pathology at Wake Forest College School of Medicine, has been appointed professor of pathology at the Medical College of Virginia, Richmond.

DR. ALBERT BACHEM has been appointed professor of radiology and director of the laboratory at the University of Illinois College of Medicine, Chicago.

DR. HOMER G. BISHOP, instructor in psychology at Cornell University, has been appointed assistant professor of psychology at Smith College.

PROFESSOR HANS SPEMANN, of the University of Freiberg, has been called to the chair of zoology at the University of Berlin, to take the place of Professor Heider, who has been made professor emeritus.

## DISCUSSION AND CORRESPONDENCE

### A NOTE ON THE SURFACE VISCOSITY OF COLLOIDAL SOLUTIONS[1]

THE excellent paper by R. E. Wilson and E. D. Ries on "Surface films and plastic solids" (Colloid Symposium Monographs, 1923) encourages me to publish the results of preliminary experiments made in 1922, before I had heard of Messrs. Wilson's and Ries's work, which are in complete accordance with their results.

The method I used differed from theirs. They employed a torsion pendulum, the polar moment of inertia of which was equal to 485 gr cm$^2$, and a circular glass plate, 3.8 cm in diameter, in contact with the liquid. I used a slightly more elaborate but, I believe, more sensitive instrument. A small glass rod, 0.4 mm in diameter and 10 mm long, was suspended to a galvanometer wire (Leeds and Northrup rolled phosphor bronze, 0.000125 cm thick = 0.002 inch); a mirror permitted the readings on a scale, and a light damping device provided a steady spot. The instrument itself was the micro-viscometer described previously.[2] Instead of having the liquid rotated continuously by means of the constant speed motor, it was only rotated by one twelfth of one revolution (30 degrees), or even one thirty-sixth of one revolution (10 degrees), in one minute exactly. The shearing stress was thus very small, and could be decreased at will. The first measurement was made as soon as the solution was poured into the rotating vessel. The other measurements were made with the same solution after a certain number of minutes had elapsed. Hence, the slow building up of the adsorbed layer could be followed. Unfortunately, I had no time to continue this work, and made only a few experiments, one of which follows:

[1] From the laboratories of The Rockefeller Institute for Medical Research.

[2] du Noüy, P. L., *J. Gen. Physiol.*, 1919, i, 521.

VARIATIONS IN FUNCTION OF THE TIME OF THE SURFACE VISCOSITY OF A SERUM SOLUTION AT 1/10,000
TEMPERATURE = 22° C.

| Time in minutes. | 0 | 7 | 10 | 15 | 30 | 50 | 90 |
|---|---|---|---|---|---|---|---|
| Readings (proportional to the viscosity). | 0 | 27 | 40 | 55 | 104 | 170 | 284 |

When plotted on paper, the curve shows a very slight upward convexity. After 1½ hours, the surface rigidity is considerable, despite the fact that the thickness of the adsorbed layer is only 41 x 10$^{-8}$ cm, as I have shown in a preceding paper,[2] and that this is probably the mean value of the length of the individual protein molecules present in a serum solution.

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### NUMBER OF UNITED STATES SCIENTISTS WHEN THE SIGMA XI SOCIETY WAS FOUNDED

THE question has arisen as to what need there was in 1886, when the Sigma Xi Society was founded, for this organization of "companions in zealous research." Was the United States not contributing at that time its full share to the advancement of science?

To find an approximate answer to this question, a brief analytical study was undertaken, based upon the third volume of Poggendorff's Handwörterbuch, which gives the names of research men and the titles of their papers in the exact sciences throughout the world for the 25 years from 1858 to 1883. This is the period immediately preceding the founding of the Sigma Xi. I classified the scientists listed in Poggendorff by countries. As the volume covers over 1,400 pages, I took only part of the volume, namely, the first 15 pages of every 100 pages, and then multiplied the figures thus obtained by 6⅔.

On the basis of the data thus secured, the distribution of scientists over the ten leading countries, for the period 1858 to 1883, was as follows: Austria-Hungary 560, England 633, France 707, Germany, 1,927, Holland 207, Italy 280, Russia 340, Sweden 193, Switzerland 220, the United States 447. In this list Germany stands first with 1,927, and the United States fifth with 447 scientists.

But this mode of comparison is not quite fair; the populations of the various countries should receive consideration. Accordingly, we computed the number of scientists (for the period 1858–1883) for every million of population based on statistics of 1870. Per million of population, Austria-Hungary had 15¾ scientists, England 20, France 19½, Germany 47, Hol-

[3] du Noüy, P. L., *J. Exp. Med.*, 1924, xl, 133.

land 57¾, Italy 10½, Russia 4⅓, Sweden 46⅓, Switzerland 82½, the United States 11½. In this list Switzerland is highest, with 82½ scientists per million of population. Holland is second; Germany third; the United States is eighth, with only two of the ten countries below her. In proportion to the population, Switzerland had over seven times more scientists than the United States, Holland had five times more, Germany over four times more, and Sweden four times more. This statistical study gives forceful answer to the question regarding the need of organizations like the Sigma Xi, 38 years ago, in the United States.

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## ENLARGED PARATHYROIDS IN RACHITIC CHICKENS

IN truly rachitic chickens, enlargement of the parathyroid glands occurs with remarkable constancy. Similar enlargement of the parathyroids of rachitic mammals—particularly rats and the human—has been reported by several investigators, such as Erdheim, Ritter and Pappenheimer and Minor.

This enlargement of the parathyroids in rachitic chickens is a very useful means for differentiating between rickets and various other morbid conditions that occur in birds used in nutrition investigations. For instance, in the pathologic condition commonly known as "legweakness," it frequently becomes necessary to differentiate between rickets and some other condition that may give rise to leg symptoms in chickens.

The ease with which the chickens' parathyroids may be found and their remarkable responsiveness to the rachitic process make them a valuable criterion for judging the presence or absence of rickets.

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## FALL OF A METEORITE IN BRITISH COLUMBIA

A METEORITE was heard and seen to fall, and the incandescent pieces were seen to splash from the top of the mountain on the north side of the water supply creek of Manitou cannery, on the west side of Dean channel, British Columbia, between nine and eleven o'clock in the evening of August 3. This place is about opposite the mouth of Dean River. It was both heard and seen by Mrs. Harlan I. Smith, of Ottawa, Ontario, Mr. Milo Fougner, of Bella Coola, B. C., Mr. Andrew Widsten, Dominion Fishery Patrol officer, of Bella Coola, B. C., and Mrs. Humphrey, wife of the cannery caretaker. Mr. Smith and Mr. Humphrey heard but did not see it. Some passengers on the steamship *Camosun,* of the Union Steamship Line of Vancouver, then at the cannery wharf, also possibly saw or heard this meteorite. The sound was heard almost simultaneously with the sight.

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# SPECIAL ARTICLES

## ON THE UPPER CRITICAL CONCENTRATION OF OXYGEN IN ROOT GROWTH

THE writer has shown that in event of a deficiency of oxygen in the atmosphere of the soil the rate of root growth varies inversely with change of temperature[1] and that the "minimum" oxygen supply is not a fixed supply but that it also varies, but directly, with temperature change.[2] Such concentration has been termed the lower critical concentration.[3] The lower critical concentration of oxygen is thus the least concentration at which growth will take place at any temperature.

In considering the relation of root growth to available oxygen it will be apparent that there are four cardinal concentrations. Of these, one, the lower critical, has already been defined. Another concentration is that at which growth is "normal." This is termed the upper critical concentration. Between the lower and the upper critical concentration exists an oxygen deficiency, as will be seen. But above the upper critical concentration an increase in the amount of oxygen does not apparently induce change in the growth rate until a certain and possibly high concentration is reached, when the rate may fall. And, finally, the concentration may apparently be so great as to bring about entire cessation of growth. Such would be the maximum concentration. Of the upper optimal concentration, the range of the optimal or of the maximal concentration or the range of the supraoptimal, this note has nothing to do. Attention, however, should be called to certain apparent characteristics of the upper critical concentration of oxygen in root growth.

The upper critical concentration of oxygen, as above defined, is such partial pressure as will just permit a "normal" rate of root growth at any given temperature. For the reason that the oxygen requirement of roots varies with temperature changes, the actual concentration for the upper critical is greatest at the highest temperatures and least at the lowest temperatures. A test of what the upper critical con-

[1] "The influence of the temperature of the soil on the relation of roots to oxygen," W. A. Cannon, SCIENCE, n.s., 58: 331, 1923.

[2] "A note on the relation of root growth in the soil to the oxygen supply: The growth ratio," W. A. Cannon, *Ecology,* 5: 319, 1924.

[3] In a study on roots and aeration, unpublished.