

Indeed, it would not be difficult to make a strong case for the assertion that evolution doctrine as a whole would be sounder today if all speculation concerning it had been banned between the publication of "The Origin of Species" and the second or third decade of the present century. The chief possible error in such a statement is that evolution speculation might have helped stimulate the discovery of mutations and Mendel's laws, but it is not at all cleared [sic] that it exercised any such stimulus.

p. 240 Chance

The accidents involved in the production of useless traits are simply those that operate in any evolution through the Mendelian mechanism. It is to some degree a random matter what genes mutate, though not altogether so. There is chance in the collection of genes in the germ cells, chance in the union of germ cells of different content in fertilization, chance in the survival of individuals of different sorts, chance in the pairing of different kinds of individuals in reproduction, and chance in the alteration of the population by migration. As a result of all these accidents, useless mutations may arise, or useless characters spring out of certain gene combinations; individuals possessing useless qualities may increase in relative numbers even to complete ascendancy; and populations in different areas may come to be different with respect to useless characters.

p 136 Statistical Gene Concept of Species.

Visible traits are not basis of true definition of species: but the species is such a proportion among individuals of gene AA Aa aa, BB Bb bb, etc.; changes in such proportions even if invisible are evolution (shifting gene ratio), for per se, given indefinitely large population, free interbreeding equal rates of reproduction and survival, no linkage or overlapping of generations, then genes A a remain in ratio p/q; however fact does not conform absolutely to laws of probability, and each shift away from predicted proportion is permanent (without expectation of reversal)

Thus "A species is a statistical entity whose nature depends on the relative numbers of genes of those pairs which are not fixed and common to all individuals. Recombination and shifting of the gene ratios are capable of effecting an enormous amount of evolution even without further mutation (mutation effective in prop to frequency; single mut small chance of survival). Gene ratios tend to remain stable and [2] various types of individuals to reach an equilibrium, unless they are disturbed. Disturbance of the equilibrium may come about by purely accidental survival or elimination of individuals by mutation to new genes and back to the original, by migration to and from the population, and by the selective action of the favourable or unfavourable qualities of the genes themselves. These influences may be formulated if assumptions be made regarding their absolute or relative values. Both small size and large size of the population tend to restrict the opportunities for evolution, while intermediate populations are more favourable. The most favourable condition for evolution is that of a large species divided into many

local races or varieties. These shifts of gene ratios lie at the foundation of all guidance of the population.

Stability of Gene Ratio under pure probability.

Let A and a be in ratio  $p/q$ .

Then next generation AA will be  $p^2$ , Aa be  $2pq$ , and aa be  $q^2$ .

That is A occurs  $2p^2$  plus  $2pq$ , and a occurs  $2pq$  plus  $2q^2$ .

So the ratio remains  $p/q$ .

Iterum (BL) A species is the law of pure probability that any proportion of genes (at any given locus) remains the same under random conditions of mating, fertility and survival, in an indefinitely large population. The definition envisages the cause materialis dispositiva; to the biologist the gene is a curious type of chemical compound (protein prob)

[3] Shull, Evolution p 45a, McGraw-Hill 1936  
Geological time.