well be set down to unavoidable misfortune. But so long-continued a history leads one to infer a cause, and we should be glad to see something said to efface the impression that the administration is at fault.

In the way of assistance we suggest a few other questions as worthy of careful consideration. It is understood that, when the Astrophysical Society of America chose its committee to confer with the Secretary of the Navy on the question of the Observatory, especial pains were taken to select men who had never been known to express any opinion on the subject. We are quite sure that the Society would like the Superintendent of the Observatory to state how he knows that in making the selection, it was the victim of misplaced confidence, and that the members were 'known to be inspired by a hostility to its organization.'

A cognate point is this: The membership of the Society includes a respectable and influential number of members who have been connected with the Observatory at one time or another in various capacities and who would be its natural defenders. Would not some of them have objected to the appointment of a hostile committee?

The greater number of our astronomers are the mildest of men, and glad to see their science promoted in every way. How does it happen that they, as a class, are moved by 'animosity' toward a national institution for promoting their science?

We wish also to discover every possible justification for the claim that "no person, no matter how eminent he may be in science, can pretend to be a friend of the Observatory or of science while attacking its organization." This is preceded by the statement that "the number of observations made at the old and new Observatories kept pace with those made at Greenwich." If the report had said that the Observatory during the past ten years, with less than half the personnel of Greenwich, had, on the average, done nearly one-half as much work, the critics might have inquired in reply whether this was not a slight exaggeration. They might also have inquired whether it was not desirable to take account of the quality as well as the quantity of the work, and whether in that respect the observations described in the annual reports of the last ten years could compare even with one-third of the work done at Greenwich. But when we find the head of the Observatory seriously believing that some comparison can be instituted between the output of the two observatories we see that he has, from his own point of view, just cause of resentment against the critics of the institution, and feel encouraged to believe that, when he has ascertained the facts, he will, as an act of justice, fair play and public policy, admit that the 'prejudices and animosities' of the astronomers have better grounds than he had supposed.

REPORT OF THE SUPERINTENDENT OF THE NAVAL OBSERVATORY.

[WE regret that we have room only for such portions of this interesting report as relate to astronomical work and the report of the board of visitors.]

DEPARTMENT OF ASTRONOMICAL OBSERVATIONS.

The work of the year in this department may be summarized as follows:

Professor William Harkness, who retired from active service on December 15, 1899, was succeeded in the astronomical directorship by Professor Stimson J. Brown, the senior professor of mathematics on duty at the Observatory. Professor Brown's first duty was as member of a board of examiners, to fill the vacancy caused by the retirement of Professor Harkness, by the selection of a suitable candidate for appointment as professor of mathematics in the navy. The labors of this board, of which Professor William Hendrickson, U. S. N., was senior member, resulted in the selection and appointment of Professor W. S. Eichelberger. In this connection it is pertinent to observe that the present condition of the astronomical staff of the Observatory is highly satisfactory, and gives promise for the future. The vacancies, caused by the rapid successive retirement of the older professors, have all been filled by young men of marked ability, and the Observatory has followed its traditional policy in this respect, and has every reason to anticipate a renewed activity and a period of harmony, industry and usefulness.

All the astronomical instruments of the Observatory have been steadily and continuously in use during the year on every clear night and day.

The XXVI.-inch equatorial telescope has been employed on the observation of difficult double stars, the satellites of the planets and the measurement of their disks, and on other objects suitable to an instrument of its power. This instrument was in charge of Professor Brown, assisted by Professor T. J. J. See, until December 15th, and has since been in charge of Professor See.

In the month of October, during the hazy weather common at that season, the images of celestial bodies were marked by great steadiness in the field of view, unusual at other times. Owing to this favorable condition, Professor See noticed on several occasions faint markings on the disk of Neptune, similar to the equatorial belts of the planets Jupiter and Saturn. The fine definition at this time was ascribed to the selective absorption of the haze caused by the smoke of forest fires, and an attempt has been made by Professor See and Mr. George H. Peters, the photographer, to reproduce artificially the same conditions by the use of a color screen. The idea of this application to the telescope was not wholly new, although it was believed to be so at the time. It is too early to speak definitely on the result of these experiments, except to say that the general effect of the use of a screen composed of two thin sheets of plate-glass, the space between them being filled with a solution of chloride of copper and picric acid, or a solution of bichromate or chromate of potash, seems to have the effect of absorbing the blue rays and removing the halo which surrounds bright objects in the field of a large achromatic telescope, and the image appears somewhat steadied. The color screen is now in use in observations of the diameters of the planets and measurable satellites.

During the year the double floor, which was appropriated for last year, designed to obviate the difficulty experienced from currents of warm air rising from the basement, has been finished, and answers every expectation, giving highly satisfactory results.

The IX.-inch transit circle was undergoing its periodical repairs and general overhauling from the beginning of the fiscal year until January 20, 1900, during which time the routine work of the sun, moon and planets was carried on with the new VI.-inch steel transit circle. Since the resumption of the regular work on the IX.-inch circle, Professor Skinner has had charge of the zone observations and Professor Eichelberger of the routine sun, moon and planet work, while the VI.-inch circle, in charge of

Professor Updegraff, has been under strict investigation, with a view to determining the causes of several faults made apparent by the routine work and probably unavoidable in a new instrument.

In the meridian work a total of 1,114 observations of zone stars and a total of 3,105 observations in the sun, moon and planet work have been made during the year.

The XII.-inch equatorial has been used for observations of comets, asteroids and other miscellaneous objects, and will soon undergo some extensive repairs and alterations.

Assistant astronomer George A. Hill has devoted the prime vertical transit to observations of α Lyræ and a small list of suitable stars in the investigation of the variation of latitude and the constants of nutation and aberration, and the same observer has used the new V.-inch steel alt-azimuth instrument principally as a zenith telescope for observations for latitude by Talcott's method, and for the declinations of stars of the American Ephemeris.

The 40-foot photoheliograph has been used in making daily photographs of the sun whenever the weather permitted, except after April 2d, during preparations for the observations of the total eclipse of the sun on May 28th.

By an appropriation of $5,000 the Observatory was able to undertake observations of the total eclipse of the sun on the date above mentioned. Two parties were sent into the field, and attention is respectfully invited to the detailed report of the astronomical director on this subject, and also to the recommendation for an appropriation to cover the expenses of a similar expedition this year, in the eclipse of May 17, 1901, which is approved and indorsed.

Preparations are now in progress for installing at the Observatory a new standard clock which shall be entirely freed from the influences of changes of temperature, and the recommendations of the astronomical director on this subject are approved.

The work of bringing up the publications of observations to date, which has been in arrears for several years, is being vigorously pushed, and the issue of the first volume of the new series of Washington observations, commencing with the first year of the Observatory's work on the present site, will soon occur, to be followed by the succeeding volumes in rapid succession. The delay in the publication of its work has been made a reproach to the Observatory, although the causes of this delay have been reasonable and unavoidable, but the most earnest and determined effort is being made to relieve the Observatory of a condition which has been used to its disadvantage in outside criticism.

The report of the astronomical director is herewith transmitted in full.

The department of magnetism has been discontinued, as noted in the last report of the superintendent. The buildings and instruments are, however, maintained in perfect order under the charge of assistant astronomer Theo. I. King. The Georgetown and Tennallytown Electric Railway has already installed a return wire which, it is reasonable to suppose, it intends sooner or later to use. When this road ceases to ground its powerful working currents, an attempt will be made to resume magnetic observations at the Observatory. The result is dubious. Moreover, the Observatory is to a lesser extent within the influence of the Chevy Chase road, which would continue to affect observations.

BOARD OF VISITORS.

As noted in my last report, and for the first time in its history, a board of visitors was appointed which visited the Observatory in June and again in September, remaining a few days at each visit. As the report of the board, which was not made

available to the Observatory until long after its substance had appeared in the public prints, was in the nature of an attack on the Observatory, I trust that it will not be out of place, in the report of the Superintendent, to touch upon its salient features.

The board was unfortunate in having the support of several zealous newspaper writers, by whom it has been made to appear, and I think that it is generally believed in the scientific world and by that part of the public which takes an interest in scientific affairs, that the presence of the board was in the nature of a visitation distasteful to the Observatory and inflicted against its will. As the Observatory has thus been made to appear in an odious light, I take the liberty of reminding the Bureau that not only the original conception of the board of visitors was a suggestion of the Superintendent, but the selection of the three astronomical members was concurred in by him because they were already the members of a self-constituted committee to conduct a gratuitous investigation of the Observatory, and known to be inspired by a hostility to its organization. It was hoped that by placing them in a position of official responsibility an impartial judgment could be obtained.

A criticism of the report may be very briefly summarized. The board made no examination or inspection of the Observatory except in the most casual way. To quote its own language, "Owing to the lack of printed material representing the recent work of the Naval Observatory, the board of visitors finds it practically impossible to form a satisfactory opinion of that work without devoting to the task an inadmissible amount of time and labor." Nevertheless, and without such an opinion, the board did not hesitate to recommend the most sweeping changes in the present organization, and it is noticeable that the report of the board deals exclusively with the question of reorganization, while that question had not been officially presented to it at all. As a guide to the board the following letter of instructions was addressed to it by the Department:

NAVY DEPARTMENT,
WASHINGTON, JUNE 28, 1899.

SIR: I have the honor to enclose you herewith a memorandum making certain suggestions which the Department wishes the board, of which you are the chairman, to have in mind in making an examination of the Naval Observatory. This memorandum is not intended to finally limit the investigations of the board, but to convey certain suggestions in regard to which the Department desires to be informed, and which, it is believed, may assist the board in its work.

JOHN D. LONG, *Secretary.*

Hon. WM. E. CHANDLER,
Chairman Board of Visitors, Naval Observatory, Washington, D. C.

[The points covered by the enclosure, which is too long for reproduction here, are meridian observations of the sun, moon and planets, spectroscopy and photography, chronometers, the Magnetic Observatory and the publications of the Observatory.]

Not one of the subjects proposed in the above memorandum received the attention of the board or was even mentioned by it. The whole report is taken up with the proposed reorganization, a subject which it had not been asked to consider at all, and for which it could only find a general authorization in the concluding paragraph of the Department's letter.

Notwithstanding that the board had no time to form an opinion as to the condition of work at the Observatory, the conclusion upon which it bases a recommendation for a revolutionary change of organization is found in the charge that the output, in published results, is not commensurate with an extravagant annual outlay. In other words, the board lays particular stress upon the delay in the publication of the annual volume, and bases its whole finding upon that fact.

The board makes a comparison between the Naval Observatory and the observatories at Greenwich and Harvard, selecting the former because it is supposed to cover nearly the same field, and the latter because it also undertakes large pieces of routine work which are beyond the reach of smaller observatories, because the resources of Harvard approach more nearly than do any other those of the Naval Observatory, and because all the details of the Harvard Observatory were readily available, its director being a member of the board.

I ask the attention of the Bureau to the following table, which gives an exact comparison of the three observatories chosen by the board, and which, almost without elucidation, confutes the sole and only charge made by the board against the efficiency of the Observatory upon which charge the only recommendation of the board rests.

Comparison of number and cost of scientific personnel of Greenwich, Harvard, and Naval observatories, previous to July 1, 1900:

GREENWICH OBSERVATORY.

Scientific personnel.	No.	Average.	Total.
Director	1	$5,000	$5,000
Chief assistants	2	2,550	5,100
First-class assistants	4	2,000	8,000
Second-class assistants	4	1,200	4,800
Magnetic superintendent	1	1,700	1,700
Assistant magnetic superintendent	1	1,000	1,000
Computers	23	325	7,475
Total	36	.....	$33,075

HARVARD COLLEGE OBSERVATORY.

Director	1	$5,000	$5,000
Astronomers	6	2,000	12,000
Assistant astronomers	13	900	11,700
Computers	18	600	10,800
Total	38	.....	$39,500

UNITED STATES NAVAL ACADEMY.

Astronomical director	1	$3,500	$3,500
Other professors of mathematics	4	2,700	10,800
Assistant astronomers	3	1,900	5,600
Computers	6	1,200	7,200
Photographer	1	1,200	1,200
Total	15	.....	$28,300

A comparison of the figures in this table shows that the number of astronomers employed at the Naval Observatory is 5, at Greenwich 3, at Harvard 7. The Naval Observatory has the advantage of Greenwich and decidedly the disadvantage of Harvard. In the matter of assistants, however, the case is different. The total of assistants at Greenwich is 8, at Harvard 13, and at the Observatory 3; while the computers stand, Greenwich 23, Harvard 18, Naval Observatory 6.

In the years 1891 to 1893 the Observatory was removed from the site which it had occupied for nearly fifty years, to its present situation. The delays in building, the labor of dismounting and remounting the instruments, the repairs and alterations of the same and their subsequent installation, the removal of the records and Observatory property, and generally the labor involved in settling in the new place, absorbed the entire time of the whole very limited working force of the Observatory for several years. The publication of results, from this cause and from this cause alone, fell into arrears. The force of the astronomical staff, sufficient for current work in settled times, was totally inadequate to bring up back work when the work had fallen behind. It was simply a physical impossibility to keep up the publications, and to make the current observations and do the necessary work of removal at the same time. This and this alone is the cause of the delay in printing, and when the number of assistants and computers at the Observatory is contrasted with the numbers at Greenwich, and especially at Harvard, the delay is reasonable on its face. These facts were represented to the board, but are nowhere given in its report. The board, on the contrary, evaded and concealed them. It might have reasonably been shown that during the whole of this transition period current work was practically uninterrupted, and that the number of observations made at the old and new Observatories kept pace

with those made at Greenwich. But "owing to the lack of printed material the board found it impossible to form a satisfactory opinion upon that work, without devoting to the task an inadmissible amount of time and labor." The facts were laid before the board and ignored by it. They would have shown to the credit of the Observatory.

It is needless to say that the figures in the above table are not given by the board in its comparison of the three observatories named as they are given here. The board had to make a case against the Observatory, and the charge of extravagance of outlay in proportion to the output of results had to be substantiated. Accordingly, the whole staff of the Observatory, scientific and lay, is contrasted with that at Harvard, and the numbers are brought to an equality by adding in the artisans and laborers employed about the buildings and grounds, Harvard having practically none. By this process the astronomical personnel of the Observatory is shown to be one in excess of that at Harvard, and the salaries are compared on this basis, greatly to the disadvantage of the Observatory. This enumeration also charges the Observatory with two 'directors' for the same obvious reason. Although the board had no time to form an opinion, it should have learned, if it could have assimilated the information which it received, that the Observatory, like other naval establishments, has but one 'head,' and that the astronomical director of the Observatory is the head of the astronomical department, just as a naval officer is the head of the department of nautical instruments. To charge two 'heads' to the Observatory in order to increase the apparent extravagance of maintenance is clearly a perversion of fact. If the Observatory has two heads, then it has eight heads, one for each department, and including the superintendent.

The attention of the Bureau is asked to a comparison of salaries, shown in the above table, which forms the basis of the board's charge of extravagance. At both Greenwich and Harvard the salary of the director is $5,000. At the Observatory, using the board's own method of comparison, the corresponding salary is $3,500. But, by the ingenious device of a 'dual head,' the board increases it to $4,000 and then doubles it. Naval officers receive their pay, whether they happen to be on duty at the Observatory or elsewhere; but the board chooses to assume that the salary of every professor of mathematics in the navy, active or retired, except two at the Naval Academy, is chargeable to the expenses of the Observatory. It therefore charges in its exhibit the salaries of officers on the retired list, and the salary of one officer, still on the active list, whose connection with the Observatory has long since definitely ceased for cause. By such flimsy expedients as these the expense column is easily swelled. It might be swelled to any amount desired by simply charging against it the salary of any or every living officer of the navy, active or retired, who had ever been on duty at the Observatory. It is in the lower grades particularly, however, that I ask a fair comparison of salaries at the three institutions selected by the board. At Greenwich, for example, computers receive an average of $325 per year, less than one-half the pay of our laborers, and less than the remuneration of any human being doing skilled work in the United States. At Harvard computers receive an average of $600, less than the pay of any person in the United States service. These computers are largely women, who can be got to work for next to nothing. Now the Observatory pays its employees at exactly the same (or in some cases less) rate as in other branches of the government service in corresponding grades. To charge extravagance against

the Observatory because its employees are paid according to a rate fixed by law for the public service at large is clearly disingenuous and tending to mislead.

The whole report of the board is colored by the evident intention of making as strong a case against the Observatory, and in favor of its own plan of reorganization, as possible.

On page 6 the board objects to transferring responsibility of direction from the astronomical director to a committee, and then, on pages 7 and 8, recommends that the board of visitors 'shall prepare and submit to the Secretary of the Navy regulations prescribing the scope of the astronomical and other researches of the Naval Observatory and the duties of its staff with reference thereto.' In other words, the duties which should belong to the astronomical director, if he is to be held responsible for the astronomical work of the Observatory, are to be transferred to the board of visitors. Furthermore, on page 14, it is proposed that the board of visitors shall have power to make 'necessary changes,' apparently not only in the work, but also in the personnel.

On page 8 objection is made to retiring astronomers at 62 years of age, as is now done, and on page 6 it is specifically recommended that under the proposed new arrangement the astronomical staff of the Naval Observatory are to 'hold their offices until their successors are appointed,' or, in other words, they are to have no tenure of office at all, and to be liable to dismissal at any moment.

The pay table on page 9 proposes to give the astronomical director $6,000 a year, and the director of the Nautical Almanac, $5,000, making a total of $11,000 a year, for the same duties which were then performed by Professor Harkness for $3,500 a year. In view of the distinct charge of extravagance against the present administration, this proposal is only ludicrous. It is difficult to believe that it was intended to be taken seriously.

On page 12 it is asserted that the 9-inch transit circle was not then in use, although the board knew that it was simply undergoing periodical temporary repairs, and would be brought into use again as soon as they were completed.

On page 13 it is asserted that none of the directors of the Greenwich or Harvard College observatories 'have ever resigned to accept positions elsewhere,' but the author of the report forgets to mention that one of the Greenwich astronomers royal did resign.

On page 15 it is indirectly stated that when an observer is not actually observing he is only doing clerical work, which is untrue. The reduction of astronomical observations is not clerical work within the ordinary meaning of that phrase.

The statement on page 30 respecting the personnel of the Observatory board established by Rear-Admiral John Rogers is wholly erroneous. That board comprehended the entire astronomical staff of the Observatory.

In the list of professors of mathematics, given on page 41, Professor H. M. Paul is stated to be attached to the Naval Observatory, when in fact he is attached to the Bureau of Yards and Docks.

An historical sketch of the Naval Observatory, written by an individual member of the board, with the avowed purpose of showing that the system under which the Observatory has been administered since its foundation is entirely defective, is appended to the report. It is a sufficient criticism of this sketch to say that a system which, from a most modest beginning, has built up one of the few great astronomical institutions of the world, and which has produced the two most eminent living astronomers in America, can not be wholly bad.

It is particularly worthy of note that the board actually proposes to remove the affairs of the Observatory from Government control. The irresponsible governing authority of a public institution is to be 'a board of visitors independent of Government control, but having power to make necessary changes.' With the exception of this preposterous proposal, I will dismiss the plan of reorganization proposed by the board with the simple statement that subsequent events have made it impracticable, or at least highly unlikely, to be seriously considered now. To apply it at the present time would be, not to build up, but to tear down.

A determined effort was made by the board to prevent, if possible, the appointment of new men to fill the vacancies created by the retirement of the older professors of mathematics at the Observatory. New offices were created in the board's plan of reorganization, at enormous salaries. Notwithstanding the efforts of the board to prevent it, these vacancies have all been filled in line with the traditional policy of the Observatory, which has always been to take for its staff young men of promise whose career was before them, in contrast with the plan, recommended by the board, of appointing at once to high office men whose scientific reputation was already established, and whose prejudices and animosities were mature and confirmed.

I have ventured to touch in brief upon the report of the board of visitors in a manner which I trust does not transcend the legal limitations of this report, because, while the Observatory has been made the object of adverse criticism in the report, the friends and supporters of the board have not hesitated to assail it in attacks in the public prints, some of which have been extremely abusive and obviously dictated by pure malice, and with the knowledge that a reply in kind was impossible. This report furnishes the only means of replying to these attacks, which are and have been perennial, culminating in force whenever, as in the present instance, circumstances seemed to justify a reasonable anticipation of success.

The Observatory staff is now complete. The excuse afforded by the retirement of the older professors of mathematics no longer exists. For the present, at least, no person, no matter how eminent he may be in science, can pretend to be a friend of the Observatory or of science while attacking its organization. I do not mean to say that the Observatory should be exempt from criticism; but such criticism, in order to be of any benefit, must be made in a spirit of fairness, and not in a spirit of animosity. The Observatory invited such criticism from the recent board of visitors, and its invitation was slighted.

The Observatory is making an earnest and honest effort to correct faults which have, in most cases, arisen from circumstances not wholly within its own control, as the board very well knew, but omitted to point out. It is only reasonable to ask that it be allowed a fair field for its efforts.

The experience with the recent board of visitors was not such as to encourage the hope that much good can be gained by a repetition of the experiment. Nevertheless, I recommend that a board of visitors be appointed from time to time, as may be convenient to the Department, not to act in an arbitrary and irresponsible capacity of authority, 'free of government control,' as recommended by the late board of visitors, but to give the Observatory the benefit of its counsel and to give the scientific world an insight into the actual workings of the institution.

[The following extracts from the report of the Astronomical Director refer to the instruments whose work is not summed up in the preceding report of the Superintendent.]

THE 6-INCH STEEL TRANSIT CIRCLE.

[Professor Milton Updegraff, U. S. N., in charge.]

* * * * * *

This instrument is made entirely of steel and mounted very solidly, so that the constants might reasonably be expected to be unusually steady. In the case of the level and collimation this expectation has been realized, but not in the case of the azimuth. Both the collimation and the level are remarkably uniform, excepting that on one or two occasions the latter has shown slight though anomalous changes. A series of experiments made in November, 1899, showed that the variation of the azimuth keeps pace regularly with the variation of the temperature of the steel in the microscope bearers on which the pivots rest. This variation is not, however, a linear function of the temperature, but is less per degree at low than at high temperatures. The change of azimuth per degree of temperature (Fahrenheit) during the earlier part of its use seems to have been $0^s.032$. Since the instrument is provided with a meridian mark to the north, this variation of the azimuth has been productive principally of inconvenience rather than inaccurate work; but the change is too great to make the instrument a suitable one for fundamental work. The instrument will in the near future be entirely dismounted and a careful investigation made in the hope of finding the source of this variation.

THE PRIME VERTICAL TRANSIT INSTRUMENT.

[Assistant Astronomer George A. Hill, in charge.]

The work on this instrument has been devoted to observations of α Lyræ and a small list of suitable stars for the purpose of investigating the variation of latitude and the constants of nutation and aberration. The number of observations is as follows:

α Lyræ	89
Other stars	75

A careful investigation of the level-constant, with a special reference to the coincidence and parallelism of the axis of the pivots, is in progress, but the material is not yet sufficient to determine whether any defect exists in regard to this which is of sufficient magnitude to affect the observations.

THE 5-INCH STEEL ALT-AZIMUTH INSTRUMENT.

[Assistant Astronomer George A. Hill, in charge.]

This instrument is used principally as a zenith telescope for observations of latitude by Talcott's method and the declinations of the stars of the American Ephemeris. Of the former there have been made 86 observations of α Lyræ and three of miscellaneous stars, which are reduced up to date, and the results in January, 1900, together with the material from the prime vertical instrument, sent to Professor Albrecht. Of the declinations of Ephemeris stars 330 observations have been made, and the reductions are completed up to the end of the calendar year.

The results have not yet been subjected to sufficient study to determine the quality of the instrument for obtaining absolute declinations, for which purpose the general form of the mounting is admirably adapted. When its usefulness in this field is established I propose to separate the work of the two instruments and employ more observers in this important line of observation. I have not thought it expedient to attempt this until the arrears of publication are brought up—a task on which all the available force of the Observatory is now concentrated.

THE 40-FOOT PHOTOHELIOGRAPH.

[Photographer George H. Peters, in charge.]

The series of daily photographs of the sun has been continued, weather permitting, except after April 2d, when they were interrupted by the preparations for the observations of the total eclipse in May. Nega-

tives were obtained on 81 days, showing sun spots on 18, distributed as follows : Two in September, two in December, five in January, five in February, three in March and one in April. Visual observations of the sun in May indicate the same low state of solar activity.

STANDARD CLOCK.

Preparations are now in progress for installing a standard clock in a hermetically sealed case to be kept in a double-wall chamber at a constant temperature. The device for keeping the temperature constant is entirely similar to that now employed so successfully in the temperature room for testing chronometers. I consider this subject as one of the most important for the future of the fundamental work of the Observatory, and no pains or expense ought to be spared in securing the best possible performance of a standard clock under the conditions above described. I regret that the preparations for the eclipse so completely occupied the resources of the Observatory that this important matter has had to be laid aside until the present time.

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*AIMS AND METHODS OF STUDY IN NATURAL HISTORY.**

I INVITE your attention to an old but still fruitful topic, namely, the aims and methods of study in natural history. It is a well-worn theme, but one that will retain its interest to the naturalist so long as natural history remains a progressive subject; and I venture to think that it was never more timely than at the present period of intense activity in natural science, of rapid development of new aims and methods, and of continually shifting point of view. How great the changes have been in the last twenty or even ten years is, I dare say, hardly realized by many of the younger generation of naturalists to-day. To appreciate their full extent one must be old enough to have passed his student days in the sixties and seventies, at a time when it was still possible to discuss the truth or error of the evolution theory; when the germ theory of disease was itself no more than a germ; when a gastrula or a karyokinetic figure was a thing to be spoken of with bated breath, but not to be looked upon when there were no oil-immersion-lenses or Abbe illuminators, no automatic microtomes, no ribbon-sections, no chromosomes or centrosomes, no shaking of eggs, no 'taxes' or 'tropisms'; when to adopt the career of a naturalist was to face the imminent prospect of extinction in the struggle with the environment, and to incur the half-admiring, half-contemptuous compassion of one's relatives and friends.

Speaking as I am in the presence of some of those who guided my own first tottering footsteps along the pathway of science, I feel some hesitancy in claiming a place among those veterans of the old guard; but I am nevertheless able to recall days when we had to do without all the things I have mentioned, as well as a good many others, both material and spiritual, that are now considered the very bread of life in the day's work. I will confess, too, that I am old enough to be at times lost in wonder at the child-like serenity with which the modern student will accept many of these matters, which cost such travail of the spirit, and at the distant epoch to which I have referred would have produced a sensation throughout the scientific world. When, for instance, Kleinenberg made the famous declaration 'Es gibt gar kein mittleres Keimblatt' it seemed to us that the sky must fall on such a blasphemy. We have changed all that. Cite those memorable words to-day, at the climax of your cautious discussion of the

* Presidential Address delivered at the annual dinner of the American Society of Naturalists, Baltimore, December 28, 1900.