SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE NAVAL OBSERVATORY REPORT.

THE first impression of our readers on glancing at the annual report of the Naval Observatory, of which the essential portions are reprinted in our columns, will be one of pleasure that the head of the Observatory has deemed it appropriate to review the conclusions of the board of visitors appointed by the Secretary of the Navy in 1899. But pleasure will be changed to disappointment at what the review omits. It maintains with an energy of expression quite unusual in an official paper that a majority of the board was hostile to the Observatory; that it failed to report on the main points submitted, and that the measures which it proposed are 'preposterous' and 'only ridiculous.' But not a word is said in reply to the destructive criticism of the management of the institution 'during almost the entire period of its existence,' which is one of the most important features of the report. Had these strictures been now heard of for the first time some reason might have been found for ignoring them. But they are little more than an echo of strictures emanating from or endorsed by Secretaries of the Navy, the National Academy of Sciences, at least one distinguished naval offi-

cer, and every eminent astronomer in the country who has ever expressed an opinion on the subject. Utterances by such authorities are surely worthy of being honored by a refutation. We wish to facilitate in every way the task of making the most effective refutation possible, and this we can best do by stating the substance of the criticisms as clearly and forcibly as we can, without implying any endorsement of them until we hear the other side.

The only rational object that the nation can have in supporting a great public observatory is the continuous making of those astronomical observations which require to be prosecuted on a uniform plan for long intervals of time, with a force larger than private observatories can ordinarily command, and with a persistence more long-continued than they can be expected to exhibit. The first requirement of all is a comprehensive plan of work, devised by the best authorities at the command of the nation, and based on the latest aspects of astronomical science. This plan should be pursued without change except as improvements are suggested by the advance of research. It should be dependent on the life or temporary opinions of no individual, and should have a form of public support which will secure adherence to it.

The criticism directed against the Observatory is that its published observations and reports show little or nothing of this kind, and that neither permanence of purpose nor unity of object can be discerned in them. Much that we find in the published volumes looks like a collection of individual works of every degree of ability from the highest to the lowest, which have the appearance of being initiated by the worker himself, abandoned when he deemed it best to do so, and only now and then controlled by the guidance of any higher authority. Even in the case of those observations in which continuity from year to year can be best traced, gaps and unexplained changes and omissions occur through the whole history of the Observatory, for most of which no explanation is found, and none can be readily imagined except the varying moods of the observers.

In these points the critics see no evidence of any permanent improvement in the work of the new establishment. The reports for the last eight or ten years show earnest efforts made by this and that astronomer to do this, that and the other, set forth the difficulties encountered in making these efforts, report the success reached in overcoming them, and describe the alterations necessary in instruments and arrangements. Sometimes an effort made one year seems to be continued into the next, and sometimes we hear nothing more of it. It would be tedious to enumerate all the enterprises which figure for a year or two in the annual reports, without any reason being assigned, and then disappear without any explanation. There seems to be as striking an absence of continuity from year to year as there ever was, the work with the prime vertical transit excepted.

It is not denied by the critics that able and industrious astronomers have, from time to time, been attached to the institution, that the qualifications of the working force are still excellent, and that much good

work has been done by it; but it is also claimed that, for the most part, this work could have been equally well or better done at universities and private institutions, and that it is mixed up with so much indifferent work that the separation of the two is difficult. It is also admitted that much of the work compares favorably with that done by professors and students at the various colleges and universities of the country. But the critics do not see why the government should establish a great institution and give men commissions in the navy to enable them to do work which professors and students are doing at universities and which is of no special naval use.

In framing a reply to this criticism we trust that several other points which invite adverse criticism will be cleared up to the pleasure of all. One is especially worthy of mention because we think, if anything can be said to correct the unfavorable impression which it makes, it ought to be said authoritatively and as speedily as possible. Among the important subjects of scientific observation and investigation today is terrestrial magnetism. The good policy of the observatory in entering upon a field already occupied by another bureau of the government may be open to question, but this is aside from the main point. One of the best-equipped magnetic observatories was established and, we believe, observations made for a year or two. We learn from recent reports that the observations were suspended and the department discontinued, because the action of the electric current from a trolley line in the neighborhood so disturbed the instruments as to deprive the results of all scientific value. Now, we hope the head of the establishment will explain how it happened that one of the finest magnetic observatories in existence was established 400 yards from a trolley line, when a simple computation of the effect of the electric current by a magnetic expert would have shown that its inductive effect would be destructive to the results, and, unless we are mistaken as to dates, after experience elsewhere had shown that the presence of such a line within a mile or even a mile and a half of a magnetic station was fatal to the usefulness of its work. All good wishers of the Observatory would be glad of a proof that this happened through no fault of its administration.

We also suggest that something be said to remove the unfavorable impression made by the unfortunate experience of the institution with its instruments from the beginning of its history. How many costly instruments, supposed to be of the finest quality, have been procured, tested, reconstructed, found wanting and suffered to disappear from view, we cannot say without an examination of the records. But the recent easily accessible reports and documents throw some light on the later history of the subject.

The great 26-inch telescope, constructed about 1874, was found to be so defective that, on moving into the new Observatory, what was substantially a new instrument was constructed. We believe that nothing but the object-glass and, perhaps, some accessories of the old instrument were retained. Whose fault was this?

Perhaps the most necessary and important instrument the Observatory ever had was the 9-inch transit circle, constructed, we believe, some time in the sixties. It was found so defective in stability as to greatly impair the value of its results. Attempts to correct the defect proved unavailing, so radical changes were made in the instrument at a cost, if we mistake not, which could not have been greatly short of the original price. No sooner was it remounted at the new location than defects were found in its performance which, according to the annual reports, it took another year to remedy. In 1896 it is reported as again taken down for a period of five months in order that further extensive repairs might be made. The report of 1899 gives an elaborate account of renewed efforts during the first six months of the year to improve its performance, concluding with the statement: "In my opinion it should be restored as nearly as possible to its original construction." But this does not end the history. We learn from the present report that the instrument was again undergoing repairs and alterations for the first six months of the last fiscal year, and yet it winds up with the statement that "one of the defects still introduces liabilities to error which, though small, ought not to be tolerated in a modern instrument."

The defects in this instrument naturally led to the desire to have a better one. Accordingly, among the appropriations made for the new establishment was one of $10,000 for a meridian circle. This instrument was completed and mounted in 1897. We learn from the report before us that it exhibits a peculiarity of a kind so singular that it should interest physicists as well as astronomers. Its horizontal pointing changes so rapidly with the temperature that, by the aid of the delicate meridian mark, a variation produced by a change of a single degree in the temperature must be an easily measurable quantity. Consequently the instrument could be used as a fairly delicate thermometer. It is hardly necessary to add that observations with such an instrument cannot have much scientific value until the defect is corrected, and that the policy of the observers in not attempting serious work with it cannot be questioned.

The new 12-in. equatorial has proved unsatisfactory. There are also intimations that something is wrong with the prime vertical transit, and, altogether, the impression made on the reader is that, after seven years of effort to equip the Observatory with the best instruments, it is doubtful whether a single one of real importance, except the great telescope, is in order for first-class work. We hope something can be said to explain this history, which is without example. The Greenwich transit circle has been in continuous use for half a century except during a brief period of its early history, when some alteration was made in it. The small repairs which it has since required have caused no interruption in the continuity of its work. The instruments of the Pulkova Observatory have, for the most part, been in use since 1840, and it is believed that their results are to-day among the best attainable in astronomy.

Were only a single instrument involved in the case of our own Observatory, it might

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: