DR. J. B. LEATHES, F.R.S., professor of pathological chemistry in the University of Toronto, has been offered the chair of physiology at the University of Sheffield rendered vacant by the acceptance of Professor J. S. Macdonald of the chair of physiology in the University of Liverpool.

DISCUSSION AND CORRESPONDENCE

RESEARCH ESTABLISHMENTS AND THE UNIVERSITIES

PRESIDENT WOODWARD'S address[1] contains so much of concentrated wisdom on the subject of scientific research within and without universities that no American scientist should fail to read it carefully. The part which impresses me as especially timely deals with "research in academic circles." President Woodward does not discuss the question whether research is a desirable agency in the disciplining of untrained minds, but I understand this to be the theory on which most university instruction in science is now based. The so-called "inductive method" is simply the method of research. Our science courses aim only in a minor degree to impart information; their chief aim is frankly recognized to be training in methods of discovering truth. But is the training of students in *methods* of research itself *research*? This is a subsidiary question which President Woodward's words suggest and concerning which I think we are apt to deceive ourselves.

Our larger universities, and many of our smaller ones too, point with pride to the research work which they are accomplishing. But in not a few cases this work, if inspected carefully, is found to take final shape in disertations for the doctorate, of doubtful value as contributions to knowledge, prepared primarily not because the author had something of value to record but because he had to record something in order to get the coveted degree.

The chief energies of many professors entirely competent as investigators are wholly absorbed in laboriously dragging candidates through the academic mill up to the final examination for the doctorate. Their success as research professors and the standing of their universities as centers of research is commonly estimated in numbers of doctorates conferred. See the publications of graduate schools, departmental pamphlets, and even SCIENCE (Aug. 21, 1914) with its annual list of "Doctorates conferred by American Universities."

Now is this in any true sense *research*? To coach an ambitious but mediocre mind up to the point of making a fair showing for the doctorate is the more exhausting, the more mediocre the candidate. Whatever its educational value, it certainly has little value as research. Yet this makes up a considerable part of the "research" activity of our best universities. Great sums of money are devoted to it in the form of fellowships, scholarships, buildings for laboratories and laboratory equipment for the use of advanced students. A small part of this investment devoted to research by the professors themselves unhampered by a crowd of immature and incompetent students would doubtless be much more effective in advancing knowledge.

The attempt to combine teaching with research has another indirect but evil consequence. The periods which the professor can himself devote to research are intermittent and fragmentary. This affects disadvantageously the topics selected for investigation. They too must be minor and fragmentary. Great fundamental questions requiring long continued and uninterrupted investigation can not be attacked with any hope of success by one who has only an occasional day or a summer vacation to devote to research. The necessity, too, of hunting up thesis subjects for students, small enough in scope to be handled successfully by a beginner in a limited time and yet novel enough to make a showing of originality reacts unfavorably on the professor's own work. It loses both in breadth and depth. He who in the full maturity of his powers should be doing a day's work, runs errands for boys, holds their coats and carries water. Imagine what the "Origin of Species" would have been like had it been brought forward vicariously as a series of theses for the doctor's

[1] "The Needs of Research," SCIENCE, August 14, 1914.

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