brates) and Invertebrate Embryology, by Professor Harold Heath; General Physiology and Research in Physiology, by Professors E. G. Martin and F. W. Weymouth; The Algae and an advanced course in Botanical Survey, by Mr. J. I. W. McMurphy.

President Wilbur has appointed W. K. Fisher, of the Department of Zoology, director of the station.

W. K. Fisher

SCIENTIFIC EVENTS

THE BOMBARDMENT OF PARIS BY LONG-RANGE GUNS

Professor G. Greenhill writes in *Nature* that the Jubilee long-range artillery experiments of thirty years ago were considered the *ne plus ultra* by the British authorities, and were stopped at that, as they were declared of no military value. But the Germans are said to have watched the experiments with great interest, and to have carried the idea forward until it has culminated to-day in his latest achievement in artillery of a gun to fire 75 miles and bombard Paris from the frontier. Professor Greenhill writes:

From a measurement of the fragments of a shell a caliber is inferred of 240 mm., practically the same as the 9.2 inch of our Jubilee gun, which, firing a shell weighing 380 pounds at elevation 40°, with a muzzle velocity nearly 2,400 feet per second, gave a range of 22,000 yards—say, 12 miles. This was much greater than generally anticipated, but in close agreement with the previous calculations of Lieutenant Wolley Dod, R.A., who had allowed carefully for the tenuity of the air while the shot was flying for the most part two or three miles high.

The German shell is likely to be made much heavier and very nearly a solid shot, better by its weight to overcome air resistance, the chief factor to be consdered in the problem of the trajectory. If it was not for this air resistance a range of 75 miles with 45° elevation could be reached, on the old parabolic theory of Galileo, with so moderate a velocity as $V = \surd(gR) = 3{,}200$ feet per second, with $g = 32.2$, $R = 75 \times 5{,}280$; in a time of flight of about $2\frac{1}{2}$ minutes, an average speed over the ground of 30 miles per minute.

A velocity of 3,200 feet per second was obtained by Sir Andrew Noble in his experiments at Newcastle about twenty years ago with a 6-inch 100-caliber gun, with a charge of $27\frac{1}{2}$ pounds of cordite and a shot of unspecified weight, so it may have been the usual 100 pound or perhaps an aluminium shot of half the weight.

Double velocity is usually assumed to carry twice as far; at this rate the velocity of our gun would require to be raised from 2,400 feet to about 6,000 feet per second to increase the range from 12 to 75 miles; such a high velocity must be ruled out as unattainable with the material at our disposal.

But in this range of 75 miles the German shot would reach a height of more than 18 miles and would be traveling for the most part in air so thin as to be practically a vacuum, and little resistance would be experienced.

So it is possible a much lower velocity has been found ample, with the gun elevated more than 45°, for the shot to clear quickly the dense ground strata of the atmosphere. Even with the 3,200 feet per second velocity obtained by Sir Andrew Noble a surprising increase in range can be expected over the 12-mile Jubilee range when this extra allowance of tenuity is taken into account, and a range of 60 miles be almost attainable.

SOME TUNGSTEN ORES IN THE NATIONAL MUSEUM

For some years the department of geology in the United States National Museum has been making a special effort to build up its collections of the so-called rare earths and rare metals, many of which have assumed exceptional importance since the outbreak of the war. These collections include a considerable range of substances which have proved of commercial value only within the past decade, one of the most important of which is the metal tungsten, invaluable in steel manufacture. During the past year the department has received, principally through the intervention of Mr. F. L. Hess, of the U. S. Geological Survey, three most remarkable specimens illustrating the three types of ore of this metal. In its own way, each of the three is unique and undoubtedly the largest of its kind ever mined.

The first is a mass of ferberite (iron tungstate) from the No. 7 lease of the Vasco Mining Co., at Tungsten, Boulder County, Colorado, which was presented by the Vasco Mining Co., and Messrs. Stevens and Holland. The specimen is roughly oval in form, 2 feet

6 inches long, 2 feet broad, and 2 feet thick, and weighs nearly a ton. It is an ore characteristic of the Boulder tungsten field—a brecciated pegmatite and granite cemented by quartz and ferberite.

The second is a large specimen of the newly discovered mineral tungstenite (tungsten sulphide), a gift from Wm. Barrett Ridgely, of New York City. Tungstenite is a soft, lead-gray mineral, looking very much like fine-flaked molybdenite and carries some 44 per cent. tungsten. The specimen, which contains an admixture of some galena and quartz and weighs more than 100 pounds, is from the Emma mine at Alta, Utah. This mineral was identified only last December by R. C. Wells and B. S. Butler, of the United States Geological Survey, and almost simultaneously by K. D. Kuhre and Mr. J. J. Beeson, the geologist at the mine.

The third, and in some ways the most remarkable specimen, is a mass of scheelite (calcium tungstate) from the Union Mine of the Atolia Mining Co., Atolia, California. This mine is undoubtedly the richest and largest scheelite mine ever discovered, and the specimen is correspondingly large. It is a section across the main part of the vein and is 4 feet 8 inches long, about 2 feet 6 inches wide, and 2 feet thick. Some granodiorite, the country rock, is inclosed. The specimen weighs 2,600 pounds and carries possibly 30 per cent. WO_3, so that it contains in the neighborhood of 700 pounds of metallic tungsten and is worth, at the present price of ore, nearly $2,000. Great care was needed to remove the specimen from the mine intact, a work which was carried on under the supervision of Charles S. Taylor, one of the discoverers of the mine and now its superintendent.

CHEMISTRY AT YALE UNIVERSITY

IT has been arranged at Yale University to unite the staffs and laboratories of the undergraduate departments of the college and of the Sheffield Scientific School in a single department. On this plan the *Yale Alumni Weekly* comments as follows:

The article which we publish in this number on the coordination of chemistry teaching in the college and Sheffield marks a move in what we have good reason to believe will shortly become a general reorganization at the university on a new and cooperative departmental basis. Until now chemistry at Yale has been divided into two distinct and unrelated parts, with its two separate faculties and student groups, its two separate laboratories and equipments, its two separate financial systems, its two separate heads. It has furnished a striking instance of the historical cleavage between the Sheffield Scientific School and Yale College, with all the attendant lack of cooperation and sympathetic understanding which that cleavage has for so many years resulted in. If any criticism of Yale's educational organization has been unanswerable, for years it has been this continued separation between its two undergraduate schools in the teaching of common subjects. It has split Yale into two—on occasion even hostile—camps. It has hindered scientific progress in both schools. It has broken up at the start any possible unity of educational policy which might have been accomplished.

Until now it has seemed impossible to find a way to end this illogical and harmful cleavage between Sheff and the college in their educational organization. But the war, which is subtly undermining a good many of our ancient prejudices, both individual and institutional, has begun to play its deciding part in this historic Yale question. The hours of classroom exercises have recently been made to conform for the undergraduates of both Sheff and the college. The departments of chemistry have now found it necessary to reorganize to meet the new conditions, and, in reorganizing, have found it possible and even desirable to cut the old Gordian knot of departmental prejudices and consolidate as a university department. When this new plan goes into effect, Yale will have made its first definite move in what we believe will be a much more general trend in the near future, toward operating its educational machinery as one university organization rather than as two separated undergraduate departments.

In an article on the subject in the *Yale Alumni Weekly* Professors Bertram M. Boltwood and Treat. B. Johnson mention as the greatest needs of the university in chemistry: (1) an adequate endowment for research, (2) the appointment of research professors in each department to organize and direct, (3) opportunities to give greater encouragement to our younger men to carry out research work, (4)