his warning to the legislature, the bill proposed to appropriate the money, about $200,000, in a lump sum instead of by items. His veto cuts off all provision for the expense of legislative printing this year. The Geneva and Cornell experiment stations have had about $60,000 apiece yearly for the printing of reports and bulletins, and this money has been appropriated under the head of legislative printing. Reports of all state institutions have been covered under that head. Bulletins such as the agricultural experiment stations have issued throughout the year for the information of farmers have been officially regarded as anticipating parts of the annual reports of the stations. Part I. of the annual report of the college has comprised the report itself and technical bulletins; Part II. has been made up of the matter intended for popular use, such as bulletins of general value and the reading course lessons of the year.

UNIVERSITY AND EDUCATIONAL NEWS

Mrs. Russell Sage has given $75,000 to Knox College of Galesburg, Ill., to make possible the securing of the amount to complete its half-million-dollar endowment fund.

The alumni of the University of California Medical School have offered to give $400 a year for five years to maintain the William Watt Kerr scholarship in medicine in honor of Dr. Kerr, clinical professor of medicine in the University of California.

Miss Charlotte Emily Beckwith has bequeathed one half of the residue of her estate, which amounts to about £8,000, to the Victoria University of Manchester in aid of the "John Henry Beckwith Scholarship" founded by her mother.

A large company of representatives of the scientific and technical press were received at the Imperial College of Science, South Kensington, on May 31 by the Right Hon. Arthur Dyke Acland, chairman of the executive committee of the governing body, and, with the professors and other members of the staff, took them round the institution. Mr. Acland referred to the memorial which has just been presented to Lord Crewe by the professors of the college, urging the importance of securing that a larger proportion of young men in this country should be trained in scientific methods with a view to industrial research. The suggestion is that a grant of a quarter or half a million pounds, in addition to the quarter of a million (as against Germany's million and a half) which the state annually grants to the universities might profitably be used to provide an adequate number of bursaries for secondary-school boys of 16 to 18 years of age, to be followed by the offer of government scholarships tenable at a university.

Professor Mary Whiton Calkins, of Wellesley College, has been appointed lecturer on the Mills Foundation in the department of philosophy of the University of California for the half year ending December 31, 1916—the lectureship held for the past year by Professor George H. Palmer, of Harvard University.

The vacancy in geology in the University of Kansas, caused by the resignation of Professor W. H. Twenhofel, has been filled by the election of Dr. Raymond C. Moore, of the University of Chicago.

At the June meeting of the board of regents of the University of Nebraska Dr. Raymond J. Pool was elected permanent head of the department of botany. Professor Pool had been acting head of the department since the death of Professor Bessey in February, 1915.

Dr. Charles C. Adams has been promoted to the professorship of forest zoology in the newly formed department of forest zoology in the New York State College of Forestry at Syracuse University.

As assistant professor of industrial hygiene of the medical college of the Ohio State University, Dr. Emery R. Hayhurst, an authority on the subject of occupational diseases and the relation of industrial problems to the preventable diseases caused by workshop conditions, has resigned as chief of the division of occupational diseases of the state department of health and will devote his entire time to the Ohio State Medical College.

AT the last meeting of the corporation of the Massachusettts Institute of Technology promotions and appointments were made to the instructing staff as follows: From assistant to associate professor Daniel F. Comstock (theoretical physics), George L. Homer (topographical surveying), C. L. E. Moore (mathematics), Ellwood B. Spear (inorganic chemistry), William E. Wickenden (electrical engineering). Instructors were promoted to assistant professorships as follows: James M. Barker (structural engineering), Ralph G. Hudson and Waldo V. Lyon (electrical engineering), Earl B. Millard (theoretical chemistry). Dr. Frederick G. Keyes was appointed associate professor of physico-chemical research.

DISCUSSION AND CORRESPONDENCE

SOME FUNDAMENTAL DIFFICULTIES OF MECHANICS

A LONG and interesting exchange of views on the fundamental equation of mechanics, which has taken place in the columns of SCIENCE, has led me to review some old notes in that connection. It has seemed to me that the question may be viewed from two different points, that of the systematizer and that of the teacher. The former desires an equation, fundamental in that from it he can develop the science most easily. The latter must consider as the fundamental principles those which appeal most directly and forcibly to the student, which enable the student to progress most easily, with rapidity and security. By *the student* I mean the average student, who has much experience of a mechanical nature, but is unaccustomed to logic and cares little about unity.

To the teacher of mechanics students in masses, that is, to nearly every mechanics or physics teacher, even in college and technical school, the first-named viewpoint is unimportant as compared with the second. His business is to diagnose the student's difficulties, and then to obviate or remove them. Some of these difficulties are inherent in the laws of mind and matter.

Any teacher will admit that to the average student the descriptive, phenomenological, attitude toward mechanics is quite too rarefied, too impersonal. Professor C. R. Mann has well said:

> To a beginner pushes and pulls are the real forces.

The beginner can imagine himself pushing or pulling, exerting an effort and taking an interest. Descriptively, it has been questioned whether the concept of force is of much value in mechanics; but the sense and memory of effort give the student his starting point, and the teacher must begin kinetics with force as well as with acceleration and mass.

When we exert effort we observe we either change the motion of bodies, or change the relative positions of bodies or of their parts, hence the forms of bodies. During such changes of position or form, more or less temporary changes of motion occur.

Hence we all quite unnecessarily infer that when the motions of bodies are changed, or their relative positions, or their forms, there must be something going on analogous to an effort; this we call force, and we say that the above effects of effort are the effects of force.

Moreover, we observe that while the changes of relative position or form of bodies due to our effort may persist after we have ceased to exert effort, on the contrary the motion which has been produced by an effort does not continue, it always diminishes and finally ceases. We note that the effort needed for the production or increase of motion depends on the contact of the body acted on with other things, as soil, pavement, ice; water, if floating; oil, if lubricated; air, if swinging suspended; and also on the form of the body, flat or jagged or round. In some cases the production of motion is harder, in others easier, the duration of the motions is shorter or longer, but sooner or later the motions end in rest. If we want a thing to keep going we have to keep pushing or pulling; and this without exception in all our bodily experience.

Hence we hastily but naturally conclude that rest is the natural state of all bodies, and that for the maintenance of even constant motion continuous effort, or force, is necessary.

It has been pointed out that the scholastic