scientific and artistic life. Meantime, his two brothers had become famous, the one as artist, the other as architect, and aided in making the new life beautiful and profitable.

In 1876 Hirsch was appointed to the chair of 'The Steam Engine,' at the *École des Ponts et Chaussées*, and, until his retirement at the age limit in 1898, he steadily added to the fame of that great institution. After those twenty-two years of service, the Inspector-General reported:

"To great scientific knowledge he added from the first extensive practical information, the fruit of personal experience, which enabled him to conduct his course as a practitioner, as well as a *savant*, and thus to give it the character most appropriate to the *École des Ponts et Chaussées.*"

At his retirement he distributed a considerable sum, 10,000 fr. for ten years, in prizes for students '*les plus méritants et le moins fortunés.*' He 'gave much but with discretion; he took the trouble to give usefully.' Riches, in his view, created an indebtedness to his country and his people which he was always willing and glad to discharge.

Hirsch added to his work at the *Ponts et Chaussées* that of the department of Mechanics at the *Conservatoire des Arts et Métiers* (1886), and took great pleasure in directing its evening classes and teaching the crudely educated, as well as the well-prepared, pupils at the government school. In 1879 he was on the 'State Commission of Steam Engines'; in 1880 he had charge of the office of engineer-in-chief of the department of purchase and inspection of materials for the state railways. He was on the international juries of 1878, 1889 and 1900 in Paris, and in 1878 received the cross of *Chevalier de la Legion d'honneur* and, in 1900, that of *Officier*.

M. Hirsch published his course at the *Ponts et Chaussées* in the 'Encyclopédie des travaux publics,' and, in its first volume, on the steam engine, had the assistance of M. Debize. His reports upon the machinery exhibited at the International Expositions appeared in the volumes officially issued from the government press.

As M. Dartein says: "*Telles sont été les principales occupations et les travaux le plus notoires du savant ingénieur, du professeur accompli, du chercheur original, de l'homme de bien dans la plus haute acception de ce mot, qu'une mort subite vient d'arracher à la tendresse de sa famille et à l'affection de ses amis.* * * * *Adieu, camarade et ami, ou plutôt au revoir: ta mémoire nous demeurerera chère et ton example nous restera utile.*"

An acquaintance of many years' duration permits the writer to speak with confidence in confirmation of the testimony given by his professional colleagues at the meetings of various societies after his death. In his home and in his private capacity he illustrated the noblest attributes of the gentleman and the scholar; serious yet always kindly and affectionate, giving and eliciting respect and affection, sweet reasonableness accompanying correct judgment and clear views of right and wrong, familiar yet dignified, provident yet liberal, as husband, father, friend, he was invariably and completely admirable. Professionally he was a leader. Practically experienced, technically learned, cultured and efficient, he was a reliable adviser and director in his whole wide field of special work. He was admired, respected and honored by every client, as by every colleague.

His record, official, professional and private, stands a permanent memorial to the man.

R. H. Thurston.

SCIENTIFIC BOOKS.

Les Variations de Longueur des Glaciers dans les Régions Arctique et Boriales. By Charles Rabot. Archives des Sci. Phys. et Nat. Geneva, 1897, 1899 and 1900.

The literature of the variations of glaciers has been greatly enriched by the contributions of M. Rabot. He has brought together in a convenient form the observations that have been made on the northern glaciers, with references to his sources of information, so as not only to give an excellent review of what is known of these glaciers, but also to give the data for comparisons with future work. Many of the original publications which he refers to are in languages, such as Icelandic, Danish, Swedish and Norwegian, which are little known outside of the regions where they are spoken, so that his extracts and synopses bring before us important facts which could not be obtained otherwise without great difficulty. He does not confine himself to the variations of glaciers only, but also gives descriptions, measures of the motion, observations on melting, etc. Although he disclaims that his work is complete, it will be recognized that the incompleteness is not due to oversight on his part, but to paucity of exact information on the subject. One is surprised, indeed, that he has been able to collect so many facts regarding more than 250 glaciers, many in very remote regions.

M. Rabot divides glaciers into three classes: *inland ice*, such as the ice covering of Greenland with its great ice streams which reach tidewater, including smaller local ice-caps; *Alpine glaciers*, with which we are familiar in the Alps; and *composite* or *Alpine-Norwegian glaciers*, an intermediate form grading into each of the other two. Glaciers of the first class are the most common in the arctics.

In temperate regions, the variations of a glacier are easily determined by the change in the position of its end; but this is not so simple among arctic glaciers. Many of them end in fiords and the ice is continually breaking off as icebergs, so that the point where they end varies according as we observe them shortly before or after much ice has broken off. M. Rabot thinks the intensity of the calving is a better criterion of the state of the glacier; if much ice is coming off and at the same time the glacier is not materially receding, it is to be considered in growth; and *vice versa*.

M. Rabot reviews the observations of the glaciers of Grinnell Land, Greenland, Jan Mayen's Land, Iceland, Spitzbergen, Francis-Joseph Land and Scandinavia, five of which regions he has himself visited, and brings out many interesting facts, but we can only notice the most important of his conclusions. Of the regions mentioned Iceland and Norway furnish the most detailed information for the longest time. It is well established that the glaciers of these two countries were much smaller before the eighteenth century than they are now, and that this smaller extension lasted for several centuries; that there was a great advance during the eighteenth century interrupted for a short time about 1750; that during the nineteenth century there has been a slight retreat marked by several minor variations, though the glaciers are still considerably larger than they were during and before the eighteenth century. A Norwegian document of the eighteenth century contains a general description of the Greenland glaciers which might apply to the country to-day, so we must infer that the extent of the ice did not differ very greatly then from what it is now. With the exception of this document all accurate information of the Greenland glaciers refers to the period since 1850. Observations since then are not at all concordant, but they seem to show in general a stationary condition or a slight advance. The natives are unanimous in asserting that the ice has been advancing within historic (?) times. The fewer observations in Jan Mayen's Land and Spitzbergen indicate that their glaciers have followed the same history as those of Iceland and Norway. The glaciers of Grinnell Land and Francis-Joseph Land appear to be retreating at present. Local ice caps, probably of comparatively recent origin, cover the islands which make up the latter.

M. Rabot mentions that the glaciers of southeastern Alaska seem to have been at a maximum at the end of the eighteenth century; and it may be added that observations in Glacier Bay show that there was a long period in which the glaciers were much smaller than at present, followed by the comparatively short but strong advance which apparently culminated at the above date, and that since then there has been a general retreat; so that it seems quite probable that the Alaskan glaciers have experienced

variations synchronous with those of the Arctics.

The general conclusions are that in the Arctics the eighteenth century was a period of very marked advance of the glaciers, that this was preceded by several centuries of great retreat, and followed by a small retreat which is still in progress. Where the information is sufficient these conclusions are fully established; where it is meager they are partially confirmed or at least not contradicted.

M. Rabot points out certain resemblances and differences between the variations of the arctic glaciers and those of the Alps. Although, so far as can be made out, there seems to be a fair accord in the dates of the variations, there seems little relation between their respective intensities. The general advance of the arctic glaciers in the eighteenth century was not marked in the Alps; and the strong retreat of the second half of the eighteenth century in the Alps is but faintly shown in the Arctics. Moreover, it has not been possible to show a distinct relation between the variations of climate and the variations of the glaciers in the Arctics as has been done in the Alps.

M. Rabot has accomplished what must have been a laborious task, and deserves the thanks of all persons interested in the variations of glaciers.

Harry Fielding Reid.

Geological Laboratory,
Johns Hopkins University.

The Brain of Acipenser. A Contribution to the Morphology of the Vertebrate Brain. By J. B. Johnston, Professor of Zoology, West Virginia University. Zool. Jahrb., Abt. f. Anatomie, Bd. XV., Jena, 1901, pp. 204, with 12 plates and 22 text-figures.

The application of the cell theory to the nervous system (for this is what the doctrine of the neurone amounts to in the upshot) has reached its consummation only within the past decade. Accordingly, the neurology of to-day, whether human or comparative, demands not merely topographic descriptions of the tracts and nuclei within the brain, but the precise relations between the two, stated anatomically in terms of cellular morphology as well as in terms of experimental pathology. This necessitates the rewriting of some chapters in the standard text-books and the repetition of many classical researches upon the lower animals with 'modern neurological methods.'

Such, then, is the motive which has led Professor Johnston to attempt 'a *complete* study by modern methods of the brain of a lower vertebrate.' The type chosen, the sturgeon, was described in 1888 by Goronowitsch, and the present study aims to fill in the cellular details upon the basis of the topography as there laid down (with the result, we may add parenthetically, of correcting several errors both of fact and of morphological interpretation found in Goronowitsch's account). Standard histological methods—among which judicious staining with Delafield's hæmatoxylin is still unrivaled for lower brains—were, accordingly, supplemented by the use of methylene blue in various forms and by chrome silver impregnation. The author's results with the latter method are especially brilliant. He has succeeded in getting whole brains impregnated and cut into unbroken series of sections, so that the courses of the more important tracts could be controlled by the actual demonstration of the paths of individual fibers through them.

Of the 12 plates accompanying the paper, one is a chart showing all the more important fiber tracts in the brain of this fish elucidated by an ingenious color scheme, the reflex arc being represented as consisting of a chain of several links which are indicated by colors of the spectrum, sensory roots blue and motor roots red, with the connecting tracts in series between. The other plates (all photographic reproductions from untouched negatives) include seven views of the entire brain, 56 photographs of Golgi preparations, illustrating nearly all the important types of neurones in the brain, and 21 transverse sections from a series stained with Delafield's hæmatoxylin to illustrate the topography. The latter are accompanied by lettered outline drawings on transparent paper and incorporate also some results of the study of Golgi sections.

Dr. Johnston is one of the few neurologists who give evidence of an adequate appreciation of the importance of the peripheral nervous system as furnishing the key to the central, and