74 (1449)

## The relation between the number of chromosomes of a species and the rate of elimination of mongrel blood by the pure-sire method.

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[*From the Eugenics Record Office, Cold Spring Harbor, N. Y.*]

When to the neglect of individual Mendelian characters, the whole organism is taken into consideration, the common method of indicating the degree of parental qualities is to refer to the proportion of "blood" of one type or other which the particular offspring possesses. Thus the $F_1$ hybrid is called a "half-breed" or a "half-blood." Such an hybrid, bred back to the pure ancestor, gives a 3/4 blood pure, or a 1/4 blood mongrel, offspring, and so on according to the following schedule:

| | | | |
|---|---|---|---|
| $F_1$ | 1/2 blood. | $F_5$ | 1/32 blood. |
| $F_2$ | 1/4 " | $F_6$ | 1/64 " |
| $F_3$ | 1/8 " | $F_7$ | 1/128 " |
| $F_4$ | 1/16 " | | |

This nomenclature is used for all bisexual organisms. It is interesting to note that according to this scheme, theoretically there would always be a fraction of mongrel blood in each individual of a herd or group produced by the pure-sire method, regardless of the number of generations to which the process might have been carried. As a matter of practice, however, it is known that after a few generations the progeny of the pure-sire method are admitted on equal terms into the variety or species of the pure sire, and with no apparent injury to the purity of the paternal race. Thus Shorthorn breeders formerly permitted the registration of animals 31/32 pure.

According to Deniker, the male progeny of the $F_3$ generation of the mating of Spaniards of pure descent with Indians and part-bloods resulted in an individual who for all racial considerations was called a Spaniard and was taken into the social life of the Spanish people. In mating with the negro races the same consummation is achieved in the $F_4$ generation.[1]

[1] J. Deniker, "Races of Man," p. 542.

May mongrel blood be absolutely eliminated? If so, what are the chances that an $F_3$ offspring by the pure-sire method in man will carry absolutely no mongrel blood? The calculations are based upon the following assumptions: (1) that the haploid number of chromosomes in man is 12; (2) that all of the hereditary traits in the human species are carried by these 12 chromosomes, which, barring crossing over, non-disjunction and other special phenomena, segregate and recombine intact according to Mendelian expectation; (3) that the breeding between the pure sire and the mixed dams of a given chromosome-number in a given filial generation continues in proportion to the probable frequency of the latter's occurrence in each particular generation; (4) that all types of dams possess the same average fecundity.

*The chance that in man a given individual offspring produced by the continuation of the pure-sire method will carry absolutely no mongrel blood, i. e., will possess absolutely no chromosomes descended from the mongrel dam is measured by the following series:*

| | | | |
|---|---|---|---|
| $F_1$ | 0 to infinity | $F_6$ | 1 : 0.463 |
| $F_2$ | 1 : 4095.000 | $F_7$ | 1 : 0.208 |
| $F_3$ | 1 : 30.568 | $F_8$ | 1 : 0.100 |
| $F_4$ | 1 : 3.964 | $F_9$ | 1 : 0.049 |
| $F_5$ | 1 : 1.169 | $F_{10}$ | 1 : 0.025 |

*The chance that in man a given individual offspring produced by the continuation of the pure-sire method will carry not more than one (i. e., none or one out of a possible twelve) mongrel chromosome is measured by the following series:*

| | | | |
|---|---|---|---|
| $F_1$ | 1 to infinity | $F_6$ | 1 : 0.055 |
| $F_2$ | 1 : 314.077 | $F_7$ | 1 : 0.014 |
| $F_3$ | 1 : 5.313 | $F_8$ | 1 : 0.005 |
| $F_4$ | 1 : 0.829 | $F_9$ | 1 : 0.002 |
| $F_5$ | 1 : 0.205 | $F_{10}$ | 1 : 0.001 |

## SUMMARY.

1. Mongrel "blood" is eliminated by the pure-sire method not by "quartering out," but in segments, in degree governed by the relative ontogenetic potency of the particular chromosomes eliminated.

2. The degree of elimination of mongrel "blood" by the pure-sire method depends upon two factors, (*a*) the number of chromo-

somes characteristic of the species, (*b*) the proportion of mixed dams of each possible pure chromosome-number used in each generation, (*c*) the relative fecundity of dams of different pure chromosome-number, and (*d*) the number of generations through which the system is carried.

3. By the pure-sire method, without selection in the $F_5$ generation in a twelve-chromosome (haploid) species (including man), the probability that a given offspring carries absolutely no mongrel blood, i. e., mongrel-descended chromosomes is 1 : 0.205.

4. For mass improvement without selection the pure-sire method in a twelve-chromosome (haploid) species, ceases to be practically effective after the $F_5$ generation.

## 75 (1450)

## The transformation of the plant ovule into an ovary.

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In plants there is a rather wide capacity for the development of organs of various kinds from primordia normally destined to produce quite different structures. For example, leaves may replace petals, stamens or carpels; petals may occur in the place of stamens or carpels. The transformation of stamens into carpels is a well-known phenomenon.

Furthermore, the continued development of a growing point the activity of which is usually terminated by the formation of some highly specialized organ, such as the flower or fruit, is quite familiar to those concerned with problems of variation.

Among these morphological abnormalities the continued meristematic activity of the axis which is normally terminated by the formation of the ovary is of very rare occurrence. It is, however, regularly found, although in a small and variable percentage of the cases, in one of the passion flowers, *Passiflora gracilis*. Here prolification of the fruit consists in the formation of series of carpels, which may or may not be ovuliferous, within the