

# DOGS AND EUGENICS

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THE untimely death, in 1939, of Dr. Charles Stockard has cut short an undertaking seemingly too vast for a single man, and almost too ambitious for a whole department. In 1926, the Rockefeller Foundation generously provided the means for the establishment of a dog farm at Shrub Oak, near Peekskill, N.Y., to enable Dr. Stockard and his team to study the relationships between inherited constitution and endocrines in various pure breeds of dogs and their hybrids. There was scarcely any groundwork laid when this scheme was initiated, and the difficulties were enormous. Consider only the task of breeding and maintaining in good health dogs on a really large scale; of studying the gross anatomy of skeleton, dentition, skin, endocrines in numerous breeds in their relation to age and sex; of developing a set of craniometric measurements and indices appropriate to the dog skull; of studying the microscopic structure of all the endocrines from puppyhood to old age, in health and disease; and of developing and applying intricate tests for dog psychology and behaviour, to mention only a small selection of the obstacles to be overcome. The immensity of the undertaking would no doubt have deterred many a good investigator, and we have to be grateful for the vision and energy which have enabled Dr. Stockard to accumulate a great and valuable material; nor can we be surprised that a span of thirteen years has proved too short for Dr. Stockard and his team to accomplish all they set out to do. For the work has remained a torso, and the monumental memoir\* now published is largely

based on manuscripts of Dr. Stockard which, it seems probable, had not yet been cast in their final form. This unfortunate circumstance is no doubt partly responsible for some shortcomings of this publication.

It might seem ungrateful to pick holes into a work of this magnitude; for it is a work of great merits and the material accumulated is of very considerable value. But the whole investigation has an eminently eugenic background, and numerous remarks in the text show that Dr. Stockard was fully alive to these implications. It thus requires no particular prophetic gifts to foresee that the authority of this volume will often be quoted in eugenical discussions of the future. For this reason it seems important to question certain conclusions which, if unchallenged, might become harmful in the hands of uncritical or unscrupulous people.

Before proceeding to this discussion, a few words should be said about the general way of presentation of the data in Dr. Stockard's work. In the first place, high praise is due to the excellent, not to say lavish, illustration of the volume with 113 beautiful photographic plates. On the other hand the text is very verbose and contains extensive repetitions which make its study somewhat tedious. It could easily, and with great advantage, have been condensed to one-half its present length without omitting a single relevant fact. Works of this kind are often called "mines of information." This figure of speech could appropriately be applied here, not only because of the wealth of information the book contains, but also because of the amount of mining activities required to separate solid facts from redundant verbiage. Many questions are treated by verbal argument, where quantitative data would have been both shorter and more convincing. In numerous instances the author states that "about" a quarter of a

\* Stockard, Charles R., collaborators, and Anderson, O. D., and James, W. T.: *The genetic and endocrinic basis for differences in form and behavior, as elucidated by studies of contrasted pure-line dog breeds and their hybrids*. The American Anatomical Memoirs, No. 19. Philadelphia, 1941. Wistar Press. Pp. xx+775; 128 text-figures and 113 plates. Price \$7.50.

generation showed a given character, and the remainder its contrasted counterpart. It is a pity that we are not given the original data, which would have enabled us to judge critically how well the observations fit the theory. Perhaps the author had intended to fill in the precise figures from his records at a later date ; as published, we often have to be content with *demonstrations* of a principle from selected litters, where numerical *proof* from the whole experiment would have been necessary or at least desirable.

The breeds of dogs studied included the following :

1. St. Bernard.
2. German shepherd (Alsatian).
3. Saluki (a large North African greyhound-like animal).
4. Great Dane.
5. Basset-hound.
6. Foxhound.
7. Dachshund.
8. English bulldog.
9. French bulldog.
10. Boston terrier.
11. Brussels griffon.
12. Pekinese.

Of these widely differing breeds the Alsatian is rightly regarded as the most normal type, lacking obviously pathological stigmata and being closest to the wolf-like ancestors of our dog breeds. Comparatively harmonic in general shape are also the Great Dane, the Saluki, and the foxhound. The giant St. Bernards have signs of acromegaly ; Basset-hound and dachshund show marked achondroplasia of the legs, but not of skull or tail ; the two bulldogs, the Boston terrier and the Brussels griffon have extremely shortened muzzles, but normally shaped legs, while the Pekinese is highly achondroplastic both as regards skull and appendicular skeleton.

We cannot describe in detail the numerous crosses carried out between these various breeds ; they led to the discovery of many interesting genetic facts. For instance, the achondroplastic leg skeleton of dachshund and Basset-hound is conditioned by a single gene. On the other hand, the wide difference in skull shape which differentiates the short-

muzzled breeds (8-12) from those normally muzzled is complexly conditioned ; there are a few single gene differences which can be isolated ; for instance, the concave surface of the condylar process of the mandible peculiar to the dachshund differs by a single gene substitution from the convex surface as found in most other dog breeds. But the bulk of the differences is conditioned by numerous genes not analyzable in detail, which segregate independently of each other. As a consequence many exceedingly in-harmonic types are produced in  $F_2$  and backcross generations. Some of these are simply grotesque and mirth-provoking, like an Alsatian on dachshund legs ; others are more seriously pathological ; jaws may be so much undershot or overshot as to prevent the animal from feeding ; other orthodontic anomalies, from the slightest to the severest grades, are found in abundance (the work should be of great interest for dental surgeons and orthodontists), and other dysharmonic and often semi-lethal types occur commonly ; indeed some of the plates depicting  $F_2$  animals look like a bad nightmare following a visit to a dog show. If the body has regulative powers, which tend to harmonize its various organs, such powers have certainly sadly failed to correct the pandemonium let loose by the reshuffling of dog genes.

Is it surprising that the startled author of this nightmare dog show should utter warning after warning against " mongrelization " of human races ? And yet, most of these monstrosities would have been predictable from the ingredients contributed by the parent breeds. These divergences are vastly greater than anything that could possibly occur in human race crosses. And if you cross breeds of dogs which are not predictably incompatible, like a bulldog and a dachshund, or a Saluki and a Pekinese, quite alluring animals may be produced. For instance, the hybrid between Great Dane and Alsatian is a strong and distinctly handsome dog, and a similar type could no doubt be made homozygous in a later generation.

But a good deal of the highly pathological, and unpredictable, monstrosities probably owe their origin not to the race cross *per se*.

Dr. Stockard naturally started his experiments with good specimens of pedigreed dogs of his various breeds. Now, in many domesticated animals, the standard set up by the breeders does not represent a homozygous type; the "ideal" type for a given character is often a heterozygote. As a consequence, breeds of domesticated animals are usually very heterogeneous genetically. This is very much the case in dogs, and the designation "pure-line" dogs used by Dr. Stockard is grossly misleading. Indeed, close inbreeding is anathema to the dog breeder, because he knows by experience that numerous "undesirables" segregate out even in the "pure" breeds. I have studied (jointly with A. J. Lea\*) a jaw anomaly in a "pure" breed (long-haired dachshunds), which was due to a single recessive gene and in its effects comparable to certain types recovered in  $F_2$  by Dr. Stockard; heterozygotes for this gene were common in the breed, but owing to an avoidance of close inbreeding it segregated out fairly rarely; the undesirables are usually destroyed as puppies, and the breeders certainly do not advertise their occurrence in their kennels; this is by no means an exceptional case, and there is every reason to believe that all breeds of dogs are soaked with harmful recessives; in an outbred population these remain largely under the surface, but inbreeding makes them homozygous. Now Dr. Stockard's experiments involved not only race crosses, but also much closer inbreeding than is customary within breeds; for technical reasons most experiments started with a few specimens of the "pure" breed, and the production of an  $F_2$  or backcross generation involved close inbreeding. Hence the patho-

logical types recovered owe their appearance to a double reason; one is the reshuffling of genes, the other is the segregation of pathological recessives which were hidden in heterozygous form in the "pure" breeds. The latter source of monstrosities has not been recognized by Dr. Stockard, and for this reason his argument about the undesirability of human race crosses is considerably weakened. Critical evidence on the question would require experiments in which these two sources of pathological types can be separated; experiments satisfying this requirement can easily be designed.

Just to show that the argument advanced above is not a purely theoretical consideration, one example from a different field may be given. If you study the large monographs on the genetics of *Drosophila* published by the Carnegie Institution in 1923 and 1929, you will see that the majority of autosomal recessives were discovered in the course of linkage experiments. Of course nobody ever suggested that linkage experiments *per se* are dysgenic; but linkage experiments, as usually carried out, involve close inbreeding and hence tend to make hidden recessives homozygous.

We have dealt critically with the eugenical aspect of Dr. Stockard's dog breeding programme; this seems justifiable in a journal devoted primarily to the study of eugenics. But it would be entirely misleading to generalize this critical attitude. The book is of high importance and full of interesting information. Just for this reason, and because we are convinced that it should, and will, be studied widely throughout the world of eugenics has it seemed necessary to point out where the author's inferences should be treated with caution.

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