treatment, $1; medicine, laboratory tests, x-ray photographs and other supplies at cost; diagnosis of cases requiring special examinations and study, with group consultation of specialists and diagnosis, $10; thorough health examination to discover possible defects from diseases and to obtain advice regarding personal hygiene, $2.50.

THE next meeting of the International Geodetic and Geophysical Union and of its various sections will be at Rome in 1922.

UNIVERSITY AND EDUCATIONAL NEWS

UNDER the terms of the will of the late Hiram Francis Mills, A.M. (Hon.) '89, of Hingham, $200,000 has been left to Harvard University for the study of the origin and cure of cancer. The fund is to be known as the Elizabeth Worcester Mills Fund in honor of Mr. Mills's wife.

ON account of the increased enrollment in psychology courses in Purdue University, two additional instructors and an assistant have been appointed. The new instructors are: H. C. Townley, A.M. (Wisconsin '21), Peter McCoy, A.M. (Columbia '14), and Dorothy Lee, A.B. (Indiana '21). The present enrollment in general and vocational psychology is approximately 500, of whom 345 are men. Changes in the engineering curricula at Purdue make it possible for an engineering student to take two full years of work in psychology.

AT the University of Pennsylvania in the Medical School, Dr. Glen E. Cullen has been made an associate professor of research medicine. Dr. W. A. Jaquette has been made professor of oral surgery and director of the school of dental hygienists, and Dr. Samuel Goldschmidt has been made assistant professor of physiology.

Three associate professors in the Towne Scientific School have been promoted to full professorships in chemistry. They are Dr. John Frazer, Dean of the Towne Scientific School; Dr. Thomas P. McCutcheon and Dr. Hiram S. Lukens. The trustees have also elected Dr. George A. Piersol emeritus professor of anatomy. Dr. Piersol retired from the professorship of anatomy last spring.

WELTON J. CROOK has resigned as chief metallurgist to the Pacific Coast Steel Co. to accept an appointment as associate professor of metallurgy in Stanford University.

MISS EMMA FRANCIS, who resigned as head of the nutrition laboratory, Battle Creek Sanitarium, last July, has been appointed assistant professor of chemical agriculture in the Experiment Station of Pennsylvania State College.

KENNETH H. DONALDSON has been appointed instructor in ore dressing and mining at the Case School of Applied Science.

PROFESSOR F. E. GUYTON, of the Ohio State University, has been appointed assistant professor of zoology and entomology at the Alabama Polytechnic Institute.

E. EUGENE BARKER has returned from Porto Rico and has accepted a position as associate professor of botany at the University of Georgia.

J. J. O'NEIL has been appointed acting assistant professor of geology at McGill University during the absence of J. A. Bancroft.

DISCUSSION AND CORRESPONDENCE

AN EXPLANATION OF LIESEGANG'S RINGS

TO THE EDITOR OF SCIENCE: Dr. McGuigan seems to be unaware of much recent work on banded precipitates (SCIENCE, July 22). He has come to the conclusion, generally, that in some way, the chromate is attracted from the regions of the gel adjacent to the precipitate. So far this is in accordance with the theory proposed by myself in 1916 and confirmed by a long series of experiments.[1] But Dr. McGuigan's particular hypothesis will not bear examination in detail. He may be right in supposing the attractive force to be that between the silver and chromate ions. But this is not sufficient to explain why the bands form in gelatin and not in agar. Neither is the assumption tenable that the

[1] *Biochem. J.*, 1916, X., 169; 1917, XI., 14; 1920, XIV., 29, 474.

chromate of itself is unable to diffuse in the gelatin. The contrary is easily proved. Moreover, there are a great many precipitates that give bands either in gelatin, agar, silicic acid or even in filter paper and sand. It can not be assumed, in every case, that one of the reagents is fixed. Further, the facts quoted by Dr. McGuigan in support of his hypothesis are inaccurate. Bands of lead chromate can be obtained in gelatin with the right concentrations of lead acetate and potassium dichromate, as also with silver nitrate in the gel and the dichromate in aqueous solution.

Examination of a great many different kinds of precipitate in gels and other media shows that band formation occurs only when the precipitate is extremely finely divided, or, practically, in the colloid state. If the specific surface of the precipitate is insufficient there is no banding. The experiments are made conveniently in test-tubes half filled with gel on which the liquid reagent is poured. As the specific surface increases, at first, bands of denser precipitate are formed in a diffuse column of precipitate extending down the tube. With further increase of specific surface, the bands become more marked, until, eventually, there may be no precipitate between. The formation of bands in a diffuse precipitate absolutely disproves the "supersaturation" theory.

The attractive force, the effect of which is well illustrated in Dr. McGuigan's photograph, is that of adsorption. When the precipitate is sufficiently finely divided it adsorbs the solute from the adjacent zone of gel. More solute diffuses into this zone from the regions of gel more remote, where the concentration of solute has not been diminished. But the solute is adsorbed as fast as it arrives in the neighborhood of the precipitate and is removed from solution by the excess of precipitating reagent. Thus a concentration gradient is set up towards the precipitate, and a considerable region of gel adjacent to the precipitate becomes practically devoid of solute. If the rate of diffusion into the gel of the stronger reagent is sufficient, this reagent will be able to travel through the exhausted zone until it reaches a further region of gel where there is sufficient solute to form another band of precipitate. The increasing distances apart of the bands are due to the diminishing concentrations both of the solute in the gel and of the reagent diffusing in.

The specific surface of the precipitate is influenced by the concentrations of the reaction components, by the nature of the reaction medium and by the presence of electrolytes. Generally, it is determined by the value of N in von Weimarn's somewhat indefinite formula

$$N = K.(P/L),$$

where P is the excess concentration of the substance to be precipitated, L its solubility and K is a factor representing the viscosity of the reaction medium and the physical and chemical complexity of the reaction components in solution. The formula is being investigated further. But it has been shown that the occurrence or non-occurrence, of bands of a given substance in different gels is due to the influence of the reaction medium, and that, by varying its specific surface, a substance can be obtained in the banded form, or not, as desired. For instance, silver chromate and dichromate form bands in gelatin. In agar gel they occur as black ribbon-like crystals up to several centimeters in length. By increasing the specific surface of the precipitate in agar, both salts have been obtained in a banded form even more beautiful than in gelatin.

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SPECIALIZATION IN THE TEACHING OF SCIENCE

To the Editor of Science: It is somewhat amusing to note Professor Gortner's reference to the settee of science as if it were a thing of the past, and then to find, on an earlier page of the same issue, an advertisement which calls for a professor of zoology and geology.