in favor of establishing a four year course in medicine at the university. The board will prepare a bill for presentation at the next session of the legislature in 1923 to authorize and appropriate money for the establishment of a state hospital at Columbia to be operated in conjunction with the medical school.

DR. H. J. WEBBER has been appointed professor of citriculture in the University of California and director of the Citrus Experiment Station at Riverside, the position he held before he accepted an industrial position at Hartsville, South Carolina.

PROFESSOR A. V. MILLER, associate professor of drawing and descriptive geometry, has been apppointed assistant dean of the college of engineering of the University of Wisconsin, to take the place of Professor J. D. Phillips, who is now acting business manager during the year's leave of absence of H. J. Thorkelson.

DR. JOHN SUNDWALL, professor of hygiene and public health at the University of Minnesota, has been made director of hygiene and public health in the newly established department of physical education.

IN the Medical School, Boston, Dr. Fred Wilbur Thyng has been promoted to be professor of anatomy, and Dr. Jesse Leroy Conel has been appointed assistant professor.

PROFESSOR H. C. PLUMMER has been appointed professor of mathematics at the Ordnance College, Woolwich, England.

DISCUSSION AND CORRESPONDENCE

AN IMPORTANT BUT UNNAMED RADIOACTIVE QUANTITY

THE problems that are met in the quantitative study of radioactive materials and processes fall naturally into two classes. One class includes the strictly chemical problems; the other, the problems that are primarily concerned with radioactive phenomena, such as the rate of emission of energy and the rate of production of alpha particles. In problems belonging to the first class we are concerned with the total amount of material present; but in problems of the second class we are directly concerned with only the relatively small fraction (λN) of the atoms present that take part in the phenomenon studied; we are only incidentally interested in the atoms that have remained untransformed.

In such problems, comparable amounts of different radio-elements are such as correspond to the same value of λN. There should be a name by which to denote the amount of any radio-element, irrespective of family, that is thus comparable to a gram of radium. If, tentatively, we use the letter r to denote this quantity, then an r of any material may be defined as that amount of the material that will produce transformed atoms at the same rate as transformed atoms are produced by one gram of radium. This quantity plays in radioactivity a part that is analogous to that played by the gram-molecule in physical chemistry, and the adoption of some name for it will facilitate the recording, discussion, and presentation of observations and phenomena.

Thus arises the question whether the term "curie," which denotes an r of radium emanation, shall be redefined so as to cover the entire field embraced by our definition of the quantity r, or whether a new name shall be added to the nomenclature of the science. This question was submitted by the Bureau of Standards to a number of chemists and physicists; the majority of those who replied favored a redefinition of the "curie."

The advantages to be secured by adopting a name for the quantity here denoted by r are considered in greater detail in an article that will appear in an early issue of the *Journal* of the Washington Academy of Sciences.

N. ERNEST DORSEY

BUREAN OF STANDARDS,
WASHINGTON, D. C.,
July 30, 1921

THE VALUE OF TILTH IN AGRICULTURE

TO THE EDITOR OF SCIENCE: If the surface of the earth be broken up to a moderate depth, the growth of plants will be marvelously increased, as has been known from time immemorial.

A scientific explanation of this fact is sug-

gested by Mr. Jerome Alexander in SCIENCE, July 22, page 74, to the effect that the evaporating surface is increased by the comminution of the soil, with the resulting increase of evaporation of the soil water. This in turn results in a greater upward flow of the soil water from below, bringing with it a greater store of plant food than would normally be transported from the depths of the soil. This induced upward movement of the soil water is thought by the author of the note in question to account also for "the curious fact well known to farmers, that in dry weather, cultivation will to a considerable extent furnish moisture to the growing crops."

The value of cultivation (aside from the killing of weeds) is unquestionably the result of a number of diverse factors, the bare enumeration of which would transcend the limits of the space available in SCIENCE. So far, however, as the movements of the soil water are influenced by the comminution of the surface concerned, there are two chief results which prove of benefit to the growing crops.

By evaporation at the surface, the minerals held in solution are left behind at a locality inaccessible to the feeding roots, which can not long exist at the surface of the land. Cultivation of the surface moves this zone of concentration to the subsurface, and here the roots are able to take advantage of the greater concentrated solution of plant foods.

The well-known fact that tilth apparently increases the amount of moisture in the land is accounted for by the *exact reversal of the hypothesis suggested* by Mr. Alexander, the fact being that the comminution of the upper surface of the soil, instead of increasing the evaporation of the soil water, more or less perfectly *stops evaporation, and thus conserves the store of soil water.*

L. S. FRIERSON

GAYLE, LOUISIANA

BACTERIA IN THE AMERICAN PERMIAN

THE presence of bacteria in the closing period of the American Paleozoic has been suggested by the condition of the fractured reptilian spine, recalling an osteomyelitis, already noted.[1] At the time this first notice was written microscopic sections of the fossil spine had not been studied. Since then, I have received four transverse sections through the spine, showing in detail the nature of the sinuses which caused the tumefaction. Careful search through the sections has failed to reveal any sequestrum, such as is commonly found in modern chronic osteomyelitis, nor were bacteria found in the margins of the calcite filled sinuses. The presence of pathogenic bacteria in such a situation would be rather rare in a fossil state, since the nature of fossilization would prevent their preservation. It is doubtful too whether we could prove the pathogenicity of such bacteria save by their location.

Bacteria of the *Micrococcus* type, so common in the fossil vertebrate material studied by Renault from the Autun of France, are however abundantly preserved in the distorted osseous lacunæ. They are similar in all respects to those occurring in the fossil bone of fishes previously described[2] from the Devonian of America and Scotland. The bacteria, often seen isolated in the terminal bulb of the canaliculus-like burrows, which radiate out from the body of the lacuna, are no doubt those of decay and had nothing to do with the infection producing the osteomyelitis. There seems no doubt that bacteria of this type may be found in any fossil vertebrate material of the type which has been embedded in moist ground long enough to undergo a slight amount of decay, prior to fossilization. The only reason they have been seen so seldom in fossil vertebrate material is simply because no one has looked for them. They are there beyond any question.

The bodies which have been interpreted as bacteria, when seen isolated at a magnification of 1240 diameters, measuring from 1 to 2.5 microns, appear as semicrystalline, rounded, brownish bodies resembling minute specks of amber. The question as to whether they

[1] SCIENCE, N. S., Vol. LIII., No. 1371, p. 333, Apr. 8, 1921.

[2] SCIENCE, N. S., Vol. LI., No. 1305, p. 14, 1920.