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JOSIAH WILLARD GIBBS[1]

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On the one hundredth anniversary of his birth, we are here to do honor to the memory of Josiah Willard Gibbs, the greatest physical scientist that America has produced and one of the greatest original thinkers of all time. The occurrence of genius is commonly believed to be a phenomenon of pure chance, and such it may well be so far as native talent is concerned; but talent has merely a potential value; it is fruitful only when it is properly cultivated, indeed, we may say when it is self-cultivated under favorable conditions. Genius may be assisted in this process of self-cultivation but, in all cases, genius flourishes best in an environment of complete intellectual freedom. The history of American science bears this out.

Let us review, briefly, the careers of the American men of genius who contributed to the development of physical science from Colonial times up to the last quarter of the nineteenth century. Up to 1880, America had produced five great physical scientists: Benjamin Franklin, Benjamin Thompson (Count Rumford), Joseph Henry, Henry A. Rowland and Josiah Willard Gibbs.

Franklin and Rumford were products of pre-revolutionary America; they were self-taught, having received only very meager common school education. The two men, although their lives were, in certain respects, very diverse, had much in common. Both were exceptionally versatile; both were keen observers and ready experimenters; both were of a practical and inventive turn of mind; both were keenly conscious of their social environment and both did much to advance science and learning in other ways than through their scientific contributions. Franklin was active in promoting the establishment of libraries, colleges and

[1] An address delivered in Yale University on the occasion of exercises held in commemoration of the one hundredth anniversary of the birth of Josiah Willard Gibbs.

passing paraffin, due to its negligible volume, ease of application and absence of contaminated areas on which a portion of the solution may remain. It is applied by filling the vessel with a one-quarter saturated solution of ferric stearate in benzene, draining, and allowing the solvent to evaporate. This leaves a very thin coating of ferric stearate. The hydrophobic surface so formed is not attacked by thirty minutes' exposure to 0.1: N HCl, 0.1 N NaOH, saturated NaCl, petroleum ether, chloroform or ether. Further it does not adsorb methylene blue as does glass, nor interfere either in respiration or dye reduction in any of the systems so far studied. Ferric stearate may also advantageously replace paraffin in coating micro-capillary pipettes, as employed by Wigglesworth[1] in the micro-estimation of chloride. The sample of ferric stearate employed was prepared by mixing ferric chloride with a warm, concentrated aqueous solution of sodium stearate, followed by filtration and washing (*c.f.* Langmuir and Schaefer[2]).

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AMPHIBIAN GAMETES AS BIOLOGICAL TEST MATERIAL

BIOLOGICAL material suitable for testing physical or chemical variables has not been abundant, dependable nor constantly available. Through the discovery that hibernating frogs can be stimulated by the anterior pituitary hormone to release their gametes, there is now available material which may be the answer to the experimental biologist's needs. Between September and March female frogs can be induced to provide upwards of 2,000 eggs (each) at the identical stage of maturation and 24 hours after pituitary stimulation. The eggs may be stripped from the female as needed, in lots of from 50 to 100, or in case of experiments where quantitative data are desired, entire uteri may be tied off as sacks full of eggs and removed from the body. The eggs from one uterus may be used for control as against the eggs of the other uterus, which are subjected to the experimental variables. The frog testes may either be dissected in Holtfreter's modification of amphibian Ringer's (diluted to 10 per cent.) or the male may be similarly stimulated by hormone treatment to release the spermatozoa into its seminal vesicles. Uniform and concentrated suspensions of spermatozoa may be kept for many hours without loss of inseminating powers. This period is shortened with dilution and high temperatures and may be extended if the suspensions are kept at refrigerator temperatures.

[1] V. B. Wigglesworth, *Biochem. Jour.*, 31: 1719, 1937.
[2] I. Langmuir and V. Schaefer, *Jour. Am. Chem. Soc.*, 59: 2400, 1937.

In some recent investigations with both low and high voltage x-radiation, embryos from radiated gametes have shown consistent and quite uniform results. With carefully controlled x-radiation of either sperm or eggs, many of the earlier predictions of Hertwig and of Bardeen have been confirmed. There are, however, many new and biologically significant aspects of this radiation problem, which have been revealed by our modern precision equipment and this newly available biological material. It has been impossible, for instance, to render immotile frog spermatozoa with high voltage radiation even up to 120,000 r., although some abnormal embryos appear when the spermatozoa receive as little as 25 r. Early cleavage of eggs fertilized by radiated sperm is perfectly normal in both rate and pattern. There is, however, some evidence that near 10,000 r. the sperm nucleus is sufficiently damaged as to prevent neurulation, but eggs inseminated with spermatozoa which have been exposed to upwards of 30,000 r. will result in quite normal-appearing tadpoles, which may, however, be haploids. Both frog's sperm and eggs are being used to test, from a biological point of view, the qualitative difference between the soft and the hard x-rays.

The details of these radiation experiments will be reported elsewhere, but it is the purpose of this note to call attention to this extremely abundant and dependable biological test material which can be used along the lines of genetics, cytology, cell physiology and embryology.

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BOOKS RECEIVED

DUNCAN, CARL D. *A Contribution to the Biology of North American Vespine Wasps.* Pp. 272. 255 figures. Stanford University Press. Cloth, $3.25; paper, $2.50.

GOULDEN, C. H. *Methods of Statistical Analysis.* Pp. vii + 277. Wiley. $3.50.

Industrial Research Laboratories of the United States, Including Consulting Research Laboratories. Sixth edition, 1938. Pp. 270. National Research Council, Washington. Cloth, $3.00; paper, $2.50.

KOPACZEWSKI, W. *Traité de Biocolloïdologie, Tome V, État Colloïdal et Médecine; Fascicule I, Le Sang.* Pp. xvi + 151. 60 fr. *Fascicule II, Liquides et Tissus Organiques.* Pp. 153–299. 4 plates. 100 fr. Gauthier-Villars, Paris.

MACCOLL, SYLVIA H. *A Comparative Study of the Systems of Lewin and Koffka with Special Reference to Memory Phenomena.* Vol. II, No. 1, Serial No. 5, *Contributions to Psychological Theory.* Pp. vii + 160. Duke University Press. $1.50.

MCCOLLUM, E. V., ELSA ORENT-KEILES and HARRY G. DAY. *The Newer Knowledge of Nutrition.* Fifth edition. Pp. ix + 701. Illustrated. Macmillan. $4.50.

MEDSGER, OLIVER P. *Edible Wild Plants.* Pp. xv + 323. Illustrated. Macmillan. $3.50.

RIESENFELD, ERNST H. *Lehrbuch der Anorganischen Chemie.* Pp. xxvii + 706. 90 figures. Deuticke, Wien. R.M. 10.50.

WITTICK, EUGENE C. *The Development of Power.* Pp. xiv + 164. 148 figures. University of Chicago Press.