

for further observation. The supposition of a desiccated saline lake to explain the origin of the colemanite has little to support it beyond rather general assumptions. The character of the deposits themselves indicates rather a vein type of formation. Other salines which would naturally be expected in desiccation deposits resulting from natural saline solutions are not found in association with the colemanite. Those who have supported the desiccation theory have offered no explanation of the cause which might produce colemanite in such massive deposits as a product of water evaporation, while, on the contrary, its formation from limestone in veins by replacement of carbonic acid with boric acid is a natural hypothesis that deserves further investigation. The relations of the deposits to basalt lava flows indicate the probable origin of the boric acid at the time of the extrusion of these lavas, although it may be assumed that this acid continued to find its way into solution of the circulating ground waters long after the period of the extrusions.

#### UNIVERSITY AND EDUCATIONAL NEWS

PROVISIONS for the creation of a trust fund said to be approximately \$500,000 for the maintenance of male graduates of the Williamsport, Pa., high school at Cornell University are made by the will of Albert Dubois Hermance.

MR. EDGAR PALMER, a Princeton graduate of the class of 1903, has offered to build and present to Princeton University a stadium costing \$300,000. Mr. Palmer is a son of the late Stephen S. Palmer, who was for many years a trustee of Princeton University and gave large sums to the university, including the Palmer Physical Laboratory.

THROUGH the cooperation of the estate of the late Dr. C. Annette Buckel, of Oakland, a research fellowship for the study of feeble-minded children has been established at Stanford University. The department of education, under the direction of its head, Professor E. P. Cubberly, will have the appointment of the fellow, who will work in cooperation with Professor Lewis M. Terman. Dr. Buckel was

an Oakland physician known for her charitable work in Oakland and for her interest in feeble-minded, backward and delinquent children. On her death her estate was left in trust to Miss Charlotte S. Playter, of Piedmont, to be used to advance the condition of backward and feeble-minded children. Miss Playter has turned the money over to Stanford. The income amounts to about \$500 a year, and the board of trustees of the university have added an additional \$500 to the fellowship.

WORK has begun on a temporary recitation and administration building for Wellesley College. It will be a wooden structure, one story high, of the simplest possible construction. It is contracted to be finished by May 1. Classes will begin on April 7, the regular date for the opening of the spring term. There are no plans as yet to replace the geological, physical, psychological and zoological laboratories which were destroyed by the burning of College Hall.

THE recent disastrous fire at Wellesley College wiped out the entire equipment of the department of physics. This department, organized in 1878, was one of the first in the country to offer laboratory practise for undergraduates and possessed much apparatus of value. Within the last few years extensive additions had rendered the equipment thoroughly modern and up to date. The library of nearly three thousand volumes contained complete files of most of the leading periodicals, English, French and German, including the *Annalen der Physik*, the *Philosophical Magazine*, and the *Philosophical Transactions* since 1800. The loss is total.

YALE UNIVERSITY and the University of California will exchange professors next year. Professor John Wurts, of the Yale Law School, will lecture at California, and Professor G. H. Boke, of the School of Jurisprudence at California, will lecture at Yale.

DR. THOMAS H. MACBRIDE, professor of botany, has been appointed acting president of the State University of Iowa.

DR. NATHANIEL E. LOOMIS, assistant professor of chemistry at Bowdoin College, has

accepted a professorship of physical chemistry at Purdue University.

DR. L. D. BRISTOL, now of Syracuse Medical School, has been appointed to succeed Dr. G. F. Ruediger as director of the public health laboratory of the University of North Dakota. Dr. R. T. Young has been appointed professor of zoology and succeeds Dean M. A. Brannon as director of the University Biological station at Devil's Lake.

DR. PRAFULLA CHANDRA RÂY has been appointed to the Sir Taraknath Palit professorship of chemistry, and Mr. C. V. Raman to the Sir Taraknath Palit professorship of physics in the Presidency College, Calcutta.

#### DISCUSSION AND CORRESPONDENCE

##### DADOURIAN'S ANALYTICAL MECHANICS AND THE PRINCIPLES OF DYNAMICS

PROFESSOR E. W. RETTGER's review of my "Analytical Mechanics," which appeared in number 995 issue of SCIENCE, gives a wrong impression of my treatment of the principles of dynamics.

The reviewer's criticisms are directed, mainly, against my claim of having based the science of mechanics upon a single dynamical principle. Starting from certain premises, which can not stand close examination, Professor Rettger arrives at the conclusion

He makes more assumptions than are usually made in elementary text-books of mechanics.

Let us consider the main points of his criticisms in detail and see whether the foregoing statement is based upon facts.

On page 16, he introduces the conception of "force" as an "action" and without hesitation applies vector addition to a system of forces. What is he doing here, but assuming the "parallelogram of forces" in its most general form?

It is intimated here that the "parallelogram of forces" is a dynamical law which I have "assumed" without formally introducing it as a new law. It is a fact that I have applied vector addition to forces "without hesitation," but I have shown as little hesitation in treating velocities, accelerations, torques, linear momenta and angular momenta as

vectors. Why did not Professor Rettger accuse me of having assumed the "parallelograms" of these magnitudes? Is the "parallelogram of forces" more of a dynamical law than the "parallelogram" of torques, for instance? The "parallelogram" law applies to any vector and is not at all a characteristic of forces, therefore it is not a dynamical law. It does not even deserve being called a "law" when applied to a special type of vectors. In its most general form the "parallelogram law" is the principle of the independence of mutually perpendicular directions in space, a purely geometrical principle. A special case of it is known to students of plane trigonometry as the "law of cosines." In the first chapter of my book this principle is given in its most general form as well as in its several special forms, and is applied to vector magnitudes of different types. After devoting an entire chapter to vector addition and after defining force as a vector, to introduce the "parallelogram of forces" as a new law, as Professor Rettger would have it, could serve only to show that the man who did it could not have a clear conception of the meanings of the terms he was using.

On page 102 he assumes that a force is proportional to the acceleration produced. This assumes Newton's second law.

This statement is not quite right. The relation between force and acceleration, which I have called *force-equation*, is derived on page 106 from the fundamental principle which I have postulated. In this derivation I have made use of the definition of *kinetic reaction*, which is stated and illustrated on pages 102 to 105, but this is not equivalent to "assuming" a new principle. Will Professor Rettger claim that to define the terms used in a principle is equivalent to introducing or "assuming" new principles? Suppose I had based my work upon the principles of the conservation of energy and of the conservation of momentum should I have no right to classify and define the different forms of energy and of momentum without being rightly accused of having introduced new principles? Will Professor Rettger consider the definitions of momentum, of potential energy, and of kinetic