SCIENCE:

A Weekly Journal of Scientific Progress.

NEW YORK, JULY 3, 1880.

THE UNITED STATES NAVAL OBSERVATORY, WASHINGTON.

BY PROFESSOR EDWARD S. HOLDEN.

This institution has been long and favorably known to the scientific public, not only of the United States, but of the whole world. It was founded in 1844, and commenced its operations in 1845, and as it is now about to enter a new epoch of its existence by a removal to a new and better site in the District of Columbia, a brief account of its progress will not be without interest.

Astronomy did not flourish in America during the eighteenth century. A few observations were made by Professors at Harvard and Yale Colleges, and in Pennsylvania by RITTENHOUSE and others (in 1769). A telescope was mounted in 1830 at Yale College for regular astronomical observations, and the first observatory was built at Williams College in 1836, by Prof. HOPKINS. Mr. WILLIAM C. BOND, of Dorchester, a maker of chronometers, had erected a small observatory at his residence, and this was afterwards removed and formed the nucleus of the observatory of Harvard College. The observatories of Hudson, Ohio, (founded 1837), of the Philadelphia High School (1840), of West Point Military Academy (1841), of Cincinnatti (1843), of Georgetown, D. C., (1844), and the Naval Observatory (1842), were the first established, and these observatories all erected within the decade, 1835-1845, were the signs of a growing sense of the importance of astronomical research among the people.

Probably due credit has not been generally given to the efforts of General O. M. MITCHEL the astronomer of the Cincinnati Observatory, who, by lectures, treatises and personal influence, kept the subject before the reading public. In Congress a few intelligent men, like Mr. JOHN QUINCY ADAMS, had always advocated the establishment of an observatory which should be truly national, but great opposition to such an institution was constantly displayed, and so late as 1832 a bill appropriating money for the survey of the coast, contained the clause "provided that nothing in this act should be construed to authorize the construction or maintainance of a permanent astronomical observatory."

The final establishment of the Naval observatory came about in this wise, and it was due largely to the admirable abilities of Lieutenant GILLISS, of the Navy.

The exploring expedition of Admiral WILKES (1838-1842), proposed making astronomical observations in all parts of the world, and to utilize these, corresponding observations were required at home. These were made by GILLISS in a small observatory on Capitol Hill for the four years and they were of high excellence. The present observatory building was erected as a "depôt of charts and instruments" for the Navy from designs by GILLISS. The regulations of the Service required that GILLISS should be sent to sea, and the direction of the observatory was confided to Lieutenant MAURY, who retained it till 1861. A corps of astronomers was formed and a detail made of the officers from the line of the Navy to care for the chronometers, charts and instruments, and to collect hydrographical information, and this plan of organization continued till 1866, when the Hydrographic office was separated from the Observatory. Suitable instruments were provided and the observations were published in quarto volumes, twenty-two of which have appeared up to 1880. The main instruments were:

1. A Transit Instrument (by ERTEL, of Munich).
2. A Mural Circle (by SIMMS, of England).
3. A Meridian Circle (by ERTEL).
4. A Prime Vertical Transit (by PISTOR & MARTIUS, of Berlin).
5. An Equatorial (by MERZ, of Munich), with an Object Glass of 9.62 inches.

These instruments were kept steadily at work and thousands of observations were made and have been reduced and published. The mere index to these ob-

servations fills 74 quarto pages. Certain special publications deserve particular mention. A catalogue of 10,658 stars, observed with the instruments 1, 2, 3, and 4, has been made by Professor YARNALL. It may be said to have been his life work, as he made a large share of the observations and reduced all of them. This catalogue is of great usefulness.

The Wind and Current Charts of MAURY, which have been adopted the whole world over, were constructed from observations collected and discussed here. With the equatorial, three asteroids were discovered by Professor FERGUSON, and Professor HALL and himself observed a great number of comets and minor planets. The theoretical researches of Professor WALKER on *Neptune*, of Professor HUBBARD on comets, and the work of Professors COFFIN and HUBBARD on points of practical astronomy, all belong to this first epoch.

The second stage of the Observatory's life may be said to have begun in 1861, with the superintendence of GILLISS, and to have extended to the present time under the direction of Rear Admirals DAVIS, SANDS and RODGERS. Two new first-class instruments were purchased.

6. The Transit Circle (1865), made by PISTOR & MARTINS.

7. The 26-inch Equatorial (1873) made by ALVAN CLARK & Sons. Both have been kept in constant use. With the first, the sun, moon, major and minor planets have been constantly observed and the materials for a very large and important catalogue of stars (soon to be published) have been collected. The telegraphic longitudes of many points in the United States and elsewhere, have been determined by Professors HARKNESS and EASTMAN. We may mention among these the longitudes of Havana (Cuba), St. Louis, Detroit, Carlin and Austin (Nevada), Ogden (Utah), Bethlehem (Pa.), Princeton (N. J.), Cincinnati, Nashville, Columbus, Harrisburg, and others. The large equatorial, besides making a great number of observations of double stars (HALL and NEWCOMB), and of Nebulæ (HOLDEN), has been employed on the observations of the faint satellites for which it is better fitted than any other instrument existing. The masses of *Uranus* and *Neptune* have been determined by Professor NEWCOMB and the capital discovery of two satellites to *Mars* made by Professor HALL.

The theoretical researches of Professor NEWCOMB on the Lunar Theory and on Fundamental Stars, and of Professors NEWCOMB and HALL on Satellites, belong to this period.

The Transits of *Venus* (1874), and of *Mercury* (1878), have been most thoroughly observed and discussed by the various astronomers.

The solar eclipses of 1869, 1870, 1878 and 1880 have been also elaborately observed by parties sent from the observatory, and the results are all published except those for 1878 and 1880, which will shortly appear. The work done here on solar eclipses alone is of the first importance, and will greatly forward our knowledge of solar physics. There is no space to mention the miscellaneous work done: the chronometers of the Navy, the furnishing of standard time to the United States, the observations of meteors, all receive their share of attention.

The third epoch of the history of the Observatory commences with the effort to change its site to one less exposed to the sickly influences of the malaria which rises from the marshes surrounding the Observatory on the river side, and to one where the fogs from the same source will not seriously interfere with the complete use of the instruments. This subject has, since 1870, received more or less attention, but the first serious effort to change the site for these reasons was made in a report of the Superintendent in 1877.

"UNITED STATES NAVAL OBSERVATORY,

Washington, September 15, 1877.

"SIR: I found upon taking charge of the Observatory, that the malarious influences surrounding it were notorious, and that from May to about the middle of October the officers whose services were necessarily in the Observatory at night, paid the penalty in impaired health and in diminished efficiency. The fogs which arise from the river, driven by the prevailing winds, float above the instruments and lessen their usefulness.

* * * * * *

For these reasons, I earnestly recommend that a suitable site, north of the city and inside the District of Columbia, be procured for a new Observatory.

The area allotted to this purpose need not necessarily be more than twenty-five or thirty acres in extent; but as much as this is needed, since, if surrounded by dwellings or factories, the smoke would obscure the clearness of vision, the traffic would shake the instruments, and some high structure, if placed upon the meridian near our instruments, might hide a useful part of the heavens.

The present Observatory is in a very dilapidated condition.

* * * * * *

I have the honor to be, very respectfully,

Your Obedient Servant.

JOHN RODGERS,

Rear-Admiral Superintendent.

Hon. R. W. THOMPSON,

Secretary of the Navy, Washington.

The accompanying papers show that the death of two superintendents, Captain GILLISS and Admiral DAVIS, was either caused or accelerated by malarial fever, and that the death of Professors FERGUSON, SPRINGER and HUBBARD, could be traced directly to this cause. The prevalent fogs are shown to interfere with observations.

In short, this report brought prominently forward a fact which had always been patent, viz.: that it was almost a crime and certainly an extremely poor use of

the resources of the observatory, to continue its astronomers and its instruments in the present situation. A petition was presented to Congress (1878, Jan. 10), from prominent men of science, asking for its removal, and Jan. 16, 1878, a bill was introduced by Mr. SARGENT in the Senate, providing for the appointment of a commission to select a suitable site. In the mean time a plan for the new building had been prepared at the observatory, submitted to all the prominent astronomers of the country for their suggestions, corrected and adopted. The report of the Commission, consist, ing of Admiral AMMEN, U. S. N., Colonel BARNARD-U. S. A., and LEONARD WHITNEY, Esq., was made 1878, Dec. 7. It recommended the purchase of "Clifton," a beautiful site of 45 acres in Georgetown, situated on Rock Creek.

Unfortunately, it was not learned until after the report was made, that it had been seriously contemplated to build a railway down the valley of Rock Creek. This report was not acted on, owing to the fact that the presence of a railway would seriously interfere with the stability of the instruments. Therefore a new commission was appointed Feb. 9, 1880, consisting of Senator W. P. WHYTE, Representative L. MORSE, and Admiral RODGERS, U. S. N., under a bill approved Feb. 4, 1880, which appropriated $75,000 to the purchase and selection of a suitable site. The officers of the Observatory were directed to examine the many sites offered for sale. These lay in three different parts of the city: first, north of the capital near the Soldiers' Home Park, and near the Baltimore & Ohio Railroad; second, north of the main part of the city; third, northwest of the city, in Georgetown. The preferences were for the sites in the first section. Each site that was at all eligible was tried in the following way: the fundamental observations depend upon the accurate measures of the zenith-distances of stars. As the zenith is not a visible point the nadir point (which can be made visible, and which is directly opposite the zenith point) is chosen. A box of quicksilver is placed immediately beneath the meridian instrument and the position of the reflected images of the spider lines of the instrument observed; when these coincide with the spider lines seen directly, the instrument is vertical or it is pointing to the nadir. Such observations as these have to be made at all hours of the night and day, and anything that seriously interferes with them will prevent the taking of satisfactory observations. The question then was, to try each of the proposed sites with this test and to unhesitatingly reject any site which did not fulfill the conditions. To do this a post was firmly planted in the ground. On the top of this a flat basin containing quicksilver was placed. A telescope was directed towards the quicksilver about dusk, so that the image of the pole star should be seen in the telescope. This image usually showed as a neat quiet round disk. The times of the passing of railway trains was known, and at these moments the image of the star was watched. For many of the places tried, the vibration of the mercury surface caused by the tremors of the ground was so great that no image of the star could be seen for many minutes during the passing of the trains. This was a fatal objection, since similar observations may have to be taken at any moment of the night or day.

For those places near a public road the experiment was varied by causing a loaded wagon to be driven rapidly up and down. The experiments were always made at least twice to avoid errors, and only those places rejected which were plainly unsuitable on this account. No matter what might be their other advantages, if they did not stand this test they were useless for astronomical purposes.

The places just north of the city were rejected on account of the smoke always rising from the mass of chimneys, an artificial and constant fog. In this way the choice has been narrowed down to two places. One directly south of the great park of the Soldiers' Home and one in Georgetown. The first is so situated that to make it suitable for observatory purposes a very large quantity of land would have to be bought; the second place can be bought with the appropriation. The matter is in this condition at present. No choice has been made by the commission as yet. There is, of course, a great desire on the part of landowners to force the commission to buy land in their neighborhood, but the choice must finally be made on the principles heretofore adopted. The new Observatory is to stand for a century at least and no small and petty personal considerations should be allowed to enter.

THE PRACTICAL VALUE OF SCIENCE.

"I have endeavored to state the higher and more abstract arguments by which the study of physical science may be shown to be indispensable to the complete training of the human mind, but I do not wish it to be supposed that because I may be devoted to more or less abstract and unpractical pursuits I am insensible to the weight which ought to be attached to that which has been said to be the English conception of Paradise—namely, 'getting on.' Now the value of a knowledge of physical science as a means of getting on, is indubitable. There are hardly any of our trades, except the merely huckstering ones, in which some knowledge of science may not be directly profitable to the pursuer of that occupation. An Industry attains higher stages of its development as its processes become more complicated and refined, and the sciences are dragged in, one by one, to take their share in the fray."—*Huxley.*