temperature gradient between the cistern and the stem of the barometers, demand radical alterations in its design if it is to be rendered efficient. For the brief period of the voyage when the gravity barometer could be favourably observed, results were obtained which seemed to indicate that the method was one of promise, and it may be of interest to state that new apparatus of this type is in course of construction; the design has been modified in the light of experience gained at sea, and of a mathematical examination of the instrument by Sir Arthur Schuster. One specially favourable feature of the instrument is the possibility of completely immersing it in a constant-temperature bath.

Though the particular aneroid "pumped" with the motion of the ship more than was hoped, and had a reduction factor and zero which changed slightly during the voyage, the aneroid method is one which should be further examined, and certain directions in which alterations in the design are desirable were indicated by the experience on the voyage to Australia. With it the general variation of gravity with latitude over the ocean is readily shown, but whether it may be trusted to discriminate between such variations as may be found over deep and shallow waters must be a matter for further examination. We may note, as a matter of interest, that such indications as were obtained with this method suggested a defect of gravity over great ocean depths, along continental seaboards (especially when there was a coastal range of mountains), and an excess of gravity at island stations; but, as we have stated, a more rigorous test with improved apparatus is necessary before this can be accepted. The problem has therefore arrived at an interesting stage; Hecker's observations are in favour of nearly full compensation, whereas the slight evidence of the later work, so far as it goes, suggests that compensation is incomplete.

Reference has already been made to the instrument constructed in 1859 by William Siemens—in that year he was carried in a warship across the Bay of Biscay, his real object being the determination of ocean depths, which he took for granted would be shown by a diminished value of *g*. Dissatisfied with his first apparatus, he did not make a further attempt until 1875, when he constructed an instrument which depended upon balancing the pressure of a column of mercury against the tension of a spring, and this he tested on a cable-laying ship over a portion of the voyage between the Thames and Nova Scotia. The results, in spite of anomalies as regards latitude variation, which puzzled Siemens, show a surprising measure of agreement between predicted and observed depths, which, so far as they go, are in accord with the aneroid observations just referred to. This must not, however, be overemphasised, since Siemens was dissatisfied with this apparatus. Though not really directed at the solution of the problem under discussion—Siemens's "bathometers" were graduated in fathoms—these instruments are of interest in that they appear to have been the first involving gravity measurements to be submitted to an actual test at sea.

Since the Australian meeting of the British Association in 1914, further work has been carried out under the auspices of an influential committee of that body, and certain other points have received attention. From a series of experiments carried out last year on H.M.S. *Plucky*, it appears that the ship's motion through the air may very appreciably affect the pressure recorded by an open barometer, even when carried in cabins below deck; hence, as the "lag" of this instrument is in general different from that of the instrument with which it is being compared, it is very undesirable to adopt barometers of the open type for gravity determinations. On board the destroyer effects as large as one millibar were found to be due to the relative motion of the ship and the air; no doubt a similar disturbing influence affects the readings of a barometer in a building about which a wind is blowing.

Another matter which was examined on H.M.S. *Plucky* was the Eötvös effect; going east with the earth, the centripetal force is greater than when steaming west; consequently a correction for motion in longitude is indicated. After eliminating windage effects, a change equivalent to 0·1 mb. was observed when the course was altered from E. to W. when steaming at 22 knots.

There are other points the investigation of which is not yet complete: the best diameter of capillary tubing to be used in the barometer tube to damp down the effects of the ship's vertical motion, the influence of the throbbing of the ship's engines upon the barometer reading—there is some suspicion that certain divergences between gravity readings in harbour and in the open sea may be accounted for by the change in capillary forces due to this cause—the best form of constant-temperature chamber for use at sea, steady to 1/100 degree: these and allied questions are engaging the attention of those who are contemplating a fresh attack upon the problem.

Obituary.

PROF. H. A. BUMSTEAD.

THE death of Prof. H. A. Bumstead, professor of physics in Yale University, which occurred with tragic suddenness on January 1 when he was travelling from Chicago to Washington, will be felt with the keenest regret by a large number of men of science in this country. There are few American men of science with more English friends than had Prof. Bumstead, and none whose friendship and companionship were more highly prized. Born in 1870, he graduated at Johns Hopkins in 1891. He began in 1893, as instructor in physics in Sheffield Science School, that connection with Yale which continued without interruption until his death, where, for fourteen years, he had been professor of physics and director of the Sloane Physical Laboratory. Prof. Bumstead was the most enthusiastic and devoted of Yale men. He came over to Cambridge in 1904, and worked for a year at the Cavendish Laboratory; the result of his work is contained in a paper in the *Philosophical Magazine* for June, 1906, p. 292, on the heating effects produced by Röntgen rays in different metals. On his return to America he made, in spite of serious ill-health, important researches on the properties of α-rays.

Excellent as Prof. Bumstead's published work is, it gives but an inadequate idea of his powers, or of his singularly clear and sane judgment. He edited the collected works of Willard Gibbs—the greatest physicist ever associated with Yale. When America joined in the war, he threw all his energies into the application of science to the purposes of the war, and at the end of 1917 he came over to this country as Scientific Attaché to the American Embassy. Prof. Bumstead's duties were to co-ordinate the scientific work done in America and in England and France, so that the results obtained in one country should be as soon as possible at the services of the others. For this work his personal qualities and scientific attainments made him especially fitted, and he did most valuable work whilst he was in this country. He was at the time of his death president of the National Research Council in the United States.

Prof. Bumstead had a singularly attractive and charming personality. Sympathetic, modest, without a trace of self-assertion, he was the most delightful companion and most valued friend. J. J. T.

PRINCE P. A. KROPOTKIN.

THE death of Prince P. A. Kropotkin at Dmitrov, near Moscow, on Friday last, January 28, deprives the world of a picturesque figure and science of a devoted student. For many years Prince Kropotkin was an esteemed contributor to the columns of NATURE, and when he left England to return to Russia in 1917 he wrote to express regret that the very close relationships which had existed between him and us for so long were being severed. He said at the same time that he had been a reader of NATURE from the first number, and had even been permitted to receive it while a prisoner in the fortress of St. Peter and St. Paul in St. Petersburg.

Prince Kropotkin was born on December 9, 1842. At the age of fifteen he entered the select military school at St. Petersburg; on leaving he joined a Cossack regiment stationed on the Amur, and while aide-de-camp to the commander of the General Staff in Eastern Siberia, he crossed North Manchuria from Transbaikalia to the Amur and up the Sungari to Kirin, travelling in all as many as 50,000 miles. In 1867 he abandoned a military career, and returned to St. Petersburg, where he entered the University, and devoted himself seriously to geographical work. He then became closely associated with political movements, and gave himself up to propaganda. In 1873 he was arrested and imprisoned, but escaped in the following year and made his way to England, shortly afterwards going to Switzerland. After the assassination of Alexander II., Kropotkin was expelled from Switzerland, and settled in Savoy, where he was arrested in 1883 on a charge of organising a dynamite outrage, and was condemned to five years' imprisonment, but was released in 1886. He then returned to England, and remained here until June, 1917.

In 1876 Kropotkin published his "Researches on the Glacial Period," in which he described a journey in Finland and a short visit to Sweden, both made in 1871, under the auspices of the Russian Geographical Society, for the special purpose of studying the glacial formations and the eskers. His conclusions were that this low tableland was once covered by an immense ice-sheet, which, creeping from Scandinavia, crossed the Gulf of Bothnia and traversed southern Finland in a direction south by east, leaving behind it the marks of its course in the shape of numberless striæ and moraines.

Perhaps Kropotkin's most notable work was "Mutual Aid, a Factor in Evolution," published in 1902. The view put forward was that in the case of animals there is very little evidence of any struggle for existence among members of the same species, though plants, beyond all doubt, jostle their own kin out of existence. Animals, as a rule, are banded together for mutual protection, and those that have the best organisation for mutual defence are those that thrive best. Among men, mutual aid is more general than among animals; among savages, it is the chief factor in evolution. Kropotkin traced the growth of the modern benefit societies, co-operative associations, and trade unions back through successive stages of the history of a nation—through the State, the medieval city with its fortifications and hired defenders, the village communities, and finally to the clan, showing how man has attained his present position chiefly by practising mutual aid. There is no doubt that in the development of this thesis Kropotkin was keenly interested, and that the work itself represents, more closely than anything else he did, the main trend of his conception of the meaning of life and progress.

Kropotkin was a pioneer advocate of the intensive cultivation of crops, and in a suggestive little book entitled "Fields, Factories, and Workshops" he described what was done in this direction in Guernsey, as well as indicated how similar principles of culture could be applied elsewhere. His view was "that 600 persons could easily live on a square mile, and that with cultural methods already used on a large scale 1000 human beings —not idlers—living on 1000 acres could easily, without any kind of overwork, obtain from that area a luxurious vegetable and animal food, as