

BIOLOGY 102

First part - (Oct. to Feb.) Genetics and Eugenics.
Second part - Evolution.
Third part - Biostatistics.
Fourth part - Brief history of Biology.

Outline and bibliography of Second part - (Evolution)

1. Evidence for the theory of evolution.

A. Comparative biology

1. Comparative morphology

- (a) General principles (W.356-362)
- (b) Vestigial structures (M.34-48, W.362-66)

2. Comparative physiology

(a) General principles illustrated by:

- i. Reproduction in vertebrates
- ii. Concentration of body fluids

(b) Precipitin tests - Nuttall (N. ch. vii) S. 73-81

- (c) Comparison of salt concentration of blood and sea water (Note endocrine glands). (Rogers: Textbook of Physiology)
- (d) Vestigial functions.

3. Comparative psychology (M. 293-310; N. 90) Also Thorndike.

B. Classification

- 1. General principles (S H. 332 - 336)
- 2. Intermediate organisms. (

C. Embryology and Metamorphosis (M. 62 to 79; W. 366-373)

- 1. The recapitulation theory (biogenic law)
- 2. The principles of absorption and alteration. → See Sidney "Evolution and Genetics" pp. 73-75.
- 3. Crustacea and mammalia as illustrations.
- 4. Metamorphosis illustrated by the frog and the moth.

D. Geographic Distribution (M. 81 to 100; W. 388 - 402; S H. 374-390; S. 120-148)

E. Palaeontology (W. 318-355; S H 352-73; N.Ch. IV)

- 1. General principles (Smith's Theory) G.27-33)
- 2. Pre-Cambrian evidences.
- 3. Typical fossils of the Eras
 - (a) Palaeozoic
 - (b) Mesozoic
 - (c) Cenozoic
- 4. Examples of fossil records
 - (a) The horse (M. 225 to 232)
 - (b) The elephant (M.232 to 241)
 - (c) The camel

5. Illustrations from paleobotany

6. Prehistoric man (Note Keith's theory) (W.405-18; F.288)

F. Experimental biology

- 1. The contribution of genetics to evolutionary theory.
- 2. Examples of changing types. Domestication
- 3. Examples of isolation.

II. The evolutionary process (H H Ch. X. and SH.Ch.XVII.)

A. The origin of hereditary differences (W.576-599)

- 1. Mutations (F.Ch.XIV)
- 2. Chromosome changes
- 3. Recombination
- 4. Environmental theories ("pangonesis", etc.)

B. Selection (W. 600 - 628)

- 1. Natural Selection (D. p.102-107) See also "The Mammals of Ontario" - Cross + Deane - p. 9210 (The Carnivora Place in nature).
- 2. Sexual selection (D. p.107-110)
- 3. Artificial selection (C.272-8)

C. Isolation - Jordan's law. (N. 164-9; G. 190-1) S. 37-39)

II. (Cont'd.)

D. Adaptation (H. Ch. Xi; W.877-83 and 893 - 901)

1. Convergence

- (a) Examples
- (b) Homology and analogy
- (c) Does convergence contradict the evidence of morphology?

2. Divergence

3. Protective coloration and protective resemblance (mimicry) (E.245-7)

4. Establishment of physiological relationship

- (a) Symbiosis (SH. Ch. XII)
- (b) Parasitism
- (c) Saprophytism

(See article Eugil. magazine June 1936)

5. Degeneracy and regression

6. Social life and polymorphism

(L.186-224; SH.Ch.XI)

E. Primary steps in evolution

- 1. The origin of life (Ref: "In the Beginning" of H. Bradley)
- 2. The divergence between animal and plant
- 3. Exploring the possibilities of unicellular life (SH. Ch. V.)
- 4. Establishing the colonial types.
- 5. Sexual dimorphism.

F. The evolution of sex

G. Development of the "fundamental types"

- 1. Diploblastic types
- 2. Triploblastic types
- 3. The mollusc

Note the "molluscan"

4. The echinoderm

5. The arthropod (M. 174-185)

6. The cordate (H.H.Ch. XIII, M.270-291) - Sidney, Chpt. IX

7. Man (G.195-208) (H.parts 1 and 2)

8. Plant evolution (M. 137 to 154)

III. Theories of evolution (SH. 324-9)

A. Pro-scientific theories

B. Scientific theories

- 1. Lamarck - use and disuse (C.241 ff.)
- 2. Darwin - selection
- 3. The mutation-selection theory (N.169-71)

Note catastrophism

supported by Currier
contradicted by Lyell -
Prin. of Geology

C. Philosophic theories

- 1. Orthogenesis
- 2. Emergence (E.109-115)

IV. The implications of the theory of evolution (M.327-339)

A. The "universalization" of evolution. Evolution of the universe - of matter - of society. Analogy or fact?

B. Evolution versus special creation

C. Evolution and life's aims (E.479-514)

- 1. Evolution and God
- 2. Evolution and the Bible
- 3. Evolution and morals
- 4. Evolution and man's destiny.

BIBLIOGRAPHY

C. Conklin; Heredity and Environment

E. Evolution in the Light of Modern Knowledge

F. Easton; Principles of Genetics and Eugenics.

G. Gruenberg; The Story of Evolution

H. Hooton; Up from the Ape.

HH. Haldane and Huxley; Animal Biology.

M. Mason (Editor); Creation by Evolution

N. Newman; Evolution Yesterday and Today

SH. Holmes, S.J.; General Biology

W. Wells, Huxley and Wells; The Science of Life.

D. Darwin, Origin of Species (6th Ed. Appleton '21)

S. Scott; The Theory of Evolution.

JANUARY, 1946.

BIOLOGY 102

Sign here (write plainly).....

(Use blank spaces and the backs of the sheets for rough work; write answers in pencil if possible; write plainly; you have plenty of time.)

1. What ratio of phenotypes is obtained in each of the following cases?
(Express answer numerically only, e.g. 9:3:3:1)

(i) $Aa \times Aa$ 3:1 (v) $Yy \times Yy$ (if Y homozygous is lethal) 2:1
(ii) $Aa \times aa$ 1:1 (vi) $AaBb \times AaBb$ (A epistatic to B) 12:3:1
(iii) $AaBb \times AaBb$ 9:3:3:1 (vii) $AaBb \times AaBb$ (A and B complementary) 9:7
(iv) $Aabb \times aabb$ 15:1 (viii) $AaBb \times AaBb$ (A and B supplementary) 9:3:3:1

2. What ratio of phenotypes is obtained in each of the following cases? (Express answer numerically as in No. 1; assume no crossover unless given)

(i) $\frac{W+}{+s} \times \frac{++}{++} \quad \underline{2:1:1}$ (iii) $\frac{++}{ab} \times \frac{ab}{ab} \quad (10\% \text{ crossover}) \quad \underline{9:9:1:1}$

(ii) $\frac{a+}{+b} \times \frac{++}{ab} \quad \underline{2:1:1}$ (iv) $\frac{a+}{+b} \times \frac{++}{ab} \quad (20\% \text{ crossover}) \quad \underline{5:4:2:2:1:4}$

	aB	ab
A	AB	A
ab	B	$-$

$\frac{W+}{+1}$	$\frac{+1}{+1}$
$\frac{W+}{++}$	$\frac{+1}{++}$

$$\begin{array}{cc}
 & \begin{array}{cc} a & + & b \end{array} \\
 \begin{array}{cc} + & + \end{array} & \begin{array}{|cc|cc|} \hline \begin{array}{c} a & + \\ \hline + & + \end{array} & \begin{array}{c} + & b \\ \hline + & + \end{array} \\ \hline \begin{array}{c} a & + \\ \hline a & b \end{array} & \begin{array}{c} + & b \\ \hline + & b \end{array} \\ \hline \end{array}
 \end{array}$$

$$\begin{array}{cccc} 9 & 9 & 1 & 1 \\ ++ & ab & +b & a+ \\ \hline ab & \begin{array}{cc} ++ & ab \\ \hline ab & ab \end{array} & \begin{array}{cc} +b & \\ \hline ab & \end{array} & \begin{array}{cc} a+ & \\ \hline ab & \end{array} \end{array}$$

2 + + 1 a + 1 + b

40 a +	40 + b	10 ab	10 + +
40 + +	a + 16 + b	ab 4 + +	+ + 4 + +
40 ab	a + 16 ab	+ b 16 ab	<u>ab 4</u> <u>ab</u>
10 a +	ab 4 a +	+ b 4 a +	+ + 1 a +
10 + b	a + 4 + b	+ b 4 + b	+ + 1 + b

3. Indicate, by number, the type of inheritance indicated in each of the following cases according to this key: (1) multiple allelomorphs; (2) supplementary factors; (3) sex linkage; (4) sex limited; (5) cumulative factors; (6) epistatic factors.

(2) fowl comb types	(4) "hornless" in sheep
(5) negroid skin colour	(3) colour blindness
(1) human blood groups	(1) eye colour in <i>Drosophila</i>
(3) haemophilia	(4) premature baldness
(5) colour in wheat	(2) barring in fowls

4. In the following outline of the life-history of spermatophytes give the typical chromosome number at each stage as indicated:
- microspore Gametophyte(male) sperm
- Sporophyte _____ (zygote) Sporophyte _____
- megaspore Gametophyte(female) ovum
- (Ch. no.) 2n n n n 2n 2n

5. Indicate possible blood group, or groups, in the blanks in each of the following cases:

	<u>Mother</u>	<u>Child</u>	<u>Father</u>		<u>Mother</u>	<u>Child</u>	<u>Father</u>
(Sample)	O	O	<u>A, B or O</u>	(iv)	A	<u>A n O</u>	A
(i)	B	A	<u>A n AB</u>	(v)	AB	<u>A, B n AB</u>	AB
(ii)	B	AB	<u>A n AB</u>	(vi)	O	<u>O</u>	O
(iii)	B	<u>any</u>	A	(vii)	A	<u>A n O</u>	O

6. (a) A child's four grandparents all belong to blood group AB; his father belongs to group A and his mother to group B; to what group must the child belong? AB
- (b) A colour blind man has a daughter with normal vision, whose husband also has normal vision. If the daughter has a son what are the statistical chances that he will be colour blind? 1/4
- (c) In *Drosophila* a haplo-IV ($2n - 1$) is crossed with a triplo-IV ($2n + 1$). What ratio of offspring is produced? normal 2, haplo-IV 1, triplo-IV 1

$$\begin{array}{r} xy \\ 1 \\ \hline xy - xy \end{array}$$
$$\begin{array}{cc} n-1 & n \\ n+1 & \begin{array}{|c|c|} \hline 2n & 2n+1 \\ \hline 2n-1 & 2n \\ \hline \end{array} \\ n & \end{array}$$

7. Complete the statements by filling in the blanks:

(a) There are two kinds of twins, identical and _____

(b) Development of unfertilized ova is called _____

(c) When a species of animal has both sexes in one organism (e.g. the earthworm) this is called

(d) There are three principal types of mutations, viz. (1) gene mutations,
(2) chromosome mutations, and (3) genome mutations.

(e) Cell division which involves reduction in chromosome number is called

(f) In *Drosophila melanogaster* the $2n$ number is _____, in man it is _____

(g) A human showing true characteristics of both sexes is properly termed

7. (Cont'd.)

- (h) $2n + 1$, $2n - 1$ and similar types are called _____
- (i) $3n$, $4n$ and similar types are called _____
- (j) If, in a population, the number of twins is 1 to N live births, the number of triplets will be about 1 to _____ live births.
- (k) In America " N " (in the above statement) equals about 87
- (l) The fundamental distinction between soma and germ-plasm was first clearly made by _____
- (m) "Die Mutationstheorie" was written by _____
- (n) "Philosophie Zoologique" was written by _____
- (o) He set forth the theory now known as _____
- (p) Gametes include _____ and _____

8. (a) Fill each blank with the word "homozygous" or "heterozygous" _____

- (i) " Aa " is an example of the heter condition.
- (ii) In man the female is homo for the sex chromosome.
- (iii) The 3:1 ratio is obtained when both parents are heter
- (iv) An individual can show a recessive condition only when he is homo for it.

(b) Fill each blank with the word "dominant" or "recessive" ---

- (i) In round and wrinkled peas Mendel found that round was d
- (ii) In tall and short peas he found that tall was d
- (iii) In humans blue eyes are generally considered r
- (iv) In *Drosophila* most "wild type" characters are d
and their allelomorphic mutations are r