degree, each aiming to present a different point of view or a novel method of attacking evolutionary problems. Darwin might in that case have lived to see his pupils holding numerous professorships in widely scattered schools to the glory and delight of his university; the grateful pupils might even have honored him with a Festschrift on forty different and wholly unrelated subjects—but the world would still hold the theory of special creation!

Our universities need carefully to consider whether they are really *fostering research* in multiplying "research courses" in their graduate schools and making larger and larger bids for graduate students. In the interest of genuine research within the universities it is important that they with their estimated hundred millions annual income should not absorb the exclusively research institutions with their paltry two millions estimated annual income. It is important that the latter type of institution should persist, if only to point out the difference between giving all one's time to research and giving all one's time to training for research those who either are incapable of it or are never going to have time for it themselves, but will only repeat the endless process of getting others ready for it.

But it has been objected and will be objected again—If the university does not foster incipient research by training beginners, there will soon be no trained investigators. Is this true? Is it true, I wonder, in the case of astronomy, the oldest of sciences, the one which is almost never used as a stepping stone to the doctorate in a graduate school? Is there a dearth of workers there, of adequately trained and competent ones? Astronomy has certainly not ceased to advance in our time.

Should the university then abandon research? By no means, but it should cease to deceive itself as to what research is. It is not offering "Courses in Research" or conferring doctorates or publishing numerous papers or even building laboratories.

Many of our universities already have attached to them genuine research establishments which are making important contributions to knowledge. As a rule they receive no students and confer no degrees. They are invariably endowed; otherwise they would sooner or later be dragged into the whirlpool of teaching and forced to offer courses and degrees as bait to prospective students and would thus be turned aside from intensive and effective investigation. Some such establishments, however, have other functions which interfere more or less with investigation, such as exhibition and demonstration in museums and gardens.

The university is an entirely suitable place, in many respects the *best* place, for a research establishment; but when such establishments are founded in connection with a university, their purpose *for research* should be made very clear and their administration should be kept very distinct from both teaching and the demonstration of discoveries to the public.

W. E. Castle

August 25, 1914

CHONTAL, SERI AND YUMAN

A recent reexamination of the available evidence bearing on Brinton's old but not generally accepted finding of a genetic relationship between the Chontal (Tequistlatecan), Seri and Yuman Indian languages, confirms his judgment positively. Chontal and Seri being Yuman, are Hokan; and the Hokan family therefore now has a known extent of over 2,000 miles on the Pacific coast of America. So definite are the resemblances furnished by Chontal and Seri that they help to elucidate problems in the Hokan languages of northern California. The results of the study are now awaiting publication.

A. L. Kroeber

September 8, 1914

SCIENTIFIC BOOKS

The Microscopy of Drinking Water. By George Chandler Whipple, Gordon McKay Professor of Sanitary Engineering, Harvard University and Massachusetts Institute of Technology. Third edition, rewritten and enlarged. New York, John Wiley & Sons. 1914. xxi + 405.

The scientific study of the microscopical organisms in their relation to potable waters

(rather than as a source of fish food) is a subject of American origin and development. It was born in the laboratories of the Massachusetts Institute of Technology, nurtured by the Massachusetts State Board of Health and the Boston Water Board, and brought to full maturity in the Mt. Prospect Laboratory of the Water Department of Brooklyn. In Boston and in Brooklyn Professor Whipple was the leading spirit in the investigation of this subject.

His admirable book on the "Microscopy of Drinking Water" was first published in 1899 and has remained the standard text upon this subject. A third edition comprehensively rewritten to include the experience of the last fifteen years is most welcome to all workers in this fascinating and practically important field.

The main objects of the miscroscopical study of water are of course first to determine the causes of odors and turbidities in water and to control the remedial measures applied to them, and second, to work out the relation of the plankton to the life of fishes. It is also of value in certain cases as an index of sewage contamination, as a measure of the processes of self-purification of streams, as an explanation of the sanitary chemical analysis, and as a means of identifying water from particular sources. Professor Whipple is doubtless correct in his conviction that "the micrology of water is going to play an increasingly important part in the science of sanitation."

The methods used for the microscopical examination of water remain essentially as they were worked out by Professor W. T. Sedgwick and Mr. George W. Rafter in 1889. Three important modifications are, however, described by Professor Whipple, the sling filter for examinations in the field, the use of a round cell for counting instead of the expensive and cumbrous oblong one and the use of the cotton disc filter which gives an admirable general idea of the total amount of plankton in a given water. A new chapter on the microscope and its uses by Dr. J. W. M. Bunker is added to the discussion of the specific methods used in water examination.

Professor Whipple's discussion of limnology is extended and amplified in many respects, particularly in regard to the estimation of dissolved gases and their effect upon plankton growth. In general the effect of various environmental conditions upon the multiplication of water organisms is admirably discussed. The diagram of plankton changes in the Genesee River is particularly striking, showing the rise first of bacteria, then of protozoa, then of rotifers and crustacea, as each group preys upon the preceding one. The reviewer must demur at one conclusion, drawn on page 215, to the effect that a curve showing seasonal variations of blue-green algæ and bacteria in Baiseley's Pond, indicates that the former are antagonistic to the latter. It is quite true that the bacteria increase in spring and fall and the cyanophytes in summer; but it seems more probable that the increase in bacteria is merely the usual fall and spring increase due to rains and thaws, which occurs in all surface waters, than that the cyanophytes have anything to do with it. The season of the year has a great many effects upon a great many things and plotting two effects against each other as if they were related has led to many errors.

The most important additions to Professor Whipple's book relate to the practical control of the growths of microscopic organisms and the obnoxious odors and turbidities which they produce. This subject was in its infancy fifteen years ago, but to-day there are three well recognized preventive or remedial procedures, stripping of the reservoir site, treatment with copper sulphate and aeration. Stripping of the reservoir of its organic soil to eliminate the food of the microorganisms has been extensively used in Massachusetts, but the report of Messrs. Hazen and Fuller in connection with the proposed application of this method to the New York water supply (from which Professor Whipple quotes extensively) leads to the conclusion that stripping can not by itself be expected to produce satisfactory results and in most cases involves a large expense of doubtful value. The destruction of the microorganisms by treating reservoir

waters with copper sulphate, Professor Whipple rightly estimates as of great usefulness, although usually as a palliative rather than a permanent remedy. Reliance must be placed in the last resort upon aeration, which changes the odoriferous essential oils produced by the microorganisms into inodorous compounds, combined with filtration for the removal of the organisms themselves. The value of this procedure has been clearly demonstrated both experimentally and on a practical scale, and Professor Whipple describes plants in operation at Rochester and Albany and New York City, and at Springfield, Mass., a view of the Springfield aerating fountain forming a very attractive frontispiece for the volume.

About a quarter of Professor Whipple's book is devoted to a systematic description of the more important genera of water microorganisms. The plates of the first edition have been made much more valuable by being colored, and five new plates have been added, one showing the results of the cotton disc filter test and the other four being photomicrographs of important water organisms. C.-E. A. Winslow

American Museum of Natural History,
New York

Essays and Studies Presented to William Ridgeway on his Sixtieth Birthday. Edited by E. C. Quiggin. University Press, Cambridge, 1913. Pp. xxv + 656, 93 illustrations.

If a commemoration volume is an index to the scope of the work done by the man it is intended to honor, the Ridgeway volume is indeed a monument to the versatility of the distinguished British scholar. The one drawback about such a work is that only a Ridgeway could adequately review it. There are, for example, 25 papers dealing with classics and archeology—two large but related fields. Then under the head of "Medieval Literature and History" come half a dozen or more important papers.

About half the work is devoted to anthropology and comparative religion. Sample articles under this section include: "The Weeping God," by T. A. Joyce; "The Serpent and the Tree of Life," by J. G. Frazer; "The Problem of the Galley Hill Skeleton," by W. L. H. Duckworth; "The Beginnings of Music," by C. S. Myers; "Kite Fishing," by Henry Balfour, and "The Outrigger Canoes of Torres Straits and North Queensland," by A. C. Haddon.

Lack of space precludes the thought of reviewing the various articles even in a summary fashion. Only two will be selected for this purpose: "The Contact of Peoples," by W. H. R. Rivers, and "The Evolution of the Rock-cut Tomb and the Dolmen," by G. Elliott Smith. As to the contact of peoples Rivers begins with the formulation of the principle that the extent of the influence of one people upon another depends on the difference in the level of their cultures. He tests the principle by applying it to a study of two complex ethnologic problems, viz.: Australian culture and Megalithic monuments. It is shown that Australian culture is not simple, but complex, this complexity being due to many elements derived from without. These elements are supposed to have been introduced at intervals by small bodies of immigrants whose culture seemed so wonderful to the lowly natives that they were able to wield a far-reaching influence, one in fact which was carried by secondary movements throughout the continent. After a time the culture of the immigrants would degenerate, leaving little that was permanent. The traces of these successive influences, however, would live in magical rites, religion, myth, and tradition. This would account for the highly complex social and magico-religious institutions of the Australians, coupled with the extraordinary simplicity and crudeness of their material and even esthetic arts.

The same principle is called into requisition to account for the presence of megalithic monuments in such widely separated parts of the earth. Megalithic culture is thus carried not by vast movements of a conquering people, but by the migration of small bodies of men, the movement being one of culture rather than of race. Such a view is certainly