conventional and long-established forms of higher educational work.

LOUIS E. REBER
THE UNIVERSITY OF WISCONSIN

AN OPPORTUNITY FOR THE SPIRIT OF RESEARCH IN LABORATORY INSTRUCTION IN PHYSICS

A RITUAL does not require worship; a system in laboratory instruction does not demand the investment of the personality of the instructor. A smoothly operating system is a delight to the mill owner or to the manufacturer. According to general practise, such a system affords the modern laboratory instructor in physics a great deal of satisfaction.

But has not laboratory instruction in physics become enslaved to laboratory methods? The fundamental purpose of such instruction should be decided in the light of its origin. At first the laboratory work was not prescribed in the course of study. Magnus[1] in Berlin conducted such a laboratory. The experiments performed were of an investigational nature. Some of his pupils were G. H. Wiedemann, Helmholtz and Tyndall. Later, Lord Kelvin,[2] at Glasgow, entered upon certain investigations of the electrodynamic qualities of matter and, finding the labor of observing too heavy for one individual, invited certain students to aid in the work. Other students desired experimental work of a similar nature and thus was developed a research laboratory in which the students took an enthusiastic interest. The funds of this laboratory were obtained from the university, but, in the beginning, there was no systematic instruction of students similar to that in the laboratories of to-day.

As these two illustrations indicate, the student's physical laboratory had its origin in research. The zeal for new knowledge furnished the enthusiasm and prescribed the methods of work. To-day, apparently, the student enters the laboratory to learn how to perform experiments and to become expert in the use of various devices such as the micrometer microscope, or the optical lever, or the dividing engine, and to familiarize himself with certain methods of measurement, such as the method of coincidences or the method of double weighing. Indeed, quite frequently courses have such titles as "Laboratory practise" and "Electrical measurements."

Jesus claimed that the Pharisees tithed mint, anise and cummin, but neglected the weightier matters of the law. One can not deny the virtue of tithing; neither can one fail to appreciate the educational value of an experiment which requires great care and accuracy on the part of the student. But what about the weightier matters? The chief function of the laboratory is to give the student an intimate acquaintance with the phenomena and the so-called laws. The familiarity of the student with a particular instrument or method is of temporary importance and should be of little interest. Indeed, why should accurate measurements be considered so highly desirable? Do not the thoughtful regret the fact that in the progress of physics so much valuable time must be spent in accurate measurements by the investigators? Does not the physicist seek to obtain the accuracy needed in a particular investigation with the least amount of painstaking effort, and therefore the least time and labor? Accurate measurements are found in research because they are needed to obtain results, and not because they are intrinsically worthy of a scholar's time and attention. Let this be the recognition of accurate measurements in the laboratory of the student.

The Pharisees thought that they were right, and doubtless their attitude can be explained by the powerful influence of tradition. The defect in our present laboratory instruction can be explained in a similar manner. The instructor accepts the laboratory as an approved method of instruction and is not continually conscious of its highest function. The student working under his direction is just "doing laboratory work."

The slavery to method can be resisted only where the true spirit of research is supreme.

[1] Cajori, "History of Physics," p. 291.

[2] From Kelvin's Bangor address, quoted in Gray's "Lord Kelvin," p. 71.

This is the remedy. In a laboratory where such a spirit is always in evidence, the methods and devices become of secondary importance and the emphasis is placed upon weightier matters. This spirit will be maintained only by eternal vigilance. Is this possible other than by means of active research?

The needed reform in laboratory instruction in physics does not demand radical changes in equipment, but it insists that the instructor shall have the spirit of the science, and that he shall minimize the importance of method and magnify the real function of the laboratory. It is useless to claim that the remedy lies in a particular set of experiments or in the proper equipment. Any method or any equipment will eventually enslave the teacher if it is permitted to do so. The remedy lies wholly in the attitude of the instructor. The teacher who has not the true spirit of research can not obtain freedom from slavery to method.

G. W. Stewart

Physical Laboratory,
State University of Iowa

A NEW GAS VOLCANO IN TRINIDAD

The daily press recently reported that a new island had been thrown up near the coast of Trinidad, with accompanying fire and explosions. This report and the statement appearing in numerous places that the eruption was volcanic has strengthened the impression, already somewhat current, that Trinidad is a volcanic island forming part of the same chain as Martinique, St. Vincent and others of the Windward Islands. There is, however, no true volcanic activity in Trinidad and no volcanic rocks either recent or ancient are known there. The island is formed of highly folded sedimentary and metamorphic strata, and is more properly to be considered as a portion of the South American land mass. The recent eruption near its south coast was due to the sudden escape of a large quantity of gas from the strata that form the submerged coastal plateau, with the consequent ejection of the mud and other materials which had hitherto confined the pressure. Eruptions of this type on a small scale are constantly going on in southern Trinidad, forming the many mud cones and craters to be seen there, and occasionally large outbreaks such as this latest one occur. In all cases the force at work is escaping gas which rises from the gas-bearing sandy and clayey strata, bringing with it fine sediment and salty water derived from these beds.

I visited numerous gas volcanoes in this portion of Trinidad during October but left there just before the recent eruption took place. Mr. Jefferson D. Davis, of Port of Spain, in a letter dated November 6 writes as follows:

> On last Saturday (Nov. 4) land was seen to rise from the surface of the ocean 3 miles southwest of Erin. . . . The gas . . . soon took fire, and the flames must have gone to an enormous height, because they were seen from Port of Spain to shoot into the clouds, and Erin is approximately fifty miles from this place. The country was lit up for considerable time, and great consternation prevailed among the natives. . . . The governor of the colony and a party of officials with a number of prominent people from this place went down yesterday to see the phenomenon, and found a piece of land about three acres in area, about thirty to forty feet above sea-level, in the center of which was a crater. The ground seemed to be the ordinary blue mud, but was very hot, consequently baked dry and hard. Some of the more adventurous visitors went on to the land and walked about for a while, and took home some samples of the clay. Large volumes of gas were coming from the crater at this time, but there was no fire. We learned to-day by telephone that it has taken fire again.

It is also reported that four distinct detonations were heard from Port of Spain after the island had been formed and that the fire continued burning until Sunday morning. Mr A. C. Veatch, formerly of the U. S. Geological Survey, was on board ship at Brighton, Trinidad, just about to sail for New York at the time. He informs me that his notice was suddenly attracted by a great flame that shot up into the sky just at dusk, at ten minutes before six, Saturday evening. Every one thought it was an oil or gas well on fire. With