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CALENDAR, 1883–84.

Tuesday, September 18.	**Current Academic Year Began.**
Monday, June 2.—Friday, June 6.	**Examinations for Matriculation.**
Friday, June 6.	**Term of Instruction Closes.**

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Opened for Instruction in 1876.

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The foundation of the University is a capital, in land and stocks, estimated in value at more than $3,000,000; the capital of the Hospital is not less in amount.

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The Johns Hopkins University Circulars are published at convenient intervals during the academic year for the purpose of communicating intelligence to the various members of the University in respect to work which is here in progress, as well as for the purpose of promulgating official announcements from the governing and teaching bodies. During the current academic year, successive circulars may be expected in the months of November, January, March, April, May, and June, to be followed at the close of the year by an Index.

Although these circulars are designed for the members of the University, they have frequently been called for by institutions and libraries at a distance, and also by individuals who are interested in the literary and scientific activity of this University. Subscriptions and exchanges are therefore received.

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2. As the members of the University rarely require the entire room, the Trustees have taken great pleasure in inviting other persons, not connected with the University, to attend.

3. As these lectures are not intended for popular entertainment, but for the instruction of students, those persons first receive tickets, in most cases, who are known to be especially interested in a particular course,—ladies as well as gentlemen. Preference is thus given according to the character of the course, to teachers in other institutions, public and private; students of medicine, law, etc.; professional men and others. If any tickets remain undistributed, they are given out to those who may have applied for them, in order of application.

4. The hall is full when 200 hearers are present; it is uncomfortable if more are admitted. Not infrequently two or three times that number of persons apply for admission, and often applications for tickets cannot be granted. To give the lectures elsewhere would alter their character as a part of the ordinary academic work of the University.

5. *There is no general course ticket issued.* Applications should state specifically the course for which tickets are desired. Programmes and other current information pertinent to university work may be found in the *University Circulars*, sent to subscribers on the payment of one dollar per annum, either by Messrs. Cushings & Bailey, Messrs. John Murphy & Co., or the University.

The usage of giving personal notification is not likely to be continued, and those therefore who have been accustomed to receiving such announcements, should hereafter consult the *Circulars.*

6. It will save much delay if applications for tickets and inquiries on these and other routine matters are addressed not to individuals but to the JOHNS HOPKINS UNIVERSITY, *by postal card*, and answers will be promptly returned by mail. Personal applications consume time needlessly.

☞The lectures begin at 5 o'clock *punctually.* The doors of the hall are opened at fifteen minutes before 5, and the lectures do not exceed an hour in the delivery.

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II. American Chemical Journal.

This journal was commenced in 1879, with Professor Remsen as editor. Five volumes of about 450 pages each have been issued, and the sixth is in progress. It appears bi-monthly. Subscription $3 per year. Single numbers 50 cts.

III. American Journal of Philology.

The publication of this journal commenced in 1880, under the editorial direction of Professor Gildersleeve. Four volumes of about 570 pages each have been issued, and the fifth is in progress. It appears four times yearly. Subscription $3 per volume. Single numbers $1.00.

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[*Including the Chesapeake Zoological Laboratory.*]

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The following publications are also issued by the University:

The UNIVERSITY CIRCULARS. Subscription $1 per year.

The ANNUAL REPORT presented by the President to the Board of Trustees reviewing the operations of the University during the past academic year.

The ANNUAL REGISTER giving the list of officers and students and stating the regulations of the University. Published at the close of the academic year.

The JOURNAL OF PHYSIOLOGY, edited by Professor Michael Foster, of Cambridge, England, is published with the aid of the Johns Hopkins University. Vol. IV., in progress. $5 per volume.

A volume of CONTRIBUTIONS TO LOGIC by members of this University was issued in 1882, under the editorial direction of Mr. C. S. Peirce. Price $2.00. Little, Brown & Co., Boston, Publishers.

The University Circulars, Annual Report, and Annual Register will be sent by mail for one dollar per annum.

All communications in respect to these publications should be addressed to the "Publication Agency of the Johns Hopkins University," Baltimore, Maryland.

NOTES AND COMMUNICATIONS.

PHILOLOGY.

On the Final Sentence in Greek. By B. L. GILDERSLEEVE.

[Abstract of a paper read before the University Philological Association, February 1, 1884].

This paper, in the form of a review of a treatise by Philipp Weber, has for its theme the development of the final sentence from Homer to Ionic prose. The importance of such investigations as Weber's is shown, and the regret is expressed that certain points known to advanced students of grammar have not been incorporated into our school text-books, such, for instance, as the essentially poetic use of ὡς final in the classic period. Weber's results are considered, corrected, supplemented, and commented on under the heads of Homer, Hesiod and the Homeric hymns, the Lyric poets, the Dramatic poets, and Ionic prose writers. Among the subjects discussed are the constructions of ἕως, the relations of hypotaxis and parataxis, the character of the subjunctive, the shift of moods after past tenses of the indicative, the construction of verbs of fear. The character of the paper precludes an adequate presentation of the results in any concise form. In conclusion, the reviewer says: "The final sentence is now, for the first time, presented in its chronological data. One may rebel against calling such work historical syntax, because we have really nothing more than a classification of occurrences, and it is taken for granted throughout, and sometimes, as has been indicated, without reason, that each author represents fully the thesaurus of his time. The personal equation is the great difficulty, and cannot be solved without a theory of the totality of syntactical phenomena in each author. Still such chronological statistics, such records of the behavior of certain particles in certain authors, in certain departments, in certain periods, are of great importance. Without them, a history of Greek syntax is impossible. Without them, a scientific theory of syntactical style is impossible. Without them, it is impossible to understand the course of later Greek, which, after all, has an organic life, though that organic life is of such complexity that even when the mastery of classic syntax is attained, generations of students will find work enough to do in exploring its processes and its diseases.

"As soon as the second part of Dr. Weber's treatise reaches us, another study will be consecrated to the subject. Only, as has been said before, the Attic final sentence does not present the same difficulties as the early forms, although we shall have to encounter the troublesome question of the use of ὅπως with subjunctive and future.

"In conclusion, a serious gap must be noted in Weber's treatment of the final sentence—the omission of the relative form. While he admits that ὅπως is a relative, he is satisfied with giving Nägelsbach's six forms of the final relative in Homer (p. 64), without any comment except that the ὅπως form corresponding to ὅς κεν εἴποι is represented only in one passage (I 680), and that the form corresponding to ὅς κεν ἐρεῖ is doubtful (P 144). The study of the moods of the relative ought genetically to have preceded the study of this form of the final sentence.

"Yet another form of the final sentence, the future participle, and the important outgrowth ὡς with the future participle, should not have been omitted. The latter construction is one of the most interesting in Greek, and should not be relegated altogether to the domain of *oratio obliqua*, though *oratio obliqua* is the only ultimate explanation of it." (*Published in the American Journal of Philology, Vol. IV, No. 4*).

Analogy and Uniformity. By M. W. EASTON, of the University of Pennsylvania.

[Abstract of a paper read at the meeting of the University Philological Association, March 7, 1884].

The results of much of the best recent work in etymology hold good only on the basis that the phonetic laws of any one dialect admit of no exceptions. A good statement of this position was given by Brugmann, some time ago (KZ vol. xxiv), together with certain recognized limitations; particularly the recognition of the possible co-existence, for a brief period of time, of younger and older forms. This limitation is not however observed in practice, and even Brugmann himself, in the article quoted, deems it necessary to resort to the hypothesis of borrowing, or of analogical formation, to explain the co-existence of a number of forms fairly to be classed under this head. This is particularly the case in the usual treatment of forms subject to ablaut, as πατέρος and πατρός, intervocalic sigma, etc.

The principle is new; for two dialects have been generally defined as characterized simply by a different aggregate of prevailing peculiarities, rather than by single particulars carried through the whole framework of each.

Two dialects differ from each other, not merely in their phonetic systems, but still more in the different organization of their meanings, including the different distribution of the functions of their systems of flexion. Such differences of meaning must however have had their start in the period before the divergence from the common mother tongue, and could not have originated had there been a precise, fixed correspondence between vocal symbol and thought. And, in fact, the results of the study of proethnic syntax have failed in detecting such a condition of primitive perfection; rather, we should contemplate, in language, as in other things, a gradual approach to precision and fixed subordination of function. Furthermore, changes of meaning can be conceived only as starting (each) from one individual and propagating themselves by a kind of wave action to the other members of the community. But there is no reason to suppose that, in all cases of alteration, the whole vocabulary of every individual will be affected. Probably this method of change in meaning will find a close parallel in changes of form.

The tendency to precision in etymologizing is a laudable, and has proved a fruitful, tendency, but should not assume absolute uniformity in phonetic change. The recorded forms of the Indo-European languages directly oppose such an assumption. Exceptions are indeed explained away by assuming mixture of dialects, and still more frequently by appealing to analogy. No doubt the action of analogy is quite competent to remould a language to any extent, perhaps no word in the whole united vocabulary of the Indo-European tongues has altogether escaped it. But the appeal to analogy is so largely subjective, and so difficult to subject to fixed law, that it can be resorted to to this extent only, when exceptions to well established, probable law are to be disposed of, and even then is often merely of the nature of *hypothesis.* Absolute uniformity of phonetic processes, *e. g.*, that πατέρος and πατρός could not have existed side by side, the former being a remnant of a primitive formation, is not such a well-established law; nor is it a probable law.

We may note here that, if analogy is competent to produce in the later language, and to maintain in use, double forms, it is competent to have maintained them from the first, side by side. But the advocates of uniformity reason as though analogy were, as a disturbing force, quiescent during certain periods of the history of a speech.

Now no sufficient explanation of the mechanism, or of a mechanism, by which uniformity throughout a community, or even in the whole vocabulary of single individuals has ever been brought forward. Such a condition of things could be produced only in virtue of a profound alteration of the physiological alphabet, perhaps affecting the whole community at once. This has been clearly seen and clearly defined by Brugmann. But this required condition is mysterious and incomprehensible. The chief altering force known and understood, is the tendency to economize muscular action, and this is intermittent; as a very brief examination of the frequent variation in the pronunciation of our own language soon shows.

Uniformity throughout the community, in any degree, is attained, as is well known, by imitation, the new forms spreading from one person to another, and, even here, mainly due to economy, which acts in general to drive out one of two or more synonymous discordant forms. But this process is never complete; that is, the organization of a language is loose. The process is well illustrated by the history of the diffusion of new forms due to analogy; these two are diffused in the same manner, and show, as is universally confessed, the same incompleteness of diffusion. The action of economy is never thoroughgoing. Rhetorical needs, also, check it in modern languages, to a very great extent.

Double forms, due to analogy, are indeed, for various reasons, so much more numerous than those due to ordinary phonetic divergence, as to convey the impression of existing in virtue of some special exceptional law.

The principle referring the inception of phonetic change to alterations in the physiological alphabet, separates too widely such cases as might possibly fall under it, namely, where sounds entirely disappear from a language, or suffer, in all words, some alteration in mouth position, from all the other, (much more numerous) phonetic differences between cognate dialects, *e. g.*, the changes under Grimm's Law, where a proethnic *t* becomes *d*, in certain English words, although *t* still remains in the language. Compare also the laws of finals.

Nor does the simple theory of economy of muscular action fully explain such cases, as is very well known. Perhaps most purely phonetic change may also be referred to the analogy of other words in the language, already containing the new combinations of sounds; thus the inorganic ϑ in ἄνϑρωπος may be simply the result of the reminiscence of organic-νϑρ-elsewhere. From this point of view, the inception of new phonetic law may seem a little less mysterious, and additional theoretical reasons found, in virtue of which we may assume it to be probable that complete uniformity will not be attained; all analogy action is confessedly irregular.

If, however, it be once admitted that a language may present inconsistent phonetic phenomena, it follows that the reconstruction of mother tongues, and particularly of intermediate mother tongues (general Germanic, general Low German, &c.) is a very uncertain process, because a phonetic law of very limited range may extend itself and become the prevailing law in a group of derived cognate tongues. And, conversely, the deduction of a special form from one existing or hypothetical parent form, with irregularities attributable only to later borrowing, analogy, etc. is correspondingly liable to error. This is true of the relation of the Indo-European family of languages to the primitive tongue.

On the Probability of the Existence of Phonetic Law. By M. Bloomfield.

[Abstract of a paper read at a meeting of the University Philological Association, March 7, 1884].

The belief in the existence of inviolable phonetic law which according to the extremest view acts like a law of nature cannot at present be freed from the charge of dogmatism (cf. Whitney, Proc. Am. Phil. Ass., 1882, p. xviii; Fr. Müller, Techmer's Zeitschrift für Sprachwissenschaft, I, p. 213). Phonetic action, whatever its cause may be, is crossed by analogy, another powerful factor in linguistic change, which certainly does not act with sufficient regularity to enable us to point out its exact extent, to eliminate it from our count, and to leave a clean balance of phonetic action. It is only by a sense of linguistic taste or tact, qualities confessedly subjective, that the doings of analogy can be scanned; there is nothing inductive about this. Every accepted explanation through analogy is accepted only in so far as the prevailing opinion of the best grammarians holds that the deviation from the path of phonetic law has been thus and thus and not some other way. Moreover the words 'inviolable' or 'infallible' in matters of grammar are always to be deprecated, because the conscious will of the language user certainly stands above phonetic facts. We ought rather to speak of the regularity of phonetic courses, which are never left without some positive causes for deviation.

Though the doctrine of phonetic law even in this modified form is a dogma which will never be proved inductively, it can nevertheless be invested with a satisfactory degree of probability. The following are the arguments:

1. No other known theory succeeds in any way in satisfactorily explaining the origin of regular phonetic change on a large scale. There is no point in Whitney's discussions of language which provides satisfactorily for this phenomenon. In two passages of his 'Language and the study of Language' (pp. 95 and 152) he confesses himself unable to account clearly for the most prominent phonetic peculiarities of individual languages, and whatever suggestion these passages do contain is in accord with the theory of phonetic law. Prof. Easton's suggestion (*see above*) that 'perhaps most purely phonetic change may also be referred to the analogy of other words in the language, already containing the new combinations of sounds' ignores the fact that certain changes and developments of sounds must be phonetic and not analogical because they are of frequent or universal occurrence in widely different languages; furthermore, the regularity of certain phonetic facts (as *e. g.* Grimm's law when supplemented by Verner's) is in no way disposed of by this assumption. Neither are we likely to be satisfied by Frdr. Müller's parallel between phonetic law and fashion (loc. cit.)

2. Our judgment as to the intrinsic probability of the theory depends upon the extent and the character of the ground which it would cover in the case of its general acceptance. If it be framed to cover a few cases of small scope it falls from its own weakness. If on the other hand it accounts for just those parts of the language-body and language-history which are most scrutable and exposed, and if these form a sufficiently respectable share of the entire mass of the language facts this hypothesis like all others thereby itself becomes a probability. Two facts which show the latter to be true must be borne in mind here. First, there is no language which can be studied historically or comparatively that does not exhibit phonetic facts of sufficiently wide scope to allow us to apply to them the term phonetic law. Secondly, the more incisive the study of any group of languages becomes, the larger grows the number of phonetic laws. On the other hand, it would be impossible to exhibit any language where the phonetic changes either within its own special history or when compared with its kin are exclusively sporadic or arbitrary. Yet nothing would be more natural than just this state of things, providing that nothing but the semi-conscious whim of the individual, aided by his linguistic pet-vice of laziness, originally lay at the bottom of every phonetic change.

3. In the manner in which the principle of phonetic law has accomplished work lies the strongest proof of its reality and its surest hold upon linguistic science. It is obviously beyond the scope of an abstract to point this out, as it would involve a short history of Indo-European, and to some extent Shemitic, grammar within the last few years. It is not too much to say that if the doctrine of the inviolableness of phonetic law should ultimately turn out to be false that this fact would not detract very much from its methodological value; there it has approved itself by its fruits.

The Nahuatl-Spanish Dialect of Nicaragua. By A. M. Elliott.

[Abstract of a paper read at a meeting of the University Philological Association, March 7, 1884].

The text on which this investigation is based constitutes No. III in the series of Dr. D. G. Brinton's "Library of Aboriginal American Literature" and is published under the title of "The Güegüence, a Comedy Ballet in the Nahuatl-Spanish Dialect of Nicaragua." It is printed from a collation of two MSS. made by Dr. Berendt in 1874, no part of which has ever before been translated. Both the age and authorship are unknown. With reference to the former the able editor thinks we may assign the early portion of the eighteenth century as the latest date for its composition, and there is some evidence that a more remote period is not improbable.

The language represents a *mischdialekt* composed of Nahuatl and Spanish elements, the latter bearing the stamp of the home idiom when it was brought into contact with the aboriginal tongue at the beginning of the sixteenth century, through the conquest of Mexico by the Spaniards. The formal conquest of Nicaragua took place in 1522, when it was attached to the Captain Generalcy (*Audiencia*) of Guatamala, under which rule it remained till the outbreak of the revolution in 1821, thus making three hundred years of steady, uninterrupted Spanish dominion. The Europeans found in Central America the same extraordinary idiom, the Aztec, Nahuatl, or Mexican, which they had learned to know on the vast plain of Anáhuac. This was a language not only of wonderful copiousness and flexibility, but also an extremely polysynthetic speech in which the process of agglutination has the greatest sweep. The linguistic tendencies were thus directly opposed here to the strong analytic development of the Neo-Latin language with which the native idiom was brought into contact by the conquest of Mexico.

In sifting the material of this compound product, the resultant of a mixture of two contrary lines of language growth, we must take as our basis the classical Spanish of the time of Cervantes, born just a quarter of a century after the occupation of Nicaragua, with its now obsolete grammar forms and antiquated constructions, and to this add the varying dialect influences which must have been brought to bear on the new product by the common speech of the Spanish soldiers.

If we begin with the vowel system, we find the most common differences that separate the Nahuatl from the classic Spanish and bind it with the old and dialect form of the same, to be: $e = i$, $o = e$, $o = a$. For example, *Velancicos* (*Sp. villancicos*), *seno*, (*Sp. sin*) where the *i*, both tonic and atonic, has been strengthened and raised a point in the scale of phonic production. This is a special trait of the Old and Folk's language in Spain. The same tendency to raise the weak vowels we find illustrated in the Old Latin by the vacillation between *e* and *i* in such forms as *tempestatebus*, *mereto* compared with the classic *tempestatibus*, *merito*. In the Spanish Folk speech it was the *e*-form that was kept, and especially at this period of the language pretonic *i* was constantly represented by *e*, as in *Cecilia* (for *Cicilia*), *dejiste* (for *dijiste*), etc. Again, the more common raising of the vowel power from *e* to *a* is in accordance with the usual Spanish dialect influence *e. g.* *Amilio Castalar* (for *Emilio Castelar*), *Ajercito* (for *Ejercito*), used by the Folk in Castile, and is especially marked in the moulding of Nahuatl forms to suit the requirements of Spanish flexion or to satisfy the demands of Spanish euphony.

In *seno* = O. Sp. *sines*, *senes*, we have *e* = *o* just as in the modern *obispo* (*Episcopus*) or the Old Spanish *romanecer* (Mod. Sp. *remanecer*).

For the consonantal system we find, for the most part, certain classes only affected, namely, the gutturals and sibilants. In the first title itself of the *Baile* we have the aspirated Nahuatl *h* of *huehue*, "old man," passing regularly into the medial guttural, similar to the transference of the Gothic *h* from Teutonic to certain parts of the Romance soil. The lowering of the vowel *u* to *ü*, together with this gutturalization of initial *h*, is a mode of dealing with the initial *hu* that is found in various districts of the Spanish peninsula, but it is especially the Asturian who always says *güertu*, *güeso* for Castilian *huerto*, *hueso*, etc.

In the Cuban dialect there is no difference in the pronunciation of the graphic signs *c*, *z*, *s*, all of them being the simple sibilant *s*. So, too, *x* and *s* interchange in the Nahuatl-Spanish *e. g.* *Silguerio* (for Span. *Xilguero*). This *x* at the time of the conquest of Mexico was = English *sh* or Arabic ش, and hence its origin as the notation of an unknown quantity. Arabic شيء (šai) "thing" (= Italian *Cosa*), used for this purpose, was reduced to simple ش = *x*.*

In its morphology the Nahuatl-Spanish separates itself more clearly from the modern language than in its phonology. The Mexican has had little influence here so far as the individual word is concerned. In the nomen-series old Spanish forms with special dialect influence are the chief factors that constitute the difference between the new mixture and the Castilian of to-day.

But it is especially in the verb that we note the most striking characteristics both of a stage of language older than the present Castilian and of the extensive play of dialect power.

The most interesting peculiarity of the verb formation is seen in the future tense, which is built up almost exclusively in the regular periphrastic manner of the Romance languages, save that the component elements are not welded together, that is, the auxiliary is kept distinct from the infinitive by the relational *de*, so that we have *ha de hablar*, *ha de ser*, etc. It is thus we have the special idiomatic futures that represent "duty, intention, design, possible possession," passing over sometimes into a state of verbal action which does not bear these special significations. There are only a very few infinitival types in this whole play where the parts are bound together into a single whole, and these simply serve to denote indefinite future conditions without any limitations whatever.

In the new word-building of this dialect we find the same modes of procedure which come up in the adaptation of Teutonic roots to Romance uses. But with all the changes of both phonology and morphology we do not have the dialect character of the "Güegüence" so well established as in its syntax. It is here especially that we find the extended influence in certain cases of the native idiom and again witness more directly than any where else the strong drift towards a strictly agglutinated form of language in which all flexion has disappeared and where nothing but the context serves us in trying to discover the thought of the writer.

This paper will be found in full in the forthcoming number of the *American Journal of Philology*.

* Cf. Paul de Lagarde: Woher stammt das *x* der mathemateker? Gött. gel. Anz., 1882, No. 13. Prof. Paul Haupt was so kind as to call my attention specially to this article.

On the Angelology of Hermas. By J. RENDEL HARRIS.

There is a passage in the Shepherd of Hermas, Vis. iv, 2, 4, which has occasioned a great deal of perplexity to the commentators. Hermas is met by a fierce beast with a parti-colored head, which beast symbolizes an impending persecution or tribulation, and makes as though it would devour him. But the Lord sends his angel who is over the wild beasts, whose name is Thegri, and shuts the mouth of the creature, that it may not hurt him. *θεγρί* according to Gebhardt and Harnack is 'nomen inauditum'; it appears in the Vulgate Latin as *Hegrin*, and in the Palatine version as *Tegri*. The Ethiopic translation has Têgêri. Jerome seems to have read *Tyri* since in his comments on Habac., 1, 14, we have "ex quo liber ille apocryphus stultitiæ condemnandus est, in quo scriptum est quemdam angelum nomine Tyri præesse reptilibus." Much ingenuity has been expended over the origin of the word and in particular the following is the solution of Franciscus Delitzsch, as given in Gebhardt and Harnack's edition: "Si sumi possit, Hermam nomen angeli illius ex angelologia Iudaica hausisse, quæ angelos maris, pluviæ, grandinis, etc., finxit iisque nomina commentitia indidit, *θεγρί* idem est quod תִּגְרִי(תַּגְרִי) *instimulator*, h. e. angelus, qui bestias (contra homines) instimulat atque, si velit, etiam domat (Taggar = dissidium, discordia; cum î = Tigrî, quod bene transcripsit H.: *ϑεγρί*), etc."

I assent to the Hebrew origin of the name, but am unwilling to explain a 'nomen inauditum' by a 'nomen vix auditum.' A more simple solution suggests itself; if for *θ* we write *σ*, according to the confusion common in uncial script, we have *Σεγρί* for the name of the angel; which immediately suggests the root סָגַר, to close. The angel is the one that *closes* or *shuts*. This is immediately confirmed by the language of Hermas, *ὁ κύριος ἀπέστειλεν τὸν ἄγγελον αὐτοῦ τὸν ἐπὶ τῶν θηρίων ὄντα, οὗ τὸ ὄνομά ἐστιν θεγρί, καὶ ἐνέφραξεν τὸ στόμα αὐτοῦ ἵνα μή σε λυμάνῃ.*

If any doubt remained as to the correctness of this solution it would be swept away by reading the passage in Hermas side by side with the LXX of Dan., vi, 23: *ὁ θεός μου ἀπέστειλεν τὸν ἄγγελον αὐτοῦ καὶ ἐνέφραξεν* (וּסֲגַר) *τὰ στόματα τῶν λεόντων καὶ οὐκ ἐλυμήναντό με.*

The curious parallelism of the language employed in the two passages is decisive as to the etymology, and further we may be sure that the language of Hermas is an indirect quotation from the book of Daniel.

The result arrived at is an important one in many respects, and has a possible bearing upon the genealogy of the MSS. and versions of Hermas; so far as we are concerned we may simply say that those copies and versions which read *θεγρί* or any variation of the same bear conclusive marks of a Greek original. It might seem unnecessary to make such a remark, but the fact is that grave suspicions have been thrown out in some quarters as to the character of the original text of Hermas. Upon further consideration I am inclined indeed to conclude that all the versions came from an original copy which read *θεγρί*, for even the Vulgate Latin which has *Hegrin* seems to have arrived at it by dropping the reduplicated T in the words NOMEN ESTTHEGRI. There is however, another way in which the Latin variant might be explained; for, as Dr. Haupt points out to me, we have a similar transformation in the Hebrew סְפַרְוַיִם (2 Kings, xviii, 34), which appears in Berosus as *Σίσπαρα*, in Ptolemy v. 18 *Σίπφαρα*, but in Pliny vi. 123 as *Hipparenum*.

Historical sketch of Syriac Literature and Culture. By A. L. FROTHINGHAM, JR.

[Abstract of two papers read before the Society for the study of Shemitic Philology. January 13 and February 28].

The Syriac language is of especial importance from the position which it took at the time of two great religious revolutions: the conversion of the East to Christianity and the rise of Mohammedanism. In the first case it became the sacred language of the converted Eastern peoples, and in the second it was the means of communicating Greek culture to the Arabs.

During the early period of Christianity Syriac came into general use among the converts of Armenia, Persia, Arabia, and was even propagated by colonies to Hindustan and China. This universal use was facilitated by the fact that versions into Syriac of nearly all the works of the Greek Fathers were made at early dates: in fact many of their important writings have been preserved only in Syriac, *e. g.* Melito, Ambrose, Hippolytus, Theophania and Martyrs of Palestine of Eusebius, Festal Letters of Athanasius, &c.

The earliest work of importance is the version of the Bible called *Peshitta*, probably made at the beginning of the second century. Bardesanes and his son Harmonius, and Tatian the Assyrian are important writers of this century, and in the following, Mani wrote mostly in Syriac, as we know from many Eastern and Western authorities.

The fourth century was the golden age of the literature, when the language obtained a settled standard of taste, especially under the influence of the numerous writings of Ephraem.

An impulse to literature and learning was given by the Nestorian controversy in the fifth century which heresy was so vigorously supported by the famous "School of the Persians" at Edessa, that it was closed by orders of the Emperor Zeno (489) and its professors transferred their *penates* to Nisibis and Seleucia in the Persian Empire.

Connected with Nestorianism was the influence that Greek learning began to acquire over Syria, which led to the close study of the best writings of antiquity, favored by the leaders of the schools or universities. These universities had a great influence, not yet sufficiently appreciated, on the tendencies of the age; they were numerous and existed not only in the cities but attached to the principal monasteries. Their privileges were great and they were generally quite independent. The most noted were those of Edessa, of Nisibis for theology, and of Gandisapur for medicine: the great majority provided for a general liberal education. It is recorded that the students at Nisibis under Hanan (sixth century) numbered fully 800.

The sixth century was a period of great literary activity: the most prominent writers were James of Sarug and Philoxenus of Hierapolis, both belonging to the Monophysite sect. Now, for the first time, was attention given to the writing of history. Material was at hand in the precious archives of Edessa which existed from the beginning of the Christian era: some use was made of the documents there preserved by the anonymous Chronicle of Edessa (c. 540). The histories of Zacharias Rhetor and John of Asia are of value, especially for Eastern history.

An abrupt change was brought about by the Mohammedan invasion, which, although it by no means put an end to the literary activity of Syria, yet strongly influenced its development by the gradual extinction of the Syriac language among the people. The influence of Arabic began to be felt almost immediately after the conquest, although, of course, first in administrative and commercial centres.

In order to guarantee the purity of Syriac, the school of purists founded by Jacob of Edessa (710) found it necessary to establish a standard of taste and to express by written signs the mechanism of vowel pronunciation, until then left unexpressed. This movement was accompanied by an increase of Greek influence; and the combination of this with the gradual inroads of Arabic soon marred the idiomatic beauties of the language.

The Syrians had already become divided into two great camps, the Nestorian and the Monophysite or Jacobite, and each had its great centres of education and special literature. The influence of the Nestorians was greater, especially with the Arabs.

At this time many schools are founded by Syrians at Bagdad, and to these the Arabs flocked to learn the wisdom of the Greeks. From the eighth to the tenth century the Christian Syrians are the acknowledged masters of the Arabs: many like Honain, Isaac, John bar Mesue, &c., obtain fame by translating the Greek standard works on philosophy, medicine, mathematics, astronomy, geography, mechanics, &c. The Khalifs of the dynasty of the Abbassidae gloried in their munificent patronage of Syrian learning: the royal physician was invariably a Syrian, also the royal treasurer and other officers, and even governors of cities and provinces.

While Syriac literature declined in taste it acquired more scientific tendencies. Philosophy became one of the principal studies: that of Aristotle was mainly followed and many commentaries were made of his writings. Grammar and lexicography also began to receive considerable attention, and at first Greek and later Arabic models were followed. Historical studies also assumed more importance: Jacob of Edessa, Dionysius of Tellmahre (c. 775), Thomas of Marga (IX), Michael the Great (1090), and Gregory Bar'ebraia (XIII), form a long chain of writers on history who are recognized as of standard value.

Since the tenth century Syriac learning had fallen very low: in the thirteenth the Patriarch Bar'ebraia made an attempt to restore life to it, but even his scholarly genius, though embracing all branches of learning, did not succeed.

T. L. Beddoes, a Survival in Style. By Henry Wood.

[Abstract of a paper read at a meeting of the University Philological Association, November 2, 1883].

The man and his writings are so nearly forgotten, and copies of his works so scarce, that the article gives a few particulars of his life as an introduction. These serve also to explain in part the fact that Beddoes' writings, in spite of the laudatory reviews which even the earliest of them forced from every critic who took the trouble to read them, never really impressed his own age, and have been regarded as lying outside the range of English dramatic literature, the productions of "a strayed singer." The article is not further concerned with the faultiness of this traditional literary estimate of Beddoes, which sufficiently appears in the course of the investigation. Its object is to show that the style of Beddoes' writings (aside from certain peculiarities) is in the national and historical sense thoroughly English: a remarkable example of the survival of the main characteristics of such a style, in undiminished vigor, in the nineteenth century. For convenience of comparison, the Anglo-Saxon epic poetry and Shakspeare are taken as representing the two most important periods, and the similarity of Beddoes' style is shown in detail. The question of constructive power, or of the general canons of style is not entered upon, the comparison being mainly one of figures of speech. It is not assumed that Beddoes completely represents his own age. But on the other hand, his own letters and the character of his works prove him to be no imitator nor Shakspeare reviver, his vocabulary and constructions are thoroughly modern, and he profoundly admires three modern poets, Shelley, Wordsworth, and Keats. The comparison of Beddoes' style, or of any strong English style, with the intensely subjective Anglo-Saxon epic-lyric style has its difficulties, but it is plain that the prime characteristics of the A. S. metaphor recur in a marked degree in Shakspeare's and Beddoes' use of that figure, while the two latter agree surprisingly in their handling of the simile, which the A. S. scarcely used. An extended list of epithets, or kennings, is given from Beddoes, and with them are compared similar ones from Shakspeare, the A. S. Genesis, Exodus, Béowulf, and from Old Norse. A very close coincidence is revealed, and in many instances both Shakspeare and Beddoes are found to be as Anglo-Saxon as are the Anglo-Saxons themselves, in regard to the nature and scope of their epithets.

The article of which the foregoing is an abstract is published in full in the *American Journal of Philology*, Vol. 4, No. 16.

The concluding part, treating of fully expressed metaphors, similes, etc., will appear in Vol. 5, No. 18.

MATHEMATICS.

A Note on Partitions. By G. S. Ely.

[Abstract of a paper read at a meeting of the University Mathematical Society, March 19, 1884].

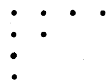
From the partitions of any number, n, can be formed the partitions of $n+1$, by the addition of a unit to each of the parts of each of the partitions of n, which is less than the previous part. Thus, for example, from the partition of 10, . . . 5, 2, 2, 1, can be generated the following partitions of 11—

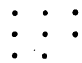
6, 2, 2, 1; 5, 3, 2, 1; 5, 2, 2, 2; 5, 2, 2, 1, 1.

Then it is evident that any partition of n, will, in this way, generate as many partitions of $n+1$, as there are parts of different values in the given partition of n, plus one: and that any given partition of $n+1$, will be generated from the partitions of n, as many times as there are parts of different values in the given partition of $n+1$. It is furthermore evident that if two partitions of n are conjugate, the partitions of $n+1$, which are generated from them, will be conjugate.

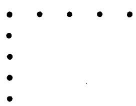
If the total number of partitions of n be of parity opposite to the total number of partitions of $n+1$, then there has been a gain in the number of self-conjugate partitions of $n+1$, over that of n, provided that n is greater than one. Passing from 1 to 2 there is evidently a loss in the number of s. c. p. (= self-conjugate partitions). But in any other case than $n=1$, let us consider a s. c. p. of n. The point at the end of the principal diagonal and the points immediately adjacent to it must have one of the two forms:

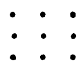
where the dotted line is the principal diagonal. In the first case we can place an extra point at the end of the diagonal and thus generate a s. c. p. of $n+1$. In the second case we may place an extra point at the end of the first line and remove the point from the end of the diagonal and place it at the bottom of the first column: and thus generate a s. c. p. of $n+1$. Thus it is evident that every s. c. p. of n may be used to generate a s. c. p. of $n+1$, and from the manner of generation it is evident that different s. c. p.'s of n will generate different s. c. p.'s of $n+1$. Thus the two s. c. p.'s of 8 are





which generate the s. c. p.'s of 9,





Therefore the number of s. c. p.'s of $n+1$ cannot be less than the number of s. c. p.'s of n $(n>1)$. Therefore when the parity of the whole number of partitions changes in passing from n to $n+1$, there is a gain in the number of s. c. p.'s $(n>1)$. And in such a case the gain must be a gain of an odd number of s. c. p.'s. It is of course possible that there should be a gain in the number of s. c. p.'s in passing from n to $n+1$ where the parity does not change, but such a gain must be a gain of an even number of s. c. p.'s. For example, in passing from 23 to 24 the parity does not change, but there is a gain of two s. c. p.'s, *i. e.*, from 9 to 11.

If we examine Euler's table we see that the parity of the whole number of partitions changes in passing from 2 to 3, from 7 to 8, from 11 to 12, from 14 to 15, from 16 to 17, from 18 to 19, from 19 to 20, etc. Hence as 2 has no s. c. p., the numbers from 3 to 7 inclusive must have at least one s. c. p. each; from 8 to 11 at least two each; from 12 to 14 at least three each; 15 and 16 at least four each; 17 and 18 at least five each; 19 at least six and 20 at least seven. Constructing the s. c. p.'s by the method which Dr. Durfee has given we find that 20 has just seven s. c. p.'s. Hence the numbers from 2 to 20 have just the number of s. c. p.'s which has been given.

Unicursal Curves of Degree $n+1$ in n-flat Space. By G. BISSING.

[Abstract of a paper read at a meeting of the University Mathematical Society, March 19, 1884].

The relation connecting the parameters of the points of intersection of a plane unicursal cubic and a right line is known. Taking then, by analogy, the unicursal curve of degree $n+1$ in n-flat space,

$$\theta x_j = a_{j,1}u^{n+1} + a_{j,2}u^{n+2} + \dots a_{j,n+2} \quad (j=1,2\dots n+1),$$

we wish to find the k conditions that $n+2-k$ of its points, say $u_1, u_2 \dots u_{n+2-k}$, should lie in an $n-k$ flat; $(k=1,2\dots n)$.

I define $A_1, A_2 \dots A_{n+2}$ as the determinants of order $n+1$ obtained by omitting respectively the first, second ... $n+2$d column from the matrix of the coefficient of the above system of $n+1$ equations, and $(u_j)_l$ as the sums of the homogeneous products of $u_1, u_2 \dots u_j \dots u_l$ taken j at a time. The k conditions are then

$$A_1 + A_2(u_1)_{n+2-k} + A_3(u_2)_{n+2-k} + \dots A_{n+3-k}(u_{n+2-k})_{n+2-k} = 0,$$
$$A_2 + A_3(u_1)_{n+2-k} + A_4(u_2)_{n+2-k} + \dots A_{n+4-k}(u_{n+2-k})_{n+2-k} = 0,$$
$$\dots\dots\dots\dots\dots\dots$$
$$A_k + A_{k+1}(u_1)_{n+2-k} + \quad \dots\dots \quad A_{n+2}(u_{n+2-k})_{n+2-k} = 0.$$

To prove this for $k=1$, take as the equation of the $n-1$ flat,

$$l_1x_1 + l_2x_2 + \dots l_{n+1}x_{n+1} = 0.$$

Substituting herein for the x's their values in terms of u, we get

$$u_{n+1}\sum_1^{n+1} l_ja_{j,1} + u_n\sum_1^{n+1} l_ja_{j,2} + \dots \sum_1^{n+1} l_ja_{j,n+2} = 0.$$

From this we obtain at once by definition of $(a_j)_l$,

$$(u_1)_{n+1} = -\frac{\Sigma l_ja_{j,2}}{\Sigma l_ja_{j,1}},$$
$$(u_2)_{n+1} = \frac{\Sigma l_ja_{j,3}}{\Sigma l_ja_{j,1}},$$
$$\dots\dots\dots$$
$$(u_{n+1})_{n+1} = (-)^{n+1}\frac{\Sigma l_ja_{j,n+2}}{\Sigma l_ja_{j,1}}.$$

Now it is evident that we shall obtain the desired relation between the u's by eliminating the l's from this system of equations. The equations being linear in the l's the eliminant is a determinant which, upon interchanging rows and columns, may be written

$$\begin{vmatrix} a_{12}+a_{11}(u_1) & a_{31}-a_{11}(u_2) & \dots & a_{1,n+2}\pm a_{11}(u_{n+1}) \\ a_{22}+a_{21}(u_1) & a_{32}-a_{21}(u_2) & \dots & a_{2,n+2}\pm a_{21}(u_{n+1}) \\ a_{32}+a_{31}(u_1) & a_{33}-a_{31}(u_2) & \dots & a_{3,n+2}\pm a_{31}(u_{n+1}) \\ \dots & \dots & \dots & \dots \\ & (n+1) \text{ rows} & & \end{vmatrix} = 0,$$

where the bracketed u's are to have the suffix $n+1$ attached. This determinant, however, evidently reduces to

$$A_1 + A_2(u_1)_{n+1} + A_3(u_2)_{n+1} + \dots A_{n+2}(u_{n+1})_{n+1} = 0,$$

which is then the relation connecting the parameters of any $n+1$ points which lie in an $n-1$ flat.

Solving this equation for u_{n+1} we get

$$-[A_2 + A_3(u_1)_n + A_4(u_2)_n + \dots A_{n+2}(u_n)_n]u_{n+1} =$$
$$A_1 + A_2(u_1)_n + A_3(u_2)_n + \dots A_{n+1}(u_n)_n.$$

Now, in general, n points determine an $n-1$ flat, and therefore for a definite system of values of $u_1, u_2 \dots u_n$ we get a definite value of u_{n+1}. If, however, these n points lie in an $n-1$ flat, there are an infinity of $n-1$ flats passing through them which therefore cut the curve in an infinity of points, and we can have no definite value of u_{n+1}. The two conditions that the n points $u_1, u_2 \dots u_n$ should lie in an $n-1$ flat are, therefore,

$$A_1 + A_2(u_1)_n + \dots A_{n+1}(u_n)_n = 0,$$
$$A_2 + A_3(u_1)_n + \dots A_{n+2}(u_n)_n = 0.$$

And so on in general.

I add that Mr. E. Weyr has obtained these relations for the case $n=3$.

HISTORY.

Additional Notes on Icaria. By ALBERT SHAW.

[Abstract of a paper read before the Seminary of Historical and Political Science, March 21, 1884].

In the *University Circular* for November, 1883, the writer gave an abstract of a paper on the career of Étienne Cabet, the French communist, and the founding of the Icarian Community, the history of which was traced from its disastrous experience in Texas and its brief residence in New Orleans, through the period of its successful existence at Nauvoo, Illinois, to the quarrel and division of the community, and the unhappy death of Cabet in St. Louis in 1856. The present paper continues the story of Icaria from 1856 to 1884. The minority, 180 in number, who had followed Cabet from Nauvoo to St. Louis only a week before their leader's death, were left in sorry straits; but they resolved unanimously to persevere in their enterprise and remain together. They purchased an estate called Cheltenham, in the suburbs of the city, and were known as the "Cheltenham Community." Their men were tailors and shoemakers, and worked in the city. The Community was weakened by a disagreement between those wishing a democratic and those wishing a dictatorial government. The civil war gave the finishing blow, and Cheltenham ceased to be.

The majority, who had remained at Nauvoo, were left with embarrassed finances; and the panic of 1857 forced them to make an assignment of their property. They retained, however, a tract of land in Adams county, southwestern Iowa, whither they removed, depleted in numbers and crushed by debt. Up to 1876 their story is a monotonous record of hardship, perseverance, and gradual recuperation. In 1877 they were on a sound material basis and their prospects seemed flattering in every way. Just at this time, however, the Community was entering upon the crisis inevitably involved in transferring the enterprise to the hands of a second generation. There arose two parties, the old party, or conservatives, and the young, or liberal party. The latter advocated more vigorous propaganda and a freer policy in the matter of admissions. The difference had been accentuated by the arrival of a number of French Internationalists, most of whom had been active participants in the Paris Commune of 1871 and all but one of whom joined the young party. Amicable adjustment failing, the young party carried the strife into the courts and succeeded in obtaining a nullification of the charter of incorporation, on technical grounds. The estate (of nearly 2,000 acres) was divided between the parties and they re-organized into two autonomous communes, the young party securing the name "Icarian Community" and the old party adopting the title "New Icarian Community." The paper proceeded to describe the industrial organization and social life of the two communities as seen by the writer on visits paid in May and October, 1883. The community of the old people is small in numbers and does not give great promise of growth.

Several members left the young party about 1880 and went to Cloverdale, Sonoma Co., California (near San Francisco), where they purchased a fruit farm and arranged for the development of a large communistic society on Icarian principles. The remaining members of the Iowa party of the young people have now formed a contract of union with the California Icarians, and are about moving thither. This new colony bears the name "Icaria-Speranza," the latter name being added in honor of the distinguished socialist and philosopher Pierre Leroux, who wrote a sketch of an ideal society which he entitled "Speranza," and whose nephews formed the nucleus of the California colony. Fruit-growing seems a business peculiarly well adapted to a communistic society of Gallic origin, and the future history of "Icaria-Speranza" will be awaited with interest. The remaining portion of the paper contained a series of personal sketches of various Icarians of the past and present, many of whom have been remarkable characters and have had curious and noteworthy careers. Among those described are: A. A. Marchand, J. B. Gérard, A. Picquenard, P. J. Favard, M. Mercadier, Eugene Mourot, Émile Fugier, E. F. Bettanier, Antoine von Gauvain, A. Souva, Émile Peron, J. Laforgue, A. Tanguy, S. Dereure, Charles Levy, Jules Leroux (pére), Pierre Leroux (fils) and Jules Leroux (fils), Adam Dehay, and Émile Bée.

The Beginnings of Connecticut. By Charles H. Levermore.

[Abstract of a paper presented to the Historical and Political Science Association, March 28, 1884].

I.—*The Dutch and the Pilgrims.* In the valley of the Connecticut river Dutchmen and Englishmen first wrestled earnestly together for the possession of the New World. The colony of Plymouth became, in the main, a trading corporation, reaching out one hand to the Kennebec and the other to the Connecticut. Still more exclusively upon an economic basis was the settlement at Manhattan. Dutch traders blazed the way where Englishmen afterwards followed. After Adrian Block's interesting voyage of exploration in his American-built yacht, "The Unrest," there are accumulating evidences of the presence of Dutch traders and settlers upon the "Versch," or Connecticut river. Of these evidences New England historians have either been ignorant or contemptuous. Out of the invaluable treasures of the Holland Documents proofs are drawn of a Dutch settlement upon the river so early as 1623. The deposition of the Walloon, Catelina Trico, in 1688 concerning the fort at "Harford river" is especially important. When Isaac De Rasier headed an embassy from Fort Amsterdam to Plymouth in 1627, and smote upon the ears of the quiet villagers with "a great noyse of trumpeters," the English obtained their first knowledge of the Connecticut valley, and were invited to share it with the Dutch. The English were also urged to visit the river by Indians, one of whom "had lived in England with Sir Walter Raleigh." In the correspondence between the two English colonies, and with the agents of the Lords States-General upon the question of jurisdiction, the Massachusetts Bay Colony played the part of the dog in the manger. In 1633 Plymouth was at Windsor, side by side with New Amsterdam in the race for pelf and peltry. The influx of Massachusetts emigrants soon after crowded both the rivals to the wall. The correspondence between Governor Bradford and the Massachusetts authorities shows too much ill-temper for the successful preservation even of the usual devout forms of expression. Plymouth colony had planned to remove bodily to the lands thus wrested from her. But of contention she had already had enough at Kennebec. It was feared, as Hubbard says, that "they all and the Gospel might be brought under the reproach of cutting one another's throats for beaver." David Peterson DeVries' account of his visit in 1639 to the Dutch fort, "The Hope," at Hartford, affords a lively picture of the numerous undignified squabbles between the Dutchmen and their English neighbors. There is an amusing story of the international fraternizing over a feast of cherries at the Dutch fort, and of the escape of a drunken Englishman from the whipping-post on account of that temporary era of good feeling. The Dutch cherry trees unfortunately could not bear fruit all the year round. Ill-feeling increased in intensity until the seizure of the fort in 1653, and its sequestration two years later.

II.—*The Massachusetts Bay Colony at Connecticut.* Out of a political and religious fermentation which pervaded every portion of the Massachusetts Bay Colony, there arose a social element, demanding democratic reform in the State, and Separatist reform in the Church. The political defeat of Winthrop and the colonization of Connecticut were two prominent results of the new movement. The central figure in the popular party during the conflict was the Rev. Thos. Hooker, the father of Connecticut. He was self-centered, magnetic, and a firm republican. In mildness he was surpassed by the even-tempered Winthrop, but his warm sympathies inspired him with a belief in the People that seemed foolish to the sagacious Governor. In public spirit and tolerant disposition he shows to advantage by the side of his rival, "the flexible Cotton." Against the conception of Roger Ludlow's character embodied in the new edition of Bancroft's "History," a protest must be filed. The testimony of his own life proves him to have been a selfish, ambitious, vindictive man, doomed to be rejected in the end by both Massachusetts and Connecticut. The democratic tendencies which are traced throughout Connecticut's constitutional development provoked much dolorous moralizing from Winthrop, who mourned that Mr. Hooker's work must "lack the blessing." Connecticut's treatment of Indians deserves a special word of commendation. Such has been the magic force of legend and of poetically inspired school-histories, that, for a century, the youth of America have heard, with awe and shame, the voices of the Delaware redskins, chanting "We will live in love with William Penn and his children, so long as the sun and moon shall shine." More than one colony surpassed Pennsylvania in a policy of kindness to the savages. Connecticut Indians live to-day upon lands that belonged to Sachem Uncas. During the contentions with Massachusetts that ensued upon the quarrel with Magistrate Pyncheon of Springfield, Connecticut appeared as the first American champion of the doctrine of "Home-instructions to representatives." A view of the economic life of the colony down to the time of the Revolution justifies that impression of slow and sure growth which is suggested in Connecticut's sobriquet "The land of steady habits."

III.—*The Colonies of New Haven and Saybrook.* A survey of the early fortunes of New Haven and Connecticut reveals the former declining from affluence to comparative poverty, while Connecticut rises from distress to comfort and power. The causes of these phenomena are to be found, not in New Haven's peculiar polity of the Church and State, but in economic conditions, in the fruitless endeavors to build a commercial metropolis on the edge of a wilderness. The complete history of the Saybrook Colony has never been written. The story is one of attempts, not of realizations. It was the only endeavor to colonize Connecticut under English chartered rights. The prospects of the colony and the purposes of its owners, Say and Sele, Pym, Hampden, Saltonstall, and the rest, varied with the fluctuating fortunes of the Puritan party in England. The first settlement was made, not at Saybrook, but at Windsor, in 1635, by Sir Richard Saltonstall's company. The letters of the knight bear abundant witness to the utter overthrow of the new foundation by the in-rushing tide of Massachusetts immigration. His just claims were finally satisfied in 1642. Massachusetts tried to use the Saybrook colony as a lever for weakening the independent position of Connecticut. The younger Winthrop's authority as Governor of Saybrook facilitated this purpose—until the time of the arrival of Col. Fenwick. Fenwick's expectations became disappointments, and, in 1644, after a separate existence of nine years, Saybrook was absorbed by the colony of Connecticut farmers.

BIOLOGY.

List of Coleoptera found in the vicinity of Baltimore. By O. Lugger.

[Abstract of a paper read before the Baltimore Naturalists' Field Club, January 16, 1884].

Although lacking a large river, the banks of which have proven everywhere such an excellent field to collect specimens of natural history, and which are always rich in species of beetles, the vicinity of Baltimore is by no means an unfavorable locality for coleoptera. Nearly every variety of soil and surface can be found within a short distance from this city. High and wooded hills with steep or gently sloping sides; broad valleys and narrow ravines, with many streams and thousands of springs; rocky hill-sides and sandy spots abound everywhere, and produce all the necessary conditions for the existence of animal and vegetable life, thus affording a very rich field for the collector. The districts along our tidewater again are the homes of many species not found elsewhere in this vicinity.

All the usual methods of catching beetles have been resorted to. Sieving, beating, sweeping, and the different traps in vogue among coleopterists, all have produced their share of species in the following list. They have also been bred in cages constructed for this purpose. By collecting very early in spring and late in autumn, and even during sunny days in mid-winter, many species were obtained that belong to the Canadian fauna, and which otherwise could not be found in this vicinity.

The following list is the work of eight years' collecting, and contains 2259 species. It includes by no means all the species that can be found in this region, and judging from those found near Washington, fully 700 more will be found in time.

The arrangement of families followed in this list is that of the late Dr. Leconte and of Dr. Horn, published two years ago by the Smithsonian Institution.

Families.	*Gen.*	*Sp.*	*Families.*	*Gen.*	*Sp.*	*Families.*	*Gen.*	*Sp.*
Cicindelidæ	2	25	Nitidulidæ	20	43	Chrysomelidæ	67	190
Carabidæ	62	258	Trogositidæ	4	10	Bruchidæ	2	15
Haliplidæ	2	5	Monotomidæ	4	8	Tenebrionidæ	35	59
Dytiscidæ	14	46	Lathridiidæ	3	7	Cistellidæ	7	17
Gyrinidæ	2	5	Derodontidæ	1	1	Lagriidæ	2	3
Hydrophilidæ	13	37	Byrrhidæ	4	5	Melandryidæ	17	25
Silphidæ	11	29	Georyssidæ	1	1	Pythidæ	2	2
Scydmænidæ	2	11	Parnidæ	5	10	Oedemeridæ	4	8
Pselaphidæ	12	26	Heteroceridæ	1	3	Cephaloidæ	1	1
Staphylinidæ	65	204	Dascyllidæ	10	22	Mordellidæ	5	40
Trichopterygidæ	5	5	Rhipiceridæ	2	3	Anthicidæ	9	28
Scaphidiidæ	3	6	Elateridæ	35	106	Pyrochroidæ	2	4
Phalacridæ	3	6	Throscidæ	2	3	Meloidæ	8	14
Corylophidæ	5	6	Buprestidæ	17	58	Rhipiphoridæ	3	6
Coccinellidæ	17	33	Lampyridæ	24	55	Rhinomaceridæ	1	2
Endomychidæ	7	11	Malachiidæ	5	12	Rhynchitidæ	4	9
Erotylidæ	7	24	Cleridæ	12	29	Attelabidæ	1	3
Colydiidæ	11	15	Ptinidæ	21	31	Otiorhynchidæ	12	12
Rhyssodidæ	2	2	Cupesidæ	1	2	Curculionidæ	61	165
Cucujidæ	9	22	Cioidæ	4	5	Brenthidæ	1	1
Cryptophagidæ	7	8	Lucanidæ	5	6	Calandridæ	10	22
Mycetophagidæ	5	15	Scarabæidæ	43	143	Scolytidæ	19	32
Dermestidæ	7	15	Spondylidæ	1	1	Authribidæ	9	15
Histeridæ	13	45	Cerambycidæ	74	163	71 families, 857 gen., 2259 sp.		

PETROGRAPHY.

Preliminary Notice of the Gabbros and associated Hornblende rocks in the vicinity of Baltimore. By G. H. Williams.

In view of the limited number of occurrences of typical gabbro which have thus far been described within the United States, it may be interesting to briefly notice two well marked types of this rock that are to be found in the immediate vicinity of Baltimore. Inasmuch as their mode of occurrence promises to throw additional light upon one of the much mooted questions of archaean geology, viz: the origin of lenticular bodies of hornblende rocks, so often interbedded in the old gneisses, the full description of these gabbros, which their geological importance warrants, must be postponed until a more complete study of their field relations is possible.

An irregularly oval area to the west and northwest of the city of Baltimore, whose greatest length, extending from the Patapsco River to Smith's avenue, is about 10 miles and whose greatest width is about 5 miles, is covered with a compact black rock, locally known as "Niggerhead." Although at first sight this all seems to be alike, a more careful examination reveals the fact that there are three altogether distinct kinds of rock within this area. By far the most common of these is a very compact mixture of dark green hornblende and anorthite, which frequently shows unmistakable signs of stratification. Associated with this rock, which we will call an *anorthite amphibolite*, is another of a dark purple color and quite massive in its character. This latter is most frequent toward the centre of the area, its best exposures being along the line of the Western Maryland Rail Road near Mount Hope. It seems to occur in irregular patches of all possible dimensions, always surrounded by the amphibolite, between which and it there is never a sharp line of contact, but everywhere a gradual transition.

A microscopic examination of the purple rock from all the principal points of its occurrence shows that it is an exceedingly fresh, fine grained mixture of triclinic feldspar, diallage and hypersthene, with accessory hornblende, magnetite, apatite, and very rarely olivine. Its structure is altogether granular or granitic, and the rock is therefore to be defined as a *hypersthene gabbro* or *hyperite*. The feldspar was isolated and proved to be from both an optical and chemical examination, bytownite, a member of the triclinic series between labradorite and anorthite. It is not otherwise remarkable, except for the presence of beautiful inclusions, so characteristic of the feldspar of gabbros. The diallage is without crystalline form, of a light green color in the section and devoid of all pleochroism. The hypersthene, whose orthorhombic character is easily proven in cleavage pieces, is strongly pleochroic, the colors being arranged as usual, and contains its characteristic inclusions in great perfection. Aside from these essential constituents there is often present a brownish-yellow hornblende, which is undoubtedly original and not paramorphic in its nature, as is abundantly proved by its occurrence in the freshest and most unaltered specimens, and the fact that it is of a totally different character from the really paramorphic hornblende to be described farther on.

The hornblende rock or anorthite amphibolite retains throughout the entire area a constancy in its petrographical character quite remarkable for a member of the crystalline schists. The only observable differences are slight local variations in the coarseness of grain and distinctness of stratification. It always shows in a hand-specimen a satiny lustre, and is seen under the microscope to be composed of a triclinic feldspar and confused aggregates of amphibole, possessing the green color, strong pleochroism, and all the other properties of common hornblende. The feldspar was isolated and found to be nearly identical with that of the gabbro, although in the special specimen examined, slightly more basic. In its chemical constitution and optical properties it agreed better with anorthite than with bytownite. Epidote was frequently observed in nearly colorless crystals, generally forming a rim around and projecting into the feldspar. Quartz is very rarely present, and never except in minute quantities.

It will be seen at once that the association of these rocks is precisely similar to that at several well-known European localities, where they have of late been the subject of much careful study. Near Rosswein and Penig in Saxony lenticular masses of hypersthene gabbro occur imbedded in hornblende schists, and from their peculiar structure are called "Flaser-gabbros." Naumann regarded them as eruptive, but Stelzner, Credner, and Dathe consider them as metamorphosed sediments. Reusch has lately described the same association and structure at Bergen in Norway, where he considers the rocks to be metamorphosed lava streams and tuffa beds. Becke has also described the same formation in Austria. The Baltimore gabbro area gains therefore much in interest by its close similiarity to these classic European localities.

Whether the shape of the masses of fresh hypersthene gabbro in the Baltimore region is as a rule lenticular or not, it is difficult to say. If they are, the great size of the larger ones and the steeply tilted position of the hornblende beds would cause them to appear rather as alternating bands, and in the case of the smaller masses the close similarity in the general appearance of the two rocks and the absence of any sharp line of contact between them renders the assigning of any definite limits to such masses nearly impossible. The general impression conveyed is that of quite irregular patches of gabbro occurring in the compact amphibolite and everywhere passing by imperceptible gradations into it.

The association of these two rocks is so intimate and the transition of one into the other so gradual, that the idea of the subsequent origin of the gabbro, as a mass intruded into the amphibolite, is out of the question; on the other hand they both retain their essential characteristics throughout the entire area, in spite of their intimate mixture, with far too much constancy to allow of the supposition that they were originally interstratified sedimentary beds whose different constitution furnished, when metamorphosed, these two different products. In fact the separation of these rocks has only a petrographical interest. Geologically they form one body as is shown, aside from their close field relations, by the great similarity of their chemical composition and the fact that the area they occupy is so sharply defined against the gneisses and mica schists which surround it. Whatever may have been their primary origin, they are essentially the same rock, and the idea naturally suggests itself that one may be an alteration product (not however a decomposition product) of the other. Now the molecular change of hornblende into augite is known to take place only under circumstances of complete fusion, whereas no phenomenon is better known in petrography than the corresponding change under ordinary conditions of augite to hornblende. The identity of the feldspar in both rocks makes the only real difference between them, the replacement of the pyroxene constituents, diallage and hypersthene, in one by aggregates of green hornblende needles in the other. The idea then that the hornblende was the paramorphic product of the pyroxene lay close at hand, and the study of several series of thin sections made from chips taken at very close intervals along lines where the gradual transition of one rock into the other was especially manifest, have disclosed every step in this process of paramorphosis with great clearness. The pyroxene at first becomes fringed with a zone of fibrous hornblende which is colorless inside like tremolite, but on its exterior edge is somewhat more compact and possesses the usual green color and pleochroic properties of ordinary hornblende. This process of alteration goes on until the pyroxene is altogether replaced by irregular aggregates of hornblende needles, those in the centre being colorless and those on the edge green. The inclusions of the pyroxene have now mostly disappeared but those of the feldspar remain intact. A short distance farther away from the gabbro the hornblende aggregates have become altogether green and the feldspar no longer presents its peculiarly fresh appearance, the characteristic inclusions have disappeared, and it is filled with actinolite needles or fringed with epidote. This process, though the usual one, was by no means the only one observed. Sometimes the hornblende, instead of being aggregates of compact green needles, retains that very fine parallel fibrous appearance characteristic of uralite. The process is also somewhat different if the gabbro contained original brown hornblende, which resists the alteration longer than the pyroxene, although it also appears finally to go over into the green variety.

The microscopical study of these two rocks, then, as well as their field relations, as far as these have yet been deciphered, seems to indicate that they are essentially the same and that the gabbro was the original type. What their primary origin was it is difficult to say, but the sharp line of demarkation by which this area is separated from the light-colored gneisses and mica schists which surround it render it at least very possible that the whole was an eruptive mass, intruded as gabbro, and subsequently partially altered by paramorphism to anorthite-amphibolite. To this theory the more or less perfect schistose structure of the latter rock presents no serious objection. The great lateral pressure to which, as the microscope plainly shows, these rocks have been subjected would naturally have tended to produce a schistose structure resembling slaty cleavage. In fact this pressure may have been the very cause of the alteration of pyroxene to amphibole, which would account for the schistose structure being most manifest where this alteration is most complete.

The third of the rocks mentioned as occurring in the particular area under discussion is altogether different in character from the two already described. In its freshest state it is composed largely of olivine together with considerable diallage and bronzite and very little feldspar. It may perhaps best be classed as an *olivine bronzite gabbro,* although the almost total absence of feldspar in some varieties would throw it into the family of the *peridotites.* Macroscopically this rock appears as a dark brown base in which large plates of yellowish bronzite and smaller glistening crystals of black diallage together with a few scattered specks of white feldspar are readily detected with the unaided eye. Under the microscope the base is seen to be composed altogether of olivine and smaller grains or shreds of magnetite separated out in the process of serpentinization, which has always commenced and some cases progressed very far. Neither the bronzite nor diallage present any marked peculiarities. Both are nearly destitute of pleochroism in a thin section, but are readily distinguished by their difference of size, color, and optical orientation. The feldspar is anorthite and is interesting as showing a rare form of alteration into some zeolite mineral instead of into calcite or kaolin as usual. This zeolite, whose exact nature has not yet been determined, forms aggregates of fibrous crystals resembling natrolite and is perhaps scolecite. This feldspar also exhibits in great perfection the border of actinolite (?) fibers, described by Törnebohm, produced by the mutual reaction between the olivine and feldspar substance wherever these come in contact.

This rock occurs at several localities within the gabbro area, generally in the form of narrow bands resembling dykes, though sometimes in masses of considerable size. It is often associated with serpentine which has plainly originated from its alteration, and suggests the idea that the large mass of serpentine forming the Bare Hills, about 7 miles north of Baltimore, may have also originated in the same way. At all localities where it is at all fresh the olivine gabbro retains its main character with great constancy. From the following chemical analysis of this rock by Dr. Leroy McCay of the Green School of Science, Princeton College, it will be seen that it must be peculiarly subject to alteration. Besides its change to serpentine, it is seen sometimes to pass over into a light green talcose rock, which also occurs alone in bands cutting the hypersthene gabbro, and whose presence in this form is thus explained:

SiO_2	41.00
Al_2O_3	7.58
Fe_2O_3	5.99
FeO	4.63
CaO	10.08
MgO	23.59
Na_2O	.52
CO_2	3.62
H_2O	4.73
	101.74

This is to be regarded as only a preliminary notice of the gabbros about Baltimore. The writer hopes before long to publish a more detailed account of them with illustrations and a number of chemical analyses.

On an excursion Map of Baltimore and its neighborhood.

By A. L. Webster.

At a meeting of the Baltimore Naturalists' Field Club, March 19, 1884, Mr. Webster made a report upon a map of Baltimore and its neighborhood soon to be published for the use of the students of the Johns Hopkins University, of which the following abstract has been prepared.

From the first organization of this Club the want of an accurate and reliable map of Baltimore and its neighborhood has been felt by its members.

The results of their excursions and studies have rolled up a large collection of facts of importance, relating to the distribution of plant and animal life, of physical and topographic peculiarities, and of geological structure.

As notes on these items of interest have accumulated, the need of a comprehensive chart of the area under study has increased proportionately, but something more than a mere excursionists' guide is required, though this is a great desideratum at present.

The classification and systematizing of material must be preceded by the accumulation of a vast number of facts the significance of which, when first presented, is frequently hidden or but hinted at, and only brought into relief by association with others subsequently developed. To prevent the loss of such facts, relating to the physical geography and natural history of the district, through misconception of their importance, a large central chart accessible to all on which to record by a system of cartographic devices each item as noted, is urgently required.

As the delineation becomes more complex it will be beyond the power of a single map to carry the growing load of information, but by a division of the burden and a grouping of great classes of material on independent but similarly prepared base maps, a clear and comprehensive graphical statement can be preserved and a ready means offered of incorporating the new results of advancing study.

With a view to ultimately obtaining such a store house for the fruits of the Field Club's labors a movement was recently made to search out existing maps of the city and its surroundings, to ascertain to what extent they supplied the deficiency and to determine upon the most feasible course toward the ultimate accomplishment of the perfected plan.

A large number of maps of the city, the neighboring counties, and the state were examined without bringing to light any publication suitable to the ends noted. Sufficient scattered material was found, however, from which a serviceable map could be compiled.

A report to this effect was presented to the Trustees of the University with an urgent request for assistance. This was very kindly received and permission granted to have the work begun.

The area to be mapped lies approximately between latitudes 39°-06′-30″, 39°-28′-30″, and longitudes 76°-21′-30″, 76°-51′-00″, and is bounded by a square of twenty-five miles side, the centre of which is the city hall.

Something more than one-fourth of this area has been covered by the accurate triangulation and plane-table work of the U. S. Coast and Geodetic Survey. The remainder has at various times been surveyed and mapped, with more or less accuracy, by numerous engineers; the results of whose work are to be found in atlases of the city of Baltimore, of many of the counties and of the state; as well as in the form of wall-maps, pocket-maps, guides, etc., etc. With the exception of the work of the Coast Survey however, the measurement of altitudes has generally been overlooked.

It was also found that the U. S. Geological Survey is at present compiling a map of the District of Columbia and adjoining country on a scale of two inches to the mile, with twenty foot contours.

The area covered by this work lies between latitudes 38°-47′, 39°-05′, and longitudes 76°-50′, 77°-18′.

Its contiguity to our own limits and the desirability of mutual harmony in scale and general plan is apparent.

With these facts in mind it was decided to have drawn on a polyconic projection with scale of 1: 31,680., or two inches to the mile, a map taken from material furnished by published and official records of the U. S. Coast and Geodetic Survey. This drawing is to serve as a basis for the entire work, but in itself is to remain untouched until results of work of equal standard accuracy can be obtained to join with it. The computed geographical positions of one hundred and forty-four points lying within the district have been furnished by the courtesy of the Survey. From the drawing a tracing is to be made to which material gathered from the most reliable published maps of the remaining area is to be added. By the kindness of the U. S. Geological Survey the reduction of these various plats to the uniform standard scale is being effected by the process of photography and from the resulting prints features desired are transferred to the tracing.

Photolithographic reproductions of the finished tracing, reduced and properly mounted, will serve as convenient pocket-maps for use in the field.

It is to be borne in mind that they will be merely the results of compilation from a variety of sources, the best however at present existing. Many errors will doubtless be found in them, due to inaccuracies in the originals, but it is for the correction of these errors that they are produced.

The tracing is to be hung in an accessible place and items of interest to the various sections or corrections of detected inaccuracies, are to be made upon it or copies of it, from time to time, in accordance with a prescribed plan and system. It will accordingly represent the sum total of information collected up to date.

As existing hypsometric material is worked over and new records made, contours will be introduced, and it is hoped another edition showing the topography in relief will be produced in the future.

To the kind coöperation of the U. S. Coast and Geodetic Survey, the Corps of Engineers of the Army, the U. S. Geological Survey, and various friends much of the progress of the work is due.

REPORTS OF RECENT LECTURES AND ADDRESSES.

VII. Dr. Billings's Lectures on Municipal Hygiene.

Dr. JOHN S. BILLINGS, Surgeon U. S. A., who has been for several years the medical adviser of the Trustees of the Johns Hopkins Hospital in respect to the construction of their buildings, gave in Hopkins Hall during the first half-year, a course of twelve lectures on Municipal Hygiene. The following abstract has been prepared by Mr. Albert L. Webster, Fellow by Courtesy of this University.

Statistics clearly show a growing tendency on the part of the populace of this country to accumulation in cities; the sanitation of cities, therefore, is the sanitary problem of to-day. Apart from all other considerations, the importance of exertion in behalf of the health of the city as a whole, commends itself to our consideration on the ground of individual, self-preservation; on the common business principle that it will pay.

The annual number of deaths in Baltimore is now nearly 9,000, having been for the last two years over 2½ per cent. of the population. If we can prevent only one-tenth of this—that is reduce the rate to 2¼ per cent., or 22.5 per thousand, which certainly can be done, we shall save nine hundred lives, and get rid of one thousand eight hundred sick, who are a constant burden and expense. The money value of this is over a million dollars. The recent experience with small-pox cost the City Treasury over $90,000, to say nothing of the cost of the deaths, and of the sickness to individuals, or the loss to the business of the city, due to the prevalence of the disease. Yet this epidemic might have been prevented at comparatively small expense.

The impulse given to the study of municipal hygiene during the last forty years is largely due to the increased consideration of vital statistics. The figures representing the mortality of a place, are not by themselves the best test of its sanitary condition, but they are, upon the whole, a very good test, and often the only available one.

The importance of accurate and complete vital statistics is but slightly recognized in this country, and the dependent mortality rates accordingly open to more or less doubt. The most fruitful cause of error is connected with the mode of estimating the average living population which has furnished the deaths for a particular period.

The case of Baltimore illustrates the diversity of results attainable by different methods. The population of the city according to the United States Census of 1880 was 332,313. By consulting previous records and applying the ordinary method in use by statisticians, of reckoning proportionate increase in corresponding intervals, the population, June 1st, 1883, would have been 354,720.

The City Health authorities believe these figures to be too small and refuse to accept the census of 1880, estimating the population at that time to have been 393,796, or over 61,000 more than the census, a deficiency in the latter, according to them, of over 15 per cent. Their estimate is based upon the following considerations:

"There are 80,000 registered legal voters in Baltimore; five inhabitants to a legal voter is a fair and reasonable allowance, which would make the population 400,000. The census taken by the police, for our School Board, of children between the ages of six and twenty-one years gave 86,961. This would be a fair estimate of one-fifth of our population, making the same 434,805. . . . Again, there are 90,000 houses in Baltimore. Deduct 10,000 for manufacturing establishments, warehouses, stores, and unoccupied dwellings, estimating five inhabitants to each house (a very low estimate), our population would be 400,000." *

The results of an application of these same methods to the computation of the populations of other cities, and conversely the application of the usual methods of other cities to Baltimore, strongly concur in endorsing the figure obtained by the United States Census.

From the consideration of vital statistics, the following facts are made clear. Large cities have a greater mortality than small ones, and the latter than rural districts. Cities are more dangerous to male than to female lives and especially is this so among children; an excess of female mortality belongs exclusively to rural population. The birth and death-rate is higher among the colored than among the white population.

A large city covers a large area and influences affecting mortality rates vary with different districts lying within this area. Thus, for Baltimore the mean mortality rates for the years 1879–81 inclusive, for the various wards was as follows—

* A. R. Carter, letter in *Sanitary Engineer*, Feb. 15th, 1881, p. 130.

Table Showing the Population and Deaths by Wards of the City of Baltimore for Three Years.

Wards.	Total Population.	Number of Deaths.				Ratio per 1,000.
		1879.	1880.	1881.	Mean.	
1	27,190	578	681	668	609	23.6
2	14,097	294	417	489	400	28.4
3	12,985	313	330	336	326	25.1
4	9,521	202	205	226	211	22.2
5	12,966	307	300	354	320	24.7
6	15,402	433	406	429	423	27.4
7	27,327	619	687	748	685	25.0
8	14,250	306	346	308	320	22.5
9	6,970	232	265	332	276	39.6
10	9,533	230	244	202	225	23.6
11	12,492	182	191	225	199	15.9
12	14,747	270	268	293	277	18.7
13	10,358	220	244	273	246	23.7
14	11,206	258	309	336	301	26.8
15	14,664	408	431	451	430	29.3
16	19,867	445	486	599	510	25.6
17	18,220	476	430	598	501	27.5
18	29,037	653	638	679	657	22.6
19	30,941	656	608	735	666	21.5
20	20,532	536	555	535	542	26.3
Total.	332,305	7,618	8,041	8,816	8,153	25.2

One of the most important factors affecting the health of a city is its water supply. Rain water is not pure water, as it contains impurities washed from the atmosphere, and from the roof which collects it and turns it toward the cistern. Well water in cities is specially objectionable, owing to the practical impossibility of protecting it from contamination. The supposed "sulphur springs" discovered a few years ago in Baltimore and Washington were but wells of dilute sewage.

Natural reservoirs and their outlets, pure running streams, are the best sources from which to draw the water supply of a city and the importance of preserving them in their natural state of freedom from filth is apparent, though not infrequently sadly overlooked.

Water pollution is of less interest to Baltimore than most cities, because the sources of our supply are unusually free from danger of contamination. Yet a small degree of danger exists, and the authorities must see that it does not increase, and that no prescriptive right to discharge refuse into the Gunpowder and its tributaries be established, for no matter how clear the law, there will be difficulties in removing a factory or drain when once established. The trouble is that the city has no jurisdiction over the greater part of the territory from which its supply is obtained. An appeal for protection to the last Legislature failed, the interests of about forty persons outweighing those of 400,000.

Next in importance to the purity of water supply stands the removal and disposal of refuse, ashes, garbage, street sweepings, excreta, foul water, etc.

There are two ways of dealing with it: the ancient, uncivilized way, leaving to the individual householder to get rid of this refuse as best he can; and the co-operative plan where the city undertakes the business. By the first, the greater part of the refuse is kept within the town, in cesspools, yards, or streets, to be disposed of by nature's scavengers.

A very large amount of evidence has been collected, proving that no population living among cesspool emanations can continue to be healthy.

Attempts to prevent soil-pollution by making the cesspools water-tight have proven failures, and involve expensive methods of removal. Such has been the experience of Paris. The annual cost of emptying the 60,000 cesspools of Baltimore—those, that is, that fill up—is about $100,000. The odorless excavating company's vacuum apparatus is employed in the removal of about one-third, the other two-thirds or more sink into the soil. The best water-closet will not be used in a cesspool city, because using much water they fill the vaults too quickly.

The abundance of water in American cities, and the necessity of disposing of the water fouled by domestic use places the water carriage system of sewerage far in advance of other methods for use in this country. The system involves three things: 1, the conveying away of polluted water; 2, drainage of subsoil; 3, removal of surface drainage, and most of the disputes upon this subject turn upon the question of how far these three objects are to be combined in one system.

Small natural water-courses have often been utilized for drainage. These gradually become polluted and offensive by refuse and filth, as in the famous Bayou Gayoso, of Memphis, and when this has progressed so as to constitute a nuisance, the stream is often arched over and called a sewer. But the functions of the two are incompatible.

The proper connection of house fixtures with the sewers is vital to the complete efficiency of the latter.

The refuse and excreta discharged into house drains are not necessarily dangerous to health if they be removed before putrefaction begins. But when, on account of defects in the pipes or traps or of that abominable plan, in which a cesspool beneath the house or in the yard is so connected with the sewer that the overflow only passes off, the sewage reaches the sewers in a state of decomposition, then the sewers must become offensive, no matter how perfectly planned or constructed. This arrangement is common in Philadelphia, and is by no means wholly unknown in Baltimore.

In a properly constructed system of sewers there is little danger from sewer gas, and in improperly constructed ones the danger can be prevented as far as house drains are concerned by means of a proper trap between the house and sewer, and by ventilating the sewers. Probably more offensive gases are produced in soil pipes than come from sewers. Pipes connected with house drains should be arranged according to the following principles, which are simple, but which involve sometimes a difficulty in their practical application. Every fixture through which foul water is to pass shall have a trap as near the fixture as possible; all the traps should be ventilated; the soil pipe should pass out through the roof, full size and be freely open at the top; and in most of our cities, as actually built and sewered, the communication of the air in the soil pipe with that in the sewer should be cut off by a trap on the house side of which should be placed a fresh air inlet. The best traps are those known as the S and half S traps, simple bends in the pipe.

The pre-eminent function of the perfect sewer is to remove with all possible speed offensive refuse without in itself becoming contaminated or offensive. Various so-called systems have been devised to effect this end. The combined system provides by a single line of conduits not only for the removal of house refuse and waste water, but also for the street water in times of rain. This, from several considerations, is a matter of doubtful advisability.

The separate or double system provides independent channels for rain and house water. The latter being carried by small pipes can be readily flushed and kept free from deposits of decomposing filth. The Lieurnur system is a small pipe system in which the excreta is forced by pneumatic pressure to a central collecting station and there disposed of. The expense of construction and maintenance of this system argue strongly against it, aside from other considerations.

As to the paving of streets, cities having heavy traffic, generally pave with blocks of trap rock or granite, known as Belgian blocks, laid in juxtaposition on a bed of sand or gravel. The objections to these pavements are that the bed of gravel and subsoil gradually becomes polluted with organic matters derived from the excreta of animals, all of which in hot and dry weather give rise to offensive and dangerous gases. The best foundation is one of cement concrete. It prevents pollution of subsoil, gives elasticity, which is desirable to prevent injury to vehicles and animals, it distributes the weight and shock of traffic evenly over the surface, and it becomes better and stronger as it grows older. Stone, wood, or asphalt may be laid upon this foundation, but wood is objectionable from a sanitary standpoint. The report of the city commissioner of Baltimore for last year contains communications from several civil engineers relative to the policy to be pursued to secure good pavements. They consider the matter from the technical standpoint of their profession without reference to sanitary considerations, and all recommend the granite block. The cobble-stone pavements which cover most of the streets of Baltimore are much commented on by strangers, and two or three hours' experience produces impressions far from agreeable. The best pavement where there is little heavy traffic is one of asphalt laid on concrete.

With special reference to the sanitary requirements of Baltimore, I should recommend to the authorities and people of the city that more elaborate health statistics be collected and compiled; that the water supply be protected by municipal and State co-operation; that connections with sewerage be made under city supervision; that cesspools be filled; that there be an increase in plumbing inspection; that cobblestone pavements be removed; that an abattoir be constructed; that schools be thoroughly inspected and scholars instructed in hygiene; that public baths be opened; that comfortable and clean tenement-houses be built, and that voluntary organizations be formed to see that these things are properly done.

VIII. *Mr. Stillman's Address on the Acropolis of Athens.*

The following is an abstract of an address by Mr. WILLIAM J. STILLMAN before the University Archæological Society, on March 22, 1884.

The influence which the site of Athens had on Greek civilization was owing to its impregnable Acropolis in the midst of a magnificent plain which must in that time have been of great fertility, watered by two rivers, with access to the sea at no great distance, all conditions combining to increase wealth and give security to its civil liberty and to the results of its material prosperity. The rock of the Acropolis is one of the most singularly difficult of access amongst all the ancient cities, the only open road to it having been that which winds along under the southern precipices where now are the ruins of the Æsculapeion and the theatre of Dionysos. The western slope, by which it is approached by carriages, was probably in early times non-existent, and the valley between the Acropolis and Mars Hill much deeper, so as to make the western approach as steep as the others. And even in the time of Pausanias this is indicated by his itinerary. There were, however, two secret staircases carried through the rock, one coming up at the northern end of the Propylaea, and the other within the hieron of the Erectheum, the latter being that by which the Persians entered. These were probably part of the early works for the defence of the Acropolis, and are generally thought to have been Pelasgic, though the great work of defence of the Pelasgi, known as the Enneapylon, was probably on the south-western angle of the rock, covering the approach from the south. There is now no trace of the Enneapylon or of the walls of the Pelasgi, that which is shown opposite the temple of Niké Apteros being a comparatively modern wall supporting a terrace. The ancient entrance was, in all probability, where the present gate in common use, is, as is shown by the footprints of the beasts which were led up to the sacrifice, and which have worn the solid rock to considerable depth. The entrance was probably changed when the Propylaea was built and the gate on the western side constructed. This was ruined by Sylla and reconstructed in haste by Valerian at the approach of the Goths, and left as we now have it until the Turks converted the ensemble of the construction on this side into a huge bastion on which they planted their batteries. This bastion was removed by Beulé.

The buildings within the enclosure whose entrance was through the Propylaea are now the Parthenon and Erectheum, many smaller temples and shrines having probably been destroyed. The temple of Niké Apteros was without the Propylaea, and was demolished by the Turks and built into the bastion, to be, piece by piece, recovered and reconstructed in our century.

The description of the Parthenon included a demonstration of the well-known system of curvature of the horizontal lines, which, with the diminution in the inter-columniations and the convergence of the columns, the lecturer considered to be an expedient to increase the apparent size of the temple by exaggerating the perspective illusions. This was illustrated by diagrams and the effect of each variation from the regularity of construction was shown to bear directly on the perspective of the building so as to increase its apparent size.

The same points were illustrated by photographs taken by Mr. Stillman, in the foreground of one of which were shown a number of unfinished drums of the Parthenon columns which had been, from defects discovered after they had been brought up, rejected, and which still lie on a bed of fragments of marble covering the débris of the buildings destroyed in the Persian sack of the Acropolis. In this stratum of débris, which varied from two to six feet in thickness, and which has recently been excavated by the Archæological Society of Athens, are found many fragments of bronze and iron with carbonized wood; and, digging into the exposed face of the mass, the lecturer discovered many relics of the conflagration, amongst them a bronze archaic ornament (which he presented to the Society), and a deposit of barley, pease, and beans, which though completely carbonized by time, had not been burned and still retained their shape. An account of the Erectheum with its triple sanctuary, illustrated by photographs showing the various portions in all their views, completed the description.

IX. *Mr. Clarke's Address on the Introduction and Fundamental Principle of the Entasis.*

The following is an abstract of an address by Mr. JOSEPH THACHER CLARKE before the University Archæological Society, on March 14, 1884.

This paper embodied original researches concerning the nature of the curved outlines of columns of round plan, based upon the suggestion of Thiersch: That the increased diameter of the middle shaft was introduced to overcome an optical deception resulting from the inability of the eye to distinguish a slight convergence in sets of lines apparently parallel. A comparison of those Athenian monuments which have been most accurately measured shows that the principle of this deception was fully understood by the Greek designers of the best period, and was determined by graphical methods. This recognition of the true character of the Entasis was entirely lost before the Renaissance, and replaced by Serlio and Vignola with clumsy and empiric makeshifts.

NOTES ON RECENT PUBLICATIONS.

MARTIN, H. NEWELL and W. A. MOALE. Handbook of Vertebrate Dissection: *Part III.* How to Dissect a Rodent. (*New York: Macmillan & Co., pp. 85, 3 plates*).

"This little book, like its predecessors in the same series (*see notice on page* 59 *of Circular* 21) is designed for use at the dissecting-table, and not to take the place of attendance on lectures or the study of a text-book of comparative anatomy. We have assumed that the teacher or text-book will supply such references to original sources as it is desirable that students should be acquainted with, and have accordingly entirely omitted all such. As some critics of Parts I and II appear to have thought that such omission made it possible that the discoveries of others should be credited to us, we desire to state that, so far as we know, no new fact in mammalian or rat anatomy is to be found in the following pages, nor any novel method of dissecting. What we have attempted is to make it easy for a student to learn practically what a mammal, regarded from a morphological standpoint, is. In pursuance of this plan, details which are diagnostic or generally characteristic of mammalia have been treated with more fullness than generic or specific peculiarities.

"From a certain point of view the title of the book may seem a little absurd. The methods suitable for the satisfactory dissection of a rat would assuredly be quite inapplicable to the practical study of the anatomy of a whale or an elephant. But to the student who dissects, not to learn the detailed anatomy of any one species, but the common structural character of a class, it matters little which animal is selected if it be readily obtainable and fairly typical. A book giving directions for the dissection of any such mammalian species may be fairly entitled 'How to Dissect a Mammal.'

"Our choice of the rat was largely determined by its abundance and wide distribution, and the fact that no one is likely to object to the killing of as many rats as can be caught. The larger size of dogs and cats would have been to a certain extent an advantage, but domesticated animals are not to be easily obtained in such numbers as to provide a liberal supply of material for students. Further, we feel sure that he who aspires to become a comparative anatomist, and yet finds a rat too small for the observation of all the main facts in its structure, has mistaken his vocation."—*From the Preface.*

HALL, G. STANLEY and HARTWELL, E. M. Bilateral Asymmetry of Function. (*Mind, London, No.* 33, *pp. 17, 8°*).

This article consists of two parts, and is to be taken merely as a preliminary account of an attempt by the authors to study comprehensively and in accordance with modern scientific methods, the problem of the relation of right- and left-sidedness to the more general law of bilateral symmetry as regards form and function in animals, especially man.

Part I contains a summary statement concerning the facts observed in the fields of anatomy, physiology, pathology, clinical medicine, and zoölogy, regarding asymmetrical structure and unbalanced functions in paired viscera, limbs and sense organs, together with a brief review of the hypotheses offered in explanation of the facts.

A bibliography of the more important literature of the subject is promised by the authors.

In Part II it is stated that a consideration of the facts and opinions brought together in Part I has led the authors "to think that other methods than those hitherto applied might bring us into closer quarters with the comprehensive bilateral problem. Of these methods two were considered: 1. Operations on the corpus callosum and cerebellum of animals, and perhaps the pyramids, to partially isolate the action of the hemispheres, and also to reduce the action of one of them. 2. More accurate measurements of the bilateral asymmetry of function; especially as regards (*a*) the upper extremity, (*b*) the lower extremity, (*c*) binocular vision."

This section is devoted to an account of investigations made by the authors, according to the second method, applied to the arms. The description of experiments made and the statement of results which occupy the remainder of the section present no substantial differences from the results of the investigation recounted by E. M. Hartwell before the University Scientific Association, May 2, 1883, in his paper "On the Relation of Bilateral Symmetry to Function." An abstract of the paper referred to may be found in *Circular No.* 25, *p.* 149.

HALL, G. STANLEY. (*Editor*). Pedagogical Library, Vol. I.—Diesterweg's Methods of Teaching History, with papers by Professors Herbert B. Adams, C. K. Adams, John W. Burgess, E. Emerton, W. F. Allen, and Mr. T. W. Higginson. (*Boston: Ginn, Heath & Co. xii, 208 and 92 pp. 12mo.*)

This book is intended to be the first of a series entitled a "Pedagogical Library," devoted to methods of teaching, one volume of which is to be occupied with each of the more important branches of study in grammar and high schools. History was chosen as the subject of the first volume from a conviction that no subject so widely taught in schools is, on the whole, taught so poorly. The editor in his preface urges the need of securing better instruction, first, by improving the special training of teachers of history, and second, by increasing the time devoted to instruction.

The book consists of three parts. The first half of it is occupied by a monograph on instruction in history, translated from Diesterweg's *Wegweiser zur Bildung für deutsche Lehrer*, in which the meaning and use of history, and various questions in regard to the method of teaching it, are treated with fullness. Part II consists of brief contributions by prominent American historical teachers. Dr. H. B. Adams describes the methods and results of topical study of history in his classes at the Johns Hopkins University and at Smith College, and calls attention to the utility of beginning historical work with the investigation of local life. Prof. C. K. Adams suggests some improvements in American historical teaching to be derived from the study of German methods, and explains the plans pursued in the School of Political Science of Michigan University. Prof. J. W. Burgess describes the system followed in the School of Political Science connected with Columbia College. Dr. E. Emerton, of Harvard, shows the advantages of an application of the seminary method to historical teaching in American colleges. An important page or two on the use which may be made of physical geography, and a few words by Col. Higginson on the reasons why children dislike history, conclude this portion of the book. Part III, by Prof. W. F. Allen, consists of classified lists of the most useful historical works in English and of selected topics for class use, with some suggestions as to the use of the latter.

J. F. J.

DIPPOLD, G. THEODORE. The Great Epics of Mediæval Germany. An Outline of their Contents and History. (*Boston: Roberts Brothers. 1884. 223 pp., 12mo.*)

This is a reprint of the first issue of the book of September, 1882. "Although no claim is made to present here anything like a history of Mediæval German poetry, it will be found that the subject, as it comes within the scope of the plan announced, has been more fully treated on the following pages than in any work hitherto published in this country or in England."—(*Extract from Preface.*)

AMERICAN JOURNAL OF PHILOLOGY. Edited by Professor Gildersleeve. Vol. IV. Whole No. 16.

Article I.—The Noctes Atticae *of Aulus Gellius.* By HENRY NETTLESHIP.

A large proportion of the surviving Greek and Latin literature consists of extracts and epitomes. The passion for making *florilegia* and miscellanies of all kinds began among the Romans in the first century after Christ and continued in activity for a long subsequent period. The *Noctes Atticae* of Gellius is only one specimen of the results which this passion produced. Prof. Nettleship gives a sketch of the life and career of Aulus Gellius, who belonged to a very old Italian family, was born about 123 A. D., was educated at Rome and studied at Athens in the time of Herodes Atticus. After his return from Athens to Rome he fell under the influence of Favorinus, an influence which extended at least beyond the time at which he entered upon professional life. What that professional life was Gellius does not tell us explicitly, but references are made to judicial functions. The title *Noctes Atticae* was given to the book as a record of the fact that Gellius began to make his collections during the long winter evenings of his student years at Rome. It is professedly a handbook of miscellaneous information; he aims at being comparatively popular. The attempts to enliven his lessons are amusing by reason of the uniformity of the devices employed. There are many marks of carelessness in composition, inconsistencies in the dialogue, re-introduction of the same interlocutor, extracts carelessly torn from the context, allusions to things the writer has nowhere mentioned, promises that are nowhere performed.

Prof. Nettleship then analyzes the whole book according to the subjects of which it treats, and discusses the sources from which Gellius derived his knowledge. The element of purely miscellaneous information is comparatively small and does not include much more than an eighth part of the whole work. A large part is given to philosophy, something to literary criticism, a respectable *quota* to history and Roman antiquities, more than a quarter of the whole to lexicography and etymology, and something considerable to grammar and textual criticism. Large as is the amount of discussion and information bearing upon philosophical questions, that devoted to lexicography, grammar, and criticism of text and style, by far outweighs it both in quantity and in value. The phenomenon is typical of the state of Italian taste and feeling. Only the antiquarian impulse retains any life. The age has no vigor of its own but builds the sepulchres of the prophets and waits for inspiration to rise from the past.

Article II.—On the Final Sentence in Greek. By B. L. GILDERSLEEVE.

Read before the Johns Hopkins Philological Association at their February meeting, 1884. (*See p.* 73 *of this Circular*).

Article III.—T. L. Beddoes, A Survival in Style. I. By HENRY WOOD.

Read before the Johns Hopkins Philological Association at their December meeting, 1883. (*See p.* 76 *of this Circular*).

Article IV.—Notes. 1. *John Evelyn's Plan for the Improvement of the English Language.* By H. E. SHEPHERD.

2. *Mercator, v.* 524. By MINTON WARREN. (*See p.* 56 *of Circular* 29).

Article V.—List of Irregular (Strong) Verbs in Béowulf. By JAMES A. HARRISON.

This number contains *Reviews* of *Guest's History of English Rhythms* by J. M. GARNETT, of *Gartner's Raetoromanische Grammatik, Ulrich's Bifrun's Uebersetzung des Neuen Testaments, Förster's Altfranzösische Bibliothek* by A. M. ELLIOTT, of *Mather's Aeschylus' Prometheus Bound* by — Y ——, of *Dunbar's Concordance to Aristophanes* by C. D. MORRIS, of *Engelbrecht's Studia Terentiana, Wölfflin's Archiv für Lateinische Lexicographie u. Grammatik*, and *Ribbeck's Emendationum Mercatoris Plautinae Spicilegium* by MINTON WARREN. Brief mention is also made of *Schuchardt's Kreolische Studien, Internationale Zeitschrift für Allgemeine Sprachwissenschaft, Weil's Harangues de Démosthène, Jebb's Oedipus Tyrannus*, the new edition of *Cauer's Delectus, Gitlbauer's Babrii Fabulae*, and *Fränkel's Quellen der Alexanderhistoriker*. The *Reports* give an account of *Englische Studien, Zeitschrift der deutschen morgenländischen Gesellschaft, Journal Asiatique, Deutsche Litteraturdenkmale.*

This number closes the volume. Vol. V, No. 1 (whole number 17), will contain articles on *Maximianus* by ROBINSON ELLIS, on the Nahuatl-Spanish Dialect by A. M. ELLIOTT, (see *p.* 74 *of this Circular*), Dr. BLOOMFIELD'S essay on *Irregular Vedic Subjunctives* (see *Johns Hopkins Circulars, p.* 6), a paper on *Researches in Cyrene* by F. B. GODDARD, and Professor HAUPT'S paper on the *Woman's Language* (see *Johns Hopkins Circulars, p.* 51).

Subscription price, $3 per annum, payable to the Editor.

THE NEW BIOLOGICAL LABORATORY
OF THE JOHNS HOPKINS UNIVERSITY.

The recently opened biological laboratory of the Johns Hopkins University is eighty-four by fifty-two feet in external measurement, and consists of three stories and a basement. It is built of Baltimore pressed brick; with steps, entry, window-sills, and band-courses of Cheat-river bluestone. A fact that at once attracts attention is the number and large size of the windows; as the laboratory is free on all sides, it is therefore very well lighted.

On ascending the front steps, and passing through the door, the visitor enters the main hall, from which a wide staircase ascends to the third story, and on which most of the rooms of the first floor open. This floor is given up to the regular class-instruction of students not engaged in special work. It has on it (see plan, fig. 1) a lecture-room with seats for sixty; a storeroom connected with this, for the keeping of diagrams and lecture-apparatus; an administration-room, the headquarters of the chief assistant; a preparation-room containining a supply of the reagents, specimens and material required for the daily practical class-work; and the large general laboratory, thirty-two by forty-eight feet.

The latter has windows on three sides. Around these sides runs a work-table, supported, independently of the floor, on brackets attached to the walls, and affording ample space for thirty students. If necessary, a second table can be set inside this, giving places for fifteen or twenty more. The centre of the room is in part occupied by a dissecting and a chemical table. The latter is supplied with the reagents and appliances for practical work in elementary chemical physiology. The dissecting table has a slate top, and is provided with a sink and water-tap between every two students. The inner side of the room has, against the wall, tables for scales and the warm-water oven; a large hood for the performance of chemical operations calculated to give rise to noxious vapors; and a dumb-waiter leading to the basement, on which articles can be sent up from the storerooms there when called for. Near the centre of the room is a chute, lined with plate-glass (so as to be readily kept clean), and passing direct to the furnace-room below. Through this chute all refuse is at once got rid of. The floor of this room, and of several others in the building, is of asphalt, and the walls of hard cement to a height of two and a half feet. Thus the floor can be flooded with water, and thoroughly cleansed whenever desirable.

The work to be done in this room annually is as follows: by the first-year students, a thorough macroscopic and microscopic examination of about twenty-five selected vegetable and animal organisms illustrative of the course of lectures on general biology, and a study of the embryology of the chick; by second-year students, a course in practical animal physiology and histology a little more extended than that given in Foster and Langley's 'Practical Physiology.'

The second floor (see plan, fig. 2) contains the following rooms: a laboratory for research and advanced study in animal morphology, and a corresponding room for botanical work (used at present as the laboratory of psycho-physiology); a photographing-chamber, with heliostat and other appliances for micro-photography; a library of biological text-books, monographs, and journals; a small lecture-room, capable of seating about thirty; an assistant's private room; a museum containing such typical osteological and other specimens as are needed by students pursuing the regular courses of class-instruction, and the beginning of a collection of the local fauna and flora, made by the members of the field-club; and a store and preparation room for the curator of the museum.

The third floor (see plan, fig. 3) is mainly given up to advanced students in physiology and histology. It has three large work-rooms; a dark chamber for spectroscopic work, for experiments in physiological optics, etc.; the director's private room; a room for the myograph; an assistant's private room; the mechanics' shop, for the construction and repair of instruments; and a small balance-room.

The building being heated by steam supplied from a boiler in the neighboring chemical laboratory, the basement (see plan, fig. 4), which is well lighted, is left free for use. The scientific work-rooms in it are a large, well-equipped room for advanced study in chemical physiology, a balance-room, and a room for the study of animal electricity. The basement also contains a suite of three rooms, which form the janitor's headquarters, where he has charge of the necessary stock of chemicals and glassware, and has also a carpenter's bench, at which he does any simple bit of carpentering required. From one of these rooms a shaft two feet square runs to the top of the building, communicating with each floor. Through this shaft it is intended to run wires to various work-rooms, transmitting electical currents for the running of chronographs, and for similar purposes. The shaft was also planned in the hope that ultimately the clock-work of kymographs and such instruments will be replaced by electrical energy generated by an engine and dynamo in the basement, and distributed thence over the building. The remaining rooms in the basement are, the 'animal room,' fitted up with tanks for the keeping of frogs, terrapins, and so forth; and the furnace-room. The latter contains a cremation-furnace, in which all the combustible *débris* of the laboratory is disposed of, and a boiler and condenser for the preparation of distilled water: it has also in it a small steam-engine, designed to be used for running a centrifugal apparatus.

In the general internal fitting up of the laboratory, the trustees of the university have acted upon the belief that it is, in the long-run, more economical to provide students with furniture which is good and attractive, and trust them to take care of it, than to supply cheap tables and cases, which the average undergraduate, at least, is apt to feel no hesitation in mutilating. The halls and lobbies are comfortably covered with cocoa matting; the tables, instrument cupboards, and cases of drawers are of polished cherry. But there has been no attempt at ostentation: the furniture is all simple; though handsome, and finished in every essential in the best manner. Every drawer runs as smoothly as in the best cabinet work; and each has its own lock, to be opened only by its own key, or the master-key for each floor kept in the administration-room.

The library is a little more luxuriously furnished than the other rooms. It is carpeted, and supplied with armchairs. So many students can only afford to hire rather uncomfortable lodgings, that it was believed desirable to provide in the library a really pleasant study, in which they might find at hand, not only the books they wanted, but writing-tables and other conveniences. None of the books are locked up. The student, on entering, finds before him a list of books which are not to be taken from the room, including text-books, monographs on the plants or animals which are used as types in the regular class-instruction, and the last-received numbers of periodicals: all other books may be taken (subject to call for immediate return at any time) on the student writing his name, and the title of the book he desires to take away, on a card provided for that purpose, and then slipping this through a slit in a locked drawer. The fellows and scholars in the biological department act in turn as librarians for the day, and are present at a stated hour to received books returned, and restore the receipts for them: until the card is returned to its signer, he is responsible for the book. This system of almost absolute freedom in taking books from the library is still on its trial: it has now been in practice for four months, and with the best results. Those who desire to take books home appreciate the trust reposed in them, and also the convenience to them of the present plan, and are anxious to secure its continuance.

The principle on which the library is managed, of inviting students to co-operate with the administrative officers in making it possible to allow the freest use of all books in it compatible with their safety, has been extended to the instruments in the various rooms for advanced work. On admission, each man has assigned to him a microscope, microtome, other histological appliances, and such chemical glass-ware as he is pretty certain to need. For these he signs a receipt, undertaking to restore the articles in good order on demand, or pay a specified sum for them. Glass slides and covers are purchased in quantity, and supplied by the janitor at cost. Other glassware, only occasionally needed, is supplied to any member of the laboratory on requisition, the recipient signing an agreement to return or pay for it. With these exceptions, free use of all the instruments required for such work as he has been permitted to undertake is allowed to every student, on condition that upon removing any piece of apparatus from its drawer or cupboard he shall leave in its place a card bearing his name. The only alternative, of course, is to lock every case, and only issue apparatus on formal application to a special officer. The men are on their honor, and also know, that, if instruments cannot be traced, the present system must cease. Hitherto the endeavor to secure their aid in carrying out this plan of making all the apparatus accessible with the minimum of trouble or delay, has had most satisfactory results; largely, no doubt, owing to the fact that the majority of the students are graduates old enough to have a sense of responsibility and to influence the younger men. Once a month one of the fellows, or graduate scholars, examines the instrument cupboards in each room, compares their contents with the inventory, notes what piece of apparatus has been taken and who has taken it. If any instrument is not accounted for, he posts a notice asking who has it. During the past four months the latter proceeding has been necessary only three or four times, when students had, in the hurry and excitement of an experiment, forgotten to write the required receipt: in every such case the delinquent has at once come to apologize and explain. What may be called the 'permanent' apparatus in the laboratory, as distinguished from glass tubing and other perishable 'current' apparatus renewed yearly, has cost more than ten thousand dollars: about fifteen hundred dollars are annually provided for repairing and adding to it. During the current year another five hundred dollars has been placed at the disposal of Dr. G. Stanley Hall for the purchase or construction of apparatus for psycho-physiological teaching and research. This stock of instruments is so valuable, and in many cases so easily injured, that a longer trial will, of course, be necessary, before it can be decided whether the present system of leaving every thing unlocked and trusting students to leave an acknowledgment for such instruments as they take, can be continued without undue risk of loss, or injury by carelessness for which no one can be found responsible.

The work for which the laboratory has been planned and built is stated in Professor Martin's lecture, (*see p.* 87 *of this Circular*). Briefly, it is to train beginners in biology in the fundamental properties of living matter, and the structural and physiological characteristics of the chief groups of plants and animals; in co-operation with the seaside laboratory of the university, to afford opportunities for advanced study and research in animal morphology and embryology; and, ultimately, similar opportunities for advanced students of botany. In addition, very special attention has been giving to providing facilities for class-instruction, advanced study and research in animal physiology and histology; and opportunity for such senior students as intend to become physicians to learn the methods of experimental pathological and therapeutical research, so far as they can be carried on in a laboratory. It is hoped that in this way the biological laboratory may prepare annually some students to enter special laboratories of pathological or pharmacological research more immediately connected with a medical school.—(*Reprinted from Science, March* 21, 1884.)

DIAGRAMS SHOWING THE ARRANGEMENT OF ROOMS.

FIRST FLOOR.

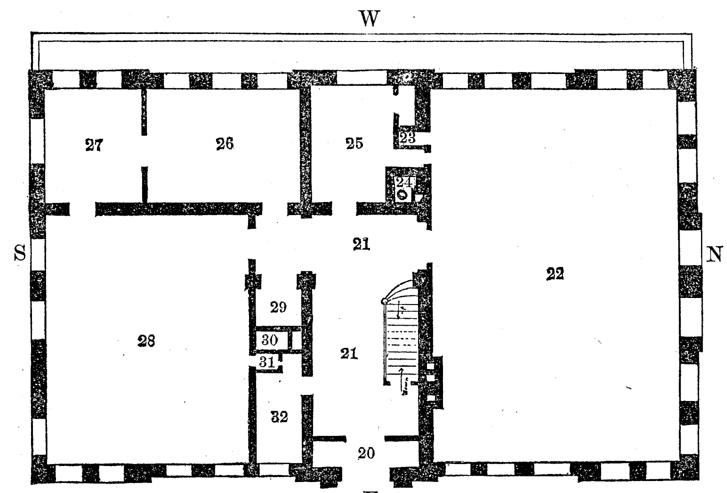


FIGURE 1.—20, vestibule; 21, main hall; 22, work-room for practical instruction of less advanced students; 24, 30, ventilating shafts; 25, storeroom of materials and reagents for general practical class-work; 26, chief assistant's room; 27, storeroom for diagrams and lecture-apparatus; 28, lecture-room; 29, elevator; 32, cloak-room.

SECOND FLOOR.

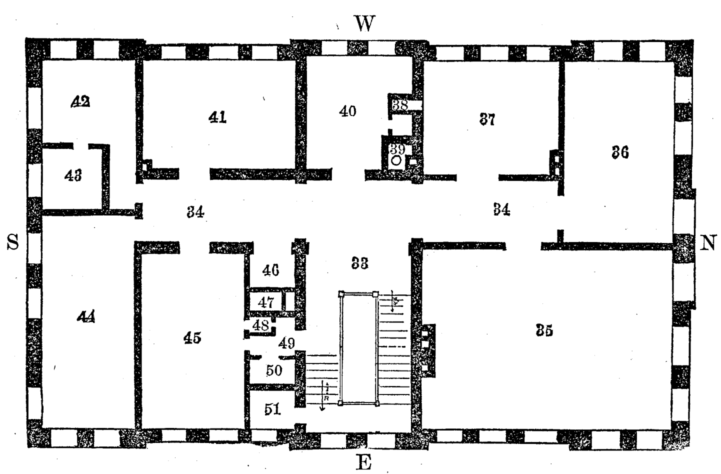


FIGURE 2.—33, 34, hall and corridor; 35, museum; 36, advanced morphology; 37, preparation-room for museum; 40, assistant's room; 41, library; 42, 43, photography; 44, advanced botany; 45, lecture-room; 46, elevator; 47, 39, ventilating shafts; 51, lavatory.

THIRD FLOOR.

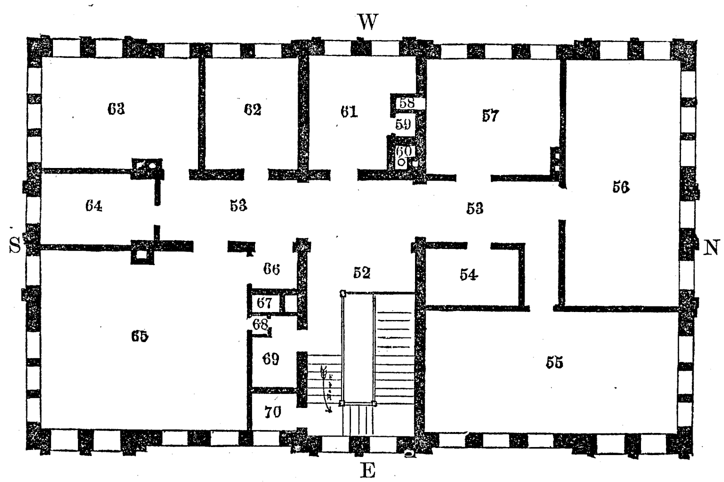


FIGURE 3.—52, 53, hall and corridor; 55, experimental physiology; 56, advanced histology; 57, workshop; 54, balance-room; 61, assistant's room; 62, myograph-room; 63, director's private room; 64, dark chamber; 65, experimental physiology; 66, elevator; 60, 67, ventilating shafts; 69, closet; 70, lavatory.

BASEMENT.

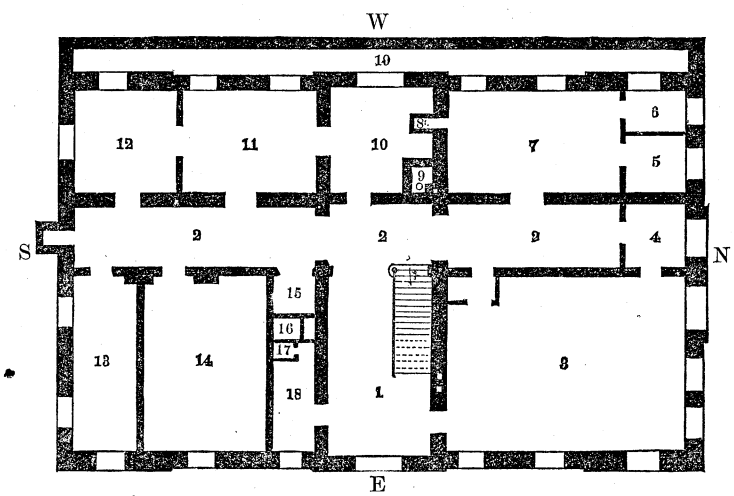


FIGURE 4.—1, 2, entrance and corridor; 3, chemical physiology; 4, balance-room; 7, furnace-room; 10, 11, 12, janitor's store and battery rooms; 13, animal-room; 14, electro-physiology; 15, elevator; 16, 9, ventilating shafts; 18, lavatory.

MODERN PHYSIOLOGICAL LABORATORIES:

WHAT THEY ARE AND WHY THEY ARE.

(AN ADDRESS DELIVERED ON THE OCCASION OF THE FORMAL OPENING OF THE NEW BIOLOGICAL LABORATORY OF THE JOHNS HOPKINS UNIVERSITY, JANUARY 2, 1884).

BY

Professor H. NEWELL MARTIN.

A little more than seven years ago I announced from this platform that the old biological laboratory was ready for use,—that set of rooms in the third story of this building, which, inconvenient in many respects as it was, will, I trust, always be remembered by some of us with affection, and mayhap with a little pride.

This night on which we have met to celebrate the completion of the new laboratory is an occasion for looking forward rather than back. But before proceeding to speak in detail of the new building, I feel sure I do what every one of the members of the biological department present would think me remiss to omit, in pausing a moment to express our gratitude to those to whom we owe it,—first to our founder, Johns Hopkins, for his munificence; and next to his trustees. Probably very few present realize how much time and thought the trustees spent on the building before a stone of the foundation was laid, and during its erection. No one but myself knows how often I have been put in good heart by the cheering words, "Well, Dr. Martin, let us get it right when we are about it." In this connection I cannot refrain from saying, that, while we owe all so much, we owe a special debt of gratitude to Mr. J. Hall Pleasants, the chairman of the building committee. Throughout the summer there was hardly a morning on which he did not visit the building; and that not merely for a glance, but far more often to spend an hour or two hours in or about it, and make sure that all was going right.

The material result of this liberality, forethought, and supervision is that stately building on the top of the hill. Handsome though not ostentatious, comfortable but not luxurious, pleasant to work in without unnecessary finery, it stands there, for its purpose unrivalled in the United States, and not surpassed in the world.

Substantial, solid, well thought out, suited to its ends, and with no frippery about it, it is now for the biologists to see that their work agrees in character with the building.

There are many here to-night, who, not being biologists, may desire to know what such laboratories are for, and why there is any need of them. I shall perhaps best begin my attempt to answer these questions by stating briefly what our own laboratory is.

It is a building constructed primarily to afford facilities for instruction and research in physiology; and secondarily, similar opportunities in allied sciences, as comparative anatomy and botany, some training in which is essential (and the more the better) to everyone who would attain any real knowledge of physiology. As so many distinct branches of biological science are pursued in it, we call it in general the biological laboratory; but it is a biological laboratory deliberately planned that physiology in it shall be queen, and the rest her handmaids. If, therefore, you visit the building prepared to see a great zoölogical museum or an extensive herbarium, you will be disappointed. I do not underrate, and no one connected with this university can,—having in mind the brilliant anatomical researches of Dr. Brooks and others, made among us,—the claims of morphology; and in time I trust we may see a sister building specially designed for study of the structure, forms, and development of plants and animals. But one or the other had to be first chosen unless we were to do two things imperfectly instead of one well, and there were strong reasons for selecting physiology. In the first place, I think even the morphologists will admit that hitherto, and especially in the United States, they have had rather more than their fair share; numerous museums and laboratories have been built for their use; while physiology, if she got anything, has been usually allotted some out-of-the-way room in an entirely unsuitable building, if no one else wanted it; and been very glad to get even that. A second and still stronger reason is, that as medicine is slowly passing out of the regions of empiricism and rule-of-thumb treatment, or mal-treatment, it has become evident that sound physiology is its foundation; and this university will at no distant day have a medical school connected with it.

As you walk presently through the rooms of the new building, and see the many instruments of precision for teaching and research—the batteries, galvanometers, induction-coils, and spectroscopes; the balances, reagents, and other appliances of a chemical laboratory; the microscope for every student; the library of biological books and journals; the photographic appliances; the workshop for the construction and repair of instruments—when you see these things, it may interest you to recall that sixty years ago there was not a single public physiological laboratory in the world; nor was there then, even in any medical school, a special professor of physiology. So late as 1856 Johannes Müller taught in Berlin human anatomy, comparative anatomy, pathological anatomy, physiology, and embryology.

DuBois-Reymond, now himself professor in Berlin, has graphically described the difficulties of the earnest student of physiology, when he attended Müller's lectures in 1840.*

"We were shown a few freshly prepared microscopic specimens (the art of putting up permanent preparations being still unknown), and the circulation of the blood in the frog's web." So much for the histological side.

"We were also shown the experiment of filtering frog's blood to get a colorless clot, an experiment on the roots of the spinal nerves, some reflex movements in a frog, and that opium-poisoning was not conducted along the nerves. There were some better experiments on the physiology of voice,—a subject on which Müller had recently been working; and there was finally a demonstration of the effect upon respiration of dividing the pneumogastric nerves."

In all, you see six experiments or sets of experiments, in the whole course, in addition to the exhibition of some microscope slides; and all these mere demonstrations. It was hardly thought of that a student should use a microscope, or make an experiment, himself. If he desired to do so, the difficulties in his way were such as but few overcame.

"He must experiment in his own lodgings, where on account of his frogs he usually got into trouble with the landlady, and where many researches were impossible—there were no trained assistants to guide him—no public physiological library—no collection of apparatus. We had to roll our own coils, solder our own galvanic elements, make even our own rubber tubing, for at that time it was not an article of commerce. We sawed, planed, and drilled—we filed, turned, and polished. If through the kindness of a teacher a piece of apparatus was lent to us, how we made the most of it—how we studied its idiosyncrasies—above all, how we kept it clean."

Of course certain men, the men who were born to become physiologists, and not mere students of physiology, surmounted these difficulties. One has only to recall the names of DuBois-Reymond himself, and of his contemporaries, Brücke, Helmholtz, Ludwig, Vierordt, Donders, and Claude Bernard, to realize that fact: and undoubtedly there was a good side to it all. Triflers were eliminated; and the class of individuals was unknown who sometimes turn up at modern laboratories (and judging from a good deal of current physiological literature, sometimes get admitted to them) with a burning desire to undertake forthwith a complicated research, though they hardly know an ordinary physiological instrument when they see it; much less know how to handle it. But they cannot wait; they must begin the next morning, believing, I presume, that laboratories are stocked with automatic apparatus,—some sort of physiological sausage-machines, in which you put an animal at one end, turn the handle, and get out a valuable discovery at the other.

*Emil DuBois-Reymond. *Der physiologische Unterricht, sonst und jetzt.* Berlin, 1878. The quotations from this pamphlet, while giving, I trust, a true idea of the substance of DuBois-Reymond's statements, have been curtailed, and are not to be regarded as literal full translations of the original.—H. N. M.

With one exception, Berlin was not in 1840 worse off than other German universities so far as facilities for physiological study were concerned, and certainly better off than any university in England or the United States. The exception was in Breslau, where the celebrated Purkinje, single-handed, had founded a physiological institute. It has usually been supposed that in this he followed the example of Liebig, who founded at Giessen the first public chemical laboratory; but this, *pace* the chemists, can hardly have been the case. It is to Purkinje that the honor belongs of founding the first public laboratory. Liebig undoubtedly conceived the plan when working in Paris in Gay Lussac's private laboratory, but it was not until 1826 that he began to put it into execution; and at that date Purkinje had already, largely at his own cost, started a physiological laboratory at Breslau, open to students,—on a small scale, it is true, but still the germ of all those great laboratories of physics, chemistry, and biology, which are now found in every civilized country, and to which, more than to anything else, modern science owes its rapid progress. Of these there must be at least forty now organized for physiological work; and almost every year sees an increase in their number. How has this come about in the fifty odd years which have passed since the opening of Purkinje's poorly-equipped and little known workrooms?

First, because of the improvement in philosophy which took place when men began to break loose from the trammels of mediaeval metaphysics, and to realize that a process is not explained by the arbitrary assumption of some hypothetical cause invented to account for it. So long as the phenomena exhibited by living things were regarded, not as manifestations of the properties of the kind of matter of which they were composed, but as exhibitions of the activity of an extrinsic independent entity,—a *pneuma, anima, vital spirit*, or *vital principle* which had temporarily taken up its residence in the body of an animal, but had no more essential connection with that body than a tenant with the house in which he lives,—there was no need for physiological laboratories. Dissection of the dead body might, indeed, be interesting as making known the sort of machine through which the vital force worked,—just as some people find it amusing to visit the former abode of a great author, and see his library and writing-table and inkstand; and there might be discussions as to the locality of the body in which this vital force resided; to carry out our simile, as to what was its favorite armchair. Various guessers placed it in the heart, the lungs, the blood, the brain, and so forth. Paracelsus, with more show of reason, located it in close connection with the stomach, on the top of which he supposed there was seated a chief vital spirit, Archaeus, who superintended digestion. It is mainly to Descartes,* who lived in the earlier half of the seventeenth century, that physiology owes the impulse which set it free from such will-o'-the-wisps. Putting aside all consciousness as the function of the soul, he maintained that all other vital phenomena were due to properties of the material of which the body is composed; and that death was not due to any defect of the soul, but to some alteration or degeneration in some part or parts of the body.

The influence of Descartes, and, in the same half-century, the demonstration of the circulation of the blood by Harvey, gave a great impulse to experimental physiology. Both Harvey and Descartes, however, still believed in a special locally placed vital spirit or *force* which animated the whole bodily frame; as the engine in a great factory moves all the machinery in it. What a muscle did, or a gland did, depended on the structure and properties of the muscle or gland; but the work-power was derived from a force outside those organs,—on vital spirits supplied from the brain along the nerves, or carried to every part in the blood. As the pattern of a carpet depends on the structure and arrangement of the loom,—which loom, however, is worked by a distant steam-engine,—so the results of muscular or glandular activity were believed to be determined by the structure of muscle and gland; but the moving-force to come from some other part of the body.

The next important advance was made by Haller, about the middle of the eighteenth century. He demonstrated that the contracting-power of a muscle did not depend on vital spirits carried to it by nerve or blood, but on properties of the muscle itself. Others had guessed, Haller proved, that the body of one of the higher animals is not a collection of machines worked by a central motor, but a collection of machines each of which is in itself both steam-engine and loom; leaving aside, of course, certain of the purely mechanical supporting and protecting apparatuses of the skeleton. This was the death-blow of the 'vital force' doctrine. Extensions of Haller's method showed that it was possible to destroy the brain and spinal cord of an animal, and separate its muscles, its heart, its nerves, its glands, and yet keep all these isolated organs working as in normal life for many hours. Henceforth the *life* of an animal could not be regarded as an entity residing in one region of the body, from which it animated the rest; the word gradually became a mere convenient phrase for expressing the totality or *resultant* of the actions of the individual organs. Physiologists began to see that they had nothing to do with hunting out a vital force, or with essences or absolutes; that their business was to study the phenomena exhibited by living things, and leave the noumena, if there were such, to amuse metaphysicians. Physiology became more and more a study of the mechanics, physics, and chemistry of living organisms and parts of organisms.

Progress at first was necessarily very slow; physics and chemistry, as we now know them, did not exist. Galvanism was not discovered, osmosis was unknown, the conservation of energy was undreamed of; modern chemistry did not take its rise until the discovery of oxygen by Priestley, and the extension and application of that discovery by Lavoisier towards the close of the last century. Physiology had to wait then, as now, for its advance upon the development of the sciences dealing with simpler forms of matter than those found in living things. But little by little, step after step, so many once mysterious vital processes have been explained as but special illustrations of general physical and chemical laws, that now the physiologist scans each advance in chemistry or physics in full confidence that it will enable him to add others to the phenomena of living bodies, which are in ultimate analysis not peculiar or 'vital,' but simply physico-chemical. Apart from the phenomena of mind, whose mysterious connection with forms of matter he can never hope to explain, if a physiologist were to-day asked what is the object of his science, he would answer, "not the discovery or the localization of a vital force, but the study of the quantity of oxidizable food taken into the stomach, and the quantity of oxygen absorbed in the lungs; the calculation of the energy or force liberated by the combination of the food and oxygen; observation of the way in which that force has been expended, the means by which its distribution has been influenced, and the form in which the unused matter, if any, has been stored."

Once it was recognized that the majority of physiological problems were problems admitting of experimental investigation, the necessity for special collections of apparatus suitable for experiment on living plants and animals, and for affording students an opportunity to study the play of forces in living organisms, had not long to wait for recognition. Physiological laboratories were organized: at first in such rooms as could be spared in buildings constructed for other purposes; later, in structures built for this special end. The first laboratory specially erected for physiological work was built for Vierordt, in Tübingen, less than twenty years ago. So far as I know, our own is the first such building in the United States.

There is still another reason which has combined with the recognition of the independence of physiology as a science to make the modern laboratory, open to all properly prepared students, a possibility; and physiology owes it to this country. I do not forget how Brown-Sequard in Philadelphia clinched and completed Bernard's great discovery of the vaso-motor nerves; nor the researches of Weir Mitchell on the functions of nerve-centres, and the action of snake-poisons; nor, in later years, the researches of Wood on the physiology of fever; and, on various subjects, of Bowditch, Arnold, Flint, Minot, Sewall, Ott, Chittenden, Prudden, Keyt, Sedgwick, and others. But speaking with all the diffidence which one, who, at least by birth, is a foreigner, must feel in expressing such an opinion, I say, that considering the accumulated wealth of this country, the energy which throbs throughout it, and the number of its medical schools, it has not done its fair share in advancing physiological knowledge; but for one thing, which makes the world its debtor. I mean the discovery of anaesthetics. When Morton in 1846, demonstrated in the Massachusetts General Hospital that the inhalation of ether could produce complete insensibility to pain, he laid the foundation-stone of our laboratory, and of many others. No doubt the men whose instincts led them to physiological research, and who realized that by the infliction of temporary pain on a few of the lower animals they were discovering truths which would lead to alleviation of suffering and prolongation of life, not only in countless generations of such animals themselves, but in men and women to the end of time, would have tried to do their work in any case. But those who can steel their hearts to inflict present pain for future gain are few in number. The discovery of anaesthetics has

*See Huxley: *The connection of the biological sciences with medicine* (*The Lancet*, Aug. 13, 1881).

not only led to ten physiological experimenters for each one who would have worked without them, but by making it possible to introduce into the regular course of physiological teaching demonstrations and experiments on living animals, without shocking the moral sense of students or of the community at large, has contributed incalculably to the progress of physiology.

On the occasion of the opening of the old laboratory I used these words: * —

"Physiology is concerned with the phenomena going on in living things, and vital phenomena cannot be observed in dead bodies; and from what I have said you will have gathered that I intend to employ vivisections in teaching. I want, however, to say, once for all, that here, for teaching purposes, no painful experiment will be performed. Fortunately the vast majority of physiological experiments can nowadays be performed without the infliction of pain; either by the administration of some of the many anaesthetics known, or by previous removal of parts of the central nervous system; and such experiments only will be used here for teaching. With regard to physiological research, the case is different. Happily here, too, the number of necessarily painful experiments is very small indeed; but in any case where the furtherance of physiological knowledge is at stake—where the progress of that science is concerned, on which all medicine is based, so far as it is not a mere empiricism—I cannot doubt that we have a right to inflict suffering upon the lower animals, always provided that it be reduced to the minimum possible, and that none but competent persons be allowed to undertake such experiments."

Those words were a declaration of principle, and a pledge given to this community, in which I was about to commence my work. That the work has been carried on for seven years among you, without a murmur of objection reaching my ears, is sufficient proof that Baltimore assents to the principle; and, gratifying as the building of our new laboratory is to me from many points of view, there is none so grateful as its witness, that, in the opinion of our trustees and of my fellow-citizens, I have carried out my pledge. There has been no hole-and-corner secrecy about the matter: the students in the laboratory have been no clique living isolated in a college building; but either your own sons, or boarders scattered among dozens of families in this city; and no room in the laboratory has ever been closed to any student: what we have done has been open to all who cared to know. On this occasion, when we make a fresh start, I desire to re-assert the principle, and repeat the pledge.

We have seen that Haller laid the foundation of our knowledge that the body of one of the higher animals is essentially an aggregation of many organs, each having a sort of life of its own, and in health co-operating harmoniously with others for the common good. In the early part of this century, before scientific thought had freed itself from mediaeval guidance, this doctrine sometimes took fantastic forms. For example, a school arose which taught that each organ represented some one of the lower animals. DuBois-Reymond relates that in 1838 he took down these notes at the lectures of the professor of anthropology: —

"Each organ of the human body answers to a definite animal, is an animal. For example, the freely movable, moist, and slippery tongue is a cuttlefish. The bone of the tongue is attached to no other bone in the skeleton; the cuttlefish has only one bone, and consequently this bone is attached to no other. It follows that the tongue is a cuttlefish."

However, while Professor Steffens and his fellow transcendentalists were theorizing about organs, others were at work studying their structure; and a great step forward was made in the first year of our century by the publication of Bichât's 'Anatomie générale.' Bichât showed that the organs of the body were not the ultimate living units, but were made up of a number of different interwoven textures, or *tissues*, each having vital properties of its own. This discovery paved the way for Schwann and Schleiden, who laid the foundation of the cell-theory; and showed, that, in fundamental structure, animals and plants are alike, the tissues of each being essentially made up of aggregates of more or less modified microscopic living units called *cells*. Our own generation has seen this doctrine completed by the demonstration that the essential constituent of the cell is a peculiar form of matter named protoplasm, and that all the essential phenomena of life can be manifested by microscopic bits of this material; that they can move, feed, assimilate, grow, and multiply; and still further, that, wherever we find any characteristic vital activity, we find some variety of protoplasm. Physiology thus has become reduced in general terms to a study of the faculties of protoplasm; and morphology to a study of the forms which units or aggregates of units of protoplasm, or their products, may assume. The isolation of botany, zoölogy, and physiology, which was threatened through increased division of labor, due to increase of knowledge necessitating a limitation of special study to some one field of biology, was averted; and the reason was given for that principle which we have always insisted upon here,—that beginners shall be taught the broad general laws of living matter before they are permitted to engage in the special study of one department of biology.

If I be asked, what have biological science in general and physiology in particular done for mankind to justify the time and money spent on them during the past fifty years, I admit it to be a perfectly fair question; fortunately it is one very easy to answer. Leaving aside the fruitful practical applications of biological knowledge to agriculture and sanitation, I will confine myself to immediate applications of the biological sciences to the advance of the theory, and, as a consequence, of the art of medicine.

So long as the life of a man was believed to be an external something distinct from his body, but residing in it for a while, diseases were naturally regarded as similar extrinsic essences or entities, which invaded the body from without, and fought the 'vital force.' The business of the physician was to drive out the invader without expelling the vital spirits along with it,—an unfortunate result, which only too often happened. To the physicians of the sixteenth century a fever was some mysterious extraneous thing, to be bled, or sweated, or starved out of the body, much as the medicine-men of savages try to scare it off by beating tomtoms around the patient. Once life was recognized as the sum total of the properties of the organs composing the body such a theory of disease become untenable, and the basis of modern pathology was laid. Disease was no longer a spiritual indivisible essence, but the result of change in the structure of some one or more of the material constituents of the body, leading to abnormal action. The object of the physician became, not to expel an imaginary immaterial enemy, but to restore the altered constituent to its normal condition.

The next great debt which medicine owes to biology is the establishment of the cell-doctrine,—of the fact that the body of each one of us is made up of millions of little living units, each with its own properties, and each in health doing its own business in a certain way under certain conditions; and no one cell being more the seat of life than any other. The activities of certain cells may, indeed, be more fundamentally important to the maintenance of the general life of the aggregate than that of others; but the cells, which, by position or function, are more essential than the rest, are, in final analysis, no more alive than they. Before the acceptance of the cell-doctrine pathologists were practically divided into two camps,—those who believed that all disease was primarily due to changes in the nervous system, and those who ascribed it to alteration of the blood. With the publication of Virchow's 'Cellular pathology' all this was changed. Physicians recognized that the blood and nerves might at the outset be all right, and yet disease originate from abnormal growth or action of the cells of various organs. This new pathology, like the older, was for a time carried to excess. We now know that there may be general diseases primarily due to changes in the nervous system, which binds into a solidarity the organs of the body; or of the blood, which nourishes all: but we have also gained the knowledge that very many, if not the majority, of diseases have a local origin, due to local causes, which must be discovered if the disease is to be successfully combated. An engineer, if he find his machinery running imperfectly, may endeavor to overcome this by building a bigger fire in his furnace, and loading the safety-valve. In other words, he may attribute the defect to general causes; and in so far he would resemble the old pathologists. But the skilled engineer would do something different. If he found his machinery going badly, he would not jump forthwith to the conclusion that it was the fault of the furnace, but would examine every bearing and pivot in his machinery, and, only when he found these all in good working-order, begin to think the defect lay in the furnace or boiler; and in that he would resemble the modern physician instructed in the cell-doctrine.

A third contribution of biology to medical science is the germ-theory as to the causation of an important group of diseases. To it we owe already antiseptic surgery; and we are all now holding our breath in the fervent expectation that in the near future, by its light, we may be able to fight scarlet-fever, diphtheria, and phthisis, not in the bodies of those we love, but in the breeding-places, in dirt and darkness, of certain microscopic plants.

From one point of view the germ-theory may seem a return to the idea that diseases are external entities which attack the body; but note the difference between this form of the doctrine and the ancient! We are no

* *Pop. sc. monthly*, December, 1876.

longer dealing with immaterial, intangible, hypothetic *somethings*; the modern practitioner says, "Well, show me the bacteria, and then prove that they cause the disease: until you can do that, do not bother me about them."

It is worth while, in passing, to note that these three great advances in medical thought were brought about by researches made without any reference to medicine. Haller's purely physiological research into the properties of muscles laid the foundation of a rational conception of disease. The researches of Schwann on the microscopic structure of plants, and since then researches of others on the structure of the lowest animals, led to the cellular pathology. Antiseptic surgery is based on experiments carried out for the sole purpose of investigating the question as to spontaneous generation. My friend Dr. Billings has described "the languid scientific swell, who thinks it bad style to be practical, and who makes it a point to refrain from any investigations which lead to useful results, lest he might be confounded with mere practical men." Well, I am sorry for the swell! because, for the life of me, I cannot see how he can make any investigations at all. The members of his class must be so few in number that we need not waste much grief on them. I never have met with an investigator who would not be rejoiced to find any truth discovered by him put to practical use; and I feel sure that in this day and generation the chief danger is that disproportionate attention will be devoted to practical applications of discoveries already made, to the exclusion of the search for new truth. So far as physiology is concerned, it has done far more for practical medicine since it began its own independent career, than when it was a mere branch of the medical curriculum. All the history of the physical sciences shows that each of them has contributed to the happiness and welfare of mankind in proportion as it has been pursued by its own methods, for its own ends, by its own disciples. As regards physiology, this is strikingly illustrated by a comparison of the value to medicine of the graduation theses of Parisian and German medical students. A candidate for the doctorate of medicine in France or Germany, as in many schools here, must present a graduation thesis on some subject connected with his studies. Every year a certain number select a physiological topic. The French student usually picks out some problem which appears to have a direct bearing on the diagnosis or treatment of disease, while the German very often takes up some physiological matter which on the surface has nothing to do with medicine. Now, any one who will carefully compare for a series of years the graduation theses in physiology of German and French candidates, will discover that even the special practical art of medicine itself is to-day far more indebted to the purely scientific researches of the German students than to those of the French, undertaken with a specific practical end in view. Situated as we shall be here, in close relation to a medical school, and yet not a part of it, I believe we shall be under the best possible conditions for work. Not under too direct pressure from the professional staff and students on the one hand, on the other we shall be kept informed and on the alert as to problems in medicine capable of solution by physiological methods.

I must find time to say a few words as to the connection of physiology with pathology and therapeutics. The business of the physiologist being to gain a thorough knowledge of the properties and functions of every tissue and organ of the body, he has always had for his own purposes to place these tissues under abnormal conditions. To know what a muscle or a gland is, he has to study it not merely in its normal condition, but when heated or cooled, supplied with oxygen or deprived of it, inflamed, or starved; and see how it behaves under the influence of curari, atropine, and other drugs. From the very start of physiological laboratories a good deal of work done in them has necessarily been experimental pathology and experimental therapeutics. I suppose to-day that at least half of the work published from physiological laboratories might be classed under one or other of these heads. And what has been the fruit? I can here refer only to one or two examples. It it not too much to say, that, though inflammation is the commonest and one of the longest studied pathological states, we really knew nothing about it before the experimental researches of Lister, Virchow, and Cohnheim; and that all we really know as to the nature of fever is built on the similar researches of Bernard, Haidenhain, Wood, and others. As to therapeutics, so far as giving doses of medicine is concerned, it, still in its very infancy, had its birth as an exact science in physiological laboratories. Every modern text-book on the subject gives an account of the physiological action of each drug. What the future may have in store for us by pursuit of such inquiries it is hard to limit. The work of Bernard,—showing that in curari we had a drug that would pick out of the whole body, and act upon, one special set of tissues, the endings of the nerve-fibres in muscle,—and the results of subsequent exact experiments as to the precise action of many drugs upon individual organs or tissues, hold out before us a hope that, perhaps at no very distant day, the physician will know exactly, and in detail, what every drug he puts into his patient is going to do within him.

Pathology and therapeutics, while almost essential branches of physiological inquiry, have nevertheless their own special aims; and, now that the physiologists have proved that it is possible to study these subjects experimentally, special laboratories for their pursuit are being erected in Germany, France, and England. These laboratories are stocked with physiological instruments, and carry on their work by physiological methods. Those who guide them, and those who work in them, must be trained physiologists: if not, the whole business often degenerates into a mere slicing of tumors and putting up of pickled deformities: pathological anatomy is a very good and very important thing in itself, but it is not *pathology*. Looking at the vast field of pathological and therapeutic research open to us, and bearing in mind the certainty of the rich harvest for mankind which will reward those who work on it, I believe it one of my chief duties to prepare in sound physiological doctrine and a knowledge of the methods of experiment, students who will afterwards enter laboratories of experimental pathology and pharmacology immediately connected with a medical school.

If the relations of the biological sciences to medicine be such as I have endeavored to point out, what place should they occupy in the medical curriculum? That men fitted for research, and with opportunity to pursue it, should be trained to that end, is all well and good; but how about the ninety per cent who want simply to become good practitioners of medicine? What relation is this laboratory to hold to such men, who may come to it, intending afterwards to enter a medical school? As a part of their general college-training, affording that education of a gentleman which every physician should possess, it should give a sound knowledge of the general laws which govern living matter, without troubling students with the minutiae of systematic zoölogy or botany; it should enable them to learn how to dissect, and make them well acquainted with the anatomy of one of the higher animals; it should teach them how to use a microscope; and the technique of histology; and finally, by lectures, demonstrations, and experiment, make known to them the broad facts of physiology, the means by which those facts have been ascertained, and the basis on which they rest. The student so trained, while obtaining the mental culture which he would gain from the study of any other science, is especially equipped for the study of medicine. Taught in other parts of his general collegiate course to speak and write his own language correctly, having acquired a fair knowledge of mathematics and Latin, able to read at least French and German, having learned the elements of physics and chemistry, and in addition, having studied the structure and properties of the healthy body, he can, on entering the technical school, from the very first turn his attention to professional details. Knowing already the anatomy of a cat or a dog, he knows a great part of human anatomy, and need do little but acquaint himself with the surgical and medical anatomy of certain regions. Knowing normal histology, he can at once turn his attention to the microscopy of diseased tissues. Well instructed in physiology, he can devote himself to its practical applications in the diagnosis and treatment of disease. The demand for an improvement in medical education, which has been so loudly heard in England and this country for some years, is (the more I think of it, the more I feel assured) to be met, not, as has been the case in England, by putting more general science into the medical curriculum, but by confining that curriculum to purely professional training, and providing, as we have attempted to do here, non-technical courses for undergraduates, which, while forming part of a liberal education, also have a distinct relation to their future work. I regard it as the most important of my duties, to prepare students to enter medical schools in this city or elsewhere.

To advance our knowledge of the laws of life and health; to inquire into the phenomena and causes of disease; to train investigators in pathology, therapeutics, and sanitary science; to fit men to undertake the study of the art of medicine,—these are the main objects of our laboratory. I do not know that they can be better summed up than in the words of Descartes, which I would like to see engraved over its portal: "If there is any means of getting a medical theory based on infallible demonstrations, that is what I am now inquiring." (*Reprinted from Science, January* 18, 25, 1884).

CHESAPEAKE ZOÖLOGICAL LABORATORY.

Report of the Director for its first six years, 1878-83.

To the President of the Johns Hopkins University:

SIR: In accordance with your request to prepare an outline or summary of the work of the marine laboratory during the six years of its existence, I have the pleasure to submit in connection with the report of the sixth session, the following review of the history of the five preceding years.

FIRST YEAR, (1878), AT FORT WOOL, VA.

In 1878, the Trustees of the Johns Hopkins University made a small appropriation, in order to enable a party of biological students to spend a few weeks at the seashore in the study of marine zoölogy under my direction. Permission was given us by the Secretary of War, through the influence of Maj. Gen. Q. A. Gillmore, to occupy the vacant buildings at Fort Wool. Prof. Spencer F. Baird also exerted his influence with the Secretary of War in our behalf, and aided us in many other ways; furnishing us with dredging apparatus and with three small row boats, which were used during the summer. The vacant buildings at Fort Wool were not sufficient for our accommodation, as only one of them was in sufficiently good repair for use, and the watchman in charge of the fort, Mr. Allen, readily consented to vacate for us all but one of the rooms in his house, and much of the success of our first season was due to his interest in our work.

Three students, who were not connected with the University, asked for permission to join our party, which, with these additions, consisted of eight persons, and we remained at the fort for seven weeks.

The scientific results of our season's work were printed in an illustrated volume, the cost of publishing which was born by citizens of Baltimore, among whom were Samuel M. Shoemaker, John W. Garrett, John W. McCoy, Enoch Pratt, P. R. Uhler, President Gilman, Professor Martin, and others.

Among these papers the most noteworthy were one on the "Development of Lingula" and one on the "Early Stages of Squilla." Both of these papers were reprinted in foreign journals, and their contents have since been incorporated in the best foreign text-books of zoölogy, such as Claus' "Zoölogie" and Balfour's "Comparative Embryology."

SECOND YEAR, (1879), AT CRISFIELD, MD., AND FORT WOOL, VA.

The appropriation for the maintenance of the laboratory was continued by the Trustees of the University for the next year.

In order to present an opportunity for studying the oyster beds of the Bay, and thus secure the coöperation of Maj. Ferguson, Assistant U. S. Fish Commissioner, I determined to open the laboratory at Crisfield, a point which is unfavorable in most other respects. The laboratory was accordingly opened at Crisfield on the 25th of June in three of the barges of the Maryland Fish Commission.

I stated in the preliminary announcement that the laboratory would be moved to some more desirable locality farther down the Bay, about July 10, but the transportation of the barges was attended with so much expense that I was not able to move them to the second station, and we occupied them at Crisfield until August 8. During part of this time, Maj. Ferguson's steam yacht, the Lookout, which he had fitted up with steam dredging apparatus for the purpose, was with us, and rendered valuable help in dredging and collecting. Through Maj. Ferguson's influence we also had the use of a small steam launch which was detailed for the purpose from the U. S. Navy.

Early in August the mosquitoes became so numerous as to render the barges uninhabitable, and we transferred our outfit to our old quarters at Fort Wool, which had again been placed at our service by Maj. Gen. Q. A. Gillmore, U. S. A., and where Mr. Allen again placed his private quarters at our service.

At the beginning of this session, which lasted for eleven weeks, a circular was issued by the University inviting other naturalists to avail themselves of our facilities, upon the payment of a small fee, and some of our party of twelve were persons who came from other institutions.

Among the more important of the published results of this season's work were a paper on the Development of the Oyster, one on the Metamorphosis of Phornis, one on the Development of the Squid, and one on the Metamorphosis of Panopaeus.

THIRD, FOURTH, AND FIFTH YEARS, (1880–82), AT BEAUFORT, N. C.

The next year, the Trustees of the University voted to continue the laboratory for three years more, and they provided a liberal annual appropriation for the current expenses, and they also voted that the sum of $4,500 be appropriated for the purchase of outfit, &c. After an examination of all the available localities, the town of Beaufort, N. C., about four hundred miles south of Baltimore, was selected as the site for the laboratory, and as a vacant house, suitable for the accommodation of a small party, was found there, it was rented for three years, and as none of the $4,500 was needed for the erection of a building, most of it was used, by the permission of the Trustees, in the purchase of two boats, for collecting. One of these, a Herreshoff launch, twenty-seven feet long, and eight feet beam, was built for us in 1880, and the second, a sloop forty-seven feet long and fourteen feet beam, was purchased in the summer of 1883.

The natural advantages of Beaufort are very great, as the fauna is exceptionally rich and varied, abounding in forms which are of peculiar interest.

The configuration of our coast line is such that Cape Hatteras, the most projecting point south of New York, deflects the warm water of the Gulf Stream away from the coast, and thus forms an abrupt barrier between a cold northern coast and a warm southern one. The fauna north of this barrier passes gradually into that of Southern New England, while the fauna south of the barrier passes without any abrupt change into that of Florida, but the northern fauna is sharply separated by Cape Hatteras from the southern.

As the laboratory of the U. S. Fish Commission and Mr. Agassiz's laboratory at Newport afford opportunities for work upon the northern fauna, it seemed best for us to select a point south of Cape Hatteras in order to study the southern fauna with the same advantages, and as Beaufort is the only town near the Cape which can be reached without difficulty, it was chosen as the best place for the laboratory.

The situation of this town is exceptionally favorable for zoölogical work, for the surrounding waters present such a diversity of conditions that the fauna is unusually rich and varied.

Close to the town there are large sand bars, bare for miles at low tide, and abounding in animal life. From these we could collect an unfailing supply of Amphioxus, Renilla, Limulus, Balanoglossus, Sea Urchins, and a great variety of Molluscs and Crustacea.

The mud flats furnished us with another fauna, and yielded a great variety of Annelids, a new set of species of Crustacea and Molluscs, Gephyreans, Echinoderms, and Polyps. The large salt marshes gave us a third fauna, and a short distance inland large swamps of brackish and fresh water furnished still other conditions of life.

As the town is situated at the point where Gore Sound connects Pamlico Sound with Bogue Sound, we were within easy reach of a continuous sheet of landlocked salt water more than a hundred miles long, and these Sounds furnished still another collecting and dredging ground, abounding in Corals, Gorgonias, Ascidians, Star Fish, Sea Urchins, and a new set of Molluscs and Crustacea.

As most of the shores are flat and sandy those animals which live upon a sandy bottom are much more abundant than those which attach themselves to solid bodies, but the stone breakwaters at Fort Macon, the wharves at Beaufort and Morehead City, and the large oyster beds which are found in the Sounds furnish a proper habitat for many fixed animals, and yielded us a rich supply of Hydroids, Corals, Ascidians, Sea Anemones, Sponges, Cirripeds, &c. The ocean beach within a short distance of the town furnished still another fauna, and a sail of three miles from the laboratory carried us to a good locality for ocean dredging.

The greatest advantage of the locality is the richness of its pelagic fauna. There are very few points upon land which are so situated that the surface animals of mid-ocean can be procured in abundance for laboratory work, and as careful work is very difficult on shipboard, a laboratory which can be supplied with a good number of living pelagic animals presents opportunities for work in an extremely interesting and almost new field.

The Gulf Stream is constantly sweeping these animals northwards along the North Carolina coast, and as the tide sets in through Beaufort Inlet into the Sounds the floating animals are carried with it. Such oceanic animals as Physalia and Porpita were frequently thrown, uninjured and in perfect health, upon the beach within twenty feet of the laboratory, and during the season we found nearly all the Siphonophora which are known to occur upon our Atlantic coast.

With all these advantages we enjoyed a mild and uniform climate which enabled us to work in perfect comfort during the hottest months of summer.

The zoölogical resources of Beaufort have not escaped the attention of American naturalists, and there are few places upon our coast, outside of New England, where more zoölogical work has been done. In 1860, Drs. Stimpson and Gill spent a season in dredging and collecting in the vicinity of Beaufort, Cape Lookout, and Cape Hatteras, and an account of their work was published in the *American Journal of Science*. Dr. Coues, who was stationed at Fort Macon during the war, occupied himself for two years in collecting the animals which are found here, and he published a series of papers on the "Natural History of Fort Macon and Vicinity" in the *Proceedings of the Academy of Natural Sciences of Philadelphia.*

These papers, which were continued by Dr. Yarrow, contain copious and valuable notes on the habits and distribution of the animals which were observed, and we found them a great help to us. These two naturalists found four hundred and eighty species of animals in the vicinity of Beaufort. Of these four hundred and eighty, two hundred and ninety-eight are vertebrates, and one hundred and eighty-two are invertebrates. Of the vertebrates twenty-four are mammals, one hundred and thirty-three are birds, twenty seven are reptiles, six batrachians, ninety-seven fishes and eleven selachians. Of the invertebrates one hundred and forty-seven are molluscs, twenty-one are crustaceans. The list of vertebrates is very nearly complete, and we made few additions to it, but the list of invertebrates is obviously very imperfect, and, although we made no attempt to tabulate the species which we observed, there would be no difficulty in enlarging the list twenty or thirty fold.

Among other naturalists who have spent more or less time at Beaufort, I may mention Professor L. Agassiz, Professor E. S. Morse, Dr. A. S. Packard, Professor Webster, and Professor D. S. Jordan. Professor Morse procured most of the material for his well known paper on the Systematic Position of the Brachiopoda on the sand bars in Beaufort Inlet.

During the years 1880, 1881, and 1882, the laboratory at Beaufort was occupied by our party for sixty-four weeks in all, and twenty-two persons availed themselves of its facilities for research.

Among the published results of our investigations, lists of which have been printed in your annual reports, two papers deserve especial mention.

One of these, a monograph on the Development of Lucifer, has been printed with eleven quarto plates in the *Philosophical Transactions of the Royal Society*, while another on the Anatomy and Development of Renilla, with fourteen plates, is now in the press of the Royal Society, and is to appear soon.

Sixth Year, (1883), at Hampton, Va.

In the spring of 1883, the Trustees of the University voted to continue the annual appropriation for the current expenses of the laboratory for two years more.

My duties this summer as a Commissioner, appointed by the Governor of Maryland to examine the condition of the oyster beds of the State, compelled me to spend the season in the Chesapeake Bay, and the removal of the laboratory from Beaufort, N. C., where it had been for three years, was therefore decided upon.

The absence of buildings for the accommodation of our party at any suitable point upon the Bay except at Fort Wool and Hampton, restricted us to these two places in our selection of a laboratory. Application was made to the Secretary of War, through Maj. Gen. Q. A. Gillmore, for permission to occupy the buildings at Fort Wool, and this permission was granted; but upon visiting the fort I found the buildings so ruinous, and the wharf so injured by storms, that I decided that it would not be prudent for our party to spend the season there, and as Gen. S. C. Armstrong, the President of the Hampton Normal and Industrial Institute, kindly consented to permit our party to use an unoccupied building which had just been erected by the Institute as a machine shop, the second floor and attic were rented by the University for the season, and were occupied by the members of our party from May 1 to October 1.

The second floor room, which is large and well lighted, furnished ample laboratory accommodations, and the attic was used as lodgings.

The location was found to be a bad one, as the collecting grounds were distant and far apart, and the fauna was not rich, but researches were carried on upon the following subjects, among others: the anatomy and development of barnacles, the anatomy and development of crabs, the histology of Eudendrium, the anatomy and development of Balanoglossus, the development of the oyster, the anatomy of Lingula, the protozoea stage of crabs, the development of Annelids, the anatomy and development of Chrysaora, the origin of the eggs of hybrids and tunicates, the function of the semi-circular canals of sharks, and the general zoölogy of the Hydro-Medusae. Most of my own time for the last year has been given to the study of the oyster industry of Maryland, and my results will be stated in the report of the Oyster Commission, which is now in press.

Propagation of the Oyster.

During the past year experiments which have been carried on in France and in this country have resulted in the practical application of the methods of artificial oyster propagation, which were discovered at the laboratory five years ago, and the great economic importance of the subject will justify a short review of the history of these experiments.

Previously to 1879 our knowledge of the breeding habits of the oyster was entirely based upon the study of the oysters of northern Europe, and nothing whatever was known of the life history of the American oyster, as our writers had accepted without question the statements of foreign authorities. The oyster of northern Europe is hermaphrodite, and as the eggs are hatched inside the shell of the parent, and the young are thus carried and protected until they are ready to fasten themselves, good authorities had stated that it is not possible to rear oysters artificially.

In 1879, I found that the sexes are separate in the American oyster, and that the unfertilized eggs are thrown out in immense numbers into the water, where they are fertilized and develop without the need for any protection from their parents. I also showed that it is possible to fertilize the eggs artificially, and to rear the young oysters until long after they have acquired their shells, although I did not succeed in keeping them alive until they became attached. These experiments showed the perfect practicability of rearing oysters in unlimited numbers, as soon as the practical difficulties should be overcome.

A full account of my experiments and of the methods employed was published with figures of the early stages of the development of the oyster, in the first volume of the *Studies from the Biological Laboratory.*

While I was engaged in these experiments, Lieutenant Winslow, U. S. N., was engaged in surveying the oyster beds near the laboratory, which he visited in order to learn my methods. The next year, while stationed at Cadiz, Spain, he repeated the experiments with Portuguese oysters, and found that their breeding habits are exactly like those of the American species; that the sexes are separate; that the unfertilized eggs are thrown out into the water, and that the young can be reared from artificially fertilized eggs.

An account of his experiments was read before the Maryland Academy of Sciences in November, 1880, and it was afterwards published in the *American Naturalist.*

The next step which has resulted in the solution of the practical difficulties, and the rearing of oysters of economic value from artificially impregnated eggs, is due to experiments which were carried on by M. Bouchen-Brandely, under the auspices of the French Government.

In a paper, entitled "Rapport relatif à la génération et à la fécondation artificielle des huîtres, adressé au ministre de la marine et des colonies par M. Bouchen-Brandely, secrétaire du Collège de France," and published in

December, 1882, in the *Journal officiel de la République Française*, this author states that he was encouraged by the experiments which Brooks, of the Johns Hopkins University of Baltimore, had made upon *Ostrea virginica*, to attempt similar experiments with the Portuguese oyster, *Ostrea angulata*. He was ignorant of Winslow's experiments with this oyster, but after two years of experiments, he succeeded in independently establishing the fact that the sexes of the Portuguese oyster are separate; that the eggs are thrown out into the water; that the young are independent of parental protection, and that they can be reared from artificially fertilized eggs.

The methods by which he succeeded in rearing these young oysters are described in his report as follows. Two oyster planting ponds, separated from each other by a straight massive wall of earth, and having an area of about 100 metres each, and an average depth of about 1 metre, were placed in communication by means of a pipe which was closed at each end by a sponge, to filter sediment from the water and to guard against the accidental introduction of spat. The outlet from the ponds was guarded by a dam of fine sand confined between boards, and thus allowing the water to escape, but retaining the swimming embryos. Artificially impregnated eggs were then poured into the lower pond in great numbers during the latter part of June and the month of July. The pond was furnished with tiles for the attachment of the spat, and on July 24th each of these tiles was found to have, attached to its surface, twenty or thirty young oysters, about two-fifths of an inch in diameter. Finally, during the early part of October he states that he had the honor of presenting to the minister of the marine a tile, upon which two thousand young oysters could be counted, measuring from two-fifths to four-fifths of an inch in diameter.

This interesting paper, which has been translated into English by J. A. Ryder, and published in the *Bulletin of the U. S. Fish Commission* for April 19, 1883, shows the practicability of the economic application of the more purely scientific experiments which were carried on at our laboratory in 1879. The author acknowledges that he was incited by these experiments, and our own share in the work is therefore exactly what we should wish: the discovery of a new scientific truth, which has, in the hands of practical economists, contributed to the welfare of mankind.

Mr. John A. Ryder has this summer repeated these experiments in Maryland, and has shown that they are as successful here as they are in France. An account of his apparatus and of the results obtained has been published in the *Bulletin of the U. S. Fish Commission* for September 6, 1883, under the title "Rearing Oysters from Artificially Fertilized Eggs, together with notes on Pond Culture, &c.," by John A. Ryder.

SUMMARY.

During the six years of its existence, work has been carried on at the laboratory for one hundred and five weeks in all. It was attended by nine persons in 1878; by twelve in 1879; by six in 1880; by twelve in 1881; by eight in 1882; and by sixteen in 1883, thus making the total attendance sixty-three. The number of persons who have used the laboratory is only forty however, as many of them have spent two or three seasons there. One-half of the attendants were members of the Johns Hopkins University, and the rest were then or now connected with the Smithsonian Institution; the United States Fish Commission; the Academy of Natural Sciences, Philadelphia; University of Cambridge (St. John's College), England; the Ontario Agricultural College, Canada; or with the American colleges and schools indicated in the subjoined roll.

The scientific papers which have been published by our party, based wholly or in part upon the work done at the laboratory, include fifty-five titles, and they have been printed in the following journals: *Studies from the Biological Laboratory; Johns Hopkins University Circulars; American Naturalist; American Journal of Science; Memoirs of the Boston Society of Natural History; Zöologischer Anzeiger; London Quarterly Journal of Microscopical Science; Proceedings and Philosophical Transactions of the Royal Society*, London. Many of the papers have been reprinted, or summarized in foreign journals, but translations and summaries are not included in the enumeration given above.

A medal of the first class of the Société d'Acclimatation of Paris and one of the Walker Prizes of the Boston Society of Natural History have been awarded to members of our party for work which was done at the laboratory.

Within the last year Professor Mitsukuri, a naturalist who received his training in zoölogical research at our marine laboratory, has organized a similar laboratory on the coast of Japan, as a branch of the Government University of Tokio.

Yours respectfully,

W. K. BROOKS,
Director Chesapeake Zoölogical Laboratory.

BALTIMORE, *January*, 1884.

ROLL OF THE CHESAPEAKE ZOÖLOGICAL LABORATORY, 1878–83.

Director.

W. K. BROOKS, Ph. D.

Members.

J. E. ARMSTRONG, *Assistant in Natural History, Illinois Industrial University.* (*1881.*)
B. W. BARTON, M. D., *Baltimore.* (*1879.*)
W. BATESON, *St. Johns College, University of Cambridge, England.* (*1882.*)
EMIL BESSELS, M. D., *Smithsonian Institution.* (*1879.*)
E. A. BIRGE, *Professor of Zoölogy, University of Wisconsin.* (*1879.*)
S. F. CLARKE, Ph. D., *Professor of Natural History, Williams College.* (*1879, '81.*)
BUEL P. COLTON, A. B., *Teacher, Natural Science, Princeton (Ill.) High School.* (*1881*)
H. W. CONN, A. M., *Johns Hopkins University.* (*1882, '83.*)
CHARLES EARLE, *New York.* (*1883.*)
H. C. EVARTS, M. D., *Philadelphia.* (*1879, '80.*)
H. GARMAN, *Assistant, Illinois State Laboratory of Natural History.* (*1883.*)
O. P. JENKINS, A. M., *Johns Hopkins University.* (*1883.*)
J. W. KING, *Professor of Natural Science, Wisconsin State Normal School.* (*1880.*)
F. S. LEE, A. M., *Johns Hopkins University.* (*1883.*)
K. MITSUKURI, Ph. D., *Professor of Zoölogy, University of Tokio, Japan.* (*1879, '80.*)
J. PLAYFAIR MCMURRICH, *Assistant in Biology, University of Toronto.* (*1881, '83.*)
T. W. MILLS, M. D., *Montreal, Quebec.* (*1883.*)
H. F. NACHTRIEB, S. B., *Johns Hopkins Uuiversity.* (*1883.*)
W. L. NORRIS, *Arlington, Ill.* (*1881.*)
E. A. NUNN, *Professor of Biology, Wellesley College, Mass.* (*1879.*)
H. L. OSBORN, A. B., *Johns Hopkins University.* (*1882, '83.*)
HENRY F. OSBORNE, A. B., *Fellow, College of New Jersey.* (*1880.*)
J. H. PILLSBURY, *Professor of Natural Science, Springfield (Mass.) High School.* (*1882, '83.*)
H. J. RICE, M. S., *Teacher of Natural Science, Brooklyn, N. Y.* (*1879, '81.*)
FERNANDO SANFORD, *Professor, Natural Sciences, Mount Morris College, Ill.* (*1881.*)
AUGUST SCHMIDT, *Teacher of Natural Science, Baltimore.* (*1878, '79.*)
H. SEWALL, Ph. D., *Professor of Physiology, University of Michigan.* (*1878, '81, '83.*)
C. SIHLER, Ph. D., *Physician, Cleveland, Ohio.* (*1878, '79.*)
W. E. STRATTON, A. B., *Johns Hopkins University.* (*1883.*)
A. H. TUTTLE, S. B., *Professor of Zoölogy, Ohio State University, Columbus, Ohio.* (*1883.*)
JOHN M. TYLER, A. B., *Professor of Zoölogy, Amherst College.* (*1882.*)
P. R. UHLER, *Associate in Natural History, J. H. U.* (*1881.*)
N. B. WEBSTER, *Principal, Military Academy, Norfolk, Va.* (*1878.*)
T. B. WEBSTER, *Teacher, Military Academy, Norfolk, Va.* (*1878.*)
E. B. WILSON, Ph. D., *Lecturer on Biology, Williams College.* (*1879–82.*)
H. V. WILSON, A. B., *Johns Hopkins University.* (*1883.*)
J. M. WILSON, M. D., *Ann Arbor, Mich.* (*1882.*)
FRANCIS WINSLOW, *Lieut. United States Navy, United States Fish Commission.* (*1882, '83.*)

Published Results of Scientific Research at the Chesapeake Zoölogical Laboratory, 1878–83.

W. K. Brooks, Ph. D.:

The Development of Lingula and the Systematic Position of the Branchiopods. (*Scientific Results, Chesapeake Zoöl. Lab.*, 1879; *Arch. f. Zoöl. exp.*, 1881.)
The Larval Stages of Squilla empusa. (*Scientific Results, Chesapeake Zoöl. Lab.*, 1879.)
Abstract of Observations on the Development of the American Oyster. (*Zoöl. Anzeiger*, 1879.)
The Artificial Fertilization of Oyster Eggs and the Propagation of the American Oyster. (*Am. Jour. of Science*, 1879.)
The Development of the American Oyster. (*Report of the Maryland Fish Commission, and Studies from the Biol. Lab., J. H. U.*, 1880.)
The Acquisition and Loss of a Food Yolk in Molluscan Eggs. (*Studies from the Biol. Lab., J. H. U.*, 1880; 10 *plates.*)
The Development of the Cephalopoda and the Homology of the Cephalopod Foot. (*Am. Jour. of Science*, 1880.)
The Rhythmical Character of Segmentation. (*Am. Jour. of Science*, 1880.)
Budding in Free Medusæ. (*Am. Nat*, *Sept.*, 1880.)
Embryology and Metamorphosis of the Sergestidae. (*Zoöl. Anzeiger, Nov.*, 1880.)
The Young of the Crustacean Lucifer, A Nauplius. (*Am. Nat., Nov.*, 1880.)
The Development of the Squid. (*Anniv. Mem., Boston Soc. Nat. Hist., March*, 1881; 3 *plates.*)
Alternation of Periods of Rest with Periods of Activity in the Segmenting Eggs of Vertebrates. (*Studies from the Biol. Lab., J. H. U.*, 1881; 1 *plate.*)
The First Zoea of Porcellana. (With E. B. Wilson; *Studies from the Biol. Lab., J. H. U.*, 1881; 2 *plates.*)
List of the Medusae of Beaufort, N. C. I. (*Studies from the Biol. Lab., J. H. U.*, 1882.)
Origin of the Eggs of Salpa. (*Studies from the Biol. Lab., J. H. U.*, 1882; 1 *plate.*)
Lucifer: A Study in Morphology. (*Proc., Royal Soc., London*, 1881.)
The Development of Lucifer. (*Phil. Trans. Royal Soc., London*, 1882; 11 *plates.*)
Handbook of Invertebrate Zoölogy. (*Boston, Cassino*, 1882.)
Chamisso and the Discovery of Alternation of Generations. (*Zoöl. Anzeiger*, 1882.)
The Development of the Digestive Tract in Molluscs. (*Proc., Boston Soc. Nat. Hist.*, 1879.)
The Metamorphosis of Alpheus. (*Univ. Circular, No.* 17.)
The Metamorphosis of Penaeus. (*Univ. Circular, No.* 19.)
On the Origin of Alternation of Generations in Hydro-Medusae. (*Univ. Circular, No.* 22; *Ann. of Nat. Hist.*, Vol. 11, p. 455.)
Notes on the Medusae of Beaufort, N. C. II. (*Studies from the Biol. Lab., J. H. U.*, 1883.)
The Law of Heredity. (*Baltimore, Murphy*, 1883.)

W. Bateson:

Abstract of Observations on the Development of Balanoglossus. (*Univ. Circular, No.* 27.)

H. G. Beyer, M. D.—(See H. W. Conn.)

E. A. Birge:

Notes on the Development of Panopaeus Sayi. (*Studies from the Biol. Lab., J. H. U.*, 1883, 4 *plates.*)

S. F. Clarke, Ph. D.:

New Hydroids from Chesapeake Bay. (*Boston Soc. Nat. Hist.*, 1882.)

B. P. Colton, A. B.—(See H. Garman.)

H. W. Conn, A. M.:

Development of Tubularia Cristata. (*Univ. Circular, No.* 17.)
On Radial and Bilateral Symmetry in Animals. (*Univ. Circular, No.* 22; *Ann. of Nat. Hist.*, Vol. 12, p. 69; *Journal Royal Mic. Soc.*, Vol. 3, p. 633.)
An Instance of Sexual Variation in the Crustacea. (*Univ. Circular, No.* 27.)
Evidence of a Protozoea Stage in Crab Development. (*Univ. Circular, No.* 28.)
The Nervous System of Porpita. (With H. G. Beyer. *Studies from the Biol. Lab. J. H. U.*, 1883, 1 *plate.*)
Evolution of Decapod Zoea. (*Science, April*, 1884, *in press.*)
Significance of the Larval Skin of Decapods. (*Studies from the Biol. Lab., J. H. U.*, 1884, 2 *plates.*)
Life History of Thalassema. Abstract. (*Studies from the Biol. Lab., J. H. U.*, 1884, 1 *plate.*)

H. Garman:

List of a few additions to the Species of Birds, Reptiles, and Batrachians mentioned in Dr. Elliott Coues' paper on the Natural History of Fort Macon and Vicinity. (*Univ. Circular, No.* 22.)
Development of Arbacia punctulata. (With B. P. Colton. *Studies from the Biol. Lab., J. H. U.*, 1881.)

J. P. McMurrich:

Origin of the so-called Test Cells in the Ascidian ovum. (*Studies from the Biol. Lab., J. H. U.*, 1882.)
Abstract of Observations on the Osteology and Development of Syngnathus Peckeanus (Storer.) (*Univ. Circular, No.* 27.)
On the Osteology and Development of Syngnathus Peckeanus (Storer.) (*Quart. Journal Micros. Science, Vol. XXIII*, 2 *plates.*)

K. Mitsukuri, Ph. D.:

On the Structure and Significance of some Abberant Forms of Lamellibranchiate Gills. (*Quar. Jour. Micros. Sci., July*, 1881; *Studies from the Biol. Lab., J. H. U.*, 1882.)

H. L. Osborn, A. B.:

The Structure and Growth of the Shell of the Oyster. (*Studies from the Biol. Lab., J. H. U.*, 1882, 1 *plate.*)
On the Growth of the Molluscan Shell. (*Univ. Circular, No.* 27; *Ann. of Nat. Hist. Vol.* 11, *p.* 149; *Am. Nat*, *Vol.* 17, *p.* 96; *Journal Royal Micros. Soc.*, *Vol.* 3, *p.* 195.)
Of the Gill in some forms of Prosobranchiate Mollusca. (*Studies from the Biol. Lab., J. H. U.*, 1884, 3 *plates.*)
—Also see J. M. Wilson.

H. Sewall, Ph. D.:

On the Equilibrium Function of the Membraneous Labyrinth in Cartilaginous Fishes. (*Univ. Circular, No.* 12; *Journal of Physiology, Vol. IV, No.* 6, 1884.)

P. R. Uhler:

List of Animals observed at Fort Wool, Va. (*Studies from the Biol. Lab. J. H. U.*, 1879.)

N. B. Webster:

Partial List of Land Plants at Fort Wool, Va. (*Studies from the Biol. Lab., J. H. U.*, 1879.)

E. B. Wilson, Ph. D.:

The Early Stages of Renilla. (*Am. Jour. of Science*, 1880.)
Origin and Significance of the Metamorphosis of Actinotrocha. (*Quar. Jour. of Micros. Sc., April*, 1881, 2 *plates; Abstract in Am. Nat.*. 1882.)
The First Zoea of Porcellana. (With W. K. Brooks; *Studies from the Biol. Lab., J. H. U.*, 1881, 2 *plates.*)
Observations on the Early Developmental Stages of some Polychætous Annelides. (*Studies from the Biol. Lab., J. H. U.*, 1882; *Abstract in Zoöl. Anzeiger*, 1880, *and in Am. Jour. of Science*, 1880.)
A New Species of Pilidium. (*Studies from the Biol. Lab., J. H. U.*, 1882.)
Abstract of Observations on the Structure and Development of Renilla and Leptogorgia. (*Univ. Circular, No.* 17.)
The Development of Renilla. (*Proc., Royal Soc., London, No.* 222; *Univ. Circular, No.* 22.)
—Also see J. M. Wilson and W. K. Brooks.

J. M. Wilson, M. D.:

Variation in the Segmentation of the Egg of Renilla. (With E. B. Wilson and H. L. Osborn; *Zoöl. Anzeiger*, 1882, No. 123; *Archiv f. Zoöl. exper.*, 1883.)

Dr. E. B. Wilson's monograph on the Development of Renilla is now in print, and it will soon appear with sixteen quarto plates, in the *Philosophical Transactions of the Royal Society*. Several other papers are now ready for publication. One of these, a paper on the Development of Thallassema, by Mr. H. W. Conn, has received one of the Walker prizes of the Boston Society of Natural History.

STUDIES FROM THE BIOLOGICAL LABORATORY.

(*Including the Chesapeake Zoölogical Laboratory.*)

The *Studies from the Biological Laboratory* are published under the direction of Professor Newell Martin, Editor, and Dr. W. K. Brooks, Associate Editor. Two volumes have been issued: Vol. I (1879–80), 500 pp., 40 plates; Vol. II (1881–83), 496 pp., 37 plates.

Vol. III., No. 1, is now ready. It contains papers on:

The Significance of the Larval Skin of Decapods. (27 pp., 2 plates). By H. W. Conn.

Life History of Thalassema. (7 pp., 1 plate). By H. W. Conn.

Of the Gill in some forms of prosobranchiate Mollusca. (12 pp., 1 plate). By H. L. Osborn.

The "*Studies*" contain the majority of the original scientific papers published by members of the Biological Department of the University.

In future they will appear in numbers issued at intervals as material for publication is ready. To each of these numbers will be affixed a price dependent on its size and the number and cost of plates printed with it. These numbers may be purchased separately or all of them will be forwarded as published to persons who subscribe in advance for the whole volume. The subscription price for the volume of about 500 pages, postage prepaid, is $5.00. Price of Vol. III, No. 1, 70 cents.

As in future no articles will be reprinted from the *Journal of Physiology*, the "*Studies*" will no longer be sold at a reduced price to the subscribers to that Journal.

Remittances and propositions for exchange should be addressed to the "Publication Agency of the Johns Hopkins University."

CURRENT INTELLIGENCE.

LECTURES ON PHYSICS BY SIR WILLIAM THOMSON.

Sir WILLIAM THOMSON, D. C. L., F. R. S. L. & E., etc., Professor of Physics in the University of Glasgow, will deliver in October next, a course of eighteen lectures on *Molecular Dynamics,* before the students in Physics of the Johns Hopkins University.

An introductory lecture will be given on Wednesday, October 1. The other lectures will follow on consecutive days.

These lectures are intended only for students who are interested in advanced work. Professors and students of physics are invited to attend, and arrangements will be made by which they may easily obtain temporary lodgings, provided an early intimation is received of their intention to come. A registration fee of $5 will be required.

PROFESSORSHIP OF PSYCHOLOGY.

Dr. G. STANLEY HALL, well-known as a writer and lecturer on philosophical and educational subjects, has been appointed Professor of Psychology and Pedagogics in this University. Dr. Hall was graduated at Williams College, and at a later day received the degree of Doctor of Philosophy from Harvard College, and afterwards prosecuted his studies in Germany under Zeller, Trendelenberg, Ludwig, and Wundt. His lectures have been sought for in many colleges, and his cooperation in educational associations has been highly prized. He has written for the *Princeton Review,* for *Mind,* for the *Nation,* and for other periodicals,—and many of his papers were collected and published in a separate volume. He is now engaged in prolonged inquiries respecting the education of young children and the methods of teaching philosophy, from which important results are anticipated. He has also been deeply engaged in psycho-physic researches soon to be published. Convenient rooms and suitable apparatus have been provided for this work.

PROFESSORSHIP OF PATHOLOGY.

Dr. WILLIAM H. WELCH, a graduate in Arts of Yale College, and in Medicine of the College of Physicians and Surgeons in New York, has been appointed Professor of Pathology in the medical faculty of this University. Dr. Welch is now Professor of Pathological Anatomy and General Pathology in the Bellevue Hospital Medical College of New York, and has given evidence of his ability as an independent investigator, and as a skilful teacher.

NEW REGULATIONS AS TO THE DEGREE OF DOCTOR OF PHILOSOPHY.

The degree of Doctor of Philosophy and Master of Arts will be conferred hereafter on the following conditions:

1. The candidate must for three years pursue university studies under conditions approved by the Board of University Studies, of which the last year must be as a matriculated graduate student in the philosophical department of this university.
2. He must satisfy the Board of University Studies as to his attainments by the preparation of a thesis and by passing written and oral examinations in one principal and two subsidiary subjects approved by the Board.
3. Unless permission to the contrary be given, the thesis must be presented at least three months before the candidate intends to take his degree.
4. The examination shall take place after the thesis has been approved; the oral part of it before the Board of University studies.
5. The above regulations as to the degree of Doctor of Philosophy and Master of Arts abrogate all previous announcements incompatible with them, with this exception: graduate students now on the roll and accepted as candidates for the degree before the close of the current academic year will be examined under the regulations hitherto in force.

An excursion map of Baltimore and its neighborhood for the use of the students of the University is now in preparation. A statement of its plan is given by Mr. A. L. Webster on page 80 of this *Circular.*

PUBLIC LECTURES.

XIII. ENGLISH LITERATURE.

Dr. H. WOOD, Associate of the Johns Hopkins University, will give a course of eight lectures on *English Literature in the period from* 1500 *to* 1580 *A. D.*, beginning Friday, April 18, 1884, in Hopkins Hall.

The lectures will be given at 5 p. m., on Mondays, Wednesdays, and Fridays.

1. *Friday, April* 18. The literary traditions of Henry the Seventh's time, and the new age: Lord Berners, Stephen Hawes.
2. *Monday, April* 21. The highest bloom of the old culture: Sir Thomas More.
3. *Wednesday, April* 23. The conservative thinker and the folk-preacher: John Fisher, Hugh Latimer.
4. *Friday, April* 25. The tradition of native poetry under the stimulus of the Renaissance: Skelton, Dunbar, Lyndesay.
5. *Monday, April* 28. The foreign literary spirit: Surrey and Wyatt, Tottel's Miscellany; Translations from contemporary literature; The novels.
6. *Wednesday, April* 30. The poets of high seriousness: Sackville, Gascoigne.
7. *Friday, May* 2. The translators from Greek and Latin, and the revivers of the classic drama: Golding, Gascoigne, Phaer, Stanyhurst, Surrey, North.
8. *Monday, May* 5. The beginnings of the true English drama: Ralph Roister Doister, Gammer Gurton's Needle, Gorboduc.

XIV. ON THE "TEACHINGS OF THE APOSTLES."

Mr. J. RENDEL HARRIS, Lecturer on New Testament Greek, gave three lectures on the newly published tract entitled *"The Teachings of the Apostles,"* in Bentley Hall, on April 1, 3, and 5.

The following topics were taken up:

I. Introduction; Narrative of the Discovery and Publication; Authenticity; Relation to Second Century Literature.

II. The Text itself.

III. The Bearing of this Discovery.

BIBLIOGRAPHY.

1. Bryennios' edition, (Greek text, with prolegomena and notes). Constantinople, 1883. 8o.

(An early copy of this was courteously placed at the disposal of the Johns Hopkins University by Rev. Dr. C. R. Hale.)

2. Harnack has given a translation in the Theologische Literaturzeitung. (No. 3, 1884.)

3. The text and translation edited by Professors Hitchcock and Brown of the Union Theological Seminary. Scribners. N. Y. 1884. Price 50 cents.

4. The Andover Review, April, contains a critique by Professor E. C. Smyth, and a translation by Rev. C. C. Starbuck.

5. Editorial articles in "The Independent," especially of February 28 and March 6.

PROCEEDINGS OF SOCIETIES.

Scientific Association.

March 5.—Fifty-sixth regular meeting. Professor Martin in the chair. Twenty-five members present.

Papers read:

On the Glucose Industry in the United States, by I. REMSEN.

On the Gastropod Gill, by H. L. OSBORN.

On a Case of Endocarditis in a Dog, by W. T. COUNCILMAN.

April 2.—Fifty-seventh regular meeting. Professor Martin in the chair. Twenty members present.

Papers read:

On Compound Reaction Time, by G. STANLEY HALL.

On the Coagulation of the Blood, by W. H. HOWELL.

Philological Association.

March 7.—Fifty-third regular meeting. Professor Gildersleeve in the chair. Thirty-three members present.

Papers read:

On Uniformity and Analogy, by Professor M. W. Easton of the University of Pennsylvania, presented and criticised by M. Bloomfield. (*Abstract on p.* 73).

On the Nahuatl Spanish Dialect of Nicaragua, by A. M. ELLIOTT. (*Abstract on p.* 74).

April 4.—Fifty-fourth regular meeting. Professor Gildersleeve in the chair. Thirty-five members present.

Papers read:

On Rhythmical Pronunciation of Greek and Latin Prose and a few remarks on Accent, by C. W. E. MILLER.

On Parallelisms in Beowulf, by C. B. WRIGHT.

Historical and Political Science Association.

February 29.—Dr. H. B. Adams in the chair.

Luther Martin, a Biographical Study, by H. P. GODDARD.

Martin was for fifty years the leader of the Maryland bar and twice held the office of Attorney General. A bitter opponent of the Constitution in 1787, he afterwards became a strict constructionist and an advocate of State's rights. He was one of the counsel for the defence in the trials of Judge Chase and Aaron Burr. In 1822 the latter took Martin to his own home in New York, where the once brilliant Maryland advocate died, a mental wreck, in 1826, at the age of 78.

March 7.—Dr. H. B. Adams in the chair.

The Development of the Passover Scandal, by J. RENDEL HARRIS.

The paper established the historical continuity of the calumnies concerning the use of human flesh and blood at religious banquets from the times of the early Christians down to the persecuted Jews in modern Hungary. The charges made by Jews and Pagans against Christians were subsequently transferred by the latter and made against herectical sects, *e. g.*, the Montanists, and, in the course of the middle ages, these charges were brought home to the Jews. Almost every Christian nation has had some legend of child-sacrifice by the Jews like that illustrated by Hugh of Lincoln.

March 14.—Dr. R. T. Ely in the chair.

Moses as a Statesman, by JOHN DUNLAP, ESQ., of Richmond, Va.

This paper related to Hebrew civic, religious, and military institutions, to penal law, administration, etc.

March 21.—Dr. H. B. Adams in the chair.

Additional Notes on Icaria, by ALBERT SHAW. (*Abstract on p.* 77).

Rudimentary Society among Boys. Part I. Land Tenure, by JOHN JOHNSON.

Review of the American edition of Laveleye's Elements of Political Economy, edited by Dr. Taussig, by R. T. ELY.

Review of the Hon. A. C. Goodell's monographs on the History of Witchcraft, the Seals of Massachusetts, etc., by J. F. JAMESON.

March 28.—Dr. H. B. Adams in the chair.

Tammany Hall, a Study of New York City Politics, by TALCOTT WILLIAMS, of *The Press*, Philadelphia.

April 4.—Dr. H. B. Adams in the chair.

Old Teutonic Life in Beówulf, by JAMES A. HARRISON.

The paper is an attempt to reconstruct an outline of Old Teutonic life as contained in *Beówulf*, a poem of the eighth or ninth century written in Anglo-Saxon. Though the texture of the poem is Dano-Scandinavian, this poem was found to contain much that could be called in general Teutonic; it is filled with folk-lore, superstitions, customs, traces of ancient, and foreshadowings of modern life; a reservoir of dynastic traditions and legends very valuable to the student of the origins of Germanic history.

Samuel Adams, the Man of the Town-Meeting, by JAMES K. HOSMER.

Society for Semitic Philology.

December 13.—First meeting. Professor Haupt in the chair. Seven members present.

Papers read:

The City of Harran and its Place in Ancient History, by C. ADLER.

Harran and its Condition after the Christian Era, by A. L. FROTHINGHAM JR.

The People and Language of the Medes founded on Delattre "Le Peuple et l'Empire des Mèdes," by C. LEHMANN.

An etymology of the Name of S. Luke given by Isidore of Seville, by J. RENDEL HARRIS.

Dr. A. L. Frothingham Jr., was elected Secretary.

January 13.—Second meeting. Professor Haupt in the chair. Eight members present.

Papers read:

The Differences in the Pronunciation of many Letters in Hebrew among the Jews of different countries of Europe, by C. ADLER.

The History of Syriac Literature from the beginning of the Christian Era to the period of the Mohammedan Conquest, by A. L. FROTHINGHAM JR. (*Abstract on p.* 75).

February 28.—Third meeting. Professor Haupt in the chair. Seven members present.

Papers read:

The Massora and its Critical and Editorial Treatment, by A. H. HUIZINGA.

The history of Syriac Literature from the Mohammedan Conquest to its extinction in the XIII century (continued), by A. L. FROTHINGHAM JR. (*Abstract on p.* 75).

March 17.—Fourth meeting. Professor Haupt in the chair. Nine members present.

Papers read:

The exchange of *šin* and *nun* in the Proto-Babylonian Language, by C. LEHMANN.

A Hebrew MS. of C. 1300 important for its various readings of the Old Testament text, by C. ADLER.

Semitic loan-words in Old Greek, by W. M. ARNOLT.

Mathematical Society.

March 19.—Dr. Story in the chair. Eleven members present.

Papers read:

On a System of Straight Lines determined by two Given Lines, by W. E. STORY.

A Certain Class of Transcendental Functions, by T. CRAIG.

A Note on Partitions, by G. S. ELY. (*Abstract on p.* 76).

Unicursal Curves in n-Flat Space, by G. BISSING. (*Abstract on p.* 77).

A Note on Cycles, by A. S. HATHAWAY.

Some Remarks on Unicursal Curves, by E. W. DAVIS.

Metaphysical Club.

March 11.—Thirty-seventh regular meeting. Dr. G. Stanley Hall in the chair. Sixteen members present.

Papers read:

The New Psychology, by J. DEWEY.

The Body as a Spiritual Residence, by E. M. HARTWELL.

Archæological Society.

March 14.—Second general meeting. Dr. Adams in the chair. Fourteen members present.

Paper:

Report on the Collection of Casts in the Peabody Institute, by L. HOSKINS.

This paper was drawn up with the object of showing what field the collection covered and what opportunity for study it afforded to the Society.

Address:

On the Entasis in Greek Architecture, by J. T. CLARKE. (*Abstract on p.* 83).

March 22.—Third general meeting. Professor Gildersleeve in the chair. Thirty-one members present.

Address:

On the Acropolis of Athens, by W. J. STILLMAN. (*Abstract on p.* 83).

Report:

On the Library of the Peabody Institute (Ancient Art), by A. EMERSON.

Baltimore Naturalists' Field Club.

February 20.—Dr. G. H. Williams in the chair. Twenty members present.

Communications:

On Economic Entomology, by O. LUGGER.

This paper treated of the excessive insect depredations in the United States and their causes.

On the Peculiarities of certain Linden trees on Cathedral street, by B. W. BARTON.

These trees show at different heights from the pavement large swellings, the reason for which has not been clearly understood. It was shown that the swellings were caused by the grafting of the European Linden on the American bass-wood.

MR. BRUCE gave an account of the bad-lands in the south-western part of Dakota, noted for the abundance of fossil remains of extinct animals to be found there.

March 19.—Dr. G. H. Williams in the chair. Fifteen members present.

Communications:

On Insects injurious to Herbaria, by O. LUGGER.

In looking over a collection of 3500 species of alpine plants of Europe presented to this University by Dr. A. F. W. Schimper, several species of injurious insects were found. Amongst them were the Sitodrepa panicea, Ptinus fur, and a very destructive species of Ptinus not found before in this country. The three species named belong to the family of Ptinidæ, popularly known as the death-watch. Two species of the apterous Psocus were also found in limited numbers.

MR. WEBSTER made a report on the map of the region around Baltimore which is being prepared. (*Abstract on p.* 80).

DR. BARTON read some notes in Botany. He gave an account of some yellow jessamine visited by humble bees.

The bees were unable to get at the nectar from the mouth of the corolla and were obliged to puncture it from the base. They died, however, from its effects. Several seeds were described, apparently oat-seeds, having on the back a long awm bent near the middle. The thigh of this leg-like awm was found to be spirally twisted and if held fast and moistened the seed attached was turned upon its axis. The theory was advanced that by its hygroscopic quality when the seed was dropped and covered by drifting sand and moistened by rain, the unwinding of the awm now held fast in the sand would bore the seed into the earth to a depth sufficient to insure germination.