Breve histórico do estudo de variação

‘Modularidade: Conectando padrões e processos em evolução multivariada’

Monique N. Simon
IB – USP
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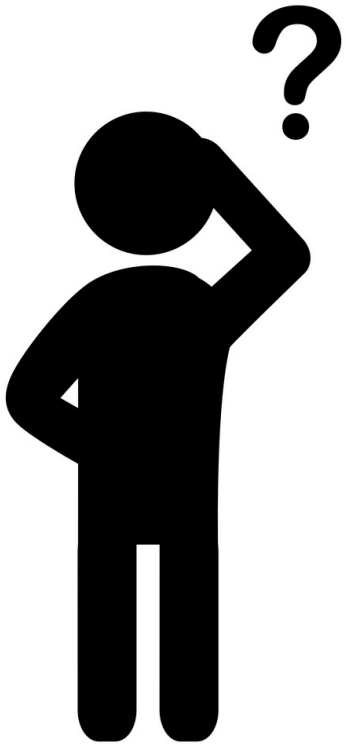
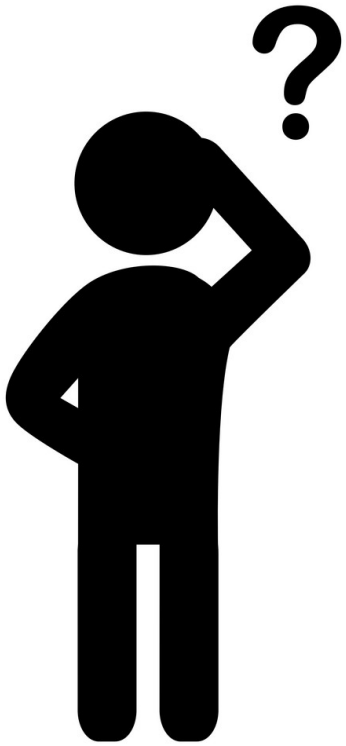
Why study variation in biology?



Why study variation in biology?

Where does variation comes from?



How is variation organized in populations?

What are the evolutionary consequences of a particular organization of variation?

VARIATION

A CENTRAL CONCEPT IN BIOLOGY

ON

THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE

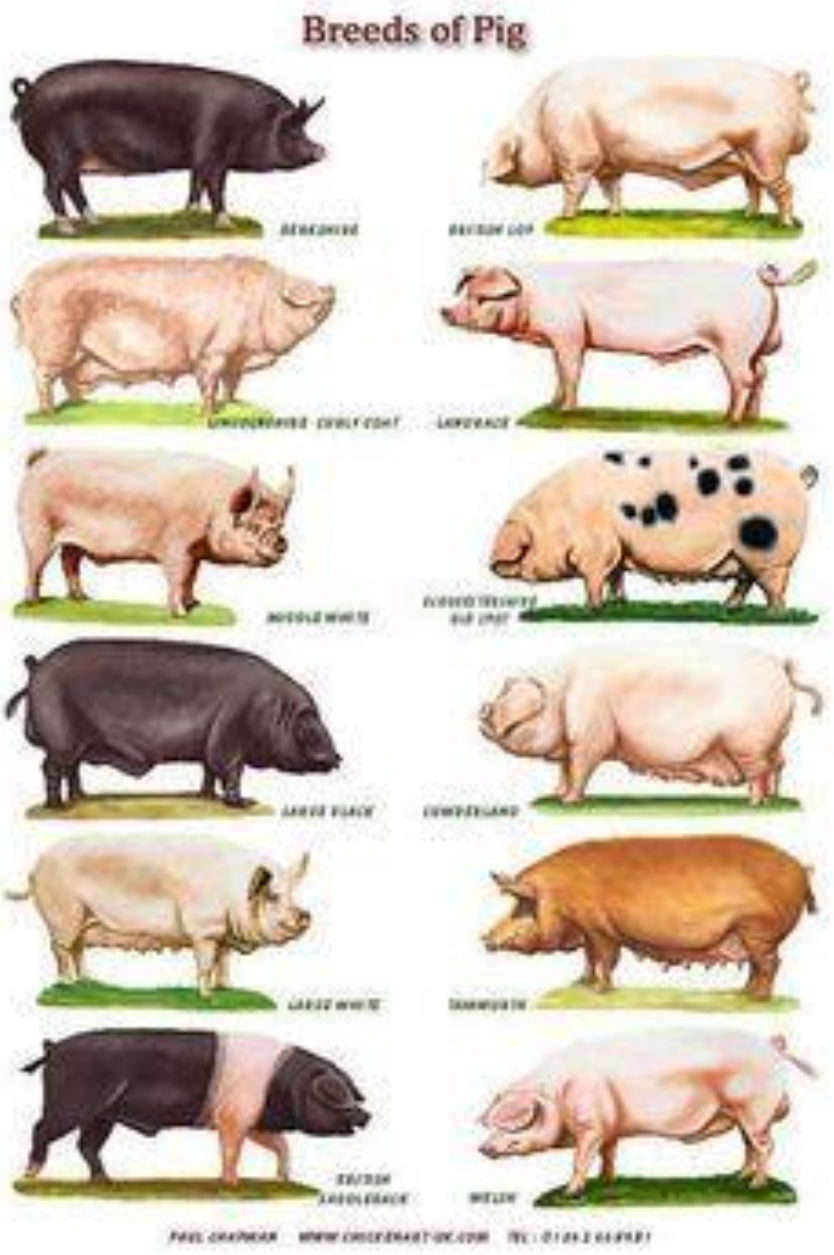
PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE.

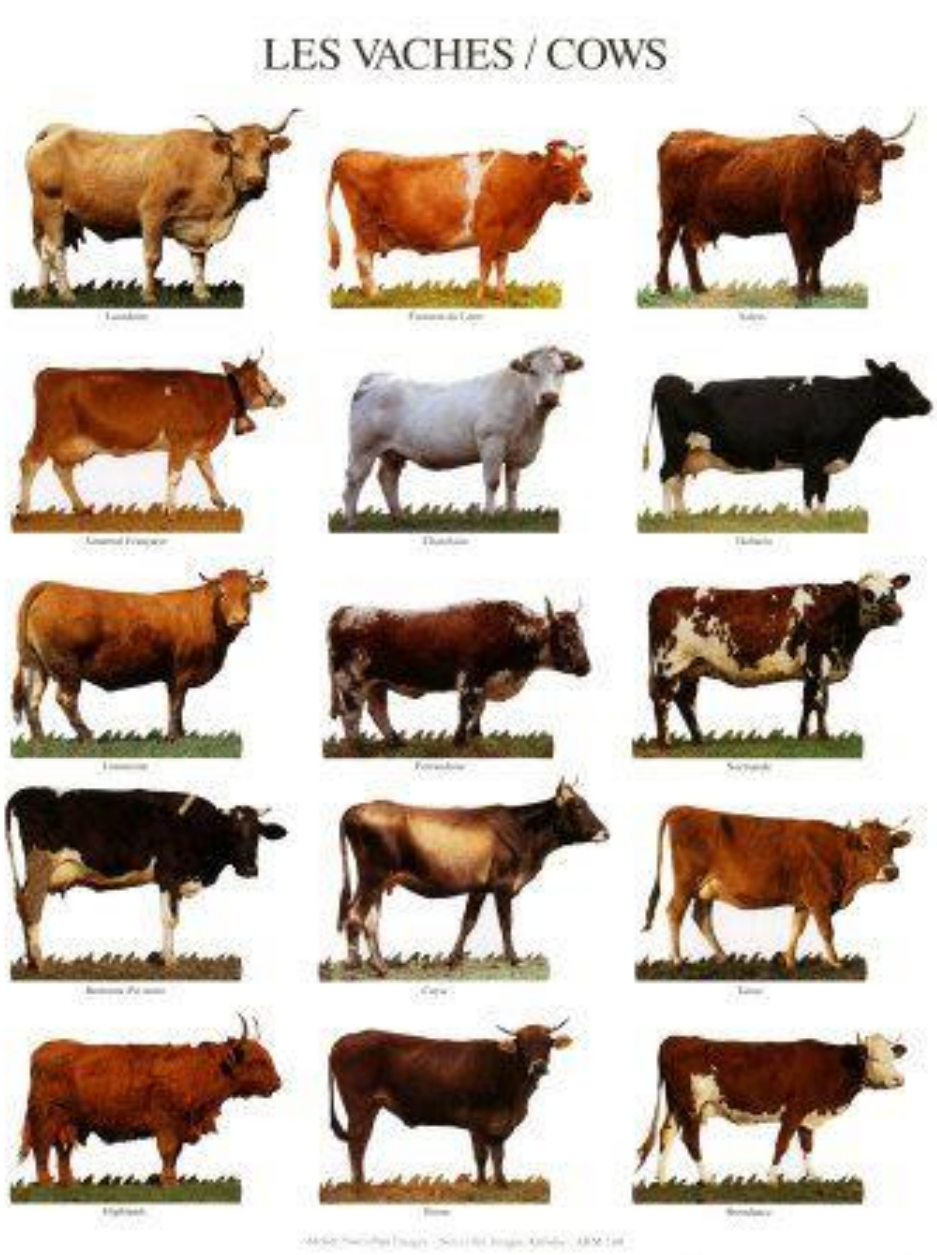
By CHARLES DARWIN, M.A.,

FELLOW OF THE ROYAL, GEOLOGICAL, LINNÆAN, ETC., SOCIETIES;
AUTHOR OF 'JOURNAL OF RESEARCHES DURING H. M. S. BEAGLE'S VOYAGE ROUND THE WORLD.'

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1859.

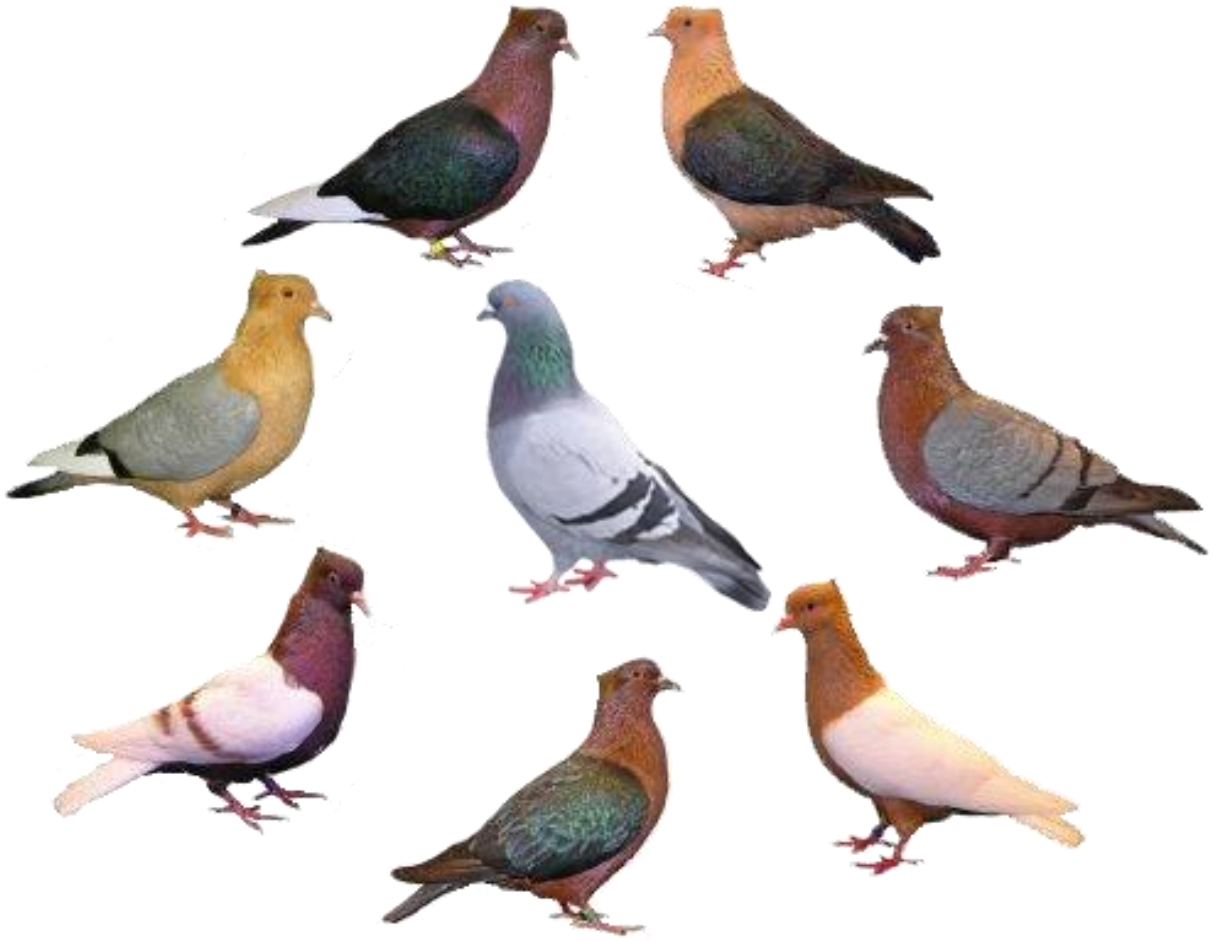
CONTENTS.


Breeds of Pig


LES VACHES / COWS

Darwin and Variation

"Great as are the differences between the breeds of pigeons, I am fully convinced that all are descended from the rock pigeon, *Columbia livia*."



THE VARIATION

OF

ANIMALS AND PLANTS

UNDER DOMESTICATION.

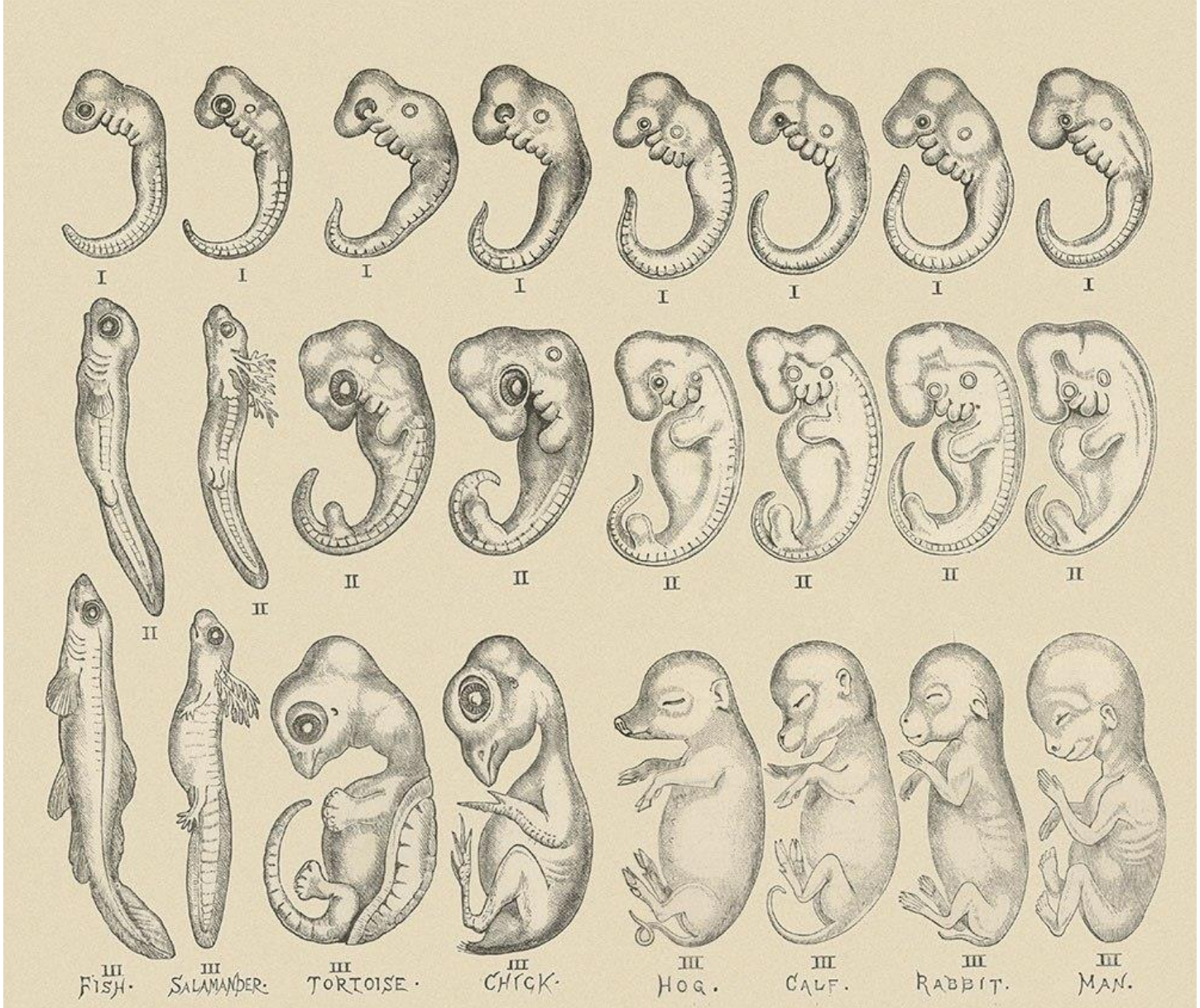
By CHARLES DARWIN, M.A., F.R.S., &c.

IN TWO VOLUMES.—Vol. I.

WITH ILLUSTRATIONS.

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1868.

Fig. 24.—Skulls of Pigeons viewed laterally, of natural size. A. Wild Rock-pigeon, *Columba livia*. B. Short-faced Tumbler. C. English Carrier. D. Bagadotten Carrier.

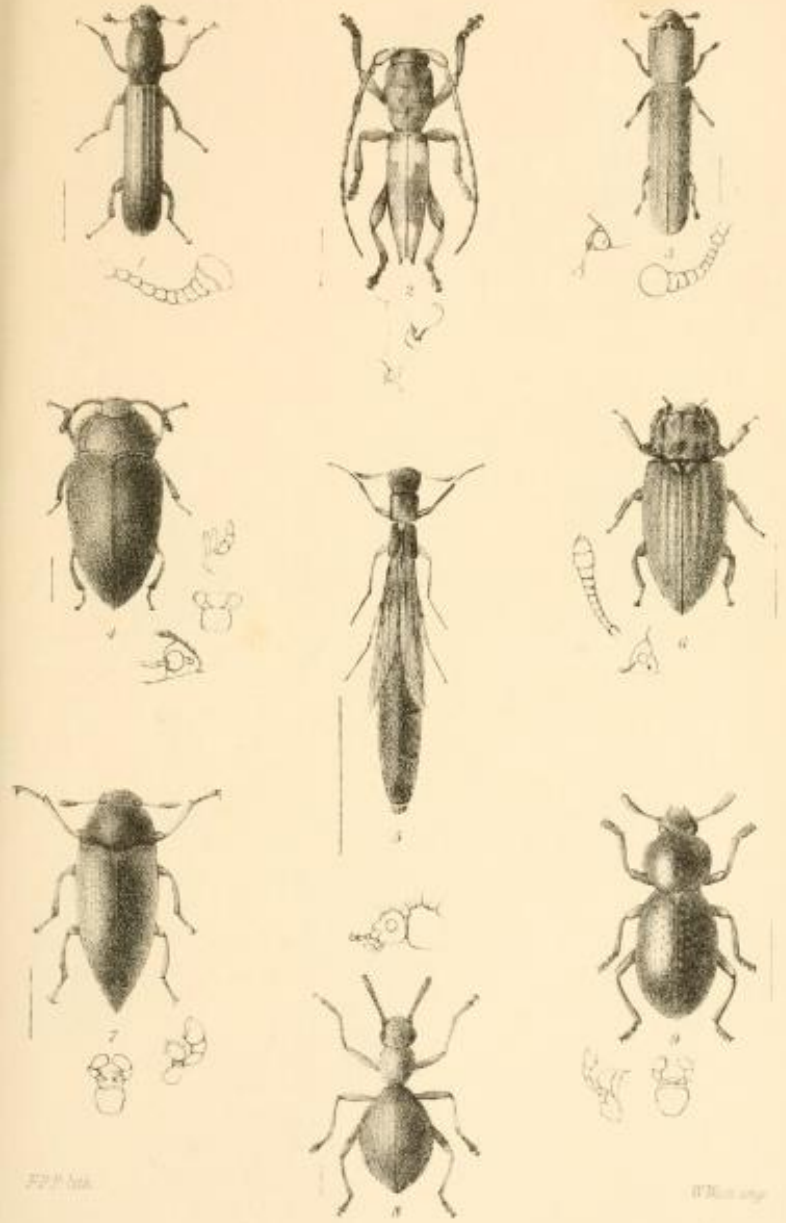


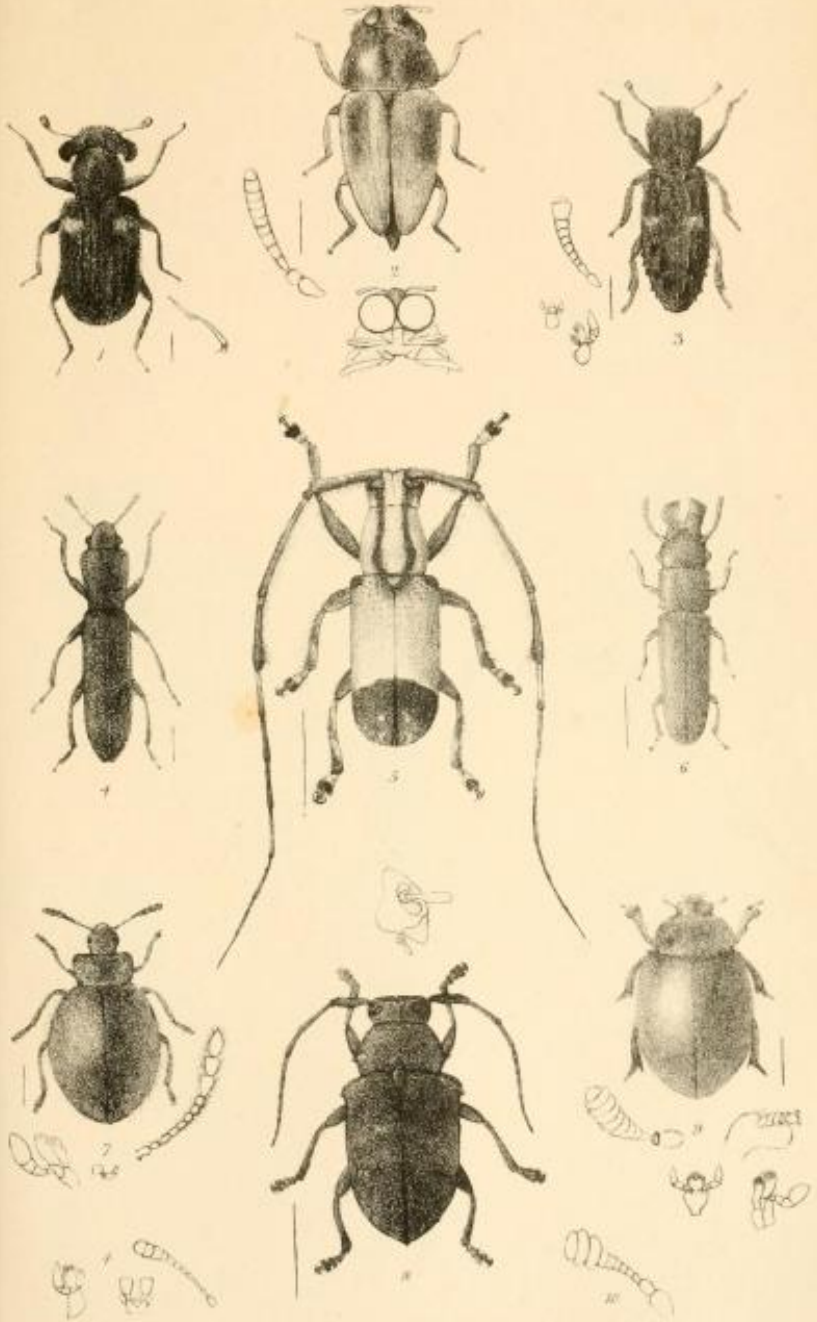
HAECKEL'S EMBRYOS

Wallace and Variation

On the Phenomena of Variation and Geographical Distribution as illustrated by the Papilionidæ *of the Malayan Region*. 1864

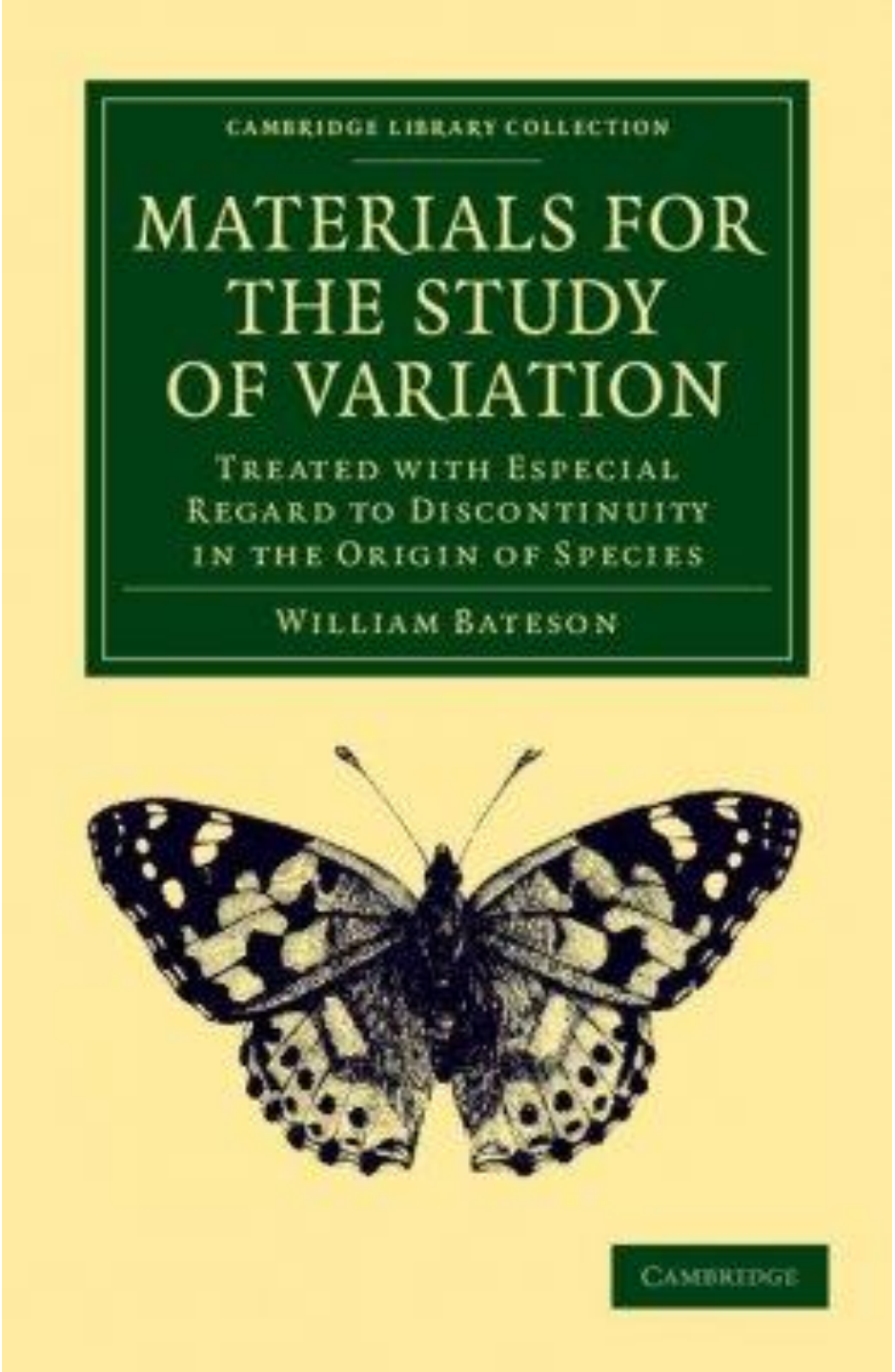
"I find as a general rule that the constancy of species is in an inverse ratio to their range. (…) When they extend to many islands, considerable variability appears; and when they have an extensive range over a large part of the Archipelago, the amount of unstable variation is very large".





Bateson and Origin of Variation (1890)

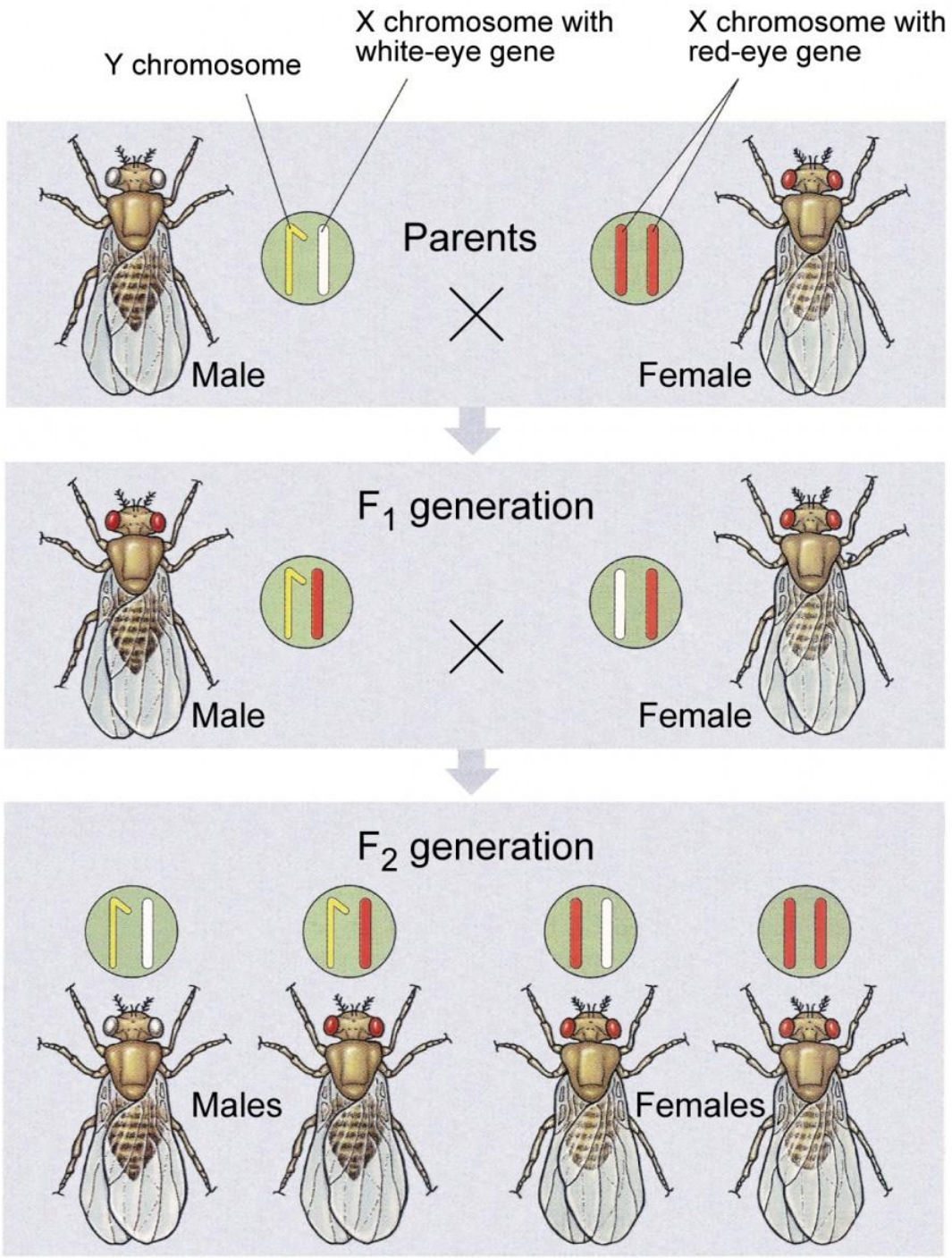
Developmental rearrangements



De Vries and Origin of Variation (1894)

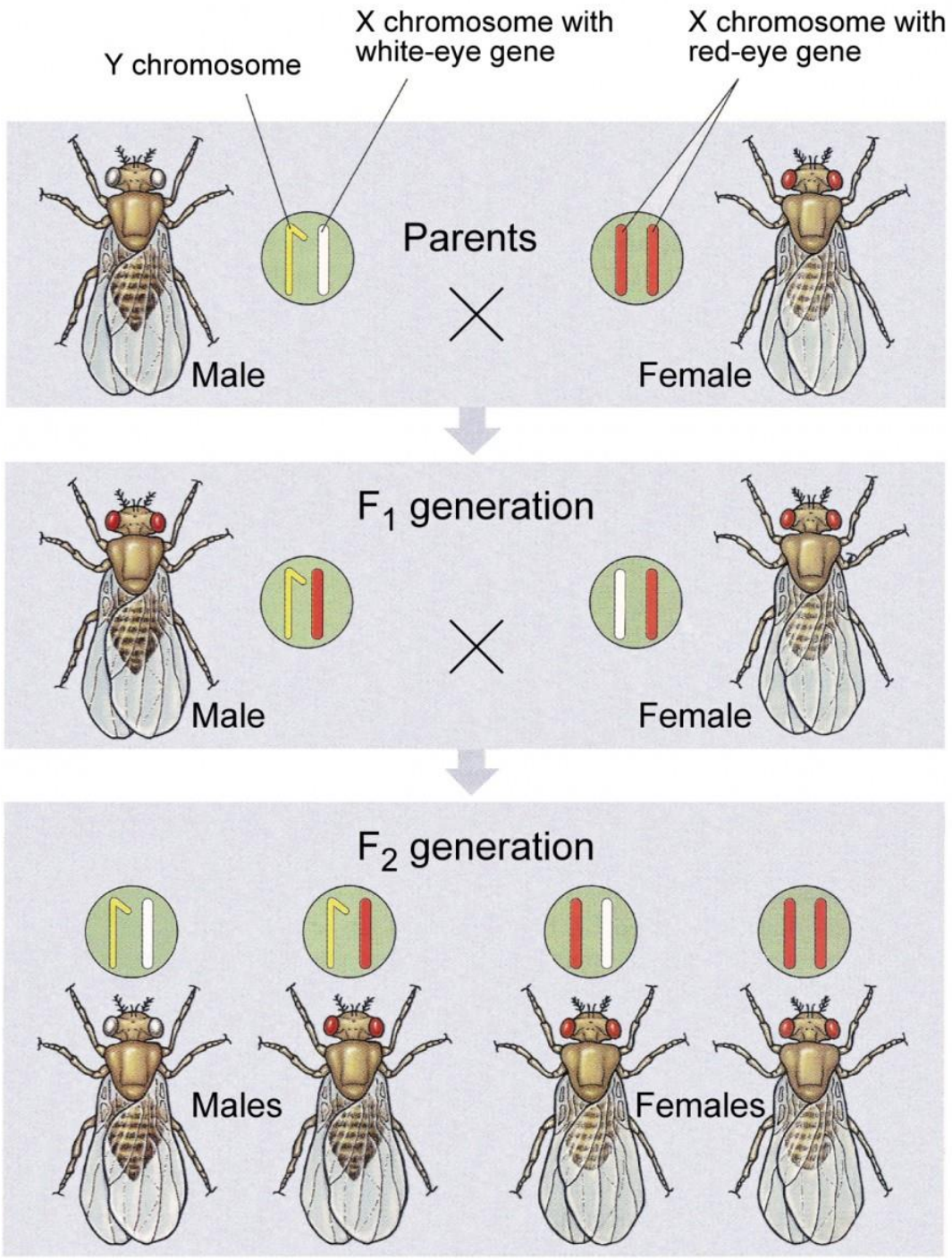
Coined the term ‘mutation’ and thought that drastic mutations could lead to new species in a single generation.

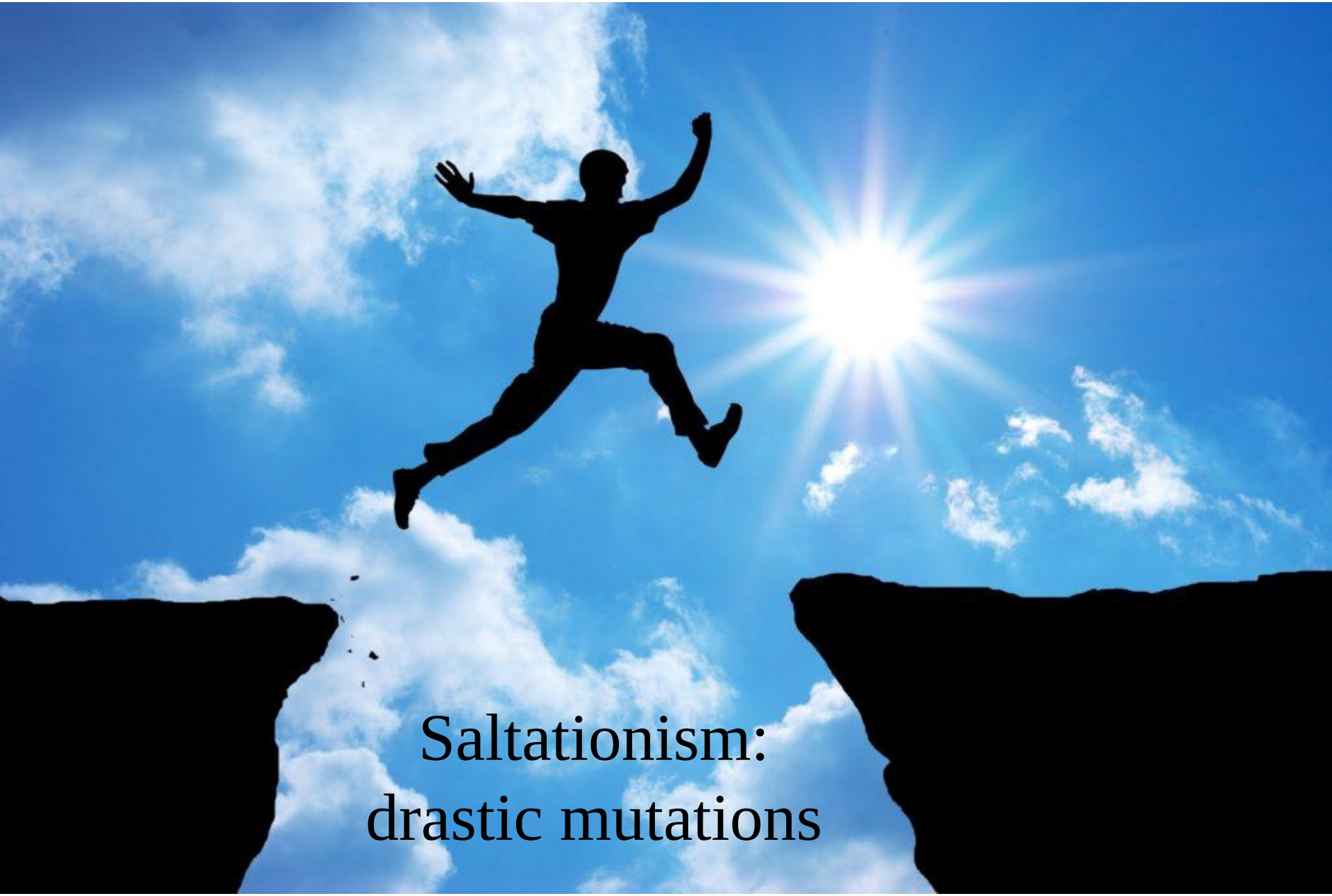
T.H. Morgan and Origin of Variation



T.H. Morgan and Origin of Variation

X-linked inheritance of eye color in Drosophila: mutation and genes are in chromosomes.




Saltationism:
drastic mutations

Origin of Variation: use and disuse

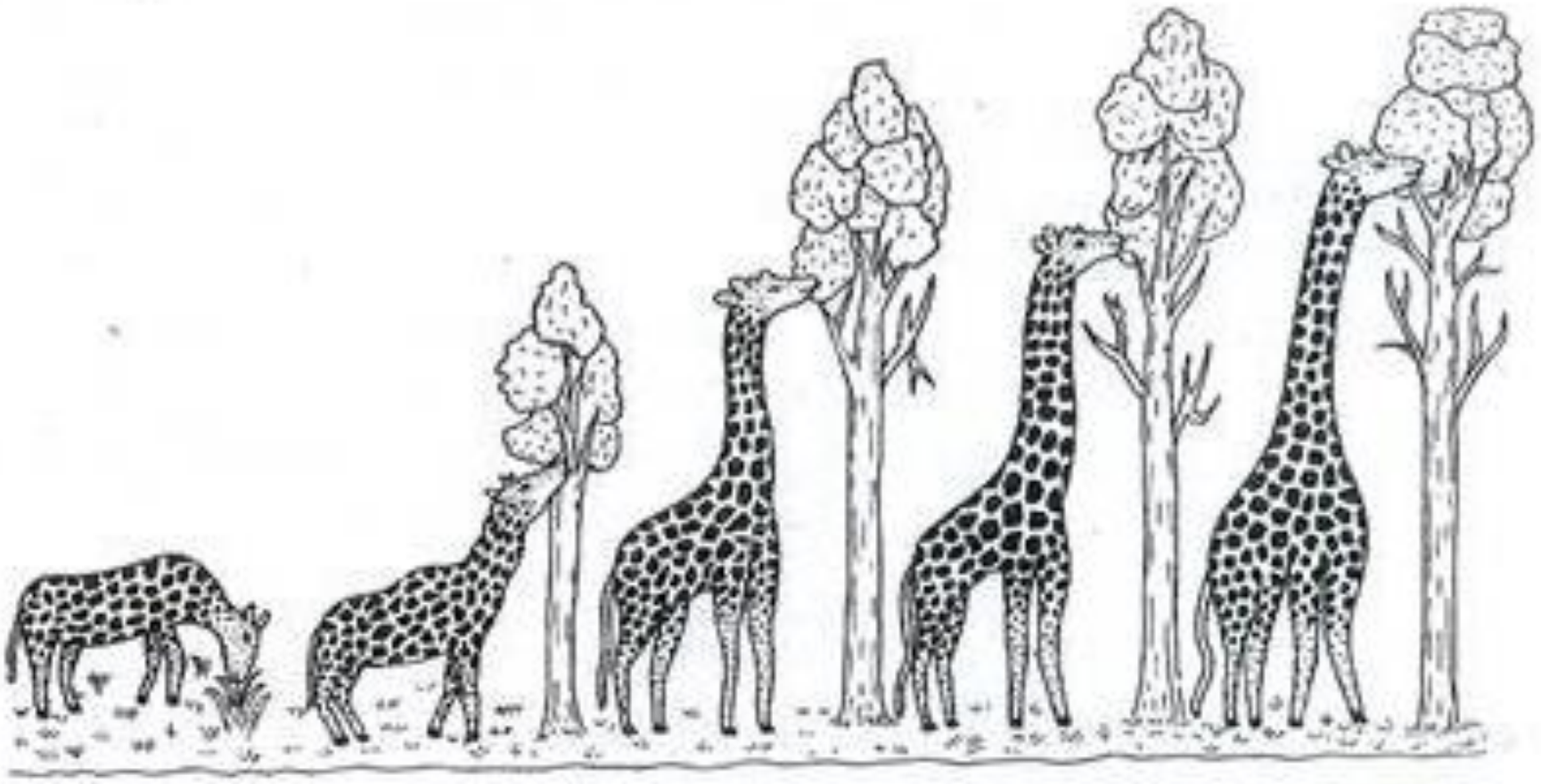
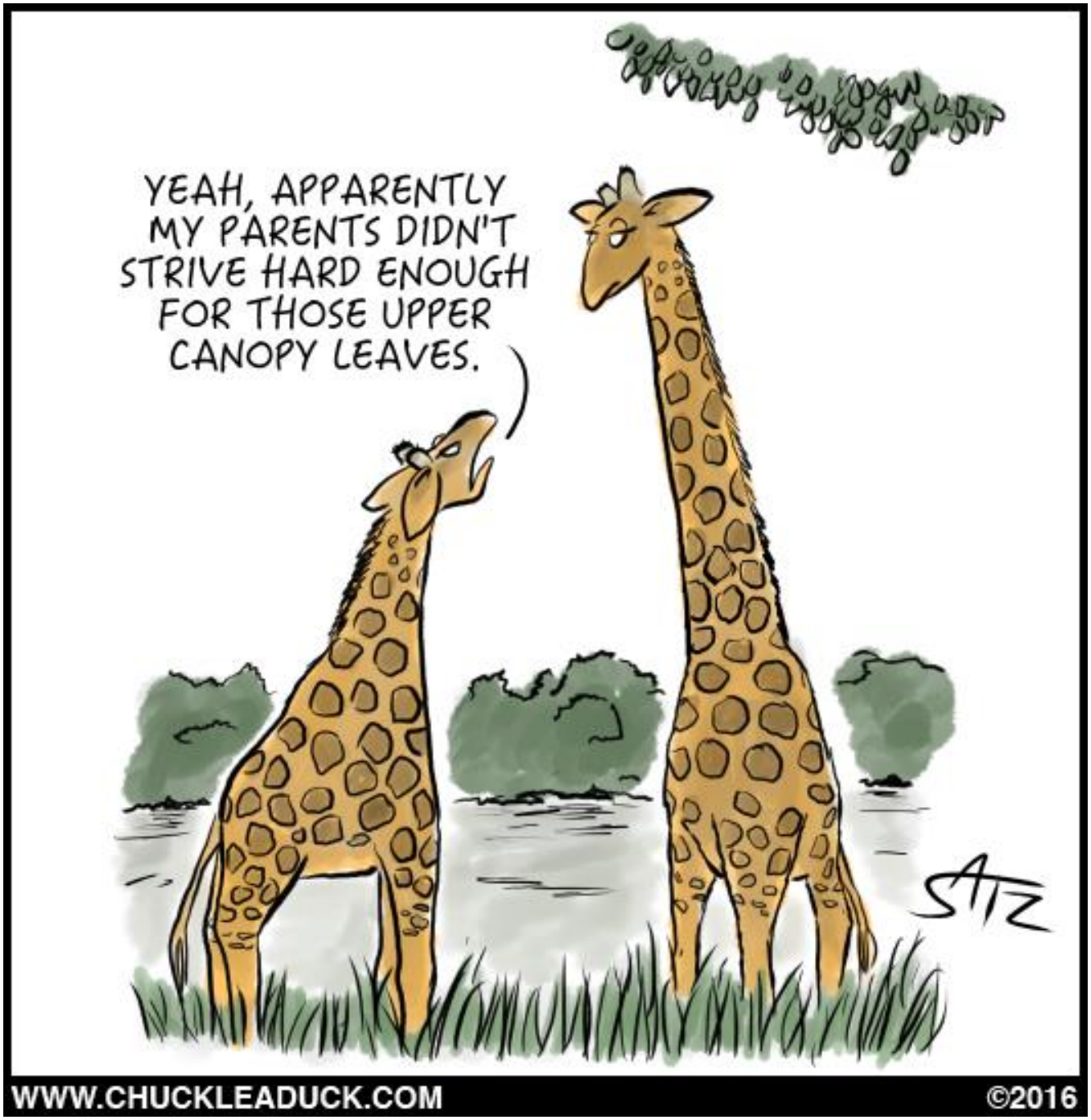
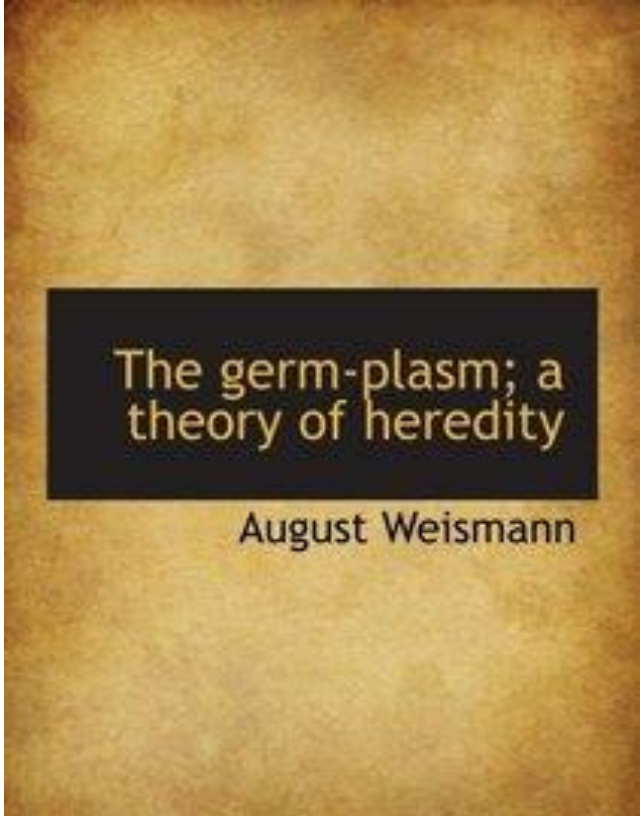


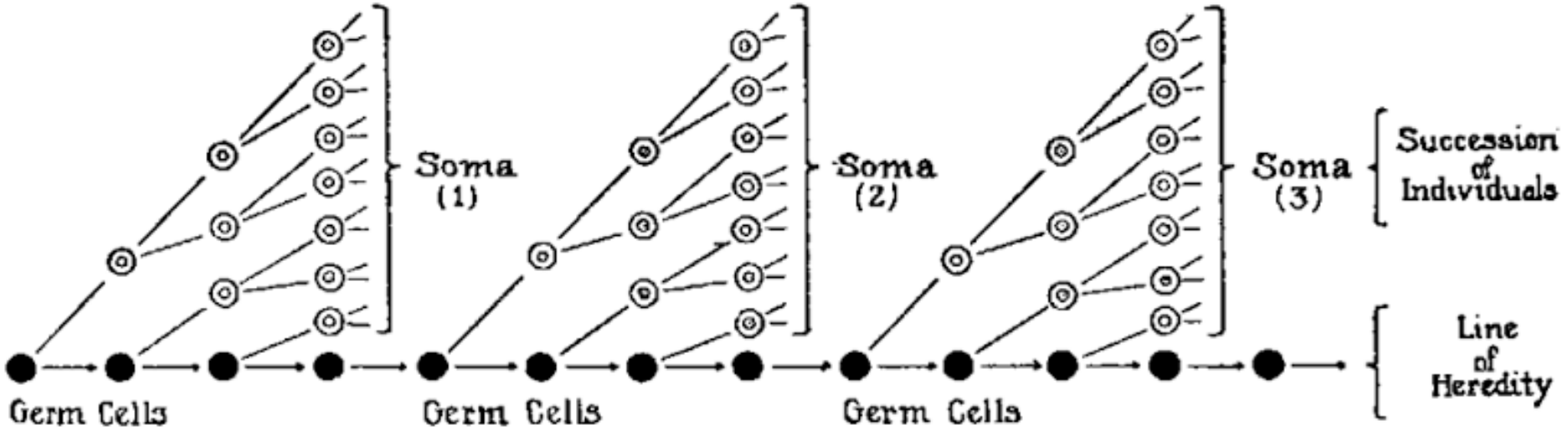
Diagram showing elongation of neck in giraffe according to Lamarck.


YEAH, APPARENTLY MY PARENTS DIDN'T STRIVE HARD ENOUGH FOR THOSE UPPER CANOPY LEAVES.
SATZ
WWW.CHUCKLEADUCK.COM
©2016

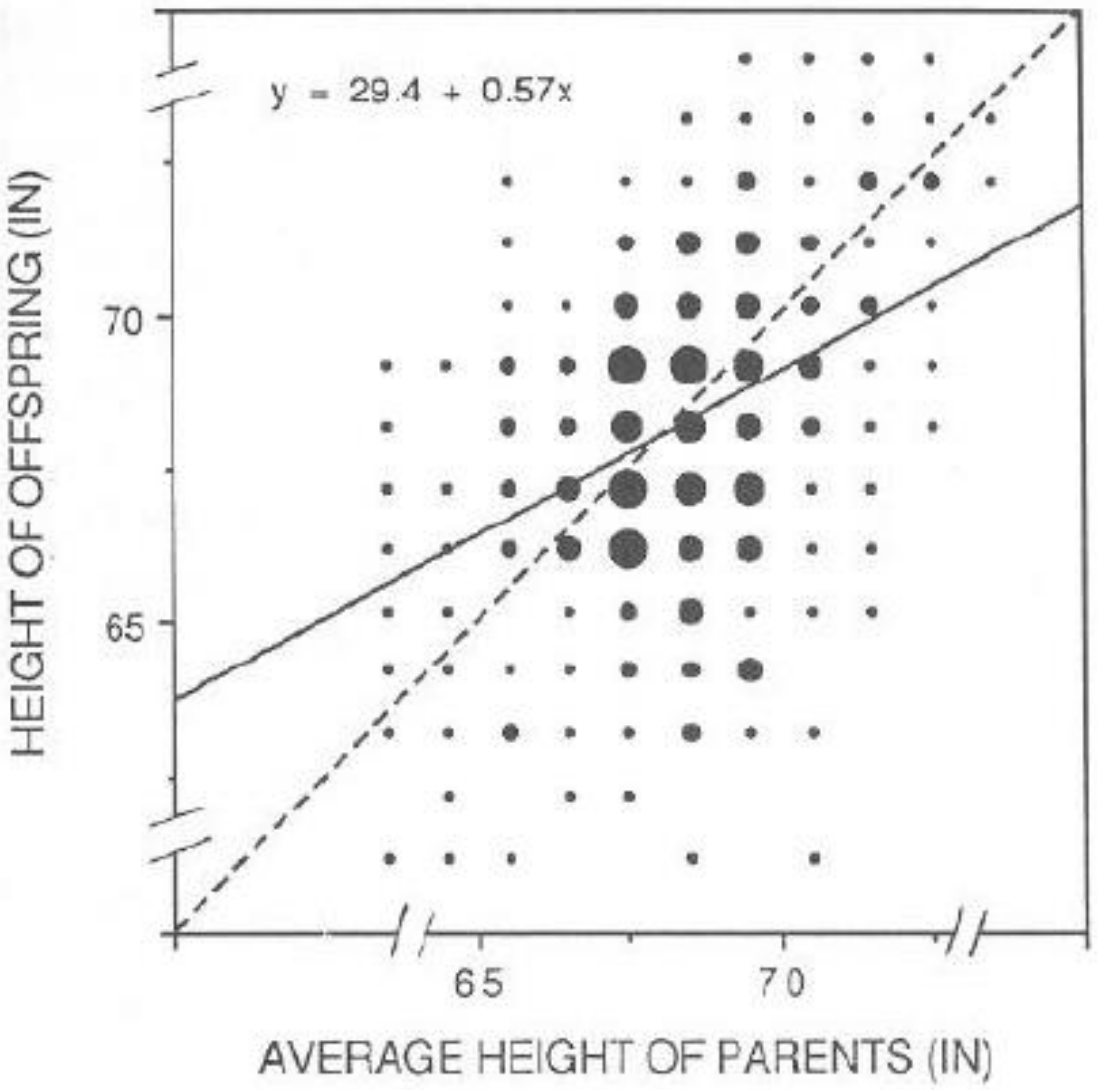
Weisman and Origin of Variation (1893)



No feedback from development to the germ-plasm.



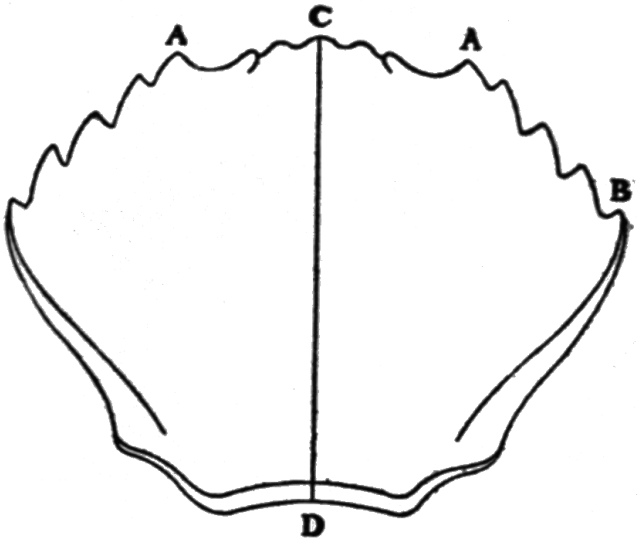
Galton and the Biometricians



Quantitative Genetics

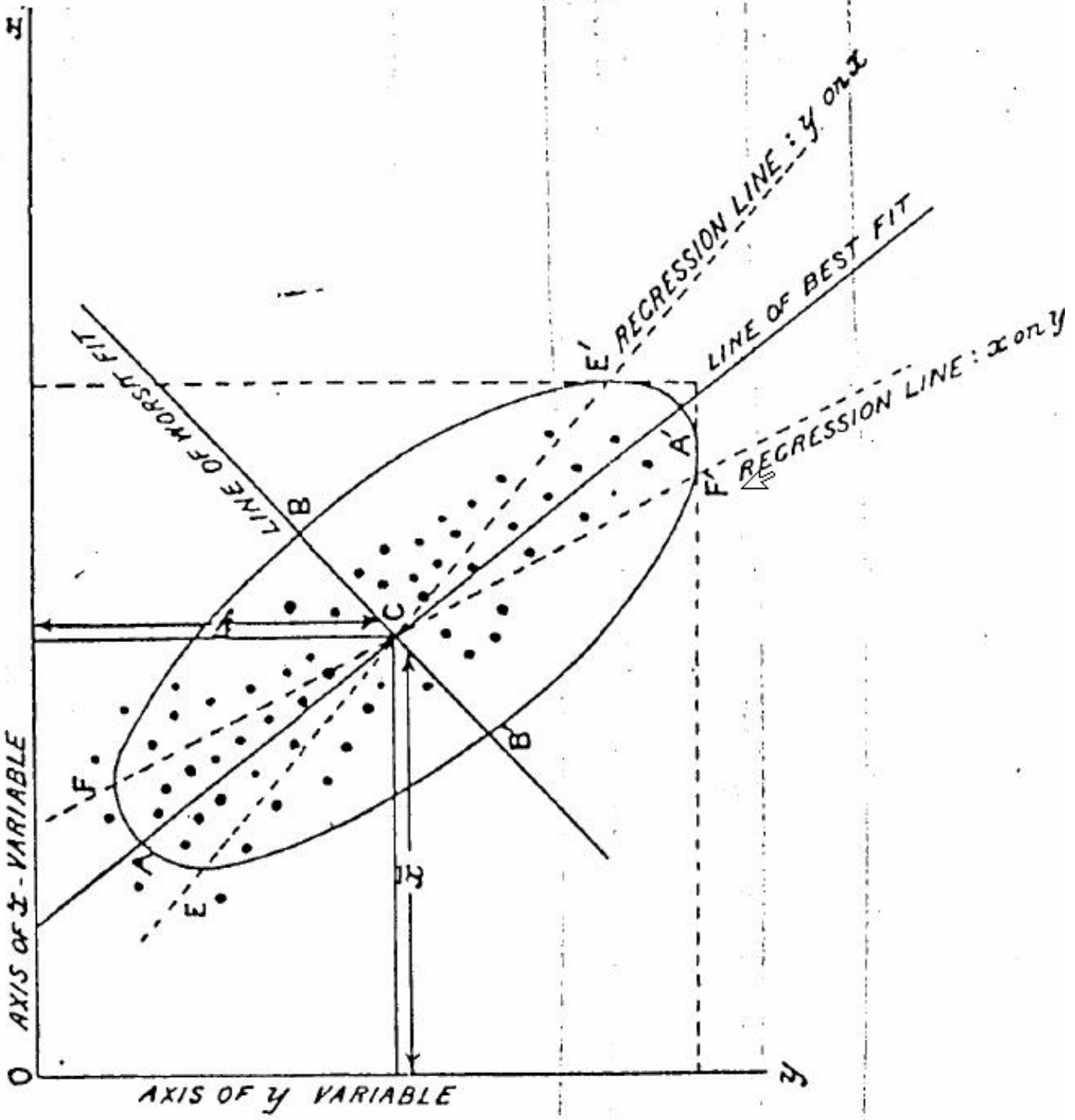
Phenotypic resemblance between parents and offspring reveals heritable variation

Weldon and Variation in Natural Populations subjected to Selection

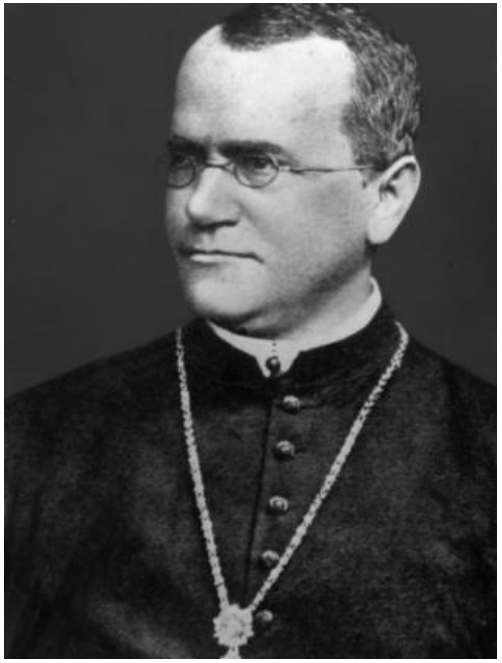


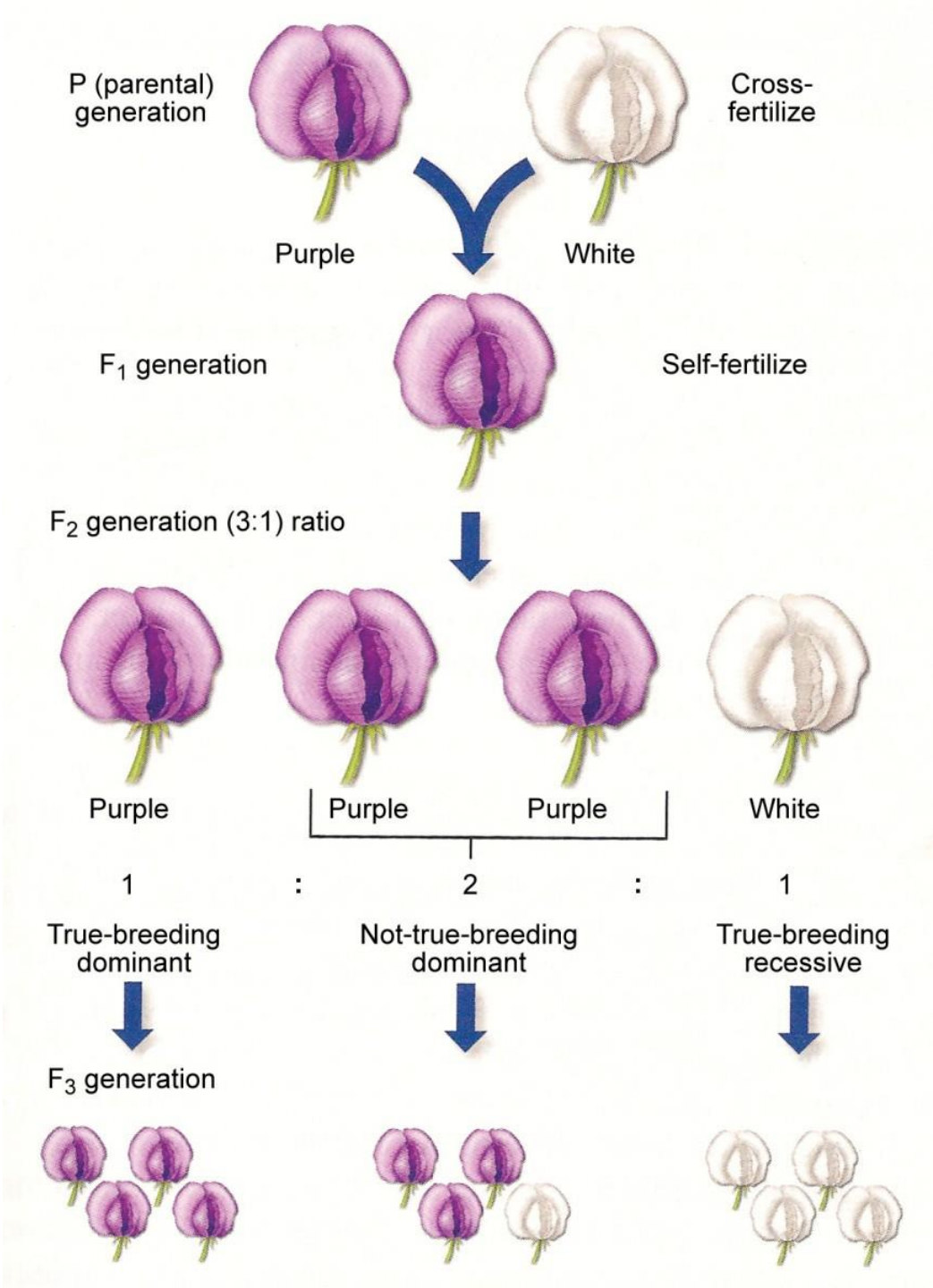
" Such selection is, of course, indirect,' that is to say, the life or death of the individual is determined in each case by the value of a (probably large) number of correlated characters, of which the length of the peripheral radius is only one."

Pearson and statistical thinking in evolution

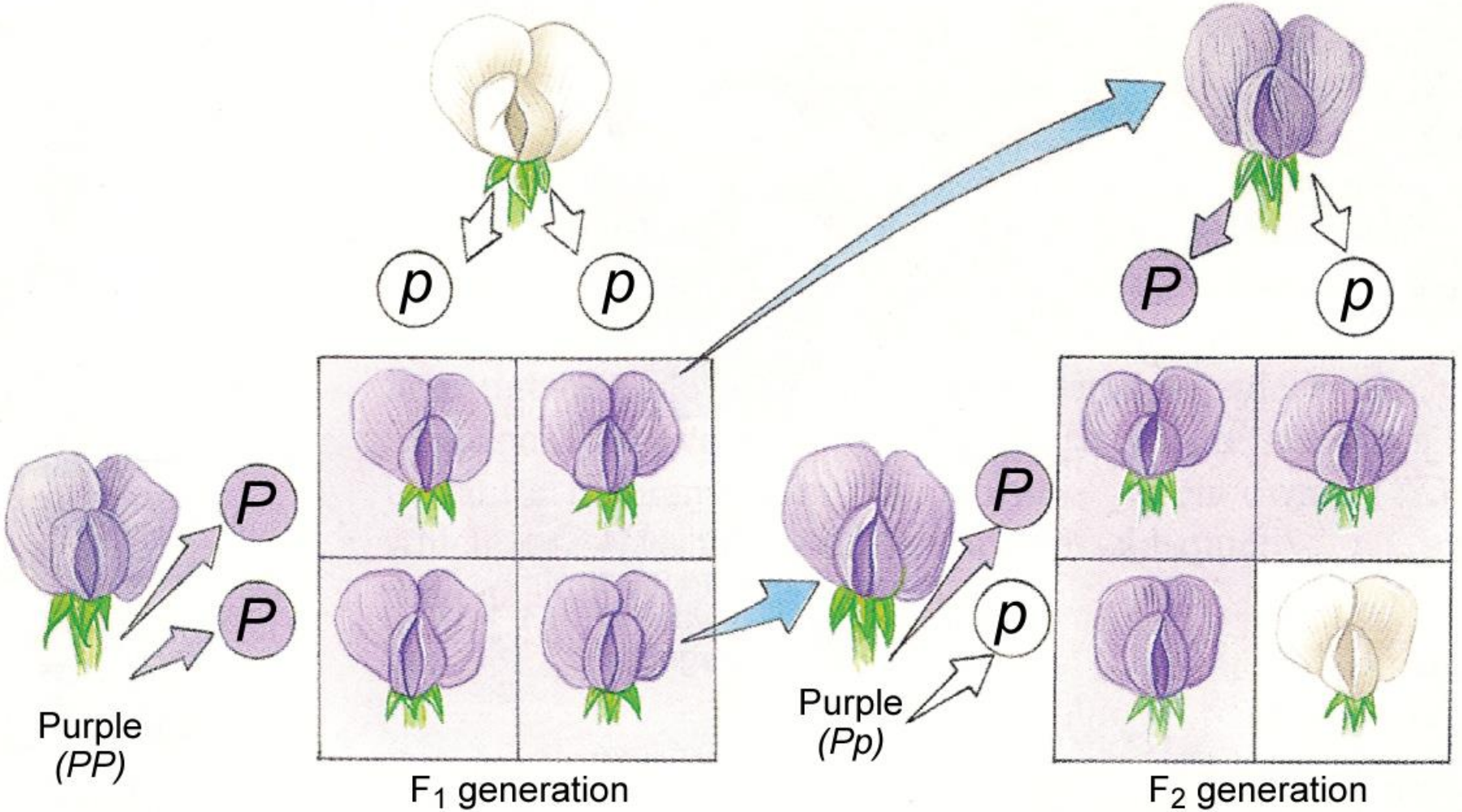


Redescovery of Mendelian Genetics (1900)

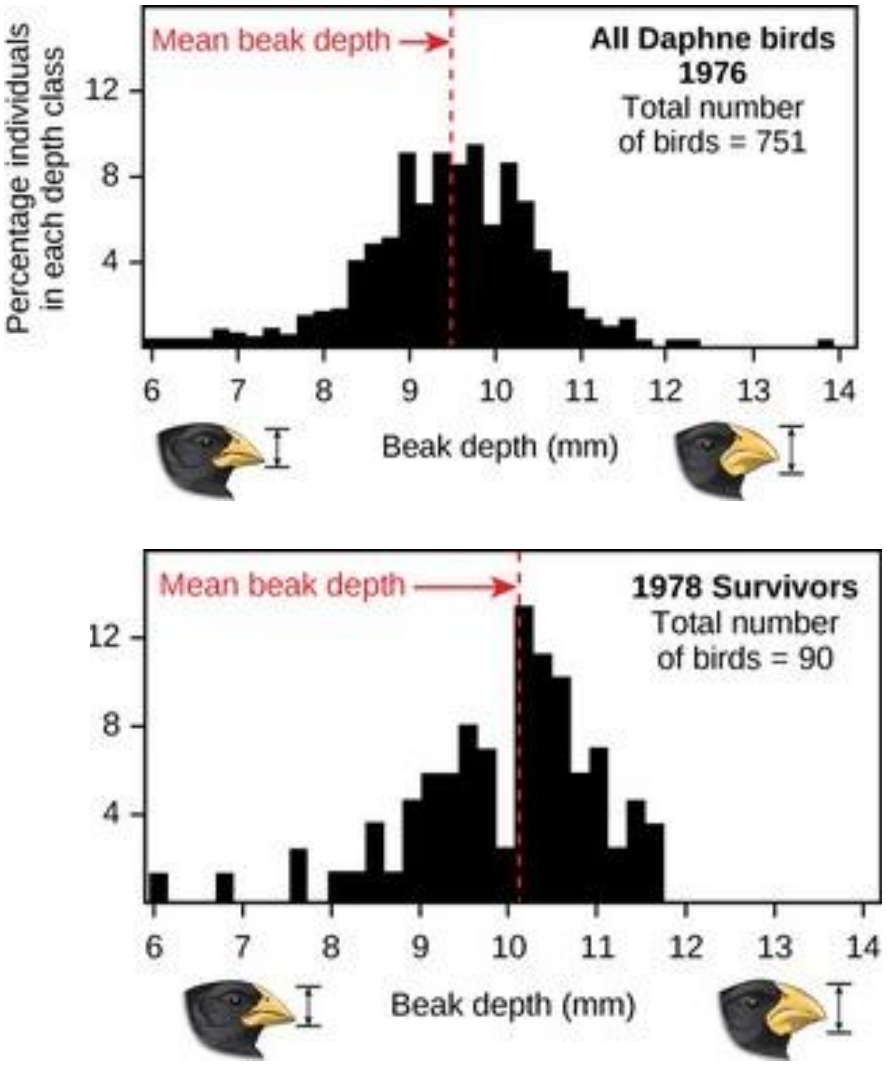




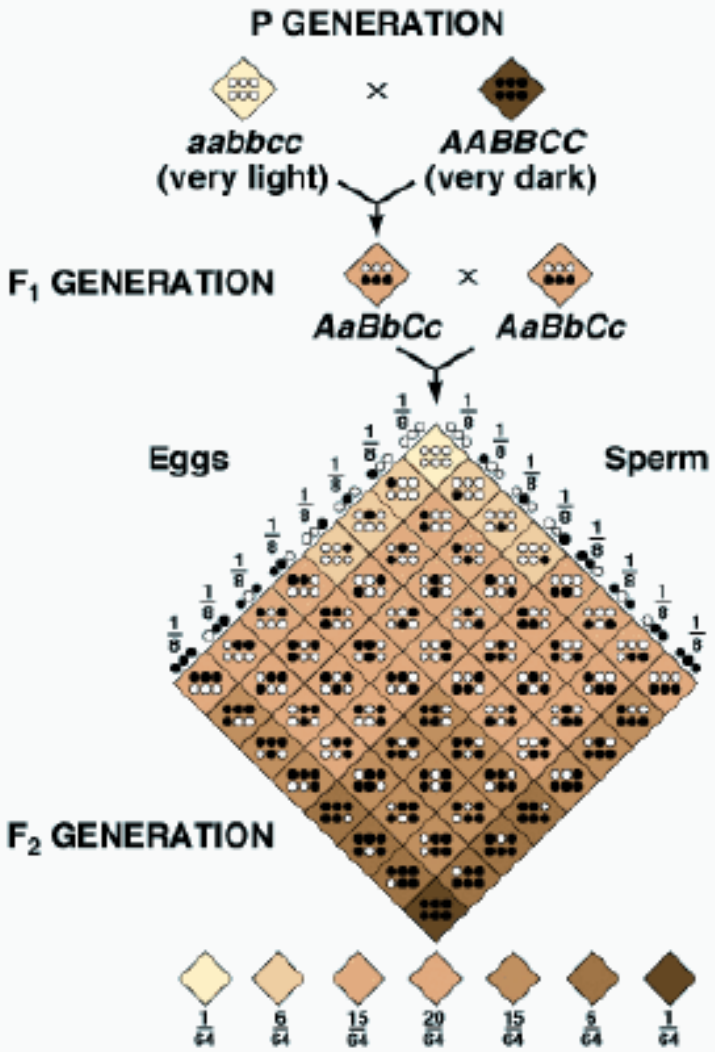
Discontinous variation and Independent segregation

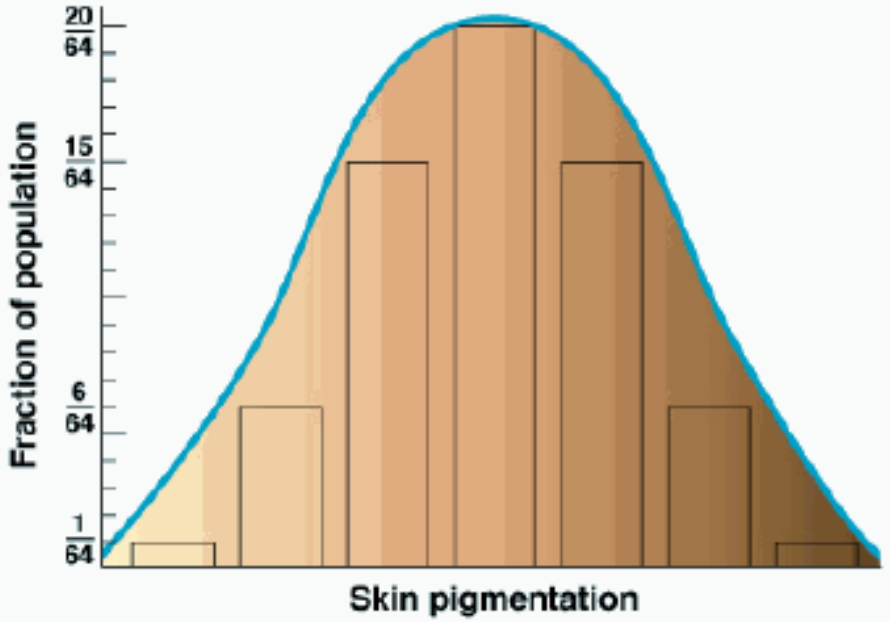


Biometricians X Mendelians or Selectionists X Mutationists



Fisher and Multiple Loci of Small Effect (1930)





Fisher and Variance Partitioning

$$V_P = V_G + V_E$$

$$V_G = V_A + V_D + V_I$$

Aditive variance

=

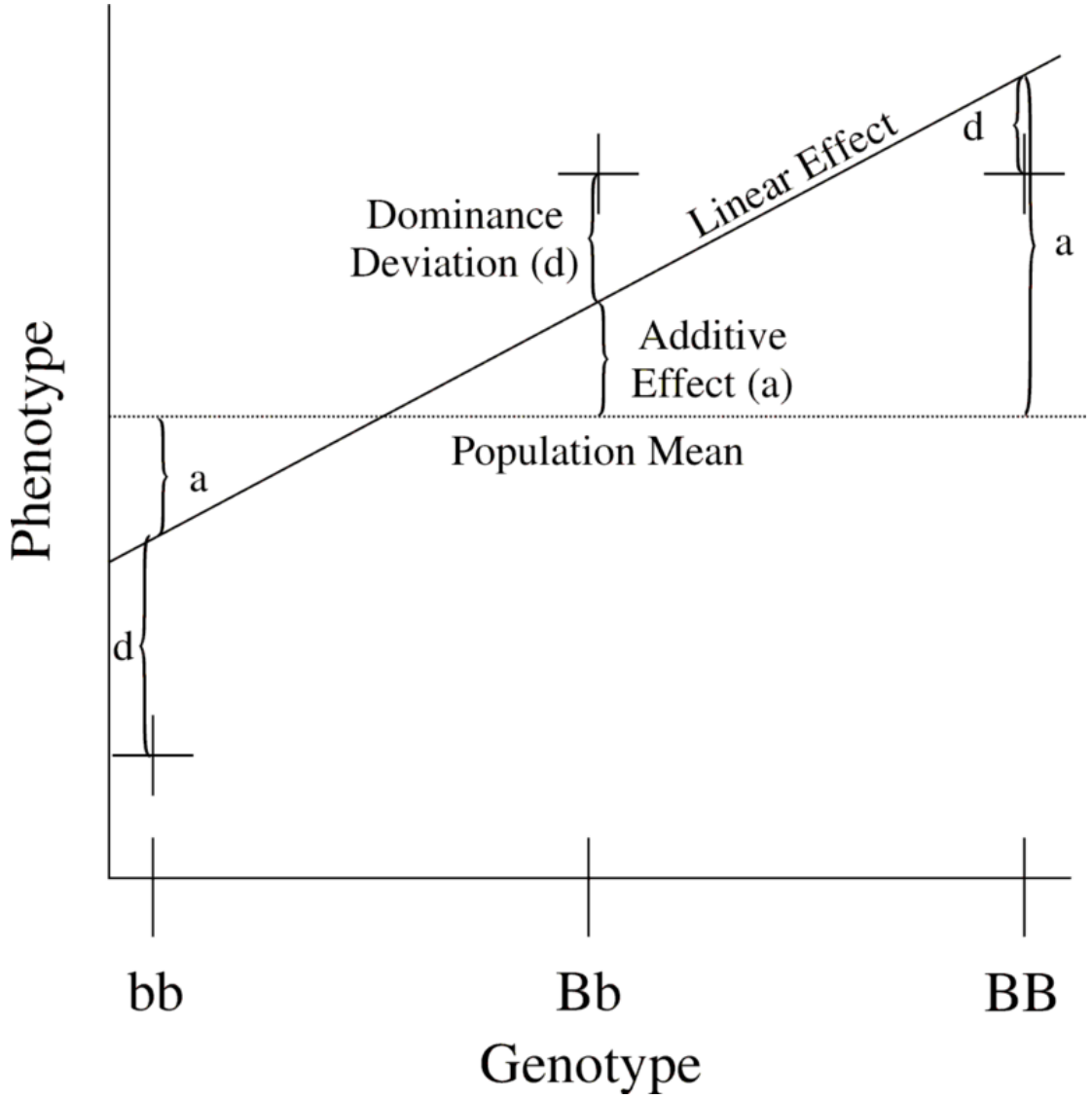
Variance in breeding values

=

Sum of allele's mean effects

=

Heritable variance



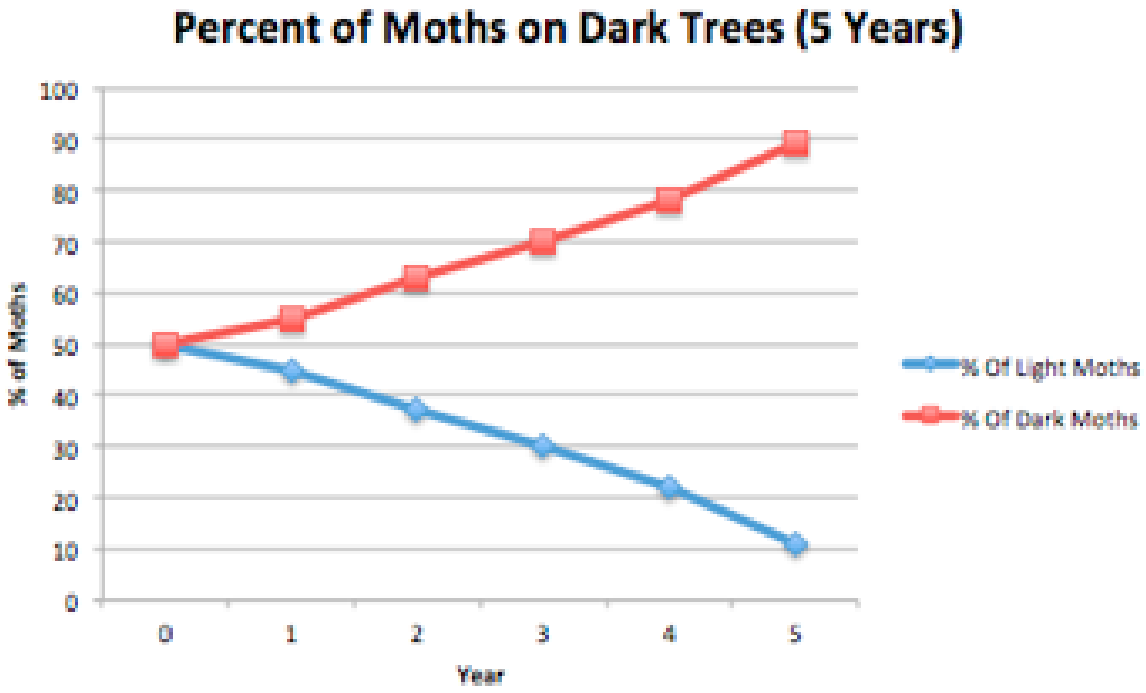
Fisher's fundamental theorem of natural selection

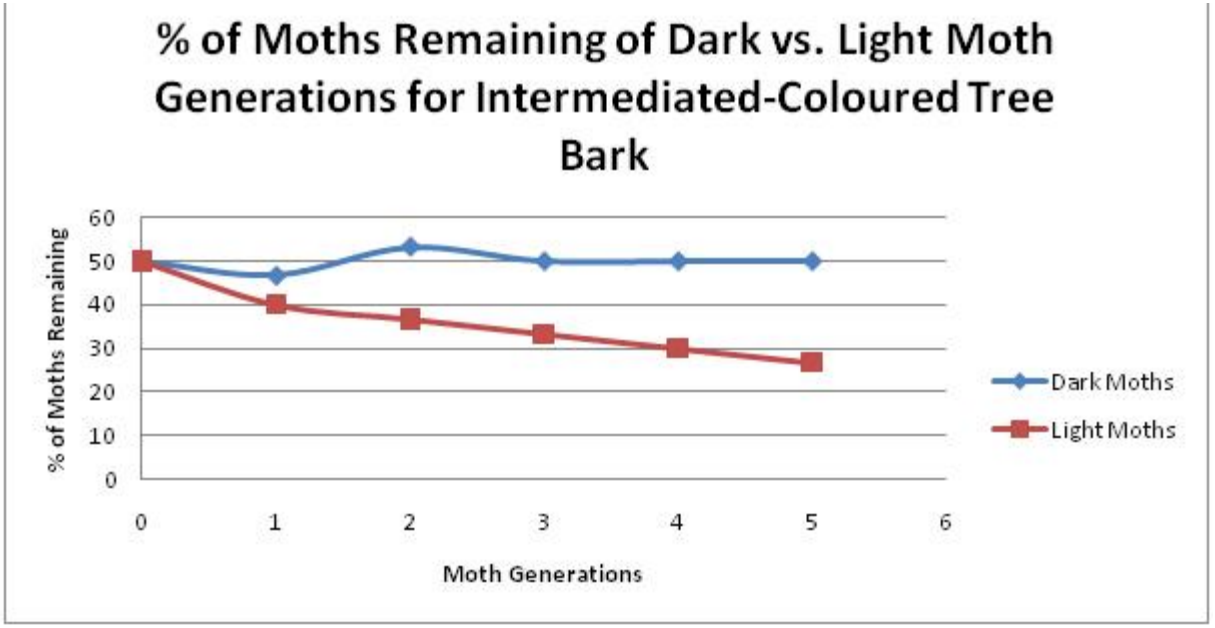
'The rate of increase in fitness of any organism at any time is equal to its genetic variance in fitness at that time'

'The rate of increase in fitness of any species is equal to its genetic variance in fitness'

Haldane and the Pepper moths

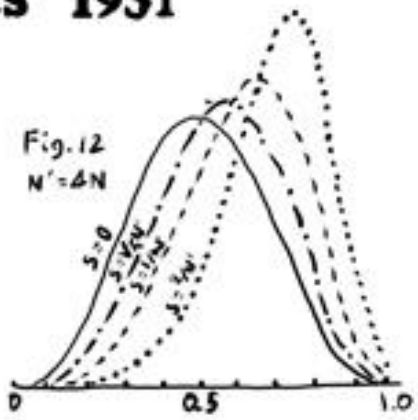
Haldane and Natural Selection on discrete variation

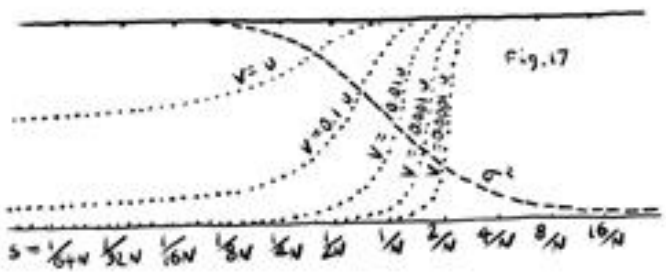




EVOLUTION IN MENDELIAN POPULATIONS

WRIGHT **GENETICS** 1931





EVOLUTION IN MENDELIAN POPULATIONS

SEWALL WRIGHT
University of Chicago, Chicago, Illinois

Received January 20, 1930

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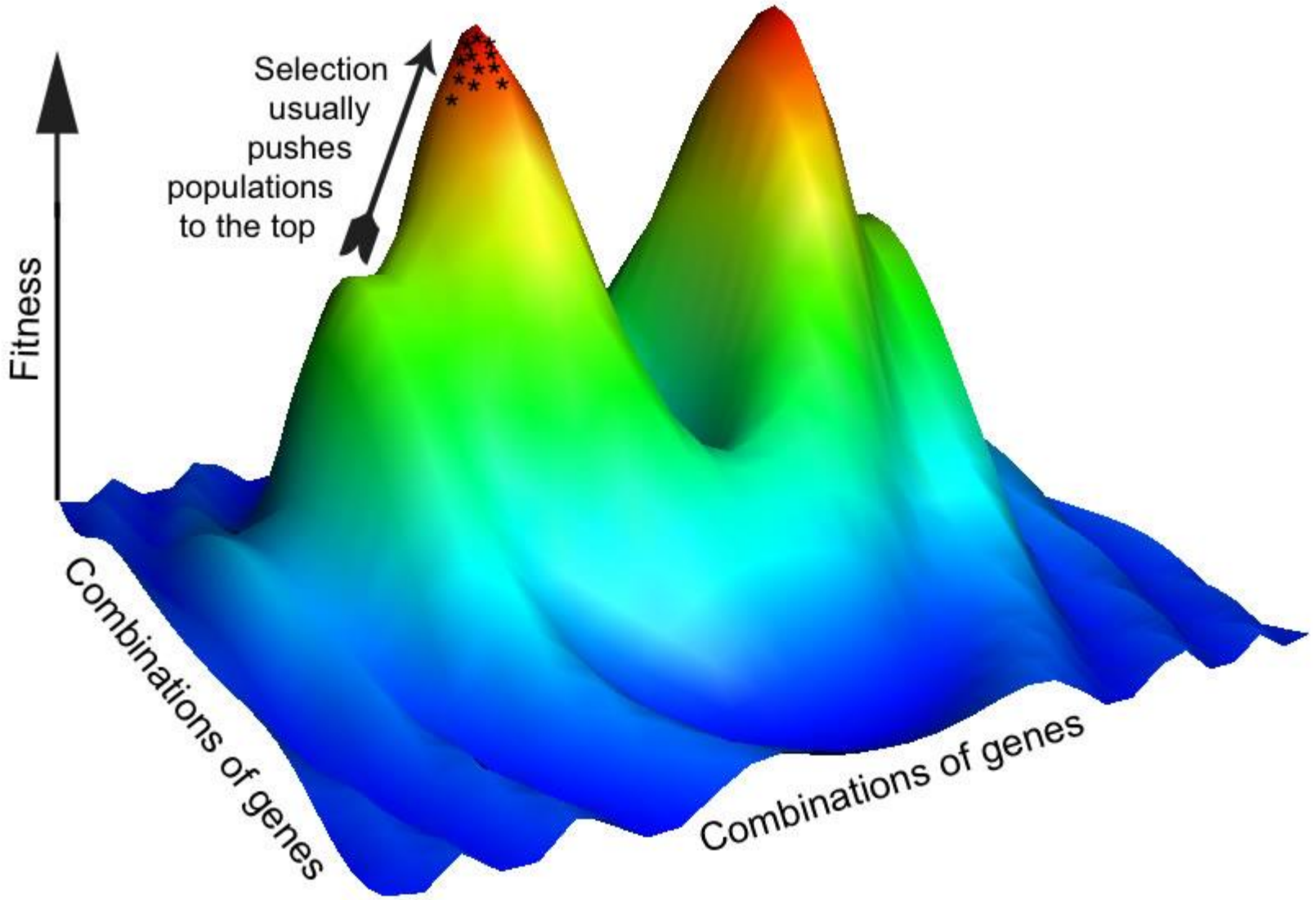
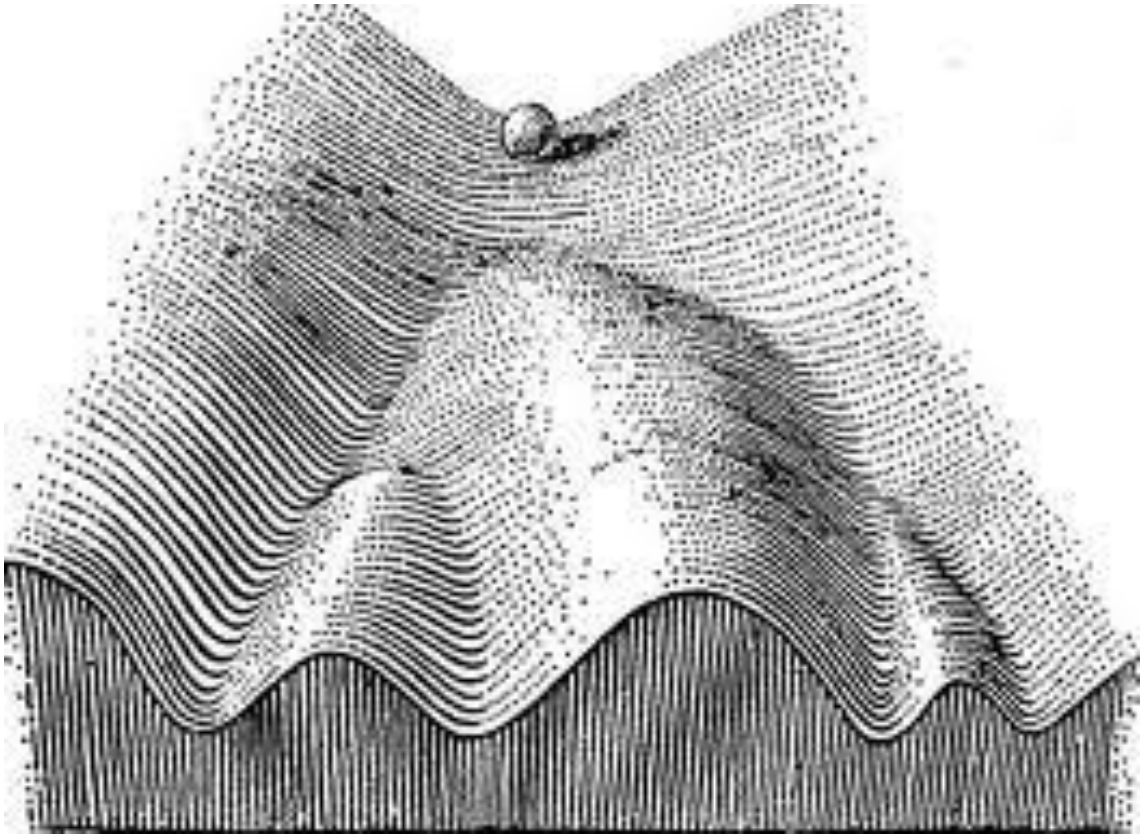
THEORIES OF EVOLUTION

One of the major incentives in the pioneer studies of heredity and variation which led to modern genetics was the hope of obtaining a deeper insight into the evolutionary process. Following the rediscovery of the Mendelian mechanism, there came a feeling that the solution of problems of evolution and of the control of the process, in animal and plant breeding

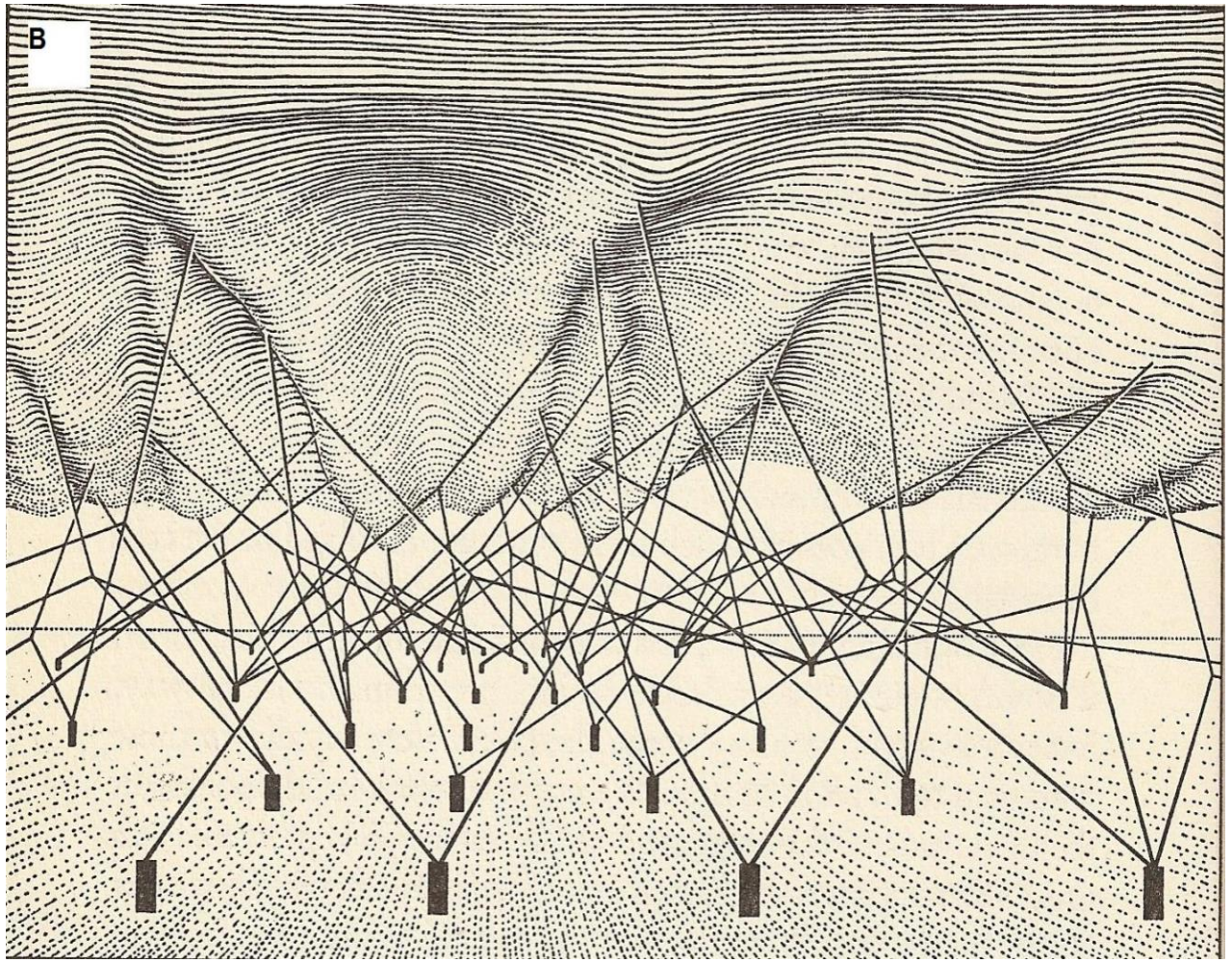
Wright and Epistasis



Waddington and the Epigenetic Landscape (1942)



Canalized developmental pathways



‘... each developmental pathway depends on the interaction of a certain set of genes.’

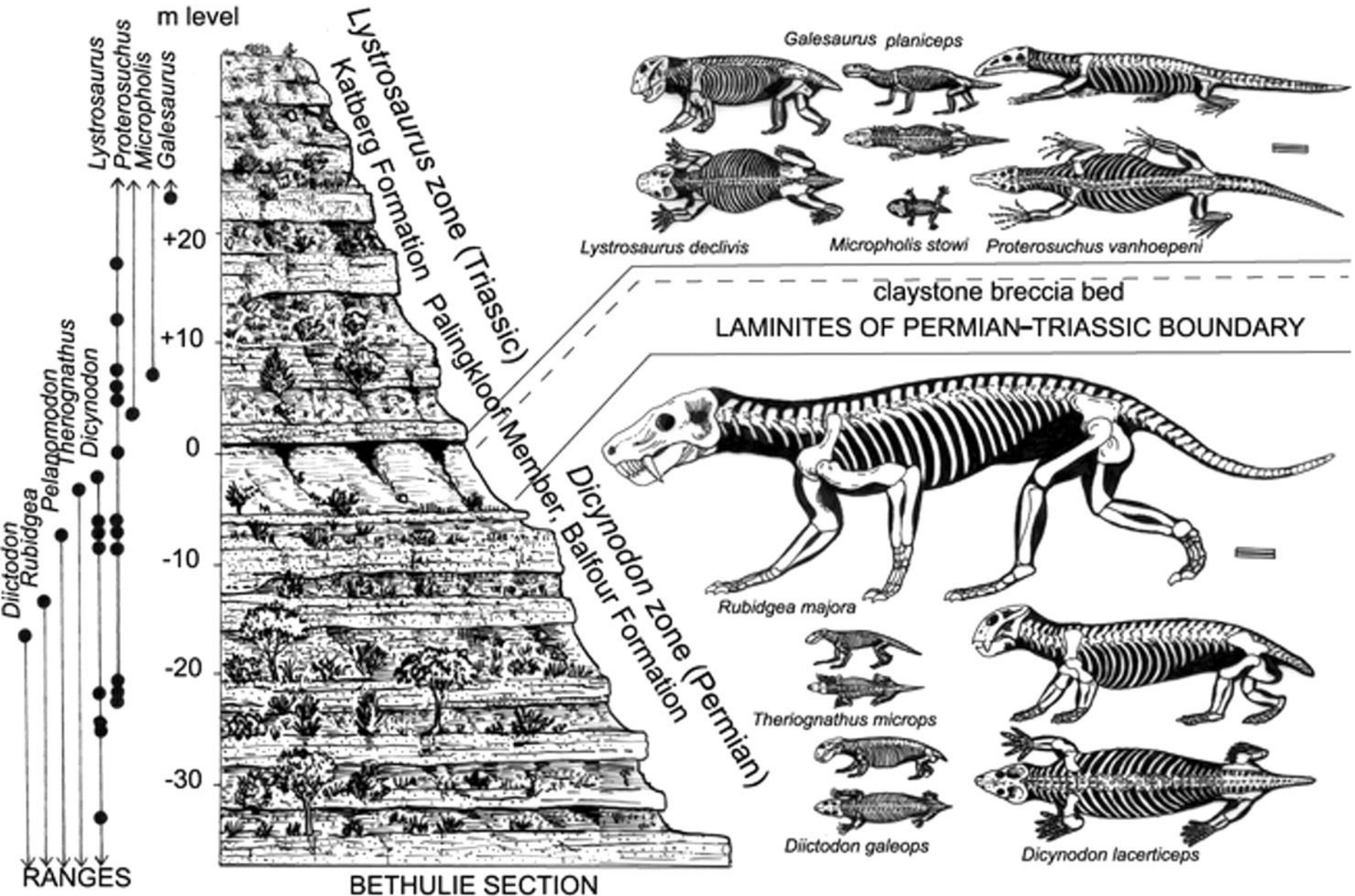
The Strategy of Genes, 1957

The theory of Morphological Integration/Modularity (1958, 1960)

Photo by Ruth O. Hotton

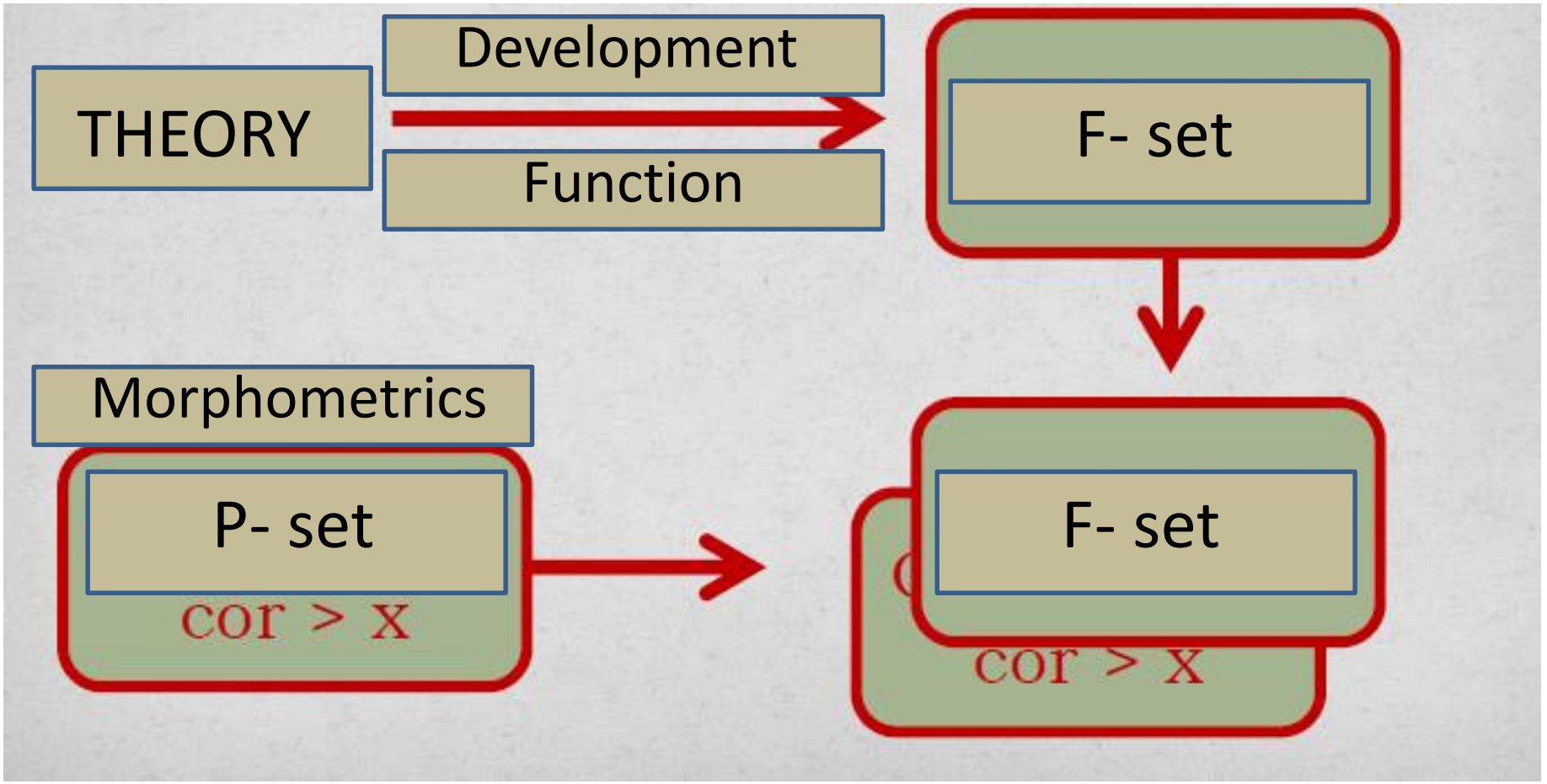
Raissa Berg

Olson and Vertebrate Paleontology

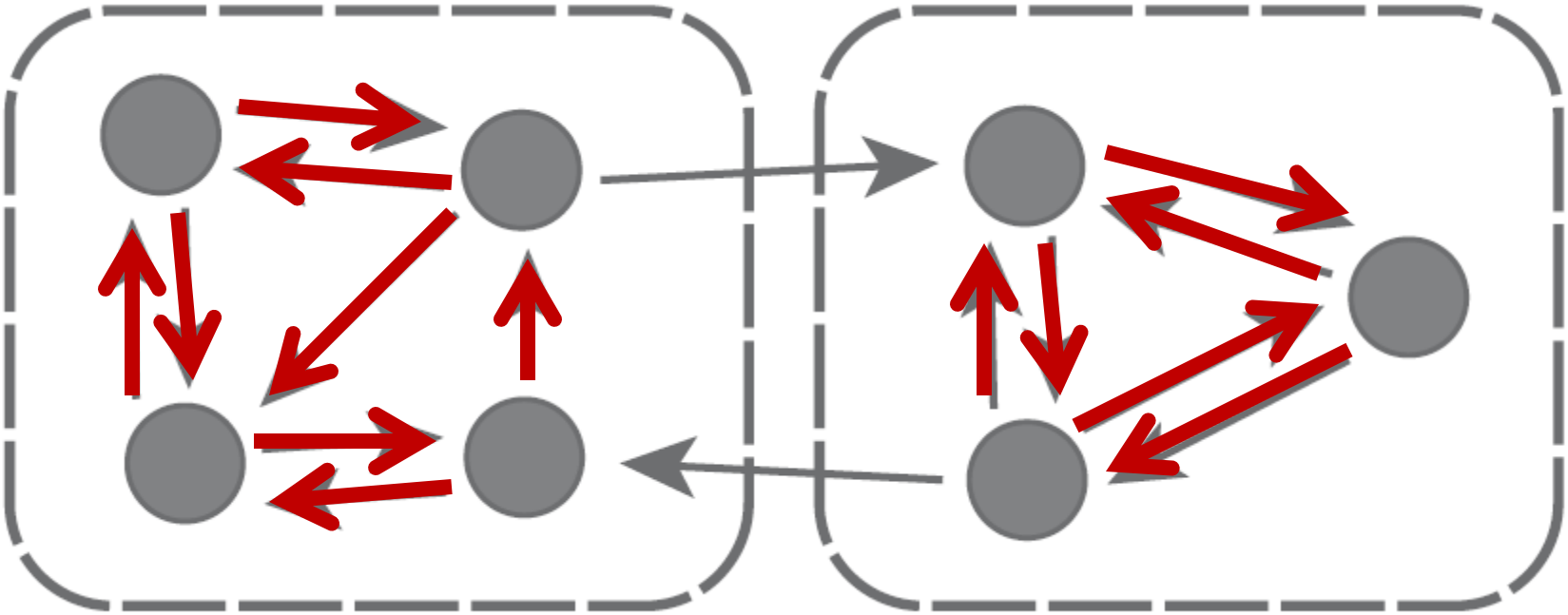


Phenotypic Correlations = relations among traits

Olsson and Miller (1958)

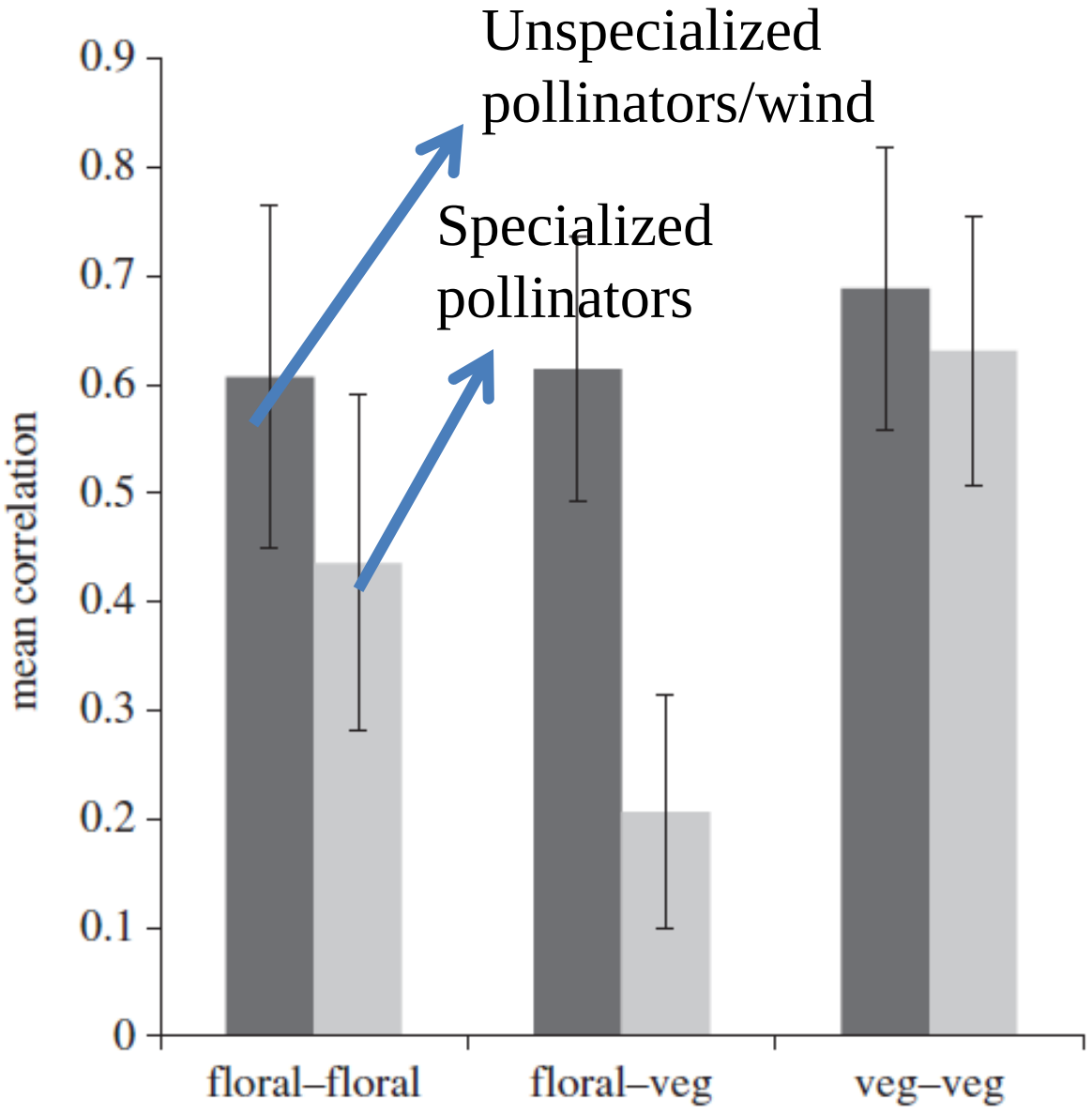


Integration within sets

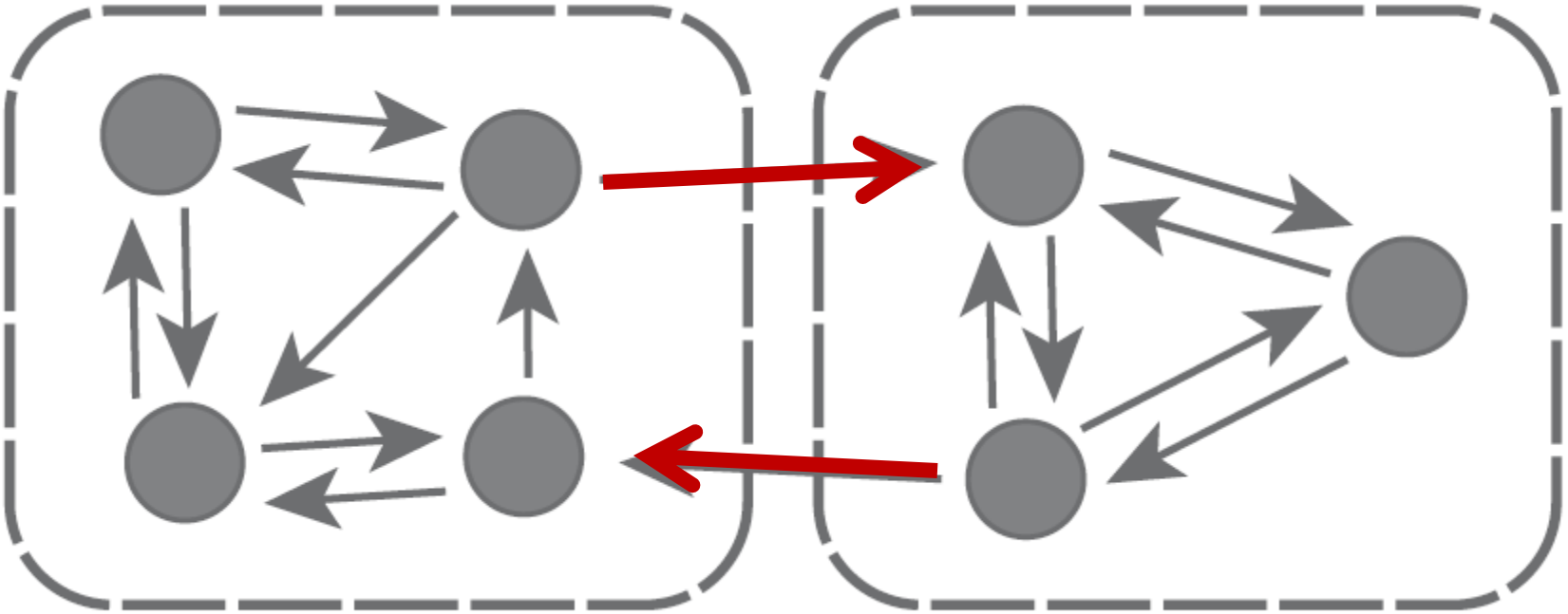


"It seemed evident . . . that character changes occurring in evolution of species could not be considered to be independent of each other and that studies which did not consider this dependency ignored a significant aspect of change . . ." (Olson and Miller, 1958).

Berg and independence among Correlation Pleiads



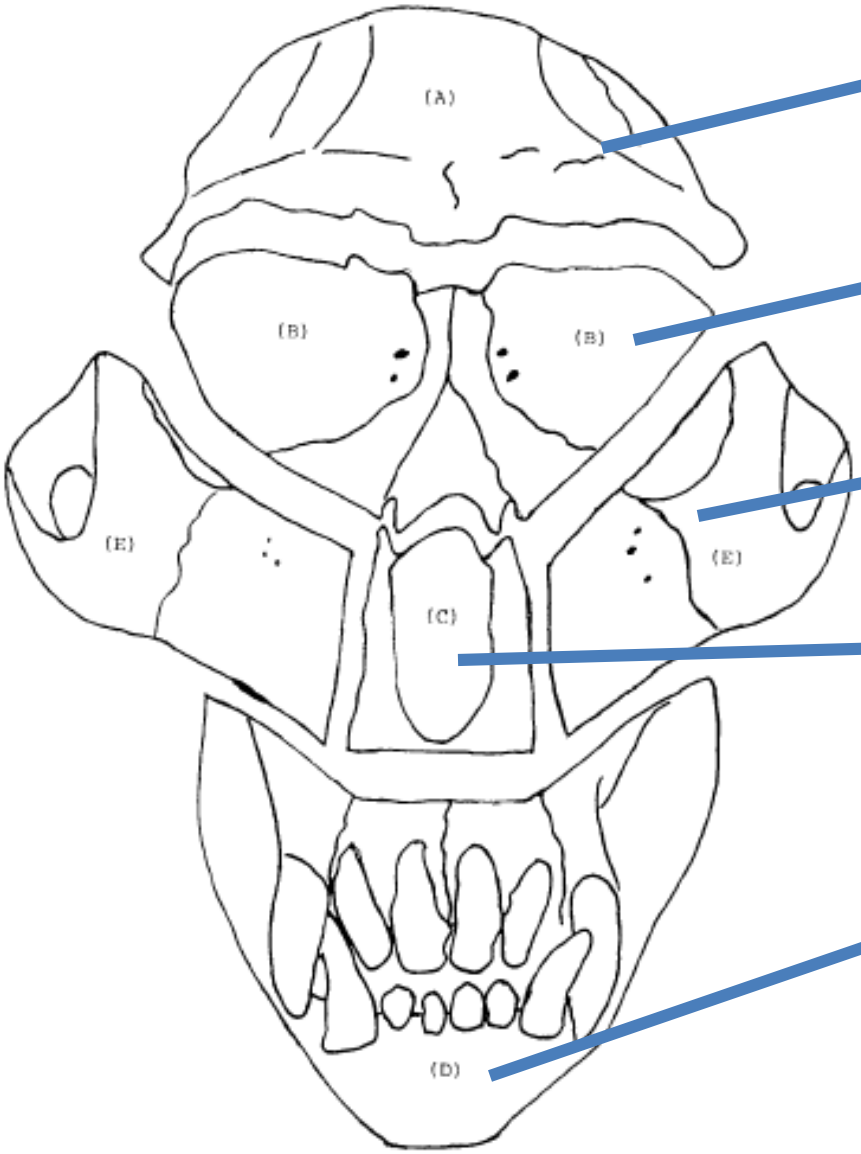
Modularity: semi-independence between sets



‘In all the instances of existence of pleiades it was the flower that had become free of the correlation interdependences within the plant organism’.
(Berg 1960)

Cheverud 1982: Cayo rhesus macaques

Functional sets



FRONTAL

ORBITAL

MASTICATORY

NASAL

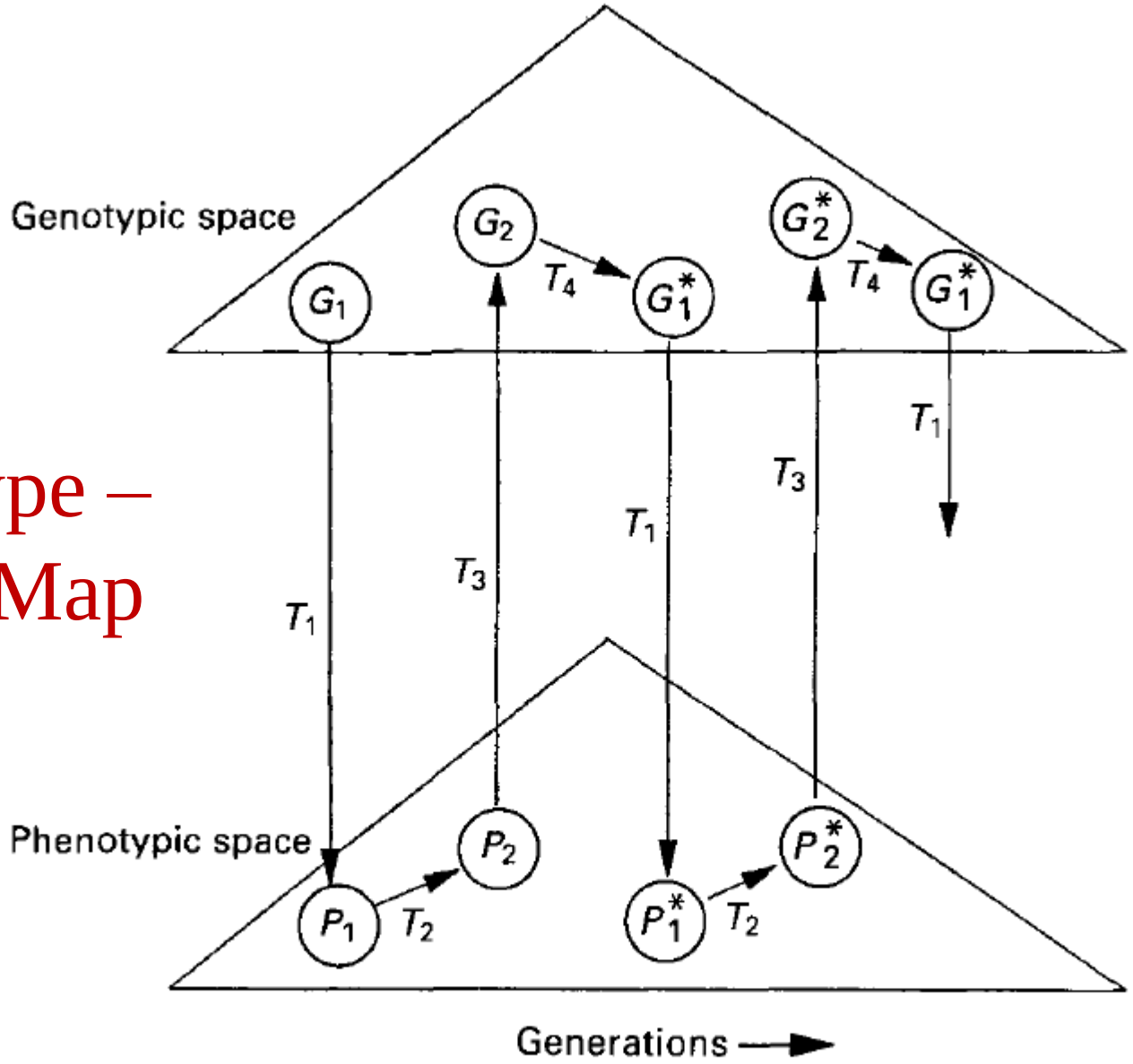
ORAL

TABLE 5. *Average phenotypic, genetic, and environmental correlations and squared correlations within and between* **F**-*sets.*

Correlation	Within *F*-set r	Between *F*-set r	Within *F*-set r^2	Between *F*-set r^2
Phenotypic	0.269	0.105	0.127	0.023
Environmental	0.281	0.093	0.228	0.092
Genetic	0.270	0.138	0.385	0.248
Genetic (neuro.)	0.370	0.110	0.517	0.159
Genetic (facial)	0.123	−0.042	0.190	0.264

‘Individual phenotypic characters and genes only evolve within the larger context of the organism in which they occur. Therefore, the organisms are the integrated functional units which evolve.’

The Genotype – Phenotype Map

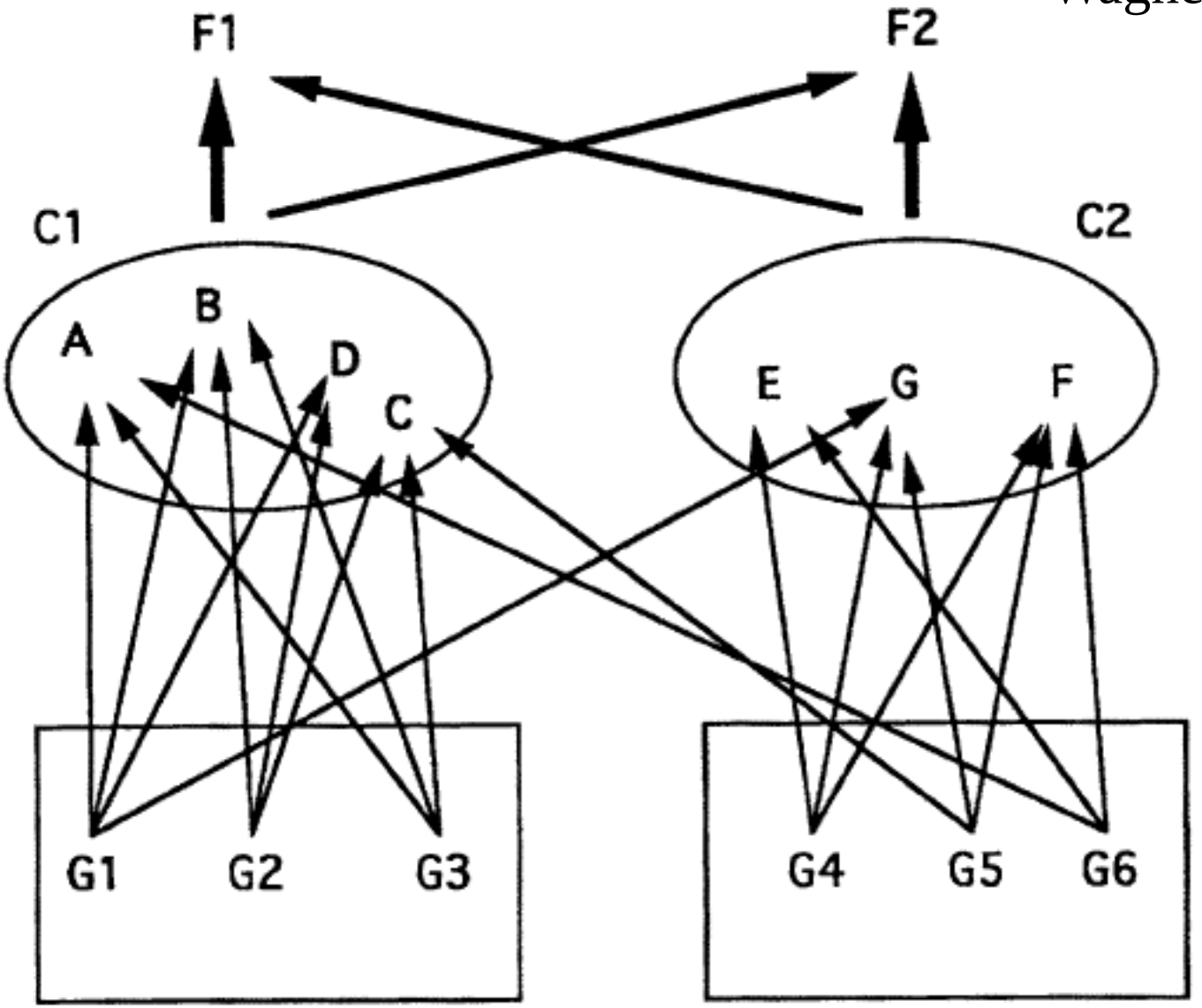


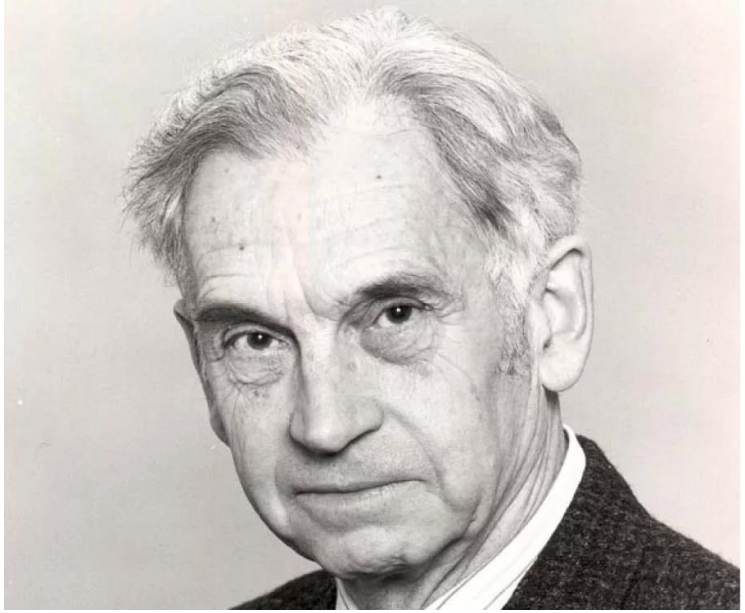
Lewontin 1974

$$E(P_1) \xrightarrow{T} E(P_1^*)$$

Modular Genotype – Phenotype Map

Wagner 1996





Ernst Mayr

‘In short, variation is an endless source of challenging questions’

Quiz

Cite uma diferenca entre a genetica mendeliana e a genetica quantitativa.