PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY

HELD AT PHILADELPHIA

FOR

PROMOTING USEFUL KNOWLEDGE.

Vol. XXVIII.

JANUARY TO DECEMBER, 1890.

PHILADELPHIA:
PRINTED FOR THE SOCIETY
BY MAC CALLA & COMPANY.
1890.

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

Vol. XXVIII. January to June, 1890. No. 132.

THE BEOTHUK INDIANS.

By Albert S. Gatschet.

Third Article.

(*Read before the American Philosophical Society, January 3, 1890.*)

Among the three vocabularies which I have recently had the good fortune of receiving, there is one just as old as the century, and another comes from an aged person who has actually heard words of the language pronounced by a Beothuk Indian. I take pleasure in placing these lists before the Society, together with a number of new ethnographic facts gathered in the old haunts of the extinct race, which will prove to be of scientific value.

BIBLIOGRAPHY.

Since my first article the following publications on the Beothuk Indians have come to my notice :

Blake, Mrs. Edith: "The Beothuk Indians," in the monthly periodical, *Nineteenth Century* (Kegan & Co., publishers, London), December, 1888, pp. 899–918. This article contains important extracts from J. Cartwright's manuscript and interesting details about Shanandithit. An American reprint of the *Nineteenth Century* is published by Leonard Scott, New York City.

Murray, Chas. Aug. (author of the "Prairie Bird," etc.): "The Red Indians of Newfoundland." Philadelphia : T. B. Peterson, 98 Chestnut street (no date, about 1850 ?) ; illustrated. The book is pure fiction ; the first chapter alone contains some ethnologic points.

New York Herald, Correspondence of. Date specified below.

Stearns, Winfrid Alden : "Labrador : A Sketch of its Peoples, its Industries," etc. Boston : Lee & Shepard, 1884. Small 8vo, 8 and 295 pages. The description, pp. 254–272, suggests interesting comparisons of the Labrador Indians with the Beothuks.

Storm, Prof. Gustav : "Studies on the Vineland Voyages." In Mémoires de la société royale des antiquaires du Nord ; nouvelle série. Copenhague, 1888. 8vo. The Beothuks are spoken of, pp. 361, 362. Storm assumes, that the Helluland of the Norse explorers was Labrador ; Vineland, Nova Scotia ; Markland, Newfoundland.

The Harbor Grace Standard and Conception Bay Advertiser : Linguistic and biographic article. Date specified below.

ETHNOGRAPHIC NOTES.

While returning from one of his annual explorations in the autumn of 1882, Mr. James P. Howley met Mr. Duggan, who owns a settlement at La Scie, one of the more northern harbors of Newfoundland, in north-east part of the isle ; he informed him that numerous stone implements and utensils had at various times been found in his neighborhood, especially at Pacquet and Fleur-de-lys harbors,* and that the officers of the French men-of-war, as well as the fishermen of that nationality, who annually frequent that part of the island, took away many of these relics. He noticed that the marine officers took special care in collecting such specimens, and hence they may have been commissioned to do so by one or some of the scientific institutions of France. At Fleur-de-lys, he stated, many stone pots were found, the material having been evidently quarried from the steatite rock occurring in the neighborhood. Many cavities are seen in the rock corresponding with the size of the pots themselves, while others are still there half-grooved out. His description of the process, by which he supposed the Indians performed this difficult task, struck Mr. Howley forcibly as being identical with the one described in Lieut. Geo. M. Wheeler's "Reports," Vol. vii, pp. 117–121 ("The Method of Manufacture of Soapstone Pots." By Paul Schumacher ; with illustration exhibiting method, p. 121).

A pipe of black marble found on an island in White Bay, and given away by Mr. Duggan's father to one of the French ship captains about 1850, had a large bowl and was beautifully finished, but part of the stem was broken off. The carved figure of what seemed to be a dragon rested against the inner side of the bowl, with its head projecting over the edge of the latter, while the tail was twisted around the stem (a similarly carved pipe from Vancouver's Island was deposited in the Geological Museum, Ottawa). Before this it had always been asserted that the Beothuks were not acquainted with tobacco or any narcotic usages ; but they had a word for *tobacco*, nechwa, and *kinnikinnik* as well as *red-rod* are abundant upon the island ; when the Micmacs have run short of the white man's tobacco, they make use of these. Black marble exists not far from where the pipe was found.

While engaged in locating land and making a survey of the Bay of

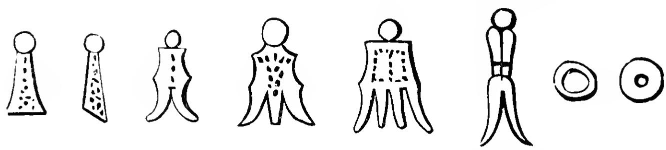
* Fleur-de-lys island and harbor is situated near Partridge Point, in 50° 7″ Lat.

Exploits during the summer season of 1886, Mr. J. P. Howley had the opportunity of conversing with some of the oldest settlers, who saw and remembered well the last individuals of the Red Indian race. He also collected a number of relics from an old burial place of theirs, which was known as such to the fishermen for the last thirty-five years, and hence had been ransacked repeatedly and by different parties. Lloyd visited it when there and took away everything he could find. While overhauling this interesting spot, Mr. Howley found a number of curiously fashioned and carved bone ornaments, with fragments of human skeletons scattered about. The latter appear to be of little scientific value. In another part of the Great Bay of Notre Dame, the interesting and valuable find of the mummified body of a boy, about ten years old, was made. Besides this, the following objects were found there and afterwards placed on exhibition at St. John's, in 1886:—the skull and leg bones of an adult male, several stone implements, a large number of ingeniously carved bone ornaments, models of canoes, cups, dishes, etc , made of birch bark, beautifully sewn together and all daubed with red ochre ; fragments of deer-skin dresses, models of bows, arrows, paddles, a package of dried fish bound up in a casing of birch bark, and other articles. In the mummy a few of the neck vertebræ are disconnected, and one of the hands is missing, but otherwise the body of the boy is perfectly preserved. It is doubled up with the knees against the stomach, feet slightly crossed, arms folded across the chest, and when found it lay on the left side. The skin is intact, even the finger and toe nails being uninjured. The fleshy portions appear to have dried up completely, leaving only the bones encased in the shrunken and wrinkled skin, which latter has the appearance of dressed deer skin or well-tanned chamois. The whole was encased first in a deer-skin robe, then placed into a casket of birch bark neatly and closely sewn together, being apparently almost air-tight. The mummy bore a close resemblance to the Alaskan mummy preserved in the National Museum in Washington, and described by Mr. William H. Dall, in Vol. xxii of "Smithsonian Contributions to Knowledge," 1878, 4to. The reason why this body was interred with so much care, provided with fine and new clothing and accompanied with food, tools and spare garments, must be sought for in the *tender years* of the deceased child, which needed more care and support on its peregrinations toward the future abode of the soul than an adult would require.

The same find is referred to in the article on the Beothuk by Mrs. Blake, and in a correspondence of *The New York Herald* from St. John's, N. F., dated October 23, 1886, where the locality is distinctly specified as being on *Pilley's island*, Notre Dame Bay. That bay may be described as forming the northern part of the Bay of Exploits, one of the old homes of the Red Indian people; the island is situated about 55° 42′ Long. west of Greenwich, and 49° 35′ Lat. The *Herald* correspondent adheres to the old and mistaken idea that the Beothuks are a branch of the Algonkin family. His statements, not included in the reports of others, are as follows :

"'Only a few relics o the Beothuks have been preserved ; they are either in private hands, or on exhibition in the Newfoundland Museum. * * * In the Pilley island excavation the skull of an adult was found in an excellent state of preservation. It has the characteristics of the skull of a savage, but it is well shaped and pretty well developed in the intellectual region * * * and proves that the 'Bethuks' were by no means of a low type. * * * Only three bones of the skeleton were found along with the skull. * * * But the greatest curiosity is the nearly perfect skeleton of a young 'Boethic' nine or ten years of age. The body had been wrapped in birch bark, doubled together, laid on its side and covered with a heap of stones ; * * * it has somewhat the appearance of a mummy. The skull is detached from the body, the vertebræ of the neck having been destroyed or removed. It is well shaped and in a good state of preservation. In addition, there are in the collection specimens of beautifully finished arrow-heads, small models of canoes made of birch bark, bone ornaments, * * * which, according to the Indian custom, had been buried with the dead."

Small objects made by this people, especially *bone carvings*, have lately come into Mr. Howley's possession which attract attention through their peculiar form and nice finish. He thinks they were used as pendants to their deer-skin dresses, and all have some rude design carved upon either side. Many of them are simple flat pieces, either square or cut obliquely at the lower ends ; others have from two to four prong-shaped ends :



Perforated circular pieces of bone and shell accompanied the above carvings, also some red ochre tied up in small packages encased in birch bark, and some neatly made birch-bark cups of an oval pattern and red-ochred. Also a small iron knife and tomahawk with wooden handles. Some of the above articles manufactured of bone apparently represent the human frame.

What Mr. Howley learned on the Bay of Exploits about the peculiarities of *Shananditkit* was the following : When any of the Micmacs came near her during her stay with Peyton and his family, she exhibited the greatest antipathy toward any of them, especially toward one Noël Boss, whom she greatly dreaded. Mr. Peyton stated that, whenever he or even his dog appeared near the house, Shananditkit would run screeching with terror towards him and cling to him for protection. She called him *Mudty Noël* ("Wicked Noël"), and stated that he once fired at her across the Exploits river, wounding her in the hips and legs, as she was in the act of cleaning venison. In proof thereof she exhibited several shot wounds at the spots referred to, and W. E. Cormack confirms this statement. The enmity between the two tribes must have been at a high pitch to prompt a man to perform such an act against a defenseless woman.

Micmac tradition states, however, that in earlier times a better feeling existed between the two peoples. The Red Indians certainly were on good terms with the "Mountaineers" or Naskápi of Labrador, whose language is of the same family as that of the Micmacs.

The above anecdote fully proves that Shananditiit became acquainted with individuals of the Micmac tribe, and this explains why Cormack has so many Micmac terms mixed with his Beothuk words. He was unable to distinguish the ones from the others. Mudty, "bad," is a Micmac, not a Beothuk word.

A CAPTURE FOLLOWED BY A WEDDING.

The capture of another Beothuk woman is related at length in the following traditionary account, which Rev. Silas Tertius Rand, of Hantsport, Nova Scotia, sent me in August, 1886. The event may have occurred as early as the beginning of the nineteenth century, for Mr. Rand heard it from an aged woman of Hantsport, Mrs. Nancy Jeddore, and she heard it from her father, Joseph Nowlan, who died about A. D. 1870, ninety-five years old. Nowlan had at one time stayed with the family of which that Beothuk woman was the mother and mistress, in Newfoundland, and had also lived long with the Eskimos. His regular home was in Nova Scotia, at St. Margaret's Bay, on the side of the Atlantic ocean.

The history of this woman is rather extraordinary, and with serious people I might incur the peril of being regarded as pitching into the domain of romance. But to avoid all suspicion, I shall transcribe the account with the very words of my correspondent, who made use of the same provincialisms, which have served in delivering the "story" to him. The absence of the Beothuk woman's name is a great deficiency in the tale. Some of the more learned remarks will be readily recognized as additions made by Mr. Rand, whose works prove him to have been a studious expounder of the Micmac grammar and lexicon (died October 4, 1889).

"The Micmacs have been in the habit of crossing over to Newfoundland to hunt 'time out of mind.' They called it Uktakumcook, *mainland*; so they supposed at the time when the name was given that it was not an island. Still it is as good or perhaps better than the silly and untruthful *long* name Newfoundland. The Micmacs could never 'scrape acquaintance' with the Indians of the *other tribe* there. Still, they found them *out*, also their *red* custom (their skin was quite white) and their power of magic, by which they became aware of the distant approach of strangers, when they fled on their snowshoes for their lives. But once three young hunters from 'Micmac-Land,' Meghum-ahghee, came upon three huts belonging to them, which were built up with logs around a 'cradle hollow,' so as to afford protection from the guns of the foe. These huts had just been deserted, but the three men gave chase, came as near to the fugitives as to hail them and make signs of friendship, which were left unheeded. On and on they pursued--one of the young women of the party snapped the strap of the snowshoes and had to sit down and repair it. Her father came back, assisted her and they fled again; but the mended strap failed a second time. The poor girl shrieked with fright; she was left and overtaken. She could not be induced to go with her pursuers; so they constructed a small wigwam and remained on the spot a day or two. At first, she touched no food for days; then her fear relented in regard to one of the young men, and starting out again with the hunting party, clung to that youth who had first won her confidence. This she showed by keeping him between her and all the others. After staying two years with the Micmac people she acquired their language and was married to that same young man. She often recounted the eventful story of her life, and conversed with Nancy Jeddore's father on the circumstances connected therewith, after she had become the mother of a family."

A correction of a former statement needs to be inserted here. The Hudson Bay Company never had control of Newfoundland, but it was a number of English merchants who retarded settlement in the interior. The immense tracts and forests of the interior were given up to the deer, bears, foxes, wolves, and to a few straggling Micmac hunters, whereas the entire white population was *compelled* to live along the sea-coast.

Mr. Howley having favored me with more particulars about these firms, I would state first that these merchants were chiefly *fish dealers*, and that they purchased furs only incidentally. Even now fish is the chief article of trade with them. There are but few of these *old* firms now in existence, and of these, Newman & Co.'s establishment at Harbor Button, Fortune Bay, and Gaultor's, in Hermitage Bay, south side of the island, are probably the oldest. Slade & Co. once ruled supreme in Notre Dame Bay during the first half of this century, and to their employés is ascribed the cruel treatment of the last Beothuk Indians. But things are now assuming a different aspect, and the present mercantile firms no longer oppose the opening up of the country, for a railway act together with a loan act has lately passed the legislature. The railway is now being constructed, and will be of best service for opening the lands for settlement.

THE JURE VOCABULARY.

While engaged in surveying the Bay of Exploits during the summer months of 1886, Mr. Howley became acquainted with Mrs. Jure, then about seventy-five years old, who once had been the fellow-servant of Shananditbit, or Nancy, at Mr. John Peyton's, whose widow died about the close of the year 1885. Mrs. Jure was, in spite of her age, hale and sound in body and mind, and remembered with accuracy all the little peculiarities of Shananditbit, familiarly called "Nance." Many terms of Beothuk learned from Nance she remembered well, and at times was complimented by Nance for the purity of her pronunciation; many other terms were forgotten owing to the great lapse of time since 1829. Mr. Howley produced his vocabularies and made her repeat and pronounce such words in it as she could remember. Thus he succeeded in correcting some of the words recorded by Leigh and Cormack, and also to acquire a few new ones. He satisfied himself that Mrs. Jure's pronunciation must be the correct one, as it came directly from Shananditbit, and that its phonetics are extremely easy, much more so than those of Micmac, having none of the nasal drawl of the latter dialect. She also pronounced several Micmac words exactly as Micmacs pronounce them, and in several instances corrected Mr. Howley as to the mistranslation of some Beothuk words. The twenty-three words which Mr. Howley has obtained from this aged woman embody nine new ones; he repeated all of them to his brother, Rev. Dr. M. F. Howley, P.A., and I received a second copy of the list written by that gentleman, having the words accentuated. This enabled me to add in parentheses their true pronunciation and wording in my scientific alphabet.

THE MONTREAL VOCABULARY.

Although this is a misnomer, I shall designate by it another copy or "recension" of the W. E. Cormack vocabulary which I obtained from Rev. Silas T. Rand, of Hantsport, N. S., on September 1, 1885. It was accompanied by the following remarks:

"Sir William Dawson, my excellent friend,* sent me this list of Beothuk words some years ago, and I had to return his copy to him. There were copyist's mistakes in it, *u* for *a*, *u* for *n*, etc. I don't remember the name of the man who took the vocabulary, nor that of the woman who gave it to him. But I remember that the woman was said to have married a man of another tribe, and that she was the last of the race and the only one of the race ever *tamed* (to use the Indian term). She cannot have been Mary March."

This vocabulary contains 228 items, including the numerals and names of months; the words are syllabicated, and begin with capital letters. The copy before me was written by a scribe who evidently did not realize the importance of the document, for even the English significations are, in part, faulty, as *anus* for *arms* (memayet), *catte* for *cattle*, *celp* for *cup*, *ticklevee* for *ticklas* (gotheyet), on page 419, and others. The letter u is often put instead of n, l for t, o for a, t for k, r for z, e for c, and *vice versâ*, the whole being written in a sloven hand, as all the Beothuk vocabularies are which I have seen. The manuscript has haddabothie *body* instead of haddabothic, molheryet *cream jug* for motheryet, adademiuk *spoon* for adadimiute, jigganisut *gooseberry* instead of jiggamint; but, in many instances, appears to have a more original form preferable to the one copied by Mr. Howley, which I have utilized, as in giwashuwet *bear* for gwashuwet,

* Principal of McGill College, Montreal.

atho-onut *twenty* for dtho-onut, and in some instances has two words for one English term, as in *ankle* moosin, *and* gei-je-bursut ; (to) *bite* boshoodik *or* boshwädit ; *boat* and *vessel* adothe, *or* odeothyke ; and what will be found under *head, man, moon, stockings, sun, teeth, woman, woodpecker.*

This vocabulary is arranged alphabetically after the English terms, which stand *before* their Beothuk equivalents, and contains many terms new to us, which corroborates the supposition previously advanced by me, that the original Cormack vocabulary must have been more extensive.

To insert all the two hundred and twenty-eight terms of this new "recension" of the Cormack collection *in bulk* into the list to be given below, would have the result of increasing the confusion already existing in the wording of the Beothuk terms. Therefore, I have omitted not only those terms which are written *alike* to the terms which stand first in my list of 1885, pp. 415–424, but also those which rest upon an evident erroı of the copyist, as mamiruateek *houses* for mammateek, berroieh *clouds* for berroick, moocas *elbow* for moocus, etc.

It is probable, that W. E. Cormack made several copies of his vocabulary himself, which differed among each other, or were written in an illegible hand ; this would explain many of the "lectiones variæ" which now puzzle the Beothuk student, and cause more trouble to him than it does to edit a Roman or Greek author from the mediæval manuscripts with all their errors and mistakes.

THE CLINCH VOCABULARY.

A vocabulary of Beothuk has just come to light, which appears to be, if not more valuable, at least older than the ones investigated by me heretofore. It contains one hundred and twelve terms of the language, many of them new to us. It was obtained, as stated, by the Rev. John Clinch, a minister of the Church of England, and a man of high education, stationed as parish priest at Trinity, in Trinity Bay, Newfoundland. The original is contained in the "Record Book," preserved in the office of Justice Pinsent, D.C.L., of the Supreme Court at Harbor Grace, and it has been printed in the *Harbor Grace Standard and Conception Bay Advertiser*, of Wednesday, May 2, 1888, some biographic and other notes being added to it in the number of May 12.

Among these the following will give us a clearer insight into the question of authenticity of Clinch's vocabulary. John Clinch was born in Gloucestershire, England, and in early youth studied medicine under a practitioner at Cirencester, where he became a fellow of Dr. Jenner, who discovered the celebrated specific against small-pox. In those times, no law compelled a man to undergo examinations for diplomas ; so Clinch migrated to Bonavista, Newfoundland, and established himself there in 1775 as a physician, but in 1783 removed to Trinity. Besides his practice, he conducted services in church, was ordained deacon and priest in London, in 1787, then worked over thirty years at Trinity in his sacred calling, until his death, which must have occurred about 1827. He has the merit of introducing vaccination upon that island, and there are people living now who were vaccinated by him. He was also appointed to judicial charges.

Simultaneously with Mr. Clinch, a Beothuk Indian stayed in that town, known as John August. Tradition states that he was taken from his mother when a child and brought up by a colonist, Jeffrey G. Street. He then remained in Street's house as a faithful and intelligent servant, and when arrived at manhood was entrusted with the command of a fishing smack manned by whites. Frequently he obtained leave to go into the country, where he probably communicated with his tribe. The parish register of Trinity records his interment there on October 29, 1788.

As there is no other Beothuk Indian known to have resided among white people of Newfoundland at that time, it is generally supposed that Mr. Clinch, who lived there since 1783, obtained his collection from none else but from John August. The selection of words differs greatly from that in Leigh's vocabulary, but the identity of a few terms, which are quite specific, as *hiccups, shaking hands, warming yourself*, induces Mr. Howley to believe that he had Clinch's vocabulary before him. One item in Clinch's list, "Ou-bee: *her own name*," seems to indicate that it was obtained from a female. Indeed, in 1803, a Beothuk woman was captured, presented to Governor Gambier, and subsequently sent back to her tribe. Mrs. Edith Blake, in her article, "The Beothuks," gives a description of her and of her presence at a social meeting at the Governor's house, at St. John's.

I have obtained a copy of the printed vocabulary through Mr. Howley. It was full of typographic errors, and these were corrected by him with the aid of a copy made of the original at Trinity by Mrs. Edith Blake, who took the greatest pains to secure accuracy. The "Record Book" states that Rev. Clinch obtained the vocabulary in *Governor Waldegraves' time*, and the volume which contains it embodies documents of the year 1800; this date would form an argument against the supposition, that it was obtained from the female captured in 1803. Below I have reproduced all the terms of this vocabulary, as it surpasses all the others in priority, though perhaps not in accuracy. The words are all syllabicated, but none of them shows accentuation marks; I have printed most of them in their *syllabicated* form.

Capt. Robinson has consulted and partly copied the Clinch vocabulary, as will be readily seen by a comparison of the terms in both.

THE THREE VOCABULARIES COMBINED.

Abbreviations.—CM.: The W. E. Cormack vocabulary from a Montreal copy of the manuscript.

J.: The Jure vocabulary.

No letter: The Clinch vocabulary.

Words in parentheses contain the transcription of vocables into my scientific alphabet.

abenick *gaping*, CM.
abideeshook *domestic cat*, CM.
abus-thib-e *kneeling*.
adayook *eight*; ee-adajook *eighteen*, CM.
adi-ab *wood*.
adjieich *two*; ee-ajike *twelve*, adjeich atho-onut *twenty-two*, CM.
adothe or odeothyke *boat*, *vessel*, CM.
agamet *buttons* and *money*, CM.
ah-wadgebick, awadgebick (ā'wa-dshibík), *middle finger*, J.
amshut or yamyess *get up*, CM.; cf. kinnup.
anaduck *sore throat*, CM.
arrobauth *blood*; ashabooutte or ig-gobauth (for izzobauth) *blood*, CM.
atho-onut *twenty*; adjeich atho-onut *twenty-two*, CM.
bashedtheek *six*; ee beshedtheek *sixteen*, CM.
bay-sot, băzot, besot, besut, *to walk*, J.
beathook *Red Indian*, CM.
beteok *good night*, CM.
boas-seek *blunt*, CM.
bobodísh *sea pigeon*, J.; bobbidish *pigeon*, *black guillemot*, CM.
boddebmoot *woman's bosom*, CM.
boo-it, buit (bú-it), *thumb*, J.
boshoodik or boshwădit *to bite*, CM.
botonet - onthermayet *teeth*, CM. (onthermayet alone means *teeth*; cf. below).
buggishamā'n *man*, J.; bukashman or bookshimōn *man*, CM; push-aman *man*.
buggishamí-h *boy*, J.; bugasmeesh *white boy*, CM.
chee-a-shit *groaning*; cheasit, CM.
chee-thing *a walking stick*.
cobthun-eesamut *January*, CM.
co-ga-de-alla *leg*.
coosh *lip*.
corrasoob *sorrow*; *snow* (snow, by confounding it with kausussa-book ?).
cowasazeek *July*, CM.
cusebee *louse*; casebeet, CM.
cush *nails*.
dabseek *four*; ee-dabseek *fourteen*, CM.
deshudodoick *to blow*, CM.
deu-is *sun* or *moon* (doubtful).
dis-up *fishing line*.
dogemat or ashoog-ing (Howley: ash-vog-ing) *arrow*, CM.
drúmmet, drúm-mĕt (drúm't), *hair*, J.; don-na (Clinch).
ebauthoo *water*; ebanthoo, CM.
eemommoos, ímmawmoose (íma-mūs), *woman*, J.
eemommooset, ímmomoosét (íma-muset), *girl*, J.
eewo-in, éwoin (i'wo-in), *knife*, J.; yew-oin *a knife*.
ejeedowéshin, edgedoweshin (edshi-dowéshin), *fowl*, J.
ejibidinish *silk handkerchief*, CM.
emeethook *dogwood*, CM.
ersh-bauth *catching fish*.
euano *go out*, CM.
eve-nau *feathers*.
gei-je bursūt; see moosin.
giggaremanet *net*, CM.

giwashuwet *bear*, CM.
gosset *stockings*; gasaek, CM.
gothieget *ticklas*, CM.
goun *chin*, CM.
gun or guen *nose*, CM.
hadda-bothy *body*.
hadibiet *glass*, CM.
hados-do ding *sitting*.
hanamait *spoon*.
han-nan *a spear;* first letter uncertain.
ha the-may *a bow*.
hedy-yan *stooping*.
hods-mishit *knee*.
hod-thoo *to shoot*.
hod-witch *fool*.
hurreen and huz-seen *a gun*.
huzza-gan *rowing*.
ii-be ath *yawning*.
io-ush-zath *stars* (doubtful).
is-shu, izhu, ishu (i'zhu), *make haste*, J.
ite-ween *thigh*.
jib-e thun (or, jib e-thun) *a trap or gin*.
jigganisut *gooseberry*, CM.
yamyess; see amshut.
yaseek *one;* ee-yagiesk *eleven*, CM.
yeothoduck *nine;* ee-yeothoduck *nineteen*, CM.
yew-one *wild goose*.
yew-why *dirt*.
keathut; gorathun (obj. case) *head*, CM.; he-aw-thou *head*, ke-aw-thon *your head*.
kess-yet *a flea*.
king-abie *standing*.
kinnup, kinup, *get up*, J.
koo-rae *lightning; fire*.
koothabonong - bewajowite *February*, CM.
kuis; mangaronish *sun*, CM.; kuis *watch*, CM.
kuis and washewnishte *moon*, CM.
mady-u-a *leaves*.
magorrm *deer's horns*, CM.
mamasheek *islands*, CM.
mām-isutt *alive*, CM.
mamegemethin *shoulders*, CM.; momezabethon *shoulder*.
mammadronitan *lord bird*, CM.
mammasamít *dog*, J. (mammasavít is incorrect); mammasareet, mamoosernit *dog*, CM. (*reet* false for *mit*).
mamoosemich *puppy*, CM.
manarooit *blanket*, CM.
mangaronish; see kuis.
manjebathook *beard* (on page 421: *bread*, which is probably false; see annawhadya), CM.
mau-the-au-thaw *crying*; cf. su-au-thou.
memajet *anus*, CM. (false for *arms*).
memet *hand*, CM.; memen (obj. case) *hands and fingers;* meman momasthus *shaking hands*.
me-ma-za *tongue*.
menome *dogberries*.
me-roo-pish *twine, thread*.
midy-u theu *sneezing*.
mithie *coal*.
mi-a-woth *flying;* meaoth *flying*, CM.
mis muth *ear*.
moadamŭtt *to boil, as dinner*, CM.
mom-au *a seal*.
mome-augh *eyebrow*.
moocus *elbow*.
moosin and gei-je-bursŭt *ankle*, CM.
mowgeenúck, mougenuk (maudshinúk), *iron*, J.; mowageene *iron*.
mudy-rau *hiccups*.
mud-ty *bad* (dirty); mudeet *bad* (of character).
mush-a bauth *oakum* or *tow*.
nethabete *cattle*, CM.
nine *knife*, CM. (false for u-ine, yewoin).
ninejeek *five*; ee-ninezeek *fifteen*, CM
no-mash-nush *scalping*.
now-aut *hatchet*.
obodísh, obbodísh, *cat*, J.; obditch *a beast;* cf. abideeshook.

obosheen *warming yourself.*
obseedeek *gloves*, CM.
odasweet-eeshamut *December*, CM.
od-au-sot *rolling.*
oddesamick, ŏdd-essămick (odesă-mík), *little finger*, J.
odemet *ochre*, CM. (ochre mixed with oil, emet, Howley).
onnus, onnûs (o′nĕs), *forefinger, index*, J.
oodzook *seven;* ee-oodyook *seventeen*, CM.
oregreen (?) *scissors*, CM.
oreru *ice*, CM.; cf. ozeru.
osarate *rowing*, CM.
ōsweet (ō′swit) *deer*, J.; osweet, CM.
Ou-bee (nom. pr. fem.) "*her own name.*"
ou-gen *stone.*
ou-ner-mish *a little bird* (species of?).
outhermay *teeth.*
ow-the-je-arra-thunum *to shoot an arrow perpendicularly.*
pa-pa de aden *a fork.*
pau-shee *birch rind; paper.*
peatha *fur, hair of beast.*
pedth-ae *rain.*
pe-to-tho-risk *thunder.*
pig-a-thee *a scab.*
pis-au-wau *lying.*
podibeac *oar*, CM.; poodybe-ac *an oar.*
poopusraut *fish.*
poorth *thumb;* cf. boad.
popa-dish *a large bird* (species of?).
posson *the back.*
poss-thee *smoke;* cf. baasdic.
pug a-thuse *beating;* pug a tho *throwing.*
pug-a-zoa *eating.*
pug e-non *to break a stick.*
puth-u-auth *sleep.*
shabathooret *trap*, CM.
shamye *currants.*
shansee *ten*, CM.
shaub-ab-un-o *I have to throw your trap.*
shau-da-me *partridge berries.*
shebohowit; sheebuint *woodpecker*, CM.
she-both *kissing.*
shĕdbasing *upper arm*, CM.
she-ga-me *to blow the nose;* shegamik, CM.
shemabogosthue *moskito* (black fly), CM.
shendeek (or sheudeek ?) *three;* ee-shaedeek *thirteen*, CM.
shisth *grass.*
shucodimít *Indian cup*, CM.
sou-sot *spruce rind.*
stioeena *thumb*, CM.
su-au-thou *singing.*
su-gu-mith *bird's excrement.*
susut *fowl, partridge.*
tapaithook *canoe*, CM.; cf. thub-a-thew.
tedesheet *neck.*
the-oun *the chin;* cf. goun.
thub-a-thew *boat or canoe.*
thub-wed gie *dancing.*
tis eu-thun *wind.*
traw-na-soo *spruce.*
tus-mug *pin;* tus-mus *needle.*
tu-wid-yie *swimming.*
waine *hoop*, CM.
washeu *night, darkness*, CM.
wasumaw - eeseek *April, June, September*, CM.
washewnishte; see kuis and washeu.
weshemesh *herring*, CM.
who-ish-me *laughing.*
wíddun (wídun or wídăn), *asleep;* also euphemistically for *dead.*
woodrut *fire*, CM.
wothamashet *running*, CM.; wothamashee *running.*
wooth-yan *walking.*
wyabick (wáyabik) *ring-finger*, J.
zatrook *husband*, CM.
zosweet *partridge* (willow grouse), CM. (same word as susut).

REMARKS ON SINGLE TERMS.

The ending -bauth occurs so frequently that we may have to consider it as a suffix used in the derivation of substantives; thus we have, *e. g.*, izzo-bauth *blood*, ersh-bauth *catching fish*, mushabauth *oakum, tow.*

emamoose *woman*, emamoset *child, girl*, resemble strongly the following Algonkin terms: amemens *child* in Lenape (Barton), amosens *daughter* in Virginian (Strachey, Vocab., p. 183). Ama'ma is *mother* in the Greenland Inuit.

The sound *l* occurs but four times in the words which have come to our notice: adolthtek, lathun, messiliget-hook, nadalahet. In view of the negligent handwriting in which all of these vocabularies have reached us, it is permitted to doubt its existence in the language.

menome *dogberries* is a derivative of manus *berries*. mamoose *whortleberries*, Rob., is perhaps misspelt for manoose. Cf. min *grain, fruit, berry*, in all Eastern Algonkin dialects.

ozeru, ozrook, *ice;* E. Petitot renders the Montagnais (Tinné) ezogè by "gelée blanche" (*frost*), t'en-zure by "glace vive." The resemblance with the Beothuk word seems only fortuitous.

poopusraut *fish* is identical with bobboosoret *codfish* (or *bacalaos*, Mscr.).

pug-a-zoa *eating*; the latter probably misspelt for *beating*.

stioeena *thumb*, CM., is misspelling of itweena, which means *thigh*, not *thumb*.

The new ethnologic and linguistic facts embodied in this "Third Article" do not alter in the least the general results which I deduced from my two previous articles and specified in "Proceedings" of 1886, pp. 426 to 428. On the contrary, they corroborate them intrinsically and would almost by themselves be sufficient to prove that the Beothuk race and language were entirely *sui generis*. By the list contained in this "Third Article" the number of Beothuk vocables known to us is brought up to four hundred and eighty, which is much more than we know of the majority of other American languages and dialects.

The violent hatred and contempt which the Beothuks nourished against all the races in their vicinity seems to testify by itself to a radical difference between these and the Algonkin tribes. The fact that we know of no other homes of the Beothuk people than Newfoundland, does not entitle us to conjecture, that they were once driven from the mainland opposite and settled as refugees upon the shores of that vast island. It is more probable that this race anciently inhabited a part of the mainland *simultaneously* with the island, which would presuppose that the Beothuks were then more populous than in the historic period. Numerous causes may account for the fact that we do not notice them elsewhere since the beginning of the sixteenth century: fragmentary condition of our historic knowledge, rigorous colds, epidemics, want of game, famine, infanticide, may be wars among themselves or with strangers. Some of these potent factors may have coöperated in extinguishing the Beothuks of the mainland, from whom the island Beothuks must have once descended—while the tribes settled upon Newfoundland may have increased and prospered, owing to to a more genial climate and other physical agencies.

ENGLISH-BEOTHUK VOCABULARY.

alive mām-isutt.
ankle; see moosin.
anus; see memajet.
April wasumaw - eeseek.
arm, upper, shēdbasing.
arms memajet.
arrow; see dogemat.
asleep wi'ddun.
bad mud-ty.
back, the, posson.
beard; see manjebathook.
bear giwashuwet.
beast; see obodísh.
beast, hair or *fur of*, peatha.
beating pug a thuse.
birch rind pau-shee.
bird, a little (not specified), ou nermish.
bird, a large (not specified), popadish.
bite, to, boshoodik.
black guillemot; see *sea pigeon*.
blanket manarooit.
blood arrobauth.
blow, to, deshudodoick.
blow the nose, to, she-ga-me.
bosom, woman's, boddebmoot.
blunt boas-seek.
boat adothe, thub-a-thew; see *canoe*.
body hadda bothy.
boil, to, v. trans., moadamūtt.
bow ha-the-may.
boy buggishamísh.
break a stick, to, pug-e-non.
buttons agamet.
canoe tapaithook; thub-a-thew; see *boat*.
cat, domestic, abideshook; ob'bodísh.
cattle nethabete.
catching fish ersh-bauth.
chin goun, the-oun.
coal mithie.
crying mau-the-au-thaw.
currants shamye.
dancing thub-wed-gie.
darkness washeu.
dead wíddun.
December odasweet - eeshamut.
deer ōsweet.
deer's horns magorrm.
dirt yew-why.
dirty mud-ty.
dog; see mammasamít.
dogberries menome.
dogwood emeethook.
ear mis-muth.
eating; see pug-a-zoa.
eight adayook.
eighteen; see *eight*.
elbow moocus.
eleven; see yaseek.
excrement of bird su-gu-mith.
eyebrow mome-augh.
feathers eve-nau.
February koothabonong - bewajowite.
fifteen; see ninejeek.
fingers; see memet.
finger, middle, ah-wadgebick.
fire woodrut; koo-rae.

fish poopusraut.
fishing line dis up.
five ninejeek.
flea, a, kess-yet.
fly, to, mi-a-woth.
fool hod-witch.
fork, a, pa-pa-de-aden.
forefinger onnus.
fourteen ; see dabseek.
four dabseek.
fowl ejeedowéshin ; susut.
fur peatha.
gaping abenick.
get up amshut ; kinuup.
gin, a ("a trap or gin"), jib-e-thun.
girl eemommooset.
glass hadibiet.
gloves obseedeek.
good night beteok.
gooseberry jigganisut.
go out euano.
grass shisth.
groaning chee-a-shit.
grouse ; see zosweet.
gun, a, hurreen.
hair drúmmet.
hand memet.
handkerchief of silk ejibidinish.
hatchet now-aut.
head ; see keathut.
herring weshemesh.
hiccups mudy-rau.
hoop waine.
husband zatrook.
ice oreru ; ozeru.
I have to throw your trap shaub-ab-un-o.
index onnus.
Indian cup shucodimít.
iron ; see mowgeenúck.
islands mamasheek.
January cobthun - eesamut.
June wasumaw - eeseek.
July cowasazeek.
kissing she-both.
knee hods-mishit.
kneeling abus-thib-e.
knife ; see eewo-in, nine.
laughing who-ísh-me.
leaves mady-u-a.
leg co-ga-de-alla.
lightning koo-rae.
lip coosh.
little finger oddesamick.
lord bird mammadronitan.
louse cusebee.
lying pis-au-wau.
man buggishamā'n.
make haste is shu.
money ; see *buttons.*
moon deu-is ; kuis.
moskito shemabogosthue.
nails cush.
neck tedesheet.
needle tus-mus.
net giggaremanet.
night washeu.
nine yeothoduck.
nineteen ; see *nine.*
nose gun, guen.
oakum mush-a-bauth.
oar podibeac.
ochre odemet.
one yaseek.
Oubee ; nom. pr. fem.
paper pau-shee.
partridge susut ; zosweet.
partridge berries shau-da-me.
pigeon ; see *sea pigeon.*
pin tus-mug.
puppy mamoosemich.
rain pedth-ae.
Red Indian beathook.
ring-finger wyabick.
rolling odausoot.
rowing huzza-gan ; osarate.
running wot amashet.
scab pig-a-thee.
scalping no-mash-nush.
scissors ; se oregreen.
seal, a, mom-au.
sea pigeon bobodísh.

September wasumaw - eeseek.
seven oodzook.
shaking hands; see memet.
shoot, to, hod-thoo.
shoot, to, an arrow perpendicularly, ow-the-je-arra-thunum.
shoulder; see mamegemethin.
singing su-au-thou.
sitting hados-do-ding.
six bashedtheek.
sixteen; see *six.*
sleep puth-u-auth.
smoke poss-thee.
sneezing midy-u-theu.
snow; see corrasoob.
sore throat anaduck.
sorrow corrasoob.
spear; see han-nan.
spoon hanamait.
spruce traw-na-soo.
spruce rind sou-sot.
standing king-abie.
stars io-ush-zath.
stockings gosset.
stone ou-gen.
stooping hedy-yan.
sun kuis; deu-is (?).
swimming tu-wid-yie.
teeth outhermay; see botonet.
ten shansee.
ticklas gothieget.
thirteen; see *three.*
thigh ite-ween.
tongue me-ma-za.
tow or *oakum;* see *oakum.*
thread me-roo-pish.
three shendeek.
throwing; see pug-a-thuse.
thumb boo-it, poorth; see stioeena.
thunder pe-to-tho-risk.
trap, a, jib e-thun, shabathooret.
twelve; see *two.*
twenty atho-onut.
twenty-two; see *two.*
twine me-roo-pish.
two adjieich.
vessel adothe.
walk, to, bay-sot; wooth-yan.
walking stick chee-thing.
warming yourself obosheen.
watch, a, kuis.
water ebauthoo.
wild goose yew-one.
willow-grouse zosweet.
wind tis-eu-thun.
woman eemommoos.
wood adi-ab.
woodpecker shebohowit.
yawning ii-be-ath.
your, in: "your head;" see keathut.

The Eye, Ocular Muscles and Lachrymal Glands of the Shrew-mole (Blarina talpoides Gray).

By John A. Ryder.

(Read before the American Philosophical Society, January 3, 1890.)

As far as I am aware, the minute anatomy of the eyes of the American Soricidæ or shrew-mice has been but little studied. Recently I have had an opportunity to obtain the eyes of the short-tailed shrew-mole, *Blarina talpoides,* and thinking their anatomy might present something novel, they were cut into series of sections. These disclosed the peculiarities to be mentioned later.

The eyes were dissected out, and, as the sequel proved, together with the uninjured lachrymal glands and ocular muscles.

The eye and gland together measured 2.5 mm. in the longest diameter, and about 1.5 mm. thick, and nearly 2 mm. wide. The form of the whole mass was that of a depressed oval. So far as the evidence goes, that can be derived from the sections, it indicates that the ocular muscles do not reach the skull, and that the eyes are no longer under the control of the same kind of a muscular mechanism as is found in other mammals. In fact, the tendons and muscles of the snout seem to completely cover the skull in the region of the orbit. Indeed so slight is the attachment of the eyes to the skull, that in removing the skin from the head but little difficulty is found in removing the eye-ball and lachrymal gland with the former. In *Scalops*, our common mole, this happens with still less difficulty.

The whole eye-ball in *Blarina* measures 0.9 mm. in diameter or considerably less than one-twenty-fifth of an inch. The lens is well developed and is very large in proportion to the whole eye-ball, measuring more than half the diameter of the latter. Consequently there is but little aqueous humor, and also but little vitreous, since the lens fills nearly the whole of the chamber of the ball. The cornea is thin, very convex, and approximates the lens anteriorly. At the edge of the cornea there is no thickening of the sclerotic, such as occurs in the eyes of other vertebrates as a result of the development of the ciliary muscles or apparatus of accommodation. This apparatus is obviously very rudimentary and defective, from which it may be inferred that the power of adjustment of the lens for different ranges of vision is poorly developed in *Blarina*.

There is a retinal coat of pigment and a choroid coat, which latter extends for a little distance over the optic nerve. The thickness of the sclerotic, choroid and retinal layer of pigment taken together is not over a fourth of the total thickness of the retina, thus showing other strong contrasts in respect to the development of the tunics of the eye-ball in other forms of vertebrates.

The total thickness of the retina is nearly a third of the total diameter of the eye-ball, and is developed as far forward as the ciliary region, though it is thickest a little behind this point. The usual number of layers are discernible in the retina, and it is perforated as usual by the very slender and diminutive optic nerve, which is only .07 mm. in diameter. The retina is therefore developed as usual, though the rods and cones were not well enough preserved in my materials to be certainly made out. At any rate, it is clear that such an eye may still be more or less functional as a visual organ even though obviously degenerate in some respects. The number of retinal elements is absolutely and relatively much less, however, than in a larger eye where the arc covered by the retina is part of a larger circle than in Blarina. There is a well-defined iris and pupil.

The lachrymal gland is many times larger than the entire eye ball. Its duct opens into the conjunctival cavity.

The muscles of the eye consist, first, of a choanoid muscle or retractor of the ball. It is inserted upon the sclerotic in a circular manner near the entrance of the optic nerve ; it extends back and its origin is lost in the connective tissue of the lachrymal gland. No definite account of the recti muscles or of the oblique muscles can be given here. All that my sections disclose is the fact that muscles which are apparently the homologues of the recti are inserted upon the sclerotic nearly as far forward as the ciliary region. These muscles, like the choanoid, pass backward to arise from the connective tissue of the lachrymal gland with which they blend and in which they become lost, or they join a relatively thick muscular tunic composed of voluntary muscular fibres which invests nearly the whole lachrymal gland.

This muscular investment of the lachrymal gland suggests that the function of such a muscular apparatus is to compress the tear gland and force its secretion over the eye-ball, and to thus wash away any dirt which may find its way under the very much reduced eye-lids, the opening in which is scarcely half a millimetre wide.

The foregoing brief sketch of the anatomy of the eyes of one of the commonest of our American shrew-mice suggests much in the way of further study. The remarkable and apparently voluntary mechanism for compressing the tear gland is evidence distinctly against the conclusion as respects at least our North American shrews, reached by Mr. Darwin in regard to the Tucu-tuco or *Ctenomys* of South America, in which case he suggests that the repeated irritation and inflammation of the eyes of these burrowing rodents, due to the dirt or sand which found its way beneath the lids, would aid in rendering the eyes inefficient, and in the course of generations abortive, as they are sometimes found to be. It is clear that if the interpretation of the function of the muscular investment of the tear gland in *Blarina* here suggested is correct, that in this case, at least, there is a direct and very special structural provision by which irritation from the presence of sand or dirt in the eyes, as a consequence of a burrowing habit, may be guarded against in the most efficient manner conceivable.

That the eye of *Blarina*, as a whole, has suffered from degeneration may be inferred with certainty from the diminutive size of the eye-ball and optic nerve, and the evidence furnished by the muscles suggests that while the eye-ball is no longer rotated in precisely the manner which obtains in other forms, it is clear that there are ocular muscles, and that the eye is capable of adjustment for the direction of vision, though it is evident that the muscles which effect such an adjustment no longer arise directly from the skull, as in all other normal forms of the eye of vertebrates. The extra tunic of voluntary muscular fibres investing the lachrymal gland seems to be something which has been superadded to the optic apparatus of *Blarina*, which, like the relatively large lachrymal gland itself, is really an indication of specialization to meet the requirements of special conditions of life.

Description of a New Species of Carollia and Remarks on Carollia brevicauda.

By Harrison Allen.

(*Read before the American Philosophical Society, December 6, 1889.*)

Carollia is one of the most common of the South American leaf-nosed bats. Notwithstanding its wide range of distribution (it is found from Mexico to the southern limit of Brazil, including the Antilles), the type of the genus is that of the single species also. I have recently examined this form—*Carollia brevicauda*—with the object in view of determining whether or not an example of Carollia in the collections of the National Museum might prove to be new.

The facts which led me to suppose that this might be the case were the following:

The specimen was smaller than *C. brevicauda*, the color was of a light chestnut brown tint, instead of the ashy shade of *C. brevicauda*. The interfemoral membrane was not incised. The nose-leaf was relatively small, delicate, with entire, rounded nostrils, and the lower border sharply defined to a point near the median line, where a small naked space alone was seen.

I have had a knowledge of these facts for a long time, but I hesitated to describe the form as new, for in general appearance in the proportions of the membrane, in the form of the ear, in the markings of the wing membranes and the shapes of the terminal phalanges, the two forms appeared to be essentially the same. I had but a single specimen—a young male from Costa Rica. I concluded that before describing it an examination of all the specimens of *Carollia* should be made. A large number of specimens of the genus were available for the purpose from the collections of the Museum of Comparative Zoölogy, but unfortunately nine only of the twenty-six examples were in good condition.

From among these a young male was found, and I was thus able to show that the smaller size of the specimen, as well as the difference of coloration of the new form, as compared with the old, were not due to age.*

As a result of this examination, I venture to describe the single example as a type of a new species in the following language:

CAROLLIA CASTANEA, n. sp.

Smaller than *C. brevicauda*. Fur long and silky. Above, lustrous light chestnut brown at basal one-half and at the tip. The intervening portion is yellow brown (old gold). Below, the same colors prevail, excepting that over the abdomen and pubis the brownish tip is absent and the body of the hair not golden. There is no hair on the forearm (the parts are slightly

*The teeth were all erupted, the epiphyses of the radii, metacarpals and phalanges were united to their shafts, but the tibia was slightly flexible and the foot was covered by a looser skin than is seen in matured individuals. It is not always easy to determine the age of bats.

rubbed), and scarcely any on the dorsum of the metacarpal bone of the thumb. The distribution of the hair on the wing membrane is as in *C. brevicauda*.*

The general form of the auricle as in *C. brevicauda*, but is proportionately longer. The outer border is more emarginate. When the auricle is laid on the head, it reaches a point as far as the end of the muzzle. The tragus is obscurely acuminate; the inner border, therefore, not straight, but the apical half abruptly narrowed. The outer border crenulate, rather than pectinate. The basal lobe and the process above it well developed. The nose-leaf is more delicate than in *C. brevicauda*. The height is 7 mm.; the breadth $4\frac{1}{2}$ mm. The lower border is much more distinct than in *C. brevicauda*. The nostrils are rounded, well defined, and not continuous with a concavity on the outer border.† The warts on the mentum are arranged in three obscurely disposed rows, the middle one being the larger, but none of them are elongate. The tail reaches to a point opposite the knee.

Skull. The general proportions of the skull are the same in the two species. The brain case at the procephalon is inflated and the temporal crest does not extend over the inflated part. Hence the impressions for the temporal muscles are not defined on the frontal bone. The upper border of the anterior nasal aperture is on a line with the canine tooth. The distance between the lachrymal ridges is greater than between the lachrymal ridge of one side and the corresponding central incisor. The distance from the last maxillary molar to the posterior limit of the nasal chamber is less than the distance from the point last named to the end of the long endopterygoids. The palatal rugæ are more trenchant, curved and wider apart opposite the premolars, than is the case with *C. brevicauda*.

Teeth. The number of the teeth is the same as in *C. brevicauda*, viz.:

$$\frac{2}{2} - \frac{1}{1} - \frac{2}{2} - \frac{3}{3} \times 2 = \frac{16}{16} = 32$$

The maxillary central incisors touch their entire lengths.‡ The lateral

* The fur of *C. brevicauda* is described as follows:

Above, moderately long only. The base is plumbeous, the tip brown, and the intermediate part pallid—almost white. Below, the fur is short, plumbeous at basal half, and of the peculiar mouse gray so often seen in Phyllostomidæ. G. E. Dobson (Cat. Chir. Br. Mus., 1878) describes the fur as brown above and beneath. None of the nine specimens examined were so marked. The brown aspect of the animal as seen in spirit is much more apparent than when dried. The nose-leaf is covered with fine short hairs on both sides. The back of the thumb is densely covered with short hair in *C. brevicauda*.

† The nostrils are oval in outline, are not separable from the outline of the nose-leaf above, and are continuous with a concavity (as one speaks of a mouth of a pitcher being concave), on the outer border. The peculiarity just named is best seen by holding the specimen so as to keep the vertex of the head upward, the observer looking downward from the tip to the base of the nose-leaf.

‡ G. E. Dobson (Cat. Chir. Br. Mus., 1878) gives this as a character of *C. brevicauda*. From my examinations, I cannot agree with this writer. The teeth exhibit a Λ-shaped space between the cutting edges.

incisors are very small and are free from both the central incisor and the canine. The first premolar is distinctly caniniform and does not touch either the canine or the second premolar.

The mandibular second premolar does not touch the third premolar. The distance from the anterior border of the canine to the first molar is 3 mm., a distance over ½ mm. greater than that from the anterior border of the canine to the central incisors.

Measurements.		*mm.*
Head and body (from crown of head to base of tail)		44
Length of arm		25
" forearm		32
First digit	Length of first metacarpal bone	4
	" first phalanx	3
Second digit	Length of second metacarpal bone	26
	" first phalanx	3
Third digit	Length of third metacarpal bone	32
	" first phalanx	16
	" second phalanx	20
	" third phalanx	10
Fourth digit	Length of fourth metacarpal bone	30
	" first phalanx	13
	" second phalanx	11
Fifth digit	Length of fifth metacarpal bone	32
	" first phalanx	11
	" second phalanx	10
Length of head		15
Height of ear		15
" tragus		6
Length of thigh		11
" tibia		13
" foot		10
" interfemoral membrane		15
" tail		8

Costa Rica. Collections of National Museum. Collected by J. C. Zeledon.

The nine specimens of *C. brevicauda,* which formed the basis of my study, were chiefly interesting from the measurements which were made of the peripheral parts. These are arranged in tabular form (p. 22).

TABLE OF MEASUREMENTS OF CAROLLIA BREVICAUDA. — CAROLLIA CASTANEA.

		3997 ♀	3129 ♀	3128 ♀	3231 ♀	3998 ♀	3993 ♀	3230 ♂	3220 ♂	4192 ♂	12,914 ♂
		mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
	Arm*	26	26	26	28	25	25	26	27	25	25
	Forearm†	37	37	39	40	37	38	38	39	35	32
I	Metacarpal	5	5	5	5	4	6	5	5	5	4
	1st phalanx	4	6	5	5	4	4	5	4½	4	3
II	Metacarpal	24	30	30	27	30	31	31	28	28	26
	1st phalanx	3½	5	4	4	3	3	5	4	3½	3
III	Metacarpal	34	37	37	36	35		37	36	35	32
	1st phalanx	13	17	17	17	14	16½	17	15	16	16
	2d phalanx	21	22	22	21½	20	22	21	18	21	20
	3d phalanx	11	11	11	11	11	11	10½	11	10	10
IV	Metacarpal	32	36	36	35	34	34	34	34	34	30
	1st phalanx	13	13	13	11	13	13	14	12½	13	13
	2d phalanx	14	12½	12½	10½	13	12	13	11	12	11
V	Metacarpal	36	37½	37½	35	35	35	36	36½	35	32
	1st phalanx	11	12	12	12	12	12	12	11	12	11
	2d phalanx	11	11	11	11	11	12	10½	10	11	10
	Femur	14	14	15	12	13	12½	14	12	12	11
	Tibia	14	14	17	16	15	15	18	18	14	13
	Foot	11	11	11	11	11	11	11	11	11	10
	Tail	7½	5	7	6	7½	7½	7	7	13	8
	Head	22	22	22½	24	22	22	23	22½	23	20½
	Auricle‡	12	12	13	13	12	13½	12	12	12	15
	Tragus‖	6	5	6	6½	6	6	6	6	6	6
	Width of 2d digital interspace	6	4	5	5	4½	6	6		5	4
	Width of 3d digital interspace	22	16	20	21	23	21	19	20	20	21
	Width of 4th digital interspace	31	28	32	31	35	35	26	27	28	30

*From top of shoulder to epicondyle.
† From epicondyle to end of radius.
‡ From outer border posteriorly.
‖ Outer border.

With the exception of the foot, which is constantly 11 mm. long, all the measurements are subject to variation—indeed, no two specimens in all respects are alike. This statement is made while making due allowance for the difficulty in taking some of the measurements, as for example those of the thigh and of the membranous expansions. Specimens which had been macerated in weak alcohol were rejected. But among those which were accepted it was not always possible to determine (owing to the contraction of the tissues), the exact extent to which the parts should be extended, so as to represent as far as possible the position of the wings in flight. One of the most interesting measurements is that of the width of the third digital interspace. This space, so small in Pteropidæ, Molossi, and in Noctilio, is wide in Phyllostomidæ, excepting Phyllostoma. Another interesting feature is the extent of the incision on the free margin of the interfemoral membrane. In well-preserved specimens of *C. brevicauda* the incision is conspicuous, while in the type of *C. castanea*, which is also in good condition, the incision is absent. Yet in slightly macerated specimens of *C. brevicauda* the incision disappears, showing that it is a character which is dependent upon tonicity and not on any distinctive structural peculiarities, and cannot, therefore, have much value. One of the marked ranges of measurements is seen in the length of the tail. The shortest tail is 5 mm. long and the longest 7 mm. The tip of the tail answered in three specimens to the middle of the femur, in four to the junction of the middle with the lower third, and in two lack one-fifth only in being as long as the femur. In none, therefore, was the tail as long as in the single example of *C. castanea*.

The length of the thigh varies from 12 mm. to 15 mm. Hence the relative lengths of these quantities will be also variable, especially so since even in the same individual the length of the tail does not tautogenize* with the length of the femur. The length of the tibia—a character of value in Cheiroptera—varies from 14 mm. to 18 mm.

The length of the forearm, perhaps the most important single measurement which can be taken, varies from 35 mm. to 40 mm.

The following includes the variations of the manus and their range:

		mm.		*mm.*		*mm.*
First metacarpal	from	4	to	6	Range	2
Second "	"	24	"	35	"	9
Third "	"	33	"	37	"	4
Fourth "	"	32	"	36	"	4
Fifth "	"	35	"	37½	"	2½
First phalanx first digit	"	4	"	6	"	2
†First " second "	"	3	"	6	"	3
First " third "	"	13	"	17	"	4

* Tautogeneity—a word introduced by Prof. Rolleston as a more correct term in this connection than corelation.

† An apparent anomaly exists on the left side of specimen No. 3993. There are *two* phalanges to the second digit.

			mm.		mm.		mm.
First phalanx	fourth digit	.... from	11	to	14	Range	3
First "	fifth "	.... "	10	"	12	"	2
Second "	third "	.... "	20	"	21½	"	1½
Second "	fourth "	.... "	10½	"	14	"	4½
Second "	fifth "	.... "	10	"	12	"	2
Third "	third "	.... "	10	"	11	"	1

The length of the head appears to be subject to very slight variation, namely, from 22 mm. to 23 mm. That of the ear, from 12 mm. to 13½ mm., a slight difference and yet one which might disturb the novice in attempting to identify the species, since the proportion between the height of the ear and the length of the muzzle is so often used in descriptions of bats. In *Carollia* these quantities are not fixed. The height of the auricle is variable, but the length of the muzzle is constant. No estimate of relations of measurements between them can be undertaken.

The tragus varies in height from 5 mm. to 6 mm. It presents different degrees of thickness along the median border. As a rule, very thick, this border may be thin and membranous. The processes on the outer border may be two or five, those toward the apex of the tragus tending to merge in one another. This tendency appears to be most marked in males.

The size of the nose-leaf is constant, being 10 mm. high and 6 mm. broad. The lower border shows striking peculiarities in some specimens.

Three of the males exhibited warts arranged in one or two rows across the upper lip on the line occupied in *Artibeus*, *Phyllostoma*, etc., with a well defined ridge or border. This variation is one of generic rather than specific value. At least it does not indicate any disposition to reversion to *C. castanea*, since in this species no warts are seen, the intervals between the margins of membrane at the side of the base of the nose-leaf simply being smaller than usual, and giving to the eye the appearance of extending directly across the lip. I know of no genus in which this variation of the nose-leaf of *Carollia brevicauda* is a constant character.

In *C. brevicauda*, the warts in the second row on the mentum are elongate in all the nine examples, except one in which they are rounded and do not differ from those of the first row. This arrangement resembles that seen in *C. castanea*.

It is probable that the two outermost rows of warts in *C. brevicauda* coalesce to form the elongate wart, which, as a rule, exists.

In reviewing the measurements of *C. castanea*, when placed in tabular form with those of *C. brevicauda*, it is seen that in the species first named that many of the measurements are the same ; that is to say, in some one of the examples of *C. brevicauda* the measurement of a given part will be found to be the same as in *C. castanea*. Thus the arm is of the same length in three specimens of *C. brevicauda*. The length of the bones of the digits find their complements in *C. brevicauda*, excepting the metacarpals of the fourth and fifth digits, which are shorter than in any example of that species. The metacarpal of the first digit is of the same length in one specimen of *C. brevicauda*, while the first phalanx is shorter than in any. The head is shorter while the ear is longer. The tragus remains the same in the two species. The thigh and the leg are both shorter in *C. castanea*, while the tail is absolutely longer by 1 mm.

The proportion of the widths of the second, third and fourth interdigital spaces is shown to be subject to variation. Specimens numbered 3129, 3231, 3128, 3230, 3229, and 4192 are of those in the best condition ; and it is seen that the differences are less than in the remaining specimens. But after all possible sources of error are eliminated, it will be seen that in three only of *C. brevicauda* (the males, Nos. 3230, 3229, 4192—and thus suggestive of sexual distinction) is the difference between the widths of the second and third spaces less than 10 mm., while in the single example of *C. castanea* (also a male), the difference amounts to but 9 mm.

In this connection I may allude to the value which attaches to the last-named measurements in the study of the Cheiroptera.

If a specimen of a bat, which is preserved in spirit, is so held in the hand that the wing is supported in the position of flight, it will be seen that the intervals between the metacarpal bones hold a definite relation to each other.

The width of the spaces between the metacarpals, now being recorded (the measurements are taken at their widest parts), it will be seen that the second interspace is the narrowest and the fourth the widest. In this way a formula may be stated. It is proper to add the length of the fore-arm to the formula, since this measurement is one of relative constancy and is of importance in framing the diagnosis of the species.

Examination of the table herewith presented exhibits at a glance the marked contrasts which obtain in the Phyllostomidæ in the composition of this formula.

It is especially interesting to note the difference which exists between the widths of the second and the third interspaces. It will be observed that no two formulæ are alike, nor is any fixed ratio preserved between the formulæ of genera which are allied. Nevertheless the measurements are sufficiently distinctive to warrant the recommendation that they be taken in all discriminating studies, not only of the Phyllostomidæ, but of the entire order.

Formulæ of the Widths of Second, Third and Fourth Interspaces in the Genera of Phyllostomidæ.

	II	III	IV	Forearm.	Differ'e bet. III & IV
	mm.	*mm.*	*mm.*	*mm.*	*mm.*
Lophostoma	7	17	18	49	1
Schizostoma	3	16	21	32	5
Macrotus	2	15	22	44	7
Desmodus.........	2	21	37	53	10
Vampyrops	3	17	27	36	10

	II	III	IV	Forearm.	Differ'e bet. III & IV
	mm.	*mm.*	*mm.*	*mm.*	*mm.*
Sturnira	3	21	31	38	10
Chilonycteris	$1\frac{1}{2}$	15	17	40	12
Carollia	5	20	32	26	9–12
Vampyrus	16	41	53	105	12
Lonchoglossa	3	19	32	33	12
Monophyllus	3	17	34	32	14
Artibeus	4	21	39	51	18
Brachyphylla	3	25	43	64	18
Mormoops	3	16	35	50	19
Phyllostoma	4	29	62	81	45

The study of measurements has given valuable results in the study of the human cranium and has enabled anatomists to come to definite conclusions respecting the validity of characters even when derived from scanty and imperfect material.

No reason can be urged why similar methods may not prove acceptable in describing a new species of mammal.

Extended observations on a number of examples of allied species enhance the value of those upon which it is proposed to announce a new one.

The following table includes the formulæ in families other than the Phyllostomidæ:

Rhynchonycteris	5	16	25	40	9
Cynopterus marginatus	10	18	27	58	9
Vespertilio murinus	2	11	31	59	10
Epomophorus franqueti	13	21	39	83	11
Rhinopoma	3	13	30	64	17
Atalapha	$\frac{1}{2}$	9	26	37	15
Molossus rufus	$\frac{1}{2}$	5	35	46	30
Noctilio	2	13	58	83	45
Pteropus edwardsii	18	17	69	145	52

Stated Meeting, January 3, 1890.

Present, 10 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

Letters acknowledging election to membership from Mr. A. Sydney Biddle and Dr. George Friebis, Philadelphia; Dr. C. C. Abbott, Trenton, N. J.; Rt. Rev. John J. Keane and Hon.

Fernando Cruz, Washington, D. C.; Hon. J. M. Le Moine, Quebec, Canada.

The San Francisco Public Library was, on motion, placed on exchange list to receive Proceedings and Transactions.

The Brooklyn Entomological Society communicated a change of address to No. 200 Washington street, Brooklyn.

The decease of members was announced as follows:

Dr. Charles A. Ashburner, Pittsburgh, Pa. (b. February 9, 1854; d. December 24, 1889).

Dr. James H. Hutchinson, Philadelphia (b. 1834; d. December 27, 1889).

Hon. George H. Boker, Philadelphia (b. October 6, 1823; d. January 2, 1890).

On motion, the President was authorized, at his discretion, to appoint suitable persons to prepare the usual obituary notices.

The President reported that he had appointed Hon. Richard Vaux to prepare the obituary notice of the late Franklin B. Gowen, and the appointment of Hon. James B. Angell to prepare the obituary notice of the late Henry S. Frieze, and that the same had been accepted.

The clerks and judges reported that at the annual election for officers and council, held this afternoon, the following gentlemen had been duly chosen:

President.

Frederick Fraley.

Vice-Presidents.

E. Otis Kendall, W. S. W. Ruschenberger, J. P. Lesley.

Secretaries.

George F. Barker, Daniel G. Brinton, Henry Phillips, Jr., George H. Horn.

Counselors (for three years).

Daniel R. Goodwin, William A. Ingham, Thomas H. Dudley, Robert Patterson.

Curators.

John R. Baker, Patterson DuBois, J. Cheston Morris.

Treasurer.

J. Sergeant Price.

Mr. Henry Phillips, Jr., was nominated for Librarian, and the nominations were closed.

Dr. A. S. Gatschet presented through the Secretaries a "Third Article on the Beothuk Indians."

Prof. Ryder presented a paper on "The Eye, the Ocular Muscles, and the Lachrymal Glands of the Shrew-mole."

Pending nominations Nos. 1203, 1204 and 1205, and new nominations Nos. 1206 and 1207 were read.

And the Society was adjourned by the President.

Stated Meeting, January 17, 1890.

Present, 20 members.

President, Mr. Fraley, in the Chair.

Dr. George Friebis, a lately elected member, was presented to the Chair, and took his seat.

Correspondence was submitted as follows:

A letter from Dr. Antonio Peñafiel (Mexico), announcing that his address would be, for some time to come, Berlin, Prussia (Kupfergraben 4).

Accessions to the Library were announced from the Académie des Sciences, Cracow, Austria; Physiologische Gesellschaft, Berlin; Gartenbauverein, Darmstadt; Deutsche Gesellschaft für Anthropologie, Ethnologie, etc., Munich Bavaria; Académie Royale de Belgique, Bruxelles; Senator Pietro Ellero, Bologna, Italy; Biblioteca N. C., Firenze; R. Accademia dei Lincei, Rome; Rédaction "Cosmos," Sociétés de l'Enseignement, Geographie, Ethnographie, Ecole des

Mines, Paris; Geological, Astronomical, Meteorological, Geographical Societies, Lords Commissioners of the Admiralty, "Nature," London; Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne, Newcastle-upon-Tyne; Philosophical Society, Glasgow; Geological and Natural History Survey of Canada, Montreal; Canadian Institute, Toronto; American Academy of Arts and Sciences, Society of Natural History, Boston; Museum of Comparative Zoölogy, Cambridge; Brown University, Providence, R. I.; Yale University, "American Journal of Science," New Haven, Conn.: Entomological Society, Prof. W. Le Conte Stevens, Brooklyn; Cornell University, Ithaca; New York Academy of Sciences, American Chemical Society, New York Historical Society, Rev. John Hall, D.D., New York; College of Pharmacy, Franklin Institute, Editors of the "Medical and Surgical Reporter" and the "Medical News," Prof. H. D. Gregory, LL.D., Philadelphia; U.S. Naval Institute, Annapolis; Maryland Institute, Baltimore; U. S. Engineer Office, Department of the Interior and of State, Commissioner of Education, U. S. Fish Commission, Mr. Lester F. Ward, Col. Garrick Mallery, Washington, D. C.

Photographs were received from Il Marchese de Gregorio Palermo, and Dr. R. H. Alison, Ardmore, Pa.

The deaths of the following members were announced:

J. H. C. Coffin, U.S.N., January 8, 1890, Washington, D.C. æt. 75.

William D. Kelley, M. C. (of Philadelphia), at Washington, D. C., January 9, 1890 (b. April 12, 1814).

The stated business of the meeting was then taken up, and Henry Phillips, Jr., was unanimously reëlected Librarian for the ensuing year.

On motion, the President was authorized to appoint at his leisure the Standing Committees of the Society, which he subsequently appointed as follows:

Finance.

William B. Rogers, Philip C. Garrett, C. S. Wurts.

Publication.

Daniel G. Brinton, George H. Horn, Samuel Wagner,
Patterson DuBois, Horace Jayne.

Michaux Legacy.

Thomas Meehan, J. Sergeant Price, Aubrey H. Smith,
William M. Tilghman, Isaac Burk.

Hall.

J. Sergeant Price, William A. Ingham, Charles A. Oliver.

Library.

Edwin J. Houston, William V. McKean, Wm. John Potts,
Jesse Y. Burk, William H. Greene.

Henry M. Phillips' Prize Essay Fund.

Richard Vaux, Henry Phillips, Jr., William V. McKean,
Furman Sheppard, Joseph C. Fraley,
and
The President of the Society, } *ex officio.*
The Treasurer of the Society, }

Dr. Harrison Allen made an oral communication on "The Variations of the Forms of Human Teeth."

He stated that monocuspidate teeth are those which first appear in any given series, and that the bicuspidate and the multicuspidate forms are complications due to additions to the monocuspidate. He claimed that the quadritubercular human molar resolves itself into two pairs of adjoined cusps which are arranged endo-ectally, and not as he at one time stated* into a tritubercular form to which is appended a rudimental fourth cusp. He also believed that teeth when degenerated do not of necessity descend along the lines of ascent. As a rule they infrequently do so. In his opinion, degenerated teeth (and these were illustrated from the orders of Cheiroptera, Rodentia, and Primates) are all essentially alike, inasmuch as they exhibit losses of characteristic details, while retaining the lateral thickenings and contour lines. Some of these may be mimetic of the true tritubercular molar. It is necessary to remember, that forms of teeth when passing into degeneration are in reality expressions of teratological phenomena and have little or no taxonomic value.

* "Dental Cosmos," December, 1874.

Pending nominations 1203, 1204, 1205, 1206, 1207 and new nomination 1208 were read.

Mr. Henry Phillips, Jr., presented some statistics relating to the Society.

Dr. Oliver offered the following preamble and resolution:

Whereas, It is both honorable and just that we, the present representatives of the American Philosophical Society, should show our affection and regard for our illustrious founder and first President, Dr. Benjamin Franklin, who died on the 17th day of April, 1790, be it,

Resolved, That we commemorate his life, his wisdom, his labors, and his achievements by proper and fitting ceremonies becoming such an occasion, on the 17th day of April, 1890; the form of the commemoration to be referred to a Special Committee of five members, to be appointed by the President, who shall be empowered to take all necessary action.

Which, after discussion, was adopted.

The President subsequently appointed as such Committee, Messrs. Charles A. Oliver, Henry Phillips, Jr., Arthur Biddle William John Potts and William H. Greene.

Dr. Morris made some remarks on the desirability of better accommodations for the possessions of the Society. On motion of Mr. Dudley it was

Resolved, That the President appoint a Committee of five members to consider the whole subject, and to ascertain if the Society can obtain additional space in the vicinity of its Hall, and that the President should also be a member of the Committee.

The President subsequently appointed as such Committee, Messrs. J. Cheston Morris, Thomas H. Dudley, J. Sergeant Price, Richard Vaux and William P. Tatham.

A communication from the Chairman of the Committee on the Michaux Legacy, in reference to an appropriation of $150 towards the expenses of a scientific expedition about to proceed to Mexico, was referred to the Committee to report upon at the next meeting.

And the Society was adjourned by the President.

Stated Meeting, February 7, 1890.

Present, 8 members.

Prof. EDWIN J. HOUSTON in the Chair.

Correspondence was submitted as follows:

Letters from Sir George G. Stokes, F.R.S., London, and Dr. Friederich S. Krauss, Vienna, accepting membership in the Society.

A letter from the Physikalisch-Oekonomische Gesellschaft zu Kœnigsberg in Preussen, announcing the approaching Centennial Anniversary of its formation (February 22, 1890).

An invitation from Columbia College, New York city, N. Y., to be present by delegate at the inauguration of Seth Low as President, on February 3, 1890.

Letters of envoy were received from the K. Leopoldinisch-Carolinische Akademie, Halle a. S.; Meteorological Office, London.

Letters of acknowledgment were received from the Royal Society of Victoria, Melbourne (129); Naturwissenschaftlicher Verein des Regierungs-Bezirks, Frankfurt a. O. (129); K. Leopoldinisch-Carolinische Akademie, Halle a. S. (129); Prof. J. Victor Carus, Leipzig (127, 128); Société des Sciences Physiques et Naturelles, Bordeaux (129); Sir Monier Monier-Williams, London (128, 129); Hon. J. M. LeMoine, Quebec (129, 130); Nova Scotian Institute of Natural Science, Halifax (96–130, Catalogue, etc.); Anthropological Society, Washington, D. C. (125, 126, 127, 128); Prof. James B. Angell, Ann Arbor (129); Geological Survey of Missouri, Jefferson City (129, 130, Catalogue, etc.).

Letters of acknowledgment (130) were received from the Geological and Natural History Survey, Ottawa, Canada; University of Toronto, Canadian Institute, Toronto; Maine Historical Society, Portland Society of Natural History, Portland, Me.; Northern Academy of Arts and Sciences, Prof.

C. H. Hitchcock, Hanover, N. H.; Mr. John G. Whittier, Amesbury, Mass.; Boston Athenæum, State Library of Massachusetts, American Statistical Association, Boston Society of Natural History, Massachusetts Historical Society, Hon. Robert C. Winthrop, Boston; Harvard College Library, Museum of Comparative Zoölogy, Profs. Alexander Agassiz, Joseph Lovering, Robert N. Toppan, Cambridge, Mass.; Mr. James B. Francis, Lowell, Mass.; Free Public Library, New Bedford; Dr. Pliny Earle, Northampton; Essex Institute, Salem; American Antiquarian Society, Worcester; Rhode Island Historical Society, Prof. Thomas Chase, Providence; Connecticut Historical Society, Hartford, Conn.; New Haven Colony Historical Society, Profs. H. A. Newton, W. D. Whitney, New Haven, Conn.; Profs. James Hall, Edward North, C. H. F. Peters, Clinton, N. Y.; New York Hospital, Astor Library, Dr. Daniel Draper, New York State Library, New York Historical Society, Columbia College Library, Prof. Joel A. Allen, Messrs. J. Douglas, R. W. Raymond, Dr. J. J. Stevenson, New York; Vassar Brothers' Institute, Poughkeepsie; Oneida Historical Society, Utica; U. S. Military Academy, West Point; Mr. William John Potts, Camden; New Jersey Historical Society, Newark; Prof. C. F. Brackett, Princeton; Dr. Charles B. Dudley, Altoona, Pa.; Academy of Natural Science, College of Physicians, Wagner Free Institute, Pennsylvania Hospital, Numismatic and Antiquarian Society, Messrs. Harrison Allen, John Ashhurst, Richard L. Ashhurst, R. Meade Bache, Cadwalader Biddle, George D. Boardman, W. G. A. Bonwill, Arthur E. Brown, Samuel Castner, Jr., Henry C. Chapman, C. H. Clark, Thomas M. Cleemann, E. D. Cope, Samuel Dickson, Patterson du Bois, Persifor Frazer, F. A. Genth, Jr., Daniel R. Goodwin, William H. Greene, H. V. Hilprecht, E. J. Houston, Francis Jordan, Jr., E. Otis Kendall, Joseph Leidy, Francis W. Lewis, Morris Longstreth, E. Y. McCauley, F. A. Mühlenberg, Isaac Norris, Charles A. Oliver, C. Stuart Patterson, C. N. Peirce, William Pepper, Henry Phillips, Jr., Franklin Platt, Theodore D. Rand, George B. Roberts, W. S. W. Ruschenberger, Lewis A. Scott, Aubrey H. Smith, Albert H. Smyth, George Stuart, William P. Tatham, William Thomson, H. Clay Trumbull, David K. Tuttle, William H. Wahl, Ellis Yarnall, Mrs. Helen Abbott Michael, Philadelphia; Dr. Robert H. Alison, Ardmore; Prof. E. B. Wilson, Bryn Mawr; Prof. Lyman B. Hall, Haverford; Mr. Philip C. Garrett, Logan, Phila.; Mr. J. Vaughan Merrick, Roxborough; Mr. Burnet Landreth, Bristol; Mr. Eckley B. Coxe, Drifton; Dr. Traill Green, Profs. James W. Moore, Thomas C. Porter, Easton; Linnean Scientific and Historical Society of Lancaster, Pa.; Mr. Peter F. Rothermel, Linfield; Mr. John F. Carll, Pleasantville; Mr. Peter W. Sheafer, Pottsville; Mr. M. Fisher Longstreth, Sharon Hill, Pa.; Philosophical Society, Mr. Philip P. Sharpless, West Chester; State Library of Pennsylvania; Mr. Andrew S. McCreath, Harrisburg; Naval Institute, Annapolis, Md.; Maryland Institute, Baltimore; Library of the Surgeon-General's Office, Anthropological Society, U. S. Naval Observatory, Smithsonian Institution, Messrs. S. F. Emmons, Albert S. Gatschet, Thomas J. Lee, Garrick Mallery, Charles A. Schott, William B. Taylor, Lester F. Ward, Washington, D. C.; Virginia Historical Society, Richmond; Prof. John W. Mallet, University of Virginia; Prof. Lyon G. Tyler, Williamsburg, Va.; Elliott Society of Science and Art, Charleston, S. C.; Georgia Historical Society, Savannah; University of Alabama, Tuscaloosa; Prof. E. W. Claypole, Akron, O.; Denison University, Granville, O.; Society of Natural History, Cincinnati Observatory, Hon. J. D. Cox, Prof. James M. Hart, Cincinnati; Rev. Henry S. Osborn, Oxford, O.; Dr. Robert Peter, Lexington, Ky.; Athenæum, Columbia, Tenn.; St. Louis Academy of Science; Profs. James B. Angell, Alexander Winchell, Ann Arbor; Gen. William F. Reynolds, Col. William Ludlow, Detroit; Prof. John C. Branner, Little Rock, Ark.; Davenport Academy of Natural Sciences; Iowa University Library, Iowa City; Kansas State Historical Society, Washburn College, Topeka, Kans.; Prof. John L. Campbell, Crawfordsville, Ind.; Chicago Historical Society, Newberry Library, Chicago, Ill.; State Historical

Society of Wisconsin, Madison; Colorado Scientific Society, Denver; Prof. Joseph Le Conte, Berkeley, Cal.; Prof. Daniel Kirkwood, Riverside, Cal.

Accessions to the Library were announced from the K. Böhmische Gesellschaft der Wissenschaften, Prag; K. K. Geologische Reichsanstalt, K. Akademie der Wissenschaften, Vienna, Austria; Gesellschaft für Anthropologie, etc., Deutsche Geologische Gesellschaft, Gesellschaft für Erdkunde, Messrs. Friedländer & Son, Berlin; Senckenbergische Naturforschende Gesellschaft, Naturwissenschaftliche Verein des Reg.-Bez., Frankfurt a. M.; Verein für Erdkunde, K. Leopoldina Carolina Akademie, Halle a. S.; Sociedade de Geografia, Lisbon; Meteorological Council, Society of Arts, Prof. B. Loewenberg, London; Trustees of Prof. James Henry, Dublin; Nova Scotian Institute of Natural Science, Halifax; Natural History Society, Montreal; Theological Seminary, Andover; American Statistical Association, Hon. Robert C. Winthrop, Boston; Museum of Comparative Zoölogy, Prof. Samuel D. Scudder, Cambridge, Mass.; Essex Institute, Salem; Editor of "The Traveller's Record," Hartford; Meteorological Observatory, American Institute of Electrical Engineers, New York; Mr. William John Potts, Camden, N. J.; American Pharmaceutical Association, Wagner Free Institute, Editor of "The Naturalist's Leisure Hour," Daniel G. Brinton, I. Minis Hays, Henry Phillips, Jr., Philadelphia; Pennsylvania Geological Survey, Harrisburg; Prof. Ira Remsen, Baltimore; Treasury Department, Smithsonian Institution, Department of the Interior, U. S. Coast and Geodetic Survey, Hydrographic Office, Anthropological Society, Washington, D. C.; Charles C. Jones, Jr., Augusta, Ga.; State Board of Health, Nashville, Tenn.; Public Library of Cincinnati; State Historical Society, Iowa City, Ia.; Wisconsin Academy of Sciences, Arts, etc., Madison; Washburn College Laboratory of Natural History, Topeka, Kans.; Los Angelos Public Library; University of California, Sacramento; Observatorio Meteorologico-Magnetico Central, Observatorio Astronomico Nacional de Tacubaya, Sociedad Cientifica "Antonio Alzate," Mexico; Museo

Michoacano, Morelia, Mexico; Deutsche Wissenschaftliche Verein, Santiago, Chili.

The death of Gustav Adolph Hirn, Colmar, Alsace, January 14, 1890, æt. 75, was announced.

Dr. Daniel G. Brinton presented a paper on "Etruscan and Libyan Names."

Prof. Houston made a communication on "Muscular Contractions following Death by Electricity."

Pending nominations Nos. 1203, 1204, 1205, 1206, 1207, 1208 were read.

On motion, the Society subscribed to "American Notes and Queries," and ordered the purchase of the three previous volumes.

Dr. Oliver reported the following preamble and resolutions, which were adopted, and the same committee continued and requested to make all the arrangements necessary to carry out the same:

The Committee to which was referred the following preamble and resolution: "Deeming it both honorable and just that we, the present representatives of American Philosophical Society, should show our affection and regard for our illustrious Founder and First President, Dr. Benjamin Franklin, who died on the 17th day of April, 1790, be it resolved that we commemorate his life, his wisdom, his labors and his achievements by proper and fitting ceremonies becoming such an occasion, on the 17th day of April, 1890; the form of the commemoration to be referred to a special committee of five members, who shall be empowered to take all necessary action," presented by Dr. Oliver at the meeting of the Society on the 17th of January, 1890, begs respectfully to submit the following report:

Resolved, That we commemorate in a becoming manner the approaching Centennial Anniversary of the death of Benjamin Franklin.

Resolved, That a series of short addresses upon his life, character and work be delivered before the Society upon this occasion.

The Committee on the Michaux Legacy reported in favor of an appropriation of $150 to assist the expedition of Prof. Heilprin to investigate the forest growths of Mexico and Yucatan; and on motion the amount was granted for the purpose.

The Finance Committee offered the following resolution which was adopted:

Resolved, That J. Sergeant Price, Treasurer, be and he is hereby authorized to sell and transfer three thousand dollars of the loans of the City of Philadelphia now standing in the name of the Society.

And the Society was adjourned by the presiding member.

On Muscular Contractions Following Death by Electricity.

By Prof. Edwin J. Houston.

(Read before the American Philosophical Society, February 7, 1890.)

Accurate data are wanting as to whether death resulting from accidental contact with electric conductors conveying the powerful currents employed in systems of electric lighting or power distribution is, or is not, practically instantaneous. Certain facts, however, are known which show that when the nature of the contacts is such that the discharge passes through the respiratory, the cardiac or the brain centres, that true physiological death, as evidenced by the complete failure of these centres to perform their normal functions, and their inability to afterwards perform these functions, is practically instantaneous.

In cases of death from a lightning bolt, for example, instances are on record where death has been so nearly instantaneous that the bodies have remained so nearly in the positions occupied during life that passers-by have failed to recognize the presence of death.

On the regaining of consciousness lost by a lightning discharge or a contact with an electric conductor, the subject as a rule has no memory of pain or suffering, and in many instances is even ignorant of the cause of the accident.

A fact, however, which appears to disprove that practically instantaneous physiological death follows a powerful electric discharge, should be alluded to. In some instances, it has been observed that the body of the person receiving the discharge showed prolonged convulsive muscular contractions and contortions. The question thus arises, Do such muscular movements necessarily prove actual suffering on the part of the subject? Do they even necessarily prove the existence of life while they are taking place? While, of course, the answer to this question must necessarily be to a certain extent uncertain, the following considerations are offered to show that in all probability such muscular contractions follow physiological death, and are, therefore, unattended by consciousness or suffering.

Two general cases of contact resulting in death may occur, viz.:

1. A momentary contact, where the discharge is only temporary, as in the case of the lightning discharge, or the case of a person falling against the wires and remaining in contact therewith but a few seconds or fractions of a second.

2. A prolonged contact where the current continues to pass through the body for some time after death.

In cases of death by the first class of contacts, no convulsive movements occur. Death results from physiological shock, or possibly from changes in the nervous or muscular tissues.

In the second class of contacts, death in many cases probably occurs practically instantaneously. The question then arises, How can the muscular contractions be explained ?

The classic experiments of Galvani with the excised legs of recently killed frogs prove conclusively that the passage of an electric current causes convulsive muscular movements. The same phenomena, too, have been observed in the human subject, as numerous experiments with the bodies of criminals shortly after their execution have shown.

It would seem, therefore, probable, to say the least, that when the electric current continues to pass through the body of the subject after physiological death has occurred, such convulsive muscular movements may occur, and that, therefore, their existence do not prove suffering.

When a powerful current traverses the body, tetanus occurs, and muscular movements in such parts cease. The nerve loses its sensibility, and, if the current is too strong, changes occur in its structure or composition, either as a result of polarization, or electrolysis, or otherwise, which prevent it from being further affected by the electric discharge. Since such changes presumably occur in cases of death by electric discharges, it would appear that muscular contractions would therefore be impossible after death. A brief consideration of the manner in which an electric current traverses the human body will show that such a conclusion is unwarranted.

When the electrodes of any source are applied to any two parts of the human body, a current passes through the body from the positive to the negative electrode. The density of current that passes, or the current strength per unit of area of cross-section, is different at different parts of the body. Those portions that lie in the paths of least resistance, which, in general, are situated in paths of least distance between the electrodes, receive the denser and more powerful current, while those lying in paths of greater resistance, receive weaker currents. In other words, in the passage of the electric current through the human body, a diffusion of the current occurs.

While, therefore, the nerves and muscles lying in the direct path of a fatal discharge may be almost instantly deprived of their sensibility by the passage of the powerful and fatal discharge through them, the nerves and muscles which lie in the paths of less powerful currents may still retain their power of electric excitation.

It is therefore probable, that in cases of prolonged fatal contact with electric conductors, the ensuing convulsive muscular contractions do not of necessity prove suffering.

I offer these views with some diffidence from the standpoint of an electrician rather than that of a physiologist.

On Etruscan and Libyan Names. A Comparative Study.

By Daniel G. Brinton, M.D.

(*Read before the American Philosophical Society, February 7, 1890.*)

§ 1. *Introductory. Libyan Epigraphy.*

In October last (1889) I laid before this Society a series of considerations drawn from the physical traits of the Etruscans, their customs, arts and language, going to show that they were an offshoot or colony of the Libyans or Numidians of North Africa—that stock now represented by the Kabyles of Algeria, the Rifians of Morocco, the Touaregs of the Great Desert and the other so-called Berber tribes.

So far as I was aware, this opinion had never been advanced before, although it would seem a natural and obvious one. Nor have I yet found that any writer had clearly stated it previously; though I have discovered that occasional earlier observers have been struck with some of the resemblances which so impressed me, and I am glad to add the weight of their testimony to my own. Thus, M. Louis Rinn, Vice-President of the Historical Society of Algiers, after alluding to what he considers a point of resemblance between the Berber and the Etruscan language, adds, "A comparative study of these two peoples would certainly bring into prominence other similarities, yet more remarkable, in their customs, in the forms and designs of their potteries and in their tongues."* M. Rinn quotes the old traveler, Dr. T. Shaw, as suggesting one or more similarities in Kabyle and Etruscan place-names, but he gives no exact references, and a search through Shaw's *Travels* has not enabled me to find the passages.

In the present article, I shall carry out to a limited extent a comparison between the proper names preserved in the oldest Libyan monuments and a series of similar names believed to be genuine Etruscan. I am aware that this is not the way to study the relationship of languages *à fond;* but the material is not obtainable in this country to do more, and if it were, I have not that familiarity

* *Les Origines Berbères. Etudes Linguistiques et Ethnologiques*, p. 196 (Alger., 1889). I regret that I cannot speak favorably of this laborious production; but its author is fantastical rather than scientific in most of his researches. The similarity referred to is that of the geographical name *Taderta* which I mention hereafter.

with the Punic and Berber dialects with which one should be equipped to approach the question from that more difficult side.

For the Numidian or Libyan epigraphy I have depended upon the *Collection* of General Faidherbe,* and the admirable *Essay* of Prof. Halévy.† Even with these materials I believe more could be accomplished than I have attempted, and the most that I hope from this and my former paper is to enlist the attention of Etruscologists to the possible derivation of the nation from the Libyan stock. These Libyan or Numidian inscriptions, to be sure, date from a long time after the Etruscans had founded their cities in Italy. The oldest of them are probably not beyond 200 B.C., and then nearly a thousand years had elapsed since the formation of the Etruscan commonwealth. We must not therefore expect frequent identities, especially as the Etruscans notoriously borrowed largely the names and terms of their various neighbors. On the other hand, it must be remembered that the Berber is a group of dialects singularly tenacious of its traits, both grammatic and lexicographic. To this day, its tribes are mutually intelligible, from the western boundaries of Egypt to the Atlantic coast, and from the Mediterranean to the Soudan. Therefore it is not incongruous to attempt the explanation of an Etruscan name (assuming that it is of Libyan origin) by the modern Kabyle or Touareg.

A preliminary question of interest is that of the

§ 2. *Etruscan Invasions of Egypt.*

This subject has been brought to the attention of Egyptologists by the supposed references to the Etruscans in the ancient inscriptions, and to Italian archæologists by the evident Egyptian inspiration in some of the Etruscan art remains. I shall sum up briefly the main points of the question.

From the earliest times the movement of the Libyan tribes toward the east is recorded in the annals of the Egyptian monarchy. In the third dynasty—according to the chronology of Mariette some 4200 years B. C.—the incursions of the Temhu (the Touaregs ?) are mentioned. In the eighteenth dynasty (1703–1462 B.C.) the mother of Amenhotep IV. is represented as a blonde with blue

* *Collection Complète des Inscriptions Numidiques (Libyques).* Par le General Faidherbe (Paris, 1870).

† *Études Berbères. Essai d'Epigraphie Libyque.* Par J. Halévy (Paris, 1875).

eyes, and bore the name, at once Libyan and Etruscan, of "Taia." She was probably a Libyan by birth.*

The most important general migration of the Libyan tribes seems to have taken place about 1300 years B.C. At that time, as we are informed by an inscription of Meneptah II. on the wall of the great temple of Ammon at Api, the king of the land of *Libu*, by name Mar-ajui, a son of Did, led a great army composed of his own troops and mercenaries from other nations into Egypt, entering near the city of Presopis. He was defeated with heavy loss, and many thousands of his soldiery were slain.† Among his allies were the "Tursha," who are considered by some Egyptologists to have been the nation called in classic writings, *Turseni* or *Tyrrheni*, *i.e.*, the Etruscans. This identification is rejected by Dr. Brugsch Bey, who ventures the yet wilder theory that they were *Taurians*. Halévy, on the other hand, is inclined to see in this and the other names given in the list of allies merely various Libyan tribes, neighbors of the Lebu;‡ and this is quite probable when we consider the impracticability of large bodies of soldiery being transported across the Mediterranean in that early age. It is possible, therefore, that the "Tursha" were the "Turseni," and that in consequence of this defeat they left their native land and founded the Etruscan colonies on the west coast of Italy—which were commenced about that time.

Dr. Deecke has already pointed out the probability that the *Tuirsa* who attacked Egypt by sea in the time of Ramses III (twentieth dynasty, 980–810 B.C.) were the Turseni or Etruscans. They are represented on the paintings with pointed beards and helmets of Etruscan form.§ The very early signs of Egyptian culture visible in ancient Etruria, on which Deecke lays stress, may be explained by the proximity of the Libyo-Etruscans—the *Tuirsa*—to the Nile valley before they founded their Italian colonies. It is quite sure that the main body of the army of Mar-ajui was composed of the blonde type of the Berbers, as the Egyptian name applied to them on the monuments is *thuheni*, "the light-colored or fair-complexioned people."

* On the presumably feminine termination in Etruscan *aia*, see Deecke in Müller, *Die Etrusker*, Bd. i, s. 475.

† Dr. Brugsch Bey, *History of Egypt*, Vol. ii, p. 129.

‡ *Essai d'Epigraphic Libyque*, p. 170.

§ See his note in Müller, *Die Etrusker*, Band i, s. 70.

§ 3. *The Libyan Alphabet.*

The ancient Libyan or Numidian alphabet, preserved in the *tifinagh* and *tiddebakin* of the Touaregs, was composed of twenty-three letters, five of which served both as vowels and consonants. As in the Etruscan alphabet, all letters could act as either initial or terminal sounds. Two letters are in the Libyan which do not appear in the Etruscan—*b* and *o*. It is a notable coincidence, however, that not only was the former sound usually rendered by the ancient Roman writers by an *f*,* but it is absent or rare in the Ghdames, Rif, Bougie and Mzab dialects of modern Berber.† Evidently the Etruscan in its omission of this phonetic element is brought into closer relations to a large part of the Libyan speech.

Diphthongs, double consonants, guttural and sibilant sounds are of frequent recurrence in Libyan as they were in Etruscan, the former trait being a similarity which separates both from pure Semitic tongues.‡

The most frequent permutations of the Libyan letters, both in the ancient and modern dialects, are as follows:

b into *f*.
k into *x* (guttural), or *ch*.
l into *d*, or *r*.
s into *z*, or *ch*, or *sh*.
t into *d*, or *dj*, or *dh*.
tch into *k*.
ts into *sh*.
th (θ) into *t*.

§ 4. *Names of Divinities.*

The religion both of the Libyans and Etruscans resembled that of most of their neighbors in being a marked polytheism. It is said that more than two hundred Etruscan divinities have been discriminated;§ but I do not find the names of anything like this number. Otfried Müller and Dr. Deecke give about fifty, of which

* "Le changement de *b* et *f* est très fréquent dans les dialectes berbers." Halévy, *Essai*, p. 21. "Le *b* libyque est souvent transcrit par *f* en latin." *Ibid.*, p. 156.

† Basset, *Manuel de langue Kabyle*, p. 6.

‡ Louis Rinn, *Les Origines Berberes*, p. 59.

§ Richard Burton, *Etruscan Bologna*, p. 192.

some are probably Italian or Greek. From among those apparently really Etruscan, I select for comparison the following:

Apulu, or *Aplu*, was the Etruscan god whose fane was upon Mt. Soracte, and who, according to a tradition recorded by Virgil, was the earliest divinity worshiped by the Tuscans.* From the similarity of the name to the Greek Apollo, most writers have considered it a corruption of that word, and the later Etruscans no doubt transferred the attributes of the famous Greek divinity to their national god. But an examination of the ancient Numidian inscriptions discovers a divinity so closely similar that the suspicion is excited that the two are identical, and the resemblance to Apollo a mere coincidence. This divinity bears the name in the Numidian character *Abru*, and is almost certainly identical with the Guanche *Abŏra*,† showing the wide extension of the cult in the ancient Libyan peoples. Halévy thinks it reappears in a Latin inscription, *Ifru augusto sacrum*, found near Constantine.‡ The phonetic changes from *Abru* to *Aplu* are justified by numerous examples in both Etruscan and Libyan, and that this widely worshipped god of the Libyans should be referred to by the Etruscans as the first they adored is very natural.

Culzu; a member of the Etruscan pantheon, represented with torch and shears, a divinity apparently who decided the day of death.§ Allowing for the constant permutation of *l* and *r* in these dialects, Corippus mentions a Libyan divinity of the same name, of whom the Mauritanian chieftian Ierna was priest:

> "Ierna ferox his ductor erat Gurzilque sacerdos."—*Johannidos*, ii, 109.

The idol of the god represented a divinity of horrid mien, suitable to a god of death.

> "Simulacra sui secum tulit horrida Gurzil."—*Johannidos*, vi, 1139.

The derivation of the Libyan *Gurzil* is not very clear; but as the god who decided on the day of death, and cut or shortened the thread of life (for which purpose Culzu holds the shears in Etruscan portraiture), I am inclined to connect both names with the modern Berber verbal *guezzil*, pl. *guezlen*, to be short, *m'gazzil*,

* The poet has a Tuscan say:

> "Summe deum, sancti custos Soractis Apollo,
> Quem primi colimus."—*Æneid.*, xi, 785.

† Berthelot, *Bulletin de la Société d'Ethnologie*, Tome ii, p. 131.

‡ *Essai*, p. 156.

§ Müller, *Die Etrusker*, Bd. ii, s. 110.

separation, dismemberment, which Newman compares to the similarity of the English *shear*, *shears*, *short* (*Libyan Vocabulary*, p. 50). In the ancient Numidian epigraphy this deity is referred to in the literation *ghrsl* (Halévy, *Essai*, p. 121), and the final *l* seems to be retained in the Etruscan form *culsl* quoted by Corssen.*

Lala, goddess of the moon, probably the new moon, and hence of birth and fecundity. The name seems connected with the Libyan *lal*, to be born, *θalalil*, birth, etc. In Numido-Latin inscriptions, this precise form *Lala* appears (see Halévy, *Essai*, p. 83).

Leucothea, the white goddess. This is the Greek translation of the name of a female divinity much honored by the Etruscans, and especially at Pyrgos, the port of Caere, where a great and beautiful temple was dedicated to her (Müller, *Die Etrusker*, Bd. ii, s, 54–56). The Etruscan form of the name is not given, but in the list of their beneficent goddesses occur the names *malavisχ*, and *melacuχ*, where the initial radical seems to be the same as in the Libyan *amelal*, white, *mellul*, it is white, etc. (Newman, *Lib. Vocab.*, pp. 61, 62). In these, I believe, we may recognize the goddess of Pyrgos. Whether her attribute of whiteness was derived from the sea foam or the morning light, or from some other cause, we have no means of knowing.

Manes, *Mania*, *Mantus*. The *dii Manes* of the ancient Latins are generally recognized to have been derived in character and name from Etruscan antecedents. The derivations of the word *Manes* offered by the later grammarians are as usual merely fanciful and worthless, nor has any acceptable one been suggested by modern writers. I believe it is revealed in the name of an ancient Libyan deity, *Motmanius*. This occurs in a votive inscription found near Constantine—*Motmanio et Mercurio sacrum* (Halévy, *Essai*, p. 157). The name seems to be clearly a compound of Libyan *emet;* aorist, *imūt*, to die, dead, and *emān*, soul,—a lord of the souls of the dead. In the first syllable we recognize the Etr. *mut-na*, a tomb, a place of the dead (see my *Eth. Aff. of Etruscans*, p. 19), and in *Manius* is the Etr. *Manes*, the current meaning of which was "the souls of the dead,"† allied to which was the Etr. name of the god of the underworld, *Mantus*, the goddess *Mania*, and perhaps the

* *Sprache der Etrusker*, s. 610.

† "Die Seele der Hingeschiedenen," Müller, *Die Etrusker*, Bd. ii, p. 98.

goddess often portrayed on Etruscan mirrors with the name *Munθu*, or *Munθχ*, believed by Deecke to be one of the auspicious *Manes* or spirits.

Mars. The old Italic name for this divinity was *Marmar*, which reappears in the Etr. *Mamar-ce*, a personal name, and *Maris*, the name of a divinity shown on Etr. mirrors. One of the months in the Etr. calendar was named from him. This name in the form *Marmar* was quite frequent in Libyan. I need but recall the Libyan general *Marmaria*, the tribe *Marmaridæ*, etc. It also appears in the Libyan inscriptions of Djebel-Thala (Halévy, *Essai*, p. 68). The identification appears therefore complete.

Menerva, the Etr. forms of which are *mnarva* and *meneruva*, is believed to be distinctly a Tuscan goddess whose original vocation was that of a protectress of children; only in later days did she assume the attributes of the Greek Athene (Müller, *Die Etrusker*, Bd. i, s. 46 *sq*.). The name has a strong Libyan physiognomy. The prefix *men* is common in the dialects of that stem, and in the remainder of the name, *arna*, *eruva*, we are close to the modern Kabyle *arau*, pl. *arawan*, child, a meaning most consonant with her original character.

Sethlans. The Etr. compound *Seθre*, or *Set-ria*, is a proper name, the root of which *Set* (*seθ-*) probably reappears in the initial syllable of *Seθ-lans*, the Etr. Vulcan. This initial syllable *set-*, *sed-*, *sit-*, is a common one on the Libyan tombs of the earliest centuries (Inscrips. 77, 105, 128, 216, etc.). One of the Numidian names appears in the Latin form, *Sit-ilia*, and the Libyan *Sit-ila* (Inscrip. 216) is close to Etr. *Seθ-lans*. Halévy suggests its relationship to the Egyptian god *Set* (*Essai*, p. 81); but its origin may as well be from the Libyan root *s't*, now preserved in the Touareg, *is-suhet*, strong, *essahet*, violence, etc.; Kabyle, *set-mara*, by force, by might, etc.

Tina, Tinia. This divinity is stated to have corresponded to the Jupiter of the Romans, and his figure often appears on Etruscan mirrors and coins with the symbols of the lightning, the sceptre and the crown of rays. For these and other reasons (set forth in detail by Müller), he is looked upon as "the chief divinity of the Etruscans and the centre of their celestial world."

It must be regarded as a striking example of the permanence of mythologic conceptions that the same deity with the same name is recorded by Corippus as the Jupiter of the Libyans in the sixth century A. D. In his lines referring to the gods they invoked on entering battle, he writes:

> "Mastiman alii; Maurorum hoc nomine gentes
> Tænarium dixere Jovem."—*Johannidos*, Lib. vii, 307.

The name *Mas-timan* is compounded of the common Libyan (and Etruscan) prefix of grandeur *mas*, and *timan*, in which the *n* in *Tina* has changed into *m*, a permutation frequent in the Moroccan (Rifian) dialect of Berber, in which the *mim* of the Arabic alphabet is often substituted for the *nun*.* The terminal *n* in so many of the Libyan names given by Corippus is thought by Halévy to be often an extraneous addition to the native form.†

Turm's, the Etruscan Mercury.
Turan, goddess of love.
Tarsu, a mythical Gorgon.
T'ruisie, a hero god.

In these and similar Etruscan names we appear to be in the presence of the exceedingly common ancient Libyan radical TR, seen in the inscriptions in such names as *Toura*, *Touran*, *Tir-mag*, *Tor-dak*, *Tour-sha*, etc., and in Corippus' poem in *Tor*, *Tur-ṣus*, etc.

The prefix used thus frequently in both dialects is likely to be a term of reverence, affection or amplification. It does not appear current in modern Berber. In its dialects the syllable means a height, a hill or mountain, *dar*, *adrar* (pl. *daran*); *tareelit*, a hill. The transfer of the idea of physical to social elevation is common to all languages (*son altesse*, his serene highness, etc.), and may be at the base of the meaning here.

Usil, the sun-god of the Etruscans, was portrayed with rays around his head and a bow in his hand (Müller, *Etrusker*, Bd. ii, p. 80). As I have remarked in my previous essay, the Libyan word for the sun at high noon is *ăsl*.

§ 5. *Names of Persons.*

The Etruscans were accustomed to employ both individual and family names, and in some instances all three of the names in use

* Basset, *Manuel de Langue Kabyle*, p. 9.
† "La terminaison *n* est une particularité de la prononciation punique des expressions libyques." *Essai*, p. 121

by the later Latins (prænomen, cognomen, agnomen). The same form frequently appears in different cases as family name and surname. A comparison of such personal names with those found on the sepulchral monuments of the ancient Libyans may lead to some definite results.

Avile is said by Deecke to be one of the most ancient and genuine of Etruscan personal names. It appears both as surname and family name on a number of the oldest inscriptions (see his remarks in Müller, *Die Etrusker*, Bd. i, s. 443). It is also found in the ancient Numidian character as *Avvil* (Inscrip. 215), and in the Numido-Latin inscriptions as *Avilius* and *Avilia* (Halévy, *Essai*, p. 142). These are precisely the Latin forms derived from the Etr. *avile*.

Aules, *Aulesa*, *Aulesla*, a very common, pure Etr. prænomen (Müller, *Etrusker*, Bd. i, s. 444). It is exceeding close to that of the Libyan goddess *Aulisva*, which figures in a Latin inscription found near Constantine (Halévy, *Essai*, p. 156).

Betuus, *Betua*; a Latinized form of Etr. *fetiu*, *feθiu*; perhaps also *petvia* (Müller, *Etrusker*, Bd. i, s. 477, 486). Probably allied to the Libyan *battus*, *bahatus*, chief, ruler (Halévy, *Essai*, p. 164).

Cæcina, the family name of the celebrated Etruscan gens of Volterra. The Etr. orthography is *caicna* or *ceicna*, in which the *na* is a usual termination, leaving the root *caic'* or *caeci*. This is similar to the names *kaka*, *ghaka*, of the Libyan inscriptions Nos. 206, 246.

Fastia, or *Hastia*, a pure Etruscan name, very frequent at times in the abbreviation *fas*, or as *hasθi*. A very common Libyan name is *bas* = *fas*, *fazth* (Inscrips. 3, 4, 5, 6, 8, etc.). A similar initial syllable is found in Corippus, as has been pointed out by Halévy (*Essai*, p. 24, note).

Lucŭmo, *Lucmo*, often appears in the Roman historians as the Etruscan name of individuals, but probably means "prince." Its usual Etr. form is *lauχumes*.* This is almost identical with the name of the son of Oesalus, king of Numidia, *Lacumaces*.† The radical reappears in the Etr. prænomen *laχu*, which is identical with the Libyan prænomen *laχo* in Inscrip. 185 (Halévy, *Essai*, p.

* Müller, *Die Etrusker*, Bd. i, ss. 337, 496.

† *Livii Historiæ*, Lib. xxix, c. 29.

111). I am inclined to believe it identical with the *leku* tribe of the Libyan enemies of Meneptah I. *

The prefix *Mas*. Throughout the Libyan dialects *Mas* is an initial syllable of many personal names, and was common in the earliest times, applied both to persons and to gentes, *e. g.:* †

Mas-aesyli, an ethnic name.		
Mas-ight,	"	"
Mas-ulis, *or* Musulus, an ethnic name.		
Mas-adkam, a person		(Inscrip. 27).
Mas-wā,	"	(Inscrip. 34).
Mas-oulat,	"	(Inscrip. 31).
Mas-i,	"	(Inscrip. 32).
Mas-sirā	"	(Inscrip. 50).
Mas sivo,	"	
Mas-akra,	"	(Inscrip. 221, etc.).
Mas-ilal	"	

In Roman historians we find:

Mas-inissa, a Numidian king.		
Mas-tumus,	"	prince.
Mas-timan,	"	deity.
Mas-intha,	"	noble.

And numerous other examples.

General Faidherbe calls attention to the frequency of this prefix, and both he and Prof. Halévy are inclined to derive it from a root "to beget," and assign it the signification of "son of," "children of," etc.‡

This derivation is doubtful, as its radical has not such a signification in modern Berber. In the Touareg dialect *mess* or *messi* means ruler, lord, master, and *mas*, a paternal uncle.§ The former significations are the most applicable and fill all the conditions of the employment of this prefix to personal and tribal names.

This same prefix appears with almost equal frequency in Etruscan proper names, especially those of prominent people and families, as the following examples show:

Mas-tarna (Etr. *Macstrna*), the Etr. appellation of Servius Tul-

* Comp. Halévy, *Essai*, pp. 111, 173, etc.

† See Faidherbe, *Collection Complete des Inscriptions Numidiques*, pp. 22, 36.

‡ *Essai d'Epigraphie Libyque*, p. 126.

§ Newman, *Libyan Vocabulary*, p. 196.

lius (see Müller, *Die Etrusker*, Bd. ii, s. 111, note), a title of thoroughly Libyan physiognomy, meaning "great conqueror," from the verbal *irna*, to conquer; *tarna*, supremacy, victory (Newman, *Libyan Vocabulary*, p. 172).

Mas-entius, *Mezentius*, an ancient Etruscan ruler of Caere, said by Cato to have been a contemporary of Æneas (Müller, *Die Etrusker*, Bd. i, s. 109). Deecke believes that the name reappears in family names *mes-i*, *mes-ial*, etc., of Perugia (*Ibid.*, s. 495).

Mus-onii; Latinized form of an Etruscan family name near Orvieto, borne by the writer C. Musonius Rufus. Deecke compares it with the Etruscan names:

Mus'-ni, found near Cortona.
Mus-enial, found near Perugia.
Mus-u, found at Corneto.
All corresponding to *mas*.

Mas-o; Latinized form of Etr. *mas-u*, allied to *mas-ve*, *mas-veniai*, etc. (Müller, *Die Etrusker*, Bd. i, s. 501).

Mat-, *Met*. A frequent initial syllable in Etr. names, as *mat-ves*, *mat-ausnal*, *met-usnei*, *mat-ona*, *mat-ulna*, etc. It is sufficiently common in the Libyan epigraphy as *mat-ti*, *mat-ar*, *met-ut*, etc. Halévy considers it from a root indigenous to Africa, where, in some of the Hamitic dialects, the radical *met*, *mid*, *mutu*, signifies "man" (*Essai*, p. 18).

Tania, *θannia*, *θanna*. This, says Pauli, "is one of the few pure Etruscan feminine prænomens." * It is seen in the name of the wife of Tarquin, "Tanaquil" (Etr. *θanχvil*), and was one of the most frequent of the surnames of the Etruscan women. † It is preserved in the same form in the Touareg branch of the Berber, in which *anna* = mother, and *t* is the feminine prefix. ‡

Tite, *Titeia*, a prænomen rather common in these and allied forms, and considered pure Etruscan. In Libyan epigraphy *did* and *dides* recur in the sepulchral inscriptions. The precise form *tites* appears on various Etr. inscriptions (see Deecke, in Müller, *Die Etrusker*, Bd. i, s. 471). The Libyan prince already mentioned who invaded Egypt in the nineteenth dynasty was Mar-ajui, "a son of Did."

Vel-, *Vul-*, *Vol-*, *Volt-*. These were extremely common Etr. pre-

* *Etruskische Forschungen*, 1882, s. 114.
† See note of Deecke in Müller, *Die Etrusker*, Bd. i, ss. 457–9.
‡ Newman, *Libyan Vocabulary*, p. 197.

fixes, both to personal and place names, as *Vel-aθri*, *Vel-suna*, the Etr. goddess *Vol-tumna*, the family names *Vel-usna*, *Vel-ce*, *Vel-imna*, the prænomens *Vel*, *Vel-θur*, and many others.

They occur with equal frequency in the Libyan epigraphy, as *Vol* (Ins. 167, 200), *Volt* (Ins. 146, 148), in *Volux*, son of the Numidian Bocchus (Sallust, *Jugurtha*, 105), etc.

§ 6. *Proper Names from Corippus.*

A. Cresconius Corippus was an African bishop who lived at the court of Justinian, and wrote a description, in good Latin verse, of the successful campaign of Johannes, a proconsul, against the Mauritanians, about 550. His epos, called the *Johannis*, is peculiarly valuable for my purpose on account of the numerous Libyan proper names it contains, defaced no doubt by forcing them into smooth Latin forms, but often recognizable in their radicals.

In comparing them with the Etruscan onomasticon we must remember that nearly 1800 years had brought their changes on Libyan speech since the Etruscan colonists quitted the African shores.

I shall not undertake to do more than present a list of names from Corippus, side by side with others from Corssen's *Sprache der Etrusker*, to illustrate their strong phonetic resemblance and occasional identity. To discover their etymology and signification is a task I must leave to future students.

Comparison of Libyan personal names from Corippus with Etruscan personal names from Corssen :

LIBYAN.	ETRUSCAN.
afun,	*afuna*.
alantas,	*aleθna*.
ancus,	*ancan*.
anestus,	*anes*.
arcan,	*arcenzios*.
azan,	*ezunu*.
bezina,	*felzinal*.
buranto,	*farθana*.
caggun,	*caicun*.

LIBYAN.	ETRUSCAN.
calamen,	*calu.*
camars,	*camals.*
canapus,	*canpnas.*
carcasen,	*carkna.*
cullen,	*clellu.*
cullan,	*c' lan.*
cusina,	*cusinei.*
gamas-oran,	*camas.*
gantal,	*caneθa.*
ierna,	*herina.*
ilasan,	*lasa.*
irtus,	*hirtunes.*
mas-,	*mas-.*
narti,	*nortia.*
sacoma,	*secune.*
sarzun,	*sertuna.*
s artifan,	*sauturin.*
succur,	*seccu.*
sucrus,	*secis.*
tamazu,	*tama.*
tanadus,	*tanna.*
tanin,	*tania.*
tarincus,	*tarchnas.*
tor,	*tarsu.*
tumudan,	*tumu.*
tursus,	*tursu.*

The word *clan* in the above list appears on a hundred or more Etruscan sepulchral inscriptions. It has been generally translated "son" (see Müller, *Die Etrusker*, Bd. i, p. 502, note of Deecke). Sometimes it appears as *klan*, or simply *cl; clen* is an occasional variation.

In this word the vowel of the first syllable has been syncopated, as Deecke has pointed out was exceedingly common both in pure Etruscan words and those drawn from the Greek (see his note and examples in Müller, *Etrusker*, Bd. ii, p. 333). The full reading should therefore be *kel-an*. This explanation discloses at once the sense of the word by means of the Libyan tongue. There the word *kel* means household, one family, those dwelling in one tent or home. The Etruscan *clan*, or *clens*, should be translated "of the home of," "of the family of," or something to that effect; not necessarily a son.

§ 7. *Place Names.*

The place names handed down to us from Etruscan times offer peculiar difficulties in etymology, for it is very likely that the immigrant Libyans who founded the Etruscan State generally adopted the geographical names they found locally current, and only exceptionally applied others from their own tongue. In some Italian examples we may be tempted to recognize Libyan roots. Thus, in *Arbona*, *Arretium*, *Arno*, *Arna* (near Perugia), etc., there may lurk the Libyan *ar*, mountain. This is rendered more probable by the Etruscan name for the Atlas mountains, or their mythical hero Atlas, which was *Aril*, where we can scarcely err in recognizing the root *ar* (Müller, *Die Etrusker*, Bd. ii, s. 113).

M. Rinn believes with Dr. Shaw that the geographical name *Tadertos*, *Τυδερτα*, is identical with the Berber *taddert*, a village or town of stone houses.* Many Etruscan remains have been discovered there, proving that it was one of their settlements (Müller, *Etrusker*, Bd. i, s. 98).

In the name of the very ancient Etr. city called by the Latins *Caere*, in Etr. *χaire*, we seem to have the Berber *gari* or *gheri*, a fortified town or city.

An extended examination of these place names offers yet greater difficulties than of the personal names, and I shall not undertake it at present.

Should the above comparative notes of Etruscan and Libyan proper nouns indicate a recognizable relationship between the two tongues, other students will soon be found, with larger command of material, to carry out the comparison and to ascertain what closeness of origin a prolonged investigation is capable of revealing.

* As distinguished from *adouwar*, a village of tents. *Dictionaire Français-Berbere*, s. v., village. See also Rinn, *Les Origines Berbères*, p. 195.

Obituary Notice of Charles Albert Ashburner.

By J. P. Lesley.

(Read before the American Philosophical Society, February 21, 1890.)

Born at Philadelphia, February 9, 1854, and graduated at the University of Pennsylvania, June, 1874, Mr. Ashburner was elected a member of the American Philosophical Society January 16, 1880. Proud of this honor, as he justly esteemed it, he took the liveliest interest in the history, the principles and the meetings of the Society, and became the personal friend of its members, all of whom can testify to the vivacity of his zeal for science, to the geniality of his nature, and to his honor as a gentleman. Those of them who cultivated or who practiced geology, whether in its abstract or in its applied forms, will easily join me in testifying to his ability as a geologist. But no one can relate so confidently and precisely his short, brilliant career of student, field-worker, explorer, discoverer and publisher of physical truths in this branch of science, as one to whom he gave his unbroken friendship for nearly twenty years, one who received from him a thousand benefits. My gratitude for his life equals my grief at his death, and any eulogium my fellow-members accord to me the privilege of giving to his memory will seem cold and empty in comparison of his deserts; for by such examples we learn by heart the lesson, that praise of a wise good man must, after all, be left to the good and wise Creator who invented him.

This learned and ancient Society is one of the few that refuse to be chained to the service of the purely material and useful sciences; one of the few that, in these modernest times, still avouch a willingness to discuss the supernatural; to investigate the invisible and impalpable; to philosophize on the functions of soul as well as body; to protect from destruction and oblivion the claims of human virtue to precede wit and work. Therefore we hold to our traditions, and, in our quarterly elections, we prefer to the question: "Is the candidate for membership a genius or an expert?" the more important question: "Is he a just and honorable gentleman?" A genuine respect for Christianity still lingers in this hall of science; and when we place on record a memorial of some member lately lost to our meetings, we recall with more satisfaction the pleasures which his actually admirable character has contributed to our social intercourse than the profit which accrued to us from his contributions to our Transactions and Proceedings, or even than the fame which he may have won for himself and for the Society.

Governed by this, the real genius of our Society, I put in front of all Mr. Ashburner's virtues his virtue itself; in short, his Christian character, his rooted love of his kind, of just dealing, of exact truthfulness, his honesty, his generosity, his amiability, his respect for the rights and sympathy with the wrongs of other men; qualities which, in him, I know by long and close acquaintance with him were not words, but things; not theoretical, but practical; and of these things I could reveal many instances not known to nor suspected by others. He had an exceedingly sweet and gentle nature. Had it not been for these fundamental and innate principles of character his irritable, nervous temperament would have done him and others a world of mischief. His master passion, I think, was the desire of fame; he loved above all things to be correctly understood and well and widely esteemed, but I never knew him to sacrifice either truth or justice to this passion; and I have often had occasion to wonder at the pleasure which he took, in the most child-like way, in the genuine fame of other men, even when they were his competitors. He had the great good fortune of possessing ambition as a virtue and not as a vice; and the line which his ambition took was a conduct in life having for its object the establishment of a universal confidence not so much in his ability as in his trustworthiness. It was successful. All worthy men who knew him well came to the point of trusting him implicitly, and the satisfaction he took in this was touching to those who loved him, it was so naïve, so simple hearted, so truly beautiful.

In this Society, among whose members are so many religious men, I can venture to add that Mr. Ashburner was a religious man without derogating from his reputation as a philosopher. He was a zealous Protestant Episcopalian, and, when a young man, "was an active worker in Trinity Church, West Philadelphia, showing great ability as a teacher of a large men's Bible class; and, when he moved to Pittsburgh, he became at once connected with Calvary Church." I quote these words from *The Churchman* as part of the record of his life. The writer goes on to say: "Here, as elsewhere, and in everything he did, he illustrated how a scientific student can be an earnest Christian believer, and an indefatigable man of business can find time to do Christian work and show an interest in all Church matters. It was characteristic alike of his nature, thoughtfulness and Christian character, that one of his last acts, when death was fast approaching, was to send a contribution to his rector to be used for benevolent purposes; and his devout spirit is equally attested in the fact that he received with quiet joy just before he died the memorial of his Lord's death."

Of all this I know nothing as a churchman and nothing from my personal intercourse with him, for we never broached between us a single bottle of that hot wine, theology; I respecting the genuine spiritual convictions of a young man born and bred in "The Church," and he knowing perfectly that I accepted no creed for more than a human invention, and thought no better of a good man who taught an Episcopalian Bible class than of a good man who sent in an exact record of an oil-well boring. It was quite enough for me to know that he was growing year by year into the likeness of the man Christ Jesus; and for him, that he knew that I knew it. On that basis, all our intercourse proceeded happily. And on that basis, I feel sure, rose slowly and steadily the fine structure of his reputation, capped at last by fame. For he became famous. He became known and respected more widely in the United States and other countries than commonly happens to a man who dies in his thirty-sixth year. Yes, young and famous, worthily so.

Now, what a wonderful, what a mysterious thing it is, that while millions of old men are annually exhaled from the surface of this planet whom nobody a few miles from their temporary resting places ever heard of, and who are no more noticed when they pass away than so many drops of dew disappearing from a field of grass, it should happen that now and then when a young man dies hundreds of eyes are moist with tears and thousands of people express the most sensible and selfish regret. Usefulness is the only explanation of the phenomenon.

This is the American Philosophical Society for the Diffusion of Useful Knowledge. To that title it was born ; with that title, it still lives and works. It is not a club. It is not a monastery. It is not a museum of curiosities in human form. It is not a theatre on which the vulgar, selfish passions of the heart can display themselves—vanity, pride, self-interest, dressed in their motley of untruths and antipathies. Its *raison d'etre* was public usefulness ; its only claim to permanence is continual usefulness. Genius is a valid claim to its membership, but only on condition of being useful to the world, and doing wrong to no man. Knowledge is a claim to its membership, but only on the conditions of modesty, kindness and usefulness. We philosophers of Philadelphia belong by name at least to a utilitarian school of philosophy. Our motto is *pro bono publico.* Every member of this Society should adopt as the leading principles of his knowledge, *non sibi sed toti.* In Syria, the chief ceremonial was the anniversary celebration of the death of Adonis ; this Society should have an annual celebration of the death of the personal selfishness of each and all of its members. Self-sacrifice is a *sine qua non* for usefulness.

Therefore, thinking thus, much as I esteemed Ashburner for his personal, manly and Christian virtues, I admired him most of all for his usefulness, his perpetual and varied usefulness, in so many ways, to so large a number of persons. His restless energy was useful to the old and the sluggish ; his masterful will was useful to the young, the reckless and the insubordinate. His accurate methods of investigation, his patient, exhaustive observation of facts, his indefatigable coördination and discussion of them to avoid false generalizations, his dogged perseverance in every attempt to devise the very best apparatus and arrange the very best method for the useful publication of the knowledge he thus won—these made him not only a master of subjects in his branch of science, but a master of less able men, whom he thereby helped largely to educate. But he took special delight and exhibited his greatest skill in "diffusing useful knowledge"—a genuine child of Franklin—a worthy member of this Society. In season and out of season he kept on diffusing useful knowledge, knowing the best ways of doing it. He had not a spark of false pride about it. He never acted or spoke as a savant. He did not in the least know how to speak to the public *de haut en bas.* He went straight in, everywhere, and at all times, for spreading the useful knowledge he had accumulated, much of it by his own discoveries, *pro bono publico.*

Mr. Ashburner was educated at Friends' Central School, the Philadelphia High School and the Towne Scientific School of the University of Pennsylvania. While an undergraduate, he was one of a party who made a survey of Delaware river and bay for Government purposes. His special course in the University was civil engineering, and he was graduated first in his class. He began his professional career in the service of the United States Light House Board. The year following the installation of the Second Geological Survey of Pennsylvania (1874) he was commissioned as one of the aids to Mr. Dewees, Assistant Geologist for the Juniata River district. Mr. Dewees confined his attention to the fossil ore beds, leaving Mr. Ashburner and Mr. Charles E. Billin to make a survey and contour map of the south slope of Jack's mountain and the little valleys and ridges between it and the river. The excellence of this map proved the value of the severe drill they had had in the drawing room of the geological department of the Towne School, and the admirable instruction of Prof. Haupt. Their cross-sections at Logan's Gap, Lewistown, McGeesville, Mount Union, etc., published in "Report of Progress F," in 1878, are among the most perfect and beautiful works of that kind in the literature of our science in this or any other country.

The same kind of work was afterwards carried on by them south-westward into Huntingdon county, as far as Orbisonia and Three Springs. The beautiful maps and sections of this Aughwick division of the district, and the accurate discussion of the cross-faults at those two places, so thoroughly established their reputation as field geologists, that separate districts were assigned to them as independent Assistant Geologists on the survey ; to Mr. Billin, the complicated region of the Seven Mountains, in Snyder, Union, Lycoming, Centre and East Huntingdon counties ; and to Mr. Ashburner, Sideling hill and East Broad Top Coal basin, in West Huntingdon county. Here again his maps and sections showed that he combined the qualities of geologist and artist in the highest degree.

In 1876, he was commissioned to survey McKean county with the Bradford oil region ; and afterwards Elk, Cameron, and Forest counties. Two years were spent in this work, ably assisted by Mr. Arthur W. Sheafer. His report on McKean with many illustrations, including a complete contour map of the county, was published, as "Report of Progress R," in 1880 ; and his second report on the other three counties (RR) in 1885, being delayed by his survey of the anthracite region and the necessity for revisions and additions which he deemed it necessary to make himself.

In 1880, he was commissioned to plan the long-delayed survey of the anthracite coal fields of Eastern Pennsylvania. His plans were approved, and that survey was placed in his hands. He himself selected his corps of able assistants; established his offices at several points of the region; entered into personal relations with railroad and coal companies; made friends and correspondents of all the civil and mining engineers, colliery managers, superintendents, and mine bosses; laid out a general map of the region; planned its division into sheets to be successively published; and gradually, by a wise and skillful system of proof reading of each advance sheet by all intelligent interested parties previous to actual printing, he acquired the entire confidence and respect of the mining community.

The sheets that appeared with his first report on the Panthar Creek basin (the east end of the Southern field, between the Lehigh and Little Schuylkill rivers) showed what was to be expected of this great geological survey. Those of the Northern field (Wyoming basin), of the Eastern Middle field (Beaver Meadow group), and of the Western Middle field (Mahanoy and Shamokin basins) followed during the years 1881 to 1887, when he resigned his commission to accept business relations with Mr. Westinghouse, of Pittsburgh, as geological expert of his companies.

Previous to this, however, Mr. Ashburner had a heavier load laid upon him, for he acted as responsible First Assistant Geologist of the State Survey, and had a general supervision of all that went on in the State, being the trusted adviser and executive officer of the State Geologist. The anthracite survey was finished by his accomplished first assistant, Mr. Frank A. Hill, who resigned with all the other members of the corps, June 1, 1889, the term fixed by the last act of Legislature for the completion of the work of the Survey.

Mr. Ashburner, for two years before his death, was chiefly occupied in visiting and reporting upon supposed new oil and gas regions in Canada and the United States, and also upon gold and copper properties in the Rocky Mountain regions. On his last return from Arizona he fell ill and suddenly died at his home in Pittsburgh, at the age of thirty-six, leaving a wife and two children, and a multitude of ardent friends and admiring acquaintances, to lament an irreparable loss.

His contributions to the current literature of his science may be found in the Proceedings of this Society under the titles: "On Kintzie's Fire-damp Indicator," Vol. xxi, p. 283; "Notes on the Natural Bridge of Virginia," xxi, 699; "Remarks on the Recent Publications of the Geological Survey of Pennsylvania," xxii, 86.

He was a member of the American Institute of Mining Engineers from 1875, and one of its managers in 1885, 1886, and 1887; and his papers will be found in its Transactions, entitled: "The Bradford Oil District," vii, 316; "The Bragos Coal Field, Texas," ix, 495; "New Method of Mapping the Anthracite Coal Fields of Pennsylvania," ix, 506; "The Flannery Boiler setting for the Prevention of Smoke," x, 212; "The Anthracite Coal Beds of Pennsylvania," xi, 20; "The Product and Exhaustion of the Oil Regions of Pennsylvania and New York," xiv, 419; "The Geology of Natural Gas," xiv, 428; "The Classification and Constitution of Pennsylvania Anthracites," xiv, 706; "The Geological Distribution of Natural Gas in the United States," xv, 565; "The Geological Relations of the Nanticoke Disaster," xv, 629; "Coal Production in Utah," xvi, 356; "Petroleum and Natural Gas in New York State," xvi, 906; "The Development and Statistics of the Alabama Coal Fields for 1887," xvii, 206; "The Geology of Buffalo, as related to Natural Gas; Explorations along the Niagara River," xvii, 398; "Statistics of Coal Mining and of Miners' Wages in the United States," xviii (*in press*); "Natural Gas Explorations on the Ontario Peninsular" (*in press*). A "Biographical Notice of Captain W. R. Jones, of Pittsburgh," is among his unpublished papers.

But his lasting fame will depend more upon his "Reports of Progress of the Geological Survey of Pennsylvania," and the sheets of the "Anthracite Coal Fields," than upon the admirable generalizations in the papers mentioned above, proofs as they are of the healthy maturity of his native genius for a true and broad synthesis of facts. It was in recognition of the high value of his Reports that the University of Pennsylvania conferred on him the degree of Doctor of Science.

Were I called to enumerate his actual discoveries, I should begin with that of the curious ninety-foot side-throw in the Black Log Mountain gap at Orbisonia, dying out at each end of the fault. It is worthy of special notice as the only cross-fault as yet detected in any of the many mountain gaps of the State, and as throwing a clear light upon the curious system of throws encountered by the Rock Hill Iron and Coal Company in driving their gangways westward, showing that the whole district had been subjected to a warp movement fracturing it in parallel lines at right angles to the strike.

Then I would cite the Three Springs fault in the same district of Southern Huntingdon county, exhibiting the same features, but with a maximum side-throw at the present surface of 1200 feet. In "Report F" will be found his beautiful geometrical construction of this fault in the underground, determining its extent in depth.

I would cite also his discovery of the unsuspected subcarboniferous coal measures in the Pocono (Vespertine) formation, No. X, cut by the East Broad Top railroad through Sideling hill in the same county. The immediate appreciation of the great importance of this revelation, by so young a field worker, was the best evidence of his scientific genius that could be given; and his section of these very curious coal beds at the dawn of the Coal Age has been our guide through a most difficult chapter of Appalachian geology.

Of equal importance to the petroleum industry was his discovery of the increase in thickness of the Pocono formation, overlying the Bradford oil formation, southward into Elk and Cameron counties, for it fully explained the failures of oil-well sinkers to reach the oil horizon which they sought by rule of thumb, supposing that the same number of feet would avail them in all parts of that region.

His determination that the Salamanca conglomerate of New York was much lower in the series than the Olean conglomerate of Pennsylvania was another important contribution to our knowledge.

But his best discoveries were in the Anthracite region. He revolutionized our old ideas of the cross-sections; discovered the most remarkable overlaps and plication faults in the bottoms of the synclinals; and in a word differentiated the simple structure of Whelpley and McKinley into a complicated series of unexpected irregularities; giving precisely that knowledge to the colliery engineers which they most needed.

Another important discovery resulted from his later work for Mr. Westinghouse in the Catskill region of New York, viz., that the great Ordovician (Siluro-Cambrian) limestone formation, topped by the Trenton, was greatly thicker than had been supposed, and consequently that its supposed thinning out from Pennsylvania northward towards Canada was, in a good degree, a mistake. Subsequently he was able to substantiate this important fact over a wider field in the West.

Lastly, I would cite his discovery of the true general rate of rise of the Palæozoic formations from Pennsylvania into Canada West, by his discussion of the recent borings on the south shore of Lake Ontario and the north and south shores of Lake Erie. The slope from Franklin to Erie had been pretty well fixed in 1840; and Carll's measurements had made the rate more accurate; but we have it now in a perfectly reliable form, with a constant that cannot be well altered.

His discovery that some of the western petroleum comes from the drift was one of many minor additions to our knowledge made by this admirable field geologist, who has passed away in his prime, yet so young, leaving us only to regret that our science has not a larger store of them.

Obituary Notice of Henry Simmons Frieze, LL.D.

By James B. Angell, Ann Arbor, Mich.

(*Read before the American Philosophical Society, March 7, 1890.*)

Henry Simmons Frieze, LL.D., was born in Boston, Mass., September 15, 1817, and died in Ann Arbor, Mich., December 7, 1889. He was the son of Jacob Frieze and Betsy (Slade) Frieze. His father, who was a native of Rhode Island, and, during most of his life, a resident of that State, was for several years the pastor of Universalist churches in Massachusetts and in Rhode Island. Subsequently, he became an editorial writer for newspapers in Providence, and in the days when pamphlets were one of the main instruments in political warfare, he was somewhat noted in Rhode Island for his skill as a pamphleteer.

The son was obliged at an early age to gain his own livelihood. He served first as a clerk in Providence, and then engaged in teaching music and playing the organ in Newport. He made a hasty preparation for college, and entered Brown University in 1837. Through his conspicuous musical talent he supported himself during his college course. He graduated in 1841 with the first honors of his class.

He was at once appointed Tutor in Latin, and discharged the duties of that post for three years with eminent success. In conjunction with a classmate he then took charge of the University Grammar School in Providence, and assisted in the conduct of it until 1854. Many of the men who have since been prominent in Rhode Island affairs were trained there either for business life or for admission to college.

In 1854, Mr. Frieze was appointed to the chair of Latin in the University of Michigan, a position which he held to the day of his death. It has always been deemed by the friends of that University a singular good fortune which brought it in its early days so accomplished a classical scholar and so refined a gentleman as Prof. Frieze. He awakened at once a fervid enthusiasm for the studies he taught, and has during his long life exerted a remarkable influence in promoting a taste for literary and æsthetic culture.

He has published editions of Virgil and of Quintilian which have received the warm approbation of our best scholars. He also wrote a volume, which was published in London, on the art-life of the eminent Italian sculptor, Giovanni Dupré. It contained translations of two dialogues on Art by Prcf. Conti, of Florence. Two addresses of his are noteworthy ; one a commemorative discourse on Dr. Tappan, the first President of the University ; the other on the subject of Religion in State Universities, delivered at the semi-centennial celebration of the University, in 1887.

Three times he held the office of Acting President of the University, from 1869 to 1871, from June, 1880, to February, 1882, and from October, 1887, to February, 1888. For fourteen years he was Dean of the Literary Faculty. His reports as Acting President attracted attention as very able discussions of University problems. Especially vigorous was his argument in his Report for 1881 in favor of shortening the college course from four years to three. Probably few men in the country had more carefully considered the questions of University administration, whether in Europe or in America. Several of the very important innovations which have been successfully introduced into the University of Michigan in the last twenty-five years owed their origin to him. Conspicuous among these is the system of admitting students without examination from preparatory schools which have been visited by a committee of the Faculty and approved. The plan has now been widely adopted, sometimes without the precautions with which he guarded it. The introduction of the elective system, the conferring of higher degrees only on examination, and the establishment of a Professorship of Music, found in him an effective advocate.

He was a most attractive and inspiring teacher. He was passionately fond of art, whether painting, sculpture, architecture, or music. He was an accomplished pianist and organist. He lectured on the history of art for many of the last years of his life. His critical judgment of works of art had been cultivated by prolonged residence in Europe. He was a man of sensitive and delicate nature. His modesty was almost a fault. He was the most agreeable of companions and the most faithful of friends. A more refined, gentle, cultured, lovable man, one would seldom meet. Withal he had a most devout spirit. He was almost from boyhood a communicant of the Protestant Episcopal Church, but was in most catholic relations with Christians of every name. He represented the finest type of American scholar, college officer, Christian gentleman.

Obituary Notice of Franklin B. Gowen.

By Richard Vaux.

(*Read before the American Philosophical Society, March 7, 1890.*)

Called to our Federal Capital, in the District of Columbia, by onerous and perplexing professional engagements, Franklin B. Gowen there died on the 14th day of December, 1889.

His life was remarkable. It was a lesson and an example. His mind was of more than exceptional power. His energy seemed exhaustless. A courage that met, without hesitancy, opposition and antagonism, was animated by a temperament so sanguine, that defeat was obscured by the brilliant promise of anticipated success.

Mr. Gowen was devoted to literature, assiduously cultivating his taste for its highest standards, proficient in scientific knowledge, to which he applied intelligent study, and an eloquent, impressive and learned lawyer.

He possessed capacities for the management of great enterprises involving great interests, so that it may be said of him, he was the peer of the distinguished men of his day.

His public speeches were masterly. In the discussion of principles, the treatment of details, grouping the arguments as to each, he brought out the strongest points of his contentions with a forensic ability recognized to be of a high order.

He was capable of augmented possibilities. His memorable and successful effort to maintain the safeguards of imperiled rights and public security attests his force of character, latent till stimulated into action. This statement is not amenable to the criterion of a too florid coloring; it is rather in harmony with the natural tints of his character.

Earnest, aggressive, sanguine, capable, laborious, his capacities and acquirements were forces that demonstrated his powers. It has been said by high authority, that if elsewhere, certainly in Philadelphia, her most prominent citizens are best understood and appreciated after they are buried.

Franklin B. Gowen was born at Mount Airy, near Germantown, in the county of Philadelphia, February 9, 1836. He inherited some of the marked mental and moral traits of his father, whose life in Philadelphia demonstrated his striking individuality.

It can hardly be doubted that what is known as heredity is the outcome of the parents' characteristics in their descendants. Mr. Gowen's character in this respect may be judged by the recognized principles of pathognomy.

Yet in his social relations he was genial, agreeable and attractive. His acquirements rendered him notable in association with cultured and refined society. His information, belle lettres and scientific reading and the charm of his conversation were thoroughly appreciated by his personal friends and associates.

Mr. Gowen was, at an early age, sent to Emmetsburg, in the State of Maryland, to receive the instruction which made the college located there so eminent as an institution of learning.

After marked proficiency in his studies, he returned home and finished them at the Moravian School, at Litez, Lancaster county, Pa.

His youthful training was intended to qualify him for a business life. The first introduction to his proposed avocation was entering the store of Mr. Baumgardner, at Lancaster. Acquiring sufficient knowledge of the business, Mr. Baumgardner sent him to his iron furnace, at Shamokin. All this was prior to his majority, for at twenty years of age Mr. Gowen formed a partnership with a Mr. Turner, for the purpose of mining anthracite coal. This promised well, but in the monetary panic of 1857 the firm failed, with liabilities amounting to some $60,000. Mr. Gowen seems to have been disappointed in his business venture. He then studied law at Pottsville, Pa., with Mr. Benjamin W. Cumming. On the 31st of May, 1860, he was admitted to the bar of Schuylkill county.

To indicate the integrity and energy of Mr. Gowen, he paid in full the liabilities of the firm of Gowen & Turner. In 1862, Mr. Gowen was elected the District Attorney of Schuylkill county. His legal standing being assured, he continued to represent the pleas of the commonwealth in Schuylkill county until his increasing professional business required him to resign that office, and devote himself entirely to his private practice.

Mr. Gowen was the counsel of the Reading Railroad Company in 1864, and in 1867 it became necessary from the increase of his professional duties to remove to Philadelphia. He was then in the thirty-second year of his age. In 1869, Mr. Gowen was elected President of the Philadelphia and Reading Railroad Company.

He reluctantly accepted the position at the request of a majority of the controlling interest in the company. From this period in his life, Mr. Gowen began a career burdened with great responsibilities. The large interests which were involved in the management of this corporation are not easily to be described. It may be said, however, that the holders of the various securities of the company, and those who were engaged in providing the chief traffic of the road, were not usually unanimous in their agreements as to the conduct of its affairs.

From 1869 to 1884, he was President of the company. He then resigned, and in 1886 he was again elected President and served till 1888, when he again resigned.

It was well said of Mr. Gowen's Presidency, that it was "fifteen years of struggle and achievement."

Reference to Mr. Gowen's administration of the business and policy of the Reading Railroad is here out of place.

The interests involved were enormous and the contentions of the parties representing them were inspired by efforts to control the management vested in the executive authority of the company.

The President and the Board of Directors were subjected to the consequences of divergent views and opposing opinions of their constituents.

Mr. Gowen's responsibility was not divisible.

During his Presidency he met antagonisms, hostilities and obstacles that would most likely have overwhelmed a less courageous, able, self-poised and confident administrator. Criticism followed the course he pursued—severe criticism often—but patiently listening, ready to defend himself, he followed out his plans. His views were broad, far reaching and based on what, to his extraordinary comprehension of the vast possibilities of the Reading Railroad, were vital to the permanent triumph of the producing and transporting capacities of this coal-carrying company.

Securing coal fields by purchase, thus owning the sources of supply of freight for the support of the traffic and the augmentation of the earnings, and with the topographical advantages of his line of road, Mr. Gowen conceived that he could place the Reading Railroad beyond the reach of competing rivals.

This much is said in some sort to indicate the character and capacity of Mr. Gowen. And let it be proclaimed that during his management of the company, amid all the contentions it occasioned, in the direction of the policy he regarded as essential for the success, not a word was ever uttered that expressed a doubt as to his spotless integrity.

The Engineering and Mining Journal, of New York, a professional periodical of high standing, in an editorial reference to Mr. Gowen, thus epitomizes his character :

"Mr. Franklin B. Gowen was undoubtedly one of the most admirable men this country has produced. To brilliant ability, eloquence, undaunted courage and an incorruptible honesty which placed him, even with his bitterest antagonist, above the faintest suspicion of doing a dishonorable thing, Mr. Gowen united a winning personality that firmly attached to him all who had the honor and pleasure of his acquaintance.

"His devotion to duty was not lessened when it called for the risk of his life and fortune, and the administration of the immense interests of the Reading Railroad and Coal and Iron Companies was never influenced by his personal advantages, but was always and solely in that of his stockholders. A man of firm convictions and of utter and unconcealed abhorrence of dishonesty in every form, he naturally made many enemies as well as friends, but even his enmities were to his honor.

"Mr. Gowen was a firm and very enthusiastic believer in the immense value of our anthracite coal deposits, and he secured for the Reading Coal and Iron Company the most valuable mineral estate in the world. It is true much of it was purchased with bonds, and this involved an interest account so heavy as to have crippled his companies; but the policy of controlling this magnificent source of future profits, both for the coal company and for the railroad was, when exercised in moderation, a far-sighted and wise one. Mr. Gowen's sanguine temperament may have led him to a larger investment, in undeveloped lands, than was prudent, but there is no question of the immense value of the estate (which covers fully one-half of all the anthracite coal in Pennsylvania), that he purchased for his company, or the moderate cost of the same.

"In the council chamber he was an acute and profound legal adviser; at the bar a pleader of unsurpassed logical force and magnetic influence. Handsome, witty and eloquent, he was master alike of the rapier and the battle ax. After the glamour of his speech had passed away, there remained the convincing strength of his statement.

"These qualities, together with his fearless determination, found, perhaps, their highest exhibition in the victory which he won, at the end of more than three years of patient preparation, over the secret society of murderers which had so long maintained a reign of terror in the anthracite regions. If Mr. Gowen had never achieved anything else, this one performance would have entitled him to the gratitude of mankind."

Operating the coal mines that yielded profit to the railroad, employing large numbers of laborers, supplying the demand for their products, it came to pass that, by violations of law, life and property in the mining localities were put in peril. Arson and murder were committed by members of secret combinations of men in this coal region. Mr. Gowen undertook the suppression of this combination and the punishment of the guilty. He went before the legal authorities of Schuylkill county, indicted the leaders of the "*Molly Maguires*," as this combination was called, convicted them, and some were hanged and others imprisoned. The combination was destroyed and peace followed.

His ability as a lawyer could not be better tested. His personal courage could not have been better proved. Fidelity to public duty and the assertion of the obligation to society by one of its citizens have no nobler attestation.

Mr. Gowen's domestic life was hallowed by his unpretentious religious principles, which were expressed in his communion with the Protestant Episcopal Church.

In his profession he was behind none of the leaders of the bar, for Mr. Gowen ranked among the great lawyers of the country.

His last, or among the latest of his professional achievements, was the decision (March 20, 1890), of the Supreme Court of Ohio, in the case of Rice against the railroads under the Inter-State Commerce Law.

Had Mr. Gowen been tempted by the inducements held out to him to enter political life, he would have attained the distinction of a statesman in that high order of men who made their mark in their time on our history. His extraordinary capacity for orally expressing his opinions, his command of language, his wonderful memory, not needing the aid of written notes to direct the course of his argument, the attraction of his manner and his personal presence would have established his position as an orator.

Less than is here said would have been an injustice to the memory of our lamented colleague. It is at best but a tentative effort, and when the color of the perspective round the prominent figure, which Mr. Gowen became in the circle of the physical scientists of his day, is mellowed by age, then his biography will be the just tribute to his phenomenal character.

Obituary Notice of Leo Lesquereux. By J. P. Lesley.

(Read before the American Philosophical Society, March 21, 1890.)

The venerable botanist and palæo-botanist, Leo Lesquereux, of Fleurier, Switzerland, late of Columbus, Ohio, has been a member of this Society since his election, January 18, 1861. Born in 1806, and dying on the 20th of October, 1889, his long life was full of unusual adventures, and great discoveries.

When a boy, on one of his excursions to find new flowers, he fell from the top of the mountain which walls the Val de Travers on the north. Rolling and dropping from cliff to cliff, a descent of several hundred feet, he was found by his family hanging in the branches of a tree, mangled in every part of his body, and apparently dead ; but after lying insensible for several weeks, he recovered health and strength, and continued his boyish explorations as though nothing had happened. The place is in full view of his father's house in Fleurier, and is pointed to by the villagers as Lesquereux's cliff. Just below it to the right the Pontarlier Railway line from Neufchatel to Paris, leaves the Val de Travers and enters the gate-like gorge across which the Swiss stretched their iron chain to keep the marauding Burgundians in check.

This gorge is similar in its general features to that of our Lehigh river from Mauch Chunk upward; a trench two thousand feet deep cut from north to south across one of the extensive limestone plateaus of the Jura range; the upper surface of the plateau being occupied partly by reclaimed farm lands and villages, and in part by unreclaimed peat bogs traversed by artificial drains, and quarried periodically for fuel. These peat bogs were the young botanist's favorite tramping grounds; and he got to know every safe and every dangerous spot on their treacherous surfaces. He made the acquaintance of every flower that grew on them and on the surrounding cliffs. He devised for himself an auger, like a flour inspector's, with an adjustable handle; and with this tool he investigated the character and structure of the bog, its stratification, the specific gravity of its different layers, the deformation of the sphagnum by pressure, and the rate of its growth. He was the first to determine the true causes and conditions of peat formation; unconsciously making the first step in the science of the geology of coal.

Going for his education to Neufchatel, his results were not accepted by the naturalists, until, a Cantonal Commission being appointed, Agassiz being one of the commissioners, he was permitted to demonstrate the subject on the surface of the bog itself; then his theory was accepted. I have in manuscript an autobiography of the earlier portions of his life, and his naïve expressions of satisfaction at this victorious defense of his young scientific work are very amusing. The whole of this manuscript, written for my pleasure three or four years ago, is well worth a place in the published Proceedings of this Society, and I am tempted to enrich from its store of racy details this poor sketch of his most noteworthy career.

When twenty four years old (1830) he married the daughter of one of Goethe's intimate friends, General Von Wolffskeel, the Baroness Sophia of Eisenach. Three sons and a daughter of this most happy union survive him. His wife would tell how she used to sit on Goethe's knee, while the poet and her father conversed together. The account of his courtship and wedding given in the manuscript makes charming pictures of German life.

Lesquereux had been appointed to a chair in the College at La Chaux de Fonds. But his career as teacher of science was suddenly cut short by an illness which destroyed his hearing. He went for relief to Paris, but was treated by a noted oculist and aurist there with the brutal recklessness customary at that time in the medical profession of that metropolis, and which is not entirely unknown even at the present day. His eustachian tubes were burst, and an inflammation of the brain superinduced which threatened to destroy his sight. When he returned home he became stone deaf, and never heard a sound from that time to the day of his death. In despair he learned the trade of a chaser of the backs of watches, but gradually lost his health and courage and was long nursed by his devoted wife. Then the strength of her admirable character made itself known; for she practiced her husband's art, and supported the family herself, until he could resume his handicraft. Twelve years he engraved watches and made and tempered watch-springs, a delicate process, the knowledge of which was hereditary in his family.

At the age of nearly forty his fame as a bryological botanist induced the King of Prussia to commission him to examine and report on the origin, growth, size, quality and condition of the peat bogs of that kingdom. Neufchatel the Canton still belonged to Prussia. He had been commissioned by the Cantonal government and had reported on the peat bogs of the Jura. Now he traversed the mountains of Germany, the shores of the North sea and Baltic, and after publishing his report at Geneva, examined the bogs of Denmark, Sweden and Norway, and if I mistake not some of those of Great Britain; but of this I am not sure; and still later those of Canada and the United States: taking into the range of his researches the Dismal Swamp of Virginia and North Carolina; and going out alone, unarmed and deaf, far over the prairies of the West, sleeping on the grass without covering, sometimes several nights in succession.

Lesquereux followed Agassiz, Desor, Guyot and Matile to America in 1848. He settled his family in Columbus, Ohio, where his sons began business on several thousand dollars' worth of watches loaned for this purpose by their father's friends, who took that method of enlarging their trade. Agassiz had promised him scientific employment, but was unable to carry into effect his friendly intentions. The family were at first in great distress; afterwards they prospered; and the father was able to devote the rest of his life to his adopted science. He was always poor; his work always poorly paid; but he was one of the wisest, most cheerful, and most contented of mortals. His modesty ran into self-depreciation; a sentiment sadly reinforced by the physical infirmity which cut him off from easy intercourse with his fellow men, and made him not only unduly grateful for the salaries or fees which he received for work ordered, but unduly modest in the estimation which he placed upon his work. He reminded me of some gentle wild beast or bird living on the chance resources of nature, patient when he found but little, most thankful when he found anything. But a very noble independence was manifest in all his intercourse with others. His manners were simplicity and refinement embodied and illustrated. His considerateness was best shown by the restraints he imposed upon himself in conversation. His visits even to his best friends were rare and short. He made excuse that it must be a wearisome act of friendship to talk to a stone-deaf man. Yet he was a delightful interlocutor.

Only to those who grew accustomed to conversing with the lips alone did he feel quite free to hold intercourse. He read language by watching the movements of his friend's mouth. When introduced to a stranger, and usually when meeting one of his old friends, the first question was: "Will you speak in German, in French, or in English?" and according to the answer he prepared himself for the conversation. "Did you tell me that your friend Lesquereux was deaf?" said one to me one day. "Yes." "But how is that possible? I noticed him talking French in the most animated manner with his friend just now, and he seemed to hear him as well as you or I could."

With those who wore beards it was more difficult, and he was obliged to beg a repetition of many sentences. But with most persons he carried on conversation in writing, always carrying tablets and pencils with him for that use. Experience had also taught him to gather up all the loose papers on which there were any sentences of the conversation, and throw them into the fire before he left the room, or tear them to pieces if in the open air. So expert was he in interpreting what was said to him, that he usually gathered the whole of a sentence by watching the first few words of it written. He seldom permitted the sentence to be finished. I suppose this quickness was not a mere consequence of his intellectual cultivation, but was one of the many necessities he felt for diminishing what he considered the burden which his infirmity laid on his interlocutors ; he was so delicately generous to others ; and making no distinction at all between the highest and lowest class of man.

Lesquereux took no part in politics. I think they did not interest him. His friend, Agassiz, was a born aristocrat. His friend, Desor, was a democrat of the most pronounced type, and continued to be one of the two most influential leaders of the Democratic party in the Canton, after the not bloodless revolution which made Neufchatel free of Prussia, until his death in 1886. But Lesquereux's letters to me through nearly thirty years scarcely mentioned the political situations on either side of the Atlantic ; with one exception ; he deeply sympathized with the preservation of the Union, and the emancipation of the slaves.

Lesquereux's religious opinions, if he had any, are unknown to me. But I have innumerable evidences in his letters that he entertained a very remarkable faith in an Overruling Providence, as fixed as it was simple. "I have known what it was to have no bread for my family," he writes in one of his letters, "but the good God has never forsaken me." I am reminded that I compared him to Heinrich Stilling, after reading one of his cheery pages, in reply to some desponding confidences of my own less sure faith. I am sure that not a complaining expression can be found in our long correspondence.

I first met Lesquereux in Schuylkill county, Pa., in the summer of 1851. Prof. H. D. Rogers was revising the Anthracite region for his Final Report. Desor, who had worked with Agassiz in Boston and on Lake Superior, had accepted an offer to study the surface deposits of Pennsylvania ; and Lesquereux, who was employed to provide a report on the Coal plants of the State, sat day after day on the Anthracite tip-heaps, collecting and classifying whatever the roof shales afforded him. His names, descriptions and figures were published seven years later (1858) in the Second Volume of the Geology of Pennsylvania.

His "Fossil Coal Flora of Arkansas" was published in 1860.

His "Fossil Coal Plants of Illinois" appeared in Worthen's Second and Fourth Volumes in 1866, 1880.

His "Tertiary Plants of Mississippi" appeared in Hilgard's Report of 1863.

His "Cretaceous Flora of the Dakota Group" appeared as a monograph in 1874, as a "Report of the U. S. Geol. and Geog. Survey of the Territories" under Dr. Hayden.

His monograph of the "Pliocene Flora of the Auriferous Gravel Deposits of the Sierra Nevada" appeared in 1875.

His "Tertiary Flora" as a monograph in 1878.

His "Cretaceous and Tertiary Flora" as a monograph in 1883.

"The Coal Flora of Pennsylvania and the United States," Report P of the series of geological reports of that State, Vols. i, ii in one, with an atlas in a separate volume, 1880, and Vol. iii, text and plates, 1884, was the fruit of his more or less continuous connection with the State Survey from 1875. He regarded it as the crowning labor of his life, and resumed into it all his knowledge of the flora of our coal measures. Another volume, in preparation at the time of his death, was intended to contain the figures and descriptions of about a hundred new species, some of them of exceptional beauty and interest; and many of which were founded on specimens in the rich private collection of his most intimate friend and fellow-worker, Mr. R. D. Lacoe, of Pittston, Pa., who looked much after the old man's comfort, and frequently entertained him as his guest for days and weeks together, most of the time being spent in examining, comparing and discussing doubtful species and new discoveries.

For his comparisons of foreign species, his three principal correspondents were Schimper of Strasburg, Heer of Zurich, and Count Saporta. Schimper was one of his earliest intimates in botany and he was never willing to consider a question settled until after letter after letter had passed between them. His American studies of the Cretaceous and Tertiary floras of America supplied copious and constant food for botanical correspondence with Heer.

In the earlier years of his residence in the State of Ohio he was employed by Mr. W. S. Sullivant, a wealthy citizen of Cincinnati, a bryologist given to the study of mosses, and assisted him in the publication of many new species. This brought him into intimate correspondence with the well-known bryologist of Philadelphia, Mr. Thomas P. James, a member and officer of this Society. After Mr. James left Philadelphia to reside in Cambridge, Mass., Mr. Lesquereux's botanical intercourse with him was constant and fruitful, and much of the value of the "Manual of the Mosses of N. America," published in their respective names, was due to the zeal with which he thus kept alive those earliest studies of his life. Another of his closest friends was the veteran professor of botany at Lafayette College, Easton, Pa., Thomas C. Porter, who has some amusing anecdotes to tell of their adventures among the rare plants surviving on the banks of the Delaware.

Lesquereux was elected a member of this Society January 18, 1861, and of the National Academy of Sciences in 1864, the year following its constitution by the Senate and House of Representatives of the United States; but his deafness excused him from attendance at the meetings, and his membership was understood to be in honorable testimony to his character. Many other learned bodies in Europe and America also placed his famous name on their lists; among these the Geological Societies of London and Brussels made him a corresponding member; and he continued to be accounted by his *Alma Mater*, the Academy of Neufchatel, one of its honorary professors.

Lesquereux did not attempt further field work after 1884. He was then 78 years old. The last five years of his life were passed in quiet retirement in his cottage on the edge of Columbus, at which books, monograph pamphlets, and specimens of fossil plates for identification or description were constantly arriving from old correspondents and fresh young workers. He began to lament the widowed loneliness and failing brain-power of old age, and predicted his own death from spring to spring. But his strength held out until the end of the summer of last year, after which he existed in an almost insensible condition, and in a few weeks peacefully ceased to breathe.

Description of a New Species of Pteropus. By Harrison Allen.

(Read before the American Philosophical Society, March 21, 1890.

Pteropus lanigera, sp. nov.

Crown covered with dark gray, unicolored hair. The hairs between the eyes are directed backward, but over the rest of the crown are erect. Face everywhere hairy. In front and below the eye the hair is thicker than elsewhere. On the cheeks and lips the hair is directed downward, while on the horizontal ramus of the lower jaw it is directed backward. The region of the whisker is composed of long, woolly hair of the same nature as that of the crown but of an obscure brown shade, and extends like a collar to the neck. The under surface of the head, therefore, unusually full and woolly. The space between the rami to a point a short distance back of the rictus is of a dark brown.

The side of the neck covered with long, brown, unicolored hair, the same color passing more to the front of the neck than to the back where the shade is of a gray tinge. The base of the prebrachium ventrally is covered with long, woolly hair as on the side of the neck.

The side of trunk with long, silky, unicolored brown hair, the front the same with ashy tips. The middle of the chest is remarkable for exhibiting a pure gray-white spot the size of an almond. In one specimen the hair of the spot is unicolored, and in the other it retains a black-brown base. The infraanal region is the same as the front and conceals the interfemoral membrane.

The back of the trunk measures 35 mm. across, and is covered with dark-brown hair with ashy tips. It becomes more woolly and brown at the rump. Hair of the same texture extends a little beyond the knees on the dorsal surface of the posterior extremities, but is entirely absent from the front. With the exception of a few hairs on the flexor surface of the forearm near the elbow the membranes are naked. Ears a little longer than the muzzle, naked (save a few hairs at the base), ovate, nowhere emarginate.

Palatal rugæ between the molars but four in number.

Skull.—Ecto-pterygoid process with trenchant laminated pedicle which reaches to the anterior margin of the undivided foramen ovale. Post-glenoid process in height equals one-third the anterior and posterior measurement of the glenoid cavity; zygomatic arch curved above the level of the optic foramen.* The sagittal crest elevated, entire. An orbito-frontal foramen lies behind the postorbital process. Frontal bone with scarcely any inflation at the inner border of the orbit and on the vertex.

The maxilla as it lies in the orbit is marked by a tuberosity placed to the median side of the groove which leads to the infraorbital canal. The median border of condyloid process is flat, thin, not robust.

Teeth.—Maxillary incisors not touching; they possess well-defined posterior cingules. The incisorial series but slightly arched. The lateral incisors larger than the centrals and grooved anteriorly. The first premolar in contact with the second. The second premolar with a well-defined palatal cusp. The second molar one-third the length of the first which lies in line with the infraorbital canal and not under the root of the zygomatic process.

The mandibular incisors scarcely separated. The lateral incisors larger than the central but moderately raised above their level. The first premolar larger than the maxillary or mandibular last molar. It almost occupies the interval between the canine and the second premolar. The second premolar with conspicuous lingual cusp.

The maxillary canine on the right side with a rudiment of a postero-lateral cuspule. The maxillary second premolar shows a similar rudiment on the external cusp much the same as in *P. keraudrenii.* The teeth of the left side of the maxilla and those of the mandible are without these rudiments. No antero-basal projection present on the maxillary third premolar.

This species is most closely allied to *P. phæocephalus.* Like it it belongs to the same group of the genus with *P. keraudrenii* and *P. molossinus.* The latter species I have not seen. *P. keraudrenii* is a larger species and quite differently colored. *P. molossinus* agrees closely in size, but differs in distribution and color of the fur. The other species which resemble it in size are *P. rubricollis, P. temminckii,* and *P. personatus.*

* By this expression is meant that when the skull is viewed in profile the zygomatic process lies above the plane of the optic foramen.

Measurements.

Length of head and body	180 mm.	
" head	43	"
" thumb	40	"
" second m. c.	47	"
" third "	67	"
" fourth "	67	"
" fifth "	73	"
" forearm	98	"
" tibia	48	"

Habitat, Samoa islands. Type in Ward's Nat. Hist. Establishment, Rochester, New York.*

Description of a New Species of Macrotus. By Harrison Allen.

(Read before the American Philosophical Society, March 21, 1890.)

In Article xvi, extracted from "The Bulletin of the Am. Mus. Nat. Hist.," Vol. ii, No. 3, p. 166, entitled "Notes on a Collection of Mammals from Southern Mexico," by Mr. J. A. Allen, occurs the following statement: "Macrotus Californicus, *Baird.*—Eight skins and skulls, and three additional skulls, all males. Bolanos, Jalisco, July 3, 1889. 'Occurs in immense numbers in the adits and old mine drifts of the Mineral de Bolanos. Of the fourteen captured all were males, whereas in the case of the other kinds of bats taken here females generally predominate' (Audley Buller, MS. notes).

"In the absence of specimens for comparison, it is difficult to say certainly, whether they are the same as the California specimens. Judging by descriptions, they are somewhat darker in color."

I had an opportunity, through the courtesy of Mr. J. A. Allen, of examining two of the specimens of this series, and concurred with Mr. Allen in identifying them as *M. californicus.* The skins were of immature individuals and the parts about the auricle apparently mutilated. The dark cinereous tips of the hair, while in striking contrast with the more northern form of the species, was not thought to be distinctive, since southern variations of other species, as *Artibeus perspicillatus* and *Atalapha noveboracensis*, are known to be differently colored from the northern. The main measurements were the same. But since Mr. Allen published his notes I have carefully soaked one of the skins in dilute spirits and have detected that the apparent mutilations of the auricle were due to distortion, and that the form of the auricle was sufficiently pronounced to warrant a careful examination of the cranium. In response to my request

* I am indebted to Mr. F. A. Ward for an opportunity of examining this interesting form.

Mr. Allen sent to me eight crania for inspection. The characters of these specimens are in many respects quite different from those of *M. californicus*. I have therefore concluded to describe the Mexican species as new in the following language:

MACROTUS BULLERI, sp. nov.

Auricle scarcely longer than head; the internal basal lobule rudimental and projects about a millimetre beyond the juncture of the interauricular membrane. External basal lobe reduced to a thin ridge which leaves the tragus exposed. Tragus with convex anterior border for basal two-thirds, and an abruptly acuminate apical third. The outer border is straight—apparently without basal notch or lobule.

The nose-leaf without well-defined lower border—scarcely longer than the face. Chin apparently without divided plate.

Skull.—Facial region without depression on the frontal bone; indeed, it is faintly ridged posteriorly; region over ethmoid scrolls scarcely inflated. Squamosal portion of zygoma not more than one-half the size of the same part in *M. californicus*. No projection of vertex at occiput, but the entire superior curvature of the head simple. Angle of mandible projects scarcely at all back of the condyloid surface. The two halves of the mandible closer together than in *M. californicus*.

Fur.—On the back the basal two-third is white, the apical third very dark plumbeous, the tip tending to gray. These distinctions are best defined on the sides of the neck. At the middle of the back the gray tip is absent. The colors undergo no variation over the posterior surface of the prebrachium, the humerus, or the rump. On the endo-patagium the hairs are shorter, sparsely developed, and of a fawn color throughout.

On the ventre a disposition exists for the basal two-thirds of the hair to be whiter than the rest of the hair. This is most marked on the sides of the trunk, and is nearly absent from the middle. The apical third is less markedly plumbeous and the tip is more gray than on the back. On the whole the ventre gives the impression of being gray, and the back as being of a dark, sooty hue.

Two immature examples (the distal epiphyses of the metacarpal bones of the third, a fourth, and fifth, manal digits ununited), 2004, 2005 (Am. Mus., N. Y.), from Bolanos, Jalisco, Mexico.

Measurements.

Height of auricle from vertex		7	mm.
"	tragus (slightly distorted)	6	"
"	nose-leaf	7	"
Length of forearm		44	"
1st digit	m. c.	4	"
	first phalanx	4	"
	second "	2	"
2d digit	m. c.	45	"
	first phalanx	5	"

Measurements.

3d digit...	m c	32 mm.
	first phalanx	15 "
	second "	15 "
	third "	9 "
	fourth "	4 "
4th digit..	m. c	31 "
	first phalanx	14 "
	second "	11 "
	third "	½ "
5th digit..	m. c	33 "
	first phalanx	14 "
	second "	10 "
	third "	1 "
Length of	femur	15 "
"	tibia	16 "
"	foot	13 "
"	tail	25 "
"	free portion of tail	3½ "

Notices of New Fresh-water Infusoria.

By Alfred C. Stokes, M.D.

(*Read before the American Philosophical Society, April 18, 1890.*)

Mastigamœba reptans, sp. nov. Figs. 1–5.—Body constantly amœboid, at its apparently greatest extension ovate, depressed, about two and one-half times as long as broad, the pseudopodia few, scattered, lobate, short and unbranched, progression being chiefly by the amœboid expansions of the body; flagellum apical, about three times as long as the extended zooid, only the tip usually vibrating; nucleus not observed; contractile vesicles several, small, scattered; motion commonly very slow, occasionally rapidly and irregularly vibratory. Length of the extended body $\frac{1}{1800}$ inch. Hab.—Pond water with decaying vegetation.

Heteromita fusiformis, sp. nov. Figs. 6 and 7.—Body elongate fusiform, from three to four times as long as broad, widest centrally, tapering thence to both extremities; soft and changeable in shape, having the ability to protrude filamentous pseudopodic prolongations of the body substance, the extremities of these extensions not rarely becoming amœboid and producing a reticulation by the interlacing of the minute branches or by the formation of minute vacuoles; flagella diverse in length, originating close together at the frontal extremity, the anterior one vibratile, less than twice as long as the body, the other trailing and more than twice the body in length; contractile vesicle small, apparently single, situated in the posterior body-half; endoplasm finely granular. Length of body $\frac{1}{1500}$ inch. Hab.—Standing pond water. Movements rapidly vibratory.

Heteromita triangularis, sp. nov. Fig. 8.—Body ovate or subtriangular, depressed, smooth, twice as long as broad, the anterior border obliquely truncate, sometimes slightly concave, the shorter lateral border often flattened; the longer convex; posterior extremity obtusely pointed; anterior flagellum about one-half as long as the body, the posterior or trailing appendage from two to three times the length of the zooid; contractile vesicle single, posteriorly situated near the longer lateral border; nucleus apparently represented by a small light spot near the centre of the anterior body-half. Length of body from $\frac{1}{4500}$ to $\frac{1}{3000}$ inch. Hab.—Standing pond water.

Food seems to be engulfed chiefly near the anterior extremity, this region surrounding the particle by an irregular outflow of endoplasm, the zooid then becoming indescribably unsymmetrical in form. The anal aperture is postero-terminal or nearly so.

Macromastix (μακρος, long; μαστιξ, lash), gen. nov.—Animalcules free swimming, ovate, having three flagella arising near together, one short, antero-terminal and vibratile, two opposite, lateral and trailing; food engulfed at any point on the surface. Inhabiting standing water.

Macromastix lapsa, sp. nov. Figs. 9 and 10.—Body ovate, about twice as long as broad, the anterior region changeable in shape, that margin rounded and often obliquely truncate, the posterior obtusely pointed; anterior flagellum short, arising from the centre of the anterior truncation, the lateral appendages trailing, about three times as long as the body; endoplasm colorless, transparent; contractile vesicle single, laterally placed near the body centre; nucleus not observed. Length $\frac{1}{1500}$ inch. Hab.—Standing pond water.

This form is a member of the Trimastigidæ of Saville Kent, and resembles most nearly the *Dallingeria* of the same authority, differing chiefly in the diverse length of the flagella, these appendages in *Dallingeria* being subequal. The lateral flagella of *Macromastix* arise from opposite points nearer the frontal border than do the similar appendages of *Dallingeria*, in the last named form arising from the lateral borders at some distance from the frontal margin, and possessing adhesive power in the distal extremities, nothing of the kind having been observed with the present form. Food is engulfed at any point of the surface.

Trachelomonas cervicula, sp. nov. Fig. 11.—Lorica subspherical, smooth, orange yellow in color; anterior orifice with a thickened, slightly projecting external border, and produced internally as a straight, cylindrical, chitinous tube about one-third as long as the diameter of the lorica, its anterior border attached around the anterior orifice of the sheath, its posterior or internal margin circular and free, the long flagellum of the enclosed animalcule protruded through this internal, tubular passage, and the body, when completely filling the lorica, surrounding the cylinder as if pierced by it. Diameter of the lorica $\frac{1}{1125}$ inch. Hab.—Pond water.

The species differs from all other known forms by the presence of the internal tubular prolongation. It was collected in some abundance from a sheltered pond in the early part of February, 1890. It is, therefore, probably a vernal Infusorian.

Trachelomonas similis, sp. nov. Fig. 12.—Lorica oval or subelliptical, nearly twice as long as broad, the extremities subequally rounded, the surface irregularly and finely punctate, the aperture produced as an obliquely directed neck-like prolongation, the margin oblique and irregularly denticulate; color chestnut brown. Length of lorica $\frac{1}{900}$ inch. Hab.—Standing pond water, with aquatic plants.

This approaches most nearly the *T. lagenella* (Ehr.) Stein, which is described as colorless and entirely smooth, neither of which conditions are observable in the present form.

Trachelomonas obovata, sp. nov. Fig. 13.—Lorica obovate, less than twice as long as broad, the anterior border convexly truncate, the posterior obtusely pointed; surface minutely hispid, aperture slightly projecting, its margin rather more coarsely hispid; color deep chestnut brown; flagella twice or more as long as the lorica. Length of lorica $\frac{1}{1125}$ inch. Hab.—Standing water from the pools of early spring.

Trachelomonas spinosa, sp. nov. Fig. 14.—Lorica oval, about one and one-third times as long as broad, both extremities equally and evenly rounded, the entire surface clothed with slightly recurved spines, which are largest at the posterior border; the anterior aperture produced as a short, smooth, truncate extension; color brown. Length, exclusive of the spinous processes, $\frac{1}{500}$ inch. Hab.—Pond water, with aquatic plants.

Epipyxis socialis, sp. nov. Fig. 15.—Lorica elongate subcylindrical, from eight to ten times as long as broad, often variously curved and bent, the lateral borders nearly parallel, tapering posteriorly to the subacute point of attachment, the anterior border truncate, usually not everted, sometimes slightly flaring. Length of lorica $\frac{1}{600}$ to $\frac{1}{550}$ inch. Hab.—Pond water in early spring; attached to Confervæ. Social, occasionally forming radiating, rosette-like clusters composed of fifty or more thecæ, or in irregular fascicles produced by the attachment of from eight to ten loricæ to a single supporting theca.

The colonies formed by the attachment of one or more loricæ to a single theca as a basis of support, would seem to foreshadow the polythecium or compound branching colony of *Dinobryon*, to which *Epipyxis* is closely allied. Groups not rarely occur formed of from eight to ten thecæ basally attached to one and the same supporting lorica.

Epipyxis eurystoma, sp. nov. Fig. 16.—Lorica elongate-vasiform, about three times as long as broad, widest at the anterior aperture, that orifice flaring, constricted near the anterior border, widening subcentrally and thence tapering to the subacute posterior point of attachment. Length of lorica from $\frac{1}{900}$ to $\frac{1}{1000}$ inch. Pond water, attached to various aquatic plants.

Cryptoglena alata, sp. nov. Fig. 17.—Lorica obovate, colorless, less than twice as long as broad, the anterior region widest, the frontal border obliquely truncate; the lateral margins thinned and projecting beyond the borders of the enclosed animalcule in a wing-like manner, the borders somewhat curved in opposite directions as seen when the Infusorian is examined "end on," or with the anterior or posterior region presenting upward; posterior border narrowed, obtusely rounded; the dorsal and ventral aspects apparently encircled by a shallow transverse groove or depression, at times two; anterior orifice circular, its walls comparatively thick, the two vibratile flagella passing out close to the lateral margins; enclosed body elongate ovate, granular. Length of lorica $\frac{1}{1000}$ inch; greatest width $\frac{1}{1500}$ inch. Hab.—Pond water in early spring.

Furcilla, gen. nov.—Animalcules persistent in shape, free-swimming, the anterior border rounded or minutely and centrally pointed, the posterior extremity bifid, the bifurcation remote or approximate; flagella two, subequal, arising close together from the anterior apex.

The position of this newly instituted genus in a scheme of classification would probably be in the Heteromonadidæ of Bütschli, Goniomonas of Stein and the Amphimonas of Dujardin, having its affinities closer to those of the former than of the latter. Although the single known species of the genius was exceedingly abundant in the infusion, I have not seen the oral aperture in any, neither have I seen any in the act of taking food, nor observed any whose endoplasm contained colored granules or other presumable food particles. I therefore assume, on these negative grounds alone, that the genus should be classed among the Flagellata-Pantostomata of Saville Kent.

Furcilla lobosa, sp. nov. Figs. 18-21.—Body more or less ovate, less than twice as long as broad, or in dorsal and ventral view somewhat horse-shoe-shaped, the posterior region bifid, the bifurcation forming about one-half the entire length of the body, straight, somewhat divergent or slightly and inwardly curved, tapering and their extremities obtusely rounded; anterior border convex, with a slight central acumination from which arises the two subequal, vibratile flagella; the lateral borders bearing two rounded lobules or conspicuous protuberances, one on each side, oppositely placed and alternating with the elongated furcated region, the body in transverse optic section presenting an unequally quadrilobate outline, but in lateral view more or less ovate with two opposite, lateral, obtusely rounded wing-like projections or protuberances; flagella exceeding the body in length; contractile vesicle double, near the centre of the frontal border; nucleus single, located anteriorly near one lateral margin; endoplasm granular. Length $\frac{1}{2250}$ to $\frac{1}{1500}$ inch. Hab. A vegetable infusion of decaying Algæ and aquatic plants. Movements rotatory and tremulous.

The body, as far as the prolongation and two lateral protuberances are concerned, is somewhat variable. The latter are, at times, so obscurely developed and are apparently so nearly merged into the anterior body-half that the region becomes subglobose. The posterior prolongations vary in curvature, in their distance apart, and somewhat in their extremities, being at times rounded, at others subacute. The varying direction of the furcation is such that they may slightly diverge, or be so closely approximated that their inner borders are almost in contact and broadly obovate in outline.

Lagenophrys bipartita, sp. nov. Fig. 22.—Lorica subhemispherical, depressed; dorsal surface rounded, ventral flattened, and surrounded horizontally by a depression that gives the adherent margin a projecting aspect as if bordered by a narrow rim, an internal membrane extending as a floor across the lorica at the position of the encircling constriction and dividing it into two unequal parts; posterior border irregularly crenate, the surface obliquely striate or ridged; the anterior valvular aperture small, the valves acuminate. Diameter of the lorica $\frac{1}{260}$ inch. Hab.—Ectoparasitic on *Daphnia*.

This was taken abundantly adherent on the entomostracon mentioned, being observed in a gathering made on January 19, 1890. The winter had been an exceptionally mild one, and this collection resembled collections made in the early spring in the abundance, variety and activity of their microscopic life. Even the entomostraca were burdened by their usual load of infusorial parasites.

This is the only member of the genus in which a dividing membrane has been observed above the region adherent to the supporting object, and acting as a floor on which rests the soft body of the enclosed animalcule. This floor-like structure exists, and is readily demonstrated if the lorica can be detached uninjured from the host, as the writer has several times had the opportunity to do. The enclosed zooid seems to rest on this floor-like partition, being of course adherent at the anterior valvular orifice, as is commonly the structural arrangement with all the observed species. The projecting basal rim has a tendency to become brown, as is so frequently observed in many infusorial loricæ, and its surface is irregularly crenulate. With advanced age it probably changes color entirely.

Podophrya pusilla, sp. nov. Fig. 23.—Body subspherical, pedicle comparatively stout, its length equaling about one-half the diameter of the body; tentacles from twelve to fourteen, irregularly distributed, distinctly capitate, often twice as long as the diameter of the body; contractile vesicle apparently single, situated near the centre of the frontal border: nucleus obscure, apparently subspherical; endoplasm usually finely granular. Diameter of the body $\frac{1}{1930}$ inch. Hab.—Pond water, attached to various aquatic weeds.

Solenophrya oblonga, sp. nov. Fig. 24.—Lorica oblong, very much compressed, less than three times as long as broad, often tapering posteriorly, the lateral borders nearly straight, the posterior margin rounded or somewhat flattened, seemingly by the pressure of the supporting object; anterior margins somewhat convex, not continuous but separated by a narrow interval, the lateral borders enlarged and rounded; tentacles in two antero-lateral fascicles, capitate; contractile vesicle single, small, located near the anterior border; nucleus ovate, slightly curved, placed subcentrally near one lateral border; endoplasm granular, almost entirely filling the cavity of the lorica. Length $\frac{1}{140}$ inch. Hab.—Standing pond water, attached to the rootlets of aquatic plants.

Solenophrya alata, sp. nov. Fig 25.—Lorica, when viewed laterally, irregularly ovate, depressed, longitudinally traversed by five broad, thin, equidistant, perpendicular and anteriorly converging alæ, their free margins irregularly undulate, and their height varying, usually being greatest near their centre; posterior border evenly convex, the anterior narrowly concave and alate. Lorica when viewed from above pentagonal, a longitudinally disposed ala originating from each angle, converging anteriorly and meeting at the summit of the sheath which is apparently continuous across the frontal region; enclosed animalcule almost entirely filling the cavity of the lorica, the tentacles capitate, protruding through the alæ; endoplasm granular; nucleus obscure, apparently ovate and subcentrally located; contractile vesicle single, posteriorly placed near one border. Diameter of the lorica $\frac{1}{530}$ inch, height $\frac{1}{600}$ inch; length of each of the five sides $\frac{1}{815}$ inch. Hab.—Attached to the rootlets of *Lemna*.

Apgaria purpurascens, sp. nov.—Body elongate ovate, longitudinally furrowed, anteriorly flattened, in general outline and aspect resembling *A. elongata;* endoplasm deep reddish purple in color; nucleus double, ovate, the nodules situated in the posterior and the anterior body-halves respectively, and connected by a funiculus; contractile vesicle double, located near the posterior extremity. Length of mature forms $\frac{1}{150}$ inch, the length being from three to four times the width. Hab.—Pond water, and on the lower surface of water-lily leaves, near Minneapolis, Minn.

This beautiful and interesting form was originally discovered by Dr. P. L. Hatch, of Minneapolis, where it was abundant, and specimens were kindly sent to me. From *A. elongata*, which it resembles in general contour, it differs widely in three important particulars: the remarkable deep purplish-pink color of the parenchyma, in the double nucleus with a funiculus connecting the nodules, and in the great size. *A. elongata*, the most nearly related species, is colorless, it has but a single nucleus, and is in size only about $\frac{1}{300}$ inch in length. Reproduction with the form here referred to as *Apgaria purpurascens* takes place by transverse, often somewhat oblique, fission.

Homalozoon (ὁμαλός, flat; ζῶον, body), gen nov.—Animalcules free-swimming, hypotrichous, soft, flexible and elastic; elongate, much depressed, the anterior border obliquely rounded, thickened and abundantly supplied with trichocysts; oral aperture terminal, very expansile; no differentiated neck-like prolongation; ventral surface flattened, entirely ciliated.

In the *Annals and Magazine of Natural History* for August, 1887, the writer described an Infusorian under the name of *Litonotus vermicularis*, relegating it to that generic group with much doubt and hesitation. In the *Journal of the Trenton Natural History Society* for January, 1888, the diagnosis is republished without comments, and without any expression of that doubt as to its proper position which was still felt by the writer. Recently another Infusorian closely related to the one here referred to, but differing from it specifically, has confirmed the opinion that the former must, with the latter, be denied admission into the genus *Litonotus*, and perhaps into the family Litonotidæ. The forms differ from the typical *Litonotus* in the absence of the neck-like prolongation, in the absence of the rounded and often conspicuously elevated dorsum, and especially in the position of the oral aperture, which in *Litonotus* is ventrally situated near the base of the neck, while in *Homalozoon* it is exactly apical and terminal. The Infusorian therefore formerly described by the writer under the name of *Litonotus vermicularis* is here transferred to the generic group now proposed for the reception of the two allied forms.

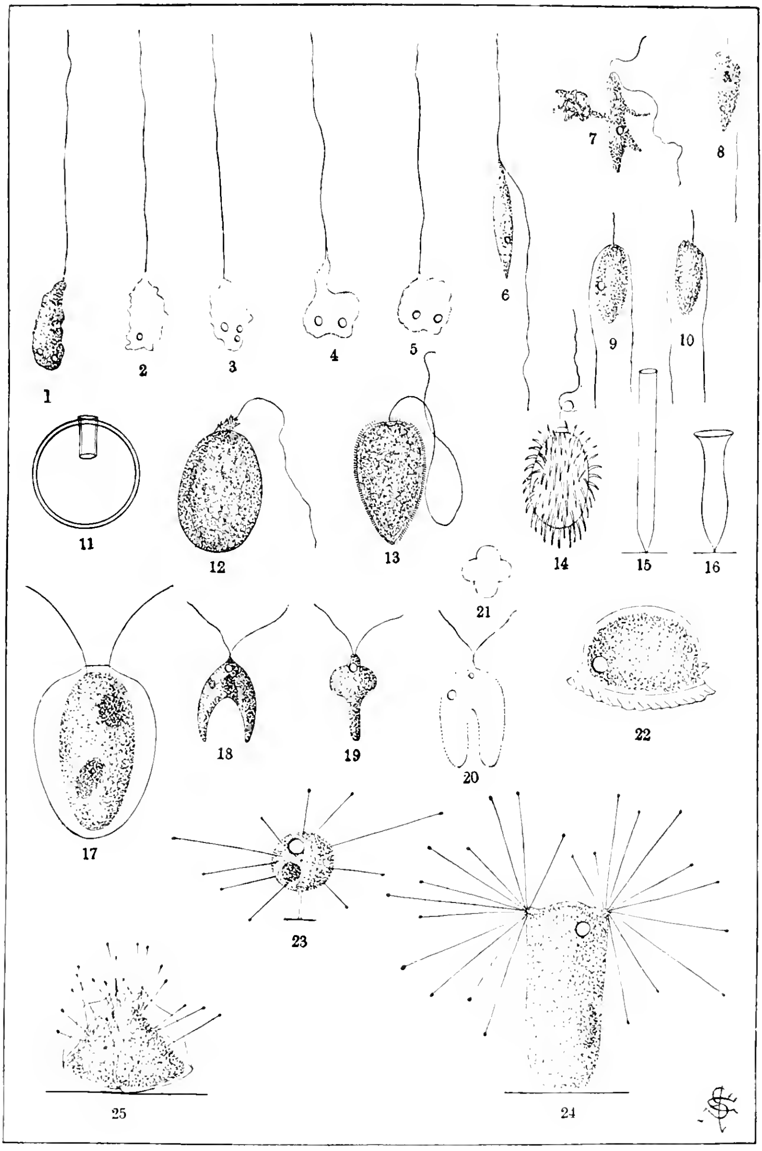
Homalozoon vermiculare, Stokes.—*Litonotus vermicularis*, Stokes, *Ann. and Mag. Nat. Hist.*, Aug., 1887; *Journ. Trenton Nat. Hist. Soc.*, Jan., 1888.

Homalozoon flexile, sp. nov.—Body elongate, from twelve to fifteen times as long as broad, widest centrally, tapering to the obtusely pointed posterior extremity, and to a slight anterior constriction beneath the thickened and obliquely rounded frontal border; cilia short and fine, arranged in longitudinal lines on the flattened ventral surface; dorsal aspect bearing numerous, minute, hispid setæ; trichocysts within the frontal extremity abundant and conspicuous, a few scattered throughout the anterior region; contractile vesicles from twelve to fifteen, arranged in a series near one lateral border; nucleus long, narrow, band-like, variously curved; endoplasm usually granular. Length of body $\frac{1}{165}$ to $\frac{1}{110}$ inch. Hab.—Pond water, with aquatic plants.

This resembles *Homalozoon vermiculare* in contour, but differs in size, in the number of contractile vesicles, and especially in the form of the nucleus and the absence of a keel-like ridge traversing the dorsal aspect.

EXPLANATION OF THE PLATE.

Fig. 1 to 5. Various forms assumed by Mastigamœba reptans.
" 6. Heteromita fusiformis.
" 7. " " with amœboid protrusions.
" 8. Heteromita triangularis.
" 9 and 10. Two forms of Macromastix lapsa.
" 11. Trachelomonas cervicula. An empty lorica.
" 12. Trachelomonas similis.
" 13. Trachelomonas obovata.
" 14. Trachelomonas spinosa.
" 15. Epipyxis eurystoma. An empty lorica.
" 16. Epipyxis socialis. An empty lorica.
" 17. Cryptoglena alata.
" 18. Furcilla lobosa.
" 19. " " lateral view.
" 20. " " a variety.
" 21. " " transverse optic section; diagram.
" 22. Lagenophrys bipartita.
" 23. Podophrya pusilla.
" 24. Solenophrya oblonga.
" 25. Solenophrya alata.



Fresh-water Infusoria.—Stokes.

The Asiatic Affinities of the Malay Language.

By C. Staniland Wake.

(*Read before the American Philosophical Society, April 18, 1890.*)

The existence of a connection between the language of the Malagasy and that of the Malays is so evident that all matters relating to the latter people are of importance, as bearing on the question of the origin of the natives of Madagascar.

The Malays would seem to be first mentioned in the Chinese annals, which refer to the existence, between the years 618 and 939 of our era, of eighteen small States, probably Shan, in Further India, *north of the country of the Malays.* The Shans, to whom the Siamese are closely allied, were therefore preceded in that region by not only the Burmese, who are probably related to the Naga tribes, but also the allied Chams and Malays, whose affinities would be rather with the Mongolian peoples of India, now represented by the Kolarian tribes. This view is evidently supported by the statement of M. Vivien de Saint-Martin that there is a general and primitive relationship between the "innumerable ramifications of the non-Aryan race of India and Indo-China." The Rev. Dr. Mason and other writers have found a similarity between the language of the Môn of Tegu and that of the Mundakols of Chutia Nagpur, and Dr. Latham states that the Malay language is connected with the Môn, and therefore also with the Kolarian dialects of India. He associates with them, as belonging to the same group, the language of Cambodia. Mr. Cust agrees in allowing a relationship between Môn and Cambodian, but he classes the Malay language as a distinct family. Prof. A. H. Keane affirms, on the other hand, that the Khmer of Cambodia has nothing in common with the Kolarian except a few verbal resemblances through the Talaing, and that the Malay is "unmixed in structure and fundamentally related to the Cambodian." If we test these statements by reference to the numerals of those languages, we find that the Khmer differs from Malay and agrees with the Kolarian dialects. This is shown by the following table :

	Khmer.	Kolarian.			Malay.
		Talaing.	Hos.	Sontal.	
1.	muy	mooa	mi	mia	satu
2.	pir	ba	bara	baria	dua
3.	bey	pee	apia	pia	tiga
4.	buon	paun	apania	ponia	ampat

The Malay numeral *ampat,* four, is probably derived from the Kolarian, but some of the others are evidently of Dravidian origin. This is true doubtless of *satu,* one, which appears to be connected with Brahui *asit,* one, in Dravidian *or-u,* the r and s being interchangeable. The Malay numerals *dalapan,* eight, *sambilan,* nine, and *sapula,* ten, are certainly connected with the Dravidian. Dr. Caldwell remarks* that the classical Tamil grammars teach that *pattu,* ten, may in certain connections be written *pahdu,* from *pag-u,* to divide, which corresponds to *pagudi,* classical Tamil *pâl,* a division. Thus the ancient Tamil *orupukadu* is *oru pahdu,* one ten. We have here the explanation of the Malay *sapula,* which likewise means "one ten," the word *pula* being evidently connected with the Dravidian numeral. The Malay word *sambilan,* nine, has a similar explanation. Dr. Caldwell explains the Tamil *onbadu,* nine, in Malayalam *ombadu,* as compounded of the ordinary Dravidian *or*, one, and *padu,* ten, and as having the meaning of "one from ten." The Malay *sambilan* has the same sense, and is compounded of *sa(m),* one, and *pula* (bilan), ten. Dr. Caldwell applies to the Dravidian numerals the rule "characteristic of the Scythian languages," that they "use for eight and nine compounds which signify ten minus two and ten minus one." This rule applies, as we have seen, to the Malay numeral nine, and it does so also to *eight.* Thus *dalapan* is compounded of *dua,* two, and *pula,* ten ; as in Telugu *enimidi,* ten, meaning "two from ten," is formed of *eni,* two, and *midi,* which is really identical with *padi,* ten.

Prof. Keane refers to the Indo-Pacific numerals as common elements in the Malay and Polynesian languages : he points out that in the Samoan *sefalu,* ten, we have a reduplication of the "enunciative particle," "the expression being really equivalent to *sa-sa-falu,* 'a one-ten.'" He says further that "the needless repetition shows that the original sense has long been lost : a further proof of the vast antiquity and independence of the Sawaiori [Polynesian] tongues." Prof. Keane adds that as the "common elements in the Indo-Pacific languages are organic and not borrowed," these languages "form a linguistic family in the same sense that the Aryan or Semitic are linguistic families." The evident connection between the Malay and the Dravidian numerals throws doubt, however, on that conclusion. Prof. Keane refers also to the Polynesian word for five, *lima,* which he supposes to have originally meant hand, as it still usually does, and he states that "this meaning is lost in Malay, Javanese, Malagasy, etc., where *lima,* retained as a numeral, has been replaced in the sense of hand by *tanghan, tahan,* etc." So far, however, from the Malay having exchanged *lima* for *tanghan,* the probability is that it never used the former word in the sense of "hand ;" as *tanghan* or an allied form is thus used by the Asiatic peoples to whom the Malays are most closely related. This view is not inconsistent with the remarks on the numeral "five" in the Dravidian languages made by Dr. Caldwell, who suggests that it might be derived from *kei,* in Tamil a hand. Probably

* Grammar of the Dravidian Languages, p. 248, 1875.

the Dravidian word for hand, in Gond *kaik*, as well as the numeral five, *saighan* in Gond, and the Malay *tanghan* are derived from a common root meaning "hand." It is noticeable that in Samoan the word *lima* is not used in speaking of a chief's hand. This is *'a 'ao*, in other Polynesian dialects *kakao*, which is the original form, and is evidently allied to the words just referred to. The origin of the word *lima* is probably to be sought in the languages of Cochin China, in which the numeral five is *naru* or *laru*, unless it is derived from the Shan dialects, which have the word *mu* or *mi* for "hand." The Malay would seem to have taken its numerals "two" and "three" from the same source as that to which it was indebted for the word *tanghan*. In the Tungus languages "five" is *tonga*, or a slightly differing form of this word, and in the same languages we have *dzur*, *dzhoua*, *dyul*, *dyur* for "two," and *ela*, *gilang*, *ilan* for "three," answering to the Malay *dua* and *tiga*, which in Polynesian become *lua* and *tolu*.

The consideration of the numeral systems of the Malay and Cambodian does not support the conclusion that these languages are of the same family. Prof. Keane refers, however, to a feature possessed by both of them, which he considers so peculiarly distinctive as of itself alone almost to be sufficient to establish their common origin. This is the use of identical *infixes*.* It should be noted, however, that this important feature is not met with in the Polynesian dialects, which employ a prefix† instead, although it is found in all the true Malayan dialects, and is especially frequent in those of the Philippine islands. Prof. Keane does not give the origin of this "Malayan feature," as it is termed by the Rev. L. Dahle, who first pointed out its presence in Malagasy. It is somewhat difficult to understand how the use of infixes can be universal in Malay, but nct be met with in Polynesian, if, as Prof Keane supposes, those languages form one family with the "polysyllabic untoned languages of Indo-China," which the Malays are said to have acquired. If the Polynesian and Cambodian languages belong to the same family, that feature must either have been developed after their separation or have been acquired by the latter from a foreign source. When we consider that the use of infixes is essentially Malayan, we are tempted to believe that it has been taken by the Cambodian from the Malay or an allied language, such as the Cham. The latter opinion is supported by certain other characters of the Khmer tongue. This is classed by Mr. Keane with the "polysyllabic untoned languages," and rightly so inasmuch as the Khmer is pronounced *recto-tono;* although the same word has several significations, the sense of the phrase alone giving the true signification. According to M. Moura, however, the Cambodian language is really monosyllabic. He says expressly, "like all the languages and idioms spoken in our days by the peoples of the extreme East, the Cambodian is a monosyllabic language."

* Prof. Keane says that the infix is always the liquid *m* or *n* or *mn*, with or without the vowels *a*, *o* with *m*, or *a*, *i* with *n*.

† The Samoan *prefix* is *mo*.

He adds, "in books of poetry, theology and even sometimes in ordinary language, a certain number of polysyllabic words are found, but these words are generally of Sanskrit or Pali origin, and prove nothing against the general character of the language." M. Moura cites various words which have been derived from the Pali, and which could be indefinitely added to. He states that they have been shortened, so as to reduce them as much as possible to the monosyllabic form, "which is one of the distinctive features of the genius of the Khmer language." If this language is in reality monosyllabic, Prof. Keane's argument, based on its polysyllabic character, cannot be sustained, but even if M. Moura is wrong, we must conclude that the Khmer has been indebted for certain of its features to the Malay rather than the reverse.

As to the verbal relationship between the Khmer and Malay languages we may judge from the comparative vocabularies contained in M. Moura's work. Of the 124 words there given only twenty-four are the same in those languages, of which sixteen are however the same also in Cham, which has thirteen other words common to it and Khmer alone. It appears, therefore, that Cham is more nearly related to Khmer, judging from their vocabularies than is Malay. This agrees with the fact of the early communication between the Khmers and the Cham. Moreover, Malay and Cham agree in thirty-three instances out of the 124, showing a closer relation between these two languages than exists between either of them and Khmer. That all these languages include both Kolarian and Dravidian elements is shown by reference to the short comparative vocabulary appended to this paper. Those elements have, however, been derived from different sources. M. Moura would, indeed, seem to think that the language as well as the written character of the Cambodians is derived from the Sanskrit and Pali, and it has no doubt obtained its foreign element chiefly from the north. The Malay, on the other hand, is fundamentally related to the Kolarian and the allied Mongolian languages, and its Dravidian element has been obtained from the south. This feature occupies a more important position in Malay than Dr. Caldwell appears to allow. When referring to the Dravidian word *kappal*, a ship, he says that the Malay word for "ship" is kapâl. He adds, however, that "this has probably been borrowed direct from Tamil, and forms one of a small class of Malay words which have sprung from a Dravidian origin, and which were introduced into the Eastern archipelago, either by means of the Klings (Kalingas), who settled there in primitive times, or by means of the Arab traders, whose first settlers in the East were on the Malabar coast, where the Malayálam, the oldest daughter of the Tamil, is spoken." Reference has already been made to the Dravidian origin of some of the Malay numerals, to which may be added that the affix *tu* in Malay *satu*, one, appears to be only the neuter formative *du*, which, according to Dr. Caldwell, is contained in various shapes in the first three Dravidian numerals. Moreover, the Malay *sa*, like the Dravidian *oru*, one, is used as the indefinite article. Other verbal agreements could be mentioned, but I will refer to only one other example. Dr. Caldwell states that *tî* is the classical Tamil word for "fire," but that the more commonly used word is *neruppu*, in Telugu *nippu*. Here we have, no doubt, the origin of the Malay *api* (in Samoan *afi*), which in Cham takes the form *apui*. Dr. Leyden long since pointed out that the language of the Malays contains a great number of Tamil, Malayalam and Telinga words which are not found in Sanskrit or the allied Indian languages, and particularly "a variety that are only to be found in Telinga," the vernacular of the ancient kingdom of Kalinga.*

*Asiat. Researches, Vol. x, p. 171.

		Khmer.			Cham.		
1	Bird	sat hor	*Dravidian* *Persian*	kôr-i khor-os(coc :)	chim po	(see *Egg*)	
2	Dog	chhkê	*Tibetan* *Hindi*	khyi kootha	asau	*Sanskrit* *Kolarian*	swan sétà
3	Ear	trachiek	*Tibetan(Sok)* *Kolarian*	khikhé khetway	tanhu	*Naga* (see *Malay*)	tenhaun
4	Egg	pong	*Yeniseian*	ong	bo	*Kolarian*	pito
5	Eye	phnek panék	*Dravidian* *Hindi*	kank ānkh	mata	*Kolarian* *Mon* (Tegu)	met mot
6	Female	nhi	*Dravidian*	henn-u	benai	*Dravidian*	pen,henn-u
7	Fire	phlung	*Kolarian*	sengel	apui	*Dravidian*	nippu
8	Fish	trey	*Kolarian*	hai	akan	*Kolarian* *Burmese*	haku kha
9	Foot	chung	*Tibetan* *Mon* (Pegu)	kango jaing	takai	*Kolarian*	kata
10	Hand	day	*Kolarian* *Dravidian*	tih kei	tangun	*Yeneseian*	hanga
11	Head	kabal	*Sanskrit* *Dravidian*	kapâla tala	akak	*Dravidian* *Burm.* (*Sak*)	kuk akhú
12	Horse	sē	*Tibetan* *Sanskrit*	ta aswa	asè	(see *Khmer*)	
13	House	ptea	*Drav.*(Gond)	erpa	sang	*Tibetan*	nang
14	Man	menus pros	*Pali* *Sanskrit*	manut manusha	orang lokay	*Kolarian*	koro, lokka
15	Moon	ke	? { *Burmese* *Shan*	la len	bulan	*Kolarian*	lerung
16	Mouth	mot	*Kolarian* *Bengali*	tamode mukh	chebuoi	? *Yeneseian*	hohui, bu- [khom
17	Nose	chrèmo	*Mongolian* *Siamese* *Sanskrit*	khamar tamua ghrana	adung	*Yeneseian*	hang [ma, elu-mbu
18	Ox	ku	*Sanskrit*	go (cow)	lama	*Dravidian*	eruma, er-
19	River	tanla	*Dravidian* *Nepaul*	kole khola	sungai	*CochinChina* *Mongolian*	song uhung(wa-
20	Serpent	{ pos { sbêk (skin)	*Nep.*(Tharu) *Dravidian*	sapa pab, pavu	ala	(see *Malay*)	[ter)
21	Sky	mik	*Siamese* *Burmese*	mic mo	langik	*Kolarian*	sengil (fire) singi (sun)
22	Star	pakai	*Drav.*(Gond)	binka	bintang	*Dravidian*	binka
23	Stone	thma	*Mon* (Pegu)	tmauon	botau	(see *Egg*)	
24	Sun	thngai tangai	*Kolarian* (see *fire*)	singi	haray	*Mongolian* *Sanskrit*	nara sûrya
25	Water	tenk, tak	*Kolarian* *Mon* (Pegu)	dah dai	ea	*Dravidian*	yer
26	Wood	chhu	*Dravidian*	chettu (tree)	kayon	*Dravidian*	chettu,gida
	1	muy	*Kolarian*	mia	sa	*Dravidian* *Brahui*	or-u as-it
	2	pir	*do.*	baria	dua	*Tungusian*	dzur, dyur
	3	bey	*do.*	pia	klau	*Tungusian*	ela, gilang
	4	buon	*do.*	ponia	pac	*Kolarian*	ponia, apa- [nia
	5	pram	? { *Tonkin* { *Annam*	lam nam	lèmu	*Tonkin* *Annam*	lam nam
	6	pram muy			nam	*Tungusian*	nungun
	7	pram pil			tuju	*Dravidian*	edu, yetu
	8	pram bey			dopan	(two from ten)	
	9	pram buon			samlan	*Dravidian*	onbadu (one from ten)
	10	dap	*Dravidian* *Tonkin* *Hindi*	padu tap das	saphu	*Dravidian*	oru padu (one ten)

		Malay.			Samoan.		
1	Bird	burang tarbeang			manu	*Fiji*	manumanu
					moa (fowl)	*Khmer*	mon (fowl)
2	Dog	anjing	*Dravidian*	nây	uti, maile	*Fiji*	koli
		asu (*Java*)				*Singhalese*	balla
3	Ear	talinga	*Naga*	telanno	taliga	*Fiji*	daliga
			Arakan (Kumi),	kano			
		kana (*Java*)	*Singpho*	kana			
4	Egg	talor	*Sanskrit*	sila (stone)	fua	*Fiji*	vua (fruit)
			Dravidian	kal (stone)			
			Koreng	talo (stone)			
5	Eye	mata	(see *Cham*)		mata	*Fiji*	mata
6	Female	botina	(see *Cham*)		fafine		
7	Fire	api	*Dravidian*	nippu	afi		
			Thai	fai			
8	Fish	ikan	(see *Cham*)		i'a		
9	Foot	koki	*Kolarian*	kata	vae	*Dayak*	pai
			Tibetan	kango		*Fiji*	yava
			Permian	kok			
10	Hand	tangan	(see *Cham*)		lima	? *Siamese*	mu
					'a'ao (chief's)	*Fiji*	liga
11	Head	kapala	*Sanskrit*	kapâla	ulu		
		ulu	*Dravidian*	tala			
			Arakan (Kumi)	alú			
12	Horse	kudo	*Dravidian*	kudirei			
			Yenescian	kut			
13	House	ruma	*Dravidian* (Gond)	roon	fale		
			Arakan (Kumi)	úm			
			Kolarian	ora			
14	Man	orang koki	(see *Cham*)		tane, tugata	*Fiji*	tagane, tamata
15	Moon	bulan	(see *Cham*)		ma-uli, ma-sina	*Fiji*	vula
16	Mouth	mulot	(see *Khmer*)		gutu	*Fiji*	gusu
			Arakan (Kumi)	amoká		*Singhalese*	kata
17	Nose	hidong	(see *Cham*)		isu	*Fiji*	ucu
						Sanskrit	nāsa
18	Ox	lambu	(see *Cham*)				
19	River	sũngei	(see *Cham*)		vaitafe	(see *Water*)	
20	Serpent	ulor			gata	? *Siamese*	ngu
		kulet (skin)	*Dravid.*	tol			
		uli (skin *Bugis*)					
21	Sky	langet	(see *Cham*)		lagi	*Fiji*	lagi
22	Star	bintang	(see *Cham*)		fetū	(see *Khmer*)	
23	Stone	botu	*Kolarian*	pito (egg)	fatu	*Fiji*	vatu
24	Sun	mato hari	(see *Cham*)		la	*Fiji*	siga
						Kolarian	singi
25	Water	ayor	(see *Cham*)		vai	*Fiji*	wai
					taufa (chief)		
26	Wood	kayu	(see *Cham*)		la'au	*Fiji*	kau (tree)
			Eskimo	keiyu			
	1	sátu			tasi	*Malagasy*	iray, isa
	2	dúa			lua	*do.*	roa
	3	tiga			tolu	*do.*	telo
	4	ampat	(*Bugis* apa)		fā	*do.*	efatra
	5	lima			lima	*do.*	dimy
	6	a'nam			ono	*do.*	enina
	7	tújoh			fitu	*do.*	fito
	8	delápan			valu	*do.*	valo
	9	sambilan			iva	*do.*	sivy
	10	sapúloh			sefulu	*do.*	folo

Stated Meeting, February 21, 1890.

Present, 23 members.

President, Mr. FRALEY, in the Chair.

Letters of envoy were received from the Nova Scotian Institute of Natural Science, Halifax; Museum of Comparative Zoölogy, Cambridge, Mass.; Department of the Interior, Washington, D. C.

Letters of acknowledgment were received from the Naturwissenschaftlicher Verein, Bremen (129); Entomological Society, Brooklyn (130); University of the City of New York (130); Prof. Henry M. Baird, Yonkers (130); Dr. Charles C. Abbott, Trenton, N. J. (130); Dr. F. A. Genth, Prof. Lewis M. Haupt, Dr. George H. Horn, John Marshall, Hon. Henry Reed (130), Prof. John A. Ryder, Philadelphia (125, 130); State Historical Society, Topeka, Kans. (130); University of California, Prof. John Le Conte, Berkeley, Cal. (130); Mr. George Davidson, San Francisco, Cal. (130).

A circular from the Sociedade de Geografia, of Lisbon, embodying a protest against the English aggressions in Africa.

The Section für Naturkunde des Œsterreichen-Touristen Club was placed on the Society's exchange list to receive Proceedings from No. 130.

Accessions to the Library were announced from the Geological Survey of India, Calcutta; K. K. Sternwarte, Prag; Anthropologische Gesellschaft, Vienna; Verein für Erdkunde, Metz; Statistika Central Byrån, Stockholm; Prof. Lorenzo M. Billia, Turin; Societé D'Ethnographie, Ministerè des Travaux Publics, Mr. Henry Carnoy, Paris; Royal Society, London; Mr. William H. Whitmore, Boston; Harvard University, Cambridge, Mass.; Yale University, New Haven; Astor Library, New York; State Museum of Natural History, Albany; Historical Society of Pennsylvania, Editor of "American Notes and Queries," Dr. George H. Horn, Mr. Henry Phillips, Jr., Philadelphia; Johns Hopkins University, Baltimore; War Department, Department of the Interior, Washington, D. C.; Rev. Stephen D. Peet, Mendon, Ill.; State Historical Society of Wisconsin, Madison; State University of Iowa, Iowa City.

Prof. John A. Ryder presented his photograph for the Society's Album.

Prof. Lesley read an obituary notice of the late Charles A. Ashburner, D.Sc.

The Proceedings of the Board of Officers and Council were submitted.

Pending nominations, Nos. 1203, 1204, 1205, 1206, 1207 and 1208 were read, spoken to and balloted for.

Prof. E. D. Cope made some observations on the gigantic chincilla of North America, *Casteroides ohioensis.*

The annual report of the Trustees of the Building Fund was presented.

Prof. Cope offered the following resolution, which, he stated, was intended to supersede the one presented by him to Council at its meeting last week, and by it deferred until its next stated meeting:

Resolved, That the Proceedings of the Society be issued whenever an amount of matter is ready for press which will make seventy-five pages of text.

On motion, the resolution was referred to the next regular meeting of the Board of Officers and Council.

The Committee on Accommodations reported progress and was continued.

All other business of the meeting having been finished, the Tellers reported the result of the poll to the President, who thereupon declared that the following gentlemen had been duly elected members of the Society:

No. 2175. Hon. James T. Mitchell, Philadelphia.

No. 2176. Samuel Timmins, Arley near Coventry, England.

No. 2177. Prof. Robert W. Rogers, Haverford College, Pa.

No. 2178. Prof. Henry Willis, Philadelphia.

And the Society was adjourned by the President.

Stated Meeting, March 7, 1890.

Present, 10 members.

Mr. RICHARD VAUX in the Chair.

Prof. Henry Willis, a newly elected member, was presented to the Chair and took his seat.

Correspondence was submitted as follows:

Letters accepting membership from Prof. Robert W. Rogers and from Prof. Henry Willis, Philadelphia.

Letters of envoy were received from the Museo Nacional de Buenos Aires; Royal Statistical Society, London.

Letters of acknowledgment were received from Sir J. W. Dawson, Montreal (130); University of Pennsylvania (129, 130), Mrs. Helen Abbott Michael (130), Prof. Henry D. Gregory (130), Philadelphia; Maryland Historical Society, Baltimore (130).

A letter from the Department of State in reference to certain MSS. in the possession of the Society was ordered to be filed.

A letter was read from E. Frank Carson, requesting the loan of the Society's Hall for an approaching reunion of the Rittenhouse family, to be held April 8, 1890, being the 168th anniversary of his birth; and also requesting that the Society should be represented on the occasion, which, on motion, was referred to the President with power to act.

Accessions to the Library were reported from the Académie des Sciences, Cracow, Austria; Section für Naturkunde, Ö C., Vienna; Verein für Lübeckische Geschichte und Alterthumskunde, Lübeck, Germany; Société Hollandaise des Sciences, Harlem, Holland; Philological Society, Cambridge, England; Rousdon Observatory, Devon, England; Geological, Royal Statistical Societies, London; Geological and Natura History Survey of Canada, Montreal; Harvard University, Cambridge, Mass.; Mr. Charles J. Hoadley, Hartford, Conn.; Prof. Robert W. Rogers, Philadelphia; Wyoming Historical Society, Wilkes-Barré; Johns Hopkins University, Baltimore;

U. S. Coast and Geodetic Survey, Bureau of Ethnology, Interstate Commerce Commission, Washington, D.C.; Kansas Academy of Science, Topeka; University of California, Berkeley; Observatorio Meteorologico-Central, Mexico; Museo Nacional de Buenos Aires, S. A.

Mr. Phillips exhibited and presented to the Cabinet of the Society a bottle of "Earthquake sand from the Geysers at Summerville, S. C., August 31, 1886."

Mr. Vaux read an obituary notice of the late Franklin B. Gowen.

An obituary notice of the late Henry S. Frieze, LL.D., by Hon. James B. Angell, was presented by the Secretaries.

The death of Martin B. Anderson (formerly of Rochester, N. Y.) was reported as having taken place at Lake Helena, Florida, on February 26, 1890 (born February 12, 1815).

Prof. Barker exhibited to the Society four stellar photographs taken by Prof. Pickering, Director of the Harvard College Observatory, as a part of the Henry Draper Memorial. The photographs were of the spectrum of the star β Aurigæ, and showed the K line single in the first set and double in the second, although taken only about seventeen hours apart. This result appears to show that this star is binary, its components revolving about each other in somewhat less than four days. From the displacement of the components of the K line, the change in wave length and the velocity of motion may be calculated. Prof. Pickering finds this velocity to be 150 miles per second. The distance apart of the components he estimates to be eight million miles, and their joint mass about 2.3 times that of the sun. Since the spectrum method of detecting binary stars is independent of distance, it must always have an advantage in detecting such stars over the telescopic method.

Dr. Brinton offered the following resolution, which was adopted:

Resolved, That the Committee on the Commemoration of the Death of Franklin be instructed to select all speakers on that occasion from members of the Society, and if engagements of others have already been made, that they be informed that owing to alterations in the plan of the commemoration, the thanks of the Society are tendered them, but their attendance will not be expected.

Dr. Horn offered the following resolution, which was adopted:

Resolved, That a Committee of three be appointed by the President to examine an oil portrait of Prof. S. F. Baird by Mr. H. Ulke, report on its desirability, and, if favorably, to solicit subscriptions for its purchase at a price not exceeding $200, for the gallery of this Society.

The President subsequently appointed as such Committee, Dr. George H. Horn and Messrs. J. Sergeant Price and William A. Ingham.

And the Society was adjourned by the presiding member.

Stated Meeting, March 21, 1890.

Present, 30 members.

President, Mr. FRALEY, in the Chair.

Prof. Robert W. Rogers and Mr. Talcott Williams, lately elected members, were presented to the Chair and took their seats.

Correspondence was submitted as follows:

Letters from Hon. James T. Mitchell and Mr. Samuel Timmins accepting membership.

A circular from the University of Toronto, requesting donations to its library, to replace the one destroyed by fire on the 14th of February last; on motion, the Librarian was directed to forward to it such of the Proceedings of the Society as could be sent.

A letter from the Naturforschende Gesellschaft in Emden, Hannover, thanking the Society for its letter of congratulation on the late celebration of the seventy-fifth anniversary of its foundation.

A letter from the Trinity Historical Society, Dallas, Tex., asking for autograph letters.

A letter from the *Societas linguam universalem scientiarum ac negotiorum ancillam fundantium Internationalis.*

A prospectus of the "Antananarivo Annual," published in Madagascar.

The Museo Michoacano, Morelia, Mexico, was placed on exchange list from No. 96.

Letters of acknowledgment (Transactions, xvi, 3) were received from the Boston Public Library; Museum of Comparative Zoölogy, Cambridge; American Antiquarian Society, Worcester; Buffalo Library; Astor Library, New York; Library U. S. Military Academy, West Point; New Jersey Historical Society, Newark; Pennsylvania Hospital, Franklin Institute, Library Co. of Philadelphia, Historical Society of Pennsylvania, Philadelphia; State Library of Pennsylvania, Harrisburg; U. S. Geological Survey, Washington, D. C.; University of Michigan; State Historical Society of Wisconsin, Madison; University of California, Berkeley.

Letters of acknowledgment (Proceedings, 130) were received from Prof. William P. Trowbridge, New York; Mr. Inman Horner, Philadelphia; Colorado Scientific Society, Denver; Central Meteorological Observatory, Mexico; Deutscher Wissenschaft Verein, Santiago de Chile.

Accessions to the Library were reported from the K. K. Zool.-botanische Gesellschaft, Vienna; Verein zur Beförderung des Gartenbaues, Berlin; Dr. Paul Topinard, Paris; Royal Institution, Dr. Benjamin W. Richardson, London; Hon. John Canon O'Hanlon, Dublin; Massachusetts Bureau of Statistics of Labor, Boston; Mercantile Library, Drs. Daniel G. Brinton, F. A. Mühlenberg, Mr. Henry Phillips, Jr., Philadelphia; Editor of "American Journal of Philology;" Legation de la Republica de Costa Rica, C. A.; Chief of Engineers, Department of State, Washington, D.C.; Museo Michoacano, Morelia, Mexico.

A photograph of the alleged Runic characters on Mananas island, near Monhegan, Maine, photographed and presented by Prof. J. F. Rothrock, Philadelphia.

A letter from Rev. F. A. Mühlenberg, D. D., accompanying his donation of the botanical note books of his grandfather, Rev. Henry E. Mühlenberg, a former member of this Society, and the letters to him of Rev. Christian Fr. Denke, a Moravian missionary.*

Botanical Journals, etc., by Dr. Henry E. Muhlenberg; born Nov. 17, 1753, died at Lancaster, Pa., May 23, 1815; presented to the American Philosophical Society, of which he was a member, by his grandson, Dr. F. A. Muhlenberg, March 21, 1890:

1. Botanice.
2. Book of descriptions, without title.
3. Plants not determined, according to Linnæus' System, etc., 1788.
4. Folia plantarum Lancast. and a catalogue of the plants of North America, 1808.
5. Tage Buch, 1784.
6. Tage Buch, 1785.
7. Noten Buch, 1785.
8. Tage Buch, 1786–89.
9. Catalogus arborum et fruticum Americæ Septentrionalis.
10. Cryptogamia Lancastriensis, 1791.
    I. Filices.
    II. Musci.
    III. Fungi.
    contains, also, Lichens Lancastriensis, etc.

* There is no autobiography in existence of Christian Fr. Denke; but, from information gained from conversations with Denke and others, a biographical sketch of Christian Heinrich Denke was published in "Nachrichten aus der Brüder Gemeinde," 1811, Heft iii, pages 467–177. (The name *Heinrich* is either a mistake, or possibly Denke may have been baptized Christian Friedrich Heinrich. I have not yet examined the baptismal records in Bethlehem). Denke was born at Bethlehem, Pa., September 8, 1775, and was sent to Nazareth Hall in 1785, remained there after his father's death, and afterwards was appointed one of the teachers. In 1797, he resolved to become a missionary among the Indians. After having been ordained Deacon in Bethlehem, he left May, 1800, with Heckewaelder for Gosen on the Muskiagum, remained here until August, studying the Delaware language, and then went to Fairfield in Upper Canada, commencing in June, 1801, his labors among the Chippeways. He translated into the Delaware language various parts of the Bible, of which the Epistles of St. John were printed. In 1803, he returned to Pennsylvania, married August 7, at Lititz, Anna Maria Heckedorn, went back to Canada, 1801 to Youngquakamick, 1807 to Pettquoting, then back to Fairfield. After the burning of Fairfield in autumn, 1813, he fled to Delawaretown. In September, 1815, he began to build New Fairfield, but returned to Bethlehem in 1818. Receiving a call as pastor to Hope, in the Wachau, he reached Salem, N. Car., in summer, 1820; in 1822, he became pastor at Friedberg, but retained charge also of the small congregation in Hope. His wife died in 1828, and September 12, he married Marie Steiner. 1832, he retired from his spiritual labors, and intended to again devote his time to botany and other branches of natural science. 1834, symptoms of dropsy appeared; his right side was paralyzed in November, 1837, and he died at Salem, January 12, 1838.

John M. Maisch.

11. Agrostographia Pennsylvaniæ, etc.
12. Gräser, die bei Lancaster wild wachsen oder die ich sonst auf meinen inländischen Reisen bemerkte.
13. Plantæ cryptogamicæ Lancastriensis, etc.
14. Fungi Pennsylvaniæ, Mediæ, etc., 1793 et annù seq.
15. Monographien von Gewächsen von Lancaster, 1790, Vol. i.
16. Monographien plantarum Lancastriensis, Vol. ii.
17. Descriptio plantarum ex alies partibus Americæ Septentrionalis, incepta a 1792.
18. Sammlung von Beiträgen zur Kenntniss der Natur. 1785. With observations on agriculture.
19. Fortsetzung meines Journals von Jahren 1799–1806.
20. Botanical Journal, 1807–1815, to May 20, three days before his death.
21. Flora Lancastriensis, 1790.
22. Letters, etc., of the Rev. C. F. Denke, Moravian preacher and missionary, and one of the early botanists of America.

Prof. Lesley read an obituary notice of the late Leo Lesquereux.

The death was announced of Rev. Daniel R. Goodwin, D.D., Philadelphia, on March 15, 1890, in the seventy-ninth year of his age.

On motion, the President was authorized to appoint a suitable person to prepare the usual obituary notice.

Mr. J. Vaughan Merrick was subsequently appointed by the President.

The death of Dr. Gustav Weil, Heidelberg, September 10, 1889, æt. 71, was also announced.

The Secretaries presented for the Proceedings the two following papers by Dr. Harrison Allen: "Description of a New Species of Macrotus" and "Description of a New Species of Pteropus."

New nomination 1209 was read.

Dr. Horn, from the Committee on the Portrait of Prof. Baird by H. Uhlke, reported it now at Earle's Galleries in this city, and to be a good painting. On motion, the Committee was continued.

Dr. Oliver, from the Committee on Franklin Celebration, reported progress.

The President of the Society reported that he had conferred with the writer of the letter to the Society respecting the Rittenhouse celebration (March 7, 1890), and that he was of the opinion that such a use of the Society's Hall as was therein requested, was not expedient.

Dr. Brinton asked as a question of privilege what action the Committee on the Franklin Celebration had taken on the Society's resolution passed at the last meeting.

Mr. Biddle, of the Committee, stated it had been carefully and respectfully considered, and that after two meetings it had been laid over until the next meeting.

Dr. Horn offered the following preamble and resolution:

Having been present at the meeting of March 7, and voting in the affirmative, I move to reconsider the following resolution passed at that time:

Resolved, That the Committee on the Commemoration of the Death of Franklin be instructed to select all speakers on that occasion from members of the Society, and if engagements of others have already been made, that they be informed that owing to alterations in the plan of the commemoration, the thanks of the Society are tendered them, but their attendance will not be expected.

The motion was seconded by Dr. Brinton, and the question was discussed by Messrs. Horn, Brinton, Oliver, Biddle, Morris, Vaux, Martindale, Potts, Cope, Lesley, and Greene.

The question being put it was agreed that the Society should reconsider the original motion.

The original motion then being put, by a *viva voce* vote was not agreed to. On which the ayes and nays being demanded the resolution was voted on and not agreed to by 26 nays to 2 ayes.

Dr. Jayne offered the following resolution, which was agreed to:

Resolved, That the Secretaries be requested to communicate with the Lords Commissioners of the Admiralty with a view to obtaining as a donation the Reports on the Voyage of the *Challenger*. And, further, should such application prove unsuccessful, that the Committee on Library should procure the same by purchase.

And the Society was adjourned by the President.

No Meeting of the Society was held on April 4, 1890, it being Good Friday.

April 17, 1890.

The One-hundredth Anniversary of the death of Benjamin Franklin was commemorated at Association Hall, by the Society. Addresses were delivered as follows:

A Short Biography of Dr. Franklin, by John Bach McMaster, Professor of American History in the University of Pennsylvania; "His Literary Labors," by G. Brown Goode, Assistant Secretary of the Smithsonian Institution, at Washington; "His Scientific Work," by Prof. J. W. Holland, Professor of Medical Chemistry and Toxicology in the Jefferson Medical College; "His Association With the Society," by Frederick Fraley, LL.D., President of the Society; "His Diplomatic Services," by Prof. Henry M. Baird, Professor of English Literature and Greek in the University of the City of New York.

A full account will be published in Proceedings, No. 133.

Stated Meeting, April 18, 1890.

Present, 14 members.

President, Mr. Fraley, in the Chair.

Correspondence was submitted as follows:

Letters of envoy were received from the Australasian Association for the Advancement of Science, Sydney; Societas Pro Fauna et Flora Fennica, Helsingfors; Observatoire Astronomique et Physique, Tashkend; Physikalische Gesellschaft, Berlin; Bureau des Longitudes, Paris; Bath and West of

England Society and Southern Counties Association, Bath; Meteorological Office, London.

Letters of acknowledgment were received from the Royal Society of New South Wales, Sydney (129); Academie Royale Danoise des Sciences, etc., Copenhagen (128, 129); Natural History Society, Montreal (129, 130); Sociedad Cientifica "Alzate," Mexico (129, 130).

Letters of acknowledgment (130) were received from the K. K. Central-Anstalt für Meteorologie, etc., Wien; Naturforschende Gesellschaft, Emden; Naturwissenschaftliche Gesellschaft "Isis," Dresden; Dr. Julius Platzmann, Leipzig; Société Linneenne de Bordeaux; Société de Borda, Dax; Société d'Anthropologie, Profs. Abel Hovelacque, Léon de Rosny, Rémi Siméon, Paris; Geological and Natural History Survey, Ottawa, Canada; Mr. Talcott Williams, Philadelphia; Prof. S. P. Langley, Washington, D. C.; California Academy of Sciences, San Francisco.

A letter of acknowledgment for diploma was received from Prof. Dr. Hugo Von Meltzel, Koloszvar, Hungary.

A letter of acknowledgment, Transactions, Vol. xvi, Part iii, was received from the San Francisco Free Public Library, San Francisco, Cal.

A letter from Daniel F. Wolf, suggesting that the tombstone of Franklin should be re-lettered and a bronze tablet placed on the graveyard wall with a suitable inscription.

The following letter from M. P. Massion (Notaire, Boulevard Haussmann, 58, Paris, France) was read:

P. MASSION, PARIS, le 31 Mars, 1890.
NOTAIRE,
SUCCESSEUR DE SON PÈRE
58, BOULEVARD HAUSSMANN.

MONSIEUR LE PRÈSIDENT:

J'ai l'honneur de vous informer qu'aux termes de son testament déposé en mon étude, Monsieur Auguste Carlier, décédé en son domicile à Paris, rue de Berlin, N°. 12, le 16 Mars courant, a légué à la Société Philosophique de Philadelphie, dont il était membre, une somme de vingt mille francs. Cette Société en fera l'usage qu'elle jugera convenable pour l'aider dans ses travaux.

Quand cette somme pourra être mise à votre disposition, je vous en aviserai.

Veuillez agréer, Monsieur le President, l'assurance de mes sentiments distingués,

MASSION.

MONSIEUR LE PRÈSIDENT DE LA SOCIÉTÉ PHILOSOPHIQUE, PHILADELPHIE.

On motion, the letter was referred to the Committee on Finance, and the President was requested to prepare and transmit a suitable answer to the same.

Accessions to the Library were reported from the Royal Society of New South Wales, Australian Association for the Advancement of Science, Sydney; Société des Naturalistes, Kief; Observatoire Astronomique et Physique, Tashkend: Societas Pro Fauna et Flora Fennica, Helsingfors, Finland; K. K. Naturhistorisches Hof-Museum, K. K. Geographische Gesellschaft, K. K. Geologische Reichsanstalt, Wien; Gesellschaft für Erdkunde, Physikalische und Physiologische Gesellschaft, K. P. Akademie der Wissenschaften, Berlin; Mr. A. Radcliffe Grote, Bremen; Oberlausitzer Gesellschaft der Wissenschaften, Görlitz; Mr. Aug. Nilson, Gefle, Sweden; K. Danske Videns Rabernes Selskab, Copenhagen; "Flora Batava," Leyden; R. Istituto, Lombardo, Milan; Accademia Reale delle Scienze, Turin; Corpo delle Miniere, Servizio Geologico, R. Accademia dei Lincei, Rome; R. Istituto Veneto di Scienze, Lettre ed Arti, Venice; Société Historique, etc., du Cher, Bourges; Société de Borda, Dax; Académie des Sciences, etc., Dijon; Sociétés d'Anthropologie, Zoologique de France, Bureau des Longitudes, Paris; Société des Antiquaries de la Morinie, Saint-Omer; R. Academia de la Historia, Madrid; Commission des Travaux Geologiques de Portugal, Lisbon; Bath and West of England Society, and Southern Counties Association, Bath; Philosophical Society, Cambridge, Eng.; Meteorological Council, London; Mr. Horatio Hale, Clinton (Ontario), Canada; Museum of Comparative Zoölogy, Cambridge, Mass.; Essex Institute, Public Library, Salem; American Antiquarian Society, Worcester; Rhode Island Historical Society, Providence; Commissioners of the State Reservation at Niagara, Albany; Academy of Sciences, Dr. J. S. Newberry, Mr. J. Bleecker Miller, Messrs. Ivison, Blakeman & Co., New York; Mr. Franklin Leonard Pope, Elizabeth, N. J.; Academy of Natural Sciences, Mercantile Library, Messrs. Edwin A. Barber, W. C. Blelock, D. G. Brinton, E. D. Cope, Walter M. James, Henry Phillips, Jr., Philadelphia; Maryland Academy of Sciences, Baltimore; U. S. Coast and Geodetic Survey, Fish Commission, Geological Survey, Bureau of Education, Smithsonian Institution, Secretary of War, Dr. Albert S. Gatschet, Hon. Charles O'Neill, Washington, D. C.

Mrs. Jane Rittenhouse Wilson presented a cornelian said to have been formerly worn by Dr. Benjamin Franklin, of which she gave the following account:

Benjamin Franklin, during his attendance at the Convention that adopted the Declaration of Independence, wore a certain watch chain on which was a cornelian charm.

This chain and charm he gave to a personal friend, a veteran of the war of 1812, named Daniel Leman, who gave it to his friend,

MRS. JANE RITTENHOUSE WILSON,

One of the Rittenhouse family.

The following deaths were reported:

M. Louis A. C. Carlier, Paris, March 19, 1890, æt. 87.
Mr. Frederick Graff, Philadelphia, March 30, 1890, æt. 73.

On motion, the President was requested to appoint suitable persons to prepare the usual obituary notices.

A paper on "Fresh Water Infusoria," by Dr. Alfred C. Stokes (Trenton, New Jersey), was presented through the Secretaries.

A paper on the "Asiatic Affinities of the Malay Language," by C. Staniland Wake, was presented by the Secretaries.

Pending nomination No. 1209 and new nominations Nos. 1210, 1211 and 1212 were read.

The Committee on Extended Accommodations presented the following Report:

PHILADELPHIA, April 16, 1890.

The Committee on Extended Accommodations, appointed January 17, would respectfully report,

That they have carefully considered the various propositions referred to them; and after due deliberation, concluded to request from J. M. Wilson, Esq., Architect, plans for the alteration of the present building, such as would render it completely fire-proof, harmonize with its surroundings, and provide for the Society's present needs as well as its prospective ones for a period of at least twenty years to come.

He has submitted the accompanying plans and proposal, the adoption of which we would recommend: and therefore offer the following resolution:

That the Committee on Extended Accommodations be continued and empowered to enter into negotiations for alterations to the present buildings in accordance with the plan now submitted.

W. P. TATHAM,
RICHARD VAUX,
FREDERICK FRALEY,
J. CHESTON MORRIS,
Chairman.

A discussion ensued upon the subject, in which Messrs. Morris, Hays, Baker, Dudley, Vaux, Tatham, Potts and others took part.

Dr. Hays moved that the subject be made the special order for the next stated meeting and that notice thereof be put on the meeting cards.

Mr. Vaux moved that the subject be considered at a special meeting, to be held on next Friday (April 25), and that notice should be placed on the meeting cards, and further that the Librarian should place on the cards the words "the plans can be examined at the rooms of the Society."

Mr. Vaux's motion was carried *nem. con.*

On motion, the Treasurer was authorized and empowered to satisfy a mortgage of William J. Norris for $4000, the same having been paid off.

And the Society was adjourned by the President.

Special Meeting, April 25, 1890.

Present, 27 members.

President, Mr. FRALEY, in the Chair.

No Secretaries being present at the time of calling the meeting to order, Mr. J. Sergeant Price was chosen as Secretary *pro tem.*

The object of the meeting, as ordered at the last meeting of the Society, was announced, and Dr. J. Cheston Morris, Chairman of the Special Committee on Extended Accommodations, made a detailed statement of the changes proposed to the building and exhibited and explained the plans for the same. Mr. Price made a statement in regard to the rights of the Society to the property and read the various Acts of Assembly bearing on the subject.

The resolution from the Committee on Extended Accommodations, submitted at the last meeting (April 18), came up for consideration as follows:

Resolved, That the Committee on Extended Accommodations be continued and empowered to enter into negotiations for alterations to the present building in accordance with the plan now submitted, or such modifications thereof as may be suggested by the Committee or its architect.

After discussion and debate, the resolution was adopted by a vote of 21 to 5, and the yeas and nays being called the vote stood as follows: 21 to 5.

On motion of Mr. Vaux, it was resolved that the Committee be directed to proceed with the business authorized by the Society to be done by it.

And the meeting was adjourned by the President.

Stated Meeting, May 2, 1890.

Present 14 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

The annual program of the R. Academia Nederlandica, *ex legato Hoeufftiano*, for 1891 was presented.

Letters of envoy were received from the K. P. Meteorologisches Institut, Berlin; Mr. Clifford P. MacCalla, Philadelphia; Smithsonian Institution, U. S. Coast and Geodetic Survey, Washington.

A letter of acknowledgment (Transactions xvi, 3) was received from the Geological and Natural History Survey, Ottawa, Canada.

Letters of acknowledgment (129) were received from the K. K. Sternwarte, Prag; Drs. Friederich Müller, Dionys Stur, Edward Suess, Vienna.

Letters of acknowledgment (130) were received from Drs. Friederich S. Krauss, Vienna; Naturforschende Gesellschaft des Osterlandes, Altenburg; Naturhistorische Gesellschaft, Hannover; K. Sächsische Gesellschaft der Wissenschaften, Leipzig; Verein für Vaterländische Naturkunde, Würtemberg; Royal Society, Royal Meteorological, Royal Astronomical Societies, Linnean Society, Society of Antiquaries, London; University Library, Cambridge, England.

The Tokyo Anthropological Society was placed on the exchange list to receive Proceedings from 119.

A letter from Mrs. Harriet Maxwell Converse (New York city, N. Y., April 28, 1890), soliciting subscriptions for a monument to Red Jacket, was read.

The following letter was read:

1325 WALNUT STREET.

TO THE HONORABLE FREDERICK FRALEY, AND THE MEMBERS OF THE AMERICAN PHILOSOPHICAL SOCIETY:

Gentlemen:—I have the honor to offer for your acceptance, the portrait of my brother, the late Henry M. Phillips, formerly a member of your Society, in whose memory The Prize Essay Fund was established.

Very respectfully,

EMILY PHILLIPS.

PHILADELPHIA, May 1, 1890.

On motion, the Society accepted the gift and requested the President to express its thanks for the same.

Accessions to the Library were reported from the Société de la Littérature Finnoise, Helsingfors; Naturforscher-Verein, Riga; Société Malacologique de Belgique, Bruxelles; K. K. Geologische Reichsanstalt, Vienna; K. P. Meteorologische Institut, Physikalische Gesellschaft, Gesellschaft für Anthropologie, Ethnologie, etc., Messrs. M. Friedländer & Sohn, Berlin; K. Gesellschaft der Wissenschaften, Göttingen; Voigtländische Alterthumsforschende Verein, Hohenleuben; Biblioteca N. C. V. E., Rome; The Boletin Meteorológico, Madrid; Public Library, Salem, Mass.; Yale University, New Haven; Engineers' Club, Mr. C. P. MacCalla, Philadelphia; U. S. Coast and Geodetic Survey, Smithsonian Institution, Washington, D. C.; Leander McCormick Observatory, University of Virginia; Mr. William Harden, Savannah; Society of Natural History, Cincinnati; Historical Society, Mr. Philip C. Frieze, Chicago; Iowa Academy of Sciences, Des Moines; University of California, Berkeley; California Academy of Sciences, San Francisco.

The President announced that he had appointed Mr. William P. Tatham to prepare the obituary notice of the late Frederick Graff, and that the appointment had been accepted.

The death of James McClune (Philadelphia, May 1, 1890, æt. 83) was announced.

Dr. Bonwill, through the Secretaries, presented a paper entitled "Geometry and Mechanics Deny Evolution."

Pending nominations Nos. 1209, 1210, 1211 and 1212 were read.

The Committee on the Purchase of the Baird Portrait reported progress and was continued.

And the Society was adjourned by the President.

Stated Meeting, May 16, 1890.

Present, 22 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

Letters of envoy were received from the Observatoire Physique Central, St. Petersburg; Royal Observatory, Greenwich; Literary and Philosophical Society, Liverpool.

Letters of acknowledgment were received from the Institut Egyptien, Cairo (128, 129, 130); Bureau des Longitudes, Paris (126); Library of the University of California, Berkeley (126, 127, 129, 130).

Letters of acknowledgment (130) were received from Societas pro Fauna et Flora Fennica, Prof. Otto Donner, Helsingfors, Finland; Comité Géologique de la Russie, Observatoire Physique Central, Prof. Serge Nikitin, St. Petersburg; K. Zoologisch Genootschap, Amsterdam; K. Zoologisch-Botanisch Genootschap, The Hague; Bataafsch Genootschap der Proefondervindelijke Wijsbegeerte, Rotterdam; Prof. Dr. Japetus Steenstrup, Copenhagen; Société Vaudoise des Sciences Naturelles, Lausanne; K. Bibliothek, Berlin; Verein für Erdkunde, Dresden; Editor of "Cosmos," Mr. A. Des Cloezeaux, Comte Hyacinthe de Charencey, St. Maurice-les-Charencey, Paris; Royal Dublin Society, Dublin; Cambridge Philosophical Society, Cambridge, England; Dr. John Evans-Hemel, Hempstead; Yorkshire Geological and Polytechnic Society, Chevinedge, Halifax, England; Royal Institution, Local Government Board, Dr. Joseph D. Hooker, Sir John Lubbock, London; Mr. Joseph S. Harris, Philadelphia.

Accessions to the Library were reported from the Linnean Society, N. S. Wales; Anthropological Society, Tokyo; Société Impéreale des Naturalistes, Moscow; Physikalische Central-Observatoriums, St. Petersburg; Prof. Hugo von Meltzel, Dr. M. Faths, Kolozsvár, Hungary; Société de Physique, etc., Geneva; Ronsdon Observatory, Devon; Royal Observatory, Greenwich; Literary and Philosophical Society, Liverpool; Rhode Island Historical Society, Providence; Cornell University, Ithaca; Editor of "The Nation," New York; State Librarian of New Jersey, Hopewell; Zoölogical Society, College of Physicians, Franklin Reformatory Home for Inebriates, Mr. Henry Phillips, Jr., Philadelphia; Johns Hopkins University, Baltimore; National Academy of Sciences, Mr. Lester F. Ward, Washington, D. C.; Elisha Mitchell Scientific Society, Raleigh, N. C.; University of Alabama, Tuscaloosa; Prof. James B. Angell, Ann Arbor; Public Library, Peoria, Ill.; Geological Survey of Missouri, Jefferson City; Commissão Geographica Geologica, S. Paulo, Brazil.

Pending nominations Nos. 1209, 1210, 1211 and 1212 were read, spoken to and balloted for.

The proceedings of the Board of Officers and Council were submitted.

The Secretaries reported that the paper presented by Dr. Bonwill at the last meeting of the Society should appear, if at all, in the Transactions and not in the Proceedings.

On motion, the President was authorized to appoint at his leisure a committee of three members to examine and report upon the same.

Prof. Cope made a communication on "The Dinosauria of the Laramie Formation," illustrating the subject with many fossil specimens.

Prof. Ryder presented a paper entitled "On the Origin of Sex through Cumulative Integration and the Relation of Sexuality to the Genesis of Species."

On motion of Mr. Tatham, the Society adopted the following resolutions:

Resolved, 1. That whenever the Committee on Extended Accommodations, charged with the alteration and improvement of the building, shall have perfected the plans and specifications for the same and have had a contract prepared for the execution thereof, the President and Treasurer of the Society shall be and are hereby authorized to execute such contract under the corporate seal of the Society.

Resolved, 2. That said Committee, in conjunction with the Curators and the Committee on the Hall, be authorized to rent a suitable place or places to which to remove the Library, Portraits and other Collections and to have such removals effected in such manner as will secure the property from injury, and to continue the insurance thereon against loss by fire, and also to rent a suitable room in which the Secretary and Librarian can transact the business of the Society until the Hall can be reoccupied.

Resolved, 3. That the Treasurer be authorized to make payments upon the contracts for the alterations and improvements and of other expenses incident to the removal.

Resolved, 4. That the Librarian of the Society be added to the aforesaid Committee as a member thereof.

The following resolutions, offered on behalf of the Trustees of the Building Fund, were adopted:

WHEREAS, The American Philosophical Society, at a meeting held on October 5, 1866, did adopt a preamble and resolution setting forth that it was "expedient for the security of the books and property of the Society there should be erected a fire-proof building," and did thereby also provide for the appointment of Trustees of and the raising of money for a Building Fund and to "continue to invest and reinvest all principal, interest and income of said fund until this Society shall determine to build for itself a fire proof building, and make commencement thereof, and then to pay to the Treasurer of the Society out of the proceeds of such investments such sums as the Society shall from time to time direct to be paid to him for that purpose."

AND WHEREAS, The Society, on April 25, 1890, after having had plans for the alteration of their Hall submitted to them, authorized and empowered their Committee on Extended Accommodations to enter into negotiation for alteration of their present building in accordance with the plans then presented, or such modifications of them as might be suggested by the Committee or its architect.

AND WHEREAS, The said plans have been so modified by the Committee as to make said Hall a fire-proof building; therefore, be it

Resolved, That the Trustees of the Building Fund of the American Philosophical Society be directed to pay to the Treasurer of the Society out of the proceeds of the investment held by them such sums as will be necessary to pay for the addition and improvement to the present Hall of the Society, so as to make it a fire-proof building.

Resolved, That the Trustees of the Building Fund of the American Philosophical Society are hereby authorized and directed to sell and dispose of the City Loans and other securities held by them, and to make and execute the necessary transfers and assignments thereof so as to vest in the purchasers a full title to said securities.

The Committee on the Franklin Centennial Commemoration reported that it had duly taken place, and presented bills amounting to $258.93, which were ordered to be paid, and on motion the Committee was discharged.

The Special Committee on the Purchase of the Baird Portrait reported progress and was continued.

The Society adopted the following resolution reported from Council:

Resolved, That hereafter 250 copies of "separata" of papers published in the Proceedings be furnished to the author if requested by him, and that Council recommends that the Society should request the Secretaries to inquire how far it would be practicable in the present state of its finances to adopt a resolution to issue the Proceedings more frequently than at present.

All other business having been finished, the Tellers counted the ballots cast for the respective candidates and reported the result to the President, who declared the following to have been duly elected to membership in the Society:

2179. Prof. George S. Fullerton, Philadelphia.

2180. Robert Patterson Field, Philadelphia.

2181. Rev. Heman L. Wayland, D.D., Philadelphia.

2182. Charles Godfrey Leland, London.

And the Society was adjourned by the President.

The Origin of Sex through Cumulative Integration, and the Relation of Sexuality to the Genesis of Species.

By John A. Ryder.

(Read before the American Philosophical Society, May 16, 1890.)

General Considerations.

A careful survey of the living world leads to the conclusion that sexuality has been, in all probability, one of the many results of the operation of the forces of evolution. A further examination of the evidence discloses the fact that sexuality has arisen very gradually and only through an extensive series of very gentle progressive and successive steps. These steps seem to have had a definite sequence and to have been accompanied by such a gradual complication of means, that it seems highly probable, indeed certain, that in many instances, a given higher grade of sexuality has grown out of the preceding one. This serial superimposition of means to serve apparently more advantageous ends proceeds according to fixed rules or laws, apparently determined by the already attained structural complication and physiological activities of organisms, and in conformity with the controlling conditions offered by their surroundings.

A still further examination of the data of sexuality leads to the conclusion that the methods of it which may be observed in the vegetable and animal worlds have proceeded along two parallel but distinct lines of progress. Both have ended in the achievement of the same result, namely, viviparity or the production of offspring in an advanced state of development, before the latter is set free from the parent to begin an independent existence for itself. An acorn is as truly a product of viviparous development as an infant human being. The elaborate process of organic evolution through which it has been possible to develop the one, is just as wonderful as in the case of the other.

The end-result of the achievement of viviparity has been to enable forms so produced to survive with far more certainty, and to begin their struggle for existence with a greater chance of success than if the complex series of processes of germ-development, in these cases, had to proceed to the same stage without the elaborate means of protection afforded by the parent. This is so obvious that it seems hardly necessary to call attention to the significance of the gradual complication of sexual processes. Yet, as one finds the subject usually dealt with, sexuality seems to be regarded, by the majority of writers, as an ultimate fact, and as such, incapable of interpretation in more general terms.

That sexuality has an important bearing upon some of the most important questions in evolution, no thoughtful biologist would probably doubt. Notwithstanding this, there have been few serious attempts made to grapple with the problem of "sex." Many of the attempts which have been made have failed because of the way in which the fundamental question, sex itself, was ignored. Most of the speculations in relation to sex have been content with determining the effects of self and cross-fertilization, and have accordingly dealt with some of the consequences of already achieved sexuality, but have thrown no light whatever upon the probable origin of sex itself.

Without questioning the high value of the results of such experimental investigations, the question of the origin of sex is probably nearly or quite beyond the pale of experimental inquiry, in virtue of the fact that even the lowest organisms in which sexuality is manifested, are already so persistently adapted to a certain habit of life, and are consequently so fixed in organization that experimental investigation looking to a modification of their reproductive processes through artificial interference is quite impossible within the limits of a single life-time devoted to experimental research. We shall accordingly have to examine the phenomena of sexuality as we find them, and upon careful analysis and comparison try to reach such conclusions as seem to be warranted by the evidence.

Since sexuality leads to processes of discontinuous growth in the production of new beings or offspring, it is of the utmost importance that this very important fact should be kept in mind from the start. That it has a significance there can be no doubt, when considered in connection with the manner in which germs are produced in the various types. The manner in which such discontinuity is effected varies within wide limits and is associated with other preliminary processes, such as the formation of fixed colonies of animal organisms and the multiplication of axes or branches in the vegetable kingdom. One of these two processes is, in fact, usually the prelude to the occurrence of the process of the dehiscence of the definitive sexual elements in a great variety of forms.

When the one process, namely, that of continuous growth of the parent organism, ceases, the reproductive process seems to recur, so that sexual genesis and growth seem to be opposed to each other, as has often been pointed out. The impossibility of otherwise adding or integrating more tissue through the incorporation of more nutriment to a structure already finished, or fully developed, at least for the time being, leads apparently to the recurrence of sexuality. The expression of sexuality is accordingly largely, if not wholly, dependent upon nutrition, and it is from this fundamental standpoint that it will be dealt with here.

It will be equally important to consider the peculiar characteristics of sexual cells. In almost all biological works it is asserted that the germ-cells of multicellular forms are in all respects, at first, morphologically identical with the other undifferentiated cells of the parent body. While this statement is true of the young germ-cells, it is untrue of nearly all mature germ-cells. The latter, in their mature condition, present us with form-elements, either of a size greatly in excess of those of the rest of the body or others which are, invariably within the limits of the animal kingdom at least, smaller than any of the cells of the parent organism. The significance of this fact must also be constantly borne in mind, as well as the equally important one respecting the usual morphological equivalence of myriads of the smaller or male germ-cells and a single large or female germ-cell, in the majority of higher forms.

This frequent, indeed usual, lack of equivalence of the male and female reproductive bodies has been almost entirely ignored by many authors, and has led, as the present writer is convinced, to erroneous interpretations of some of the most important phenomena of subsequent development. The peculiar function of growth of the female cell and its specialized method of segmentation, after the initiation of development, has apparently contained little of significance for the great majority of biologists. Segmentation of the oösperm, as the fertilized egg is termed, is a matter of course with the majority of embryologists, whose work begins with the institution of segmentation and not with any apparent anxiety as to the origin or cause of the thing which segments, and which does little else for a considerable space of time. While the high value of the work done through careful embryological research is to be properly appreciated and is so appreciated by no one more than by the present writer, I believe that embryological teaching and investigation should begin with a consideration of the probable causes which have led to the production of the fully developed and united elements which are usually the subject of the embryologist's study.

The universal occurrence of sexuality amongst all plants and animals, except amongst the very lowest forms, is surely evidence enough, if any were needed, that somehow sex must have been a most important factor in biological development. To say that sexuality was developed solely for the purpose of inducing variability or of favoring fertility and vigor through crossing does not suffice in the face of the evidence presently to be offered. When the defenders of the view, that sexuality was developed in order to favor variability and cross-fertilization, are asked to give any probable reason for the origin of sexuality, the causes alleged are such as have seemed, to the present writer at least, so unsatisfactory that they are hardly worth serious attention.

What, then, was the origin and meaning of sexuality? What were some of the causes which may be reasonably supposed to have been operative in inducing sexual differentiation? Was sexuality differentiated for any purpose, or was its development merely the result of the operation of natural causes? These are some of the questions that the present writer has set before himself to answer, with such light as may be derived from the facts in the present state of our knowledge.

The value of this attempt at an approximation to an answer to these questions must be determined by the judgment of those most competent to form an opinion and the value of the results as a working hypothesis in the hands of such persons.

If, as the writer believes, sexuality has been the means through which morphological complexes or organisms of all sorts, animal and vegetable, have been built up, that alone would be a sufficient reason for a renewed discussion of the subject. If, moreover, the evolution of sexuality, through natural causes, has not only been one of the most important agents in evolution of all the multicellular types past and present, but also the means through which the first possibilities of individual variability, fertility and morphological capability were greatly augmented, it is exceedingly desirable that the evidence upon which such claims are based, should be presented. Finally, if sexuality has led to consequences as far-reaching as these, it is also obvious that its claim to consideration, as a factor in biological evolution, is, perhaps, quite as great as that of the principle of natural selection, to the elucidation and demonstration of which Darwin devoted the best years of his life with a singleness of purpose which has been rarely equaled.

That so strongly expressed a characteristic as sexuality, in both the animal and vegetable kingdoms, should have been developed for mere reproduction, is completely disproved by the data of sexuality themselves. It is clear that sexuality becomes more specialized with the progress of the structural complication of organisms, yet external influences may lead to the suppression of fully developed sexuality. It has been most conclusively proved, that if a species is artificially cared for, in a word, cultivated, as in the case of plants, it may be indefinitely reproduced by means other than those of sexuality. It is even probable that partial or complete sterility has been so induced in not a few plants cultivated for their fruits. The only remaining effect, if effect it can be called, is the impotent fructification of the ovules, whereby the fleshy esculent mesocarp of the ovary or fruit is stimulated to growth and development, for which alone the plant is valued by its cultivator, man. But, so far as I am aware, it has not yet been even proved that such fertilization is necessary.

If parthenogenesis can and does occur in *Cœlobogyne* and in *Saprolegnia*, there is no reason why, even in highly developed monocotyledons, such as the astonishingly productive Banana, in spite of its sterility, should produce indefinitely, through a kind of abortive parthenogenesis and as a result of its great vigor, its succulent but seedless fruits.

If the progressive differentiation or the gradually more intensified expression of sexuality means anything at all, in both plants and animals, beyond providing for mere reproduction, it must mean something of far more utility to species than to provide for variability alone. If the gradual acquirement of viviparity in both animals and plants has any significance, it includes not only a provision for variability, but also achieves the far more important end of providing greatly increased chances for the survival of the thus protected germs or viviparously produced young.

That the young of such forms are more susceptible to the altering influences of outer conditions than the adult is conspicuously established by the evidence drawn from comparatively complex forms. It is well known that the normal alga-like, filiform protonema of *Sphagnum* may, in some cases, become a flat thallus if grown upon a solid, moist substratum. And doubtless, corresponding modifications may be otherwise induced in the further development of its sexual offspring, but of this I know of no direct proof.

That it should have been assumed that sexuality provides for variability is not strange. If one considers the problem of variability from morphological and physiological points of view, the evidence is wholly in favor of the conclusion that increased complexity would favor variability. That sexuality has increased the complication of its attendant processes there cannot be the slightest doubt. If the results have become more complex as viviparously developed germs were evolved, not only would the capacity of those germs to vary be increased in virtue merely of such increased complexity, but the offspring of two parent individuals, differing even very slightly, would also have to be added as a factor favorable to variation.

Unfavorable to some forms of the doctrine of rejuvenescence or that view which regards sexuality as a means of rejuvenating certain cells by means of conjugation or the act of fertilization, are the facts which prove that, in the vegetable world at least, growth may go on indefinitely without the recurrence of sexuality, and with increased, rather than with diminished, vigor. I need only to cite the Banana which has been asexually propagated by cuttings for centuries. The significant and persistent vigor through twenty centuries of a Dracæna, or Dragon's blood tree, is also of interest in this connection. The persistent growth of the asexual generations of tree ferns in the present age and of the gigantic Lepidodendrons and Equisetums of the carboniferous period, shows that conditions of life have much to do in maintaining the vigor of such asexual generations.

Senility, or impairment of vigor, does not then seem to result from continued growth, as is shown by these facts, and this conclusion is equally well established by the facts which are known in relation to the reproduction of the Cyanophyceæ, Schizomycetes and the yeast plant.

This unimpaired vigor seems to be associated with the continuous production of new axes in the higher plants, or with continuous fission of cell-units in the lower ones. In animals, on the other hand, this vigor shows itself most pronounced in the colonial forms (cormi), or in such as are specially nourished, as the Queen Bee or ant-queen of Termites, amongst Anthropods, and amongst which these animals are also the longest lived, and where it finds expression partly, at least, in parthenogenesis. The astonishing vigor of the fertile parents of these forms is largely determined by their abundant nutriment.

The genesis of sexuality, upon final analysis, will probably be found to be a purely physiological question, in the discussion of which the energies represented by the cytoplasm of the egg on the one hand, and its nucleus and that of the spermatozoan on the other, will have to be considered. This will, however, represent only the germinal or embryological side of the problem, which takes no cognizance of the preëmbryonic history of the germinal elements before the latter are set free from the parent. The attempt to formulate the laws of sexuality without examining into the preëmbryonic history of the germinal elements must necessarily end in failure and disappointment. The generative forces at work within the parent organisms are nicely adjusted, or in a state of equilibrium with those which are concerned in the conduct of the ordinary physiological activities of the parent body. It is, therefore, imperatively necessary to consider the question of sex not simply as one involving embryological data, but rather as embracing the sum total of physiological energies of the parent organisms, and where the sexes are separate these energies must be considered as represented in the species by the sexually differentiated individuals composing the latter.

It will be obvious to those who have kept pace with the growth of physical science, that sexuality may be thus brought more nearly within the dominion of purely physical laws. In other words, sexuality is a question involving the discussion of matter and its energy of motion, and should be so treated if it is expected to reach conclusions which are in harmony with the genius of modern science.

That such a project may be accomplished in the present state of our knowledge may well be doubted, yet there is ample reason to warrant making an attempt to clear the ground for further work in that direction.

The attempt to trace the ways in which one form of reproduction gave place to a more complex one in the next higher type is beyond the scope of the present paper. To consider this question adequately would require a far more extensive acquaintance with the facts than is possible at present. In plants it would require a consideration of the modifying effect of the evolution of a mechanical supporting system and the correlative modifications which this must have induced in the sexual processes, since the evolution of powerful supporting axes, which were capable of indefinite growth, dichotomy, and consequent multiplication of fertile apical axes enabled the plant to multiply the possibilities of the production of male and female prothalli, or of protected and attached macrospores and dehiscent microspores. Not only this, but aërial currents would now become available, as the plants become taller, in carrying the microspores, or male prothalli, as pollen grains, from one flower to another. Finally, this was supplemented by flying insects, which, it is fair to assume, first began to visit the plants for the sake of their microspores or pollen as food. Later, as these insects began to set up irritations in the flowers, there is reason to think that the surfaces which they habitually abraded would, if wetted with saccharine solutions regurgitated by such visitants, begin to pour out additional nectar or saccharine matters in obedience to well-known rules of ormotic action. That such a result would happen is, at any rate, strongly indicated by the experimental results obtained by my colleague, Prof. W. P. Wilson, in wetting abraded surfaces of leaves with saccharine solutions. The elaboration of sweets so begun would be a stimulus, causing the insect world to become still more interested in the flowers, and such may have been the further effect of the new diet upon insect life as to be directly responsible for the evolution of those wonderful insect communities developed amongst the honey-loving hymenoptera or bees. The further consequences of entomophilous traits developed by plants must react in other ways, probably through epinasty and hyponasty, in modifying the shapes of flowers, while protandry, a natural consequence of the earlier maturation of the andrœcium, as a lower whorl of the flower, would eventually tend to establish cross-fertilization, through insect agency, as an imperative necessity, and not wholly, perhaps, because cross-fertilization meant the production of a more vigorous offspring.

The gradual evolution of sexuality by slow stages in plants is now so well understood, that it is not necessary to enter into the details which may be found in any standard botanical text-book. It is sufficient to indicate that the transition from asexuality to female macrogonidia and male microgonidia is effected by mere differentiation of cells as respects their size. From naked oöspores to carpospores is the next step, with microscopic flagellate male elements. Finally, the prothallus appears, first, with both oöspheres and antherozoids; then the prothalli themselves become distinguished as small male and large female ones; then the female prothallus is no longer at once detached, but becomes covered in, while the minute male prothallus still dehisces, but finally becomes partially parasitic upon the stigma where it vegetates and throws out a hollow process, which serves to convey the now highly modified antherozoid to the ovicell. The prolonged adherence of the female prothallus to the parent axis enables the next important step to be taken in the evolution of the seed containing a viviparously produced embryo provided with a store of nutriment and protective envelopes.

In this way the superimposition of more and more successful means of reproduction seems to have occurred in plants, tending also to secure the final victory of the phanerogams over all other rivals in the struggle for existence, largely through the evolution of viviparity as supposed above. How much of this success was due to the principle of overgrowth or cumulative integration, which made rapid, continuous assimilation and growth possible through the evolution of a mechanical supporting system, is hard to tell, but it doubtless was quite as important a factor as natural selection itself.

Similar conclusions are borne in upon the zoölogist in a study of the reproductive processes in the animal world. From asexual fragmentation and consequent multiplication, the advance to larger and smaller, or female and male elements, was a gradual one, with or without hermaphroditism. Then came hermaphroditism with large female and small male germs, then maleness and femaleness, as characterizing distinct individuals of the same species. Finally, protective processes were developed, accompanied by ovulation, followed by parental care, such as incubation, nidification, gestation with or without placentation, and at last, in the highest forms, lactation was developed.

These processes seem to have grown up as if superimposed upon each other, just as it can be shown that the progress of embryological ontogenetic development has followed as a consequence of the superimposition of one morphological complication upon the immediately preceding one, and often as a consequence of direct adaptation. Similarly, the inclusion of the germ tracts, as morphological advances shut off the gut-pouches from the archenteron, became more decided. The complexity of the outlets for the reproductive products, at first by way of the nephridia, as these were fused into a serially connected system, became more marked, the sexual products were now discharged through the passages serving also for the emission of the urinary secretion. Finally, this passage became divided lengthwise, so as to serve for the separate discharge of the urinary and sexual products, until at last the lower end of the reproductive channel became modified into a brood chamber or uterus for the viviparous development of the young, accompanied with sexual intercourse, now rendered possible by the further modification of the extreme outer portions of the reproductive passages and the parts immediately adjacent to them.

Pari passu with the higher development of the reproductive processes the fertility of the female became absolutely reduced, partly in consequence of the precocious overgrowth of the female germs through a primary suppression of the tendency to spontaneous segmentation of such germs, as will be more fully illustrated later. This reduction in the fertility of the female gonads is also doubtless correlated with the increased chances of the survival of the offspring produced by the more protective methods of reproduction, while the material diverted from ovogenesis, to carry on the formation of secondary egg-envelopes, incubation, nidification, gestation, placentation, lactation and other parental care, also reacts directly upon fertility, while the great lengthening of the period of fœtal and infantile development, tends to still further reduce the possibilities of rapid reproduction. The recurrence of the seasons tends to make the reproductive periods annual in all forms except the lowest asexual, and the highest form, man, who lives under approximately uniform artificial conditions of his own creating. There is, therefore, a widespread tendency toward a reduction of the fertility of most forms below what it would be if there existed uniformly favorable conditions throughout the year, due solely to the recurrence of unfavorable annual periods.

The fertility of the male, or rather his functional activity, may be affected in a corresponding manner by the seasons, but the absolute fertility of the male as compared to the number of germs produced is invariably greater than that of the female, usually by many thousand-fold. This greater male fertility depends upon the minute size and rapid production of male elements through the breaking down of protova—spermatogonia—and the rapid integration of chromatin or nucleoplasm as will be shown later. Such a rapid and abundant production of male elements may be one of the causes leading to the persistent pursuit of the female by the male, and one of the causes of the genesis of sexual passion as interpreted farther on. Sexual passion, which accompanies the highest forms of reproduction, finally becomes functional in this intricate series of superimposed processes as a means tending to maintain the fertility of all the females of a species at its highest point of efficiency, and thus reacts as an aid in the survival of species. The superabundant fertility of the male renders the possibility of the conjugation of the male and female elements more certain, under the favor of the various devices which have been evolved to effect that process, and thus again be the means of assuring reproduction and the survival of the species.

The necessary correlation of the male and female is probably secondary. In my view, that the flagellate forms are the oldest, since they are certainly the simplest and minutest, the male element represents, morphologically, a perpetuation of the most primitive form of organized existence. Through cumulative integration the germ elements, which would otherwise have tended to break down into flagellate germs, have, on the contrary, been impelled to grow to large dimensions as ova, through the rapid access of nutriment to them, which probably prevented their cytoplasm from having time to elaborate nucleoplasm and chromatin, and thus become male in character. The male element is certainly the most ancient, the female is a secondary and later product of evolution. The correlation of the male and female was, therefore, secondary; the male elements represent, morphologically, the primordial asexual type. The primitive representative of the male element was at one time "maternal," through simple fission and a capacity for growth; it became "paternal" through conjugation. Sexuality was the outcome of the unequal growth of germ-cells of the same species, induced by the self-regulative influences exerted by internal physiological conditions operating under the influence of varying external conditions. The determination of the sex of an embyro has depended in some way upon a tendency, early established through some internal equilibration of the forces of growth, in response to outer conditions of nutrition, etc. There is no conclusive evidence tending to show that the sex of an embryo is predetermined in the egg; on the contrary, much evidence exists tending to show that the sex of an embryo may be influenced by an increase or diminution of the supply of food.

It is a curious circumstance to note that many writers on sex seem to have failed to see that the sexual cells of multicellular forms were functionless, in that they exercise no physiological function which is essential to the life of the parent organism. In that such functionless cells could not disintegrate their substance through the active metabolism which obtained in respect to all the other cells of the body, in consequence of the action of the principle of cumulative integration or assimilation beyond the current physiological needs of the body, they must either increase enormously in size and become ova, or run down as a result of rapid karyokinesis into minute male elements which are rapidly dehisced and set free. It is this exemption of the germ-cells from the disintegrating effects of active or functional metabolism which has given the first impulse to the accumulation of yolk and the overgrowth of the spermatogonia, ending in the production of the ovum and the essentially female condition. The apical position in many plants of the female germ is significant in this connection, no less than the fact observed by Mr. Meehan, that in conifers the female flowers are produced at the apex of the tree and by the most vigorous shoots.

The Origin of Karyokinesis, the Significance of the Polar Bodies, Variability, Sexual Passion and Sex in Relation to the Genesis of Species.

It is a remarkable fact that in the lowest forms of life no evidence of karyokinetic changes has ever been noticed. Spores are produced within the body of the parent individual by the direct fragmentation of the slightly more chromatophilous or deeply staining portion of the parent plasma that fills nearly the whole of the latter, so that it is still not possible to speak of a nucleus in contradistinction to a cell-body of cytoplasm in these organisms. These facts tend to show that in such very low forms there is still a want of mobility of the plasma itself as well as a lack of differentiation into nuclear and cytoplasmic matter.* Is or is not the want of a differentiation of cytoplasm associated with the absence of karyokinetic phenomena? There is much reason to assume that it is from the consideration of a great variety of facts, mainly those observed in the earlier stages of development of higher sexually produced forms.

The main argument in favor of such a view is the circumstance which has fallen under the eyes of every investigator, that the karyokinetic phenomena are most pronounced in the earlier stages and on a larger scale than in the later stages when the cells become smaller. This is either associated with a larger proportional amount of cytoplasm or it is independent of it. So far as observation has extended, the facts of early segmentation tend to favor the first alternative of the foregoing proposition. Another body of facts is equally favorable to such an interpretation, namely, that of spermatogenesis. It is true that many forms of spermatogenesis are known where karyokinesis is maintained up to the time that the spermatic elements are beginning to form, but there are many other cases known where this is not the case and where during the later stages of spermatogenesis leading to the fragmentation of the spermatogonia there is no evidence of accompanying karyokinesis. These facts tend to show that, with the gradual diminution of the amount of investing cyto-

* De Bary, in his Lectures on Bacteria, affirms that a nucleus is wanting in the Schizomycetes, and the only case where these forms have been known to exhibit amœboid movements, so as to throw out processes, is that described by Prof. Samuel G. Dickson, of this city; at least I have been unable to find any other instances of the kind described. There appears to be little cytoplasm in these forms, so that these organisms correspond mainly to the nuclei of the cells of higher types.

plasm, the process of karyokinesis or movement of the fragments of chromatin is finally restricted to such an extent, from the want of a cytoplasmic field, that nuclear movement is at last rendered impossible.

Much as the lengthening of the spermatozoön resembles a diastolic phase of karyokinesis, there is no evidence that the elongation of the male element preparatory to being set free, can be identified in any case with such a final karyokinetic diastolic phase. If this were so it might be supposed that the momentum of karyokinesis, in this case, had reached a potential state or condition of tension ready to exhibit itself as segmentation, as soon as there was a large enough cytoplasmic field, as in the cytoplasm of the egg, in which the opposite condition of systole could occur, and thus bring back the nucleus to a condition of equilibrium.

While the foregoing conclusion cannot be assumed, it may be assumed that the male cells, in undergoing their rapid multiplication, do acquire a certain karyokinetic momentum predisposing them to set up segmentation in other functionless plasmic bodies—ova—which they may enter. Yet, as we have seen, karyokinesis is not always an accompaniment of spermatogenesis, a condition which may arise, as supposed above, from the gradual diminution of the cytoplasmic field.

The method of evolution of spermatozoa is not uniform in all cases. In *Ostrea edulis* there are rarely individuals in which spermatogenesis approximates that of *O. virginica*. Then, rarely, intermediate forms occur between this and the normal form, where large masses of chromatin are formed by direct elaboration from the nuclei of elements which cannot be regarded as other than ova. In the latter case the metabolism which leads to the development of spermatozoa is clearly carried a step further than in ovogenesis, because the huge masses of chromatin imbedded in the ova from which the nuclei of the spermatozoa are formed are very certainly developed *after* the stage is reached which answers to that of the mature ovum. The male condition is reached therefore in this last case after the female, and is an outgrowth of the latter consequent upon the development of large masses of chromatin in the egg and its direct fragmentation into the nuclei of spermatozoa. In those cases where the spermatozoa are developed more directly from smaller cells which never reach the dimensions of ova, we have a totally different case, and one which indicates a protandrous tendency. The other case where the male condition depends upon the previous development of a fully differentiated female state of the germ-cells obviously corresponds to a protogynous condition.

The formation of chromatin in the last case does not proceed as a result of metabolism and growth following a rapid series of karyokineses alternating with periods of rest, but follows the formation of a female nucleus in which a rapid endogenous formation of chromatin first occurs, followed, as it increases in bulk, by the extrusion of the chromatin from the parent nucleus into the surrounding cytoplasm, where it breaks up into small masses which are later separated in large groups as the nuclear basis of large coherent clumps of spermatozoa.

Clearly, then, the amount of chromatin in relation to the amount of cytoplasm varies all the way from an almost inappreciable quantity in the nucleus of the true egg to a very great quantity in proportion to the cytoplasm in the egg which produces a large quantity of chromatin from its nucleus to provide the material for the nuclei of the multitudes of spermatozoa to which such an egg gives rise.

Maleness, therefore, in the case of *Ostrea edulis* is certainly, and probably in all other forms, a condition where the chromatin preponderates over the amount of cytoplasm, while, conversely, femaleness is characterized by the preponderance of cytoplasm over chromatin or nuclear matter ; that is to say in the sexual elements only.

Such a preponderance is not simply relative, it is absolute as respects the one or the other of the primary germ-constituents. It is also a fact that the amount of chromatin or nucleoplasm in an egg-nucleus, when nearly mature, is in excess, as expressed in volumes, by at least four times that of the chromatin contained in the mature male element of the same species. Does this last fact signify anything in reference to the expulsion of the polar bodies? It probably does if the interpretation of the polar bodies presently to be offered is true. And that that interpretation probably is true or more nearly true than any other yet offered, will become clearer as we proceed, since it imports nothing into the discussion of the data which is not in conformity with the facts of continuous growth or which must be brought in in order to save previously suggested hypothesis. It postulates only continuous growth under the condition of an excess of nutrition beyond that required in the secular exhibition of the physiological activities of living forms. It supposes that this excess is somehow influenced in one of two ways, that is, it is either preponderatingly converted into chromatin or preponderatingly into cytoplasm.

If mainly into cytoplasm, the process may go on until the cytoplasm itself may tend to run down chemically into the more stable conditions of oils, or yolk granules and tablets consisting of simpler molecular units. This last process may go on until an enormous yolk is developed which is composed of inert or immobile nutritive matters, while the active cytoplasm itself may become small in amount and reduced to a relatively small volume.* Such a process never occurs in the male. Here karyokinetic processes keep the upper hand (not necessarily katabolic ones, or those leading to destructive metabolism), and the result is that the male element tends to be reduced in dimensions with no katabolically simplified contents, such as are met with in many eggs, but, on the contrary, consisting mainly of plasma in a highly anabolic condition as chromatin.

How these differences on the sexual elements are produced is not known, but it is certain that they must be produced by the action of the physio-

*This is so clearly in its general features a katabolic process, that it is impossible to see how Geddes and Thomson can reconcile this with their hypothesis that the egg is anabolic, while the male element is essentially katabolic (see their work, "The Evolution of Sex," New York, 1890.)

logical activities of the parent organism modified or swayed toward maleness or femaleness, through some series of correlated influences which are self-regulated in some way through nutrition, in the struggle of the parts of the parent organism with each other for their allotment of nutriment.

So far, the evidence tends to indicate that the egg is a repressed condition of maleness. That is, the high anabolic condition of the male element is the consequence of unimpeded growth resulting in rapid segmentation, while the female element is in some respects katabolic with an unimpeded growth of its cytoplasmic constituents accompanied by a repression of the capacity for segmentation.

The peculiar conditions of growth of the egg, and its usual trait of great size, constitute probably the real essence of the meaning of sex. as a means of favoring, in an increased ratio, the survival of offspring.

The preponderance in the actual volume of the chromatin of the egg, over that of the spermatozoön, expresses a physiological differentiation not reached by the latter so much more quickly matured. This might be due to the fact that the cytoplasm in the male element is smaller in amount than that of the egg, and may be coördinated or physiologically controlled by less chromatin. On such a basis the hypothesis of Minot and Balfour might be rehabilitated in part, but not on the erroneous basis of sexuality as they supposed, but upon the far more significant one of physiological differentiation or division of labor.

Maleness is characterized, in the male element, by the absence of a cytoplasmic field in which nuclear motion or karyokinesis can occur. With this in the male element goes an inability, after sexuality is fully established, to maintain further nutrition and growth without the help of the female element.

Femaleness, on the other hand, is characterized by the presence of an enormous cytoplasmic field in the midst of which there is placed a large nuclear body containing proportionally to its envelope of cytoplasm a very small amount of chromatin. Such a germ is incapable, except under the antecedent stimulus of exceedingly vigorous processes of growth, as in the case of parthenogenesis, of spontaneously beginning and maintaining an orderly process of karyokinetic movement leading to further metabolism growth and development, unless "fertilized" or fused with the male element.

The tendency in the male cell is towards a preponderance of chromatin, in the female cell towards a preponderance of cytoplasm. The elaboration of the chromatin in the male clearly takes place in some cases at the expense of cytoplasm ; the elaboration of cytoplasm in the female is possibly at the expense of chromatin, and certainly at the expense of the prolonged exercise of the function of the latter as an essential part of the egg nucleus.

These processes in the two sexes admit of further contrasts. The cytoplasm is mobile and amœboid and the immediate instrument of intussusception of new material. The chromatin, on the other hand, while appearing to centrally control this process, is never immediately, but only mediately involved in its execution. No cases are recorded where the chromatin shares directly or immediately in the process of digestion or intussusception of new matter, except possibly the Bacteria or Schizomycetes.

The female cell previous to final maturity has been involved in the accumulation of the cytoplasm ; in this process its chromatin has been indirectly involved and has increased in volume proportionally. This same fact is illustrated in the increased dimensions and complexity of the nucleus as growth in cytoplasmic dimensions increases in even such simple forms as *Amœba,* as may be clearly seen in Leidy's monograph upon the Rhizopods of North America, where the changes in the relative proportions and arrangement of these substances are fully illustrated in the progress from the young to the adolescent stages.

There is therefore ground for the belief that there is a certain minimal proportion of chromatin necessary for every cell which is necessary to maintain its physiological integrity. In the egg cell the chromatin must share in the constructive metabolism involved in the prolonged growth necessary to mature the ovum. It is not improbable that this function of sharing in constructive metabolism and not in that of karyokinesis has rendered the egg incapable of spontaneous segmentation, unless it be the product of a tremendous energy of growth and conditions of assimilation, as in the case of parthenogenetic ova.

Not only the chromatin, but also the whole of the rest of the nucleoplasm of the egg, is probably, like that of any other physiological differentiated cell of the parent body thus rendered in most cases incapable of undergoing immediately the spontaneous changes necessary to cause the beginning of development.

The equilibration of forces leading to the growth of male and female elements, respectively, in the parent organism is in some way self-adjusted or self-regulated. It is probably true that in many cases there is good reason to assume that the eggs are more favorably situated in reference to supplies of nutriment than the spermatogonia, or conditions subsist which tend to repress spermatogonial segmentation.

Such a view may be fortified with a great host of facts drawn from the relations of the male and female reproductive organs, in many forms, to the sources of nutriment. In many cases the ovaries are clearly in a more direct and favorable relation to the sources of supply of nutriment than the testes, as in many Bryozoa, for example. Or the source of supply of nutriment for the reproductive organs is more remote for the testes than it is for the ovaries, as is actually the case in many forms, notably a large proportion of mammals where a *descensus testiculorum* supervenes. Or, in other cases, the surplus nutritive matters are competed for within the organism by structures which are usually described as belonging to the category of the secondary sexual characters. Or, in another very large class of data, we have evidence tending to show that the ovum is placed under conditions of growth, or is encapsuled within a porous basement membrane—the zona radiata—so as to favor from every point on its surface its cumulative growth in bulk, rather than its cleavage or segmentation within the parent, which would end in its breaking up into male elements. The male elements, on the other hand, are not encapsuled, at least in a very large proportion of cases, and are free to grow in another way without an intracapsular repression of karyokinetic processes. It would be an easy matter to cite multitudes of facts in support of the argument here offered, though I am aware that strong counter-arguments might be produced, yet I do not believe that they are anything like as weighty as the affirmative evidence.

Again, all the facts tend to prove that the recurrence of male forms in parthenogenetic types is associated with a decrease of the supply of nutriment and a slight lowering of temperature.

How do these facts comport with the data in our possession respecting the manner of development of the characteristic male plasma or chromatin? We find that after a certain limit of size has been attained by the egg or spermatogonium in *Ostrea edulis* that the evolution of chromatin begins and with this process the production and freeing of spermatozoa. It looks as if the chromatin or characteristically male plasma required a longer time for its elaboration than the cytoplasm, which is in consonance with fact. In other words chromatin can be formed only from previously elaborated cytoplasm, and the latter when its sources of nutriment are cut off or diminished tends, in virtue of its freedom from any functional duty in the parent body to be built up into a still more complex molecular form, as chromatin. Or the struggle of cells in the gonads for nutriment may tend towards the male condition provided all take part, and spermatozoa result; if only a few take part in the struggle, under encapsuled or other conditions unfavorable to the elaboration of chromatin and karyokinesis, the female or large celled type of germ is formed.

That something of this nature must occur is evident if we contemplate the problem from the purely morphological side, but with the physiological aspect of the matter still in view. The chromatin is primitively the most central element of the plasmic contents of the cell. It is the most homogeneous of all cell contents; it is least like an emulsion of any of the cellular constituents. In that it is the most distantly removed from the periphery of all the cell-contents and the latest to appear when developed in great quantity from the nuclei of egg-like spermatogonia, it is the highest and latest product of cellular metabolism. It is therefore clear that the element of time is to be considered, and that chromatin or the most characteristic plasmic basis of the male element is the end-product of the untrammeled exhibition of the energies of functionless or sexual protoplasm. It is upon this ground that it is safe to assume that the male element is the primary one and that the female element is secondary and has arisen through a repression of the processes which lead to the metamorphosis of cytoplasm into chromatin. The male state is therefore the oldest; the female the youngest. The male state also as represented in the spermatic body tends to revert to the most ancient form of all free mobile organisms, namely, the flagellate Schizomycetes. The tendency towards maleness is therefore also to be identified with a universal tendency of all organisms to recapitulate the most ancient and primitive of living conditions when organisms existed only in watery or fluid media. The further generalizations that all organisms tend to recapitulate the primæval monadiform condition is also fully justified, and that the really primordial type of the germs of all living forms is a flagellate cell and not an ovum. This will become clearer, as it will be later shown that the ovum is secondary and is really a germ which has been arrested in its attempt to reach the flagellate condition, and that the polar bodies are merely the expression of an expiring tendency in the egg to revert to the male or primæval flagellate condition.

The genesis of sexuality itself is merely incidental to the continuous processes of growth manifested by all living forms. It is an outgrowth of self-regulated processes of nutrition and of the repulsion of accumulations of surplus nutriment to parts of the organization of multicellular forms where it is not in the way of the other physiological activities. This is the real significance and origin of the process of the isolation of germinal matter. It is not a "device" or an "expedient" specially contrived for the preservation of the immortality of "germ-plasma," which was not first "set aside" in Metazoa, as held by Weismann, but which began to be pushed aside and out of the way in Protozoa, as many facts show even as low down in the scale as Amœba, thus placing Lendl's criticisms of Weismann upon the basis of fact.*

We have seen that the female and male germs can be actually contrasted only on the ground that they are constituted of two kinds of plasma in different proportions. We have also seen that the chromatin presumably preponderates in the lowest living forms, which are also universally asexual but capable of the most prodigious rates of multiplication owing to rapid growth of their substance (mainly chromatin-like) under favorable conditions. These lowest forms are also flagellate, probably universally so under certain conditions. In the next stage of evolution the tendency is for certain cells to grow to a large size and then break down into flagellate spores which are alike and constitute the germs of the species. The next stage is where certain of these enlarged cells break down into flagellate spores of unequal size, the larger become female and the smaller male and incipient sexuality is developed. The process may even begin with the conjugation of similar binucleated individual cells, as in ciliate Protozoa, but there again the production of the spermatic plasma

* In this connection see Brass, "Die Zelle das Element der Organischen Welt," pp. 63–65. Leipzig, 1889. Also Lendl, "Hypothese über die Entstehung von Soma- und Propagations-Zellen." Berlin, 1889. Also Lillie E. Holman, "Observation on Multiplication in Amœbæ." Proc. Acad. Nat. Sci. Philad., pp. 346–348, 1886. Leidy's "Rhizopods N. America," where the chromatin balls of the nuclei are figured as being expelled from the nucleus and the animal presumably as germs.

or chromatin proceeds in a way which may be compared to an endogenous or intraplasmic fragmentation of the chromatin substance, part of which is probably not functional as the nucleus, so that even here the germinal matter is "set aside" contrary to the assumption of Weismann, who only finds such a process taking place in Metazoa. These binucleated forms have one macronucleus functional and another sexual micronucleus which is not functional in the ordinary life processes of the species. It is this latter which multiplies and grows at the expense of the cytoplasm of the parent cell, so as to form not only the material for the new micronucleus but also that of the new macronucleus, the old macronucleus when exhausted being disintegrated and absorbed by the cytoplasm. In this case the process of conjugation signified a reconstitution of the exhausted macronucleus, a process which always occurs in some forms only when the cytoplasm of the parent is free from unelaborated and non-assimilated constituents. An excess of chromatin and nucleoplasm is produced, part of which becomes the functional nucleus and part is thrust aside as a quiescent functionless body, the micronucleus. When conjugation occurs it acts as a stimulus, causing the rapid growth and division of the micronucleus at the expense of the cytoplasm of both individuals which are not feeding during this process. The reconstitution of the nucleus is therefore to be interpreted in terms of continuous growth and as a physiological process which is directly adaptive under the conditions of morphological differentiation attained by these organisms. The reciprocal fusion of one of the nuclear bodies produced by a subdivision of the micronucleus is to be understood in the way which will be indicated later.

The death and loss of the power of coördination of movement shown by the cytoplasm of lower unicellular forms, when the nucleus with its chromatin is removed, simply demonstrates the transcendent physiological importance of the nucleus as a directive centre. This view is also sustained by the fact that ultimate nerve terminations in the Metazoa are lost in some cases within the nucleus. The effects produced by the artificial removal of the nucleus in impairing the power of growth and reproduction are due to the destruction of the physiological equilibrium between the chromatin and cytoplasm as well as the morphological integrity of the individual. It does not necessarily mean that the nucleus is the reproductive agent, but rather that this highest end-product of protoplasmic metabolism is the central object for which the investing cytoplasm labors. Neither can, probably, become the centre of reproductive energy or the energy of growth in absolute independence of the other, notwithstanding the fact that there is an apparent absence of the nucleus in Monera, while the cytoplasm is reduced to a minimum in Schizomycetes.

The conjugation of ciliated Infusoria therefore becomes plainly a process wherein the nucleus has the usual reproductive function through division of labor coupled with an adaptive arrangement by which a physiological substitution of an old for a new nucleus is effected, while the act of conjugation is merely the stimulus through which the active functions are diverted into another channel ending in the metabolism of both individuals manifesting itself in the production of a larger amount of fresh chromatin, capable of taking upon itself the work of the former nucleus, a part being pushed or "set aside" as a functionless surplus ready to be stimulated to growth through conjugation. Maupas' theory of senescence may therefore be regarded as in the highest degree probable, in that in those cases where conjugation has long been in abeyance the stimulus of growth leading to the production of an abundance of chromatin has been absent. From this point of view the Infusoria present a most specialized type of reproductive activity in which the cytoplasm and chromatin have never been freed or separated from each other as marking independent sexual states in which these two cellular constituents have preponderated, as the female and male respectively. In other words, the Infusoria are practically oösperms which are reciprocally stimulated to reproductive activity through the act of conjugation.

The ovum of the Metazoa is in the same case with the Infusoria, but behaves differently because it is purely an ovum. Here the polar bodies are to be regarded as exhausted chromatin or nucleoplasm with a decidedly male tendency in that the cytoplasm investing them is usually small in amount. The polar bodies are to be regarded as representing not only the disintegrated macronucleus but also the disintegrated fragments of the first or preparatory stages of division of the micronucleus. While the products of the fusion of the pronuclei of Infusoria again contrast with the fusion products of the pronuclei of Metazoa, in that they are at once divided into a functional or physiological and a functionless or reproductive nucleus. In the Metazoa the separation of reproductive functions from the other physiological ones is effected through cell-division and does not coëxist in two nuclei lying side by side in the cytoplasm of the same cell.

Nevertheless, there is reason to believe that the chromatin of the egg is partly exhausted, as it is in the Infusoria, and must be got rid of in part in order to regenerate the remaining chromatin through a process of growth accompanied by active karyokineses. This exhaustion supervenes upon the prolonged exercise of its physiological function in building up a large amount of investing cytoplasm under conditions which have interfered with the normal segmentation of the whole into cells no larger than those of the rest of the body. The characteristic overgrowth of the ovum beyond the size of its companions in the body of a Metazoan, is the real ground of the specialization of the egg through which it may be supposed that part of its nuclear matter has been exhausted through prolonged exercise of the physiological functions of the nucleus. It will be seen that this view is similar to that of Weismann, but it is more specific. Accordingly the degree of specialization of an ovum must influence the extent to which its nucleus is exhausted. Parthenogenetic ova are for obvious reasons to be regarded as less specialized than those which are not parthenogenetic. This hypothesis therefore fits in well with the fact of the decrease of the number of polar bodies in the eggs of many parthenogenetic forms, in which the period of growth of the eggs is often shortened, and where the physiological function of the chromatin in the constructive metabolism of the egg is exerted over a less prolonged period. The result is that the exhausted chromatin or nucleoplasm which is to be expelled from some parthenogenetic ova is just half that of the other type requiring fertilization. Such a separation and regeneration leave enough chromatin or nucleoplasm behind to initiate development by beginning a spontaneous and continuous fission of the egg without the access of the male element. This I believe, however, to be only a partial explanation of the causes leading to the expulsion of the polar bodies, since the genesis of the ovum itself remains unexplained. The specialization of the ovum and its hypertrophy as a cell is connected in another way with the operation of the processes of continuous growth, and with the evolution of the primæval form of germs which were unquestionably flagellate. That the ovum is the most specialized cell of the two kinds of sexual cellular types found in Metazoa there can be no doubt.

If it is true that the only thing that stands in the way of the development of any cell of the body into a germ is its physiological and morphological specialization, then the egg with its mass of cytoplasm in excess of that of any cell in the body is certainly a morphologically and physiologically specialized cell-unit. The expulsion of the polar bodies brings it back to an unspecialized condition, in which its nucleus (the female pronucleus) no longer bears any imprint of its former physiological specialization which it had acquired during the elaboration of its bulky mass of cytoplasm.

The history of the spermatic body, or cell, is exactly the reverse of the preceding. If protandrously developed, karyokinetic or fissive processes go on more rapidly from the start than processes of growth through constructive metabolism and spermatozoa result. If the spermatic body is produced through a protogynous process and from large cells simulating ova, the fissive tendency again finally obtains the upper hand, but only after a certain maximum size of the female cells is reached, when they may be recognized as ova. The tendency towards maleness is thus constantly against any persistence of a condition favoring constructive metabolism in the direction of the elaboration of cytoplasm. In fact, so rapidly does the fissive process go on, that the nuclei of the spermatic or male cells have no opportunity to acquire any physiological function, such as that enjoyed by the nucleus of the egg. The tendency in the male cells is rather to intensify the tendencies of metabolism towards the elaboration of chromatin only, carrying the latter process so far that little or no field of cytoplasm finally remains in which fission or nuclear movement can occur ; nay, many instances are known where even the remaining remnant of the cytoplasm is cast off from the spermatozoön previous to maturity, this being in exact contrast again with the extrusion of a part of the egg's chromatin as polar bodies. The rapidity of the successive processes of fission in the course of the development of the male cell is such as to give its quiescent nucleus, in its restricted cytoplasmic field, a karyokinetic momentum, so to speak, which will be expressed as segmentation as soon as it is fused with the female pronucleus in a large cytoplasmic field, in the egg, where karyokinesis or nuclear motion again becomes possible.

In the same way the tendency towards developing a karyokinetic momentum must occur in the egg, owing to the limited number of rapidly successive karyokineses in the expulsion of the physiologically differentiated chromatin in the form of the polar bodies, which may themselves manifest subsequent spontaneous segmentation, or even make abortive unions with spermatozoa, which are abortive only, probably, because of the small size of the cytoplasmic field. If the results of Hertwig and Boveri in fertilizing non-nucleated fragments of the cytoplasm of the eggs of Echinoderms are correctly reported, it is certain that the spermatozoön is in a condition of karyokinetic tension, which lacks only a cytoplasmic field in which to find expression as segmentation.

The views here developed also harmonize with what is known of the behavior of the nuclei of conjugating *Infusoria*. It is only the *micronuclei* or *paranuclei* which enter into the reciprocal conjugation. The macronuclei or functional centres of control of the physiological energies of these animals never enter into the process, but are disintegrated and lost in the cytoplasm, while some of the new micronuclei now formed become, after conjugation and reciprocal fertilization, the new functional or physiological nucleus, and one or two remain, for the time being, at least, as passive, and probably functionless, micronuclei.*

It may be supposed by some that the foregoing account is merely a recapitulation of Weismann's hypothesis respecting the significance of the polar bodies. Not so; Weismann's very elaborate and artificial methods have no charm for me. He is continually trammeled by his own cumbersome hypothesis of a germ-plasma. But he is probably right as far as assuming that the first polar body represents chromatin of a "histogenetic" character, but I should say in a totally different sense from that which he implies. I should also agree with him that it is expelled in order that the egg may revert to its unspecialized condition, but again in a widely different sense from that which he holds.

Unfortunately for Weismann, he renders his hypothesis utterly improbable from the necessity of working out a second hypothesis to account for the expulsion of the second polar body, in order to save his first unfounded assumption respecting the immortality of the germ-plasma. That doctrine, driven to its logical conclusion, leads ultimately to the molecular disintegration of the vast series of ancestral plasmas, finally present in the egg in the course of a vast series of generations. Accordingly the only way to save his hypothesis was, as soon as certain parthenogenetic

*In this I follow the recent researches of Maupas: "La Rajeunissement Karyogamique chez les Cilies." Arch. Zool. Exper. et Generale. 2e Ser., Tome vii, Nos. 1 and 2, 1889. Pp. 149–320 *et seq.*

eggs were discovered by him, to expel only one polar body; to make use of this new fact in such a way as to make the expulsion of the second polar body in perfectly sexual forms, remove a certain proportion of the ancestral germ-plasma, else, in time, the subdivisions of the ancestral plasmas would ultimately be so great in number as to destroy, by repeated division, the molecular integrity of the molecules representing such ancestral plasmas. Unfortunately for such an hypothesis, Nature does not work through foresight and does not anticipate such difficulties, and he is unable to produce the slightest evidence that she does. Organisms do not possess the power to foresee the remote consequences of their processes; they respond directly to conditions, or not at all.

The logic of this argument of Weismann is exactly similar to that used by Balfour in reference to the polar bodies in his "Comparative Embryology" (i, p. 63), when he says "that the function of forming the polar cells has been acquired by the ovum for the express purpose of preventing parthenogenesis." This implies that the egg possesses foresight of harm coming to it through falling into a parthenogenetic habit! And when Weismann proceeds to elaborate his necessary hypothesis of a reduction of ancestral germ-plasmas, and says "this *must* be so," he seems to forget altogether about the probably self-regulating physiological factors controlling the dimensions of cells and their proportions of chromatin and cytoplasm.

The same difficulty was perceived in a somewhat different form and very pointedly alluded to as fatal to the hypothesis of pangenesis, as early as 1878, by Prof. J. Clerk-Maxwell, in his article, "Atom," in the third volume of the "Encyclopædia Britannica," p. 42.

Lately, however, Platner's discovery that in *Liparis dispar* parthenogenesis occurs with the extrusion of *two* polar globules, is sufficient to render Weismann's hypothesis as to the significance of the second polar body thoroughly untenable.

There is clearly nothing left but to suppose that the polar bodies are an expedient through which the egg returns to a condition of equilibrium different from what it possessed prior to their expulsion. We have no warrant whatever for assuming that this return is other than automatic or comes from other than self-regulated impulses arising within the ovum. Such impulses are very probably merely a manifestation of the attempt to recur to and maintain a continuous process of growth, in the course of which the production of polar bodies is only an incident.

The physiological impulse from within which effects this equilibration works, if my hypothesis has any value, as if certain parts of the egg were to be excreted. In fact, if the hypothesis that the huge mass of cytoplasm represented by an egg is a highly differentiated cell-product, resulting from a very prolonged activity extending sometimes over many months, or even years, of the nucleus and its chromatin, while the spermatic body is produced in a much shorter period, it must necessarily follow that the controlling central nuclear body of the egg would undergo a corresponding greater specialization and differentiation than that of the spermatozoön.

This view then satisfactorily accounts for the expulsion of the polar bodies and also gives some indication of the significance of the reduction of the cytoplasm of the spermatozoön or its complete loss, if we regard the egg and spermatozoön as antipodal expressions of a physiological process of evolution, which has resulted in forming bodies which are complementary to each other in every physiological trait which they present.

Since spermatozoa, also, are very often produced from what are manifestly ova, by the breaking down of the latter and the augmentation of their chromatin, it is clear that the spermatic body is a product derived from the egg by carrying its cleavage farther either by means of the direct or indirect method, but while still attached to the parent or nourished by it. From this consideration it follows that the egg and spermatic body are not homologues before the final maturation of the former. It is, therefore, useless to expect to find any structures thrown off by spermatozoa which are complementary, in the sense implied by Minot and others, to the polar bodies of the egg.

As I have been led to the views expressed above by following a totally different path from Weismann, and as I reject his hypothesis of the physiological isolation of the germ-plasm on the basis of fact, as shown elsewhere,* as incapable alike of proof or of serving a better purpose than a much simpler hypothesis, it seemed best to continue the argument upon the lines begun in earlier papers.

It may, however, be well to point out here that what Weismann means by his "histogenetic" or "ovogenetic," nucleoplasm, I distinctly limit to the genesis of the huge cytoplasmic field or cytoplasm and yolk of the ovum. The egg membranes are basement membranes and it is difficult to say what share the egg had in their formation except in lower forms, so that they are of far less consequence in this discussion than Weismann supposes.

Another point is that parthenogenetic ova are certainly smaller than the fertilized ova of the same species, in some forms, though this is not always the case. This fact, however, is in accord with the hypothesis of the polar bodies set forth above. The mode of feeding the queen bee † shows, also, that parthenogenetic eggs, or those capable of developing in that way, are probably produced through the expenditure of less energy in the parent organism than those which develop only in the sexual way in strictly sexual forms. The connection of these facts with the explanation offered of the expulsion of the polar bodies is so obvious that it hardly needs to be indicated.

It has been made clear that the overgrowth of the egg has resulted in its specialization, but the question still remains, What led to such an over-

* "A Physiological Hypothesis of Heredity and Variation." *American Naturalist*, pp. 85–92, xxiv, 1890.

† Cheshire, "Bees and Bee Keeping," Vol. i, pp. 82–85.

growth of the ovum? This, I believe, may be answered on the supposition already to some extent elaborated that the egg is an abortive attempt at the production of an overgrown spermatogonium which is set free before it has been fully matured, as a result of the precocious determination of superabundance of surplus nutriment to it.

This has been due to forces operating within the parent organism; how, we are still unable to clearly state. If this is so, then the specialization of the egg is accounted for and the expulsion of the polar bodies may be approached from another point of view, namely, that of their morphological equivalence to spermatozoa, since they represent largely the characteristically male plasma in their chromatin. The egg is, therefore, specialized in so far as it is an abortive spermatogonium, and the number of polar bodies, produced as abortive spermatic elements, represent its degree of specialization. The consequent reduction of the chromatin in the egg nucleus may then also be compared with the processes of spermatogenesis in which a certain minimal size of the chromatin mass of the egg is reached, which now makes the ovum the exact homologue of the spermatozoön, but with an enormous cytoplasmic body fitted for the exhibition of active karyokinetic movements and an elaborate series of successive and finally simultaneous karyokineses.

In this way it may be supposed that the peculiar advantages offered for the survival of a species through sexual processes may be realized.* But such advantages were developed not as the result of any foresight, but as a consequence of the action of the principle of overnutrition ending in the production of spermatogonia which failed to segment or break down into male elements before they were freed from the parent. In this way it may be supposed that the ovum itself arose, but that it was a later phase of development than that of the flagellate male germs, which type still prevails in asexual or very primitive forms. This gives us the real grounds for the evolution of the ovum; accounts for its specialization, for the reduction in volume of its chromatin to that of the male element through the expulsion of the polar bodies, through which it also again becomes the immobile overgrown, but exact morphological homologue of the spermatazoön. The specialization which the ovarian egg has attained as an overgrown spermatogonium also makes it certain that the cells expelled as polar bodies represent the energy in part which has been expended, and which is signified by the great size of the ovarian egg. These products of specialized development must be got rid of so that this part of my hypothesis respecting the polar bodies is a necessary corollary of the first part developed in the earlier portion of this paper.

The impulse towards the expulsion of the polar bodies comes from within, upon the advent of an adequate stimulus, and the tendency is to run down towards the male condition from the egg, but such a result is prevented from proceeding far by the small original amount of chromatin in the egg which prevents the formation of more than two cleavages, on the

* "Origin and Meaning of Sex." *Am. Naturalist*, June, 1889, pp. 501–508.

average, when the chromatin is reduced to a volume equivalent to that of the chromatin in a single spermatozoön of the same species. The tendency towards the expulsion of polar bodies is therefore probably self-regulative as soon as a certain minimum in the size of the chromatin masses is attained. The impulse leading to such a result arises from the presence of a large cytoplasmic field sensitive to external stimuli, but in that such a field is cut off from further possibility of growth by detachment from the parent organism and incapable of further growth except through the stimulus of its chromatin, and in that no more of the latter is for the time being elaborated after detachment, it is clear that the cleavages which give rise to the polar bodies are self-limited in number by conditions arising within the egg, and as a consequence of the specialization of the latter as a cell, and in the sense that it differs from primitive types of cells as a consequence of its method of protected growth within the parent.

Why, however, should the polar bodies be so small? Why does not the egg divide equally? This may be answered on the ground already assumed that the chromatin is yet neither male nor female, but tends universally to be reduced to male dimensions even in the egg. The cytoplasm being the most abundant in the egg and the chromatin in the spermatozoön, it is clear that totally different physiological characters must be offered by the two elements. This, in fact, is the essence of the meaning of the term specialization as applied to them, and involves the conception of wide differences in the modes in which physiological energy has worked to produce them, respectively. If the yolk is abundant, the cytoplasm, at one pole of the egg where nuclear cleavage occurs most readily to form the polar bodies, is reduced to a thin layer or disk. This, in many cases, is the condition under which polar bodies are produced so that a great inequality in the size of the cleavage products must result. Later, when the egg nucleus is reduced and can return to a deeper position in the egg, it can gain control of a still larger cytoplasmic field, which is still further enlarged by the advent of a fresh male chromatin and cytoplasmic element. When the male and female elements finally unite there is a complete readjustment of the equilibrium between the cytoplasm and chromatin centres, because the introduced male is capable of taking control of a still larger cytoplasmic field and may even at times overtop the female, as in the case of *Rhynchelmis* described by Vejdowsky. The two together now regain control of the cytoplasmic field of the egg, but cut off from direct dependence upon the parent, so that a new cycle of changes can go on in a new way, and instead of running down towards the male condition, normal segmentation goes on which ends in the formation of a new being under the impulse of the tendencies towards continuous growth under new conditions. The cases of egg and spermatozoön are clearly merely specialized states of chromatin and cytoplasm and their separated and united conditions are merely phases of a continuous process of growth under widely differing conditions which are ushered in as the results, first, of an incipient and complete exclusion from the parent (formation of polar bodies and spermatogenesis), and, secondly, as the results of their union as complementary bodies through which a new development is initiated. Their reciprocal saturation of each other also prevents polyspermy and is self-regulative, just as all of the processes of development will ultimately be found to be, and as we have seen good reason for believing must be the case in respect to the polar bodies.

Finally, on our hypothesis it may be said that the chromatin and cytoplasm in the egg bear a certain proportion to each other, regulated in the ovary. The effort to adjust this relation further after the ovum is free (usually) ends in the expulsion of the polar bodies, which represents an effort at the production of male cells, since the egg as a protovum is invariably the prelude to the production of spermatozoa. The ovum precedes the spermatozoön in the order of time, and the latter must be produced from the former. Protogyny is, in the widest sense, therefore universal, since it is only ova-like bodies which can break down into spermatozoa in which chromatin preponderates. But this may be further qualified by the statement that protogynous tendencies greatly developed must finally themselves lead to the development of an ovum with a large cytoplasmic field. Or, in other words, a condition is reached in which great cytoplasmic specialization is attained, so that the expulsion of the polar bodies may be regarded as the expiring effort of protogyny to produce spermatozoa.

If this is so, why do not all ova develop parthenogenetically? Simply because these spermatic elements—polar bodies—are not completely matured or developed, and while the transmitted energy of growth is insufficient. The remaining body with its reduced chromatin is now, however, the equivalent of a spermatozoön but with an enormous cytoplasmic body. It is complementary to the male element in that it is physiologically receptive, and food through karyokinesis for further processes of segmentation. But how about parthenogenetic ova? Why do these develop and why do some of these develop two polar bodies? Here we often, if not always, have, as already supposed, a greater momentum of growth, with frequently a smaller mass, protogyny is not so markedly developed, and the tendency towards maleness and cleavage is therefore inherently greater. If now new relations or rather want of former modes of nutrition of the cytoplasm supervenes after oviposition, the momentum of growth tending to segmentation, received from the parent even after the expulsion of the polar bodies, is still sufficient, so that the so-called female pronucleus is able to proceed under these new conditions to take possession of the cytoplasmic field and initiate normal development under new and independent conditions, through segmentation, leading to the formation of an embryo. If these views are correct, parthenogenesis is the vanishing point of maleness and femaleness, yet, in some cases, its energy is so great that it sometimes, even then, ends in maleness as seen in the development of drones amongst bees, thus illustrating still further the tendency in some cases to run down to the male condition.

If these conclusions will hold universally, there is good ground for believing that in the gradual evolution of protogyny the cytoplasmic field, in which rapidly successive segmentations were possible, was also evolved. If this is true, then sexuality itself arose as the consequence of protogyny starting in parthenogenesis. The primary and secondary sexual characters of multicellular forms were also probably the outgrowth of secondary and adaptive processes consequent upon the effects wrought as here supposed through protogyny and the evolution of a large cytoplasmic field. The origin of sex at any rate hinges upon the decision of how the disproportion between the chromatin and cytoplasm arose in the sexual products of the two sexes respectively. Upon its last analysis this problem must resolve itself into purely physiological factors.

These views are in accord with the first part of this paper, though it may at first seem that the theory that the egg expels polar bodies because of its specialized nature is not well founded. What there is in favor of such a view is, that it harmonizes with the morphological and physiological data of ovogenesis, and the conjugation of Infusoria. In any event, it is certain that if ova represent an incompleted effort to produce spermatozoa, it is very certain that they are specialized in so far as this effort has been realized as supposed, in the formation of polar bodies and a large volume of cytoplasm.

Consequently ova may be regarded as incompletely differentiated spermatogonia. The undoing of this specialization whereby the egg becomes the morphological equivalent of spermatozoön so far as its chromatin is concerned brings us back to essentially the same basis as was followed in the first part of this paper.

Experimental evidence shows that the process of fertilization is self-regulative and restricted to a single spermatozoön. Indeed, one might infer from the evidence of the phenomena of fertilization that such must be the case, and that the ingress of the spermatic element, in sexual forms, is a consequence of the exhaustion of the power of continuous growth, as shown in the abortive effort at spermatogenesis in the extrusion of the polar bodies. A consequence, however, following because of the appetency of the spermatozoön to set up a segmentation in the cytoplasm which should end in a continuation of the process of spermatogenesis set agoing by the expulsion of the polar bodies. Yet, this does not occur, and, as we have seen, a good reason can be assigned why spermatogenesis does not go on indefinitely after being initiated by the extrusion of the polar bodies. Equally good reasons can be assigned why the method of nuclear movement is changed after the entrance of the spermatozoön. On my view this is wholly due to the sudden advent of wholly new conditions, since about the time of the ingress of the spermatozoön the egg is not only cut off from its supply of nutriment and is now an isolated being the whole of the cytoplasmic field of which is at the mercy of the combined action of the pronuclei, while the preparatory equilibrium resulting from the extrusion of the polar bodies has been attained beforehand.

The new external conditions constitute a continuously acting series of stimuli provoking the action and reaction of the chromatin, achromatin, and cytoplasm upon each other, as has been rendered probable by the studies of Boveri and Watase. The isolation of the egg makes it independent; its cleavage products now cohere and the whole plan of its fragmentation depends upon its using every particle of its cytoplasm as reciprocally nutritive material for the maintenance of the integrity of the whole.

Maturation is truly the proper name for the process of the extrusion of polar bodies, and it may be that in some cases the polar bodies may be large enough to merit the name of protova, especially the first one, and that a large enough cytoplasmic field may exist around its nucleus to attract spermatozoa. Yet the polar bodies are nevertheless to be regarded as abortive attempts at the production of spermatozoa.

It may also be that the male condition characterized by the assumption by the elements of that sex of a monad-like flagellate form, is really an attempt at the recapitulation of the most ancient ancestral monadiform condition. In the female we have seen that the attainment of such a condition is abortive, but enough is left in the disguise of the polar bodies to represent a reminiscence of the lowest phase of organic evolution.

We have now recapitulated all the important and difficult queries that have arisen in regard to the meaning of the polar bodies, which we also now see probably have a phylogenetic significance.

The evolution of complicated apparatus and processes for the emission of the sexual products, when mature, is only an accessory and a secondary consequence of the continuous series of processes described above, and which has also proceeded *pari passu* with the divergence in the morphological and physiological characters of the products of the two sexes. The primary sexual characters and probably also the secondary ones have been evolved in response to the all-important requirement of most efficiently disposing of the sexual products. The habit of copulation itself must have so arisen, and the stimulus effecting the discharge of the sexual products finally acts through the sensorium and through the reciprocal contact of the nerve terminations in special dermal tracts concerned in copulation in the two sexes.

In this way it must be supposed that eventually the sexual passion became intensified as the provisions for effecting the union of the sexual cells became more elaborate, and as the parent-body became more and more differentiated and specialized to take a more and more important share in this process. The presence of the germ cells has undoubtedly reacted upon the soma or parent body so as to intensify the tendency towards a greater differentiation of the primary sexual organs, and this through the sensorium and its sensory terminals.

It is interesting to reflect that the tendency to a repression of the male traits in the ovum has been manifested in the adult organization of the two sexes in Metazoa. The assertion of some writers to the effect that the female is merely a retarded stage of the development of the male may be correlated with the singular and suggestive contrasts between the egg and spermatozoön.

The evolution of sex and the evolution of sexual love or passion are inextricably intertwined. The history of the one is the history of the other. There are many reasons leading to the conclusion that the earliest and lower forms of sexuality were never in the past and are not now impelled to conjugate by anything akin to the gratification of passion such as is met with amongst the higher series of animal forms. Sexual passion is the outgrowth of a gradually developed and increased capacity for experiencing pleasurable sensations by the parent body or soma which is the producer or bearer of the sexual products. The high specialization of the sexual processes in higher forms has also unfortunately led to the possibility of their perversion. No sexual perversion is possible amongst lower forms where the essence of sexuality is the mere concrescence or conjugation of sexual cells. Courtship, violence towards and pursuit of the female, sexual love, etc., are the consequences of the evolution of a soma or parent body, which is the mere carrier of germ-cells, but which is capable of experiencing exquisite pleasure in the consummation of the sexual act.

The intromission of an erectile organ covered with highly sensitive nervous end-organs into the genital passages of the female is the appetency for the sexual elements to conjugate reflected upon the soma. Copulation and the development of erectile or other sensitive intromittent and reciprocally coadapted primary sexual organs must have been due to the effect of use, since disuse, as in castration, affects the development of the parts, while abnormal activity, under favorable conditions, is said to increase their development. This view is sustained by the evidence in both plants and animals ; in both the devices for effecting conjugation of the sexual elements and developed in the most gradual manner, until, in plants, the pollen-grains, with the help of various secondary adaptations, such as their morphological development, insect agency, the wind, etc., are evolved into true intromittent organs answering to the function of a penis in the form of a growing pollen-tube, stimulated to growth by nutriment supplied by the stigma and carrying the very minute, elongate, male chromatin element in its very narrow passage to the ovicell of the ovary. In the same way the male intromittent organs of animals have been developed from a mere cloacal papilla, or a low-grooved fleshy erectile process to a highly differentiated and excessively complex penis with, in some cases, an elaborate series of rosettes and flanges covered with a thin integument with highly sensitive terminal sensory nerves, that are in reflex connection with the higher parts of the sensorium and through the lumbar region of the spinal cord with the testes, spermatic vesicles and accelerator urinæ and other muscles which they may throw into spasmodic contractions in order to compress the vesiculæ and cause the emission of the male elements in the act of coition. Similar actions result in the female which affect the peristaltic contraction of the oviducts, the enclosure of the ovary by the fimbriæ leading to conditions favorable to the emission of the egg at the time of coitus.

In animals, the provisions for rendering the male elements more efficient are thus rendered more perfect. There is not wanting evidence that the glans penis mav serve as a sort of piston, fitting closely against the sides of the vaginal passages so as to prevent the regurgitation and loss of the semen. In mice I have observed that in those which have recently been in coitus, the uterus is actually distended with semen. These contrivances, many of which are of the most singular conformation, as that of the pig, for example, probably serve the purpose of more efficiently carrying the seminal matter into the genital passages of the female where they are to subserve the essential purposes of reproduction. At any rate, the wonderful contrivances in the higher plants serving the purpose of efficient fertilization are no more remarkable than those in the higher animals, the study of which has been singularly neglected by physiologists.

In the lowest types of living forms there is nothing which suggests in any way the gratification of passion. The mere tendency towards conjugation of animals and plants without nerves cannot be identified with an appetency arising from any pleasure experienced in such conjugation. There are at first no provisions made for conjugation except such as the accident of contiguity of the conjugating elements as the germinating spores of Myxomycetes, the intracellular spores of *Hydrodictyon*, etc. When the process is so primitive as this, there is no evidence to show that it is anything more than the expression of the cessation of one order of things at the termination of one set of external conditions giving place to a new order of things under the stimulus of a new set of outward conditions more favorable to growth. Under this view of the case the incipiency of conjugative phenomena is simply the expression of a readjustment of the processes of growth under the influence of more or less favorable conditions of life. The physiological traits of that life are expressed in the mode of molecular aggregation and constitution of the cellular unit or units composing the individual. Its tendencies are to increase the mass of the individual by processes of integration of new matter in the course of which such new matter becomes molecularly identical with that of the organism engaged in such integration, a process commonly expressed by the term assimilation.

The consequence of such newer integrations are that still other integrations are possible, under favorable conditions, on a much larger scale than the first ones. The increased power to make continuously more and more extensive and rapid integrations of identical molecules is possibly in some way due to the increase of mass and surface and the consequently increased capacity to liberate energy, or to perform work in a still more active integration and assimilation of molecules.

The Malthusian principle therefore rests, in its last analysis, upon a chemico-physical basis. It is probably, therefore, not an unjustified assumption to state that the acquisition of an increased mass in organic bodies leads to an increased capacity to integrate and assimilate still further additions to the original organized mass, and that if this process could go on indefinitely without the intervention of death and a necessity for oxygen, the earth might be gradually transformed, in so far as its available materials held out for such a purpose, into a few organized individuals. Such a supposition is, however, absurd, since such masses, even were their growth possible, would finally become helplessly immobile from their own weight ; such a process would be self-destructive and incapable of indefinite maintenance.

If, however, the principle that successive increments in the mass of organized bodies, carries with it the implication that such increments imply their capacity to increase more and more rapidly, under favorable conditions, or as it may otherwise be expressed, are thus enabled to grow, in virtue of such an inherent property, far beyond the bulk of their original germinal mass, then this deduction must form the basis upon which the phenomena of growth, reproduction and sex must finally be interpreted. This principle affords also the physico-chemical or physiological reason for the foundation of the Malthusian principle that the production of organisms would if unchecked outrun the available food production for a certain section of such organisms, as an aggregate—namely, the animal world.

The foundation of the principle of Malthus and of the Darwinian principle founded upon it, therefore lies within the domain of ultimate biological physics or the molecular dynamics of organized bodies. The mainspring of the principle of natural selection, upon final analysis is not itself a choice between two things but an inevitable consequence of the innate molecular habit of living matter, if I may so express myself. It is physical in that the chemical and physiological laws under which growth or molecular integration can take place are themselves resolvable into physical laws which can be coördinated under the principle of the conservation of energy.

This physical principle of continuous and continuously augmented integration and the consequent increase of the mass of living bodies is the primary conditioning factor of growth by intussusception of similar molecules. It initiates the struggle for existence, as the struggle due to motion and the attraction of stellar bodies, maintains the latter in their harmonious relations in space.

This principle must, however, be further qualified in that the properties of the molecular integrating factors of living organisms differ very widely. Some forms (vegetal) under one set of conditions can integrate new and more complex assimilable molecules by recombining binary compounds ; other forms—animals—can assimilate only such new ternary molecules or such as are very nearly similar to their own, while a third form, the sexual, is probably the highest expression of this integration of similar molecules in that here the molecular differences are zero or nearly so, and at most goes no further than molecular differences, having their origin in the individual traits of either of the two parents. The last or sexual form of integration or intussusception also occurs, *en masse*, and without any reciprocal sacrifice of molecular identity. This last form of organic molecular integration is therefore effected with the least expenditure of energy on the part of the sexual elements themselves which are involved. Sexuality according to this view as expressed primarily in conjugation is a sort of refined hunger, in which neither the "eating" nor the "eaten" expends but a minimum of energy in a process of reciprocal assimilation. It is a hunger in which the sense of "taste" in the vulgar, anthropomorphic sense is unknown ; it is an affinity developed possibly through the attraction of identical molecular aggregates for each other.

The principle of cumulative molecular integration is similar in some respects to the cumulative principle operative in organic structural evolution, through which a superposition of adaptations results, not necessarily as the consequence of selection but as the result of the morphological and physiological necessity of conforming in the next step of morphological and physiological complication to that which had preceded it. Many instances in illustration might be cited, such as the annular placenta of the ovum necessarily conforming to the easiest possibility of internal contact with a tubular uterine canal. This principle has been responsible for much that has happened in organic evolution, but it is again dependent in curious, circuitous ways upon the still more primary principle of cumulative integration, overgrowth of organisms, or their capacity to grow beyond their own bulk at certain points, as implied by Haeckel.

The highest form of cumulative integration ending in an overgrown and abortive spermatogonium, which is the equivalent of the egg, together with its further expression in the production of spermatozoa which have had their cytoplasmic field reduced, leads to a condition where the one becomes helpless without the other. It also presumably leads to the evolution of an appetency or affinity of the male for the female element in that the one possesses what the other does not, and in that they are produced in similar organisms or those of the same species their idioplasmic constitution must be very nearly the same, except for the morphological differences which characterize them. These differences are again the preponderance of nucleoplasm in the one or the element immediately concerned in growth and the physiological integrity of the living cell, and the preponderance of cytoplasm in the other, which is the medium in which free nuclear motion, karyokinesis, and consequent growth is possible. The affinity so developed through cumulative integration by the divergent processes of ovogenesis and spermatogenesis ends in what I shall term *reciprocal integration* without loss of molecular identity, or in what is usually termed "fertilization."

The advantages offered by such a process is that it provides for the development of metazoan or multicellular embryo, which is without the need of immediately feeding, but which is enabled to reach a certain self-helpful morphological complication before it begins the struggle for existence for itself. It provides a large cytoplasmic field in which rapidly recurrent successive and simultaneous karyokineses can take place under the guidance of the inherited tendencies resident in the nucleoplasm and cytoplasm of the combined germs. The one sex appears to supply the field for segmentational activity, the other the segmentational impulse itself. In other words, sexuality is the expression of the action of the principle of the physiological division of labor, extended so as to involve two kinds of individuals of the same species, or two different functionless parts of the same individual, as in hermaphrodites.

There is no convincing evidence that the male induces variability. The argument from hybrids is of little value. The tendency to an equilibrium as the consequence of close interbreeding or of continued promiscuous interbreeding is the same, and is to be interpreted as the result of the constancy of the mode of growth of the average individual which must finally result, following from the average of hereditary characters which are finally thus transmissible. As soon as slightly differing forms are crossed the karyokinetic equilibrium is disturbed and variability ought on *a priori* grounds to ensue. To saddle the induction of variability upon the male does not seem to be demonstrated, as the factors involved are too numerous to enable us to decide what ones are important and what are unimportant.

A view which has far more in its favor is that a large oösperm, interpreted as above, with a large cytoplasmic field, is inherently more liable to vary its karyokinetic processes through very slight variations in the external influences than a small or a parthenogenetic one. That sexuality, taken in the widest sense, is responsible for variability is probably nearer the truth. That the oösperm, with its large cytoplasmic field, is the real arena in which variability disports itself, may be taken for granted. It is also very evident that the evidence derived from the development of monsters is clearly in favor of such a view. Monsters are developed only when the early stages of development are karyokinetically disturbed, as is well known. Moreover, there is no hard and fast line between monstrosities and variations of a less and less monstrous character until those of an almost imperceptible and unimportant character are encountered. That the tendency towards variability is more marked in the young than in the adult stages of fixed and slightly variable types of Metazoa may be regarded as a truism, and must be considered the foundation of these views.

In that temperature affects the rate of karyokinetic processes, it is clear that inequalities of temperature simultaneously affecting different points on the surface of an egg would affect the rate of segmentation of the cells of such different points and thus induce variability. A single karyokinesis disturbed or impeded on one side of an embryo must disturb all subsequent ones. A mechanism so delicate as this of karyokinesis may also be interfered with in other ways. It seems almost self-evident that where karyokineses become simultaneous and rapidly successive there must be a greater inherent probability that variations should be induced through disturbances of the karyokinetic processes.

Latterly much discussion has taken place regarding rejuvenescence and the relation of the process of fertilization to a supposed renewal of the youth of the sexual cells. It may be suggested that the sexual cells probably never grow old from the causes which act upon the other cells of the body to render them senile, and it may be that the real ground for a theory of rejuvenescence lies not in fertilization itself but in the fact that the sexual cells are functionless and have not been belabored with physiological duties in the parent body. Where they are produced annually, as in many animals and in all plants, they are also the youngest cells of the parent body, while the spermatozoa, produced in some animals at hourly intervals, are still younger, or more youthful. The male cell is therefore the most youthful, the least functional and the one most disposed to exhibit its activities of growth under favorable conditions with the greatest energy, though not necessarily in the sense that such a display of greater energy would be favorable towards provoking variability, except as provided for by the cytoplasmic field of the ovum or female element.

It has also been pointed out that the first cleavage of the oösperm corresponds to the future median plane of the embryo or to the line dividing the future hypoblast from the epiblast. But there are still other relations which connect these phenomena with the fore and aft disposition of the body of the parent. It is a matter of common knowledge that the Infusoria when undergoing division divide either lengthwise or crosswise. In fixed forms—*Vorticella*—the division occurs lengthwise of the parent and in conformity to the mode in which the future individual is related to the colony by its base. In many free forms the division is crosswise, and it is a singular fact that the end of the hinder individual next to the posterior end of the anterior one becomes the future anterior end of the hindmost one. These two forms of division have been developed adaptively and in conformity with very different conditions in the two cases. Why should the end of the young Paramœcium next the foremost or parent individual become its anterior extremity preferably to the other one? Does this not indicate that use and habit may have had an influence in giving the plasma of both a bias which extended to the sōma of the posterior bud and which expresses itself in this peculiar polar conformity to that of the anterior parent individual, which is more somatic in its character?

Numerous other forms, such as *Volvox*, illustrate the same tendency of the axis of the young to conform to the axis of the parent. In Fishes the embryos of *Batrachus tau*, which are attached to a fixed substratum after the rupture of the egg-membrane, by the adhesion of the yolk sack to the latter, show that, at the time of deposit, *the future axis of the whole brood of embryos was predetermined in the body of the parent.* That this must be so may be concluded from the astonishing fact that the heads and tails of a whole brood conform in direction, within a degree or two, to a common axial plane. How was such an astonishing conformity to a common axis brought about, if it was not developed in the ovary of the parent before oviposition? If this is true then the axis of the parent and the polarity of her body, as expressed in its fore and aft extension, exerted such an influence upon the brood as to impress such a polar tendency, and transmit it directly to every egg matured in her body. If this is true, then the parent body does transmit characters directly to its offspring, Weismann, Lankester and other deluded skeptics to the contrary notwithstanding. Here is a whole brood of young fishes, fixed to the surface upon which they were hatched, every one of which conforms, to within a degree or two, to lines running parallel to each other in a common direction. Does or does not either parent transmit this; since one or the other must do so, how is it done, and why is this not proof that the soma of the parent transmits certain polarities, and those of the most important character, directly to the germ-plasma from which the embryos are developed? The case here is just as clear as in the case of Vorticella or Paramœcium; they are in exact conformity, so that we have here once more direct evidence of the untenability and absolute falsity of some of Weismann's deductions as to the non-transmissibility of acquired characters.

In a similar way, how is the polar conformity of the chick in the egg to the axis of the parent bird to be accounted for? Though in this case the axis of the embryo lies constantly at right angles to that of the parent as the ovum descends through the oviduct. Equally striking are the constant relations of the embryo Rabbit, in the uterus up to the tenth or twelfth day, at right angles to the axis of the parent body. The same is true of the Cat, Dog, Mouse, Rat, and other forms. The same principle also holds in Arthropods, where egg-tubes are formed and where there are also constant anterior and posterior poles of the eggs developed, which bear a constant relation to those of the parent. Here are bodily habits directly transmitted which involve nothing like a change of structure; does the germ-plasma accomplish this, or does the direct influence of the mother's organism accomplish this remarkable result? For me the latter alternative seems to be the only explanation.

Similarly the phenomena of budding in Salpa, as worked out by Brooks and Seeliger, tend to establish the same conclusion, namely, that the polarities of the immediate parent influence those of the offspring directly. It looks as if the bodily functions of the parent either impressed themselves as if from a distance, or through the pole of the germ most directly in a nutritive relation to the parent upon the still unconscious germinal matter giving it these tendencies to conform in these curious ways to the polarities of the parent organism. It is also tolerably clear that the so-called "promorphology" of the egg is preceded by a still earlier morphological history, which has been scarcely more than touched by students of the Metazoa. The direct influence of the source of the nutriment supplied to the growing embryos is probably indicated in these singular examples, no less than in the fact that the polarity of young, viviparously developed aphides corresponds to the fore and aft polarities of the parents. Or, as in the case of the ovarian leaflets of the ovary of the lamprey, the micropyles are found to be invariably turned towards the vascular core of the leaflets, and consequently towards the sources of nutriment and oxygen. In this last case also, these factors have determined the position of the future germinal or animal pole, and consequently the point on the egg where development shall begin.

The points which have thus far been elaborated tend, in a general way, to support the conclusion that, in the production of ova and spermatozoa, both have arisen from a common basis. The lowest forms, we certainly know, tend to multiply without attendant karyokinetic processes, probably, as suggested, because a cytoplasmic field or arena in which nuclear movement is possible, is wanting. In the lowest Monads sporulation results in the breaking up of the parent body into infinitesimally minute germs, which are, presumably, composed in the main of chromatin or nucleoplasm, a conclusion which comports with the fact now ascertained, that the chromatin or nucleoplasm of lower forms, if deprived of its envelope of cytoplasm, may regenerate it. Overgrowth of mass, so as to form a large cell-body composed of cytoplasm, is unknown amongst the very lowest forms, which are also flagellate. In the next step (*Nostoc*), the overgrowth of certain cells means that they are incapable of development. In the next step, the conjugation of overgrown cells, with those in which nucleoplasm preponderates, restores the power of growth or the power to integrate cytoplasm anew, or, as in Infusoria, conjugation stimulates the production of nucleoplasm through the constructive metabolism of the investing cytoplasm.

All of this evidence tends to prove that maleness, or the condition of the flagellate spore, is the primitive one as already stated. Since the very lowest animal forms are likely to preserve some reminiscence of the primitive processes leading up to animal sexuality in its most generalized form, it will be desirable to appeal to the evidence offered by such forms. The Amœba is undoubtedly animal in nature, but notwithstanding the persistence and frequency with which it has been studied, much still remains to be learned of its life history.

Leidy has shown that, in certain forms of Amœba, the nuclei tend to multiply after reaching a certain size, and through a tripartite division without karyokinesis. One of these nuclei is then transported to near the surface, where it bursts and allows the balls of chromatin adherent to its walls to escape into the surrounding water, presumably as germs, but he did not trace their history. If this should prove to be a true case of sporulation, it would prove that in the Amœba there are conditions which favor the production of chromatin, and that the germinal matter or nucleoplasm is "set aside" in the nucleus from which it is expelled.

Mrs. Lillie Holman's observations (*l. c. supra*) also tend to show that a conjugation may occur where one Amœba swallows another and then disgorges it. The disgorged one then comes to rest and becomes encysted : it then discharges upwards of two hundred spores, since the further results of the development of the latter were observed the next day in the same "life-slide" as very minute young Amœbæ.

Brass* has given a more circumstantial account. According to him the body of the Amœba after encystment undergoes at least superficial subdivision into cells. The cyst then bursts or opens at one point and these superficial cells escape from the cyst as minute flagellate monads, which soon lose their flagella, becoming at the same time again amœboid and settle upon objects over which they creep about as did their parent, of which they are a fragment. They now also feed very actively, grow rapidly and soon become the counterparts of the parental organism, which gave rise to them by fragmentation. A somewhat similar history has been worked out by Haeckel for *Protomyxa*, and Weldon has reported the detachment or escape of small germs from the body of *Pelomyxa*.

We have the spermatogonium typified in this peculiar method of fragmentation of the Amœba, especially as described by Brass. It is an overgrown cell breaking down in part, but first elaborating more chromatin, just as a spermatogonium does. The overgrowth in mass of the parent cell is due to cumulative integration. The flagellate offspring represents the spermatozoa produced by a spermatogonium in a multicellular form, but with this difference that a spermatozoön cannot withdraw its flagellum and begin to feed. Such a flagellate germ of a higher multicellular form must then perish if it is not nourished in some other way. The only way in which it can be nourished is to blend with the cytoplasmic body of another abortive but hypertrophied spermatozoön—the ovum, as supposed above. In other cases, mammals and birds, it is known that the spermatozoa or flagellate germs of the male die if not kept at the same temperature as the parent body. They are not adapted to continue to live in the cold medium in which the flagellate germs of an Amœba would at once begin to feed and grow.

The flagellate or wandering germs of the Amœba are wandering in habit, probably because they inherit an organization favorable to vagrancy from still lower monad-like creatures. And this wandering habit is doubtless advantageous to the young Amœba, as they are thereby scattered so as to be placed where food is more plentiful, at any rate, the offspring of one parent Amœba do not, as a consequence, fall into a heap at one place so as to come into such close competition with one another for food.

Such vagrant habits would be of advantage to the germs of almost any species and they are certainly of use in many cases in that they favor the distribution of a species. In the case of the male germs of higher, in fact, of all forms, this vagrant habit becomes useful in effecting their distribution, and at last of aiding them to find the egg and the micropyle, if such is developed, through which they enter the ovum. So that here again we find that a habit which has at first thought apparently no preëminent

* "Die Zelle, das Element der Organischen Welt," pp. 63–65, Thiéme, Leipzig, 1889.

value or importance in the very highest forms, but which has such an importance in lower ones, may serve a very different purpose in higher types, that is, to find the female element so as to combine with it, which, of course, would be an advantage to the species. In this example, we find an illustration of change of function, or rather the use of an old function in a new way, illustrating also the principle that, any further advantageous step in evolution avails itself of the service of the next preceding one in the order of time, or rather, the latter is apt to thus become a stepping stone to farther progress, as is shown in this instance.

The parallelism of the Amœba before breaking up into flagellate germs, with a spermatogonium in a higher form is, however, complete, and it is from this basis that further criticisms and suggestions may now proceed.

Geddes and Thomson, in their suggestive work on sex,* have attempted to identify the evolution of the female germ or ovum with a tendency to develop a leaning towards constructive metabolism or anabolism, while the male germ exhibits the reverse tendency or towards destructive metabolism or katabolism. So far as the directly palpable facts are concerned which lie upon the surface, these conclusions of Geddes and Thomson would seem to be justified. There is apparently nothing in them which conflicts, at first thought, with the facts of morphology and physiology. Yet, I believe that the prime conclusion of these authors is capable of further analysis, and consequently that it is not as important as it appears to them, nor is it strictly and entirely true in a physiological sense.

The growth of an egg we will admit requires constructive metabolism to extend over a longer period than if the germ were male. While it is true that growth represents the expenditure of a certain amount of energy in the form of metabolism, it is by no means clear that the energy of growth required to produce a number of male elements equal in volume to an egg is any greater in the one case than in the other. It may be said that there must necessarily be more cell divisions or karyokineses in the case of a given volume of male elements than in the female, but this goes for nothing in that it cannot be shown that the metabolism or energy expended in building up and segmenting the one is any greater reckoning the additional and usual formation of an egg membrane in the egg (which is wanting in the other element), than in building up the large mass of plasma in the ovum. But in some eggs there is no egg membrane. Even then the process of spermatogenesis is not strictly to be compared with a disruptive metabolism or katabolism; on the contrary, as an end product of cytoplasmic activity, the male cell is in the main the highest achievement of constructive metabolism as represented in its preponderant nucleoplasm. The lowest forms of life have apparently a greater capacity for the development of nucleoplasm or chromatin-like substance, than the cells of higher animals, but even there, as in higher forms, there is the best evidence that the cytoplasm is the real agent in the production of the nucleoplasm; the latter grows, as we know, at the expense of the former.

* "The Evolution of Sex," New York, 1890.

The processes of metabolism, it is true, are carried a stage further in the production of flagellate germs and male elements than in the female, but it is not towards a lower plane of molecular structure, but towards a higher one than in the female germ. It may be said that metabolism is controlled by the nucleoplasm or chromatin, in that the volume of the one increases with the volume of the other as in a growing Amœba. An insufficiency of nucleoplasm would render a cell inert and incapable of coördinating its large cytoplasmic field, as experiment seems to demonstrate. The continuous processes of growth therefore ending in the expulsion of the polar bodies bring about such a stage of cytoplasmic inertia, in which the process of fertilization and the concomitant access of a highly complex and anabolic male element would restore the balance between the cytoplasm and the nucleoplasm. The "katabolic tendency" of the male element is more apparent than real; it has a greater capacity for katabolic change than the female as measured by the relative volume of its nucleoplasm, but absolutely it has far less because of its small size as compared with the whole ovum. The question of the genesis of sex is not to be disposed of in quite so simple a way as is done by Geddes and Thomson, or in a sentence. These authors have missed the essence of the matter in that they have not noted the essential distinction which exists between the egg and the spermatazoön, nor the transcendant importance of the process of cumulative integration. The cytoplasm preponderates in the one, while the nucleoplasm preponderates in the other. No reason for this has been assigned by these authors. Is not the evolution of a larger amount of nucleoplasm than is contained in the egg, as must happen were it to break up into spermatozoa expressive rather of preponderant anabolism than of preponderant katabolism? Is also the greater mobility of the male element an expression of a specially katabolic tendency? Is not its mobility due to an inherited tendency in part, derived from its most remote flagellate ancestor, and partly to its small size, form, mode of genesis and molecular structure?

The contrast between the modes of production of the male and female elements in *Ostrea edulis* is typical. The difference appears to lie *solely* in the fact that, in the case of the egg, the *whole* of the overgrown spermatogonium is expelled, but is not a mature ovum until after the expulsion of the polar bodies; in the expulsion of the male elements only a *part* of the spermatogonium is expelled, this process being accompanied beforehand by the elaboration of an excessive amount of chromatin by the mother nucleus of the spermatogonium, this chromatin serving to form, in the main, the nuclei of the multitudes of spermatozoa so set free. In that the chromatin used in the development of spermatozoa is formed at the expense of the cell body of the spermatogonium, there is an almost exact equivalence in the plasma that remains as the cell body of the ovum, so far as the metabolism expended in its production is concerned. The essential difference seems to me to lie not so much in any supposed diatheses which are more or less anabolic as in a difference in the functional properties of the plasma of egg and sperm, developed as a consequence of the physiological division of labor in the cell between cytoplasm and chromatin. The former is the immediate agent of intussusception, the latter controls and coördinates the processes of the former. The one is produced in a confined place tending to repress segmentational activity or nearer abundant supplies of nutriment. The other is produced in open cavities which admit of the free escape of sex products, or in regions, or at times when the determination of pabulum is less abundant than in the case of ova. Looking over the arrangement of the reproductive organs and their relation and proximity to the nutritive system, in many forms these views will be found to have much evidence in their favor. Nevertheless there is no evidence in favor of the one process being more katabolic than the other. They are equivalent, only that in the ovum there is a repressed segmentational tendency, in the spermatogonium an unrepressed one. The tendencies are towards the male or primitive monadiform condition in both, only that secondary physiological influences are repressive in the female and irrepressive in the case of the male element. Segmentation into spermatozoa is hindered in the egg, favored in the case of the spermatogonium. Yet despite this there is not the slightest evidence that the results in the two cases are not equivalent so far as the expenditure of energy is concerned.

The real difference in the result lies in this, that in the female element there is an enormous cytoplasmic field in which simultaneous and successive nuclear movement can take place leading to the realization of a coherent process of development instead of an incoherent one such as occurs in the breaking down of the spermatogonium into spermatozoa. The process in the one case is cohesive, in the other disruptive and self-destructive. The tendency then in the female is towards morphological integration, in the male towards morphological disintegration, but upon the common basis of the spermatogonium.

The real gain of this is not in the absolute bulk of the embryo simply, but in that such an embryo may become self-mobile and self-helpful in spite of its size. Herein lies the true significance of sex and of the cumulative process initiated through the repression of the primitive segmentational tendency of the spermatogonium. An embryo thus developed can go through an entire and elaborate cycle of embryonic development without requiring to take food at all and attain to a self-helpful, self-mobile condition.

It is therefore obvious that in such a process of repression of segmentation of the spermatogonium there has been a distinct advantage gained in the struggle for existence, in that such a spermatogonium could directly become the means by which a rapid or saltatory process of evolution could be accomplished, resulting in the evolution of larval forms. From such a stepping-stone the hypertrophied spermatogonium—ovum—other advances were possible, especially in the direction of variation, since such rapid simultaneous and successive segmentations would provide the most extensive possibilities for variation. This must be true upon the simple ground of the theory of permutations, since every cell added to the aggregate of a segmenting germ must increase its capacity to vary. This gives not simply a capacity to vary as if variation were fortuitous, but as a consequence a capacity of adaptation which is proportionately and demonstrably greater during their earlier stages, a circumstance again in conformity with the fact that all living metazoan types have diverged directly from the ovum, as is proved by their ontogeny.

The reproductive cells, as stated in a previous paper by the writer,* are functionless, so far as being of any service to the parent body producing them is concerned. The only function they have in relation to the parent body, is to lead a pseudo-parasitic existence at the expense of the surplus nutriment elaborated by the parent organism ; but these pseudo-parasitic generative cells are themselves the products of the continuation of the processes of cellular growth and fission of the parent plasma.

Being functionless, the reproductive cells of both sexes also tend to revert to the most primitive form of reproduction, namely, to break down into spores, as illustrated by the bodily fragmentation of the majority of lower forms into spores, or the multiplication of the nuclei of some of these forms at the expense of their cytoplasm.

In the male this reversion and breaking down into spores is most complete in the evolution of a spermatogonium, in the female it is incomplete in that the reproductive cells are in some way prevented from breaking down either by excess of nutriment or proximity to nutriment under enclosed or encysted conditions, which tends to be overcome at about the time the eggs are set free or after that time, as expressed in the expulsion of the polar bodies. The female individual may therefore be regarded in the light of a male organism in which the excessive tendency to sporulation has been repressed or retarded. The female state of all higher forms may be regarded as a suppressed or retarded male condition.

This repression of the male condition within the parent body leads however to a process of cumulative growth in the ovary or female gonad which expresses itself as the continued increase of the volume of the spermatogonium, leading to the evolution of a large amount of cytoplasm. After detachment of the hypertrophied spermatogonium, as an ovum, the source of supply in the form of nutriment is cut off, and whatever karyokinesis now goes on must proceed at the cost of a small amount of nucleoplasm, which soon exhausts itself so far as any exhibition of the energy of growth is concerned in the production of the polar bodies. After the expulsion of the polar bodies the egg is probably able merely to so adjust its internal forces so as to prevent the ovum from disintegrating.

In this condition the egg is incapable of further growth and in that the spermatic body from a fully developed spermatogonium, developed in the male is alone capable of reinforcing the exhausted female nucleus, so as to let loose the potential energy, for the time being, stably locked up in

* "Origin and Meaning of Sex," *Amer. Nat.*, 1889, pp. 501–508.

the cytoplasm or cytoplasm and yolk of the hypertrophied female spermatogonium or ovum, it must have access to the latter.

The egg before the expulsion of the polar bodies is a spermatogonium, after that and exclusive of the polar bodies it is the exact homologue of the spermatozoön in that its nucleoplasm is now reduced to the volume of the nucleoplasm of the male element of the same species.

The male spore is however so specialized as an organism in nearly all forms that it is incapable of nourishing itself. Clearly, the only way it can do so is to find lodgment in a body whose molecular constitution is as nearly as possible similar to itself, otherwise its identity must perish in that it would either be digested or in some way absorbed, neither of which fates befall it in the egg, as we know from observation. That body in which it can find lodgment is the female spore or germ of its own species, in which it is not only not digested but is taken in as a partner literally, since it completely fuses with the female centre of control hitherto coördinating and maintaining the integrity of the cytoplasm.

But as soon as this fusion of the starved spore—male element—and the overgrown female element happens, the further changes which now take place must proceed in the presence of the stimulus of abundant nutriment (represented by the cytoplasm of the egg) for the male; but this is not all, the egg is now detached and cannot be nourished for a time, and its career of development is now also profoundly influenced by such all important new conditions as the surrounding oxygen affords for renewed metabolism, under the new free condition, all of which taken together makes for a tendency towards a new mode segmentation which tends to recapitulate the growth of the parent form.

The process of fertilization is probably more like one in which there is a reciprocal blending of two living bodies in which there is no loss of identity of either in that their essential molecular constitution is exceedingly similar. Reciprocal digestion does not occur since the organization of both germs would be sacrificed if such a process were to occur. So far from that the organization of both germs is in a sense maintained, and we have in the blending of male and female elements the paradox of two cells becoming one without the sacrifice of organization in either during the process of fusion. It is therefore manifest that the application of the term mutual or reciprocal digestion as attempted by Rolph and maintained by Geddes is wide of the mark and not descriptive of the process at all. "Fertilization" is really the highest and most specialized form of molecular integration, and is itself the highest phase, and a consequence of the universal principle of cumulative integration, which underlies all continuous growth which in turn must end, on account of the requirements demanded by the surroundings, in discontinuous growth, the production of unlike germs by the same species, and consequently in sexuality.*

* The theory of the polar bodies developed in this paper remains to be put to the test. I find that the nuclei of the spermatozoa of *Ostrea edulis* take up the methyl green while the nuclei of the spermatogonia take up the saffranin from a solution of those two dyes

The causes of the "setting aside" of the "germ-plasma have acted directly and in an adaptive manner." "Nature is no spendthrift but takes the shortest way to her ends." Weismann assumes that the reproductive cells are "set aside" as the consequence of the action of the principle of the physiological division of labor. The cause of the physiological division of labor he attributes to the "action" of "natural selection." Is this true?

Taking one of the lowest forms of reproductive activity as illustrated in *Volvox* we find that the germ-cells are not yet constantly or definitely localized except that we may say that they arise in the posterior hemisphere of the colony. Examining *Volvox* from the standpoint which recent knowledge has afforded, it is clear that the anterior pole is differentiated to a degree not attained by the posterior pole. This differentiation clearly stands in a definite relation to the greater action of the light on the anterior pole from the germinal condition onwards through life. It also stands in a definite relation to the differentiation of the anterior pole as the directive and phototaxic one in the course of the execution of the motions of the whole organism rotating on a definite axis.

Furthermore, the organism when at rest, as it frequently is at the surface of the water, has the upper pole turned towards the light, and under these circumstances is it not to be supposed that the lower pole, which is the heavier on account of the presence of the large germs, would gravitate into its inferior position? I do not see how such an admission is to be avoided. If this is so the tendency once begun would tend to be intensified, since those peripheral cells which began to be receptive to the surplus nutriment elaborated by the whole organism would tend to maintain that tendency and the heavier they grew the more constantly they would tend to turn the anterior pole, where the largest "eye spots" are found upward towards the light. This would give the light an opportunity to maintain the specialization of the anterior pole as the photophilous one, and thus intensify its phototaxic tendencies.

The anterior pole would then be most active in its reactions to light, the posterior one least so as is actually the case. The evolution of the physiological differentiation of *Volvox* can therefore be directly traced to the action of the principle of overgrowth or overnutrition reacting under the influence of gravity upon the equilibrium of the colony so to adjust it that the colony will be uniformly acted upon generation after generation in the same way upon the upper pole. This would be an all-sufficient cause of the physiological differentiation or the real cause of the physiological

mixed together. Balbiani has obtained somewhat similar results with the testes of Elasmobranchs and Mammals, using picrocarmine and methyl green. If the polar cells are abortive male elements they should have a greater affinity for methyl green than the female pronucleus. If such results were secured my hypothesis would obtain microchemical verification. Indeed, I am inclined to think that the fact which I have observed, that the one pole of the dumb-bell-shaped chromatin mass in the nucleus of the immature egg of *Ostrea* stains with methyl green, while the other pole stains with saffranin is distinctly in favor of my interpretation.

division of labor observed. This process of morphological specialization in *Volvox* is therefore not necessarily due to natural selection alone.

There are still other reasons why the physiological specializations in *Volvox* have proceeded along the lines they have. It may be asked why the germ-cells tend to bulge inwards as they enlarge into the jelly which fills the cavity of the colonial sphere. Why do they not bulge outwards?

To this it may be replied that light, oxygen and food react from the exterior of the colony. The mobile protoplasm through which supplies of nutriment come, must be most exterior. The katabolic running down of the accumulated nutriment matters into less mobile coarse granules which need and consume less oxygen, requires that these materials shall be pushed inwards where they will not obstruct respiration.

In this way, upon the ground of physiological anatomy and the reaction of the incident surrounding forces, the process of the "setting aside of the germ-plasma" in *Volvox* can be fully accounted for without appealing for an instant to natural selection. There is clearly nothing further needed.

It might be said that "natural selection" would favor only those individuals which did not have the germ-cells bulging outwards, because they could not so conveniently rotate or move forwards. Yes, but *Volvox* does not, in the first place, continuously rotate. In the next place, even if "natural selection" did work the wonders claimed for it, it is clear that the explanation here suggested is one which involves no waste of the forces of growth or of individuals, but is operative in virtue of the continuity of the processes of growth, besides it meets the requirements equally well with the hypothesis of natural selection.

The natural selectionist will next appeal to the morphology of *Volvox* in some other direction and ask, How was the hollow sphere evolved? This, in its turn, is clearly and purely adaptive. The growth of the original colonies, which were doubtless evolved from such as broke down into planogametes, grew directly into larger multicellular aggregates which would directly arrange their cells so as to derive the greatest advantage from the surroundings and in attaining that adjustment, the globular form was assumed, in that it offered the maximum opportunity for oxygen, food, etc., in the form of a hollow sphere with the gametes joined by protoplasmic bonds. The selection of the pattern of the form of the whole organism is thus traced to internal forces acting in direct response to outer conditions and not as the result of a murderous process of "selection" and "survival of the fittest." *

But this is not all, if the argument applied to the driving inward of the

*The method of segmentation itself must be regarded as a necessary adjustment of the cleavage planes in such wise, as to divide the large globular ovi-cells into approximately equal parts continuously. An adjustment of this sort effects the equal reduction of all the cells resulting from segmentation, and keeps them below a dimension or mass which outruns the surface to an extreme degree, since according to the Leuckart-Spencer principle beyond a dimension of six, mass begins to rapidly exceed surface and bring about conditions unfavorable for respiration and metabolism.

accumulated products of assimilation in order to avoid the peripheral obstruction of respiration the same argument can be applied to the localization of the germinal matter at the posterior pole. Suppose an ancestral Volvocine form still in a condition when it had not yet began to permanently cohere into a spherical colony. Suppose further, that when its maximum dimensions of growth had been nearly attained all its cells were so nearly alike that the differences would be extremely slight between them. But suppose them to be even very slightly different enough in size to respond to an equilibration of the colony by gravity at the surface of a still pool on a quiet sunny day. The upper cells would undoubtedly be stimulated into a slightly greater assimilative activity than the lower ones away from the light and shaded by the upper ones. The assimilated materials would not only be repelled towards the lower pole by this activity of the protoplasm of the upper pole, but would actually gravitate towards that pole. We thus see that, analyze the physiological data in whatever manner we please, there finally remains no warrant for the hypothesis that the germ-plasma is set aside in special cells for the express object of maintaining the continuity of the processes of reproduction. This apparent setting aside of germinal matter is itself the consequence of the necessary mode of the correlated action of physical agencies, ending in cumulative integration through continuous growth, and is clearly not the result of any elaborate selective process.

The running down katabolically of some of the assimilated or stored germinal matter is proof of its loss of function and uselessness to the parent organism except in so far as such cells are a repository for such materials. There is therefore no conclusion open to us but that one which assumes that the motive force of all these elaborate correlations in such a simple multicellular organism * are the results of the indirect action under cosmical conditions, of the principle that living matter tends to increase in bulk beyond the actual physiological requirements of its secular existence.

Summary of Conclusions.

1. Cumulative integration or assimilation beyond the current needs of the parent organism seems to have arisen as a consequence of the physical properties of "living" matter, as manifested in metabolism or the characteristic continuous disintegration and integration of such matter. It is a property of "living" matter which is a consequence of its molecular constitution ; if so, "living" and the continuity of molecular change through metabolism is a physical process, differing only from ordinary chemical processes in its complexity, continuity and capability of self-maintenance under certain conditions; its most important consequence is continuous growth.

* The researches of Overton and myself have proved beyond doubt that Volvox is not a protozoön or protophyte as erroneously supposed by Lankester and Bütschli.

2. The law pointed out by Leuckart and Spencer that beyond the sixth dimension above unity mass outruns surface, may be regarded as in some way operative in hindering the growth of cells, through cumulative integration, beyond certain dimensions, in order that they may carry on respiration, nutrition, in a word, metabolism, most efficiently, under ordinary cosmical conditions. The average of cellular dimensions varies in different forms. So does the molecular constitution of living matter, giving rise to idioplasms.

3. The continuity of growth is maintained through cumulative integration, the continuous reduction in mass of "living" matter is effected through segmentation in some self-regulated way, presumably according to the Leuckart-Spencer principle.

4. The growth of the lowest forms of living beings is effected in the main or ends principally in the production of a single kind of living matter. In higher forms, in which the cells are also generally much larger, two kinds of living matter are developed in very unequal proportions. In the first case when division occurs, due to growth, there is little or no reaction between the two kinds of living cellular substance and division is direct or without karyokinesis. In the second case there is a reaction between the two kinds of living matter which is expressed most strongly as karyokinesis, or nuclear motion on the one hand and the development of fibres on the other radiating from or converging upon the nucleus.

5. The effect of cumulative growth of the cell-mass has been to finally produce a preponderating quantity of plasma which invests the primitive nuclear plasma or chromatin with a thick envelope; this envelope is known as the cell-body or cytoplasm, and also provides a *field* or space in which the action and reaction of the two kinds of living matter found in the cells of higher forms may display itself as karyokinesis. The plasmic space in which this occurs may be called a *cytoplasmic field.*

6. The action and reaction between the two kinds of plasma controls the order and direction in which the phenomena of growth take place, but in conformity to certain dimensions and earlier relations of the cytoplasmic field to its sources of nourishment.

7. The effect of the forces at work in cumulative integration is to augment mass, the effect of the action of segmentation so as to effect a readjustment according to the Leuckart-Spencer principle, is to bring about discontinuity of growth or reproduction through fission.

8. The asexual method of reproduction seems to have been purely a consequence of the operation of forces under the laws of cumulative integration and the law of Leuckart and Spencer, under varying conditions, and to have led to a continuously repeated division of living matter, as fast as it was formed into small masses, through direct processes of fission, composed at first almost wholly of nucleoplasm or chromatin.

9. As cytoplasm began to be developed more abundantly there seems to have been developed a tendency for the products of segmentation to cohere. We may therefore distinguish very sharply these two kinds of segmentation as *disruptive* and *coherent*. But the greater development of cytoplasm was itself a consequence of cumulative integration, which proceeded so fast that its products could not be converted into nucleoplasm or chromatin with sufficient rapidity so as to be in a condition to fall apart as small cells as a consequence of the action of the direct process of fission. The evidence for this is the fact that the nucleoplasm or chromatin, in higher forms, is derived by constructive metabolism from cytoplasm and is the end-product of the latter.

10. The secondary evolution of a cytoplasmic field led to a process of divergent evolution or in the production of two kinds of cells, the most primitive or ancestral of which was poorly provided with cytoplasm, while the secondary form was provided with a thick cytoplasmic envelope.

11. The primitive minute form of cell is to be identified as the asexual one, which afterwards became "male," while the large overgrown type of cell, loaded with cytoplasm and its secondary products, is to be identified as "female" or as a cell on the way towards disruption into male cells, which tendency it still betrays in the process of extrusion of polar bodies. The arrest of this process of fragmentation in the case of such large cells loaded with cytoplasm, led to the evolution of the ovum from the spermatogonium or such a cell as was primarily destined to produce male cells as a result of its further fission.

12. The male state is therefore the primitive one, and in the prodigious fertility of the male represents the primordial, asexual, flagellate types. The female cell is a secondary and derived form developed after a cytoplasmic field has been evolved and after cell-aggregates began to become coherent.

13. This differentiation was primarily due to cumulative integration, or assimilation beyond the current needs of the organism ; the female cells to which this overgrowth was diverted have tended to grow far beyond the average dimensions of the other cells of the body of the parent, and this excessive size is proof that they have in some way lost the power to undergo spontaneous segmentation, except in the case of parthenogenesis. Cumulative integration is consequently responsible for the evolution of the asexual, sexual and parthenogenetic modes of reproduction.

14. Ovarian egg and spermatozoön are not homologous ; ova after extrusion of polar bodies are the homologues of spermatozoa. Ovarian ova and spermatogonia are, in many cases, exactly homologous.

15. The expulsion of the polar bodies and detachment of the egg from the parent exhaust its power of continued spontaneous growth except in case of parthenogenesis.

16. The male cell as a consequence of the reduction of its cytoplasmic field at last became incapable of further independent development.

17. The male and female elements became reciprocally attractive to one another (sometimes through the production of certain chemical substances in the vicinity, Pfeffer), and in that their idioplasm is less different from one another than that of other cells there is no bar to their fusion, which is also favored by the fact that in the male cell with its preponderant chromatin there is now an attraction or need developed for more cytoplasm similar to its own diminished quantity, while conversely there is a similar need or attraction developed in the egg for additional chromatin in consequence of its preponderating cytoplasm. This leads to the highest form of cumulative integration through direct fusion of the male and female elements, or what I shall call reciprocal integration without loss of molecular identity, or as it is commonly called, to "fertilization." "Fertilization" is a reciprocal restoration of the equilibrium between the chromatin or nucleoplasm and the cytoplasm of both ovum and spermatozoön, this takes place not with accompanying molecular disintegration but by the actual fusion of both elements without the sacrifice of the molecular identity of either. Mutual digestion is not possible, for both elements are already composed of similar molecules. This molecular similarity constitutes the means through which the hereditary traits and tendencies of the male and female are transmitted.

18. The accumulation of cytoplasm in the egg through cumulative integration has enlarged its cytoplasmic field beyond that of any cell of the parent body. The result is that when "fertilization" occurs or fusion with the male cell, a series of segmentations are set up in this mass which are independent, and under the influence of new conditions, lead to the continuation of growth as the development of an embryo. This development is rendered directly possible only in virtue of the fact that there is a large cytoplasmic field in which nuclear motion and growth can take place in three dimensions temporarily without access of nutriment, while the resulting segmentations are coherent and tend to take place in such order and relation as to produce a being similar to the parent. The aggregation of large masses of segmentable plasma through the operation of cumulative and reciprocal integration has enabled the products of such simultaneous and successive segmentations to cohere and remain a multicellular aggregate, and to lay the foundation and become the direct cause of all metazoan and metaphytic organization.

19. The augmentation of the mass of the egg through cumulative integration and the development of the oösperm through reciprocal integration, has rendered possible the development of embryos without need of other nutriment during the preliminary or larval stages of ontogeny, thus leading also to the evolution of all larval forms, through processes of direct adaptation.

20. The achievement of the multicellular condition is probably to be

traced to the secondary evolution of a cytoplasmic field, sexuality also having so arisen at about the same time. The multicellular or coherent condition produced new and more complex morphological relations leading to the manifold differentiation of physiological functions in relation to diversification of surroundings, thus introducing a new and powerful cause or capacity for variations and adaptations under such diverse conditions. It is in the highest degree probable that the evolution of a cytoplasmic field and of sexuality, which depends upon the former, first rendered variability possible.

21. Cumulative integration in the vegetable led to the process of cumulative integration in the animal world and to the overproduction of germs or young in both of these kingdoms of life. The rate of increase thus became augmented in a geometrical ratio, as supposed upon the Darwinian hypothesis, which on the basis of the theory of the struggle for existence and the process of natural selection so evoked, accounts for the preservation through survival and inheritance of valuable or advantageous variations which first arose as supposed above. Cumulative integration is regarded as the primary cause of morphological differentiation under the stress of diverse conditions, as well as of the geometrical ratio of increase of individuals and consequently of the struggle for existence. The effects of the struggle for existence have however been modified through the already attained morphological differentiation of many forms in that the nature of further possible modifications have been in some cases very clearly determined by the character of those which have immediately preceded the last modification. This principle of cumulative adjustment through which superposition of adaptations occurs, is the law of cumulative morphological differentiation.

22. The only cells in multicellular forms which are absolutely otherwise functionless are the germ-cells. They alone, therefore, can become the vehicles for the transmission of all the traits of the parent in higher forms. They are the only cells of the body which, by any stretch of the imagination, can be supposed to possess the recapitulative power manifested in ontogeny.

23. In that the germinal cells are never belabored with any physiological function in the parent body, except cumulative integration, they are also the only ones which lead the charmed life of a perpetual youth. Upon this peculiarity of germ-cells depends rejuvenescence through reproduction, and the maintenance of the maximum vigor of the species.

24. In that maximum vigor of growth concentrated upon apical or nearly acropetal cells in plants determines their sex, and in that this seems to hold in great measure in Algæ and Fungi, and in that the gradually deeper inclusion of germ-cells and germ-tracts in animals is clearly a consequence partly of further morphological development, as well as of the effect of the repulsion of the functionless germ-cells into positions where

they are out of the way of interference with the exercise of the functions of the rest of the cells of the body, we have some clews to the reason why germ-cells are "set aside," not as the consequence of a *foreseen* (by the organism or natural selection) necessity for their isolation, *a la Weismann*, but as a consequence of the continuous action of cumulative integration ending in continuous growth, sexuality, morphological and physiological differentiation under the stress of surrounding conditions to which adaptive responses must as continuously be made.

25. With the evolution of the multicellular condition and sexuality, through cumulative integration, sexual correlations and interdependences between plants, insects and air-currents were evolved, as supposed in the text, while in animals sexual passion was evolved in the progress of sexual evolution. These factors became the motive forces which sustained the process of reciprocal integration or fertilization at its maximum of efficiency, and thus provided for the continuous rejuvenescence of living forms.

26. "Maternal" and "paternal" are relative terms. There was a time when asexual reproduction, through fission without karyokinesis, was effected by forms which were morphologically male. When individuals became developed in which the physiological functions of the individual were so adjusted automatically through a correlation of those functions as to impede the production of chromatin or nucleoplasm, presumably through the too rapid action of cumulative integration, cytoplasm was produced in a preponderating measure, the spermatogonia were hypertrophied and discharged before complete maturation as ova. In this way femaleness arose, and as "sex" thus became reflected in the physiological tendencies of the individuals of a species, some became male and others female. This carried the principle of the physiological division of labor beyond organs and extended it to individuals of the same species. The female, let me repeat, is a repressed male state.

27. In the production of female germs (ova, oöspheres) there occurs a prolonged process of integration of plasma so as to increase the volume of the cell-body, under conditions different from those obtaining in the production of male elements. In the production of male elements (spermatozoa, antherozoids), on the contrary, an actual process of elimination of cytoplasm often occurs, so as to reduce the latter to a minimum, and leave little remaining except the nucleus and its chromatin. The modes of production of the male and female elements, therefore, stand in the most extreme contrast to each other. The male state, on account of its prodigious fertility and the flagellate type of its products, is to be regarded as a reversion to the asexual method of reproduction as respects the physiological methods involved and the morphological character of the elements produced.

28. Reciprocal integration or sexual conjugation, otherwise "fertiliza-

tion," is an asexual method of reproduction superimposed or blended with another in which the last evolved sexual element has been hypertrophied as an ovum. The exhaustion of the central controlling mass of nucleoplasm or chromatin after expulsion of the polar bodies, together with the great size of the egg, has rendered it passive. The recurrence of the minute flagellate condition as "male" has rendered the male element active.

29. Male and female "sexual" products were at first and still continue to be dehisced as useless products of overassimilation or as a consequence of the cumulative action of integration, after further recapitulative growth in the form of new axes or individuals, growing in organic union, as in colonial organisms, became impossible, due to crowding, the culmination of seasonal growth or the morphological specialization leading to definite or constant formal individuality.

30. The "setting aside" of germ plasma must therefore be attributed to the direct action of cumulative integration, and cannot logically be considered as a "device" through which the immortality-isolation of germinal matter was to be achieved as a purpose or end.

31. Continuity of growth as continuously maintained through the physical capacity for living matter to increase its mass, was the primary factor in divergent evolution. The first step which it effected in adaptation was the necessity for segmentation either with or without karyokinesis, according to the law of Leuckart and Spencer. As soon as coherent, successive segmentations became possible, the first stage of which is seen in *Volvox*, the first step of morphological differentiation also conformed directly to the requirements of external conditions in that a blastula form was assumed which gave the maximum of surface in combination with the simplest form of coherence which could be developed through successive and simultaneous coherent processes of cleavage.

32. Sexuality, parthenogenesis, the extrusion of the polar bodies, larval development and the direct divergence of all higher types from the oösperm, are some of the effects of continuous growth as caused by continuous cumulative integration working under diverse conditions and the capacity to make direct adaptive responses.

33. The available evidence tends to show that sex is not predetermined in the egg, but is dependent upon internal conditions and correlations of metabolic activity within an embryo, so that sex may very often be influenced directly by the regulation of the food-supply long after development has begun.

34. The polar bodies are a phylogenetic reminiscence of the asexual or male flagellate state. There is not the slightest evidence to show that they are other than one of the manifold effects of continuous growth impelled to proceed as supposed above. They can certainly not be identified

as a "device" intended to prevent parthenogenesis, as supposed by Balfour, nor is it established that one of them is extruded "ovogenetic" plasma, while the other is *conveniently* extruded to save Weismann's ancestral germ plasma from molecular disintegration !

35. The divergence of type from the oösperm was determined by variations in the surrounding conditions, the effects of which could not be reflected upon the germinal matter set aside through the continuous action of cumulative integration, resulting in continuous growth, except through the action of the concurrent metabolism so affected. Metabolism under diverse conditions was therefore the only source through which the idioplasms of species could be developed, through which the continuity of the phenomena of inheritance is maintained.

36. The principle of continuous growth through cumulative integration, its rhythmical interruption through the "setting aside" and dehiscence of the useless sexual elements, the evolution of a cytoplasmic field, the direct adaptation to their surroundings of colonial aggregates of cells resulting from the coherent segmentation of masses of plasma resulting from reciprocal integration, the necessarily cumulative superimposition of adaptations upon one another, have been, in the main, the materials upon which natural selection was dependent in order to become operative in biological evolution.

37. The view that the female is preponderatingly "anabolic" and the male "katabolic," as held by Geddes and Thomson, cannot be sustained on the basis fact, since it is readily demonstrated that the male element represents a higher product of constructive metabolism than the female.

38. The most important result of the evolution of sexuality is the physiological process of nuclear substitution through reciprocal integration or "fertilization," thus blending and superposing matter and energy from two sources and causing the latter to be potentially stored. Hunger has brought about the material overflow, the divergence of the sexual elements from a common basis has ended in the production of countless adaptive modifications and the evolution of "species," while the accessory devices favorable to conjugation which have been slowly and adaptively evolved have led to a gradually intensified expression of passion and love, which have become important motive forces in the drama of evolution at large.


HIS EXCELLENCY B. FRANKLIN L.L.D. F.R.S. PRESIDENT OF PENNSYLVANIA, & LATE MINISTER OF THE UNITED STATES OF AMERICA AT THE COURT OF FRANCE.

THE AMERICAN PHILOSOPHICAL SOCIETY

FOUNDED MAY 25, 1743
INCORPORATED MARCH 15, 1780
FIRST OCCUPATION OF HALL NOVEMBER 21, 1789

PROCEEDINGS

COMMEMORATIVE OF THE

CENTENNIAL ANNIVERSARY

OF THE

Death of Benjamin Franklin

APRIL 17, 1890

COMMITTEE OF ARRANGEMENTS

CHARLES A OLIVER *Chairman*

HENRY PHILLIPS JR
WILLIAM JOHN POTTS
ARTHUR BIDDLE
WILLIAM H GREENE

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXVIII. April 17, 1890. No. 133.

In Commemoration of the One Hundredth Anniversary of the Decease of Benjamin Franklin.

April 17, 1890.

At a stated meeting of the Society, held January 17, 1890, Dr. Oliver offered the following preamble and resolution :

WHEREAS, It is both honorable and just that we, the present representatives of the American Philosophical Society, should show our affection and regard for our illustrious founder and first President, Dr. Benjamin Franklin, who died on the 17th day of April, 1790, be it,

Resolved, That we commemorate his life, his wisdom, his labors, and his achievements by proper and fitting ceremonies becoming such an occasion, on the 17th day of April, 1890; the form of the commemoration to be referred to a Special Committee of five members, to be appointed by the President, who shall be empowered to take all necessary action.

Which, after discussion, was adopted.

The President subsequently appointed as such Committee, Messrs. Charles A. Oliver, Henry Phillips, Jr., Arthur Biddle, William John Potts and William H. Greene.

At a stated meeting of the Society, held on February

7, 1890, Dr. Oliver reported the following preamble and resolutions, which were adopted, and the same committee continued and requested to make all the arrangements necessary to carry out the same:

The Committee to which was referred the following preamble and resolution: "Deeming it both honorable and just that we, the present representatives of the American Philosophical Society, should show our affection and regard for our illustrious Founder and First President, Dr. Benjamin Franklin, who died on the 17th day of April, 1790, be it resolved that we commemorate his life, his wisdom, his labors and his achievements by proper and fitting ceremonies becoming such an occasion, on the 17th day of April, 1890; the form of the commemoration to be referred to a special committee of five members, who shall be empowered to take all necessary action," presented by Dr. Oliver at the meeting of the Society on the 17th of January, 1890, begs respectfully to submit the following report:

Resolved, That we commemorate in a becoming manner the approaching Centennial Anniversary of the death of Benjamin Franklin.

Resolved, That a series of short addresses upon his life, character and work be delivered before the Society upon this occasion.

On the 17th day of April, 1890, at 8 P.M., the Society and its invited guests assembled at Association Hall, in the city of Philadelphia, and Mr. Talcott Williams, introducing the speakers, made the following remarks:

Mr. President and Associates of the American Philosophical Society, Ladies and Gentlemen, and last, but most honored of all on this occasion, the descendants of Dr. Franklin: Few words of mine are needed to explain the occasion of our meeting or to refer to the men who are to address you. None are necessary to recall him or the memory of his death. We assemble not to widen his fame—an impossible task—but to deepen and display our loyalty to our founder and first head. This anniversary itself falls in a week thick sown with memory. It was but two days since that there was commemorated in this city, the anniversary which rounded out twenty-five years since the death of the first American of this century.* To-night we meet in recognition of one hundred years which have elapsed since the death of the first American of any century.

For us all the death of Lincoln still brings senses of loss for a leader taken away with his work unfulfilled, his mission unaccomplished. For none in the generation which stood by the open grave in which were buried the hopes of one section and the sorrow of both, can "the lilacs bloom with blossom of mastering odor" without thought that "the sweetest, wisest soul of all our days and lands" passed away when the task of retribution was over, and before the office of reconciliation began. To-night, as a century ago, the death of Franklin can only remind men that he left no task unaccomplished and no aim unfulfilled. In the supreme prosperity of his life nothing became him like its leaving. *Felix opportunitate mortis*, not like the Roman of old, in death escaping evil to come, but leaving countless and completed good behind. Death, for other men, lays the corner-stone of that fabric of appreciation and honor which posterity erects. For Franklin the hands of death set in place the cap-stone of the great structure which noble deeds had raised in honor, whose fame we cherish and whose shadow the descending years of a century still lengthen and prolong.

It is not our task to-night to magnify his deeds or add to his praises. In the presence of a career like his, eulogy is an impertinence and praise presumption.

* The Twenty-fifth Anniversary of Abraham Lincoln's death was celebrated in Philadelphia by the delivery by Walt Whitman of his address on the subject, April 15, 1890.

We assemble but to ratify and record the final judgment of a century. One hundred years ago, when this Society called upon one of its members to commemorate his life among them and his labors for man, it was possible to ask of a single speaker* to express the world's estimate of Benjamin Franklin. To-night that great monument of his achievements which death completed when no man's effort could add aught to it, has cast so broad a shadow across one hundred years, that no one, however able, can compass its breadth within the circumference of his intellectual horizon. Along whichever of the many paths that Franklin traveled to greatness, lesser men may wearily plod to-day, each is still aware, however high he may ascend, that his experience is too narrow and his vision too short to know and survey all the field of Franklin's achievements in the past or their fruits in the present. One hundred years ago, we heard one speaker; to-night we listen to five. For this occasion this Society has summoned here the biographer of Franklin; it has called upon the historian of the land in which he served his country abroad; upon the man of science; upon one both the man of science and letters, and lastly, to represent the civic and associated acclivities in which Franklin was engaged, upon the President of this Society. From this jury, thus constituted, presenting the garner of all the manifold fields which Franklin sowed to rich fame for himself and richer harvest for others, we hear summed up to-night the verdict of the century. This finding, which but ratifies the earlier presentment made by that greater jury which includes the civilized world,

*After the death of Franklin, Dr. William Smith was appointed by the American Philosophical Society to pronounce a eulogy upon the founder.

will have its full and ultimate record in the volume which this Society will transmit to learned societies through the world. It will give the acts and the character which have placed Franklin alone in all history as the one man who inspired the enthusiasm of France and satisfied the sober judgment of the English-speaking race—the solitary and unique figure in our history or in any history whose work and fame and name is alike honored, cherished and loved by the two opposing streams whose conflict is the history of twenty human centuries—the Latin and the Teuton.

Many biographers have emulated the record in which Franklin, all too briefly, told the story of his early life. We have to-night with us the only one of these biographers who has set in life and light those dreary past Revolutionary years, when as in those now passing and passed the high tide of war had ebbed and uncovered endless corruption when, as to-day, the State must be served and saved, if served and saved at all, while the clash of party and the din of faction drowned the nobler voice of principle. In describing that period when the hands of Franklin guided to its last, its final, its eternal abiding place the corner-stone of constitutional liberty, and all the morning stars of heaven sang together with joy as the pillars of organic law arose above the foundations of freedom, our historian has described the character and achievements of Franklin in a passage which will be cherished and remembered with the like utterances of Jeffrey and of Mackintosh; of Brougham and of Brancroft. He resumes to-night the task which he there began. I need not introduce, I need only present to you, the youngest and most widely read of American historians, John Bach McMaster, who will give you

A Short Biography of Benjamin Franklin.

Benjamin Franklin began his career, at Boston, as the youngest son in a family of seventeen children. The day of his birth was January 6, 1706. But, long before he died, the Gregorian calendar came into use in the English colonies and changed the date of his birth to January 17. As the boy grew up his parents attempted to determine his career. His mother was anxious to see him a minister. The boy was resolved to go to sea. The father tried hard to make him a tradesman, took him round among the carpenters and bricklayers, the joiners and the tanners to see which trade he liked the best and ended by binding him over to an elder brother to learn the trade of a printer. The apprenticeship did not long endure. The two made up an ill-mated pair. From disagreements they passed to insults. Insults led to quarrels. Quarrels to blows, and with blows they parted. The one to drag out an humble existence. The other to become the most illustrious American of his day.

Unable to find any work in Boston, Benjamin took packet for New York. Faring no better there, he crossed the bay to Perth Amboy, made the journey from Amboy to Burlington on foot, and, early one Sunday morning in October, 1723, reached this city. Here he found work and, in time, fell in with William Keith who governed Pennsylvania for the children of Penn.

Keith sent him to Boston to urge his father to buy him a press and some type. The father refused, and Keith sent him on a yet more foolish errand to London. When he set sail he believed he was to have letters of introduction and letters of credit, that he was to buy types, paper and a press and come back to America a master printer. When he reached London he found Keith a knave and himself a dupe.

His life at London forms the crisis of his career. None of the wise maxims of "Poor Richard," none of the prudence displayed in his "Advice to a Young Tradesman," none of the just principles set forth in after years in his moral essays then served to guide him. He wasted his substance. He kept bad company. He misused money entrusted to his care. He wandered from printing house to printing house, thought for one while of setting up a swimming school and for another while of wandering over Europe on foot. From this life he was turned by a merchant whose acquaintance he made on the long voyage to London, and who now gave him not advice but a situation. With him Franklin returned to Philadelphia, and at twenty began to keep books, sell goods and learn the secrets of mercantile affairs. He was indeed fast becoming a merchant when his employer died and he once more went back to the trade of printer.

For a time he was foreman in the shop of Samuel Keimer. But the two soon quarreled and Franklin with the aid of a friend established the "New Printing Office in High Street near the Market." From that hour prosperity never deserted him. At twenty-six he had bought out his partner, paid his debts, married a wife, and opened a shop that defies description. There were to be had imported books and legal blanks, paper and parchment, Dutch quills and Alleppo ink, perfumed soap, Rhode Island cheese, live geese feathers, Pahia tea, coffee, very good stock, and cash for old rags. Before he was forty-two he had founded one of the best newspapers, published the most famous almanac, and owned the best paying printing house in the thirteen colonies, was postmaster-general, and had written pieces which it is safe to say are the only pieces written by Americans in that age and read in ours.

And now this Yankee tallow-chandler's son, having raised himself, by a strict adherence to the maxims of "Poor Richard," from poverty to wealth, from obscurity to power, proceeded to violate one of the most often inculcated. "Shoemaker," says "Poor Richard," "stick to your last." "A rolling stone gathers no moss." "Keep thy shop and thy shop will keep thee." But Franklin now sold his shop, his newspaper, his almanac, and gave his time to the study of science. So well was the time spent that, before he was fifty, he had made discoveries and written papers that made him world-famous, secured for him membership in the Royal Society of London and won for him the Copley medal.

While the whole scientific world were thus doing him honor, he suddenly abandoned his studies, went back to politics and was once more loaded with public duties. His townsmen elected him Assemblyman. The home government appointed him Postmaster-General of the colonies. The Assembly sent him with its Speaker to hold a conference with the Indians at Carlisle; then to the Albany conference where he presented his famous Plan of Union; and then to represent the province in England.

The five years he now passed in England were the closing years of what is commonly known as the French and Indian War, but what might with more fitness be called the struggle for expansion. On his return to Philadelphia, in 1761, he seems for a time to have thought of quitting politics, living at his ease, building a fine house, studying electricity and writing a book on the "Art of Virtue." But the conspiracy of Pontiac, the massacre of the Conestoga Indians by the men of Donegal and Paxtang, and the bitter pamphlet war that followed drew him again into politics. Once more he entered the Assembly, became the leader of the Antiproprietary party, and, having lost his seat in the bitter contest that followed, was a second time sent to represent the colony at London. His business was to present a petition to the king asking that Pennsylvania be taken from the Penns and made a royal colony. But he had not been there many weeks when the Stamp Act passed, the contest for independence began, and, in the exciting times that followed, the petition went unheeded.

Having little to do, Franklin now passed his time in writing pieces on American affairs for the English newspapers, and in defending in many ways the cause of the colonies. It was during these years that he republished a London edition of the "Farmer's Letters," that he brought out "The Votes and Proceedings of the Freeholders and other Inhabitants of Boston," that he sent over the "Hutchinson Letters," and underwent the memorable examination before the Privy Council.

For the part he took in the Hutchinson affair he was deprived of his place in the post-office and was soundly abused by the English press. In the midst of this abuse parliament passed the Boston Port Bill, the Massachusetts Bill, the Transportation Bill and the Quebec Act; the first Continental Congress met and the revolution began in earnest. As the news of each act of resistance came over, the position of Franklin became daily more dangerous and unpleasant. For a time his work seemed ended. He shunned the court, went no longer to the houses of the ministers and kept away from the office of Lord Dartmouth. Indeed, he was about to come home when news that Congress was to meet detained him. From that Congress came the Declaration of Rights, and, having presented this to Lord Dartmouth, Franklin set sail for Philadelphia, March 21, 1775, and landed on the 5th of May at home.

He had been abroad ten years and six months. During these ten years many and great changes had taken place. Old friends were gone. New faces met him on every street. The growth of the city, the spirit, the prosperity of the people amazed him. But the greatest of all changes were in his own family. His wife was dead. His daughter was married. His son, a strong loyalist, was estranged by politics. Happily, no time was given him to feel these changes, for he was instantly involved in public affairs.

The day after he landed he was chosen a member of the Continental Congress, took his seat four days later and served for fourteen months, was on eleven committees, was made Postmaster-General, was sent on one mission to Washington at Cambridge and on another to Arnold at Quebec; was dispatched, after the disastrous battle of Long Island, to confer with Lord Howe; and, in September, 1776, was sent out to join Arthur Lee and Silas Deane in France.

There he was received as no other man has ever been received. He became the sensation of the hour. Everything that he said, everything that he did, everything that he wrote was quoted and read all over France. His bust was set up in the royal library. Medallions of him appeared in the palace of the king. His face was to be seen on rings, on bracelets, on the covers of snuff boxes, hats, coats, canes were all "*à la* Franklin." Nor was his diplomatic success less noticeable. He concluded the treaty of alliance with France, the treaty of amity and commerce, negotiated loans for great sums of money, and, in 1783, signed the treaty of peace with Great Britain. In 1785, old and loaded with honors, he came back to Philadelphia. Yet his career was far from ended. The people made him a member of council and the council and assembly made him President of the State, and while President, the people sent him to the convention that framed the

Constitution of the United States. He was now in his eighty-second year and at the height of his fame. Every ship brought him letters from the most renowned men Europe could produce. Not a traveler came to America but he turned aside to see Dr. Franklin. Pamphleteers did him honor in fullsome dedications. Towns were proud to bear his name. No newspapers ever mentioned him without some grateful remark. He was the venerable Dr. Franklin, "our illustrious countryman and friend of man," "the Father of American independence." To his house came regularly the Philosophical Society, the Abolition Society, the Society for Political Education.

Thus surrounded by friends and admirers, the closing years of his life passed quietly away. He died on the 17th of April, 1790. To say that his life is the most interesting, the most uniformly successful yet lived by any American is bold. Yet it is strictly true. Our country has, indeed, produced many men who have gathered greater fortunes; who have been more successful as philanthropists; who have made greater discoveries in physics. But it has produced none who have acquired greatness in so many ways, or have made so lasting an impression on the mass of his countrymen. His face is known all over the world. His writings are to be read in every tongue. His maxims are in every man's mouth. His name is all over the United States bestowed on counties, on towns, on streets, on societies, on corporations. The lightning rod and the papers on electricity give him no mean place among men of science. The Autobiography, "The Way to Wealth," the Bagatelles entitle him to a place among our men of letters. But his success was greatest as a statesman and his name is bound up with many of the most famous documents of our Revolutionary history. Indeed, it is the only one which appears alike at the foot of the Declaration of Independence, at the foot of the treaty of alliance with France, at the foot of the treaty of peace with England and at the foot of the Constitution under which we now live.

In introducing Mr. Frederick Fraley, the President of the American Philosophical Society, Mr. Williams said:

In all the long list of achievements which make the biography of Franklin read like the history of his country, nothing has proved more useful or lasting than the societies and associations which he established. Born in a land whose countrymen have a genius for organization, he had himself supreme aptitude for this work and was equally at home in drafting the Constitution of a fire company or of a Nation. Transmitted to his descendants in one generation after another, the exercise of a like power has given this city institutions of the highest value, the last of which, of the utmost importance to a manufacturing city, owes its origin and success to one of his descendants, whom sex and sex alone debars from membership in our Society.* Of all the societies which Franklin organized, the American Philosophical Society has proved the most conspicuous, the best known in the field of science and, we may modestly believe, the most useful in the service of his and our country. I have the high honor of introducing its President, who will address you upon

*Among other institutions in Philadelphia, the Philadelphia City High School was established, in 1831, by A. D. Bache, LL.D., a grandson of Dr. Franklin, and the Pennsylvania Museum and School of Industrial Art owed its foundation in 1876 and its growth afterwards, principally to the efforts of Mrs. E. D. Gillespie, a great-granddaughter of the philosopher.

Benjamin Franklin's Association with the Society.

It is difficult for me to realize that I stand here to-night as the representative of the American Philosophical Society briefly to present to you Dr. Franklin as the founder of that Society, as the spirit which influenced its life, as the one who crowned its career with the scientific honors of the day in which he lived; the Society that has endeavored to perpetuate his memory by an adherence to the principles which he incorporated in its origin and which have been faithfully, I think, preserved by his successors.

The origin of the American Philosophical Society may be traced to that junto which Franklin established in the city of Philadelphia when he was about twenty-two or twenty-three years of age, for the promotion of useful knowledge. His associates, with himself, prosecuted their studies and their deliberations with such success that it influenced, no doubt, all of their careers, but especially the career of Benjamin Franklin. He never forgot his early introduction to the kingdom of knowledge and he went on year by year with the great idea in his mind and memory that a part of his life-work was to be found in the establishment of a great Society having for its object the promoting of useful knowledge. In the year 1740 he issued his proposals for the formation of such a Society and labored sedulously for its accomplishment, sketching out the objects that it should pursue, the duties that its members should perform, their applications to science and to each other, and, aware that there must be a pilot to steer the ship and a man to keep the log, was not ambitious to be president of the Society, but took upon himself the humble office of its secretary. He performed the duties appertaining to that office with such fidelity and success that it reached a considerable point of influence in its existence. Then the jealousy of the times and the jealousy of Franklin led to the establishment of another Society claiming part of the title of the American Philosophical institution established by Franklin and the attempt to carry on an opposition society to his, with great damage to both, and with the result that about the year 1768, the gentlemen composing those institutions, finding that both could not survive, that there was not room enough in the city of Philadelphia for two institutions of the sort—happily coalesced, and on January 2, 1769, Benjamin Franklin was elected President of the associated institutions and continued to be reëlected for twenty-one years, from 1769 to 1790, without any opposition on the part of any member of the institution.

Our friend, Prof. McMaster, has given you a brief but admirable biography of Franklin's life, telling the story of his birth, of his early education, of his trials, and of his triumphs. In his connection with the American Philosophical Society you will recognize all the traits we have seen so skillfully delineated and which have marked the institution that bears the stamp of his creative genius, which has been influenced throughout its existence by his spirit, and which to-day, as our friend, Mr. McMaster, has told you, has its correspondents throughout the whole of the world of science, has upon its list of members distinguished scientific men of every country, representatives of all the departments of science in cities of the United States, and is preparing still to go on, carrying forward the good work that Franklin founded, that has been so successful in the hands of his successors, and we are hoping that Franklin's shadow will always be within view to guide the destinies of the Society to new honors and to new triumphs.

The minutes of that early Society that he founded in 1742 are still in existence in the beautiful handwriting of the philosopher, and its pages are turned over year by year by visitors to the halls of the Society; who tracing in the lines which he there wrote, realize to a certain extent the character of the man, the carefulness with which he did everything, and whether he turned his attention to the curing of smoky chimneys, or to the invention of an improved fire-place, or to drawing the lightning from the heavens and demonstrating its identity with electricity, or in proposing new theories of light and heat, or in encouraging the manufacture of large sheets of paper, or in his correspondence with the distinguished members of the Society—in all these things his connection with the American Philosophical Society illustrates the character of the man and the institutions which he founded in Philadelphia, cognating their purposes for the promotion of useful knowledge and which still remain and flourish among us in the types of the library company of Philadelphia, the old University of Pennsylvania, the Philadelphia Contributionship for the insurance of houses against loss by fire, the establishment of the first fire engine company of Philadelphia. Whether we look for him in the fields of philosophy or in the walks of business, or in works such as the framing of declarations of independence, constitutions or treaties, the admirable character of Benjamin Franklin is impressed upon every one of these things to which I have referred. And especially has his character been impressed upon the foundations, the traditions, the applications of the American Philosophical Society. That Society honors him as its founder and participates in honoring him in all those illustrations of human character to which our historian, Mr. McMaster, has referred and which have crowned our country with so much honor, with so many blessings and with such useful instruction to rising generations.

In introducing Mr. G. Brown Goode, Mr. Williams said:

American science owed its foundation and its first great discovery to a master of English style. The example of Franklin has never been forgotten by the scientific men of America. The record of their work has often become a part of the literature of their land. The clarity of their style has matched the brilliancy of their discoveries. It has been especially true of the Smithsonian Institution, which owes its endowment to the liberality of a private citizen, a liberality whose infectious example ought to attract new additions to his useful gift, that it has maintained in its registers of advancing knowledge, the dignity as well as the accuracy of science. A Henry and a Langley both remind us that the ability to make great discoveries may well be joined with the capacity to give them adequate expression. Representing a scientific institution with these traditions, Mr. Goode has come to be naturally selected to speak of the attainments of a man of science in the field of letters. With much of Mr. Goode's labors we are all familiar. The literature of our woods will never be complete without including the pages of Audubon, and the full record of our seas begins with the work of Goode. To this research, whose fruits are known to many, he has added labors in the field of early American literature whose results we hear to-night. As representing at once, organized science and literary research, I have the honor to introduce to you, Mr. G. Brown Goode, of the Smithsonian Institution, who will speak upon

The Literary Labors of Benjamin Franklin.

When the New World sent Franklin to Europe, England and France received him, without question, as the equal of their own greatest men. Lavoisier, Turgot and Raynal, Buffon, Rousseau and Condorcet were his admirers, Gibbon, Hume, and Adam Smith, Kames, Robertson, Bentham and Priestly, his friends, while to the poet Cowper praise by him atoned for all the carpings of the critics.

When he first met Voltaire, in the hall of the French Academy of Sciences, the two old men saluted affectionately, amid the tears and the applause of the spectators, and it was proclaimed through Europe that Sophocles and Solon had embraced.

His colleague, John Adams, by no means the most ardent of his admirers, said of him :

" His reputation was more universal than that of Leibnitz or Newton, Frederick the Great or Voltaire, and his character more beloved and esteemed than any or all of them. Newton had astonished, perhaps, forty or fifty men in Europe ; for not more than that number, probably, at any one time had read him and understood him, and these being held in admiration in their respective countries, at the head of the philosophers, had spread among scientific people a mysterious wonder at the genius of this, perhaps the greatest man that ever lived. But *his* fame was confined to men of letters. The common people cared nothing about such a recluse philosopher. Leibnitz's name was still more confined. Frederick was hated by one-half Europeans much as Napoleon is. Voltaire was considered as a vain and profligate wit, and not esteemed by anybody, though admired by all who knew his works. But Franklin's fame was universal. His name was familiar to government and people; to kings, courtiers, nobility, clergy, and philosophers, as well as to plebeians, to such a degree that there was scarcely a peasant or a citizen, coachman or footman, a lady's chambermaid or a scullion in the kitchen who was not familiar with his name, and who did not consider him as a friend of human kind. When they spoke of him, they seemed to think he was to restore the golden age."

In a nation of three millions, he was first in every field of action, as printer, publisher, editor, and humorist—in political economy, administration and statesmanship, in science, philosophy, diplomacy, and in literature. He stands to-day a colossal figure in the world's memory, his popularity in no wise lessened by lapse of time, and Americans still wonder at his stature, seemingly unable to measure the extent of his greatness. In Europe he is still thought the first of Americans, the most perfect embodiment of the spirit and genius of his country, and its one great writer who lived before the days of Irving.

His easy-going freedom of speech, his liberal views on theological questions and his irreverence, coupled with a certain coarseness, almost Rabelaisian, in his early writings, have lessened his popularity among educated Americans. Then, too, the subjects of which he wrote—the current political issues, the manners and morals of every-day people, common abuses and how to do away with them, passing events and their lessons, household economies, and the like—although they gave him a great popular audience, were not of the kind best fitted to call forth the admiration of his literary contemporaries.

His choice of subjects was, nevertheless, the best evidence of his preëminence. "Great men are more distinguished by range and extent than by originality. A great man does not wake up on some fine morning and say, 'I am full of life, I will go to sea, and find an Antarctic continent; to-day I will square the circle; I will ransack botany, and find a new food for man; I have a new architecture in my mind; I foresee a new mechanic power.' No; but he finds himself in the river of thoughts and events, forced onward by the ideas and necessities of his contemporaries. He stands where all the eyes of man look one way, and their hands all point in the direction in which he should go. The church has reared him amidst rites and pomps, and he carries out the advice which her music gave him, and builds a cathedral needed by her chants and processions. He finds a war raging; it educates him by trumpet, in barracks, and he betters the instruction. He finds two counties groping to bring coal, or flour, or fish, from the place of production to the place of consumption, and he hits on a railroad. Every master has found his materials collected, and his power lay in his sympathy with his people, and in his love of the materials he wrought in." *

The spirit of the hour was Franklin's constant inspiration, and his writings were a legitimate result, the natural outgrowth of his activity in all matters of public concern. Admirable in themselves, their chief interest is nevertheless due to the fact that they form so complete a record of the deeds and the personal character of their author.

"Though he was a voluminous writer and one of the great masters of English expression, Franklin wrote habitually with a single eye to immediate practical results. He never posed for posterity. Of all the writings to which he mainly owes his present fame, it would be difficult to name one which he gave to the press himself or of which he saw the proof. Yet he never wrote a dull line nor many which the century of time has robbed of their interest or value. What-

* Emerson.

ever he wrote seems to have been conceived upon a scale which embraced the whole human race, as well as the individual or class to whom it was specifically addressed, the one evidence of true greatness which never deceives nor misleads. If he wrote to his wife, it was, more or less, a letter from every husband to his wife; if to his daughter, it was a letter that any daughter would be pleased to receive from her father; if to a philosopher or statesman, there was always that in the manner or matter of it which time cannot stale, and which will be read by every statesman and philosopher with the sort of interest they would have felt had it been addressed personally to them." *

The gathering of "Frankliniana" has become of late years a favorite pursuit of book lovers, and there are many excellent private collections besides the magnificent assemblages of his printed books, manuscripts and imprints in the public libraries of Boston, New York, Philadelphia, and Washington. The pioneer in this movement was Prof. Justin Winsor, who, in 1869, established a Franklin Alcove in the Boston Public Library, for the reason, as he said at the time, "that Franklin is to Boston what Shakespeare is to England."

A complete library of Frankliniana, including not only the books by him and about him, but also the products of his press, would embrace nearly two thousand separate units. Such a collection would possess a very great value in money. †

Several bibliographies of Franklin have been printed. One

* Bigelow's Preface to Franklin's Works.

† One of his imprints, the translation of Cicero's "Cato Major," in good condition, has sold for $200. A complete series of "Poor Richard" would be almost priceless. Of the twenty-six numbers, the Pennsylvania Historical Society had, when Ford's book was printed, only sixteen; the Lenox Library, seventeen; the Library Company of Philadelphia, twenty-one; the Congressional Library, thirteen; and the American Philosophical Society one, which, however, is the first. Of the issues of 1734 and 1735 none are in the possession of any of these libraries.

of the most serviceable is that of Sparks in the latter part of his tenth volume. Another is the admirable one of Lindsay Swift, printed seven years ago by the Boston Public Library. The latest and fullest is the "Franklin Bibliography," of Paul Leicester Ford, a very stout octavo volume of nearly five hundred pages, which is intended mainly for the collector and is a minute and exhaustive catalogue of the variations of every possible bibliographical unit.

In this are cited nine hundred and ninety-seven titles, arranged as follows:

I.	Books and pamphlets wholly or partly written by Franklin.	1–600
II.	Periodicals and serials containing writings of Franklin....	601–618
III.	State Papers and Treaties, in forming which Franklin aided.	619–633
IV.	Works containing letters of Franklin........................	639–709
V.	Pseudonyms used by Franklin.	710–784
	Works relating to, written to, or dedicated to Franklin.	790–1002
	In addition to these there are named in the accompanying Reference List other publications, relating in part to Franklin, to the number of..................................	508

Of the six hundred titles given by Ford in his list of books wholly or partly written by Franklin, there are only about ninety which represent distinct efforts of authorship, even though prefaces, notes in books written by others, and broadsides be counted. The remaining titles relate to reprints, advertisements, and hypothetical publications of which no copies are known to exist.

Franklin's literary remains may be classified as follows:

1. The Autobiography—from 1706 to 1757.
2. Poor Richard's Almanac, in twenty-six annual issues, 1732–58, culminating in "Father Abraham's Speech at the Auction."
3. Essays upon Manners, Morals and the Science of Life, including the so-called Bagatelles, in all sixty titles or more.
4. Tracts and Papers upon Political Economy, Finance, and the Science of Government; in all about forty titles.

5. Essays and Tracts, Historical and Political, concerning the American Revolution and the events which immediately preceded and followed—1747–1790.
6. Scientific Papers—from 1737–1790; in all 221 titles and nearly 900 pages, octavo.
7. Correspondence, Diplomatic, Domestic and Literary—1724–90; in all, some twelve hundred letters, while many still remain unpublished.

THE AUTOBIOGRAPHY.

The autobiography, prepared between the ages of sixty-five and eighty-three, is one of the most remarkable bocks ever written. It was intended for his son, and certain intimate friends, and was not published until after the death of its author, and was never printed as it had been written until a few years ago, when, in 1874, Mr. John Bigelow issued a correct version from the original manuscript, which by marvelous good fortune had fallen into his hands, while Minister at the Court of France.

The autobiography has passed through at least one hundred and seventy editions, and has been translated into German, French, Danish, and Spanish.

To understand it properly, the reader should use Bigelow's edition and none other—for its editor, with admirable skill, has supplemented Franklin's own narrative, complete in itself up to 1757, by a series of extracts from his letters and other writings, so that it is told in the philosopher's own words, and is complete almost to the day of his death.

During the twenty-eight years of his residence abroad, from 1758 to 1785, he was in constant correspondence with the governments he represented, and with his friends, who were numerous and to whom he wrote at length and with great freedom.

"To his protracted expatriation," writes Bigelow, "we owe this fact, that there is scarcely an important incident in Franklin's life which is not described by himself in his memoirs, or in his correspondence; and it is to this vast treasury of sterling English, which seems to have been almost miraculously preserved from incalculable perils by sea and by land, that the legion of his biographers have been indebted for what has most contributed to render their writing attractive.

"I am not aware that any other eminent man has left so complete a record of his own life. The part of which, from the nature of things, could not be preserved in correspondence —his youth and early manhood; his years of discipline and preparation—has been made as familiar as household words to at least three generations, in those imperishable pages which, in the full maturity of his faculties and experiences he prepared at the special in-tance of his friends, Le Veillard, Rochefoucault, and Vaughan. From the period when that fragment closes until his death, we have a continuous, I might almost say, a daily record of his life, his labors, his anxieties, and his triumphs, from his own pen, and written when all the incidents and emotions they awakened were most fresh and distinct in his mind.*

THE ALMANAC.

Franklin's Almanac is interesting in itself, but far more so in its effects on the history of American letters and American life. It was the beginning of our American periodical literature, the first successful serial, the pioneer of the great army of magazines and reviews which, even now, stand in the place of public libraries to the great majority of our people.

Franklin's was not a monthly, or even a quarterly; it was an annual magazine of instructive and entertaining literature.

* "Life," p. 6.

He was the most experienced of American journalists, the editor and principal contributor of the *New England Courant*, when, in 1723, it threw Boston into tumult, and, in 1729, founder of the *Pennsylvania Gazette*, for more than half a century the leading newspaper in the New World. He fully appreciated the possibilities of periodical literature in America and established, in 1741, a monthly called "The General Magazine and Historical Chronicle for all the British Provinces in America," * an effort which failed because the country was not yet ready.

The Almanac was to the people of that day, what the weeklies and monthlies have become to their great-grandchildren. Franklin began to print it in 1732, and it soon became a necessity in every household from New England to the Carolinas, and made the name of "Poor Richard" famous all over the world. Within twenty-five years, at least a quarter of a million copies of this treasury of homely wisdom had been distributed throughout the colonies.

Franklin wished that his Almanac should be a vehicle for conveying instruction among the common people, who bought scarcely any other books. He, therefore, filled all the little spaces between the remarkable days in the calendar with proverbial sentences, chiefly such as inculcated industry and frugality as the means of procuring wealth and thereby securing virtue; "it being," as he said, "more difficult for a man in want to act always honestly than it is hard for an empty sack to stand upright." Finally he brought together in a connected fabric, all the best of the sayings of Poor Richard for twenty-five years, in the form of the harangue of a wise old man to the people attending an auction. "Father Abraham's Speech," "The Way to Wealth," or "La Science du Bonhomme

* Six numbers of this periodical were printed.

Richard," as this composition was variously called, touched by its simple wisdom, responsive chords in the hearts of all simple-minded people.

Its influence was amazingly great. No one was better able than Franklin to judge of its extent, no one less likely to exaggerate it.

Writing about it, in 1788, he said:

"The piece, being universally approved, was copied in all the newspapers of the continent; reprinted in Britain on broadsides, to be stuck up in houses; two translations were made of it in French, and great numbers bought by the clergy and gentry to distribute gratis among their poor parishioners and tenants. In Pennsylvania, as it discouraged useless expense in foreign superfluities, some thought it had its share in producing that growing plenty of money which was observable for several years after its publication." *

Ford's bibliography shows that since it was written, one hundred and twenty-three years ago, "Father Abraham's Speech" has been reprinted about three times for each year. Seventy or more separate editions in English have appeared, fifty-six in French, eleven in German, and some in Italian. It was printed in Danish at Copenhagen (1801, 1820); in Catalan at Montroulez (1820) and Morlais (1832); in Greek in Paris (1823); in Dutch at The Hague (1828); in Portuguese in Paris (1828); in Bohemian at Teshen (1838); in Welsh in London (1839); in Spanish at Caracas in Venezuela (1858); in Russian at St. Petersburg (1809), and in Chinese at Peking (in 1884), as well as in Polish and the phonetic characters.

Ford is quite justified in saying that it has been oftener printed and translated than any other book from an American pen.

* Autobiography, Bigelow edition, i, 250.

THE ESSAYS.

Franklin's essays represented his most finished work. Among them indeed are the only compositions written with a distinctly artistic purpose. Many years after his death a small, thin portfolio was found among his papers. On its cover was written "BAGATELLES," and within were fifteen or more of his own favorite essays. These were prepared for the entertainment of that brilliant circle of friends in Paris, in whose meetings the venerable author took so much delight. Among them were many of his most graceful and witty productions—such as "The Morals of Chess," "The Dialogue between Franklin and the Gout" and "The Ephemera."

The Bagatelles were written when he was over seventy. In some of his satires, half a century earlier in date, as for instance "The Speech of Mistress Polly Baker," he exhibited equal force and skill, though a wit less mellow and refined and a style less polished through familiarity with French literature.

His essay writing began when he contributed to his brother's newspaper in Boston a series of satirical letters signed "Silence Dogood"—which are highly praised by those who have read them. "So well," says McMaster, "did the lad catch the spirit, the peculiar diction, the humor of his model, the *Spectator*, that he seems to have written with a copy of Addison open before him."

Seven years later he prepared for a Philadelphia newspaper, *The Mercury*, a series of essays under the title of "The Busy Body." This was his first effort in a strictly literary direction. Some admirer has described them as being written "after the manner of the *Spectator*, but more readable."

Although the critic of to-day may not fully agree with this judgment, he cannot fail to be pleased with the graceful, easy flow of the words, and at the same time, interested in the evidences of the young printer's extensive and intelligent acquaintance with the best of English books.

After he became owner of the *Pennsylvania Gazette* he wrote for it essays in the same vein, many of which have been reprinted in recent editions of his writings.

Some of the essays were humorous or satirical, others related to religious and moral subjects and the economy of life, others still to the current events of the day. Among them was an admirable exposition of what was then known about earthquakes; and this, published in 1737, was his first contribution to scientific literature.

When he was living in England he constantly wrote for the press, and among his productions at this time were a number of papers, which although an essential part of his political writings, should also be included in that carefully-edited collection of Franklin's essays for which the world has been expectantly waiting for a hundred years. Among the best are the "Receipt for Diminishing a Great Empire," and the "Remarks Concerning the Savages of North America," written in Paris a few years later, which rank among the most brilliant of political satires.

HIS DOMESTIC AND LITERARY CORRESPONDENCE.

Franklin was the brightest and most charming of correspondents, and there is not one of his letters which is in the least degree dull or formal.

Over 1200 are printed by Bigelow, and they make up at least nine-tenths of the bulk of his literary remains. Many of them are little essays, and should be included in every edition of his short papers. In no connection are they more readable than as arranged by Mr. Bigelow* to form a part of the autobiography. "To be fully understood and appreciated," writes Bigelow, "they (as well as all the rest of his writings) should be read in chronological order and by the light of current events, for every one of them was as much the product of its time and circumstances as the fruits and flowers of a garden are of their respective seasons."

Though the signature is always "B. Franklin," the writer is sometimes the statesman, sometimes the shrewd, practical tradesman, sometimes the philosopher, sometimes the inventor concerned with mechanical details—now the philanthropist, now the wily diplomat, again the loving husband and parent, interested above all things in the affairs of his own little family, again the brilliant man of the world, gossiping with Madame Helvetius or the Abbé Morellet.

"His letters," said John Foster, "abound in tokens of benevolence, sparkling not unfrequently with satiric pleasantry, but of a bland, good-natured kind, arising in the most easy, natural manner, and thrown off with admirable simplicity and brevity of expression. There are short discussions relating to various arts and conveniences of life, plain instructions for persons deficient in cultivation, and the means for it; condolences on the death of friends, and frequent references, in an advanced stage of the correspondence, to his old age and approaching death. Moral principles and questions are sometimes considered and simplified; and American affairs are often brought in view, though not set forth in the diplomatic style."

It would seem impossible that the man who wrote at times so seriously and devoutly could have been also the author of the so-called "Suppressed Letters." Between the ages of fifteen

* Bigelow's "Franklin," i, p. 21.

and eighty-five, however, a human character has time for many transformations.

TREATISES UPON POLITICAL ECONOMY.

At the age of twenty-three, in 1729, Franklin published his "Modest Enquiry into the Nature and Necessity of Paper Money"—perhaps the earliest treatise on finance and currency written in America.

This pamphlet was written at a time of public crisis, and for a definite purpose, which was successful. It was the first of a series of political essays, published from time to time in the sixty-two years of life which remained to its author—each with some useful end in view, and each without exception productive of some definite result.

Edmond Burke was wont to say that when Franklin appeared before the British Parliament, he was like "a master examined before a parcel of school-boys," and Charles Fox declared that the ministry on that occasion "were mere dwarfs in the hand of a master."

Persuasive and convincing as were his spoken words, the power of the man was even more evident when he took up his pen to write upon topics of public interest. His political papers, however, have little meaning at the present time except to students familiar with the history of the days to which they belong, though read in connection with the story of his life they have a very great interest of their own.

In 1751 appeared "Observations Concerning the Increase of Mankind and the Peopling of Countries"—to which it would appear that Adam Smith in later years was indebted for suggestions, and which led Malthus to write his great "Essay on Population."

Franklin wrote other useful treatises, "On the Laboring

Poor," on "The Principles of Trade," on "Luxury, Idleness and Industry," on war, privateering and the Court of the Peers, and many kindred topics. None of his economical treatises were so original or so influential as the two which were first written. The last in the list, however, "On the Slave Trade," although finished only twenty-four days before his death and at the age of eighty-five, is as full of vigor and fire as his best efforts of a quarter of a century previous. It contains the speech of Mehemet Ibrahim in the Divan of Algiers, which Lord Jeffrey declared was not surpassed by any of the pleasantries of Arbuthnot or Swift.

POLITICAL WRITINGS.

Franklin's first political treatise was written in 1747.

The war between Great Britain and France, which was at that time in progress, was thought to have brought the American colonies into great danger, and the governor of Pennsylvania anxiously labored to prevail upon the Quaker Assembly to pass a militia law and to make other provisions for the security of the province. To further this project, Franklin wrote and published a pamphlet, entitled "Plain Truth," which had a sudden and surprising effect, and resulted in a few weeks in the organization of a colonial militia of over ten thousand men. This was the beginning of the conversion of the inhabitants of Pennsylvania from the Quaker doctrine of submission to that of defensive warfare, and had a most important influence upon the future of America.*

*Bigelow says of this pamphlet:

"Substituting the words 'United States' for Pennsylvania, it is as timely to-day as when it was written. Though we are at peace with all nations, we have many times as many lives and many times as much property exposed, while our defenses are relatively inferior to those which Franklin denounced nearly a century and a half ago as unpardonably deficient" (Bigelow's "Franklin," Vol. ii, p. 39).

"Plain Truth" was followed by several other tracts in relation to the struggle between Pennsylvania and the Proprietary Government in the hands of the Penn family. The most influential was that called "Cool Thoughts on the Present Situation of our Public Affairs," printed in 1764, which was a masterly argument in favor of a change from Proprietary to a Royal Government.

During his residence in England before the Revolution, and in France during its continuance and afterwards, Franklin wrote much. One of the most important of his early papers was that printed in London in 1760, entitled "The Interest of Great Britain in Regard to Her Colonies," a protest against the proposal that Great Britain should give up Canada to the French, and receive instead the Island of Guadaloupe in the West Indies.

So strong a paper was this that Burke, in replying to it, said of its author: "He is clearly the ablest, the most ingenuous, and the most dexterous of those who have written upon the question, and we may therefore conclude that he has said everything in the best manner that the case would bear."

These, however, together with his more extensive treatises upon the condition of affairs in the new Republic, belong to the statesman Franklin, rather than to Franklin the man of letters. Together with his diplomatic correspondence they make up fully half of his published works.

SCIENTIFIC WRITINGS.

Franklin's scientific writings were voluminous. Sparks reprinted 63 papers on electricity, filling 302 pages, and 157 on philosophical subjects, making 578 pages—in all 220 letters and 880 pages—which is a remarkable showing for a man so constantly occupied with private and public business.

His scientific papers are written in a style peculiar to their author—lucid, convincing, never wearisome. "A singular felicity of induction guided all his researches, and by very small means he established very grand truths. The style and manner of his publications on electricity are almost as worthy of admiration as the doctrine they contain. He has endeavored to remove all mystery and obscurity from the subject. He has written equally for the uninitiated and for the philosopher; and he has rendered his details amusing and perspicuous, elegant as well as simple. Science appears, in his language, in a dress wonderfully decorous, best adapted to display her native loveliness. He has in no instance exhibited that false dignity by which philosophy is kept aloof from common applications; and he has sought rather to make her a useful inmate and servant in the common habitations of man, than to preserve her merely as an object of admiration in temples and palaces." *

Perhaps the most judicious estimate of Franklin's qualities as a man of letters is that by John Foster in the *Eclectic Review* for 1818.

"It is unnecessary to remark," he writes, "that Franklin was not so much a man of books as of affairs; but he was not the less for that a speculative man. Every concern became an intellectual subject to a mind so acutely and perpetually attentive to the relation of cause and effect. For enlargement of his sphere of speculation, his deficiency of literature, in the usual sense of the term, was excellently compensated by so wide an acquaintance with the world and with distinguished individuals of all ranks, professions and attainments. It may be, however, that a more bookish and contemplative employment of some portion of his life would have left one deficiency of his mental character less palpable. There appears

* Sir Humphrey Davy.

to have been but little in that character of the element of sublimity. We do not meet with many bright elevations of thought, or powerful, enchanting impulses of sentiment, or brilliant, transient glimpses of ideal worlds. Strong, independent, comprehensive, never remitting intelligence, proceeding on the plain ground of things, and acting in a manner always equal to, and never appearing at moments to surpass itself, constituted his mental power. In its operation it has no risings and fallings, no disturbance into eloquence or poetry, no cloudiness of smoke indeed, but no darting flames. A consequence of this perfect uniformity is, that all subjects treated appear to be on a level, the loftiest and most insignificant being commented on in the same unalterable strain of calm, plain sense, which brings all things to its own standard, insomuch that a great subject shall sometimes seem to become less while it is elucidated and less commanding while it is enforced. In discoursing of serious subjects, Franklin imposes gravity on the reader, but does not excite solemnity, and on grand ones he never displays or inspires enthusiasm."

Although his works fill ten stately volumes, Franklin never wrote a book for publication.

The "Autobiography" was intended solely for the pleasure of his intimate friends. The sayings of Poor Richard were prepared for his yearly Almanac, with purely utilitarian ends in view. His scientific discoveries were announced, with few exceptions, in letters to his friends, who printed them without his knowledge or consent.

His political papers appeared in the newspapers and reviews, in letters, or prefaces, and in occasional pamphlets. Some of his brightest and most finished essays were set up and printed by his own hand, as broadsides, on a little printing-press which he had in his apartments while Minister to France.

The matter-of-fact character of his early writings was largely due to his surroundings and to the people for whom he wrote. When at leisure in the society of cultivated people he soon yielded to their influence. His famous essay on the "Way to Wealth," for example, was written soon after his visit to Virginia and a somewhat intimate association with General Braddock and his staff. The first, and incomparably the best, part of his "Autobiography" was written at the time of his most intimate connection with English literary society and while visiting at the country home of the Bishop of St. Asaph. The witty Bagatelles were produced in the midst of a brilliant Parisian circle.

His contributions to science were the result of a period of voluntary seclusion and temporary respite from business cares which he had learned by his frugality and industry while printer and publisher.

After he had acquired literary fame, he made use of it to promote the welfare of his country. A French writer, describing, in 1872, the events of nearly a century before, said:

"The coming of the famous American to Paris caused a profound sensation. Everybody wanted to see the author of the 'Almanach du Bonhomme Richard;' his mind was compared to that of Cato, and his character to that of Socrates. Franklin knew full well how to take advantage of the impression which he had produced upon a nation so impressionable as were the French, always ready to place their lives and their wealth at the service of a noble principle, and, following the example of Lacretelle, he decided to serve as ambassador not to a court but to a free and generous people."

He was by instinct a scholar and by inclination an author. He loved books for themselves. He became a vegetarian at the age of sixteen that he might buy them.

Some one has called attention to his "remarkable affinity for superior people." His affinity for the best of books was also remarkable, and no one was ever more sensitive to their influence. In the "Autobiography" he mentions the books which, as a boy, he liked to read, and it is easy to trace the effects of each upon his subsequent life.

His literary style, though founded principally upon a thorough study of the *Spectator*, gave evidence at a very early day, of intimate acquaintance with Bunyan, Defoe, Plutarch, Rabelais and Xenophon. His philanthropic tendencies were shaped and strengthened by Cotton Mather's "Essays to do Good," and his administrative faculties by Defoe's "Essay upon Projects." Shaftesbury and Collins strongly influenced his theological opinions. Locke's "Essay on the Human Understanding" moulded his habits of thought, as did also the "Memorabilia" of Xenophon.

Franklin has been called the founder of modern utilitarianism, but it is unjust and ungenerous to place this estimate upon his character. He knew the world in which he lived, and the people for whom he wrote. His aim was to produce immediate and practical results. His precepts were written for the unthinking, the inexperienced and the selfish. Poor Richard was a kindergarten teacher.

In his advice in regard to the treatment of the aged, for example, he reminded his readers that they would themselves in their own last years need care and indulgence, but he also first appealed to motives the loftiest and tenderest. Whoever studies Franklin in a generous spirit, will find no lack of generous thought and principle.

Like Socrates, Franklin estimated the value of every action by its utility. Moral utility was to him, however, the highest test of value. He believed that the promotion of universal happiness, by the prevention or mitigation of evil, was man's highest function. "He seems," says Weems, "to have been all eye, all ear, all touch, to every thing that affected human happiness," and he died with his eyes fixed upon "the picture of Him who came into the world to teach men to love one another. On his death-bed he often returned thanks to God for having so kindly cast his lot of life in the very time of all others when he would have chosen to live for the great purposes of usefulness and pleasure."

Is there in history a more touching memory than that of Franklin awaiting the coming of death, the venerable sage, the pride and glory of his own land, the admiration of Europe, making excuses for the moanings which were occasionally forced from him by the severity of his pains—afraid that he did not bear them as he ought, while he observed his grateful sense of the many blessings he had received from the Supreme Being, who had raised him from small and low beginnings to such high rank and consideration among men.

I have already said that nothing was further from his thoughts than to obtain for himself literary fame. He took no care of his own writings, and made no effort to secure the publication of them. And still, a century after his death, he stands prominently forth as the only great literary man of America in colonial days and in the first fifty years of the Republic.

No one who has held in his hand a copy of Franklin's edition of Cicero's "Cato Major" can doubt that the man who made it had the soul of an artist. No one who has read his tender and exquisitely graceful preface to this beautiful edition can question that he had the heart of a poet, and the touch of a master of letters.

When twenty-five he founded a great public library, the earliest in America, that others as well as he might enjoy the companionship of books.

Books were always in his mind and by his side. He compared his own life to a book. At the age of eighty-three he wrote:

"Hitherto this long life has been tolerably happy; so that, if I were allowed to live it over again, I should make no objection, only wishing for leave to do, what others do in a second edition of their works—correct some of my *errata*."

His "Autobiography," written in the same spirit, noted the "errata" in its author's career with true printer's interest, as if he were scanning a bundle of proof sheets. He did not conceal them, but marked them so that all could see, frankly confessed his errors, and did what he could in atonement.

Jefferson desired that his monument should declare that he was the author of the Declaration of Independence and the founder of a great university. Franklin, in his will, sought no higher title than that of *printer*. A maker of books he had been for three-quarters of a century, and a friend and lover of literature even longer. The epitaph, written by his own hand for his tomb, which can never become trite by repetition, is full of the spirit of the great printer.

"THE BODY
OF
BENJAMIN FRANKLIN,
PRINTER,
(LIKE THE COVER OF AN OLD BOOK,
ITS CONTENTS TORN OUT,
AND STRIPT OF ITS LETTERING AND GILDING,)
LIES HERE FOOD FOR WORMS,
YET THE WORK ITSELF SHALL NOT BE LOST,
FOR IT WILL, AS HE BELIEVED, APPEAR ONCE MORE,
IN A NEW
AND MORE BEAUTIFUL EDITION,
CORRECTED AND AMENDED
BY
THE AUTHOR."

In introducing Dr. J. W. Holland, Mr. Williams said:

It is sometimes forgotten in Philadelphia, and it is never remembered in Boston, that while Franklin became a Bostonian without being consulted, he employed the first exercise of his mature judgment to become a Philadelphian, and remained so to the end of his days. It is a happy coincidence that in commemorating the scientific labors of the man who, like another Prometheus, stole from heaven the vital spark which has given light to man and life to modern science, this Society has selected one of the many representatives of science in this city which it owes to the attractions it offers for a career rather than to the opportunities it furnishes as a birthplace. Dr. J. W. Holland represents an institution which has given to him, as it had before to a distinguished predecessor, the field for displaying in the East a learning and skill attained and acquired in the West. Like Dr. Gross, he has added one more to those men of mark in medicine whose work began in Kentucky, but the knowledge of whose labors is bounded by no one State. In dealing with the scientific work of Franklin, the physician is as much at home as the electrician. His great discovery in the field of the latter was more conspicuous, illuminating the ignorance of ages by a single flash of lightning. His discoveries in hygiene were numerous, useful and remain to-day serviceable. I take pleasure in introducing to you Dr. J. W. Holland, of Jefferson Medical College, who speaks upon

The Scientific Work of Benjamin Franklin.

The scientific labors of Franklin were not limited to any particular period nor any special field. Various branches of natural philosophy, in almost every year of his middle life, were illuminated by his discoveries, inventions and speculations. As an editor and man of business, science occupied part of his leisure, and in later life, when engrossed with public affairs, he sighed for opportunity to follow these favorite pursuits.

In presenting a sketch of these varied and fruitful labors, chronological arrangement will not serve so well as one based upon their general character. Looked at in this way his principal works are seen to fall into a few groups such as labors in sanitary science, in the art of navigation, in meteorology, and in electricity. It will be readily conceded that in the limits allotted this subject, it would be vain to attempt an extended analysis of all the philosophical productions of his fertile genius. It is possible, however, to give some impression of their variety and utility.

The science of maintaining health is rightly regarded as of very modern growth and even now its importance though constantly insisted on by its votaries is far from being generally recognized. The sound judgment of Franklin led him to consider it as a weighty matter whether it involved smoky chimneys or the water supply of a great city. His sanitary labors pertain to the person, to the house, and to the city. About that very common disturbance of health usually called "catching a cold," many fallacies still linger though Franklin did some forcible writing to remove the popular errors. He perceived what doctors nowadays all recognize that while among the causes of acute catarrh, exposure to cold was one, the most important was a predisposition due to impaired strength from any cause whatever. Too little exposure to fresh air inducing depressed vitality might thus figure as a cause. His essay on this topic with some alterations would make a good sanitary tract, even after the lapse of more than a century.

It was his constant habit to try to see all things little and great just as they are, and when he spoke of them to give a truthful report. When the time came for him to resort to spectacles to correct old sight, he found that the glass which served for society would not answer for reading. Naught that interested him was he content to look upon as if in a fog. But many things must be outlined dimly unless he carried two pairs of spectacles and changed them as the occasion demanded. To obviate this difficulty, he invented what is known as the bifocal or Franklin lens, the upper half of which was adjusted to distant objects and the lower for near view, as in reading. By changing the direction of vision through this one pair of glasses an elderly artist can see equally well the landscape one moment and his canvas the next. Franklin asserted that he understood French better by their help as they enabled him, while at table to see distinctly what he had on his plate and at the same time to note the expressive facial movements of persons who sat opposite. In the hundred years no change was made from the original form until recently. Now, instead of dividing the lens in equal halves by a horizontal line, two perfectly centred lenses of different sizes are cemented together. The larger, having two-thirds the size of the entire glass, is devoted to objects beyond arm's reach, and the smaller at the bottom suffices for reading. This invention must be considered as something better than a convenience; it takes rank with devices for maintaining health. When the imperfect eye makes frequent effort to see things without properly adjusted glasses, in sensitive persons eye-fatigue may induce various reflex nervous symptoms.

To those allied departments of domestic hygiene, ventilation and warming, he was the first one to give anything like adequate heed. On many occasions he urged the need for ventilation to prevent that personal vitiation of air indoors which depresses the energies and causes stupor and dull headache. Mr. Small, a London surgeon, credits him with being the first who observed that respiration communicated to the air a quality resembling the mephitic gases of caves, and further, that a noxious character was imparted by the volatile effluvia of persons enclosed in rooms. Franklin attached considerable importance to the use of open chimneys for the extraction of the vitiated air by the upward draught. While in London he was consulted on the ventilation of the House of Commons and recommended that the personal atmosphere surrounding the members might be carried off direct by having outlets in a part of the benches on which they sat connected with exhaust flues. The merit of the suggestion is shown by the fact that a similar provision has been introduced into the new Johns Hopkins Hospital which embodies the most approved methods of sanitary construction. Connected with the benches in the waiting rooms, and beneath each bed in the wards are grates through which the personal atmosphere passes out to the draught of a chimney.

Inseparable from the requirement of ventilation and subservient to it is that of the heating arrangements. In this matter he made a great stride by the invention of the stove that bears his name. This stove was invented to economize fuel by regulating the air supply to it and by providing large metallic surfaces for warming the air of the room. In a hundred years, from Franklin's idea many shapes have been evolved, all traceable to the original. His name is usually given the variety provided with open grates, but there can be no doubt that the original embodied also the principles of the now widely used "air-tight" stoves to which his directions are perfectly applicable. One of the advantages claimed for the stove was that it was a refuge from the nuisance of smoky chimneys. At that time the true principles of chimney construction had not been worked out so that a perfect chimney was the exception and open fire-places not an unmixed luxury. To beguile the tedium and discomfort of a seven weeks' voyage across the Atlantic, Franklin set down his observations and recommendations and gave them to a suffering world as his famous pamphlet on the "Causes and Cure of Smoky Chimneys." Having applied his accurate eye and judgment to these common-place things and having made scientific publications of mark concerning them, he had the satisfaction of knowing that by his plans for perfecting chimneys, for getting the most heat from fuel and for securing wholesome currents of air in close apartments, he had dispelled much ignorance and enhanced the sum of human comfort.

That Franklin was foremost in all public measures, for founding a hospital, advancing popular education, lighting and paving streets, and organizing fire companies, is generally appreciated, but it is not so widely known that he took steps in his will to improve the water supply of this city. Having noticed the tendency of well water in old cities to grow gradually unfit for use, he foresaw that in time a change to a better protected source would be necessary to the public health. In his last will he provided that at the end of a hundred years, if not done before, the corporation of this city should employ a bequest in bringing by pipes the water of Wissakickon creek to the town. After a hundred years, his beloved city is confronted with the same difficulty in another shape. The wells having fulfilled his prophecy have been abolished and the waters of the Wissahickon many years ago brought into service have in turn come under suspicion. What an imperial gift, if some millionaire, emulous of Franklin's example, with far greater means, should see fit to dedicate his money to provide for the people a purer drinking water, when the unfitness of the present source shall be duly recognized!

Having made eight voyages across the Atlantic at a time when it took at least a month, he had opportunities for studying the art of navigation. What he saw joined to what he learned from experienced seamen and his own wide reading lead him to inferences that have helped to master the difficulties and perils of the sea. Although early Spanish navigators were aware of the existence of the Gulf stream, so little detailed knowledge was available that up to Franklin's time the currents of the Atlantic were looked upon as hindrances rather than helps to transatlantic commerce. Franklin noticed the higher temperature marking out the Gulf stream, took many thermometric observations, and made a chart of it with a view to guide navigators in the route between England and America. He first advised that systematic use be made of the trade-winds and the ocean currents, and showed how it could be done. From the Chinese he got an idea which he was the first to urge upon the western ship-owners. He worked out the crude hint to its best form—that of dividing a ship into separate chambers by water-tight partitions so that a leak in one would not affect the others. It was not until quite recent years that this device has been put in practice with the desired results. A demonstration of its utility was seen lately in the accident that happened to the steamer *City of Paris*. Even when two of her compartments were flooded, she bore up for four days and a half, bringing her ship's company of more than a thousand souls safely into port.

The recorded experiences of ships during the last few years have fully established the efficacy of another notion of Franklin's. Thanks to his emphatic endorsement the previously known power of oil to still troubled waters is now generally employed to smooth the breaking waves when they threaten the safety of a vessel.

The occurrence of a north-east storm of unusual violence provoked those inquiries which led to his discovery of the backward course of storms and to a theory which had a marked influence on the development of meteorology. His explanation of the Aurora Borealis as a phenomenon of atmospheric electricity was at once accepted as adequate, though in its details it has since been modified to meet the demands of advancing knowledge.

In one of his charming letters to a lady correspondent he first made note of the remarkable variation in the absorptive power for the sun's heat shown by cloths of different colors. According to his suggestions, the principle has been applied to agriculture and to the clothing of armies. Under the fostering hand of the national government during this century there has been developed from his initial inquiry in navigation the admirable work of the hydrographic office. Its pilot charts are the lineal descendants of the one Franklin drew. It is not claiming too much to say that his observations on the north-east storm were the first noteworthy contribution to the science upon which is based the predictions of the weather bureau.

The present time has been called "the Age of Electricity." To estimate fairly the significance of Franklin's electrical researches in this day of the telephone, the dynamo-engines, the electric light, and the electric railway, it must be remembered that one hundred and fifty years ago not only was there no telegraph, but the magnetic, chemical and motor powers of electricity were not even dreamt of. It was fifty years before Galvani published his account of the convulsions produced in a frog's leg by the contact of dissimilar metals. Volta was just five years old. To what is now an open book full of wonders which every school-boy can read without obscurity or hesitation, naught but the preface had appeared. That preface dates from three centuries before Christ, when Thales of Miletus drew attention to the curious property of attraction developed on rubbing amber. The Greeks explained this by the theory that friction evoked the animating soul of the amber which seized upon light particles near it. For nearly two thousand years there was no substantial addition to knowledge until Gilbert discovered that glass, sealing wax, sulphur, and other substances could also be electrified. Then fifty years elapsed before a rude machine was made from which vivid sparks could be drawn. After another fifty years the resemblance between these zigzag sparks and the lightning flash was commented on. The first chapter was fairly opened when the discovery of the Leyden jar enabled the experimenter to imprison the fiery spirit and perform many remarkable tricks with it. At this time Franklin had reached middle life and retired from business with an independent fortune. He gave his scientific enthusiasm a free rein with the Leyden jar and the frictional machine. With the aid of his Philadelphia collaborators many ingenious experiments were devised. Their joint study proved so fruitful that in the course of six years they advanced the science of frictional electricity more than the rest of the world had done in two thousand.

It was this chapter which, according to Goethe, had been handled better than any other in modern times. For illustration of an admirable scientific method, let us glance at the steps of Franklin's research. First, his attention was taken with the marvels of the rubbed glass tube. These were enhanced by the storage properties of the Leyden jar. With three friends who had the same infection, he formed a coterie for mutual suggestions and encouragement. They constructed their own machines and with them made new demonstrations of attraction and repulsion, and of the power of electricity to produce light, heat, mechanical violence, nervous shock, and even death. The brilliancy of these experiments depended mainly on Franklin's discovery that the electricity of the Leyden jar was stored up on the glass, and that by increasing the extent of excited surface the energy was proportionately multiplied. The power thus obtained made it appear highly probable that the difference between the spark and the lightning flash was one of degree. Having discovered the property of pointed conductors to cause a silent and harmless discharge he next charged an artificial thunder-cloud made of Leyden jars, and with a small pointed rod conducted away its energy without noise or violence. From the truth thus established, he deduced the conjecture that sharp metallic rods fixed at the highest point of buildings would draw away quietly the charge of an approaching thunder-storm. A similar contrivance brought the atmospheric electricity within the reach of his experiments, and its identity with frictional electricity was fully demonstrated. His conjectures put to the test gave to the service of humanity the lightning-rod, accounted the most brilliant application of science that had been known up to that time.

In a hundred years, but little has been added to what Franklin revealed concerning the electricity of friction. Volta's electrophorus with his condenser and Holtz' induction machine are the only important additions to electrostatics that have since been made. The marvelous progress of this century in the adaptation of electricity as a useful agent are developments of chemical and magnetic electricity forms unknown until after Franklin's death. His apt and simple theory of an electric fluid, the excess or lack of which caused positive and negative action, held sway for so many years that to this day its nomenclature is retained in spite of defects revealed by recent advances in knowledge. The splendid results of investigations made in our time call for a broader conception which shall include Franklinism, Galvanism, and Faradism, with those manifestations of energy at a distance which seem to place electro-magnetic induction in the same category with light and other radiant forces.

But Franklin's fame as a philosopher who worked for the improvement of man's estate shall remain amid all the theoretical changes of the future. It shall remain because it rests upon the enduring truths he first laid bare; because it was builded with sound inductive methods; because it is guarded by the grateful memories of mankind. Cheerfully then let us commemorate the day of his death. It was the day when his intelligence should at last be released from "its muddy vesture," when, as he expressed it, he should be free to roam through some of the systems Herschel has explored, free to satisfy his curiosity concerning worlds he did not know.

In introducing Dr. Henry M. Baird, Mr. Williams said:

The connection of Franklin with France lay deeper than the accident of events or the needs of his native land. Of all our greater men in the last century or in this, the expression and cast of his genius alone was Gallic. He shared with Voltaire the capacity for using the highest literary form to enlighten the humblest reader or confute the keenest partisan. In his journalism, he prefigured the homely familiarity and the familiar humor which is alike the might and the weakness, the strong tower and the open pitfall of the American newspaper in this century. But in all he wrote and in much that he did, he foreshadowed that apprehension and appreciation of form for wit's sake which yearly draws us as a nation nearer to the critical standards of France in art and in letters. The historian of France therefore approaches the diplomatic career of Franklin acquainted not only with the environment in which he discharged his great services, but aware of the men and the models, the method and habit of thought which profoundly influenced the conscious and unconscious development of Franklin from the man of business into the man of science, and from the man of science into the man of affairs. To the historian of the Huguenots, the chronicler of the great Cardinals, the deep and unsparing student of the causes which prepared in France the field in which Franklin won his last and closing triumphs, these triumphs have a meaning and interpretation lost on other men. I need not remind you that our next speaker ascends this platform with this special equipment for his work in treating of the diplomatic services of Franklin, and I feel equal honor and good fortune in introducing to you, as the last speaker of the evening, Dr. Henry M. Baird, of the University of the City of New York, who will speak upon

The Diplomatic Services of Benjamin Franklin.

I have been asked to address you on the subject of Dr. Franklin's diplomatic services—a department of activity in which our great compatriot, and the founder of this Society, conferred upon his country and upon humanity benefits not inferior to those by which, as a scientific discoverer, he brought the whole world into his debt.

In the address of welcome made to Benjamin Franklin, upon his return from his last mission to Europe, the Assembly of this Commonwealth, by the mouth of its Speaker, the Hon. John Bayard, greeted him with these words: "We are confident, sir, that we speak the sentiments of this whole country, when we say that your services in the public councils and negotiations have not only merited the thanks of the present generation, but will be recorded in the pages of history to your immortal honor." *

We are here, Mr. President, to set the seal of the concluding years of this nineteenth century to the fulfillment of the prophecy made over one hundred years ago, by the enthusiastic voice of Franklin's contemporaries.

The diplomatic services of Benjamin Franklin are naturally to be referred to two periods; and the dividing line is the outbreak of the American Revolution. In the first period, his efforts were directed towards England, and his aim was to obtain for his countrymen, as citizens of the great British empire, the acknowledgment of rights inalienably theirs by reason of their birth.

In the second period, the claims of the colonists of North America having been practically denied, the energies of his

* "The Complete Works of Benjamin Franklin." Edited by John Bigelow (New York, 1887). ix, 248.

mind were turned in the direction of France, and his heroic and persistent exertions were put forth to secure, first, the recognition and help of that land, and then, with that help, the complete independence of the United States and their admission into the sisterhood of nations. Both departments of his activity, both fields of labor, elicited strenuous, concentrated, conscientious exercise of all his prodigious intellectual powers, and both were worthy of them. Yet viewing his diplomatic services as a whole, the latter part stands out prominent, as indeed the consummation of a life of singular utility to the public.

The English mission laid the foundation, broad and firm, of Franklin's fame as an able negotiator; his mission to the Continent reared on this abiding substructure a stately edifice adorned with imposing columns and entablature—in which, if I may be permitted to carry out the same figure, the aged philosopher's warm and enthusiastic attempt, in the name of humanity, to mitigate the horrors of all future wars, constituted the graceful cornice—a supreme and enduring tribute to the kindly instincts of his nature, of which it may truthfully be said: "*Finis coronat opus.*"

The richest and best fruits of man's intellectual and moral growth are found in the autumn of life, when the warm and mellowing rays of the sun have done their work, and nature gathers to itself the combined results of the entire year. Franklin's noble achievements as a diplomatist were accomplished in his later manhood and in his old age. He was past his fifty-first birthday when he sailed for England upon his first mission; he lacked less than six months of being four-score years old when he returned from his mission to France. The intervening twenty-eight years had been spent abroad in the service of his country, with the exception of two short intervals, the one of less than two years, the other of about eighteen months.

And what had he accomplished, when, with hair blanched by age, he at last returned to his native land and to the city of his choice, after so long an expatriation?

It is not with diplomacy, especially with services of the kind that Dr. Franklin rendered, as it is with the career of the military hero. If the great negotiator also has his triumphs, it is not always easy to lay the finger upon all the particular movements by means of which his bloodless victories are won. None the less do all his carefully laid but unobtrusive plans tend unerringly to the great result.

The first mission to England, though extending over not less than five years, is of subordinate interest to us now; because of the complete change that has since obliterated the political issues then regarded as momentous.

As agent for the colony of Pennsylvania, Dr. Franklin was sent to endeavor to obtain redress of wrongs sustained at the hands of the proprietaries. Subsequently appointed agent by other colonies—Massachusetts, Maryland, Georgia—his duty included vigilance respecting their interests also. The negotiation was long, tedious, dreary. We cannot tell how an obscure and unknown American, acting as a commissioner of distant provinces, would have fared at London in those times. Even Dr. Franklin, with all the great prestige of his scientific renown, did not find his position a bed of roses. The British government had evidently no very exalted opinion of the importance, present or prospective, of his gracious majesty's transatlantic plantations. Procrastination, proverbial vice of courts, had full sway. The months that Franklin was kept waiting for an answer to his petitions, were, doubtless, not altogether wasted by one who had mastered the rare art of putting the fragments, the very crumbs of time, to profitable use in the study of nature's hidden mysteries; and an abode in the midst of the most learned and appreciative scholars England could boast, was not altogether destitute of attractions. Yet the diplomatic gain—the admission in particular of the right of the colonists to tax the lands of the proprietaries, soon to be proprietaries no more—seems trifling in view of the great events shortly to happen. And still the shrewd negotiator had gained something valuable. He had gained an insight into the cardinal doctrine of the current creed of the court. For had he not heard a minister of state, Lord Granville, propound the tenet that the king's instructions to his governors in America were the law of the land, and that the king himself must be regarded as "the legislator of the colonies?" This was a strange view to Dr. Franklin, who had always supposed that the right tc make the laws was vested in the provincial assemblies, with the king's approval. And he significantly tells us: "His lordship's conversation having a little alarmed me as to what might be the sentiments of the court concerning us, I wrote it down as soon as I returned to my lodgings."*

It was not many years before it was the turn of others to take alarm at the practical assertion of the same dangerous heresy.

Respecting Franklin's second period of residence in London as a negotiator, it is not too much to say, that it brings into the clearest relief the rare capacity of the great American statesman. True, he did not attain the goal of his hopes. He was not successful in bringing the crown and people of Great Britain to a better mind, in settling the relations of the colonies to the mother country upon a lasting basis of justice and equality; in obviating the necessity of that sundering of ties which Dr. Franklin himself was reluctant to admit to be

* Autobiography (continuation) in Works, i, 296.

unavoidable, and in averting the dreadful resort to war between men of the same blood. But he did succeed in the next best thing, for he brought into the clear light of God's sunshine the righteousness of the struggle that was forced upon the colonies, by demonstrating the impossibility of obtaining redress for their wrongs from an obstinate king, from an unreasonable and prejudiced parliament, from a people that because they inhabited the mother country had fallen into the strange mistake of imagining themselves to be not subjects but governors.* For, as Dr. Franklin wrote to Lord Kames, "every man in England seems to consider himself as *a piece of a sovereign* over America; seems to jostle himself into the throne with the king and talks of *our subjects in the colonies*." †

Two scenes of dramatic interest illustrate this mission—both almost too familiar to students of history to need more than a passing notice, both, however, too characteristic and too essential to a clear understanding of the marked personality of the man who was their hero, to be left altogether without mention. The first of these is that remarkable examination before the House of Commons, so often described, so often the subject of unconcealed wonder on the part of historical writers, when for hours Dr. Franklin answered the various questions addressed to him both by friends and by political opponents, with a readiness, a calmness, an aptness, that have rarely been equaled, perhaps never excelled. While it seems too much to say that his replies to the interrogatories of his friends were altogether unpremeditated, the admirable promptness and skill with which he met the inquiries sprung upon him by adversaries, afford conclusive evidence of the breadth of his information upon American topics, and, not less, of the

* Works, iii, 486, 487.

† *Ib.*, iv, 2, 3.

singular equipoise of a mind so nicely balanced as to respond instantly to the demands of the moment, yet so firmly settled as to be proof against every attempt to disturb or disconcert.

If this famous episode was well calculated to exalt Dr. Franklin to the highest pinnacle of political reputation as yet attained by any American subject of the king of England, it scarcely surpassed in interest another occasion of the same eventful period.

It was in February, 1766, that Dr. Franklin appeared before the Commons to submit to the long but respectful examination of which I have just spoken. It was nearly eight years later (in January, 1774) that the venerable sage, the man whom the world of letters and the world of science delighted to honor, was subjected, in the presence of the Privy Council, to an attack as scurrilous as it was indecent. There is no need that I rehearse the familiar tale of the Hutchinson Letters and the storm their publication aroused. That Dr. Franklin's part in the transaction was fully justifiable, can scarcely fail, I think, to be the unanimous verdict of impartial men. But the fury of the party whose secrets were unmasked so unexpectedly, can scarcely be imagined. Of that fury the scandalous occurrence in the Cockpit of Westminster (on the 29th of January, 1774) was the direct and disgraceful consequence. The government's very purpose in summoning Dr. Franklin was to insult him; and had it been in the power of malice to affix ignominy to a great and virtuous man, the vituperative address of the solicitor-general, Mr. Wedderburn, might have compassed that end. As it was, during the whole time that this unseemly flood of abuse was poured upon his devoted head, Dr. Franklin, to use the account of an eye-witness (Dr. Bancroft), "stood conspicuously erect, without the smallest movement of any part of his body. The muscles of his face had been previously composed, so as to afford a placid, tranquil expression of countenance, and he did not suffer the slightest alteration of it to appear during the continuance of the speech, in which he was so harshly and improperly treated." *

A man conscious of the integrity of his purpose and the innocence of his actions can well afford to wait for vindication. And Dr. Franklin had not very long to wait. Not quite a year had elapsed—it was Wednesday, the 1st of February, 1775—when Lord Sandwich, in opposing in the Upper House the conciliatory measure introduced by the Earl of Chatham, seeing Dr. Franklin a few feet distant leaning upon the bar, went out of his way to express his belief that the plan under consideration was not that of any British peer, but of a person whom he saw before him, one of the bitterest and most mischievous enemies the country had ever had. In reply to whom Lord Chatham, not content with accepting the sole responsibility for the authorship of the project, proceeded to eulogize the great philosopher in these memorable words: "I make no scruple to declare that, were I the first minister of this country, and had I the care of settling this momentous business, I should not be ashamed of publicly calling to my assistance a person so perfectly acquainted with the whole of American affairs as the gentleman alluded to, and so injuriously reflected on; one whom all Europe holds in high estimation for his knowledge and wisdom, and ranks with our Boyles and Newtons; who is an honor, not to the English nation only, but to human nature!"

"I found it harder," modestly remarks Dr. Franklin in reporting the incident, "I found it harder to stand this extravagant compliment than the preceding equally extravagant abuse, but

* Works, v, 311.

kept as well as I could an unconcerned countenance, as not conceiving it to relate to me." *

And what shall I say of the importance of the services of Benjamin Franklin at the court of Versailles?

His good American friends had contented themselves with a brief enjoyment of his society at home. Little more than a year after his return from London, they voted, in Congress assembled, his dispatch to Europe, this time to France, showing scant consideration for his three-score years and ten, or for any natural desire he might have for a longer furlough from the diplomatic service. Barely had he, as a representative of Pennsylvania, affixed his name to the Declaration of Independence, before he was chosen to discharge his new and responsible functions. He reached Nantes early in December, 1776. Before Christmas he was in Paris.

He came at a critical moment. It cannot be affirmed that, without the help of France, the thirteen American colonies would not ultimately have achieved their great purpose. There is much in a courage that will admit into its vocabulary no such word as failure. Stout hearts convinced of the righteousness of the cause for which they battle, possess a great reserve of power. Unflinching resolve has learned the secret of enlisting time and opportunity as allies, and when most prostrate rises, with Heaven's help, to renew a strife which in the end must be crowned with victory.

But the American contest would have been longer, more painful, more enduring in the injuries inflicted, had it not been for the kindly intervention of France. And that intervention Benjamin Franklin secured. Humanly speaking, there was no one else that could have secured it. He was the foremost American of his time; in fact, he was the only

* Works, v, 498.

American that could claim a world-wide reputation. Even Washington was little known in Europe. Younger than Franklin by twenty-six years, he had as yet accomplished little to bring to the notice of foreigners those transcendant qualities, that commanding personal character, which years of arduous war amid trials, discouragement, and even occasional defeat, were to put to the proof. But Franklin, the man of science, the brilliant discoverer in a new and attractive realm of investigation, was known by all. His name was upon all lips. The very fact that he had come to France to advocate the cause of the new American republic conciliated for that cause the favor of great and small. And with the favor came a conviction that the side Franklin espoused would be certain to win. For, changing somewhat Turgot's celebrated line, was it not self-evident that the hand that "snatched the thunderbolt from heaven" would prove competent to wrest "the sceptre from tyrants?" Thus it came to pass that soon, according to M. Lacretelle, "no one any longer conceived it possible to refuse fleets and an army to the countrymen of Franklin."* Or, as M. Mignet, most terse and philosophical of modern French historians, has put it, "The sight of Franklin, the severe simplicity of his dress, the refined kindliness of his manners, the alluring spell of his wit, his venerable appearance, his modest assurance, and his resplendent fame, brought the American cause altogether into fashion."†

But it was not solely, nor chiefly, the reputation already gained by Dr. Franklin, that made his mission to France so productive of good to his native land. There was a wide field for the exercise of his ingenuity, for the display of his shrewd

* "Histoire de la France pendant le dix-huitième siècle," v, 86.

† "Vie de Franklin, Mémoires de l'Académie des Sciences Morales et Politiques de l'Institut de France," vii (1850), 396.

common sense, and of both dexterity and tact, in those dark days when nothing reached Europe but reports of losses, retreats, disasters to the patriots. Money was to be obtained, and that from the coffers of a monarch himself well-nigh bankrupt. A great state must be induced to enter the strife upon the seas with the most formidable of maritime powers. A friendly shelter must be found in hospitable ports for American vessels that scoured the shores of Great Britain and brought in the prizes taken to be condemned and sold.

With the joyful news of the surrender of General Burgoyne came the first rays of sunshine, presage of the complete dispersion of the thick clouds hitherto enveloping the political skies. Then it was that the king of France definitely consented to enter upon a treaty of alliance with the United States. That was indeed, as M. Guizot justly styles it, "a triumph of Franklin's diplomatic ability."* Henceforth, if the great American envoy's labors did not diminish, if instead they rather increased as the slow years of the contest dragged along, at least the firm conviction of approaching triumph made tolerable even that enormous load of responsibility which rested upon his shoulders. Others, it is true, were associated with him, at the Hague, in Madrid, and elsewhere—John Adams, John Jay, and others, whose services are deserving of everlasting remembrance. They, too, displayed true patriotism, whole-souled devotion to the cause of liberty, and rare skill in negotiation. They might not have enjoyed the opportunities for training in the school of diplomacy which had fallen to the lot of the British envoys with whom they were called upon to deal, but they proved themselves adepts in the science of persuasion and generally discomfited their rivals. As Dr. Franklin somewhat quaintly states it, not without a tinge of

* "Histoire de France," v, 346.

raillery, when writing to his English correspondent, William Strahan, once more his friend, after the conclusion of the war: "Your contempt of our understandings, in comparison with your own, appeared to be not much better founded than that of our courage, if we may judge by this circumstance, that, in whatever court of Europe, a Yankee negotiator appeared, the wise British minister was routed, put in a passion, picked a quarrel with your friends, and was sent home with a flea in his ear."* And if good Jonathan Shipley, Bishop of St. Asaph, had primary reference to the ability of Franklin himself in dealing with the French and English ministers, the remark held good also of his worthy associates: "The event has shown that, in their own arts, you were not inferior to the ablest of them."†

Yet, while others were associated with him in the honorable work, and right nobly discharged their part, it was after all, Dr. Franklin that was chiefly looked to to represent the United States in Europe entire, as it was he alone that could sustain the credit of the country when Congress in its desperation was issuing drafts which it provided the envoys with no means of honoring, and when the advances of money imperatively needed for the maintenance of the American cause must be wrung by judicious insistance from a government, not so much reluctant, as unable to meet all the demands upon its purse made by its impecunious ally.

At last perseverance met with its reward. The king of England was compelled to acknowledge the autonomy of his revolted colonies, and, on the 30th of November, 1782, in conjunction with John Adams, John Jay, and Henry Laurens, Dr. Franklin signed the provisional articles. Ten months later, he

* Letter from Passy, 19 August, 1784, Works, ix, 53.

† Letter from Twyford, 27 November, 1784, Works, ix, 280.

was associated with Adams and Jay in concluding the definitive treaty.

To the consummation of the hopes of all patriotic Americans, the wise efforts of Franklin and his fellow-diplomatists had contributed as truly, perhaps as substantially, as had the martial exploits of Washington and his companions in arms. And it is as honorable to the wisdom as it is to the reverent spirit of those great men, that both Franklin and Washington ascribed their success to the favor of God who is the friend and avenger of the oppressed. I quoted, a moment ago, the somewhat boastful terms in which Dr. Franklin was pleased to describe to William Strahan the triumphs of American diplomacy at European courts. I must be permitted here to reproduce these sentences by which he next proceeds to qualify what might well otherwise be viewed as too arrogant a claim. "But, after all, my dear friend," he says, "do not imagine that I am vain enough to ascribe our success to any superiority in any of those points. I am too well acquainted with all the springs and levers of our machine, not to see that our human means were unequal to our undertaking, and that, if it had not been for the justice of our cause and the consequent interposition of Providence, in which we had faith, we must have been ruined. If I had ever before been an atheist, I should now have been convinced of the being and government of a Deity! It is He who abases the proud and favors the humble. May we never forget His goodness to us, and may our future conduct manifest our gratitude." *

It cannot but be regarded as an interesting circumstance, that Dr. Franklin's last diplomatic service should have been rendered in the interest of our common humanity; that in the treaty with Prussia, which it was his last official duty to sign

* Works, ix, 53.

on the eve of his departure from Paris, were embodied those philanthropic provisions that are destined, we hope, to mark the era of a higher and purer civilization.

Much as Dr. Franklin had had to do with the prosecution of war, forced thereto by the circumstances of the hour, he was preëminently a man of peace. "I am of opinion," he once wrote to the banker, Le Grand, "I am of opinion that there never was a bad peace, nor a good war." * He hoped great things from the spread of intelligence and especially of mutual forbearance. Hence he rejoiced when Louis XVI, by his edict of toleration (1787), took the first step toward undoing the mischief wrought by Louis XIV's gigantic blunder in revoking the Edict of Nantes. "The *arrêt* in favor of the *non catholiques*," he wrote from Philadelphia, "gives great pleasure here, not only from its present advantages, but as it is a good step towards general toleration, and to the abolishing, in time, all party spirit among Christians, and the mischiefs that have so long attended it. Thank God, the world is growing wiser and wiser, and as by degrees men are convinced of the folly of wars for religion, for dominion or for commerce, they will be happier and happier." †

Meanwhile, as the prospect of the entire abolition of war was yet very dim and shadowy, Dr. Franklin regarded it an end well worth laboring for to reduce as much as possible the attendant horrors. Two of these—*privateering* and the *cruel treatment of prisoners of war*—he set himself to remove.

He had written frequently and decidedly in condemnation of privateering, which he stigmatized as a remnant of the ancient piracy, and argued that though accidentally beneficial to particular persons, it was far from profitable to the nation

* Works, ix, 298.

Letter to M. Le Veillard, Philadelphia, 8 June, 1788. Works, ix, 481.

that authorized it. It was a lottery in which some might draw prizes, but the whole expense exceeded by much the aggregate of individual gains. Besides, in addition to the national loss of so many men during the time they have been engaged in robbing, the agents in the nefarious work become unfit for any sober business after a peace, and "serve only to increase the number of highwaymen and housebreakers." The financial disaster that sooner or later overtakes even the most prosperous of those taking part in it, Franklin regarded as "a just punishment for their having wantonly and unfeelingly ruined many honest, innocent traders and their families, whose subsistence was employed in serving the common interests of mankind."*

In accordance with these humane views, Dr. Franklin desired to insert in the treaty of peace with Great Britain an article abolishing privateering in all future wars. To this end he drew up a proposal, which he enclosed to his old friend, Richard Oswald, the British commissioner, shortly after they had signed the "provisional articles." In the accompanying letter he wrote: "I send you also another paper which I once read to you separately. It contains a proposition for improving the law of nations, by prohibiting the plundering of unarmed and usefully employed people. I rather *wish* than *expect* that it will be adopted. But I think it may be offered with a better grace by a country that is likely to suffer least and gain most by continuing the ancient practice, which is our case, as the American ships, laden only with the gross productions of the earth, cannot be so valuable as yours, filled with sugars or manufactures. It has not yet been considered by my colleagues, but if you should think or find that it might be

*Propositions relative to privateering communicated to Mr. Oswald, Passy, 14 January, 1783, Works, viii, 246. See also, *ib.*, ix, 88, 89.

acceptable on your side, I would try to get it inserted in the general treaty. *I think it will do honor to the nations that establish it.*" *

Dr. Franklin was right, but, finding no favor with the government of Great Britain, the proposal was declined. Its author, however, did not despair. A few years later he had the satisfaction of being able to write to M. Leroy: "I rejoice to hear that the difference between the emperor and your country [France] is accommodated, for I love peace. You will see in the treaty we have made with Prussia some marks of my endeavors to lessen the calamities of future wars." Accordingly we find near the close of that document, signed as I have said by Dr. Franklin, as one of the three commissioners appointed by Congress, just before his return, an article—it is the twenty-third—almost identical in its phraseology with that which he had, two years before, offered to Mr. Oswald for consideration. In it occur these memorable words: "And all merchant and trading vessels employed in exchanging the products of different places and thereby rendering the necessaries, conveniences and comforts of human life more easy to be obtained and more general, shall be allowed to pass free and unmolested; and neither of the contracting powers shall grant or issue any commissions to any private armed vessels, empowering them to take or destroy such trading vessels or interrupt such commerce." †

Not only so, but, in a succeeding article, the attempt is made further to mitigate the sufferings entailed by war by provisions of the most kindly character, stipulating in great detail what shall be the treatment of prisoners. They shall not be sent

* Works, viii, 245.

† Text in "Treaties and Conventions concluded between the United States of America and other powers since July 4, 1776" (Washington, 1889), 905, 906.

to distant and inclement countries, to the East Indies or to any other parts of Asia or Africa, nor confined in dangerous prison-ships or prisons, nor put into irons, nor bound, nor otherwise restrained in the use of their limbs. Both officers and common soldiers shall be furnished with daily rations equal in quality and quantity to the rations given to soldiers and officers of the same rank in the army of the captors; and their quarters and barracks shall be not less roomy and comfortable than those enjoyed by the troops of the party in whose power they are.

Still further to invest these new improvements in international jurisprudence with all possible sanctity, the following clear statement is made, every line of which bears the marks of Dr. Franklin's clear and judicious pen: "And it is declared, that neither the pretense that war dissolves all treaties, nor any other whatever, shall be considered as annulling or suspending this and the next preceding article; but, on the contrary, that the state of war is precisely that for which they are provided, and during which they are to be as sacredly observed as the most acknowledged articles in the law of nature or nations."*

This was an appropriate ending of Dr. Franklin's diplomatic services, a real gain for humanity achieved by a philosopher in whose eyes no acquisition, either of his own or of others, was so precious as that by means of which the common store of comfort and happiness was enhanced. Again it had been the great fame of the founder of this Society that insured him success in the field of international negotiation. For with such a man the States and monarchs of the Old World deemed it an honor to treat. The ambassador of Gustavus III, of Sweden, was not only directed to make advances for a treaty

* Treaties and Conventions, 906.

with the United States—Sweden being the first power in Europe which voluntarily offered its friendship without being solicited—but was charged to tell Dr. Franklin that the king had so great esteem for him that it would be a particular satisfaction to his majesty to have such a transaction with him. Dr. Franklin is himself our informant, nor does he conceal the pardonable gratification which he felt at hearing the flattering assurance, adding: "I have perhaps some vanity in repeating this; but I think, too, that it is right that Congress should know it, and judge if any use may be made of the reputation of a citizen for the public service." *

The diplomatic career of Dr. Franklin closes with the year 1785, when he went home not indeed to enjoy rest, as he had fondly hoped, but to a change of scene and of employment. And here, in the city of his adoption, death overtook him rich in years, in honors, and, what he prized more, in the memory of valuable benefits conferred upon his country and upon mankind. Such men are few in any age; their number is not great in all the combined centuries that together make up the short life of our race upon this planet.

It is only meet that we should cherish their names with respect, and gratefully hand down to posterity the story of their honorable and meritorious deeds.

Upon the close of the last speech, Mr. Williams said:

I am instructed by the Committee, which I represent in closing this commemoration, publicly to express the appreciation of the Society for the attendance of its

* Franklin to Secretary Livingston, Passy, 25 June, 1782, Works, viii, 109.

guests and for the words of its invited speakers. A hundred years ago, the honor and commemoration of Franklin at the end of a century was confidently expected by our predecessors, whose example we follow to-night with this tribute in memory of his death. With increasing confidence, with enlarging hope for the future, in abiding certainty that whatever another century may bring it can add only increasing fame to his memory, we commit our discharge of this duty to our successors a century hence, in the complete and comfortable assurance, that their commemoration, like our own, will find assembled again the descendants of Franklin, this Society, its members, its invited guests, and eloquent voices to commemorate his memory and again record his fame.

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXVIII. JULY TO DECEMBER, 1890. NO. 134.

Obituary Notice of Daniel Raynes Goodwin, D.D., LL.D.

By J. Vaughan Merrick.

(*Read before the American Philosophical Society, November 7, 1890.*)

It is impossible within the limited compass of a memoir like this, to present a complete picture of the life and character of a man so pure, so strong, so gifted, so impressive in his influence upon the world in which he lived, as those of the subject of this sketch.

Many of the circumstances which moulded his earlier years have sunk into oblivion, and through the passing away of his contemporaries cannot be revived. We must be content therefore to gather up the fragments which remain, and to fill out the outlines with the more abundant records of later years.

Daniel Raynes Goodwin was born, April 12, 1811, in North Berwick, Maine. His father, Samuel Goodwin, was a farmer who also owned and worked two mills at the Falls of Negutaquis, on the outskirts of the town. He was a sensible and good man, who, after rearing a family of nine children, died in 1855 at the age of ninety-two. His mother was Anna Gerrish, who survived her husband about one year. On both sides Mr. Goodwin inherited sterling qualities; on the father's side had been men of mark for integrity, courage and patriotism, and on the maternal side, college-bred men for generations. The homestead was so situated as to present meagre advantages for school education. The nearest neighbor lived nearly a mile distant, and the nearest school-house, which was opened only about ten weeks each year, was still farther off. In those days, in New England, sparsely settled and poor, except in the cities and towns, school advantages were few, and were pursued under many drawbacks and hardships. Wherever possible they were supplemented by home teaching. Fortunately in this case, the eldest sister performed this office during the winter evenings. When fifteen years of age, he was sent to the Academy at South Berwick, and later on to Limerick Academy. In 1828, then seventeen years old, he entered Bowdoin College, at Brunswick, Me., and notwithstanding his limited preparation, he speedily took and maintained throughout his college course, the first place for scholarship, as well as for natural powers. It is stated by Rev. Dr. John Lord, one of his schoolmates at Berwick Academy, that his class were all older than himself, yet that he at once took the lead, and being ahead of his teacher in classics, really taught himself Greek and Latin. He adds that he (Mr. G.) had great precocity of talent in every study to which his attention was turned, and was regarded as a sort of intellectual prodigy by teachers and scholars alike. He graduated at the head of his class at Bowdoin, in 1832, and was appointed master of the Academy at Hallowell, Me.; soon after which, in 1834, he became a member of the Theological Seminary at Andover. In 1835, he was called from Andover to Bowdoin, his Alma Mater, as tutor under the late Henry W. Longfellow, professor of modern languages. Soon after assuming the duties of this position he was elected to succeed that eminent man, who had resigned the chair. Some faint conception of his abilities and attainments can be drawn from the fact, that such a choice should have fallen upon a man of only twenty-four years of age. Diffident of his own powers, however, and resolved to fit himself more thoroughly for his post, he at once proceeded to Europe and spent nearly two years, studying the structure of the language and the literature of Spain, France, Italy and Germany, and maturing his knowledge of philology, which then and always was with him a favorite study, and one in which his intellectual powers were strengthened and polished. In 1837, he returned and became an active member of the Faculty of Bowdoin. It is the testimony of Mr. Nehemiah Cleaveland, in his history of that institution, that "As a teacher and governor, he was assiduous, fearless and most efficient, inculcating by example as well as precept a liberal culture. Possessing a mind singularly active, clear and comprehensive, with great acumen and power of analysis, it is not strange that metaphysical and moral science largely attracted his regard." Nor were his sympathies and abilities confined in their exercise to his merely professional affairs. It is the remark of Prof. Egbert C. Smyth, the son of a brother professor, who lived near and was a boyish admirer of Prof. Goodwin, that the two colleagues were associated in many objects of public concern outside of college duties; and the same authority mentions his admirable conversational powers, the memory so unfailing and inexhaustible in its resources, the crystal clearness of his thought, the aptness of his words, his cheerful and spirited manner. He speaks also of the engaging gifts of his wife (Mary Randall, daughter of Samuel and Hannah Merrick) to whom he had been married in January, 1838. With her, his delightful home had been established; and from it the two professors would "habitually walk together to their eleven o'clock recitations; or from time to time plant together elms and maples which with their own hands had been dug up in the forests." In this charming home, a perpetual fountain of knowledge and life, Prof. and Mrs. Goodwin lived for many years, subsequently transferring it to another house in Brunswick; rearing there a family of children, the oldest of whom, Anna Harriet, now the wife of Benjamin Vaughan, of Cambridge, was born in November, 1838. Subsequently were born three daughters: Julia, and Lucy, who died in infancy, and Mary, now the widow of the late Dr. William Canfield Spencer, U. S. A. (grandson of the late Chief Justice Spencer, of New York), and two sons: Henry, who died in 1861, and Harold, at present an attorney-at-law, residing in Philadelphia.

Another witness of this home life at Bowdoin describes it as "simple, unconventional, orderly, refined, and Christian."

Mr. Goodwin, besides his professorship at Bowdoin, held, for fifteen years, the post of Librarian to the College; doubtless a most congenial office, bringing him into close companionship with the books he loved so well; and to the College students, who profited by his learning, and by his enlightened power of guidance in their reading and research, offering a priceless boon. Nor were the students the only ones who benefited by his presence in this capacity. He was making at this time a strong mark in literature by contributions to various reviews, articles upon subjects germane to his chair, or upon the results of his studies in philology and history. That these labors were not exhausting, was due to his power of intense and active exercise of mind without special effort. To his trained powers such writings were recreation.

The play of his fancy, the lucidity of his style, and the fullness of his knowledge, which were displayed in these and subsequent papers (a list of which is appended), make one regret that, from the pressure of other avocations, he could not contribute to literature more extensive works. One of his contemporaries in Berwick Academy, who followed his subsequent career with the deepest interest, and is well qualified to express an opinion on such a subject, says that if he had devoted his attention to philosophical and metaphysical inquiries he would probably have attained a fame unexcelled, perhaps unequaled, by any living scholar.

The services he rendered in Brunswick to the public schools were conspicuous. Before the introduction of the graded system in the town, he was a member of the School Board; and by his efforts the strong opposition to the change from the old methods, involving legal embarrassments, as well as a modification of public opinion, was in great measure overcome. The contest was carried to the Supreme Court, and proving successful there, the issue resulted in great advantage to public education in the State. One who is familiar with this period of his life speaks in terms of hearty admiration of "his generous and self-sacrificing labors in this cause."

During his residence at Brunswick, it was the custom of the members of the Faculty to sally out when a disturbance among the students occurred, and personally to arrest offenders. On one of these occasions, Prof. Goodwin was severely injured by a student who threw oil of vitriol into his face, occasioning great suffering, and marking him for life;

although, happily, he escaped without permanent injury to his sight. This was not the result of any special animosity against him, but the dealing of a blow to the Faculty as a body, against whom the resentment of the attacked students was aimed. The result of this untoward event was an abandonment of the old, undignified method of quelling disturbances, as well as a widespread sympathy for the sufferer, and indignation against the offender.

His connection with the Protestant Episcopal Church, of which he afterwards became so distinguished a member, began during this period of his life. He was confirmed in 1842, at Gardiner, Me.; and this circumstance, coupled with his prominent position in the college at Brunswick, was probably one of the considerations which induced Bishop Henshaw, at that time acting Bishop of Maine, to send there, in 1843, a missionary to establish a church. Mr. Goodwin at once took up the duty assigned him of aiding this missionary in forming a nucleus for a parish; although, in so doing, he placed himself in apparent antagonism to other religious influences then prominent in the college, and ran counter to the traditions of the place, as well as to correspondingly strong convictions of at least some of his colleagues. They feared the effect upon the college, of introducing the services of a communion, which was at that time the object of considerable prejudice in the State, and, indeed, in New England. Mr. Goodwin's character and influence, however, made his advocacy of the new enterprise a tower of strength; for he was universally loved and respected by Faculty and students. No event of his life displays more clearly the fortitude, the calm and steady principle with which he gave himself to the support of an unpopular movement, and of what seemed at the time a forlorn hope; and these characteristics are visible throughout his life. In 1847, he was ordained Deacon, and in the following year a Priest of the Church.

At length his career at Bowdoin closed, when, in 1853, he was called to become President of Trinity College, at Hartford; acting, also, as one of the Professors, at first, that of Modern Languages, and, subsequently, of Moral and Intellectual Philosophy.

His presidency occurred during a difficult crisis in the affairs of the college, the history of which will, perhaps, be hereafter produced. It may, however, be said, that his influence was successfully exerted to raise the standard of its requirements and of its discipline, and to promote clear and honest work among its students.

One who was under him in those days (Bishop Niles), referring to the singular majesty of his character and his power of interesting his pupils, says that "he has known bright but indolent men look forward with eagerness to the President's recitation hour, in Butler's Analogy and Whately's Logic; from which far more was learned than by the study of formal logic under any other man." There was, however, as we are told by the same authority, another side of his character, not less strongly marked, which gave a brilliant lustre to his memory; that "mirthfulness and general enjoyment of what was really bright and clever in literature, in persons, in social and domestic life," which made him, in his own home, the centre of a group of young people, delighting himself and them with witty things of all kinds.

With such characteristics, it is easy to believe, that when called to a more prominent position, he carried with him the general and earnest regrets of Faculty and students at the severance of the tie. While still at Hartford, he was in 1855 honored by his Alma Mater with the degree of D.D.

In 1860, he was elected by the Trustees of the University of Pennsylvania to be Provost of that Institution, and immediately moved to Philadelphia, in which city, in West Philadelphia, he resided till his death. The University was at that time housed at Ninth and Chestnut streets, now the site of the post-office, and although venerable in age, was but the germ of its present self. As yet it had only the Collegiate, Medical and Law Department and a very limited staff of professors. Here also his duties were of a mixed character, including besides the government of the College, a professorship (Intellectual and Moral Philosophy) which brought him into close contact with the students.

Immediately prior to his election, the University had been for some months subsequent to the resignation of Provost Vethake, in temporary charge of the Vice-Provost, the late Prof. John F. Frazer.

It had, however, been among the traditions of the University until Provost Vethake's incumbency, that it should be in charge of a clergyman, and the Trustees, in pursuance of this policy, selected Dr. Goodwin as his successor.

His inaugural address marked a new era in the history of the University, and he at once assumed a commanding position in the Faculty and among the undergraduates. The favorable impression then produced, was confirmed and strengthened, as the daily intercourse of College life showed him to be at once rigorous in the performance of his duty and in exacting the same qualities from the young men under his charge, while they found him kind and genial upon personal contact within and without the College walls.

When, in the judgment of the Trustees, it became expedient to enlarge the scope of instruction, by adding to the liberal and classical courses, a scientific department, Dr. Goodwin feared that the change would not prove successful under the conditions then existing; and this feeling, it is supposed, influenced him in retiring from his office in 1868, when called upon to become Dean of the Philadelphia Divinity School.

It is the testimony of all who were conversant with the history of the Institution during his eight years' incumbency, that he produced a lasting and most valuable impression upon the characters of the students, leading them to habits of concentration of mind and of exactness of expression, the influence of which has been of the highest value in their subsequent career.

Upon his retirement the University testified its sense of his abilities and learning, by conferring the honorary degree of LL.D.

In 1862, Doctor Goodwin became Professor of Apologetics in the Philadelphia Divinity School, which was organized that year. The title of this chair was changed to Systematic Divinity, in 1865, and so remained, he holding the office till his death. In 1868, upon leaving the University of Pennsylvania, he was made Dean of the Divinity School and retained that position till 1883, when advancing years and somewhat impaired health, coupled with the removal of the Institution to a distance from his home, compelled his withdrawal. For these duties he was preëminently fitted.

A record of the events of his life would be most incomplete, without particular mention of his labors in the Church of his love, rendered especially in her councils, both Diocesan and General. Except in one instance, St. Gabriel's, Windsor, Ct., where he remained some three or four years, he never assumed a permanent Rectorship, but was, at intervals, temporarily (sometimes for months together) in charge of parishes. This fact, and his long connection with educational interests, together with his great ecclesiastical learning and power as a debater, were undoubtedly prime factors in making him, for so long a period, a leader in the governing bodies of the Church. As early as 1853, he was sent by the Diocese of Maine to the Triennial General Convention meeting that year. From Pennsylvania he was sent in 1862, to the first Convention held after his removal to that Diocese, and continuously thereafter until that of 1889, the last one previous to his decease; thus being a member of that august assembly for ten successive sessions. At the same time he was a member of every Annual Diocesan Convention for thirty years. He promptly attained and kept throughout this period in both, a commanding position and leadership in that school of Churchmanship to which his sympathies tended (the Low Church or Evangelical party). And apart from this, his manifest qualifications for the post, caused his election or appointment in both bodies on the "Committee on Canons," and for many years past, to the chairmanship thereof. As this Committee shapes all legislation, and suppresses a multitude of proposals for revision or change, its chairmanship demands not only great learning and clearness of conception, with aptitude in debate, but also great conservatism. All these qualifications found their realization in Dr. Goodwin. Independently of the duties arising out of these positions, it is probable that few, if any, important measures brought forward in either House, failed to receive his close attention and criticism. Indeed, he suffered no resolution presented to the House to pass, without a close analysis of its phraseology and of its possible results. His support or opposition was always of weight, and in the Convention of the Diocese it was apt to be decisive.

His influence in the Diocese was further conspicuously shown by his long service as Chairman of the Standing Committee, a body which acts as constitutional advisor of the Bishop, and, in his absence, as a substitute, so far as concerns his administrative powers.

To attempt an analysis of the character of so remarkable a man, is a task peculiarly difficult; his qualities were of so varied a nature, and presented strength in such apparently opposite directions. Irradiating his whole life, was the power of Christian faith. This was, undoubtedly, its dominating influence, the keynote of his nature. Gentle and courteous to a high degree, sympathizing and consolatory to those who were suffering from trial and loss, a lover of children, his heart was womanly in its tenderness. But in the defense of right, in the attack upon vice, in the public debate upon policy, in the attempt to redress evil, whether in Church or State, he was strong and uncompromising. When measures involving ecclesiastical opinion were under discussion, he was thoroughly alert, quick to point out what he conceived to be weak points in the armor of his opponents, sharp and decisive in piercing them, unwilling to surrender the slightest advantage or to adopt any compromise.

In debate "he thought upon his feet," and it was wonderful to hear him touch upon some point in a speech or a resolution, to which his attention had just been directed, dilate upon it, unfold all its possibilities, pursue its results to their legitimate end (and sometimes, perhaps, beyond it), until nothing was left of his antagonist or of the obnoxious measure. All this time there would be no hesitation; every word would be the exact expression of his thought; the logical process was perfect, the effect overwhelming. Such self-command is rarely seen combined with such learning and logical power. Familiar with many languages, ancient and modern, a close student of their structure and the derivation of their words, these words were his weapons; the exact scope and weight of each being carefully appraised, their relation to each other as carefully measured. He used them with telling effect, and was quick to point out where others failed to appreciate their true intent. In conversation, this power of his was displayed in quite a different way. A keen humorist, he delighted in word-play, and heartily enjoyed the sallies which resulted from an encounter of wits.

But a perfect knowledge of the qualities of different weapons would be worse than useless, were it not for an enlightened power of selecting and employing them. So the philologist is not necessarily a wise reasoner. Herein, then, lay Dr. Goodwin's great power in moulding legislation, that possessing such knowledge, his clear and highly trained reasoning powers made him a logician of the highest order. In his speeches there was a singular freedom from an attempt at eloquence or at display. He was not intent on moving the imagination of his hearers, or persuading them to his side; rather to drag them with him by the irresistible force of his reasoning.

As an educator, which, after all, was the vocation in which most of his life was passed, one of his former pupils—himself now well advanced in years, and qualified by his own well-earned standing to judge fairly—Rev. C. C. Everett, says that he possessed in those days two distinctions which contributed to his success. One was that "he taught; that was something more rare in those days, in all colleges, than now. His hour was crammed full of information. This was chiefly in regard to the derivation and affinity of words; though the beauties and the meaning of the work studied had their place." The other distinction was "his habit of inviting the students to his house to tea." By this means, adopted in advance of his times, but now happily imitated, he became familiarly known to those committed to his charge, and gave them the advantage of social intercourse.

Apropos of this latter custom, it is related of him that, shortly after reaching Hartford, a friend visiting at their house witnessed the following characteristic scene. The door-bell rang about tea-time, and some half-dozen college students arrived. Doctor Goodwin and his wife welcomed them without any sign of surprise. After some delay a hospitable meal appeared and was discussed, followed by a pleasant evening; both host and hostess exerting themselves to entertain their uninvited visitors. After their departure each looked at the other, but neither was able to explain the visit. The next day the mystery was solved by a call from a delegation of students, who found they had been hoaxed by some of their fellows, and who desired to apologize for the intrusion. Needless to say, the young men were ever after strong friends of the president and his wife. The next invitation given to a set of students, however, was not accepted, they fearing the repetition of the joke upon themselves.

In personal appearance, Dr. Goodwin was tall and dignified, with finely-cut features and piercing eyes. The musical tones of his voice linger in one's memory. In late years, when time had crowned him with silver locks, and the deliberate step of age characterized his movements, his figure was one to command, as it received, the highest reverence. But he never lost a certain vivacity, which awakened at the meeting with his friends.

It has been said that Christian faith was the dominating keynote of his nature. None who knew him could fail to recognize the truth of this statement. He was a man of strong piety, in the noblest meaning of that word. Always grave and matured beyond his years, his religious life awakened during the later years of his college days, and steadily expanded during all the remaining years of his life, coloring and subduing all of his faculties, consecrating all his attainments to the service of his divine Master. His light shone more brightly as the darkness of waning years gathered around his earthly path. And his memory must remain, like a beacon, to those who knew him, an evidence of the profound truth and power of Christianity.

An examination of the list of his writings, to which allusion has been made, will show the versatility of his attainments, as well as the active interest he always took in those questions of the day, which, in his view, would affect injuriously the cause of Christian truth. This list covers only those speeches which were reprinted separately. To appreciate his activity in this respect, one must look through the journals of the Ecclesiastical Conventions of which he was a member, the pages of which are crowded with evidences of his incessant participation in debate. Other articles and works are upon questions of ethics, religion, history, ethnology, philology, politics, science, statesmanship, etc., besides numerous addresses before Church congresses, college alumni, and discussions of questions relating to the polity and services of the Church, and, in addition to all these, a great body of sermons.

Dr. Goodwin suffered greatly at times, during the latter part of his life, from insomnia. From this, however, he measurably recovered, and his death, after a brief attack of partial paralysis, came most unexpectedly. On the fifteenth day of March, 1890, he passed away, leaving a gap which, in society and in the Church, cannot soon be filled, and an enduring and grateful memory in the community, for his eminent services in the cause of religion, and good learning. His epitaph may fitly be written in words of his own choice :

"A servant of Jesus Christ, and for Him a teacher of men."

He was laid to rest in Woodlands Cemetery by the side of his beloved wife, whose death a few years earlier had closed upon earth a companionship which had endured for forty-six years; and was followed to the grave by the Bishop of the Diocese and a large body of his fellow-clergy, as well as by a multitude of friends and others distinguished in every walk in life. The resolutions of affectionate regard which were adopted by the former, are appended, together with those of the Standing Committee of Pennsylvania.

Besides his membership in the American Philosophical Society, to which he was elected early in 1861, he was a member of the Historical Societies of Maine and Pennsylvania, the American Academy of Arts and Sciences, and the American Oriental Society; and the first President of the Society of Biblical Literature and Exegesis.

Appendix A.

BIBLIOGRAPHY OF THE REV. D. R. GOODWIN, D.D., LL.D.

1. "On the Nature and Effects of Emulation;" Am. Quart. Register, Aug., 1832 (see bound vols. of Register); pp. 7.
2. "On the Worth and Care of the Soul;" Abbott's Rel. Magazine, Dec., 1833; pp. 4.
3. "Review of Upham on the Will;" Biblical Repository, April, 1836; pp. 33.
4. "On Radical Opinions;" Literary and Theol. Review, June, 1836 (3 and 4 bound in a volume of pamphlets labelled "Theol. Review, Vol. I").
5. "On Religious Ultraism;" Literary and Theol. Review, March, 1836; pp. 10.

6. "On the Philosophy of History;" Methodist Quarterly Review, July, 1842; pp. 38.
7. "The Times, Character and Political System of Machiavelli;" Biblioth. Sac., Feb., 1846; pp. 44.
8. "Civilization, American and European;" Am. Whig Review, June and July, 1846; (in columns) pp. 60.
9. "On Capital Punishment;" Bibliotheca Sacra, May and Aug., 1847; pp. 90.
10. "Fowler's Grammar;" N. Am. Review, Oct., 1851; pp. 37.
11. "Unity of Language and of Man;" N. Am. Review, July, 1851, pp. 28.
12. "Harrison's English Language;" Bib. Sac., Oct., 1851; pp. 22.
13. "Resurrection of the Body;" Bib. Sac., J 1852; pp. 26.
14. "Latham's English Language;" N. Am. Review, Jan., 1852; pp. 23.
15. "Mackay's Progress of the Intellect;" N. Am. Review, July, 1852; pp. 48.
16. "Ethnology and the Scriptures;" Prot. Epis. Quarterly, July and Oct., 1855; pp. 58.
17. "Nott and Gliddon, Types of Mankind;" Church Review, Jan. and April, 1855; pp. 60.
18. "Sawyer's New Testament;" Am. Theol. Review, May, 1859; pp. 9.
19. "Sawyer's New Testament;" Church Review, April, 1859; pp. 28.
20. "Cabell's Unity of Mankind;" Am. Theol. Review, May, 1859; pp. 10.
21. "Grant's Ethics of Aristotle;" Am. Theol. Review, Feb., 1860 (for copy, see Series of the Review).
22. Address at the Dedication of the Free Academy at Norwich, Conn., 1856; pp. 6.
23. Sermon at New Haven: "Christianity neither Ascetic nor Fanatic;" 1858; pp. 15.
24. Sermon at Middletown: "The Christian Ministry," and an extract from the same; May, 1860; pp. 21.
25. "Darwin on Species;" Am. Theol. Review, May, 1860; pp. 18.
26. Inaugural Address as Provost of the University of Pennsylvania; Sept., 1860; pp. 22.
27. "Powell on the Evidences;" Am. Theol. Review, July, 1861; pp. 19.
28. Memoir of John Merrick, Esq.; for the Maine Hist. Soc., with Appendix, Jan., 1862; pp. 40.
29. "Religious Education in Colleges;" Am. Theol. Review, April, 1862; pp. 10.
30. Speech in the Prot. Epis. General Convention, in reply to Dr. Hawks, Dr. Mahan and others, Oct. 14, 1862; pp. 35.

31. "Review of Bp. Colenso's Part I on the Pentateuch, and of Dr. Mahan's Answer;" Am. Presb. Theol. Review, April, 1863; pp. 36.
32. "Review of Bp. Colenso's Part II;" Am. Presb. Theol. Review, July, 1863; pp. 15.
33. "The Antiquity of Man. Review of Lyell's Geol. Evidences of, etc.;" Am. Presb. Theol. Review, April, 1864; pp. 26.
34. Obituary Notice of Pres't Hitchcock for Am. Phil. Soc., Nov., 1864; pp. 7.
35. "Southern Slavery in its Present Aspects:" containing a Reply to a late work of the Bishop of Vermont on Slavery; Oct., 1864; Lippincott and Co., 12mo, pp. 343.
36. Discourse Commemorative of Rev. Dr. John A. Vaughan, Oct., 1865; pp. 38.
37. "Hints on Historical Reading;" N. Y. Ledger, June 8, 1867; pp. 5.
38. Sermon on "Perpetuity of the Sabbath," 1867; pp. 64.
39. Sermon on Ritualism: "Shall we Return to Rome?" 1867; pp. 33.
40. Tract on "The Division of Dioceses, by a Presbyter," 1868; pp. 16.
41. Article on "Spiritualism *vs.* Christianity;" Penn Monthly, March, 1870; pp. 7.
42. Article on "The Supreme Court of the United States;" Penn Monthly, May, 1870; pp. 12.
43. Article on "Resurrection," in Smith's Bib. Dictionary, Am. Ed., 1867–70 (written in 1869); 23 cols.
44. "Memoir of S. V. Merrick," read before the Am. Phil. Soc., Dec. 16, 1870; pp. 13.
45. Letter on "Italian Unity," read at the New York Meeting, Jan. 12, 1871 (see Vol. Report); pp. 6.
46. "Huxley's Writings" (Lay Sermons, etc.); Am. Presb. and Theol. Review, April, 1871; pp. 32.
47. An Anonymous Article, Dec., 1871; pp. 26.
48. "Archbishop Laud," "Leo the Isaurian" and "Lactantius," in McClintock and Strong's Cyclopedia of Theol. and Eccles. Lit., 1872; 20 cols.
49. An Anonymous Article, Dec., 1872; pp. 69.
50. "The Cosmical Effects of Adam's Fall;" Penn Monthly for March, 1873; pp. 13.
51. Address before the Alumni of Bowdoin College, July 8, 1873; pp. 26.
52. An Anonymous Article, Sept., 1873; pp. 13.
53. Deposition in the Calkins *vs.* Cheney Case, Oct., 1873; pp. 75.
54. Paper presented to the Evangelical Alliance, New York, Oct., 1873; 10 cols.

55. An Anonymous Article, Nov., 1873; pp. 103.
56. Articles in *Evening Bulletin* on "The New Constitution of Pennsylvania," Dec., 1873; pp. 10.
57. Another Anonymous Article, Jan. 24, 1874; pp. 9.
58. Another Anonymous Article, 1874.
59. (Printed, not published) "Apologetics or Evidences of Christianity," a Syllabus of Lectures, May, 1874; pp. 56.
60. (Printed, not published) "Canon, Inspiration and Sufficiency of Holy Scriptures," a syllabus, May, 1874; pp. 43.
61. (Printed, not published) Syllabus of Lectures on "Systematic Divinity," Feb., 1875; pp. 190.
62. Speech before the Second Church Congress, Nov., 1875; pp. 5.
63. "Reciprocal Influence of Christianity and Liberty" (No. 54 completed), Ch. Rev., July, 1876; pp. 16.
64. Prepared Anonymously, a volume of Essays, May, 1877; pp. 448.
65. "The Church and Common Schools," (a tract) Nov., 1877; pp. 4.
66. Speech before the Fifth Church Congress, Oct., 1878; 2 cols.
67. Paper read before Fifth Church Congress, Oct., 1878; 20 cols.
68. "Dogmatic Standards," article in Ch. Rev., Oct., 1878; pp. 20.
69. Review of Dr. Shield's "Final Philosophy" in *The Churchman*, Jan. 12, 1878; 6 cols.
70. "The New Ritualistic Divinity neither the Religion of the Bible and Prayer Book nor of the Holy Catholic Church; being a Defense of the Protestant Episcopal Church in Pennsylvania against the attack of Henry Flanders, Esq., of the Philadelphia Bar," Jan. 6, 1879; pp. 101; ditto Second Edition, April 25, 1879, with an Appendix of 35 pp.
71. "The Presbyter's Reply to the Priest's Letter," Feb. 14, 1879; pp. 10.
72. Notes of the Investigation by the Bishop and Standing Committee in reference to certain practices at St. Clement's Church, May, 1880; pp. 47.
73. Address at Seventh Church Congress on "The New Revision of the New Testament," Oct., 1881; pp. 4.
74. Address at Seventh Church Congress on "The Relation of Parishes to the Diocese and of the Dioceses to the General Convention," etc., Oct., 1881; pp. 3.
75. "The Ministry We Need," An Address, etc., Nov., 1881; pp. 11.
76. "On the use of לב and *καρδία* and of *ψυχή* and *πνεῦμα* and connected words, in the Sacred Writings;" Journal of Soc. of Bib. Lit. and Exegesis, June and Dec., 1881; pp. 20.
77. "Memorial Discourse on Henry W. Longfellow before the Alumni of Bowdoin College," July 12, 1882; pp. 30.

78. "In Memoriam, John Cotton Smith;" Bowdoin Orient, May, 1882; 3 cols.
79. "Notes on the Late Revision of the New Testament Version;" Whittaker, N. Y., Sept., 1883; 8vo, pp. 212.
80. "Reminiscences of Longfellow;" Bowdoin Orient, Feb. 27, 1885; p. 1.
81. "Christian Eschatology" Phila., Easter-tide, 1885; pp. 79.
82. Two Articles in *The Church*, in defense of do., April, 1885; 8 cols.
83. Letter to Washington Bowdoin Alumni; Bowdoin Orient, March, 1886; 2 cols.
84. Eight Articles in *The Church* on "The Atonement," Nov. 29, 1885, to Jan. 16, 1886.
    "Some Thoughts on the Atonement," Pamphlet Pub. by Ev. Ed. Soc. Phila., 1887 (A second edition and enlargement of the "Eight Articles" above); pp. 59.
85. "A Lenten Meditation," in the Church Magazine, April, 1886.
86. "Note on the use of *ὑπέρ* in the New Testament;" Exeg. Soc. Journal, 1885; pp. 2.
87. "Note on the use of *καί* in Heb. x. 38;" Exeg. Soc. Journal, 1885; pp. 2.
88. Notes on *ἐὰν μή* Gal. ii. 16; *τροπῆς ἀποσκίασμα* Jas. i. 17; and *Θεοῦ υἱός* Matt. xxvii. 54 and Mark xv. 39; Journal Exeg. Soc., June, 1886; pp. 8.
89. "Notes on the Revised Translation of Matt. xvii. 9, compared with Mark ix. 9; Luke ii. 2; xix. 14; John xii, 4; Acts i. 25; ii. 2; ii. 47;" Journal Exeg. Soc., June, 1887; pp. 2.
90. "Note on the Polarity of Prepositions;" Journal of the Exegetical Society, Dec., 1887; pp. 3.
91. "Note on *πάντες οὐ* and *ἡμεῖς* in I Cor. xv. 51 and 52;" Journal Exegetical Society, 1888.
92. "On 'Again' in the Apostles' Creed;" in *The Church*, March 26, 1887; 3 cols.
93. Article on "Separate Missionary Jurisdictions for Colored People in Certain Dioceses," in *Southern Churchman*, Sept. 20, 1888; 2½ cols.
94. Article on "This Church" and "other Denominations" in the Canons; *Standard of the Cross and the Church*, Jan. 5, 1889; 1⅓ col.
95. Four articles on the "Change of Name" of our Church in *The Standard and The Church*, Jan. 19, Feb. 2, 9, 16, 1889.
    Ditto, in a Pamphlet entitled "Shall the Protestant Episcopal Church in the United States of America cease to exist?" published by the Evangelical Ed. Society, 5000 copies, May, 1889; pp. 36.
96. Speech in the General Convention, Oct., 1889, on "Proportional Representation in the House of Deputies," with a note appended, in *The Standard of the Cross and the Church*, Nov. 16, 1889; 4 cols., = 12 pp.

Appendix B.

MEMORIAL ADOPTED BY THE CLERGY.

The Clergy of the Protestant Episcopal Church in the Diocese of Pennsylvania, called together by the recent death of the Reverend Doctor Daniel R. Goodwin, desire to place on record the following minute concerning their departed brother:

Dr. Goodwin's long and faithful service here made him, perhaps, the most conspicuous figure among us. His great ability, his ripe scholarship, the wide extent, indeed, and the minute accuracy of his knowledge, his quick perception, his readiness in debate, the power of his reasoning, and his unflinching courage in the maintenance of his own conscientious convictions were readily recognized by all who knew him. There were, however, other traits of his character which, possibly, more than his vigorous intellect, his rare learning, and his logical power, endeared him to his friends. For, in union with these qualities, there was in him a wonderful degree of gentleness and tenderness. No one had a keener sympathy with those in sorrow; no one a more wonderful power of adapting himself to their spiritual needs.. His words to the sick and suffering, always happily chosen, were full of grace and consolation. They who were recipients of his ministry of mercy can never forget it. His rare judgment was never better tested than when he came into the seclusion of the sick-room to bring the comforts of religion. His fine mental powers, cultivated by long years of faithful and earnest study, shone at their brightest where the world is too apt least to esteem them.

They whose privilege it is to have known him in his home life—to have witnessed his affection for his friends, his gentle kindliness to little children, his fine courtesy, his deep love for those bound to him by tenderest ties, and his genuine humility—well know how large an element in his true greatness was found there. As his days drew towards their close (and, thank God, with unabated intellectual power on his part), it may without exaggeration be said of him that his spiritual nature seemed to be ripening more and more for the peaceful rest of the blessed.

True to his friends, true to his country—grandly so in her years of peril—valiant for the truth as it presented itself to his mind and his heart, long must his memory be cherished by all who have learned from him to prize what is best and noblest in the pursuits of life.

Appendix C.

MEMORIAL ADOPTED BY THE STANDING COMMITTEE OF PENNSYLVANIA.

At a meeting of the Standing Committee, held April 1, 1890, the following minute was adopted:

In the death of the Rev. Dr. Goodwin the Church has lost one of her brightest ornaments, Theological Learning one of its most efficient upholders, and Religion one of its ablest defenders. Were this the opportunity, we might expatiate on each of these relations in which our departed friend and brother held so conspicuous a place. It will fall to the lot of others to do him justice in these particulars. It is ours rather to speak of him in connection with his membership for so many years in this body, and for most of the time its presiding officer. To say that he presided with uniform courtesy and intelligence would be saying but little. He was our authority in all matters pertaining to ecclesiastical law, and his was the acute mind which was ever ready to untie knotty questions. The adequacy of his learning was but rarely, if ever, at fault, and the lucidness and cogency of his reasonings in almost all instances, if not in all, admitted as conclusive. We shall greatly miss him here, as elsewhere in the Church. He was always, in her deliberative assemblies, a master of sentences, a mine of learning, a logical force that elicited the admiration of all. Long will he be remembered for all these high qualities by those who, in such assemblies, listened to his voice, the voice that, alas, for us, is now hushed in death.

We, too, will remember him for all that; and not less, for his devoutness in worship, his genialness in social converse, his consistency of Christian living, his honor for his high calling, and his untiring industry and inexhaustible patience in the discharge of every duty devolving on him in the various departments of effort in which he was called to exercise his eminent abilities. We thank God for all that He made him to be, and for all that, being what he was, he did for the cause of religion in the Church, and of good learning and right thinking and acting in the world. He will take his place assuredly for long continuance in the memory of the Church, and especially the Church in this Diocese, of which he was so able and devoted a minister.

Note on the Puquina Language of Peru.

By Daniel G. Brinton, M.D.

(Read before the American Philosophical Society, November 21, 1890.)

When the monarchy of ancient Peru, extending nearly two thousand miles along the Pacific coast, succumbed to the Spanish soldiery, it was found to be peopled by diverse tribes, speaking many dialects. These, however, belonged to but a few linguistic stocks, and both the missionaries and civil functionaries soon came to recognize three or four tongues, as "general languages," *lenguas generales*, throughout this wide area. In an official report dated in 1582, these were spoken of as three in number, the Kechua, the Aymara, and the *Puquina*.* The learned missionary, Father Geronimo de Ore, writing a few years later, makes the number four, adding the Yunca to the three already given.

We have a very fair knowledge, by means of grammars and vocabularies, of the Kechua, the Aymara, and the Yunca; but up to the present time have had practically no information about the Puquina. The only specimen of it in modern treatises is the Lord's Prayer, printed by Hervas, in his *Saggio Pratico*, and copied by Adelung in the *Mithridates*.† On this specimen Hervas based the opinion that the Puquina was radically different from any other known American tongue. Mr. Clement L. Markham, on the other hand, denied this, and pronounced the Puquina "a very rude dialect of the Lupaca," and a member of the same linguistic stock as the Kechua.‡ The editors of the *Mithridates* seemed to incline to this view, as they laid stress on some similarities to the Aymara dialects (of which the Lupaca is one). Von Tschudi also adopts it in his learned work on the Kechua.§

None of these authorities had any other material to go upon than the *Pater Noster* referred to. They speak of it as the only known specimen of the tongue. Hervas credits it to a work of Geronimo de Ore, the missionary already mentioned, which it is evident that neither he nor any other of the writers named had ever seen. This work is the *Rituale seu Manuale Peruanum*, published at Naples in

* *Relaciones Geograficas de Indias, Peru.* Tome I, p. 82 (Madrid, 1881).

† *Mithridates*, Theil iii, Abth. ii, s. 548–550.

‡ Markham, in *Journal of the Royal Geographical Society*, 1871, p. 305.

§ J. J. von Tschudi, *Organismus der Ketschua Sprache*, s. 76 (Leipzig, 1884).

1607. It is indeed rare, but there is a copy in the *Bibliothèque Nationale* at Paris, which I recently consulted. It contains not only the *Pater Noster*, but thirty odd pages in the Puquina tongue, and presents a veritable mine of texts for any one to work out a satisfactory presentation of the idiom. That is not my intention, but merely to call attention to this valuable source of knowledge in the hope that some of the many able French students of linguistics will give us such an analysis of these texts as, for instance, M. Raoul de la Grasserie has accomplished for the Timucua.

The source of De Ore's information appears to be the remarkable work of Father Alonso de Barcena, *Lexica et precepta grammatica in quinque Indorum linguis quarum usus per Americam australem*, said to have been printed at Lima in 1590, but of which not a single copy is known as extant. Ore expressly states that the Puquina version of the *Doctrina Christiana* which he publishes is according to the translation of "P. Alonso de Barzana, jesuita." In addition to the *Doctrina*, he inserts a Puquina translation of the Sacraments of Baptism, the Eucharist, the Creed, various exhortations, etc. These are accompanied by renderings in Spanish or Latin, and also into the Kechua and Aymara, so that the similarities and differences of the three tongues are clearly shown.

At the time of Barcena's mission, the Puquina was spoken on various islands in Lake Titicaca, in the neighborhood of Pucarani and in several villages of the diocese of Lima. Bastian quotes Oliva as averring that it was also current on the Pacific coast, in the extreme north-west of Peru, near Lambayeque; but I should hesitate to credit this without better evidence. The Titicacan tribe who made use of it was called *Uros* or *Ochozomas*. According to the authorities they were extremely low in culture, shy and dull. Acosta says of them that they were so brutish that they did not even claim to be men, but only animals.* Garcilasso de la Vega calls them rude and stupid.† Alcedo, writing in the latter half of the last century, calls them *Hunos*, and adds that formerly they lived in great misery and degradation on the islands in the lake, but had against their will been removed to the mainland, where they dwelt

* "Son estos Uros tan brutales que ellos mismos no se tienen por hombres. Cuentase dellos que preguntadolos que gente eran, respondieron que ellos no eran hombres sino *Uros*, como si fuera otro genero de animales" (Acosta, *Hist. de las Indias*, p. 62).

† "Los Indios Puquinas * * * que son rudos y torpes" (*Comentarios Reales de los Incas*, Lib. vii, cap. iv).

in dark caves and holes in the ground, covered with reeds, and gaining a subsistence by fishing.*

They are described as very jealous about their language and unwilling that any foreigner should learn it. As they all spoke more or less Kechua, their religious exercises and necessary communications with the authorities were carried on in that tongue—which will explain the presence of a number of words appropriate to such relations in their own idiom.

The entire dissimilarity of the Puquina to both Kechua and Aymara is forcibly shown by a comparison of the numerals.

	Kechua.	*Aymara.*	*Puquina.*
1.	huc	mayni	pesc
2.	iscay	pani	so
3.	quimsa	quimsa	capa
4.	tahua	pusi	sper
5.	pichka	pisca	tacpa
6.	soccta	chocta	chichun
7.	canchis	pa-callco	stu
8.	pusacc	quimsa-callco	quina
9.	iscon	llalla-tunca	checa
10.	chunca	tunca	scata

In these lists, three of the Aymara numerals, 1, 2, and 4, are independent; four of them, 3, 5, 6, and 10, are taken from the Kechua; and the remaining three are compounds, *pa-callco* being 2 + 5; *quimsa callco*, 3 + 5, and *llalla tunca* meaning "next to ten" or "less than ten." *Callco* is derived from the word for "foot," the counting being with the toes. On the other hand, there is not a single numeral of the Puquina which can be taken from either Kechua or Aymara, and, what is more singular, there is apparently not one which is compounded.

To illustrate the general appearance of the language, I shall give some extracts from De Ore's work, presenting the versions in the other *lenguas generales* for the sake of comparison.

The Sacrament of Baptism.

P. Quid fertes ad ecclesiam, virum aut mulierem?

R. Virum.

P. Quid petit ab Ecclesia Dei?

* Alcedo, *Diccionario Geografico-Historico de las Indias*, s. v. *Chucuito.*

R. Fidem.
P. Fides quid ei praestabit?
R. Vitam aeternam.

Aymara:

P. Cuna huahuapi yglesiaro apanita; yocallati, ymillacha?
R. Yocallahua.
P. Diosna yglesiapata cunapi maysi?
R. Fè Diossaro yassañassa.
P. Fè Diossaro yassañassa cunapi churani?
R. Viñaya hacañahua.

Puquina:

P. Quiñ toopi, raago ayay, ynque atagoy ayay?
R. Raago.
P. Quiñ hatai Diosn Yglesia huananac?
R. Fè Dioshua cu hanchano.
P. Fè Dioshua cuhans anosc, quiñ hi yegue?
R. Viñaya çumano (p. 63).

[*Vita eterna* is given in Quichua as *Viñay cauçaytam*, so the *Viñaya* of the Aymara and Puquina is probably Kechua.]

In Puquina:

Quid petit?—quiñ hatai?
Quid petunt?—quiñ hatanuy?

From the Sacrament of the Eucharist.

In Puquina:

Span. Jesu Cristo, hijo de Dios.
Puq. Jesu Cristo, Dios chuscu.
Sp. Quien es Jesu Christo?
Puq. Nuy Iesu Christox?
Sp. Es verdadero Dios y verdadero hombre. (?)
Puq. Iesu Christo, checa Dios, checa miñ.
(*Kech.* Iesu Christo, checan Dios, checan runam.)

Puq. uses the expression *Capac* Iesu Cristó = Kechua, *Capac*, señor.

P. Porque no reciben este Sacramento todos los Indios?
R. Porque muchos dellos, auque estan ya Baptizados, adoran las huacas, y Idolos, como en tiempo de su gentilidad; y

no queriendo saber la ley de Dios, viven como gentiles, y beviendo con destemplanza, se emleriagan muchas vezes, y tienen enemistad los unos con los otros, y no estan en paz, usurpan la hazienda agena, sin quererla restituir, y por otros muchos vicios que tienen, les prohiben que no comulguen, y assi no reciben la Communion.

Kechua :

R. Huaquin cunaca, naupahinatac (ña baptizasca caspapas) huaccancunacta, inti, quillacta, coyllorcunacta, orcocunactapas muchascanmanta: Diospa simintapas, mana chay cama yachayta munaspa, pampa cauçascan mantahuan, huachuc cascanmanta, runa macintin checninacuc, mana allipi purictac; hucpa yma haycanta harcapuc, hiticapuc, mana copuyta munaspa; yma haycca huchactapas huc hallicuscanmanta, ama comulgancachu, ñiscam, mana chazquincuchu.

Aymara :

R. Yacapanacaca, baptizata cancassinsa, huaccanaca, inti, pacsi, huara huara, collonacasa, nayra hama hampathiri cancatapata; Diosna aropasa hani uca cama yatiña munasina, pampa hacata pampi, huatuca cancatapata, haque macipampi checnissiri, yancana çariri. maynina cunacauquisa harquiri, huaccaychasiri, hani ucaniro cutiyana munasina; cuna cauqui huchampisa huchallissitapata, hani comulganiti, satapi, hani catupisquiti.

Puquina :

R. Huaquin a miñs ehe peogunha baptizaso samp, chu uña co acoa, inti, uque, chinacuna, chatallata hamp upallisoch, Dios hors hamp, apa cogama siscano hatarahua, pampaca quichcasochin, chu uñ atago roguesach; chu uñ mih matipura checniscanunch, entot quichgueno; miñ quiñ harqueno vatiqueno; apaeheguina, eno hatarava; quiñ hinanti huchallicuscaso hamp, ama comulgascaquinch, a sos apa ytinunch.

Spanish :

Creeis en Dios Padre, todo poderoso, creador del cielo, y de la tierra, de las cosas visibles y invisibles?

R. Yo creo.

Kechua :

P. Y, ñin quichu Dios yaya, llapa atipacman, hanac pachap, cay pachap, ricuricpa, mana ricuricpa, ruraquenman?

R. Y ñinim.

Aymara :

P. Ya, stati, mayni çapaqui Dios Auqui, taque atipiriro, harac pachana, aca pachana, uñatanacana, hani uñatanacansa luriparo?

R. Ya satapi.

Puquina :

P. Cuhañapi Dios yqui vin atipeno guttac, hanigo pacas, hopacas, co hanquench, appa cohanquench, callaquenoguta?

R. Cuhañequench.

Spanish :

As adorado huacas, villcas, cerros, rios, el Sol, y otra cora?

Kechua :

Huacacta, villcacta, orcocunacta, mayucta, ymaymana cunacta huampas muchacchu canqui?

Aymara :

Huaccanaca, villcanaca, collonaca, hauirinaca, inti, pacsi, yaccapa cuna cauquisa hampa thiritati?

Puquina :

Vpallinoui chatallata, coa, chacar, cachia, paragara, pachamama, inti, vin quiñeno hamp?

I add the *Pater Noster*, as the copies in Hervas and the *Mithridates* are defective in accurracy of proof-reading.

Pater Noster in Puquina.

Señ yqui, hanigo pacas cunana ascheno, po mana vpallisuhanta; po capaca aschano señ guta huachunta, po hatano callacaso hanta, quiguri hanigopa casna ehe cahu cohuacasna hamp; Kaa gamenque ehehesuma. Señ guta camen señ tanta, señ hochaghe, pampaehe sumao, quiguri señ, señ guta huchachasqueno gata pampachanganch cagu. Ama èhe acrosuma huchaguta señ hotonsuà enahata entonana quespina sumau. Amen.

It is obvious on a superficial examination that there are a number of verbal analogies, probably loan-words, to both Aymara and Kechua. Such are *inti*, sun ; *mocna*, pl., *moccon*, hand, allied to Kechua *maqui*, etc.

The negative is *ama*, as:

Thou shalt not kill ; *ama hallanaqueuanch*. Thou shalt not commit adultery ; *ama suaguepanch*.

This is also a negative adverb in Kechua.

The plural is formed by various changes of the termination, as:

Man (*homo*), *miñ*, pl., *miñs* ; as "many men," *hoaquina miñs* ; "all men," *hinantin miñs* ; "your mother," *pomi* ; "your mothers," *pomig*.

There seems a greater tendency to monosyllabism in the Puquina than in either of the other two tongues. Such words as *raago*, man (*vir.*) ; *atago*, woman ; seem to be built up from the roots *ra* and *at*.

But as the object of this note is merely to call attention to the material for the study of this language, I shall not pursue these reflections.

Note.—About the beginning of June, the Society temporarily removed, and stored its collections, library, etc., etc., and vacated its building to enable alterations to be made that would render the same more commodious and fire-proof. The interior was remodeled, the two (southern) meeting rooms thrown into one, as also were the two northern rooms, and a new third story, to contain the books and MSS. of the Society, was added. No meeting was held until

November 7, 1890.

The Society came together in the new meeting room.

Present, 31 members.

President, Mr. Fraley, in the Chair.

Mr. Robert Patterson Field, a newly elected member, was presented to the Chair, and took his seat.

Correspondence was submitted as follows:

Letters accepting membership in the Society from Messrs. George S. Fullerton, Robert P. Field, Heman L. Wayland, Philadelphia; Charles G. Leland, London, Eng.

A circular from Mr. A. Strauch, announcing his successorship to Mr. C. Vessilosski, as Secretary of the Académie Impériale des Sciences, St. Petersburg.

Circulars from the K. Zoologisch Genootschap Natura Artis Magistra, Amsterdam, announcing the death of Dr. G. F. Westerman, and the election of Dr. C. Kerbert as his successor.

A circular from the K. Gesellschaft der Wissenschaften, Göttingen, requesting Transactions, xiii, 3.

A circular from the Société Botanique Bavaroise, Munich, requesting exchanges.

A circular from M. Miguel Perez, announcing his successorship to Prof. Mariano Barcena, as Directeur of the Observatorio Meteorológico Magnético Central, Mexico.

Letters from societies responding to the request of the American Philosophical Society for exchanges, were as follows:

The Royal Asiatic Society (Straits Branch), Singapore; K. Danske Geografiske Selskab, Copenhagen; Observatorium der K. K. Nautischen Akademie, Triest; K. K. Militär-Geographische Institut, Wien; Geodätische Institut, Hydrographische Amt des Reichs-Marine-Amt, Berlin; Verein für Erdkunde, Cassel; K. Sächs. Meteorologische Institut, Chemnitz; Siebenbergische Verein für Naturwissenschaften, Hermannstadt; Naturwissenschaftliche Verein, Osnabrück; Würtembergische Verein für Handelsgeographie, Stuttgart; Etat Indépendant du Congo, Bruxelles; Société Neuchateloise de Géographie, Neuchâtel; Union Géographique du Nord de la France, Douai; Société de Geographie, Lille; Ministero di Agr. e Commercio Direzione Generale della Statistica, Rome; Manchester Geographical Society; Belfast Natural History and Philosophical Society; Instituto Meteorologico Nacional de Costa Rica; Dirección General de Estadistica, La Plata.

Letters of envoy were received from the Secretary of Mines, Melbourne, Australia; Royal Asiatic Society (Straits Branch), Singapore; Société de Géographie de Finlande, Helsingfors; Université Royale, Lund; Fondation de P. Teyler van der Hulst, Harlem; Osservatorio Marittimo dell' i. k. Accademia di Nautica, Trieste; K. Geologische Landesanstalt und Berg-akademie, Prof. F. Reuleaux, Berlin; Würtembergische Vierteljahrshefte für Landesgeschichte, Stuttgart; Société de Géographie de Lille; Royal Statistical Society, Meteorological Office, London; Mr. W. Sinclair, Glasgow; Boston Society of Natural History; Department of State, United States Geological Survey, Smithsonian Institution, Washington, D. C.; Public Ledger Family, Philadelphia; Observatorio Nacional, Oficina Meteorológica Argentina, Cordoba, S. A.

Letters of acknowledgment (Transactions, xvi, 3) were received from the Société Royale de Zoologie, Amsterdam; Fondation de P. Teyler van der Hulst, Harlem; Bataafsch Genootschap der Proefondervendelijke Wijsbegeerte, Rotterdam; R. Accademia dei Lincei, Rome; K. Bibliothek, Berlin; Philosophical Society, Cambridge; Royal Society, Royal Institution, Royal Astronomical Society, Society of Antiquaries, London; Radcliffe Observatory, Oxford; Royal Society of Edinburgh; Boston Society of Natural History.

Letters of acknowledgment were received from Dr. Julius Platzmann, Leipzig (127); R. Academia de la Historia, Madrid (128, 129, 130); University Library, Cambridge. Eng. (133); Radcliffe Observatory, Oxford, Eng. (127–133); University of Toronto, Canada (99–133, Catalogue, Pts. i–iv, etc.); Dr. John M. Maisch, Mrs. Helen Abbott Michael, Philadelphia (128, 129, etc.); University of Iowa, Iowa City (125, 128, 129); Messrs. Lyman B. Hall (133), John A. Ryder, Benjamin Sharp, Philadelphia (128, 129, 132, 133).

Acknowledgments (129) were received from Mr. Samuel Davenport, Adelaide, S. Australia; Imperial Academy of Science, St. Petersburg; Prof. Paul Hunfalvy, Buda-Pesth, Hungary; Université Royale, Lund; South African Philosophical Society, Cape Town; Centralblatt für Physiologie, Berlin; Dr. Otto Böhttingk, Leipzig; Academie Royale des Sciences, Lisbon, Portugal.

Acknowledgments (130) were received from the Geological Survey of India, Calcutta; Tokyo Library, Tokyo, Japan; Royal Society of New South Wales, Sydney; Imperial Academy of Science, St. Petersburg; Université Royale, Lund; Fondation de P. Teyler van der Hulst, Harlem, Netherlands; Société Entomologique de Belgique, Bruxelles; Profs. Matthæus Much, Josef Szombathy, Vienna, Austria; Deutsche Geologische Gesellschaft, K. Preuss. Akademie der Wissenschaften, Gesellschaft für Erdkunde, Physiologische Gesellschaft, Berlin; Naturwissenschaftlicher Verein, Bremen; Verein für Thüringische Geschichte und Altertumskunde, Jena; Dr. Otto Böhtlingk, Leipzig; K. Sternwarte, München; Verein für Naturkunde, Offenbach a. Main; Dr. C. A. Dohrn, Stettin; Marquis Antonio De Gregorio, Palermo, Sicily; R. Accademia di Scienze, Lettere ed Arti, Padova; R. Accademia dei Lincei, R. Comitato Geologico d'Italia, Prof. Giuseppe Sergi, Rome, R. Osservatorio, Turin; Prof. Claudio Jannet, Prof. Lucien Adam, Rennes, France; Royal Society, Royal Observatory, Mr. James Geikie, Edinburgh, Scotland; Prof. J. P. Postgate, Cambridge, Eng.; Society of Arts, Juhlin Dannfelt, London; Natural History Society, Newcastle-upon-Tyne; Boston Society of Natural History; Messrs. H. D. Gregory, Inman Horner, Philadelphia; Mr. Everard F. im Thurn, British Guiana; South African Philosophical Society, Cape Town.

Letters of acknowledgment (131, 132, 133) were received from the Musée Royale d'Histoire Naturelle de Belgique, Bruxelles; K. K. Central-Anstalt für Meteorologie und Erdmagnetismus, Drs. Aristides Brezina, Friedrich S. Krauss, Wien; Naturforschende Gesellschaft des Osterlandes, Altenburg; Gesellschaft für Erdkunde, K. Geol. Landesanst. u. Bergakademie, Berlin; Verein für Erdkunde, Dresden; K. Sächs. Gesellschaft der Wissenschaften, Dr. Julius Platzmann, Leipzig; Verein für Geographie und Statistik, Frankfurt a. M.; Verein für Naturkunde, Offenbach a. M.; Société d'Anthropologie, Musée Guimet, Messrs. A. Del Cloizeaux, Abel Hovelacque, Claudio Jannet, E. Levasseur, Paris; Prof. Lucien Adam, Rennes, France; Philosophical Society, Prof. J. P. Postgate, Cambridge, Eng.; Mr. Samuel Timmins, Coventry, Eng.; Yorkshire Geological and Palæontological Society, Halifax, Eng.; Society of Antiquaries, Royal Society, Royal Astronomical, Statistical, Linnean, Geographical Societies, Royal Institution, Local Government Board, Dr. J. D. Hooker, London; Natural History Society of Northumberland, etc., Newcastle-upon-Tyne; Royal Society. Royal Observatory, Prof. J. Geikie, Edinburgh; Royal Dublin Society; Nova Scotia Institute of Natural Science, Halifax, N. S.; Natural History Society, Montreal, Canada; Mr. Horatio Hale, Clinton, Ontario; Geological and Natural History Survey, Ottawa, Canada; Hon. J. M. Le Moine, Quebec; Canadian Institute, University of Toronto, Sir Daniel Wilson, Toronto, Canada; Maine Historical Society, Portland Society of Natural History, Portland, Me.; New Hampshire Historical Society, Concord; Prof. C. H. Hitchcock, Hanover, N. H.; Amherst College Library, Amherst, Mass.; American Statistical Association, Boston Athenæum, Massachusetts Historical Society, Public Library, Boston Society of Natural History, State Library of Massachusetts, Massachusetts Institute of Technology, Dr. Oliver Wendell Holmes, Hon. Robert C. Winthrop, Boston; Museum of Comparative Zoölogy, Harvard College Library, Messrs. Robert N. Toppan, Joseph Lovering, J. D. Whitney, Cambridge; Mr. James B. Francis, Lowell, Mass.; Dr. Pliny Earle, Northampton, Mass.; Rev. Edward E. Hale, Roxbury, Mass.; Essex Institute, Salem; American Antiquarian Society, Worcester, Mass.; Rhode Island Historical Society, Providence; Franklin Society, Providence, R. I.; Connecticut Historical Society, Hartford; New Haven Colony Historical Society; New York State Library, Mr. James Hall, Albany; Prof. Walter Le Conte Stevens, Brooklyn; Buffalo Library; Prof. C. H. F. Peters, Clinton, N. Y.; Profs. J. M. Hart, T. F. Crane, B. G. Wilder, Ithaca, N. Y.; Astor Library, Columbia College, University of the City of New York, New York Hospital, New York Historical Society, Editors of "The Critic," Messrs. H. L. Abbot, Joel A. Allen, Daniel Draper, James Douglas, J. S. Newberry, J. J. Stevenson, New York; Oneida Historical Society, Utica; Vassar Brothers Institute, Poughkeepsie; United States Military Academy, West Point; Prof. Henry M. Baird, Yonkers, N. Y.; Messrs. J. F. Garrison, I. C. Martindale, Camden, N. J.; New Jersey Historical Society, Newark; Profs. C. F. Brackett, C. A. Young, Princeton, N. J.; Dr. Charles B. Dudley, Altoona, Pa.; Mr. M. H. Boyé, Coopersburg; Mr. Eckley B. Coxe, Drifton; Drs. Traill Green, J. M. Moore, Thomas C. Porter, Easton; State Library of Pennsylvania, Mr. Andrew S. McCreath, Harrisburg; Prof. Lyman B. Hall, Haverford; Mr. John Fulton, Johnstown; Linnean Society, Lancaster; Mr. P. F. Rothermel, Linfield; Franklin Institute, College of Physicians, Pennsylvania Hospital, Wagner Free Institute of Science, Messrs. John Ashhurst, Jr., W. S. Baker, Cadwalader Biddle, Andrew A. Blair, D. G. Brinton, J. H. Brinton, C. H. Clark, Thomas M. Cleemann, J. Solis Cohen, E. D. Cope, C. S. Dolley, Patterson Du Bois, Robert Patterson Field, Frederick Fraley, J. C. Fraley, Persifor Frazer, George Friebis, Philip C. Garrett, F. A. Genth, F. A. Genth, Jr., J. S. Harris, Lewis M. Haupt, H. V. Hilprecht, William A. Ingham, Francis Jordan, Jr., G. de B. Keim, J. P. Lesley, A. S. Letchworth, John M. Maisch, John Marshall, James T. Mitchell, George R. Morehouse, Isaac Norris, Jr., Charles A. Oliver, C. Stuart Patterson, Robert Patterson, John S. Packard, C. N. Peirce, William Pepper, Henry Phillips, Jr., Franklin Platt, F. Prime, Theo. D. Rand, T. B. Reed, Robert W. Rogers, W. S. W. Ruschenberger, John A. Ryder, L. A. Scott, Aubrey H. Smith, Albert H. Smyth, George Stuart, W. P. Tatham, H. Clay Trumbull, D. K. Tuttle, William H. Wahl, H. L. Wayland, Talcott Williams, Theo. G. Wormley, Ellis Yarnall, Mrs. Helen Abbott Michael, Philadelphia; Mr. John F. Carll, Pleasantville; Messrs. P. W. Sheafer, Heber S. Thompson, Pottsville; Rev. F. A. Mühlenberg, Reading; Mr. M. Fisher Longstreth, Sharon Hill; Philosophical Society, Messrs. Philip Sharples, Washington Townsend, West Chester, Pa.; United States Naval Institute, Annapolis, Md.; Maryland Historical Society, Peabody Institute, Maryland Institute for the Promotion of the Mechanic Arts, Prof.

William Osler, Baltimore, Md.; Smithsonian Institution, Surgeon-General's Office, United States Geological Survey, United States Naval Observatory, Anthropological Society, Messrs. Alexander Graham Bell, A. S. Gatschet, W. J. Hoffman, Thomas Jefferson Lee, Garrick Mallery, M. C. Meigs, C. V. Riley, Charles A. Schott, William B. Taylor, Lester F. Ward, Washington, D. C.; West Virginia University, Morgantown, W. Va.; Virginia Historical Society, Richmond; Prof. John W. Mallet, University of Virginia; Dr. Robert Peter, Lexington, Ky.; Georgia Historical Society, Savannah; Prof. Alexander Winchell, Ann Arbor, Mich.; Prof. E. W. Claypole, Akron, O.; Society of Natural History, Cincinnati Observatory, Cincinnati, O.; Rev. H. Stafford Osborn, Oxford, O.; Prof. John L. Campbell, Crawfordsville, Ind.; Chicago Historical Society, Chicago, Ill.; State Historical Society of Wisconsin, Madison, Wis.; University of Iowa, Iowa City; Academy of Natural Sciences, Davenport, Iowa; Kansas Academy of Science, Washburn College, Kansas Historical Society, Topeka; Colorado Scientific Society, Denver; University of California, Profs. John Le Conte, Joseph Le Conte, Berkeley; Mr. George R. Babcock, Oakland, Cal.; Prof. Daniel Kirkwood, Riverside, Cal.; Free Public Library, Mr. George Dadidson, San Francisco, Cal.; Sociedad Cientifica "Antonio Alzate," Mexico; Observatorio Astronomico Nacional Mexicano, Tacubaya; Museo Michoacamo, Morelia, Mexico; Bishop Crescencio Carrillo, Merida, Yucatan; Mr. E. F. im Thurn, British Guiana.

Accessions to the Library were received from the Straits Branch of the Royal Asiatic Society, Singapore; Royal Society of South Australia, Adelaide; Royal Geographical Society of Australasia, Secretary of Mines, Melbourne; New Zealand Institute, Wellington; Royal Society of New South Wales; Technical Museum, Sydney; Royal Society of Tasmania; Institut Egyptien, Cairo; Société Impériale de Geographie, St. Petersburg; Académi des Sciences, Cracow, Austria; K. Nautische Akademie, Triest, Austria; K. K. Geographische Gesellschaft, Vienna; Geographische-Commercielle Gesellschaft, Aarau, Switzerland; Geographische Gesellschaft, Naturforschende Gesellschaft, Bern; K. Universitetet, Lund; Physiologische Gesellschaft, Prof. F. Reuleaux, Berlin; K. Sächs. Alterthums-Verein, Dresden; Mr. Emile Schwoerer, Colmar, Alsace; Geographische Gesellschaft, Hamburg; Geographische Gesellschaft, Hanover; Deutsche Gesellschaft für Anthropologie, etc., Mr. J. E. Weiss, Munich; Mr. W. Grosseteste, Mülhausen, Alsace; Naturwissenschaftlicher Verein, Osnabruck; Würtembergische Vierteljahrsheft für Landesgeschichte, Stuttgart; Société de Geographie, Neuchâtel; Società Africana d'Italia, Naples; Ministero di Agricoltura, Industria e Commercio, Rome; Mr. L. M. Billia, Turin; Union Géographique du Nord de la France, Douay, France; Société de Géographie, Lille; Société Languedocienne de Géographie, Montpellier; Société d'Emulation des Côtes-du-Nord, St. Brieuc; Instituto y Observatorio de Marina de San Fernando; Royal Geological Society of Cornwall, Eng.; Meteorological Council and Office, Royal Society, Editors of "Nature," London; University College, Nottingham, Eng.; Penzance Natural History and Antiquarian Society, Boston Society of Natural History, Massachusetts Historical Society, Boston; Rhode Island Historical Society, Providence; Wesleyan University, Middletown, Conn.; American Chemical Society, New York; New Jersey Historical Society, Newark; Alumni Association of the College of Pharmacy, Publishers of "The Medical News," Franklin Institute, Library Company of Philadelphia, Dr. Charles W. Dulles, Philadelphia; War Department, United States Naval Observatory, Department of Agriculture, Washington, D. C.; Denison University, Granville, O.; Washington University, St. Louis; Kansas State Librarian, Kansas State Historical Society, Topeka; Colorado College Scientific Society, Colorado Springs; Historical Society of Southern California, Los Angelos; California Academy of Sciences, San Francisco; Bishop Crescencio Carrillo, Merida, Yucatan.

An obituary notice of Rev. Daniel R. Goodwin, D.D., was read by J. Vaughan Merrick.

The death of Dr. Richard J. Levis, November 11, 1890, æt. 63, was announced.

The following papers were presented: "Notes and Descriptions of Palæozoic Fishes," by Dr. E. D. Cope; "On Extinct Genera of Testudinata," by Dr. George Baur; "On the Mammalian Genus Palæosyops," by Charles Earle.

Prof. Harrison Allen made an oral communication on the subject of the affinity of the teeth of rats with those of Eocene mammals.

Dr. J. Cheston Morris referred to a late publication by Dr. McLaughlin, of Texas, regarding immunity from disease by carrying out the law of interference, and dilated upon the great prospective and revolutionary value of the so-claimed discovery, if the same should be verified.

New nominations, Nos. 1213, 1214, and 1215, were read.

Mr. J. Sergeant Price presented the following report from the Committee on the Michaux Legacy, with accompanying resolution, which was unanimously adopted:

To the American Philosophical Society:

The Michaux Committee respectfully reports that at a meeting of the Committee, held on October 28, a note was received from Prof. Heilprin, towards whose expedition to Mexico and Yucatan the Society last January appropriated from the Michaux Fund the sum of $200, stating that the officers of the expedition had not been as yet able to complete their report, but it was in progress, and as soon as they had fully determined the names of the trees and plants from the regions visited by them, and never before reported upon by botanist, a complete report would be made to the Society. A letter was also received from Prof. Rothrock, stating that, owing to the fact that he was about to take a party of scientists to the West Indies in his yacht and spend the winter there, and in the lands to the westward, in making scientific collections, it would be impossible for him to deliver his usual course of lectures under the auspices of the Society, but suggested that it should appropriate to him out of the Michaux Fund the sum of $300 (the amount given to him each season for said lectures) for the purpose of obtaining fresh forestry data and new knowledge of forest products and lantern illustrations for future lectures. The Committee fully approved of the suggestion of Prof. Rothrock, and its Chairman, Mr. Meehan, in written endorsement of the application, stated that it is only by the accumulation of facts of a general character bearing on special subjects, that the special subjects themselves can be well understood. That at present we are very much in the dark on the arboreal features and peculiarities of the portions of the Western Continent, outside of the United States, and that he was sure that Prof. Rothrock's labors would greatly enlighten us on the subject, and he was confirmed in his opinion by a letter just received by him from Prof. Krug, of Berlin, calling attention to the desirability of more knowledge of West India forestry and vegetation. Announcement was also made to us that Prof. Rothrock had been awarded a medal by the Paris Exhibition for his exhibits of photographs of American forestry, he having been enabled to make a portion of said exhibit by the appropriation of our Society, and in sending them copies of our photographic lantern slides.

The Committee submits the following resolution, which it desires shall be passed by the Society :

Resolved, That the sum of $300 be appropriated to Prof. Rothrock out of the Michaux fund for the purpose of obtaining fresh forestry data and new photographic lantern slides in his expedition to the West Indies for the use in future lectures under the auspices of the Society.

By order of the Committee,

J. SERGEANT PRICE, *Secretary*.

Mr. Price, having read to the Society a letter* from Prof.

* PARIS, 11 RUE LAS CASES, 16th October, 1890.

TO THE PRESIDENT OF THE AMERICAN PHILOSOPHICAL SOCIETY OF PHILADELPHIA :

Mr. President:—I sent to your address about two months ago, through the Smithsonian Institution, a copy of the last work of our regretted colleague, the late Mr. Auguste Carlier, entitled "The American Republic," in four volumes in octavo, to be offered to the American Philosophical Society.

I shall be very much obliged to you if, when this work reaches you, you will acknowledge its receipt.

I send you, enclosed in this letter, a photograph of Mr. Carlier, in case you do not possess it in your collection.

I take advantage of this occasion to send you mine also. I have had the negligence not to send it at the time when the Secretary requested this of the members; but it is time enough to repair that error and also to testify to you the high value I attach to the honor done me by the American Philosophical Society in admitting me in its midst on the presentation of the excellent Mr. Moncure Robinson.

You have already been notified by Mr. P. Massion, notary, in Paris, 58 Boulevard Haussmann, and testamentary executor of the late Mr. Carlier, that our regretted friend had left a legacy of twenty thousand francs to the American Philosophical Society. The legacy was entrusted to me, for he named me as his universal legatee, and it should be paid one year after his death by the terms of his will, that is, on the 16th of March, 1891, without interest until then.

All the rights of succession payable to the French Treasury are to my expense. The American Philosophical Society, then, will not have to pay any expenses but those of the power of attorney, that it should give to the person whom it will charge to receive this sum in Paris. This power of attorney, made before a notary public in Philadelphia, should be legalized by the French Consul in Philadelphia, and the signature of the said Consul will be in turn certified by the Ministry of Foreign Affairs in Paris.

So far as concerns me, I see no other legal steps to ask of the Society. (Of course, it is understood that the first document to produce is a resolution of the Society, at a regular meeting held in conformity with its rules, by which it shall expressly accept the legacy of Mr. Carlier, and give a power of attorney to some one to accept the same in its name in Paris, and at the same time to receive for it this sum.) But as Mr. P. Massion, the testamentary executor, who does not know, as I do, American legislation, might

Claudio Jannet to the President of the American Philosophical Society, stating that our late fellow-member, Auguste Carlier, of Paris, had, by his last will and testament, of which he was the universal legatee, bequeathed to the Society the sum of twenty thousand francs, submitted the following resolutions, which were unanimously adopted:

Resolved, That the American Philosophical Society hereby accepts the legacy of twenty thousand francs given to it by the last will and testament of Mr. Auguste Carlier, late of Paris, France.

Resolved, That a power of attorney be executed by the President, under the corporate seal of the Society, attested by the Secretary, appointing —— ——, of Paris, as its attorney in fact, and authorizing and empowering him, in its name, in Paris, to accept for it the legacy of twenty thousand francs given to it by the last will and testament of Auguste Carlier, of Paris, and to give to P. Massion, notary in Paris, 58 Boulevard Haussmann, his testamentary executor, or to any one else authorized to pay said legacy, a full and complete receipt and discharge therefor as fully as if given by the Society itself.

The President called to the attention of the Society the provisions of the will of the late Col. F. M. Etting, under which the Society has certain interests, and stated that during its recess he had requested Mr. Price, a member of the Philadelphia bar, to represent the Society in the matter.

Mr. Price explained the legal status of the case, and stated no bond was necessary to indemnify the executors; that an issue was now pending to determine the validity of the will, and that the Society had no real concern with the same.

Mr. Tatham moved that the action of the Treasurer, in declining to give any security to indemnify the executors, be approved.

Dr. Morris offered as an amendment that "the action of the President in employing Mr. Price as counsel for the Society be

---

have some difficulty, I advise you to put in relation with him the person you will charge with receiving this sum about a couple of months before the 15th of March, 1891, so that, if it became necessary, Mr. Massion would be able to correspond with you, and you could furnish him with such document as he would judge useful. So that the execution of the legacy that Mr. Carlier has made you, will not be retarded.

In waiting for another occasion to correspond with you, believe me, Mr. President,

Your very devoted,

CLAUDIO JANNET,

Professor of Political Economy at the Catholic University of Paris.

approved, and that he be requested to continue to represent the Society."

The amendment was carried, and the question being put on the motion as amended, was carried.

And the Society was adjourned by the President.

Stated Meeting, November 21, 1890.

Present, 18 members.

President, Mr. FRALEY, in the Chair.

Hon. James T. Mitchell, a lately elected member, was presented to the Chair, and took his seat.

The resignations of Rev. George Dana Boardman and Mr. George B. Roberts were accepted.

Dr. Daniel G. Brinton presented "Notes on the Puquina Language of Peru."

The minutes of the Board of Officers and Council were submitted.

Pending nominations, Nos. 1213, 1214, and 1215, and new nomination, No. 1216, were read.

The Committee on Increased Accommodations reported progress.

And the Society was adjourned by the President.

Stated Meeting, December 5, 1890.

Present, 14 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

Letters of acknowledgment (131, 132, 133) were received from the Imperial Academy of Science, Imperial Russian Geographical Society, Comité Geologique de la Russie, Prof. Serge Nikitin, St. Petersburg; K. Zoologisch Genootschap, Natura Artis Magistra, Amsterdam; K. Zoologisch-Botanisch Genootschap, The Hague, Holland; Fondation de P. Teyler van der Hulst, Harlem; Prof. C. Leemans, Leiden, Holland; Dr. Friederich Krauss, Vienna; Naturforschende Gesellschaft, Freiburg, i. B. (131, 133); Verein für Thüringische Geschichte und Alterthumskunde, Jena; "Le Cosmos," Marquis de Nadaillac, Paris; Mr. Hamilton A. Hill, Boston, Mass.; Mr. G. F. Dunning, Farmington, Conn.; Dr. H. C. Chapman, Philadelphia; Museo Nacional, Buenos Aires (130).

Société Royale de Géographie d'Anvers, Antwerp, Belgium, was placed on the Society's exchange list to receive Proceedings.

A circular was received from the American Chemical Society, New York, announcing the holding of their Second General Meeting, December 30 and 31, 1890.

A communication was received from George Reiter, Cincinnati, O., announcing a supposed new discovery that water can be raised by suction or atmospheric pressure higher than thirty-four feet, which the Secretaries were instructed to answer.

A letter from Mr. Robert Patterson, in reference to the Peale collection of stone implements, was referred to the Curators.

Accessions to the Library were reported from the Department of Mines, etc., Wellington, New Zealand; Geographical Society, Tokio; Deutsche Seewarte, Hamburg; Verein für Kunst und Alterthum in Oberschwaben, Ulm; Geographische Gesellschaft, München; Société Royale de Géographie d'Anvers; Académie Royale de Belgique, Bruxelles; Prof. L. Rütimeyer, Basel, Switzerland; Ostschweizerische Geogr.-Commerc. Gesellschaft, St. Gall; Direzione Generale della Statistica, Rome; Société de Geographie de Lisboa; University of the State of New York, Albany; Bureau of Statistics of New Jersey; Prof. Robert W. Rogers, Carlisle, Pa.; Franklin Institute, Dr. Persifor Frazer, Mr. Henry Phillips, Jr., Philadelphia; Department of State, Washington, D. C.; Academy of Science of St. Louis, Mo.; Colorado Scientific Society, Denver; Sociedad Cientifica "Antonio Alzate," Observatorio Astronomico Nacional de Tacubaya, Mexico.

The report of the Treasurer was presented.

Pending nominations, Nos. 1213, 1214, 1215, and 1216, were read.

Prof. Cope offered the following resolution:

Resolved, That the resolution of the Society which requires that papers presented for publication by the Society shall be completed for publication, shall not be construed to require completed drawings for the illustration of such papers.

A vote being taken, the resolution was not agreed to.

And the Society was adjourned by the President.

Stated Meeting, December 19, 1890.

Present, 19 members.

President, Mr. FRALEY, in the Chair.

A letter was received from the Rochester Academy of Science requesting exchanges, which was granted.

A letter of resignation was received from Mr. Herbert Welsh, Philadelphia, dated December 17, 1890, and the resignation accepted.

A plaster bust-portrait of Jefferson, for the Society's Cabinet, was received from Miss Emily Phillips, Philadelphia.

Photographs of the old Bartram Place (mansion, garden, etc.) were received from Dr. J. F. Holt, Philadelphia.

Letters of envoy were received from the Deutsche Seewarte, Hamburg; Bureau of Statistics of Labor and Industries, Trenton, N. J.; Rochester Academy of Science, Rochester, N. Y.

Letters of acknowledgment were received from the Royal

Society of Victoria, Melbourne (128, 130); Institut Egyptien, Cairo (131, 132, 133); Societas pro Fauna et Flora, Fennica, Helsingfors (131, 132, 133); Prof. Peter R. v. Tunner, Leoben, Styria (131, 132, 133); Profs. Friedrich Müller, Dionys Stur, Edward Suess, Vienna (130, 131, 132, 133); Deutsche Geologische Gesellschaft, Berlin (131, 132, 133); Geographische Gesellschaft, Hannover, Prussia (131, 132, 133); Prof. Dr. Dümischen, Strassburg, Alsace (130, 131, 132, 133); Prof. Dr. C. L. Rütimeyer, Basle, Switzerland (131, 132, 133); Schweiz. Naturforsch. Gesellschaft, Bern, Switzerland (131, 132, 133); Prof. Carl Vogt, Geneva, Switzerland (131, 132, 133); University of Tennessee, Knoxville (131, 132, 133).

Accessions to the Library were received from M. Theodor Gottleib, Leipzig; R. Università, Turin; Royal Society, Edinburgh; Geological Society, Manchester; Prof. George M. Dawson, Montreal; Astronomical Observatory of Harvard College, Cambridge; Academy of Science, Rochester, N. Y.; Henry Phillips, Jr., Philadelphia; Bureau of Education, Dr. Walter J. Hoffman, Washington, D. C.; University of California.

A letter was read from the Rittenhouse Memorial Association, requesting the Society to join in a petition to the Legislature, requesting the erection of a suitable monument to commemorate the services of David Rittenhouse to the State and the county.

After discussion and debate, the Society, on motion of Mr. Prime,

Resolved, That while the members of the American Philosophical Society individually sympathize with the proposed memorial requesting the Legislature to erect a monument to David Rittenhouse; yet, as a society, they consider it inexpedient to join in a petition so to do.

Pending nominations Nos. 1213, 1214, 1215, and 1216 were read, spoken to and balloted for.

The Committee on Finance presented its recommendations for appropriation for the ensuing year.

Mr. Prime moved to reduce the salary of the Librarian by $250.

Dr. Greene moved to raise the same to $1000.

The motion and amendment were subsequently withdrawn, and the appropriations passed, as reported.

Dr. Cope offered the following resolution:

Resolved, That a Committee, consisting of five members, be appointed by the President of the Society to consider and propose to a future meeting such measures as they may deem necessary for the well being and improvement of the Proceedings.

The resolution was adopted. The President subsequently appointed as such Committee, Dr. Cope, George F. Barker, Admiral Macauley, Dr. Jayne and Dr. Brinton.

Mr. Arthur Biddle moved that a Committee of five be appointed by the President at his leisure to consult with the Historical Society regarding the desirability of accepting the Etting bequest, and to report at the next meeting.

Dr. Morris moved to lay on the table, and a tie vote resulting on the motion, it was withdrawn, and the original motion being voted upon was carried.

The President subsequently appointed as such Committee, Mr. Arthur Biddle, Dr. Ruschenberger, Messrs. Wood, Price and Joseph C. Fraley.

Dr. Horn, from the Committee to obtain for the Society the Portrait of S. F. Baird, by Ulke, reported that it had been purchased and was now on the walls of the meeting room, and read a list of the donors for its purchase.

On motion, the thanks of the Society were tendered to the Committee for its services, and the Committee was discharged.

The ballots being counted, the following were reported duly elected members of the Society :

2183. Theodore Turrettini, Geneva.
2184. E. Mascart, Paris.
2185. William C. Unwin, London.
2186. Louis Vossion, Philadelphia.

And the Society was adjourned by the President.

INDEX TO VOL. XXVIII.

Meetings Held.

New Members Elected.

February 21, 1890.

No. 2178. Henry Willis . . . . . Philadelphia.
2177. Robert W. Rogers . . . . . Haverford, Pa.
2176. Samuel Timmins . . . . . Arley, near Coventry, England.
2175. James T. Mitchell . . . . . Philadelphia.

May 16, 1890.

No. 2182. Charles Godfrey Leland . . . . . London.
2181. Heman L. Wayland . . . . . Philadelphia.
2180. Robert Patterson Field . . . . . Philadelphia.
2179. George S. Fullerton . . . . . Philadelphia.

December 19, 1890.

No. 2186. Louis Vossion . . . . . Philadelphia.
2185. William C. Unwin . . . . . London.
2184. E. Mascart . . . . . Paris.
2183. Theodore Turrettini . . . . . Geneva.

Decease of Members.

Resignations of Members.

Obituary Notices.

Letters Accepting Membership.

Miscellaneous.

LIST OF SURVIVING MEMBERS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA

FOR

PROMOTING USEFUL KNOWLEDGE.

Corrected to January 2, 1891,

BY

HENRY PHILLIPS, JR.,

A Secretary of the Society.

List of surviving Members of the American Philosophical Society held at Philadelphia for Promoting Useful Knowledge.

The addresses here given so far as known are at the present time. Corrections of this list are respectfully solicited.

A name printed in *italics* indicates that the Society is uncertain as to whether such member is still living and desires information on the subject.

The Society will be happy to receive *photographs* of such of its members as have not already sent.

A

Name.	*Date of Election.*	*Present Address.*
1687. ABBÈ, CLEVELAND	July 21, 1871,	Army Weather Bureau, Washington, D. C.
2170. ABBOTT, CHARLES C.	Dec. 20, 1889,	Trenton, N. J.
1463. ABBOTT, HENRY L.	April 18, 1862,	New York City, N. Y.
1809. ÅCKERMAN, RICHARD	July 21, 1876,	Stockholm, Sweden.
1713. ACLAND, HENRY W.	Jan'y 17, 1873,	Oxford, England.
2128. ADAM, LUCIEN	Dec. 17, 1886,	Rennes, France.
2081. ADAMS, H. B.	May 21, 1886,	Baltimore, Md.
1238. ADAMS, JOHN COUCH	Jan'y 21, 1848,	Cambridge, England.
1381. *Adamson, Rev. John C.*	July 13, 1856.	
1779. AGASSIZ, ALEXANDER	April 16, 1875,	Cambridge, Mass.
1642. AGASSIZ, ELIZABETH	Oct. 15, 1869,	" "
1701. AGNEW, D. HAYES	April 19, 1872,	Philadelphia.
1886. AIRY, GEORGE BIDDLE, SIR	July 18, 1879,	Greenwich, England.
2091. ALBRECHT, PAUL	May 21, 1886,	Hamburg, Germany.
1812. ALCANTARA, DOM PEDRO D'	Oct. 20, 1876,	Paris, France.
1860. ALISON, ROBERT H.	May 3, 1878,	Ardmore, Pa.
1869. ALLEN, JOEL ASAPH	Sept. 20, 1878,	New York, N. Y.
1571. ALLEN, HARRISON	Jan'y 18, 1867,	Philadelphia.
1776. ALLISON, JOSEPH	April 16, 1875,	"
1927. AMES, CHARLES G.	Jan'y 21, 1881,	Boston, Mass.
2064. ANDERSON, GEORGE B.	Feb'y 19, 1886,	West Point, N. Y.
1655. ANDERSON, GEORGE W.	Oct. 15, 1869,	Rosemont, Pa.
1576. ANDERSON, M. B.	Jan'y 18, 1867,	Rochester, N. Y.
2164. ANGELL, JAMES B.	Oct. 18, 1889,	Ann Arbor, Mich.
1122. *Angelis, Pedro de*	Jan'y 17, 1840,	*Buenos Ayres.*
2102. ARGYLL, DUKE OF	May 21, 1886,	London, England.
1761. ARMSTRONG, WM. GEORGE	July 17, 1874,	Newcastle-on-Tyne, England.
1996. ASHHURST, JOHN	Jan'y 18, 1884,	Philadelphia.
2012. ASHHURST, RICHARD L.	April 18, 1884,	"

B

Name.	Date of Election.	Present Address
1995. BACHE, RICHARD MEADE	Jan'y 18, 1884,	Philadelphia.
1832. BACHE, THOMAS HEWSON	Feb'y 2, 1877,	"
1630. BAIRD, HENRY CAREY	Jan'y 15, 1869,	"
1991. BAIRD, HENRY M.	Jan'y 18, 1884,	New York, N. Y.
2015. BAKER, JOHN R.	April 18, 1884,	Philadelphia.
2075. BAKER, WILLIAM S.	May 21, 1886,	"
1157. BANCROFT, GEORGE	July 16, 1841,	Washington, D. C.
1936. BARBER, EDWIN ATLEE.	April 15, 1881,	West Chester, Pa.
1818. BARCENA, MARIANO.	Feb'y 2, 1877,	Mexico.
1741. BARKER, GEORGE F.	April 18, 1873,	Philadelphia.
2011. BARKER, WHARTON	April 18, 1884,	"
2144. BARNARD, WILLIAM T.	May 20, 1887,	Baltimore, Md.
1902. BARTHOLOW, ROBERTS	April 16, 1880,	Philadelphia.
1133. BARTLETT, W. H. C..	April 17, 1840,	Yonkers, N. Y.
2119. BASTIAN, ADOLPH	Dec. 17, 1886,	Berlin, Germany.
1934. BEAULIEU, PAUL LEROY.	April 15, 1881,	Paris, France.
1968. BELL, ALEXANDER GRAHAM. . .	July 21, 1882,	Washington.
1966. BELL, JOSEPH SNOWDEN	July 21, 1882,	Philadelphia.
1802. BELL, LOWTHIAN.	April 21, 1876,	Newcastle-on-Tyne, England
2149. BIDDLE, ALEXANDER	Feb'y 17, 1888,	Philadelphia.
2154. BIDDLE, ARTHUR	Dec. 21, 1888,	"
2173. BIDDLE, A. SYDNEY	Dec. 20, 1889,	"
1920. BIDDLE, CADWALADER	Oct. 15, 1880,	"
1831. BIDDLE, CRAIG	Feb'y 2, 1877,	"
2134. BILLINGS, JOHN S.	Feb'y 18, 1887,	Washington, D. C.
2157. BLAIR, ANDREW A.	May 17, 1889,	Philadelphia.
1554. *Blair, Thomas S.*	Jan'y 19, 1866,	*Pittsburgh, Pa.*
1669. BLAKE, WILLIAM PHIPPS	Oct. 21, 1870,	New Haven, Conn.
1790. BLASIUS, WILLIAM	Oct. 15, 1875,	Philadelphia.
1700. BLODGET, LORIN.	April 19, 1872,	"
1444. BÖHTLINGK, OTTO	Jan'y 17, 1862,	Leipzig, Germany.
2047. BONWILL, W J. A.	Oct. 16, 1885,	Philadelphia.
1852. *Borgnis, J. A.*	Oct. 20, 1820,	*Paris, France.* (?)
1126. BOYÈ, MARTIN H..	Jan'y 17, 1840,	Coopersburg, Pa.
1826. BRACKETT, CYRUS FOGG.	Feb'y 2, 1877,	Princeton, N. J.
2083. BRANNER, JOHN C.	May 21, 1886,	Little Rock, Ark.
2195. BREZINA, ARISTIDES	May 21, 1886,	Vienna, Austria.
1636. BRINTON, DANIEL G.	April 16, 1869,	Philadelphia.
2069. BRINTON, JOHN H.	Feb'y 19, 1886,	"
1745. BRITTON, J. BLODGETT	Oct. 17, 1873,	"
2080. BROOKS, WILLIAM KEITH	May 21, 1886,	Baltimore, Md.
1881. BROWN, ARTHUR ERWIN	April 18, 1879,	Philadelphia.
1333. BROWN-SEQUARD, E..	Jan'y 20, 1854,	Paris, France.
1614. BRUGSH, HENRI	Jan'y 15, 1869.	Berlin, Prussia.
1547. BRUSH, GEORGE J..	Jan'y 20, 1865,	New Haven, Conn.
1653. BULLOCK, CHARLES	Oct. 15, 1869,	Philadelphia.
1452. BUNSEN, ROBERT W.	Jan'y 17, 1862,	Heidelberg, Germany.
2008. BURK, ISAAC	Jan'y 18, 1884,	Philadelphia.
2007. BURK, JESSE Y.	Jan'y 18, 1884,	"
1378. BURMEISTER, HERMANN	April 18, 1856,	Buenos Ayres, S. A.
1938. BUTLER, WILLIAM	April 15, 1881,	West Chester, Pa.

C

1788. CAMPBELL, JOHN LYLE	July 16, 1875,	Crawfordsville, Ind.
1606. CANBY, WILLIAM MARRIATT . . .	Oct. 16, 1868,	Wilmington, Del.

Name.	Date of Election.	Present Address
2051. CANNIZZARO, TOMMASO	Oct. 16, 1885,	Messina, Italy.
1731. CAPELLINI, GIOVANNI	April 18, 1873,	Bologna, Italy.
1796. CARLL, J. B. F.	Oct. 15, 1875,	Pleasantville, Pa.
2130. CARRILLO, CRESCENCIO	Dec. 17, 1886,	Merida, Yucatan.
1911. CARSON, HAMPTON L.	April 16, 1880,	Philadelphia.
1707. CASSATT, ALEXANDER JOHNSON .	Oct. 18, 1872,	"
2147. CASTNER, SAMUEL, JR.	Dec. 16, 1887,	"
2152. CATTELL, J. MCKEEN	May 18, 1888,	Media, Pa.
1675. CATTELL, WILLIAM C.	Jan'y 20, 1871,	Philadelphia.
1908. CHANCE, HENRY MARTYN . . .	April 16, 1880,	New York, N. Y.
1783. CHANDLER, C. F.	April 16, 1875,	" "
1778. CHAPMAN, HENRY C.	April 16, 1875,	Philadelphia.
2132. CHARENCY, HYACINTH DE . . .	Dec. 17, 1886,	St. Maurice les Charency France.
1522. CHASE, THOMAS	Jan'y 15, 1864,	Providence, R. I.
2111. CHILDS, GEORGE W.	Dec. 17, 1886,	Philadelphia.
2158. CLARK, CLARENCE H.	May 17, 1889,	"
1717. CLARKE, THOMAS C.	Jan'y 17, 1873,	New York, N. Y.
1983. CLAYPOLE, E. W.	Jan'y 19, 1883,	Akron, Ohio.
2048. CLEEMANN, T. M.	Oct. 16, 1885,	Philadelphia.
1999. COHEN, J. SOLIS	Jan'y 18, 1884,	"
2005. COLERIDGE, LORD	Jan'y 18, 1884,	London, England.
1555. COPE, EDWARD D.	Jan'y 19, 1866,	Philadelphia.
1367. COPPÈE, HENRY	Jan'y 18, 1856,	Bethlehem, Pa.
2129. CORA, GUIDO	Dec. 17, 1886,	Turin, Italy.
1474. CORNELIUS, ROBERT	Oct. 17, 1862,	Philadelphia.
1867. COUES, ELLIOTT	Sept. 20, 1878,	Washington, D. C.
1662. COX, J. D.	April 15, 1870,	Toledo, O.
1672. COXE, ECKLEY B.	Oct. 21, 1870,	Drifton, Pa.
1836. CRANE, THOMAS F.	Feb'y 2, 1877,	Ithaca, N. Y.
1393. CRESSON, CHARLES M.	April 17, 1857,	Philadelphia.
2100. CROOKES, WILLIAM	May 21, 1886,	London, England.
2172. CRUZ, FERNANDO (of Guatemala)	Dec. 20, 1889,	Washington, D. C.
1439. CURWEN, JOHN	April 18, 1861,	Warren, Pa.

D

1567. DA COSTA, J. M.	Oct. 19, 1866,	Philadelphia.
1354. DANA, JAMES D	July 21, 1854,	New Haven, Conn.
1806. DANNEFELD, C. JUHLIN	April 21, 1876,	Stockholm, Sweden.
1516. DAUBRÉE, A.	July 17, 1863,	Paris, France.
1811. DAVENPORT, SAMUEL.	Oct. 20, 1876,	Adelaide, S. Australia.
1557. DAVIDSON, GEORGE.	Jan'y 19, 1866,	San Francisco, Cal.
1980. DAVIS, WILLIAM M.	Jan'y 19, 1883,	Philadelphia.
1923. DAWKINS, WILLIAM B	Oct. 15, 1880,	Manchester, England.
1468. DAWSON, JOHN W	April 18, 1862,	Montreal, Canada.
2131. DELGADA, JUAN DE DIAS DE LA RADA Y.	Dec. 17, 1886,	Madrid, Spain.
991. *Del Rio, Andres*	Oct. 15, 1830,	*Mexico.*
854. *De Montgèry*	Oct. 20, 1820.	
1964. DE ROSNY, LÉON	July 21, 1882,	Paris, France.
1876. DES CLOIZEAUX, A.	Oct. 18, 1879,	" "
2045. DE VERE, M. SCHELE.	Oct. 16, 1885,	University of Virginia.
2013. DICKSON, SAMUEL	April 18, 1884,	Philadelphia.
1341. DOHRN, C. A.	Jan'y 20, 1854,	Stettin, Prussia.
2108. DOLLEY, CHARLES S.	Dec. 17, 1886,	Philadelphia.

	Name.	Date of Election.	Present Address.
2089.	DONNER, OTTO	May 21, 1886,	Helsingfors, Finland.
1946.	DOOLITTLE, C. L.	Oct. 21, 1881,	Bethlehem, Pa.
1839.	DOUGLASS, JAMES, JR.	April 20, 1877,	Spuytenduyvil, N. Y.
1924.	DRAPER, DANIEL	Oct. 15, 1880,	New York, N. Y.
1787.	DROWN, THOMAS M	July 16, 1875,	Boston, Mass.
1918.	DU BOIS, PATTERSON	Oct. 15, 1880,	Philadelphia.
1878.	DUDLEY, CHARLES BENJAMIN	Jan'y 17, 1879,	Altoona, Pa.
1921.	DUDLEY, THOMAS H	Oct. 15, 1880,	Camden, N. J.
1615.	DÜMICHEN, JOHANNES	Jan'y 15, 1869,	Strasburg, Germany.
2063.	DUNCAN, LOUIS	Feb'y 19, 1886,	U. S. Navy.
1573.	DUNNING, GEORGE F.	Jan'y 18, 1867,	Farmington, Conn.
1727.	DUPONT, EDOUARD	April 18, 1873,	Brussels, Belgium.
2086.	DURUY, VICTOR	May 21, 1886,	Paris, France.
1679.	DUTTON, CLARENCE E	Jan'y 20, 1871,	Washington, D. C.

E

1560.	EARLE, PLINY	April 20, 1866,	Northampton, Mass.
2105.	EASTON, MORTON W.	Dec. 17, 1886,	Philadelphia.
1917.	ECKFELDT, JACOB B	Oct. 15, 1880,	"
1825.	EDDY, HENRY T.	Feb'y 2, 1877,	Cincinnati, O.
1686.	ELIOT, CHARLES W.	April 21, 1871,	Cambridge, Mass.
1981.	EMMONS, S. F.	Jan'y 19, 1883,	Washington, D. C.
1405.	*Evans, Edmund C*	Jan'y 21, 1859.	
1943.	EVANS, JOHN	Oct. 21, 1881,	Hemel Hempstead, Eng.

F

1273.	*Farnum, Joseph W.*	Jan'y 17, 1851,	*Camden, N. J.*
2180.	FIELD, ROBERT PATTERSON	May 16, 1890,	Philadelphia.
1901.	FLINT, AUSTIN, JR	April 16, 1880,	New York, N. Y.
1621.	FLOWER, WM. HENRY	Jan'y 15, 1869,	London, England.
1875.	FOGGO, EDWARD A.	Oct. 18, 1879,	Philadelphia.
1170.	FRALEY, FREDERICK	July 15, 1842,	"
1912.	FRALEY, JOSEPH C.	April 16, 1880,	"
1551.	FRANCIS, JAMES B	April 21, 1865,	Lowell, Mass.
1695.	FRAZER, PERSIFOR	Jan'y 19, 1872,	Philadelphia.
2171.	FRIEBIS, GEORGE	Dec. 20, 1889,	"
1459.	FROUDE, J. A.	Jan'y 17, 1862,	London, England.
2179.	FULLERTON, GEORGE S.	May 16, 1890,	Philadelphia.
1739.	FULTON, JOHN.	April 18, 1873,	Johnstown, Pa.
1914.	FURNESS, HORACE HOWARD	April 16, 1880,	Philadelphia.
1130.	FURNESS, WILLIAM H.	April 17, 1840,	"

G

1063.	*Galvez, Mariano*	Oct. 21, 1836,	*Guatemala, C. A.*
1988.	GARRETT, PHILIP C	April 20, 1883,	Philadelphia.
2014.	GARRISON, JOSEPH F.	April 18, 1884,	Camden, N. J.
2079.	GATES, M. E	May 21, 1886,	Amherst, Mass.
1025.	GATSCHET, ALBERT S.	Oct. 17, 1884,	Washington, D. C.
1897.	GEIKIE, ARCHIBALD	Jan'y 16, 1880,	London, England.
1803.	GEIKIE, JAMES.	April 21, 1876,	Edinburgh, Scotland.
1339.	GENTH, FRED. AUGUSTUS	Jan'y 20, 1854,	Philadelphia.
2067.	GENTH, F. A., JR.	Feb'y 19, 1886,	"
1355.	GIBBS, OLIVER WOLCOTT	July 21, 1854,	Cambridge, Mass.
1587.	GILL, THEODORE NICHOLAS	July 19, 1867,	Washington, D. C.
1800.	GILMAN, DANIEL C.	April 21, 1876,	Baltimore, Md.
1910.	*Giraldes, J. P. C. Cassado de.*	July 20, 1827.	

Name.	Date of Election.	Present Address.
1950. Gladstone, Wm. Ewart	Oct. 21, 1881,	London, England.
2162. Goode, G. Brown	Oct. 18, 1889,	Washington, D. C.
1835. Goodell, William	Feb'y 2, 1877,	Philadelphia.
1680. Goodfellow, Edward	Jan'y 20, 1871,	Washington, D. C.
1271. Gould, Ben. Apthorpe	Jan'y 17, 1851,	Cambridge, Mass.
1851. Gray, Elisha	Jan'y 18, 1878,	Chicago, Ill.
1605. Green, Traill	Oct. 16, 1868,	Easton, Pa.
1504. Green, William Henry	April 17, 1863,	Princeton, N. J.
1880. Greene, William H.	April 18, 1879,	Philadelphia.
2155. Gregorio, Il Marchese Antonio de	Dec. 21, 1888,	Palermo, Italy.
2159. Gregory, Henry D.	May 17, 1889,	Philadelphia.
1229. *Grimaldi, Cera*	Oct. 16, 1846,	*Naples, Italy.*
1939. Griscom, Wm. Woodnutt	April 15, 1881,	Haverford, Pa.
1815. Grote, Augustus Radcliffe	Oct. 20, 1876.	
2090. Gubernatis, Angelo de	May 21, 1886,	Florence, Italy.
1438. Guyangos, Pascual de.	April 19, 1861,	*Madrid, Spain.*

H

Name.	Date of Election.	Present Address.
2054. Haeckel, Ernest	Oct. 16, 1885,	Jena, Prussia.
2066. Hagan, H. A.	Feb'y 19, 1886,	Cambridge, Mass.
1658. Hale, Edw. Everett	Jan'y 21, 1870,	Roxbury, Mass.
1709. Hale, Horatio	Oct. 18, 1872,	Clinton, Canada.
1853. Hall, Asaph	Jan'y 18, 1878,	Washington, D. C.
1795. Hall, Charles Edward	Oct. 15, 1875,	Westport, N. Y.
1356. Hall, James	July 21, 1854,	Albany, N. Y.
2027. Hall, Lyman B	Jan'y 16, 1885,	Haverford, Pa.
1412. Hammond, William A	Oct. 21, 1859,	New York, N. Y.
1337. Harding, George	Jan'y 20, 1854,	Philadelphia.
2136. Harris, Joseph S.	May 20, 1887,	"
1827. Hart, James Morgan	Feb'y 2, 1877,	Cincinnati, O.
1510. Hartshorne, Henry	July 17, 1863,	Philadelphia.
1764. Hauer, Franz Ritter von	Oct. 16, 1874,	Vienna, Austria.
1681. Haupt, Hermann	April 21, 1871,	Washington, D. C.
1862. Haupt, Lewis M.	May 3, 1878,	Philadelphia.
2082. Hayes, R. Somers	May 21, 1886,	New York, N. Y.
2071. Hays, J. Minis	Feb'y 19, 1886,	Philadelphia.
2165. Hazlehurst, Henry	Oct. 18, 1889,	"
1985. Heilprin, Angelo	April 20, 1883,	"
1731. Helmholtz, Heinrich	April 18, 1873,	Berlin, Prussia.
1497. Hilgard, J. E.	April 17, 1863,	Washington, D. C.
1963. Hill, Hamilton Andrews	April 21, 1882,	Boston, Mass.
1501. Hill, Thomas	April 17, 1863,	Portland, Me.
2110. Hilprecht, Hermann V.	Dec. 17, 1886,	Philadelphia.
1768. Himes, Charles Francis	Oct. 16, 1874,	Carlisle, Pa.
1663. Hitchcock, Charles Henry	April 15, 1870,	Hanover, N. H.
2040. Hockley, Thomas	Jan'y 16, 1885,	Philadelphia.
2160. Hoffman, Walter J.	Oct. 18, 1889,	Washington, D. C.
1453. Hofmann, August William	Jan'y 17, 1862,	Berlin, Prussia.
2068. Holland, James W.	Feb'y 19, 1886,	Philadelphia.
1898. Holmes, Oliver Wendell	Jan'y 16, 1880,	Boston, Mass.
1624. Hooker, Joseph D.	Jan'y 15, 1869,	London, England.
1652. Hopper, Edward	Oct. 15, 1869,	Philadelphia.
1607. Horn, George Henry	Oct. 16, 1868,	"
2070. Horner, Inman	Feb'y 19, 1886,	"
1257. Horsford, Eben Norton	Jan'y 19, 1849;	Cambridge, Mass.

Name.	Date of Election.	Present Address.
1941. Hotchkiss, Jedediah.	Oct. 21, 1881,	Staunton, Va.
1696. Hough, George W.	Jan'y 19, 1872,	Chicago, Ill.
1698. Houston, Edwin J.	Jan'y 19, 1872,	Philadelphia.
2143. Houston, Henry H	May 20, 1887,	"
2084. Hovelacque, Abel	May 21, 1886,	Paris, France.
1843. Humphrey, H. C.	July 20, 1877.	
2116. Hunfalvy, Paul	Dec. 17, 1886,	Buda-Pesth, Hungary.
1441. Hunt, Thomas Sterry	April 19, 1861,	New York, N. Y.
1623. Huxley, Thomas Henry	Jan'y 15, 1869,	London, England.
1426. Hyrtle, Joseph.	July 20, 1860,	Vienna, Austria.
I		
2052. Im Thurn, Everard F.	Oct. 16, 1885,	Georgetown, British Guiana
1773. Ingham, Wm. Armstrong. . . .	April 16, 1875,	Philadelphia.
J		
2010. James, Edmund J	April 18, 1884,	Philadelphia.
1933. Jannet, Claudio	April 15, 1881,	Paris, France.
2049. Jayne, Horace	Oct. 16, 1885,	Philadelphia.
1954. Jefferis, William W	Jan'y 20, 1882,	"
1942. Jones, Charles C., Jr.	Oct. 21, 1881,	Augusta, Ga.
2017. Jordan, Francis, Jr.	April 18, 1884,	Philadelphia.
K		
1989. Kane, Elisha Kent.	April 20, 1883,	Kane, Pa.
2169. Keane, John J.	Dec. 20, 1889,	Washington, D. C.
1348. Keating, William V	April 21, 1854,	Philadelphia.
2021. Keen, William W.	July 18, 1884,	"
1962. Keim, Geo. de Benneville. . . .	April 21, 1882,	"
2118. Keipert, Henri.	Dec. 17, 1886,	Berlin, Prussia.
1161. Kendall, E. Otis	Jan'y 21, 1842,	Philadelphia.
1708. King, Clarence	Oct. 18, 1872,	New York, N. Y.
1537. Kirk, John Foster	July 15, 1864,	Philadelphia.
1284. Kirkwood, Daniel	April 18, 1851,	Riverside, Cal.
1767. König, George A	Oct. 16, 1874,	Philadelphia.
1971. Kopp, Hermann.	Oct. 20, 1882,	Heidelberg, Germany.
2167. Krauss, Friederich S	Dec. 20, 1889,	Vienna, Austria.
L		
1026. *Labouderie, J.*	April 19, 1833,	*Paris, France.*
1694. Lambert, Guillaume.	Jan'y 19, 1872,	Louvain, Belgium.
1858. Landreth, Burnet.	Jan'y 18, 1878,	Bristol, Pa.
1781. Langley, Samuel P.	April 16, 1775,	Washington, D. C.
1721. La Roche, C. Percy	Jan'y 17, 1873,	Rome, Italy.
1331. Latrobe, John H. B.	Jan'y 20, 1854,	Baltimore, Md.
1711. Lauth, Franz Joseph	Oct. 18, 1872,	Munich, Bavaria.
1974. Lawes, John Bennett, Sir . . .	Jan'y 19, 1883,	Rothamstead, Herts, Eng.
1595. Lea, Henry Charles.	Oct. 18, 1867,	Philadelphia.
1738. Le Conte, John.	April 18, 1873,	Berkeley, Cal.
1737. Le Conte, Joseph.	April 18, 1873,	"
1477. Lee, Thomas Jefferson	Oct. 17, 1862,	Washington, D. C.
2125. Leemans, Conrad.	Dec. 17, 1886,	Leyden, Holland.
1986. Lehman, Ambrose E.	April 20, 1883,	Philadelphia.
1263. Leidy, Joseph.	Oct. 19, 1849,	"
2182. Leland, Charles G.	May 16, 1890,	London, Eng.
2174. Le Moine, J. M.	Dec. 20, 1889,	Quebec, Canada.
1382. Lesley, J. Peter	July 13, 1856,	Philadelphia.
1376. Letchworth, Albert S.	Jan'y 18, 1856,	"

Name.	Date of Election.	Present Address.
2085. Levasseur, Emil	May 21, 1886,	Paris, France.
1415. Lewis, Francis W.	Jan'y 20, 1860,	Philadelphia.
1953. Lewis, Samuel Savage	Jan'y 20, 1882,	Cambridge, England.
1383. *Leyburn, John.*	July 13, 1856,	*Baltimore, Md.*
1756. Lockyer, Joseph Norman.	April 17, 1874,	London, England.
1728. Longchamps, Selys de	April 18, 1873,	Liége, Belgium.
1255. Longstreth, Miers Fisher	April 21, 1848,	Sharon Hill.
1872. Longstreth, Morris	Sept. 20, 1878,	Philadelphia.
1015. *Lorin, Theodore*	April 20, 1832,	*Paris, France.*
1926. Lovering, Joseph.	Jan'y 21, 1881,	Cambridge, Mass.
1977. Lowell, James Russell	Jan'y 19, 1883,	" "
2019. Lubbock, John	July 18, 1884,	London, England.
2003. Ludlow, William.	Jan'y 18, 1884,	U. S. A.
1629. Lyman, Benjamin Smith	Jan'y 15, 1869,	Philadelphia.

M

Name.	Date of Election.	Present Address.
1058. *Macedo, J. L. DaCosta*	April 15, 1836,	*Lisbon, Portugal.*
1994. Maisch, John M.	Jan'y 18, 1884,	Philadelphia.
1970. Mallery, Garrick, Jr	Oct. 20, 1882,	Washington, D. C.
2012. Mallet, John Wm.	Jan'y 16, 1885,	University of Virginia, Va.
1847. Mansfield, Ira Franklin	Jan'y 18, 1878,	Cannelton, Pa.
1857. March, Francis Andrew	Jan'y 18, 1878,	Easton, Pa.
1861. Marks, William D	May 3, 1878,	Philadelphia.
1604. Marsh, Othniel C	Oct. 16, 1868.	New Haven, Conn.
2078. Marshall, John	May 21, 1886,	Philadelphia.
1922. Martindale, Isaac C	Oct. 15, 1880,	Camden, N. J.
1018. *Martinez, Juan Josè*	April 20, 1832.	*Spain.*
1885. Martins, Charles.	July 18, 1879,	Montpellier, France.
2184. Mascart, E.	Dec. 19, 1890,	Paris, France.
1572. Mason, Andrew	Jan'y 18, 1867,	New York, N. Y.
1929. May, Addison.*	Jan'y 21, 1881,	West Chester, Pa.
1654. Mayer, Alfred M	Oct. 15, 1869,	Hoboken, N. J.
2107. McAlister, James	Dec. 17, 1886,	Philadelphia.
1928. McCauley, Edward Y	Jan'y 21, 1881,	"
1685. McCosh, James	April 21, 1871,	
1888. McCreath, Andrew S.	July 18, 1879.	Harrisburg, Pa.
1821. McKean, William V.	Feb'y 2, 1877,	Philadelphia.
2004. McMaster, John Bach	Jan'y 18, 1884,	"
1677. Meehan, Thomas	Jan'y 20, 1871,	"
1335. Meigs, Montgomery C	Jan'y 20, 1854,	Washington, D. C.
1903. Merrick, John Vaughan	April 16, 1880,	Philadelphia.
1947. Merriman, Mansfield	Oct. 21, 1881,	Bethlehem, Pa.
1744. Messchert, Mathew Huizinga.	Oct. 17, 1873,	Douglassville, Pa.
2142. Michael, Helen Abbott.	May 20, 1887,	Philadelphia.
2175. Mitchell, James T.	Feb. 21, 1890,	"
1461. Mitchell, S. Weir	Jan'y 17, 1862,	"
1735. Mommsen, Theodore	April 18, 1873,	Berlin, Prussia.
2114. Monier-Williams, Monier	Dec. 17, 1886,	London, England.
1791. Moore, Gideon E	Oct. 15, 1875,	New York, N. Y.
2029. Moore, James W	Jan'y 16, 1885,	Easton, Pa.
1811. Morehouse, George R	April 20, 1877,	Philadelphia.
1054. *Morelli.*	Jan'y 15, 1836,	*Naples, Italy.*
1976. Morris, J. Cheston.	Jan'y 19, 1883,	Philadelphia.
1577. Morton, Henry	Jan'y 18, 1867,	Hoboken N. J.
2121. Much, Mattheus.	Dec. 17, 1886,	Vienna, Austria.
1866. Muhlenberg, F. A.	Sept. 20, 1878,	Philadelphia.
2120. Mueller, Friederich	Dec. 17, 1886,	Vienna, Austria.

Name.	*Date of Election.*	*Present Address.*
1486. MUELLER, F. MAX	Jan'y 16, 1863,	Oxford, England.
1892. MUONI, DAMIANO	Jan'y 16, 1880,	Milan, Italy.
2062. MURDOCK, J. B.	Feb'y 19, 1886,	U. S. Navy.
1937. MURRAY, JAMES A. H.	April 15, 1881,	Oxford, England.

N

2087. NADAILLAC, MARQUIS DE	May 21, 1886,	Paris, France.
1575. NEWBERRY, JOHN S.	Jan'y 18, 1867,	New York, N. Y.
1852. NEWCOMB, SIMON	Jan'y 18, 1878,	Washington, D. C.
1582. NEWTON, HUBERT ANSON	April 19, 1869,	New Haven, Conn.
1703. NICHOLS, STARR HOYT	July 19, 1872,	New York, N. Y.
2060. NIKITIN, SERGE	Feb'y 19, 1866,	St. Petersburg, Russia.
1805. NORDENSKIÖLD, ADOLF ERIC	April 21, 1876,	Stockholm, Sweden.
1712. NORRIS, ISAAC, JR.	Oct. 18, 1872,	Philadelphia.
2106. NORRIS, WILLIAM F.	Dec. 17, 1886,	"
2046. NORTH, EDWARD	Oct. 16, 1885,	Clinton, N. Y.

O

2072. OLIVER, CHARLES A.	Feb'y 19, 1886,	Philadelphia.
1715. OLIVER, JAMES E.	Jan'y 17, 1873,	Ithaca, N. Y.
2135. OSBORN, HENRY F.	Feb'y 18, 1887,	Princeton, N. J.
1581. OSBORN, HENRY S.	Jan'y 18, 1867,	Oxford, O.
2039. OSLER, WILLIAM	Jan'y 16, 1885,	Baltimore, Md.
1801. OWEN, P. CUNLIFFE, SIR	April 21, 1876,	London, England.
1212. OWEN, RICHARD	Jan'y 17, 1845,	" "

P

1868. PACKARD, A. S., JR.	Sept. 20, 1878,	Providence, R. I.
1578. PACKARD, JOHN H.	Jan'y 18, 1867,	Philadelphia.
1331. PAGET, JAMES, SIR.	Jan'y 20, 1854,	London, England.
1984. PANCOAST, WILLIAM HENRY	Jan'y 19, 1883,	Philadelphia.
1593. PARDEE, ARIO	Oct. 18, 1867,	Hazleton, Pa.
1673. PARIEU, ESQUIRON DE	Jan'y 20, 1871,	Paris, France.
2036. PARVIN, THEOPHILUS	Jan'y 16, 1885,	Philadelphia.
2056. PASTEUR, LOUIS	Oct. 16, 1885,	Paris, France.
2035. PATTERSON, C. STUART	Jan'y 16, 1885,	Philadelphia.
1282. PATTERSON, ROBERT	April 18, 1851,	"
1320. *Patterson, Thomas L.*	April 15, 1853.	*Cumberland, Md.*
1772. PEARSE, JOHN B.	Jan'y 15, 1875.	Boston, Mass.
1722. PEMBERTON, HENRY	Jan'y 17, 1873,	Philadelphia.
2104. PEÑAFIEL, ANTONIO	May 21, 1886,	Berlin, Prussia.
1777. PENINGTON, EDWARD	April 16, 1875,	Philadelphia.
2073. PENNYPACKER, SAMUEL W.	May 21, 1886,	"
1518. PENROSE, R. A. F.	July 17, 1863,	"
2059. PEPPER, EDWARD	Feb'y 19, 1886,	Paris.
1666. PEPPER, WILLIAM	July 15, 1870,	Philadelphia.
951. *Pereira, José Maria Dantes*	April 18, 1828,	*Lisbon, Portugal.*
1705. PETER, ROBERT	July 19, 1872,	Lexington, Ky.
1824. PHILLIPS, HENRY, JR.	Feb'y 2, 1877,	Philadelphia.
1859. PIERCE, C. NEWLIN	May 3, 1878,	"
1760. PLATT, FRANKLIN	July 17, 1874,	Philadelphia.
2127. PLATZMAN, JULIUS	Dec. 17, 1886,	Leipzig, Germany.
2053. POMIALOWSKY, JOHN	Oct. 16, 1885,	St. Petersburg, Russia.
1539. PORTER, THOMAS CONRAD	Oct. 21, 1864,	Easton, Pa.
2044. POTTS, WILLIAM JOHN	Oct. 16, 1885,	Camden, N. J.
2097. POSTGATE, J. P	May 21, 1886,	Cambridge, England.
1216. *Poussin, William Tell*	Jan'y 17, 1882,	*Paris, France.*

	Name.	Date of Election.	Present Address.
2161.	POWELL, J. W.	Oct. 18, 1889,	Washington, D. C.
1619.	PRESTWICH, JOSEPH	Jan'y 15, 1869,	Shoreham, England.
1592.	PRICE, J. SERGEANT	Oct. 18, 1867,	Philadelphia.
1780.	PRIME, FREDERICK, JR	April 16, 1875,	"
2088.	PULZSKY, FRANCIS	May 21, 1886,	Buda-Pesth, Hungary.
1758.	PUMPELLY, RAPHAEL	April 17, 1874,	Newport, R. I.

Q

973.	*Quadrada, Francisco de Paolo*	Oct. 16, 1829,	*Madrid, Spain.*
1143.	*Quaranta, Barnardo.*	Jan'y 15, 1841,	*Naples, Italy.*

R

1448.	RAMSAY, ANDREW C.	Jan'y 17, 1862,	London, England.
1736.	RAND, THEODORE D.	April 18, 1873,	Philadelphia.
1849.	RANDALL, F. A.	Jan'y 18, 1878,	Warren, Pa.
1644.	RAWLINSON, GEORGE.	Oct. 15, 1869,	Oxford, England.
1765.	RAWSON, RAWSON W	Oct. 16, 1874,	London, "
2099.	RAYLEIGH, LORD	May 21, 1886,	Essex, England.
1784.	RAYMOND, ROSSITTER W	April 16, 1875,	New York, N. Y.
1585.	RAYNOLDS, WILLIAM F.	April 19, 1867,	Detroit, Mich.
1591.	READ, JOHN MEREDITH	July 19, 1867.	
2077.	REED, HENRY	May 21, 1886,	Philadelphia.
1842.	REED, THOMAS B	April 20, 1877,	"
1889.	REMSEN, IRA	July 18, 1879,	Baltimore, Md.
1485.	RENAN, ERNEST	Jan'y 16, 1863,	Paris, France.
1948.	RENARD, A	Oct. 21, 1881,	Brussels, Belgium.
1343.	RENARD, CHARLES	Jan'y 20, 1854,	Moscow, Russia.
1890.	RENEVIERS, E	July 18, 1879,	Lausanne, Switzerland.
1816.	REULEAUX, F.	Feb'y 2, 1877,	Berlin, Prussia.
2122.	RÉVILLE, ALBERT	Dec. 17, 1886,	Paris, France.
1500.	RICHARDSON, BEN. WARD	April 17, 1863,	London, England.
1808.	RILEY, CHARLES V	April 21, 1876,	Washington, D. C.
1957.	ROBINS, JAMES M	April 21, 1882,	Philadelphia.
1025.	ROBINSON, MONCURE	Jan'y 18, 1833,	"
1364.	*Rogers, E. P*	April 20, 1855.	
1390.	ROGERS, FAIRMAN.	Jan'y 16, 1857,	Newport, R. I.
2177.	ROGERS, ROBERT W	Feb. 21, 1890,	Carlisle, Pa.
1906.	ROGERS, WILLIAM B., JR	April 16, 1880,	Philadelphia.
1462.	RÖHRIG, F. L. O.	April 18, 1862,	Los Angeles, Cal.
2050.	ROLLETT, HERMANN	Oct. 16, 1885,	Vienna, Austria.
1907.	ROOD, OGDEN N.	April 16, 1880,	New York, N. Y.
1732.	ROSSI, GIOVANNI BATTISTA.	April 18, 1873,	Rome, Italy.
1718.	ROTHERMEL, PETER F.	Jan'y 17, 1873,	Limerick P. O., Pa.
1838.	ROTHROCK, JOSEPH T	April 20, 1877,	Philadelphia.
1264.	RUSCHENBERGER, WM. S. W.	Oct. 19, 1849,	"
1620.	RUTIMEYER, CARL L.	Jan'y 15, 1869,	Basel, Switzerland.
2109.	RYDER, JOHN A	Dec. 17, 1886,	Philadelphia.

S

1766.	SADTLER, SAMUEL PHILIP	Oct. 16, 1874,	Philadelphia.
2148.	SAJOUS, CHARLES E.	Feb'y 17, 1888,	"
2103.	SANCHEZ, JESUS	May 21, 1886,	Mexico, Mexico.
1563.	SANDBERGER, FRIDOLIN	April 20, 1866,	Würtzburg, Bavaria.
1033.	*Santarem, Viscount.*	July 19, 1833,	*Lisbon, Portugal.*
1958.	SARGENT, CHARLES SPRAGUE	April 21, 1882,	Brookline, Mass.
1730.	SAUSSURE, HENRI DE.	April 18, 1873,	Geneva, Switzerland.
1877.	SCHORLEMMER, C.	Oct. 18, 1878,	Manchester, England

Name.	*Date of Election.*	*Present Address.*
1498. Schott, Charles Anthony . . .	April 17, 1863,	Washington, D. C.
1864. Schurz, Carl	Sept. 20, 1878.	
1725. Sclater, Phillip Lutley. . . .	April 18, 1873,	London, England.
1919. Scott, Lewis A.	Oct. 15, 1880,	Philadelphia.
2112. Scott, W. H.	Dec. 17, 1886,	Princeton, N. J.
1870. Scudder, Samuel Hubbard. . .	Sept. 20, 1878,	Cambridge, Mass.
1656. Seidensticker, Oswald	Jan'y 21, 1870,	Philadelphia.
1883. Seiler, Carl	April 18, 1879,	"
1704. Sellers, Coleman	July 19, 1872,	"
1533. Sellers, William.	April 15, 1864,	"
1770. Selwyn, Alfred R. C.	Oct. 16, 1874,	Montreal, Canada.
1333. Sequard, E. Brown.	Jan'y 20, 1851,	Paris, France.
2057. Sergi, Giuseppe.	Oct. 16, 1885,	Rome, Italy.
1965. Sève de Bar, Edouard	July 21, 1882,	Brussels, Belgium.
2076. Sharp, Benjamin.	May 21, 1886,	Philadelphia.
1944. Sharples, Philip Price	Oct. 21, 1881,	West Chester Pa.
1960. Sharples, Stephen Paschall. .	April 21, 1882,	Boston, Mass.
2002. Sharpless, Isaac	Jan'y 18, 1884,	Haverford, Pa.
1514. Sheafer, Peter Wenrich . . .	July 17, 1863,	Pottsville. Pa.
1792. Sheppard, Furman.	Oct. 15. 1875,	Philadelphia.
1797. Sherwood, Andrew	Oct. 15, 1875,	Mansfield, Pa.
1822. Shields, Charles W.	Feb'y 2, 1877,	Princeton, N. J.
1532. *Shinz, Carl*.	April 15, 1864,	*Strasburg, Germany*. (?)
2124. Siméon, Remi	Dec. 17, 1886,	Paris, France.
1414. Smith, Aubrey H..	Jan'y 20, 1860,	Philadelphia.
2146. Smith, Edgar F.	Oct. 21, 1887,	"
1541. Smith, Goldwin.	Jan'y 20, 1865.	
1789. Smith, Stephen	Oct. 15, 1875,	New York, N. Y.
2141. Smyth, Albert H.	May 20, 1887,	Philadelphia.
1742. Snowden, A. Loudon	Oct. 17, 1873,	"
2009. Snyder, Monroe B..	Jan'y 18, 1884,	Philadelphia.
1720. Spofford, A. H..	Jan'y 17, 1873,	Washington, D. C.
1949. Stallo, John B..	Oct. 21, 1881,	Cincinnati, O.
1446. Steenstrup, J. J. S.	Jan'y 17, 1862,	Copenhagen, Denmark.
1990. Stevens, Walter LeConte . . .	Jan'y 18, 1884,	Brooklyn, N. Y.
1840. Stevenson, John James.	April 20, 1877,	New York, N. Y.
2168. Stokes, Sir George G.	Dec. 20. 1889,	London, England.
1167. Storer, D. Humphreys	April 15, 1842,	Boston, Mass.
1834. Strawbridge, George	Feb'y 2, 1877,	Philadelphia.
1559. Strong, William	Jan'y 19, 1866,	Washington, D. C.
1820. Stuart, George.	Feb'y 2, 1877,	Philadelphia.
1527. Studer, Bernard.	April 15, 1864,	Berne, Switzerland.
2093. Stuer, Dionys.	May 21, 1886,	Vienna, Austria.
2094. Suess, Edward	May 21, 1886,	" "
2023. Syle, E. W.	July 18, 1884,	Philadelphia.
1844. Sylvester, J. J..	July 20, 1877,	Oxford, England.
2092. Szombathy, Josef.	May 21, 1886,	Vienna, Austria.

T

1786. Tatham, William P.	April 16, 1875,	Philadelphia.
1846. Taylor, William B.	Oct. 19, 1877,	Washington, D. C.
2098. Temple, Richard Carnac . . .	May 21, 1886,	Upper Burmah, India.
2006. Thomas, Allen C..	Jan'y 18, 1884,	Haverford, Pa.
1807. Thompson, Elihu	April 21, 1876,	Lynn, Mass.
1993. Thompson, Heber S.	Jan'y 18, 1884,	Pottsville, Pa.
1726. Thompson, Henry.	April 18, 1873,	London, England.

Name.	Date of Election.	Present Address.
1755. THOMPSON, ROBERT ELLIS	April 17, 1874,	Philadelphia.
1754. THOMSON, FRANK	April 17, 1874,	Philadelphia.
1723. THOMSON, WILLIAM	April 18, 1873,	London, England.
1909. THOMSON, WILLIAM	April 16, 1880,	Philadelphia.
1530. THURY, A.	April 15, 1864,	Geneva, Switzerland.
1688. TILGHMAN, BENJAMIN C	July 21, 1871,	Philadelphia.
1233. TILGHMAN, RICHARD A	April 16, 1847,	"
1657. TILGHMAN, WILLIAM M.	Jan'y 21, 1870,	"
2176. TIMMINS, SAMUEL	Feb. 21, 1890,	Arley, near Coventry, Eng
2123. TOPINARD, PAUL.	Dec. 17, 1886,	Paris, France.
2065. TOPPAN, ROBERT NOXON.	Feb'y 19, 1886,	Cambridge, Mass.
1597. TOWNSEND, JOSEPH B	Jan'y 17, 1868,	Philadelphia.
1955. TOWNSEND, WASHINGTON	Jan'y 20, 1882,	West Chester, Pa.
1691. TROWBRIDGE, WILLIAM P	Jan'y 19, 1872,	New York, N. Y.
2024. TRUMBULL, HENRY CLAY	July 18, 1884,	Philadelphia.
1973. TSCHERMAK, GUSTAF	Oct. 20, 1882,	Vienna, Austria.
9183. TURRETTINI, THEODORE.	Dec. 19, 1890,	Geneva, Switzerland.
2166. TUTTLE, DAVID K	Oct. 18, 1889,	Philadelphia.
2163. TYLER, LYON G	Oct. 18, 1889,	Williamsburg, Va.
1529. TUNNER, PETER	April 15, 1864,	Leoben, Austria.
1602. TYNDALL, JOHN	April 17, 1868,	London, England.
2138. TYSON, JAMES	May 20, 1887,	Philadelphia.

U

2185. UNWIN, WILLIAM C	Dec. 19, 1890,	London, England.

V

2000. VAUX, RICHARD.	Jan'y 18, 1881,	Philadelphia.
1475. VIRCHOW, RUDOLPH.	Oct. 17, 1862,	Berlin, Prussia.
1646. VOGT, CARL	Oct. 15, 1869,	Geneva, Switzerland
2115. VON MELTZEL, HUGO	Dec. 17, 1886,	Koloszvar, Hungary.
1670. VOSE, GEORGE LEONARD.	Oct. 21, 1870,	Boston, Mass.
2186. VOSSION, LOUIS	Dec. 19, 1890,	Philadelphia.

W

2034. WAGNER, SAMUEL	Jan'y 16, 1885,	Philadelphia.
1748. WAHL, WILLIAM H.	Jan'y 16, 1874,	"
1724. WALLACE, ALFRED R	April 18, 1873,	Croydon, England.
2156. WARD, LESTER F.	May 17, 1889,	Washington, D. C.
2179. WAYLAND, HEMAN L.	May 16, 1890,	Philadelphia.
2033. WEIL, EDWARD HENRY	Jan'y 16, 1885,	"
2117. WEIL, G	Dec. 17, 1886,	Heidelberg, Germany.
2028. WEISBACH, ALBIN	Jan'y 16, 1885,	Freiburg, Saxony.
1975. WESTWOOD, JOHN O	Jan'y 19, 1883,	Oxford, England.
1639. WHARTON, JOSEPH.	April 16, 1869,	Philadelphia.
1637. WHITE, ANDREW D.	April 16, 1869,	Ithaca, N. Y.
1818. WHITE, I. C	Jan'y 18, 1878,	Morgantown, W. Va.
1487. WHITNEY, JOSIAH DWIGHT . . .	Jan'y 16, 1863,	Cambridge, Mass.
1502. WHITNEY, WILLIAM DWIGHT. . .	April 17, 1863,	New Haven, Conn.
1659. WHITTIER, JOHN GREENLEAF . .	Jan'y 21, 1870,	Amesbury, Mass.
1863. WILDER, BURT GREEN	May 3, 1878,	Ithaca, N. Y.
2151. WILLIAMS, TALCOTT	May 18, 1888,	Philadelphia.
2178. WILLIS HENRY.	Feb. 21, 1890,	"
1489. WILSON, DANIEL.	Jan'y 16, 1863,	Toronto, Canada.
2150. WILSON, EDMUND B	Feb'y 17, 1888,	Bryn Mawr, Pa.
2041. WILSON, JAMES C.	Jan'y 16, 1885,	Philadelphia.
1747. WILSON, JOSEPH M.	Jan'y 16, 1874,	"

Name.	*Date of Election.*	*Present Address.*
2137. Wilson, William Powell . . .	May 20, 1887,	Philadelphia.
1545. Winchell, Alexander.	Jan'y 20, 1865,	Ann Arbor, Mich.
1896. Winthrop, Robert C.	Jan'y 16, 1880,	Boston, Mass.
2140. Wireman, Henry D.	May 20, 1887,	Philadelphia.
1561. Wister, Owen Jones	April 20, 1866,	"
1881. Wood, Richard.	April 18, 1879,	"
1762. Woodward, Henry.	July 17, 1874,	London, England.
1751. Wootten, J. E.	Jan'y 16, 1874,	Reading, Pa.
1851. Wormley, Theodore G.	Jan'y 18, 1878,	Philadelphia.
1932. Wurts, Charles Stewart . . .	Jan'y 21, 1881,	Philadelphia.
2061. Wyckoff, A. B.	Feb'y 19, 1886,	U. S. Navy.

Y

1904. Yarnall, Ellis	April 16, 1880,	Philadelphia.
1759. Young, Charles Augustus . . .	April 17, 1874,	Princeton, N. J.

4248.

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXVIII. JANUARY TO JUNE, 1890. No. 132.

TABLE OF CONTENTS.

☞ It is requested that the receipt of this number be acknowledged.

☞ In order to secure prompt attention it is requested that all correspondence be addressed simply "To the Secretaries of the American Philosophical Society, 104 S. Fifth St., Philadelphia."

PUBLISHED FOR THE AMERICAN PHILOSOPHICAL SOCIETY
BY
MACCALLA & COMPANY,
NOS. 237-9 DOCK STREET, PHILADELPHIA.

Extract from the By-Laws.

CHAPTER XII.

OF THE MAGELLANIC FUND.

Section 1. John Hyacinth de Magellan, in London, having in the year 1786 offered to the Society, as a donation, the sum of two hundred guineas, to be by them vested in a secure and permanent fund, to the end that the interest arising therefrom should be annually disposed of in premiums, to be adjudged by them to the author of the best discovery, or most useful invention, relating to Navigation, Astronomy, or Natural Philosophy (mere natural history only excepted); and the Society having accepted of the above donation, they hereby publish the conditions, prescribed by the donor and agreed to by the Society, upon which the said annual premiums will be awarded.

CONDITIONS OF THE MAGELLANIC PREMIUM.

1. The candidate shall send his discovery, invention or improvement, addressed to the President, or one of the Vice-Presidents of the Society, free of postage or other charges; and shall distinguish his performance by some motto, device, or other signature, at his pleasure. Together with his discovery, invention, or improvement, he shall also send a sealed letter containing the same motto, device, or signature, and subscribed with the real name and place of residence of the author.

2. Persons of any nation, sect or denomination whatever, shall be admitted as candidates for this premium.

3. No discovery, invention or improvement shall be entitled to this premium, which hath been already published, or for which the author hath been publicly rewarded elsewhere.

4. The candidate shall communicate his discovery, invention or improvement, either in the English, French, German, or Latin language.

5. All such communications shall be publicly read or exhibited to the Society at some stated meeting, not less than one month previous to the day of adjudication, and shall at all times be open to the inspection of such members as shall desire it. But no member shall carry home with

4248.

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXVIII. APRIL 17, 1890. NO. 133.

TABLE OF CONTENTS.

☞ It is requested that the receipt of this number be acknowledged.

☞ In order to secure prompt attention it is requested that all correspondence be addressed simply "To the Secretaries of the American Philosophical Society, 104 S. Fifth St., Philadelphia."

PUBLISHED FOR THE AMERICAN PHILOSOPHICAL SOCIETY

BY

MACCALLA & COMPANY,

NOS. 237-9 DOCK STREET, PHILADELPHIA.

EXTRACT FROM THE BY-LAWS.

CHAPTER XII.

OF THE MAGELLANIC FUND.

SECTION 1. John Hyacinth de Magellan, in London, having in the year 1786 offered to the Society, as a donation, the sum of two hundred guineas, to be by them vested in a secure and permanent fund, to the end that the interest arising therefrom should be annually disposed of in premiums, to be adjudged by them to the author of the best discovery, or most useful invention, relating to Navigation, Astronomy, or Natural Philosophy (mere natural history only excepted); and the Society having accepted of the above donation, they hereby publish the conditions, prescribed by the donor and agreed to by the Society, upon which the said annual premiums will be awarded.

CONDITIONS OF THE MAGELLANIC PREMIUM.

1. The candidate shall send his discovery, invention or improvement, addressed to the President, or one of the Vice-Presidents of the Society, free of postage or other charges; and shall distinguish his performance by some motto, device, or other signature, at his pleasure. Together with his discovery, invention, or improvement, he shall also send a sealed letter containing the same motto, device, or signature, and subscribed with the real name and place of residence of the author.

2. Persons of any nation, sect or denomination whatever, shall be admitted as candidates for this premium.

3. No discovery, invention or improvement shall be entitled to this premium, which hath been already published, or for which the author hath been publicly rewarded elsewhere.

4. The candidate shall communicate his discovery, invention or improvement, either in the English, French, German, or Latin language.

5. All such communications shall be publicly read or exhibited to the Society at some stated meeting, not less than one month previous to the day of adjudication, and shall at all times be open to the inspection of such members as shall desire it. But no member shall carry home with

4248.

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXVIII. JULY TO DECEMBER, 1890. No. 134.

TABLE OF CONTENTS.

☞ It is requested that the receipt of this number be acknowledged.

☞ In order to secure prompt attention it is requested that all correspondence be addressed simply "To the Secretaries of the American Philosophical Society, 104 S. Fifth St., Philadelphia."

PUBLISHED FOR THE AMERICAN PHILOSOPHICAL SOCIETY

BY

MACCALLA & COMPANY,

NOS. 237–9 DOCK STREET, PHILADELPHIA.

EXTRACT FROM THE BY-LAWS.

CHAPTER XII.

OF THE MAGELLANIC FUND.

SECTION 1. John Hyacinth de Magellan, in London, having in the year 1786 offered to the Society, as a donation, the sum of two hundred guineas, to be by them vested in a secure and permanent fund, to the end that the interest arising therefrom should be annually disposed of in premiums, to be adjudged by them to the author of the best discovery, or most useful invention, relating to Navigation, Astronomy, or Natural Philosophy (mere natural history only excepted): and the Society having accepted of the above donation, they hereby publish the conditions, prescribed by the donor and agreed to by the Society, upon which the said annual premiums will be awarded.

CONDITIONS OF THE MAGELLANIC PREMIUM.

1. The candidate shall send his discovery, invention or improvement, addressed to the President, or one of the Vice-Presidents of the Society, free of postage or other charges; and shall distinguish his performance by some motto, device, or other signature, at his pleasure. Together with his discovery, invention, or improvement, he shall also send a sealed letter containing the same motto, device, or signature, and subscribed with the real name and place of residence of the author.

2. Persons of any nation, sect or denomination whatever, shall be admitted as candidates for this premium.

3. No discovery, invention or improvement shall be entitled to this premium, which hath been already published, or for which the author hath been publicly rewarded elsewhere.

4. The candidate shall communicate his discovery, invention or improvement, either in the English, French, German, or Latin language.

5. All such communications shall be publicly read or exhibited to the Society at some stated meeting, not less than one month previous to the day of adjudication, and shall at all times be open to the inspection of such members as shall desire it. But no member shall carry home with