hundred professors, more or less, as many gymnasium drill masters. Let us suppose that the resultant multitude were called a university. It would be just the same sort of a university we have developed in America, a place where men and boys are gathered together, each in the other's way, and where neither ideals of scholarship nor ideals of man-making can reach their most perfect achievement.—President David Starr Jordan, in *The Yale News*.

SCIENTIFIC BOOKS

Conditions of Life in the Sea. A Short Account of Quantitative Marine Biological Research. By JAMES JOHNSTONE. Pp. 332. Cambridge Biological Series, Cambridge University Press. 1908.

Many good things must be, and a few bad things ought to be, said about this book. Since it is more agreeable to speak well than ill, we will occupy ourselves first and chiefly with what is good.

The broader value of the work is two fold.

In the first place it affords an easy, reliable opening into an important, rapidly growing field of knowledge that hitherto has not been readily accessible to general readers, nor indeed to special scientific students. The field to which reference is made is marine biology as developed particularly by the countries bordering on the North Sea. Many professional biologists, especially in America, have not yet had brought home to them the fundamental nature of various conceptions and methods involved in these investigations.

In the second place the book is noteworthy for biology generally from the consistency with which the quantitative standpoint is maintained. The reviewer does not recall another semi-popular work in which organisms are regarded in a quantitative way for so wide a range of their relationships. In this the book may be looked upon as a harbinger of what biological treatises of general character will be in the future. This statement tells at once that the author is enrolled in the so-called Hensen or Kiel school of marine biologists.

Much criticism has been passed upon both the methods and results of this school. One may be indeed justifiably sceptical concerning the value of the particular calculation that a square mile of the water of the Baltic Sea contains 80 to 100 billion copepods, or that there were 180,139,000 haddock in the whole North Sea during the spring of 1895. The chief interest in the calculation lies in its significance concerning what biology's attitude toward its problems may be. In a given limited area of the ocean, the North Sea for example, there is at a given time *some* limited number of haddock. Finite quantities of substances and bodies and forces are the very foundation stones of all physical science, biology with the rest, and sooner or later as knowledge advances, values for these quantities are bound to be sought. When fishing industries unite with clearly perceived biological problems in demanding information as to how many herring there are in the North Sea, and how much food is available for them, to get such information is exactly part of the business of science. If the first attempts are not sufficiently reliable, others with better methods must be made. For biology to take the ground that such researches can not be successful, nor would be significant if they were, would be to acknowledge itself stunted in its early youth.

The book is divided into three parts. Part I. designated introductory, contains in the first place a general description of the apparatus and procedures used in the most advanced marine biological researches. An account of certain aspects of oceanography is also given as is a very general survey of the Life of the Sea. Such topics as bottom deposits, composition, temperature, transparency and circulation of the waters are touched upon.

Under the heading Life in the Sea the zones of littoral life, bottom dwellers, or the benthos, and the free life, or the nekton and plankton, and kindred subjects are spoken of and several figures showing characteristic pelagic invertebrates and algæ are given. This part ends with a chapter on sea fisheries.

The real essence of the volume is in parts II. and III., designated respectively Quanti-

tative Marine Biology and Metabolism of the Sea. Part II. is, on the whole, the most satisfactory portion of the book. The author is at his best when dealing with actual observations and matters of fact in such a way that his general biological theories have no visible influence on his conclusions, and it is unfortunate that the whole book could not have been written with a mind thus unhampered.

Although Mr. Johnstone's adherence to the Hensen ideas is unqualified it is not slavish. Most, though by no means all, of the more telling criticisms passed upon the methods and results of the Kiel school are duly heeded. The methods of collecting developed up to date are treated to the extent of nearly ten pages, and Lohmann's interesting observations on the capture of plankton by appendicularia is adequately noticed. The four methods of estimating the quantity of plankton, viz., the volumetric, chemical, gravimetric and numerical, are considered both as to processes and reliability. Of these "the actual counting of the organisms is the most satisfactory."

The surface distribution of certain kinds of planktonic organisms in the north Atlantic is illustrated chiefly by reference to Cleve's work. Two instructive charts accompany this discussion.

A chapter devoted to A Census of the Sea, and another on The Productivity of the Sea, summarizes considerable of the data on these subjects, though by no means all that has been gathered by the investigators of the north Atlantic.

On the question of the depletion of the sea through fishing, the author, though admitting the absence of conclusive proof on either side, and noting the authoritative opinion against exhaustion, thinks "we can not come to any other conclusion than that fishing operations as at present carried on, do cause a very appreciable diminution of the stock of fish on the sea bottom." More reliance is placed on Hensen's investigations than on any others for this conclusion.

Greater productivity of the ocean in high latitudes than in low is regarded by the author as proved. The three chief explanations of this supposed fact are considered in part III. Brandt's conjecture that denitrifying bacteria are more active in warmer waters and hence prevent these from containing as ample a supply of nitrogenous food-salts for the phyto-plankton as the colder waters have, is held to be "not the only hypothesis capable of explaining" the phenomenon. Nathanson has suggested that in some localities at least, colder waters may contain greater quantities of organic matter because they have up-welled from the bottom or deeper water where such matter has gradually accumulated through the settling into them of the carcases of organisms that have lived in the lighter waters above; or through the transferrence to them by convection-currents of warmer surface water from middle latitudes that have been enriched in organic matter by rivers from land areas clothed with vegetation of tropical luxuriance. Johnstone thinks this hypothesis worthy of consideration.

Finally the explanation proposed by Pütter is presented. This author supposed, to state the case in a nutshell, that animals inhabiting warm waters live faster than those inhabiting cold waters and so consume more food. Consequently since the food supply is everywhere limited, a less numerous population can be maintained in the warmer than in the colder seas.

Among the many interesting subjects treated in part III., none is more interesting than that of nitrogen in the sea and the relation of bacteria to this element.

That imagination would be dull indeed that should not be kindled by the picture outlined in this part of the book of what the earth really is as a habitation for living beings. The truly cosmic character of the problems the threshold of which has been crossed by Brandt and the few other foremost investigators in this realm, is well brought home to the reader.

The book ends with several useful appendices, one of which is a summary of A. B. Macallum's interesting though not convincing speculations on the chemistry of the early seas, and the impress this has left on living beings down to even the present.

It remains now to point out certain really bad defects in the work. In the first place the title is misleading. From it a prospective reader would anticipate a comprehensive treatise—comprehensive, that is, in the sense of reaching to the seas of the earth generally. As a matter of fact the only indication the book contains that the author knows of the existence of oceans beyond that contiguous to northwestern Europe is just enough reference to others to impress the reader with the idea that whatever such there chance to be, may be ignored, except so far as they illustrate the central truths, truths, that is, that center in the North Sea. Think, for instance, of a discussion of "The Productivity of the Sea" that does not mention the cod-fisheries of Newfoundland, the salmon-fisheries of Alaska, and the fisheries generally of Japan and China!

How shall a professedly general treatment of the problem of the depletion of the sea be characterized that makes no reference to the Alaskan salmon hatcheries or to the perennial effort to save from destruction the fur-seal herds of the Behring Sea?

Had the author taken as his title "Conditions of Life in the *North Sea*" or something of the sort, he would have saved himself from the grave criticism that must now be passed upon him. Any moderately informed reader will surely ask: Does the author not know what has been and is being done in other parts of the world on many of the problems considered, or knowing does he deliberately ignore? Desiring to be fair which alternative shall we reject as being the less creditable?

Is an author's deficiency professional or ethical, which permits him to discuss in a general book the "Stratifications of the Plankton" and make no reference to the work of Alexander Agassiz?

Professor W. A. Herdman and his colleagues of the Marine Biological Association of Liverpool have contributed importantly to the knowledge of the sea and its life, particularly of the western British seas. Does Mr. Johnstone find nothing here deserving mention beyond the fact of footnote value (p. 191), that Herdman has made "some interesting suggestions as to the use of copepoda as human food?"

Wherefore the book's deficiency in the use of accumulated knowledge? The candid, measurably informed reader is forced to this question over and over again.

Some of the chapters were turned over to the printer while their English was yet sorely in need of pruning and finishing.

On account of the limited amount of food yolk development is a rapid process and the little fish usually hatches out from the egg in a week or two, but is a very feeble and helpless creature (p. 83). (*37 words.*)

On account of the limited food-yolk development is rapid and the little fish usually hatches in a week or two, but is very feeble and helpless. (*27 words.*)

Ten useless words in thirty-seven are too many. They make twenty-seven per cent. of superfluity. On the score of mere physical loading this is unfair to the printer, the purchaser and the reader, to say nothing of the writer. Furthermore, there are the literary proprieties. Surely they deserve some consideration even at the hands of the scientific man. True no great number of sentences are as hypertrophied as is this, but it is by no means unique and those that approach it are not rare.

Despite these unsavory remarks brought upon itself, the book's merits far outweigh its defects. All English speaking people interested in the larger aspects of marine biology should feel grateful to Mr. Johnstone for having written it even though they can hardly help wishing he might have made it better in some respects.

WM. E. RITTER

Manual of Practical Assaying. By the late H. VAN F. FURMAN, E.M. Revised and enlarged by WILLIAM D. PARDOE, A.M., Assistant in Mineralogy, Princeton University. Cloth, 8vo. Pp. xi + 497. Price $3.00.

It was most gratifying to find that this book, which has been considered as a standard, and had been used extensively as a text-