in Asia where maize is but little grown and should not have come to light on the American Continent where maize is cultivated so extensively and the varieties are so much better known.

If it is admitted that the waxy character is the result of a single mutation then all discussion of the time when it arose is of course idle, for a single mutation may have occurred as well at one time as another. There still remains the peculiar distribution of waxy endosperm and the differentation of other characters as evidence of the antiquity of the waxy mutation. The Shanghai variety in which waxy endosperm was first discovered possessed other peculiarities, the most conspicuous of these being erect leaf blades, monostichous arrangement of the upper leaf blades and an early development of silks while the ear is still enclosed in the leaf sheath. Unlike waxy endosperm, these characters are not definitely alternative in inheritence, but appear in varying degrees in crosses with varieties not showing these characteristics.

Although the expression of all these plant characters is variable even in the uncrossed waxy strain, pure stocks of this variety always present a distinctive appearance that immediately separates them from any other variety. It has been demonstrated that none of these plant characters is correlated with endosperm texture nor are any of them correlated with one another. It is, therefore, not surprising that the plants grown from the waxy seeds from Upper Burma did not resemble the Shanghai variety in any other particular. If the view that the waxy maize of Shanghai came originally from the region of the eastern Himalayas be accepted, we must conclude that sufficient time has elapsed since the introduction for the Shanghai variety to acquire its distinctive characters.

In the light of our present knowledge this unique character of an American plant appears to be confined to three isolated localities in Asia. Unfortunately, nothing is known regarding the maize varieties of Yunnan or other points along the route from Burma to Shanghai. If the waxy character originated in only one of these localities, however, it would seem much more reasonable to assume Burma as the region from which Shanghai received the character than vice versa. This is indicated by the inaccessibility of the region occupied by the Hill Tribes of Burma, the specialized uses of the plant, and the extensive series of named varieties.

The finding of this peculiar type of endosperm in the mountain region of Upper Burma supports the idea that maize entered China from the west instead of the east. This is in accord with the early Chinese accounts of maize as presented by Dr. Laufer. A more thorough knowledge of the maize varieties of the Himalayan regions promises to be the key to the distribution of maize in Asia.

G. N. COLLINS

BUREAU OF PLANT INDUSTRY,
DEPARTMENT OF AGRICULTURE

PHYSICAL MEASUREMENTS IN PSYCHOLOGY

THE recent article by Dr. Paul E. Klopsteg[1] on physical methods and measurements and the obligation of physics to other sciences, carries a strong appeal for those psychologists who are obliged to prepare students for research in the investigations of human behavior. The specialization found in the psychological laboratories is often merely due to the development of a special technique in physical measurements suited to a whole series of problems, rather than to a restricted psychological interest. Recent progress in psychological methods demonstrates very clearly that every problem dealing with the fundamental aspects of human behavior is also partly a physical problem. Much of the apparatus used in making measurements is "home-made" and while good results have been secured, it is equally true that better experimental results would be secured and much time saved if some expert in physical measurements, who is also interested in the

[1] SCIENCE, April 16, 1920, N. S., 51, 384–386.

application of objective methods to research work in psychology, were available when the apparatus is designed.

Under the present methods of preparing for a research problem requiring apparatus, the student in psychology begins to look through the literature to find how the phenomena that he expects to investigate were measured by other investigators. The original method of measurement may have been merely an accident of time, place and the available equipment. If the student is not mechanically expert, imitation is the only alternative. By the trial and error method, improvements do gradually develop but at a great loss of time and at the expense of accuracy and reliability.

While as a rule the men in physics show a fine cooperative spirit, students do not feel free to take up the time of a professor when such cooperation is not a regular part of the instructor's duties. The writer is not in sympathy with the view that better preparation in applied physical measurements should be given in the elementary course. Even the relatively extended course in "engineering physics" is little enough physics for the student in psychology. The problem of adequate training in physical measurements seems, to the writer, to belong to the graduate school, and should be as integral a part of the preparation of the science student as his preparation in foreign languages. The graduate faculty should support the department of physics in developing a course in applied physical measurements whose prime function is not that of teaching physical principles but that of preparing students to take advantage of the latest technical developments in physics. The more comprehensive the student's knowledge of the fundamental principles of physics, the better, but it must be recognized that the adjustment between physical principles and the principles of the other sciences, is always a compromise.

Perhaps one reason why courses in applied physical measurements have not been developed, although every scientist will admit their value, is because the graduate students of any one department do not form a large enough group to justify the expenditure of the necessary amount of money for the extensive equipment necessary to adequately carry on such a course. If, however, all the graduate students in the biological and physical sciences were gathered together under the direction of a high-class instructor, the time devoted to applied physical measurements would actually result in a saving of time and secure better cooperation from the department of physics than is usually accorded. Such a course should be in the hands of an instructor who is willing to keep abreast of what is going on in the other sciences. Such a man should be especially well grounded in general scientific theory so he can understand the problems of the other sciences. Developmental work in the applications of physical measurements to the other sciences should offer as good research opportunities as "pure" physics for the man whose interests are in the applied field. It is a mistake to assume that an expert machinist is the man wanted.

It must be recognized that the students taking applied physical measurements will probably not contribute directly to the advancement of physics. This implicitly may develop the attitude on the part of the professor in charge that these students are mercenaries who are commercializing physics. If this attitude is general in the department of physics, it is easy to see why no particular attempt is made to get the equipment and the type of instructor necessary to teach this work as satisfactorily as in the courses intended for students specializing in physics. It is the same attitude that is so often found in the instructors who are obliged to teach "scientific" German or French.

For students specializing in experimental psychology it is coming to be recognized more and more that in the work for the doctorate, training in the allied sciences and methods of physical measurements is quite as important as training in psychology. There is no danger that the student will neglect his psychology, but he may neglect important preparatory courses unless they are taken before the doctorate is completed. Every psychologist recognizes his own limitations in applied physical measurements and a course as outlined by Dr. Klopsteg would do much toward extending the limits for the younger men.

In the writer's opinion the best time for taking such a course is before the student has begun experimental work on the problem which is to be the basis for his dissertation. At this time the question of method is uppermost and the problem has already been outlined. If the student is working on apparatus this is the time that the advice of the professor of applied physical measurements is of greatest benefit. These conditions arise in the first year of graduate work, or in a few cases, during the senior year. The course itself, however, should be under the supervision of the graduate school.

Of the seventeen types of physical measurements suggested by Dr. Klopsteg[2] the following would form an excellent background for the experimental psychologist: (1) The accurate measurement of long and short time intervals. (2) Measurement of temperatures by methods other than that of the mercury thermometer. (3) Temperature regulation and control. (4) Precision calorimetry. (5) The microscope and reading telescope. (6) Spectroscopic analysis. (7) Colorimetry and photometry. (8) The galvanometer. (9) Electrical measurements, both alternating and direct. (10) Graphic and smoke records.

With a practical knowledge of the use of these methods the student is qualified to undertake almost any problem in experimental psychology with the assurance that he is using the most approved methods of measuring his conditions and results.

A. P. Weiss

Ohio State University

2 Science, April 29, 1919, N. S., 50, 199–202.

GENERAL WILLIAM C. GORGAS

William Crawford Gorgas, Surgeon General, U. S. Army, during the four years of the European War, 1914–18, and well-known for his work as chief sanitary officer of the Panama Canal, died in London on the early morning of July 4, in the sixty-sixth year of his age. He had sustained a stroke of apoplexy on May 29, lingering for more than a month in hospital with some hope of recovery, but renal complications intervened and he passed away in unconsciousness.

General Gorgas was born at Mobile, Alabama, on October 3, 1854. He was the son of General Josiah Gorgas, Chief of Ordnance of the Confederate Army, and received his earlier education in the South, graduating from the University of the South in 1875. He then went to New York to study medicine, and received his medical degree from Bellevue Hospital Medical College in 1879. He was intern at Bellevue Hospital during 1878–80, and in the last year of his residence in hospital, took an examination for admission to the Medical Corps of the U. S. Army, receiving his commission as surgeon on June 16, 1880. He was promoted captain in 1885 and during the Spanish-American War, served as a major and brigade surgeon of volunteers, receiving his majority in the Regular Army on July 6, 1898. At the close of the Spanish-American War, he was appointed Chief Sanitary Officer of Havana, holding this position from 1896 until 1902. In connection with this important detail, it fell to his lot to apply to the sanitation of Havana the discovery of the late Major Walter Reed, that yellow fever is transmitted by mosquitoes, which was accomplished by Reed, as the head of an Army Board sent to Cuba to investigate yellow fever in 1900–1901. In February, 1901, shortly after Reed's discovery was established, Gorgas began to screen yellow fever patients and to destroy fever-bearing mosquitoes by oiling the surface of all pools or collections of water where they were likely to breed. In three months time, Havana was freed from yellow fever for the first time in nearly two centuries. For this work in eliminating the disease from Havana, Gorgas was made a colonel and assistant surgeon general by special act of Congress on March 9, 1903. On March 1, 1904, he was appointed chief sanitary officer