse-radish, the mustard, turnip, &c. It is first seen early in May. During the night, and in rainy weather, it lodges itself in the ground. It is very pernicious to young plants, attacking them as soon as the seed-leaves or cotyledons expand.

Dusting the plants with air-slacked lime, is useful in preventing the attacks of this and the preceding species. Watering plants, infested by them, with strong alkaline solutions, will kill the insects

without injuring the plants. The solution may be made by dissolving one pound of hard soap in twelve gallons of the soap-suds left after washing. This mixture should be applied twice a day with a water-pot.

The insects, whose habits I have now attempted to describe, are but a very small number of those, belonging to the order *Coleoptera*, which are injurious to vegetation. I have selected chiefly such as are the most remarkable, and as would best serve to illustrate the different families and genera to which they belong. Seven more orders remain to be treated in the same way, to carry out the plan upon which this report has been begun. Probably none of them will require to be considered so much in detail as this order, which presents a greater variety in the forms and habits of the individuals included in it, as well as a much greater number of species, than all the other orders. If, however, you take into consideration the devastations of grasshoppers, bugs, plant-lice, locusts or cicadæ, slugs, caterpillars, and maggots, you will readily perceive, that ample materials for another report are still left.

It is well known, that there is no work, in our language, on this branch of natural history, either scientific or popular, which will serve as a manual or introduction to the knowledge of *our own insects*. Detached descriptions there are, it is true; but they are available only to a few persons, and not to the great body of the people. Most of the works on Entomology, in America, consist of short treatises, compilations, or abridgments, originally published in England, and adapted exclusively to that country. Many of the most valuable publications on this subject are very expensive, and are wholly beyond the means of persons of moderate income; many, also, are printed in languages which are not generally understood by us. Even these, valuable and essential as they are to the professed Entomologist, would not supply the particular wants of our own countrymen. It is greatly to be regretted, furthermore, that our public libraries are so deficient in works on this branch of science. In these repositories of learning, we ought to find all the larger, more expensive, and general works, which are necessary for the illustration of every department of science. A scholar can no more labor in his peculiar vocation without books, than a mechanic can without tools;

and, if his own resources are not sufficiently ample to provide him with all that he wants, he ought to be able to find them in those public institutions where they properly belong. The father of physic has said that "life is short and art is long;"* why, then, should the student of nature spend the better portion of his life in making investigations and discoveries, which, were the means within his reach, he would find already recorded? Why should he be compelled to keep back the result of labors, upon which he had hoped to establish a reputation, for the want of the proper aids to enable him to put them into a scientific shape, until he shall have the mortification to find, that he has been anticipated in the publication of his discoveries by the more favored votaries of science in another land? America has been overrun by foreign naturalists and collectors, in almost every direction; it seems to have been looked upon by them, as common ground, open and free to every laborer; they have already reaped a glorious harvest from it, and only the gleanings remain to reward our toils.

I have no wish to overstate the difficulties and obstacles, which, individually, I have encountered; and only advert to them now in order to call attention to the subject, and in the hope that they will be received as some apology for the very imperfect manner in which I have performed the duty assigned to me. Should the commission, under which you, Sir, have acted in calling upon me for a report on the insects of this Commonwealth, be renewed, and should my services again be required, I shall cheerfully respond to the call. To Massachusetts belongs the credit of having been the first to procure an investigation of the animal, vegetable, and mineral productions of a whole state, at the public expense; and the various surveys and reports, which have been made during several years past, are a gratifying proof of the wisdom, public spirit, and liberality of the government by which they have been authorized. To develope the internal and natural resources of our country, to promote the diffusion of knowledge, and to render science popular and available in contributing to the comfort and happiness of the people, are objects deserving all the encouragement which can be given to them. It

* Hippocrates. Aphorism 1.

will be a source of satisfaction to me, if my own humble efforts can contribute any thing towards so great an object; and, with this assurance, I beg leave to submit the foregoing report;

And subscribe myself,

Sir,

Very respectfully,

Your friend and servant,

T. W. HARRIS.

CAMBRIDGE, MASS.,
April, 1838.

ERRATA.

Page	58,	*line*	16,	*for*	chord	*read*	cord.
"	61,	"	23,	"	appeared	"	appear.
"	"	"	35,	"	*Virginiensis*	"	*Virginiana.*
"	64,	"	27,	"	*Melonontha*	"	*Melolontha.*
"	72,	"	18,	"	prays	"	preys.

DR. GOULD'S REPORT.

Boston, April 10, 1838.

To George B. Emerson, Esq., *Chairman of the Commission for the Botanical and Zoological Survey of the Commonwealth:*

Dear Sir:—On receiving my appointment in June last, I commenced with redoubled effort to collect and study the animals assigned me, and which had already for a long time engaged my attention, viz., the Crustacea, Testacea and other Mollusca, Annelides, and Radiata. So large a portion of the Animal Kingdom, inhabiting even so circumscribed a field as the coast and territory of Massachusetts, would be but imperfectly examined by the entire labors of a long life. Most of these animals inhabit the sea; and consequently, very few persons ever have opportunity to examine, or even to see them. As therefore very little attention has been given to them, scarcely a step has been taken which has not presented something before unnoticed.

It cannot be expected, that much that is interesting can be said, of an economical or commercial nature, of such objects as Lobsters, Oysters, Shells, and Worms. Being aware of this, I undertook this part of the survey, on the presumption that the State was desirous of contributing to general science by causing to be collected, described, and illustrated, any objects not hitherto named; and that known species which might be discovered within the limits of the Commonwealth, should be added to our very imperfect catalogue. In this view alone is an examination of these families important. The scientific man alone is capable of appreciating the observations and discoveries made in this department. The theories of the geologist, and the practice of the agriculturalist, are however, in-

timately connected with a knowledge of the nomenclature, sources, and properties of these lower animals; and thus, every fact regarding them is, ultimately, of advantage to the community at large.

I have, therefore, made it a point to compare every object which I have observed with scientific descriptions and figures, where I could find them, that I might verify or correct them; or else to describe and figure them myself. The number of objects which have come to hand has been so great, that in many of the families the catalogue has been more than doubled, and in all greatly augmented, within the few months since my commission was received. These scientific details would of course be too dry to interest any but professedly scientific men. But they have been collected with the hope that when our labors shall end, they may be embodied, published, and properly illustrated, as a contribution to science.

There are some facts, however, connected with the objects of my study, which are of interest to the citizens generally; and to these particular attention has been directed. The Lobster, Oyster, and Clam trade, is an item of no inconsiderable importance in our statistics. Numerous vessels and many hundred men are constantly employed in it. Measures have been taken to obtain an accurate statement concerning this branch of industry; but as an entire year has not yet revolved, no complete view can at present be given.

Attention has also been directed to the different kinds of Leeches which are found in our waters, with the hope of aiding their introduction in place of the foreign Leeches, which have become of such extensive use among us, although commanding a high price.

As I have been more particularly engaged in the study of the Shells during the last year, I would subjoin the following list of species which may now be added to the last catalogue published by the State two years since, besides at least twenty species yet undetermined; and I may state that additions to the other classes have been proportionally numerous.

Above all, I am striving to collect a complete series of all the objects which can be preserved, so that they may all be viewed and examined in a body. Such a collection I deem to be of great value, and certainly demands much labor.

* Those marked "Cauthony" are described in the Boston Journal of Natural History vol. II. N° 1. —

Mya truncata, Penn.
Thracia Conradi, Couthouy.
Tellina sordida, Couthouy.
" tenera, Say.
Cryptodon flexuosa, Turton.
Mesodesma Jauresii, De Joannis.
Venus fluctuosa, Gould, MS.
Cardium pubescens, Couth.
Nucula thraciæformis, Storer.
" lævigata, Gould, MS.
" myalis, Couth.
" tenuisulcata, Couth.
Modiola pectinula, Gould, MS.
" discors, Lin.
" discrepans, Montagu.
Terebratula septentrionalis, Couth.
" thalassina, Gould, MS.
Chiton fulminatus, Couth.
" sagrinatus, Couth.
" Emersonii, Couth.
" pectinatus, Gould, MS.
Patella candida, Couth.
Rimula Noachina, Lin.
Galericulum ovatum, Brown.
" lævigatum, Brown.
Bulla insculpta, Totten.
" triticea, Couth.
" lineolata, Couth.
Bullina canaliculata, Say.
Bulimus lubricus, Penn.
Physa elongata, Say.
Valvata tricarinata, Say.
Paludina canaliculata, Gould, MS.
" lustrica, Say.
Oxinöe glabra, Couth.
Scalaria Nov-Angliæ, Couth.
" subulata, Couth.
Natica immaculata, Totten.
" consolidata, Couth.
Actæon trifidus, Totten.
" convoluta, Gould, MS.
Jaminia exigua, Couth.
Lacuna neritoidea, Gould, MS.
Turbo incarnatus, Couth.
" cinereus, Couth.
" obscurus, Couth.
" aculeus, Gould, MS.
Turritella erosa, Couth.
Pyramis striatula, Couth.
Cancellaria buccinoides, Couth.
Trichotropis costellatus, Couth.
Pleurotoma bicarinata, Couth.
Fusus pleurotomarius, Couth.
" harpularius, Couth.
Murex turriculus, Montagu.
" scalariformis, Gould, MS.

Presuming that a final report would not be expected of us at this time, I have thus reported progress; and unite in what I know to be the desire of all engaged in the survey, in wishing that yet another year may be granted us, during which we may hope to observe all the prominent objects in the State.

Very respectfully, your ob't. servant,

AUGUSTUS A. GOULD.