Yet there is no institution teaching it. We need to expand our few and scanty classes in zoology and physiology into an organized school of instruction and research into all the biological processes that are or can be applied to industry. We pass to another range of science in mathematics and astronomy; but it is one in which London has a special interest. It seems almost incredible that in the greatest port of the world, providing its own large quota to our mercantile marine, absolutely no public provision exists for instruction in the art of navigation, or in the application of mathematics and astronomy on which the art depends. There is urgent need for the establishment, in connection with the University, preferably in East London, of a school of nautical astronomy and navigation, including the applications of magnetism and meteorology to the sailor's art.

The Science Faculty seems thus to require:

1. Increase in staff of professors and instructors at existing centers—say, £15,000 a year (£500,000).

2. Extensions at existing centers in buildings and equipment to accommodate additional students—say, £80,000.

3. New centers — building, equipment, and endowment of science departments at, say, three at £40,000 (£120,000).

4. New subjects—provision for buildings, equipment, and endowment of centers for electro-chemistry (£100,000), mining and metallurgy (£100,000), technological chemistry (£100,000), bacteriology and biology in its industrial relations (£100,000), nautical astronomy and navigation (£100,000), etc.—total for science, £1,200,000.

SCIENTIFIC BOOKS.

Lehrbuch der vergleichenden mikroskopischen Anatomie der Wirbelthiere. By Dr. Albert Oppel. Dritter Theil. Mundhöhle, Bauschspeicheldrüse und Leber. Jena, Fischer. 1900.

With this volume is completed the discussion of the digestive system. Volume I. comprised the stomach and included 543 pages; Volume II., the esophagus and intestine, in 682 pages. The present volume consists of 1180 pages, with XI. plates and 679 figures in the text, therefore exceeding considerably the preceding volumes in size in accordance with the greater complexity of the parts considered.

The work follows closely the plan of the preceding volumes. Each subdivision is discussed in historical sequence, the statements of the author being included between oblique lines, //. In accordance with the plan, the greatest pains have been taken to show the present state of knowledge of the structure of each part in the different forms, and to this end the search in the literature has been made exhaustive, and references to all papers, however trivial, have been sought out. No prejudice has influenced the writer in favor of continental investigators to the exclusion of others; indeed, the recognition of American work seems to be greater than that accorded by many American writers. The quotation of each author is followed by his name and the year of publication. The complete title is given in a bibliography in the end of the volume.

Where there are differences of interpretation (as, *e.g.*, as to the nature of the demilunes in the mucous salivary glands), the different theories are propounded, weighed and (where possible) some choice is indicated.

The text is followed by a table of animal forms, giving a key to the position of the species considered in the text and an arrangement of their families in systematic order. This is followed by the bibliography of 50 pages, and finally, author and subject indices.

In the body of the work the oral cavity with its adnexa, pancreas and liver are taken up successively. In connection with the oral cavity are discussed: the structure of the mucous membrane in the different classes; the pharynx of mammals; the lymphoid tissue of the oral cavity; the tongue; nerves and sense-organs; and finally, the oral (salivary) glands. The teeth, which on many accounts might seem to be properly included, are omitted to be discussed with the skeletal system in a subsequent volume.

In each of the subdivisions the subject is taken up systematically and in detail. For example: the lymphoid tissue in the oral cavity is discussed (1) as to its significance, (2) the migration of the leucocytes through the epithelium, (3) the structure of the lymphatic nodules, (4) the tonsils (lingual, palatine and pharyngeal), and finally (5) the development of the tonsils. In summarizing the subdivision dealing with the tongue, Oppel arrives at the conclusion that the mammalian tongue is to be derived from the entire tongue of the lower vertebrates and not merely from the back portion of it (as Gegenbaur believed).

Especially in the case of the oral (salivary) glands has there been felt the need of a summarization of knowledge, and Oppel has furnished it admirably. The classification of the mammalian oral glands, their occurrence and structure in the different animals, have been made the subject of varied interpretations—Lavdowsky's, Klein's, Nadler's, Stöhr's and Ranvier's are given.

The interpretation of the demilunes of Giannuzzi of the mucous glands receives full discussion. The three views of the substitution theory, phase theory and special function theory are each presented and criticised. Oppel rejects the first two and considers the third as the one to be accepted in the light of recent work (Krause, Solger, Müller, *et al.*).

The pancreas seems to be of universal occurrence in the vertebrates; wherever it has been sought for it has been found. Comparison with the salivary glands to see whether it can be regarded as an 'abdominal salivary gland' (the German name) shows that there are certain specific structural differences that distinguish it.

The pancreas is discussed from the point of view of the finer structure of the gland cells, including a consideration of the so-called paranucleus, the activity of the cells, the form of the tubules, centro-acinar cells, the terminal ducts and the structure of the pancreatic ducts in the classes of vertebrates, the connective tissue of the gland. The interesting areas of Langerhans are next discussed, and in regard to their occurrence and significance, Oppel says that they have been demonstrated in most vertebrates (doubtfully in the Selachia). He regards them as permanent structures and not transitory (as developing acini) and considers them of epithelial (entodermal) origin. On the other hand, whether or not they elaborate an internal secretion, he dares not decide, but should this be found to be the case, it does not, he thinks, militate against the view that they were originally part of the gland proper giving (possibly) a clue to the structure of the primitive gland. Blood vessels and nerves are considered next. The question of the occurrence of an accessory pancreas is then discussed. The development of the pancreas in the various vertebrate forms closes the chapter and is supplemented by a helpful table showing and comparing the mode of development in the different vertebrates as ascertained by the different workers.

In dealing with the various structures no attempt is made to discuss the gross anatomy as beyond the scope of the work, save in so far as necessary, though often—as in the case of the liver—references are given to the sources whence such information may be gained. It is likewise in accordance with the plan of the work to present the discussion in historical sequence, so that the liver is considered from the standpoint of (*a*) the liver lobule, and (*b*) the liver cell and gall capillaries, despite the fact that liver lobules are peculiar to mammals.

In the consideration of the remaining structural features of the liver, bile-duct and gall bladder are taken up, followed by a discussion of the liver in the different vertebrates. The development of the organ constitutes the closing division. Few original observations or generalizations are made in this portion of the work.

The comparison of the liver with other typical glands receives considerable attention, together with the question of the anastomosis of the gall-capillaries, and the conclusion is reached that a net-like arrangement of the gall capillaries occurs in the lower vertebrates, and in the higher forms at least in early development. Under the subdivision dealing with the functional activity of liver cells, the glycogen, pigment and fat content are discussed. Most investigators agree that there are two kinds of

liver cells, but there is no answer to the meaning of the differences.

The work as a whole is a valuable treasure-house of knowledge that will save both investigator and student much time and labor. The author does not state which system will form the subject of the next volume, nor when we may expect it to appear. At the same rapid rate of work it will be due in 1902, and we feel sure that the same excellence will be maintained.

B. F. Kingsbury.

RIVER PROFILES.

An interesting and valuable publication of the Department of Hydrography of the U. S. Geological Survey on the profiles of rivers in the United States, by Henry Gannett, has just been published and is now available for distribution. It embodies within a hundred pages the leading facts of about one hundred and fifty of the most important rivers and streams of the country, noting their length, drainage area, the location of water power in their courses, their peculiarities of flow and the nature of their drainage basins.

The rivers selected are those which are the largest in size and bear most directly upon the varied interests of the country such as the Connecticut, Hudson, Susquehanna, Ohio, Potomac, Mississippi, Missouri, Platte, Colorado, Sacramento, Columbia and others. The figures for the table showing the height above sea-level and fall per mile were collected from various sources. Some were obtained from the report of the chief engineer of the U. S. Army, some from railroad companies when their lines cross the streams and some from the atlas sheets of the U. S. Geological Survey. In the case of such rivers as the Connecticut, Susquehanna, Mississippi and Colorado, where the surrounding country is in part or whole of peculiar physiographic interest, very excellent and vivid descriptions of its leading physical characteristics are given, which add to the interest, and render it valuable from an educational standpoint in geographic and physiographic instruction. The pamphlet is the result of much careful work and is the first attempt to collect and compile this information in its present form.

SOCIETIES AND ACADEMIES.

ZOOLOGICAL CLUB, UNIVERSITY OF CHICAGO. WINTER QUARTER, 1901.

I.

The first meeting of the quarter on Jan. 9 was devoted to a paper by Professor F. R. Lillie, entitled 'A Comparison of the Power of Regeneration in Three Genera of Planarians, viz., *Planaria*, *Phagocata* and *Dendrocœlum*.' The following is an abstract of the paper:

"The greater part of the large volume of recent work on regeneration of planarians has been carried out on a single genus, *Planaria*. Attention should be called to the importance of the comparative method in studies of this kind. This may be illustrated by some results of observations on two other genera, *Phagocata* and *Dendrocœlum*. These three genera are found living together in a single pond in Falmouth, Mass. *Planaria* is especially abundant in this pond, in some parts of which as many as twenty or thirty individuals may be found on the under surface of a single large stone. Scattered about among these individuals one finds usually from one-half to one-third this number of individuals of *Phagocata* and two or three specimens of *Dendrocœlum*. *Planaria* is thus much more abundant than *Phagocata* and the latter than *Dendrocœlum*. The last is more abundant relatively in portions of the pond where there is a large amount of vegetation growing on the bottom. The habits of life of the three genera in question are, however, very similar.

"*Phagocata* was found to resemble *Planaria* very closely both in the modes of, and capacity for, regeneration. *Dendrocœlum*, however, offers the greatest contrast to both *Planaria* and *Phagocata*. The first experiment was to cut a single specimen in half through the pharynx. The cut surfaces healed and the farther fate of the parts was as follows: The posterior part formed no new tissues, although it lived for some days; from the anterior part, on the other hand, there grew out a pointed piece, which acquired the characters of a tail. Two weeks after the operation this piece also died without any extensive remodeling of the whole having taken place. I afterwards repeated the ex-