trated, perhaps, by detailing a specific instance.

When a cell, in consequence of injury, is made the subject of an acid intoxication by any of the direct or indirect means enumerated in the last paragraph, the acid makes some of the proteins of the affected cells swell, while another group (the globulins) is dehydrated and precipitated. The combination of swelling with precipitation yields what the pathologists call "cloudy swelling." But as the pathologists have long noted, a persistence of cloudy swelling is followed, almost as a rule, by a "fatty degeneration" of the affected cells. On the basis of our remarks this coalescence of the oil droplets into the larger visible ones of "fatty degeneration" is dependent upon the removal, through the action of the acid, of some of the stabilizing effects of the proteins, soaps and other hydrophilic colloids contained in the cells. The increased swelling represents a dilution of the hydrophilic colloids of the cell, while the clouding represents a dehydration of certain others.

These studies on emulsions contribute toward the explanation of yet another pathological observation. When any tissue, as a portion of the brain, through some such pathological disturbance as a thrombosis is deprived of its normal blood supply, the affected member shows first a cloudy swelling accompanied or succeeded by a "fatty degeneration," and then a "softening" of the tissues. How at least a portion of this (and we are inclined to think the major portion in such tissues as the brain) is brought about is illustrated in the changes in viscosity observable in the preparation of an emulsion or its subsequent destruction. Seven per cent. potassium soap and cottonseed oil, for instance, are both relatively mobile liquids, but when mixed in proper proportion they yield an emulsion so stiff that it will stand alone. This is the analogue of the twenty-five per cent. emulsion of fat and lipoid in hydrated protein which we call the brain. If the oil-in-soap emulsion is broken through the addition of a little acid it yields an impure mixture of oil, water and precipitated colloid material—the analogue of the liquid contents found in any area of brain "softening."

Application may also be made of these studies to the problem of the giving off of such essentially fatty secretions as make up ear wax, vernix caseosa, sebum, the fatty secretions of plants, etc. *These all represent a transition from the normal type of oil in hydrophilic colloid emulsion to that of hydrophilic colloid in oil emulsion.* A homely analogue of this type of change is seen in butter-making, which consists of changing cream (essentially an emulsion of oil in hydrophilic colloid) into butter (a fat into which are divided about fourteen per cent. of water). Similarly, the essentially fatty secretions from the body as well as the fat contained in the adipose tissues of the body, all prove to be fats containing some seven to fifteen per cent. of water emulsified in them.

The details of these observations will be published in the *Kolloid-Zeitschrift.*

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GRAVITATION AND ELECTRICAL ACTION[1]

IN former publications the present writer has suggested that there is an intimate relation between gravitation and electrical action at a distance, or what has been called statical effects. There can be no doubt of the truth of the statement that the attraction between two masses of matter depends not only upon the amount of matter in the two masses, and their distance from each other, but also upon their electrical potential.

The gravitation constant has been determined by finding the attraction between two spheres of metal. In these determinations the electrical potential of the masses has been ignored. It has been assumed that there are no electrical charges on the two masses, if their potential is that of the earth.

Assume that two spheres, having radii R_1 and R_2 composed of metal having a density ρ,

[1] Extract from a forthcoming number of the *Transactions of the Academy of Science of St. Louis.*

and distant from each other r, have charges Q_1 and Q_2, the spheres having a common potential V. Their attraction for each other will be

$$A = K\frac{m_1m_2}{r^2} - \frac{Q_1Q_2}{r^2}$$

$$= K\frac{16}{9}\frac{\pi^2R_1^3R_2^3\rho^2}{r^2} - \frac{R_1R_2}{r^2}V^2$$

Here K is the value of Newton's constant of gravitation, as it would be determined by the method of Cavendish or Boys, if V were zero absolute.

If V is not zero, and the second term is omitted, the last equation might be written

$$A = K\left(1 - \frac{x}{100}\right)\frac{16}{9}\frac{\pi^2R_1^3R_2^3\rho^2}{r^2}$$

In this equation $K[1-(x/)100)]$ is the gravitation constant that would be determined under such conditions. Both K and x would remain unknown quantities.

Equating these two values of A

$$V = \tfrac{4}{3}\pi R_1R_2\rho\frac{\sqrt{Kx}}{10}$$

If V is measured in volts

$$V = 40\pi R_1R_2\rho\sqrt{Kx}$$

If $R_1 = 10$, $R_2 = 1$, $\rho = 11.35$ and $K = 6.6576 \times 10^{-8}$

$$V = 3.68\sqrt{x}$$

This result shows that if these two spheres have a common potential which differs from absolute zero by 3.68 volts, the value of K as determined by the Cavendish method will be in error by one per cent. of the above value which is that of Boys. If V were ± 8.23 volts, an error of five per cent. would result. If V were 36.8 volts the two spheres would cease to attract each other. The absolute zero in V would be the common potential of the two bodies, when their attraction for each other is a maximum.

Storm clouds and the electrified atmosphere are continually acting inductively upon the earth's surface. The potential difference at the ends of a flash of lightning may amount to thousands of millions of volts. Aside from such disturbances, we are wholly in the dark concerning the average potential of the earth.

It is evident that the smaller the masses used in such determinations, the greater will be the possibility of error in the result, when the potential term is ignored.

It seems very probable that we do not know the real value of the gravitation constant.

FRANCIS E. NIPHER

SOCIETIES AND ACADEMIES

THE AMERICAN MATHEMATICAL SOCIETY

THE one hundred and eighty-second regular meeting of the society was held at Columbia University on Saturday, February 26, extending through the usual morning and afternoon sessions. The attendance included forty-three members.

The president of the society, Professor E. W. Brown, of Yale University, occupied the chair, being relieved by Professors H. B. Fine, T. S. Fiske and H. S. White. The following persons were elected to membership: Mr. L. E. Armstrong, Stevens Institute of Technology; Professor Grace M. Bareis, Ohio State University; Professor G. A. Chaney, Iowa State College; Mr. J. E. Davis, Pennsylvania State College; G. H. Hardy, M.A., Trinity College, Cambridge, England; Mr. Harry Langman, Metropolitan Life Insurance Company, New York City; Mr. E. D. Meacham, University of Oklahoma; Dr. A. L. Nelson, University of Michigan; Mr. Elmer Schuyler, Bay Ridge High School, Brooklyn, N. Y. Six applications for membership were received.

The society has recently taken over the stock of the Chicago Papers and Boston Colloquium Lectures, heretofore in the hands of The Macmillan Company. All publications of the society, so far as in stock, are now obtainable directly from the main office. The New Haven Colloquium was published by the Yale University Press, and is sold by them.

The List of Members of the society for 1916 has just been issued. Copies may be obtained from the secretary.

The following papers were read at this meeting:

T. H. Gronwall: "A functional equation in the kinetic theory of gases (second paper)."

T. H. Gronwall: "On the zeros of the functions $P(z)$ and $Q(z)$ associated with the gamma function."

T. H. Gronwall: "On the distortion in conformal representation."

C. A. Fischer: "Equations involving the derivatives of a function of a surface."