SCIENCE

VOL. 92 FRIDAY, OCTOBER 4, 1940 No. 2388

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

PSYCHOLOGICAL APPROACHES TO THE BIOGRAPHY OF GENIUS[1]

By Professor LEWIS M. TERMAN

STANFORD UNIVERSITY

PROBABLY few words have acquired a greater variety of connotations than *genius*. On this occasion I shall disregard the numerous meanings attached to the word in the first two thousand years of its history and call attention only to common usages in modern English.

In a popular sense genius is often used to designate some kind of mystical gift that can not be explained by the ordinary laws of human nature. The scientist, of course, rejects this usage. Havelock Ellis and others have used the term as practically synonymous with eminence. Galton, while employing the criterion of eminence, follows Samuel Johnson in defining a genius as one who is endowed with superior intellectual ability. This definition is essentially identical with that given in Warren's "Dictionary of Psychological Terms," 1934, and is the one I prefer.

The *sine qua non* of genius is the ability to acquire and to manipulate concepts, the shorthand symbols without which abstract thinking can not proceed. However, there are many levels of aptitude for concept mastery and the question arises where genius may be said to begin. We have at one extreme Dr. Fields' laboratory rats which required thousands of trials and a good part of their lives to learn to respond to triangularity in visual stimuli; that is, to acquire one crude concept. At the other extreme are the Newtons

[1] Presidential address before the Pacific Division of the American Association for the Advancement of Science, Seattle, June 18, 1940.

importers are not enthusiastic about cooperation, since they think in terms of tons and they are also fully alive to the penalties that are risked if unauthorized persons secure some of the seed.

It seems clear that the long and important career of the protein edestin is coming to a close in the United States. A substitute must be found, and it is the purpose of this communication to draw attention to the problem this presents. The substitute for edestin must be a seed globulin of approximately the same solubility; it should be a protein that is easily prepared in crystalline and therefore presumably pure form; it should be derived from a seed that is an important crop not only in America but elsewhere, and it is desirable that it should be relatively cheap. A survey of possibilities in this field has led, largely by elimination on one ground or another, to the plants of the family Cucurbitaceae. Many species are commonly grown, and considerable study has been given to the proteins. Squash-seed globulin was prepared by Osborne[5] in 1892 and has been occasionally investigated since. Cantaloupe seed has been studied by Jones and Gersdorff.[6] Hirohata[7] has examined the globulins of some thirty-eight varieties and species of eight genera of this family and has drawn attention to the close similarity, if not identity, of the globulins from closely allied species. Kiesel and his collaborators[8] and also Krishnan and Krishnaswamy[9] have studied the globulin of watermelon seed.

Considerations of availability have led us to the tentative suggestion that the globulin of the pumpkin seed (*Cucurbita pepo*)[10] may be found to fulfil most of the requirements of a substitute for hemp-seed edestin. Numerous varieties are grown, and the seed is a waste product of the canning industry in some states. It is always available on the market at a price that is usually a small fraction of that commanded by most cucurbit seeds.

[5] T. B. Osborne, *Am. Chem. Jour.*, 14: 662, 1892.

[6] D. B. Jones and C. E. F. Gersdorff, *Jour. Biol. Chem.*, 56: 79, 1923.

[7] R. Hirohata, *Ztschr. f. physiol. Chem.*, 212: 1, 1932.

[8] A. Kiesel, A. Belozersky, P. Agatow, N. Biwschich and M. Pawlowa, *Ztschr. f. physiol. Chem.*, 226: 73, 1934.

[9] P. S. Krishnan and T. K. Krishnaswamy, *Biochem. Jour.*, 33: 1284, 1939.

[10] *Cucurbita pepo* includes the common field, pie and cattle pumpkin of North America and also the vegetable marrow. There are several varieties recognized in systematic works, and many varieties are commonly grown. *C. moschata* is a closely allied species that includes the cushaw and crookneck squashes and other varieties known both as pumpkins and as squashes. *C. maxima*, also closely allied, includes such well-known squash varieties as Hubbard and Boston Marrow as well as certain very large varieties commonly called pumpkins. Whether varietal or even specific differences in these plants are reflected in the main storage globulins of the seeds is unknown. Uncertainty on this point presents no graver problem, however, in this case than is presented by any other protein of vegetable or for that matter of animal origin.

A series of proteins from commonly available cucurbit seeds is under investigation in this laboratory. Although there are minor differences in the behavior of the different seeds, all yield well-crystallized globulins when the ground, whole seed is extracted by means of a hydraulic press with warm 10 per cent. sodium chloride solution. After removal of the emulsion of fat which readily rises from the warm solution, the filtered aqueous phase is diluted to about 2 per cent. sodium chloride concentration at 60° C. This clear solution is slowly cooled to about 5° C., when the protein deposits almost entirely in the form of octahedral crystals. Reprecipitation under similar circumstances gives, as a rule, a very fine product. The yield is of the order of 10 per cent., somewhat higher than that usually secured from hemp-seed.

A report on the preparation and nutritive properties of one or more of these globulins and on certain of their chemical properties will form the subject of a later communication.

HUBERT BRADFORD VICKERY
EMIL L. SMITH[11]
LAURENCE S. NOLAN
CONNECTICUT AGRICULTURAL EXPERIMENT STATION

[11] John Simon Guggenheim Memorial Fellow.

BOOKS RECEIVED

ALLEN, GLOVER M. *The Mammals of China and Mongolia. Part 2 of Vol. XI of Natural History of Central Asia.* Pp. xxvi + 621–1350. Illustrated. American Museum of Natural History. $10.00.

BELL, E. T. *The Development of Mathematics.* Pp. xiii + 583. McGraw-Hill. $4.50.

BOGERT, L. JEAN and MAME T. PORTER. *Dietetics Simplified; The Use of Foods in Health and Disease.* Second edition. Pp. xi + 742. 76 figures. Macmillan. $3.00.

CLARK, C. C. and R. H. HALL. *This Living World.* Pp. x + 519. Illustrated. McGraw-Hill. $3.25.

HAPP, STAFFORD C., GORDON RITTENHOUSE and G. C. DOBSON. *Some Principles of Accelerated Stream and Valley Sedimentation.* Pp. 134. Illustrated. U. S. Department of Agriculture. Superintendent of Documents, Washington. $0.75.

LANDIS, CARNEY and others. *Sex in Development.* Pp. xx + 329. Hoeber. $3.75.

KENDALL, JAMES I. *The Microscopic Anatomy of Vertebrates.* Second edition. Pp. 342. 197 figures. Lea and Febiger. $3.75.

KLEINER, ISRAEL S. and LOUIS B. DOTTI. *Laboratory Instructions in Biochemistry.* Looseleaf. Mosby. $1.50.

PETERS, CHARLES C. and WALTER R. VAN VOORHIS. *Statistical Procedures and Their Mathematical Bases.* Pp. xiii + 516. Illustrated. McGraw-Hill. $4.50.

Report on the Agricultural Experiment Stations, 1939. Prepared by the Office of Experiment Stations. Pp. 265. U. S. Department of Agriculture. Superintendent of Documents, Washington. $0.25.

SHUSTER, CARL N. *A Study of the Problems in Teaching the Slide Rule.* Pp. v + 103. Illustrated. Teachers College, Columbia University. $1.85.

YOUNG, KIMBALL. *Personality and Problems of Adjustment.* Pp. x + 868. Illustrated. Crofts. $4.25.