SCIENCE

VOL. 102 FRIDAY, SEPTEMBER 7, 1945 NO. 2645

SCIENCE: A Weekly Journal, since 1900 the official organ of the American Association for the Advancement of Science. Published by the American Association for the Advancement of Science every Friday at Lancaster, Pennsylvania.

Editors: JOSEPHINE OWEN CATTELL and JAQUES CATTELL.

Policy Committee: MALCOLM H. SOULE, ROGER ADAMS and WALTER R. MILES.

Advertising Manager: THEO. J. CHRISTENSEN.

Communications relative to articles offered for publication should be addressed to Editors of Science, 1215 Fifth Avenue, New York 29, N. Y.

Communications relative to advertising should be addressed to THEO. CHRISTENSEN, Advertising Manager, Smithsonian Institution Building, Washington 25, D. C.

Communications relative to membership in the Association and to all matters of business of the Association should be addressed to the Permanent Secretary, A.A.A.S., Smithsonian Institution Building, Washington 25, D. C.

Annual subscription, $6.00 Single copies, 15 cents

HUMAN ASPECTS OF SCIENTIFIC RESEARCH

By DR. WILLIAM A. HAMOR

MELLON INSTITUTE, PITTSBURGH, PA.

CONSPICUOUS throughout the world of to-day is the great diversity of science, which has been accomplished by the wide extension of the frontiers of knowledge of man and nature by the application of research. This research may be looked upon as the scientific quest for the possible. More precisely, it finds, observes, defines and applies positive facts by experimental methods and inductive logic. Research has characterized the life of the universities, which are primarily responsible for its existence. Having comprehended the spirit and power of research from the universities, the industries have utilized its methods in their own affairs with most beneficial results.

It seems that wherever research is alive it grows. The past thirty-five years have seen the number of industrial research laboratories in this country increase from a few to more than 3,000. But, without the evolution of scientific investigation in the universities, these industrial laboratories might never have been established. In addition to the very idea of research the universities have supplied the industries with men and women possessing knowledge not only of the underlying scientific facts and theories but of the methods and techniques of investigation. From the universities also has come much of the basic knowledge of science on which modern technology has been erected and will build in the future. The practical uses of science may be regarded as the dividends declared every once in a while by pure research and research education. When such research and education are hindered these dividends

breeding stock to drive his point home. The best part of the story from this reviewer's standpoint, is that relating to Mr. Mudgett's progress in breeding a splendid herd of Guernseys from 3 or 4 well-chosen foundation cows coupled with his carefully studied plan of choosing sires. In the latter is exemplified the wisdom of choosing sons of proved sires out of daughters of proved sires—said daughters also being members of good cow families. The breeding story would have been more easily followed had Mr. Russell made a family chart of the whole herd rather than using narrative and tables and had he included some pedigrees.

The large commercial dairy herd discussed is the Overbrook herd in Essex County, New Jersey. Management of this Holstein herd was assumed by Mark H. Keeney in 1923. This astute manager and breeder set as his goal a large herd that would average over 500 pounds of butterfat per cow per year and not only reached his goal but has held it over 10 years. In a herd numbering 70 to 80 cows this is a truly remarkable accomplishment. Mr. Keeney, in his own book, "Cowphilosophy," has told the story in detail. Mr. Russell in his discussion dwells largely on Mr. Keeney's choice of sires which follows the pattern already described in the small Guernsey herd of Mr. Mudgett.

In writing about his own herd, Mr. Russell says, "Four or five generations on bovine history—weaken the memory," and, of course, he might very well have added, "also the genetic influence." Mr. Russell has apparently done a splendid job of breeding Guernseys, but his telling about it would have been more clear had he used a herd chart and included some pedigrees. When several hours of work had put Mr. Russell's words into the form of a herd chart and we had traced several pedigrees, we learn that his foundation cow made 654 pounds of butterfat; 3 daughters averaged 675 pounds; 10 granddaughters averaged 697 pounds; 17 great granddaughters averaged 704 pounds and 5 great, great granddaughters 717 pounds. This is a great cow family.

Also from the chart, we can see that the first bull's daughters averaged 633 pounds of fat; the second bull's 9 daughters—688 pounds; the third, 8 daughters—689 pounds; the fourth, 4 daughters—730 pounds; the fifth, 3 daughters—737 pounds; the sixth, 4 daughters—756 pounds; the eighth, 2 daughters—681 pounds.

These are selected advanced registry records of the cows in this cow family. What all the daughters of this succession of bulls averaged and how the daughters' average compared with that of their dams, we do not know. To make progress in breeding we need all the facts—not the few selected best ones.

The chart of this cow family also reveals that there are great differences among the different lines within the family.

Part II concludes with a discussion of the Mixter Faithful strain of Guernseys and again the lack of pedigrees makes the material hard to visualize and retain.

Part III, a short essay titled "Personal Experiences and Suggestions," is utilized by Mr. Russell to sum up Parts I and II for those who may be thinking of embarking on a cattle breeding enterprise and to philosophize on farming and breeding both as a way of life and of making a living.

In this last section, as indeed throughout the book, the author seeks to warn the unwary of the seemingly devious ways of nature in failing to live up to the old adage that "like begets like" but he does not attempt an elucidation of the genetic and environmental causes of variation.

In the writer's opinion the book should be stimulating to animal lovers of all ages. His main criticisms are (1) that the author is inclined to play a little fast and loose with the science of genetics for the sake of popularization, thereby failing to make genetic principles stand out as clearly as they might have been made to do; and (2) that, since the author knew Guernsey history and pedigrees so thoroughly himself, he did not deem it wise to use more pedigrees and family charts relying alternatively on narrative and thus making reading and retention more difficult for the average reader.

V. A. RICE

MASSACHUSETTS STATE COLLEGE

BOOKS RECEIVED

BURNET, FRANK M. *Virus as Organism.* Pp. 134. Harvard University Press. $2.00. 1945.

CARTER, T. D., J. E. HILL and G. H. H. TATE. *Mammals of the Pacific World.* Illustrated. Pp. xvi + 227. The Macmillan Company. $3.00. 1945.

DRINKER, CECIL K. *Pulmonary Edema and Inflammation.* Illustrated. Pp. 106. Harvard University Press. $2.50. 1945.

HOTCHKISS, WILLIAM O. *Minerals of Might; World Power through Natural Resources.* Illustrated. Pp. vii + 206. The Jaques Cattell Press. $2.50. 1945.

JORDAN, EDWIN O. and WILLIAM BURROWS. *Textbook of Bacteriology.* 14th edition, revised. Illustrated. Pp. xvii + 909. W. B. Saunders Company. $7.00. 1945.

MACY, ICIE G. and HAROLD H. WILLIAMS. *Hidden Hunger; Tragedy of the Unbalanced Diet.* Illustrated. Pp. vii + 286. The Jaques Cattell Press. $3.00. 1945.

PETERS, JAMES L. *Check-list of Birds of the World.* Vol. V. Pp. xi + 306. Harvard University Press. $5.00. 1945.

SMART, W. M. *Text-book on Spherical Astronomy.* 4th edition. Illustrated. Pp. xii + 430. Cambridge University Press, The Macmillan Company. $4.75. 1945.

SUMNER, FRANCIS B. *The Life History of an American Naturalist.* Pp. vii + 298. The Jaques Cattell Press. $3.00. 1945.