

# ESSENTIAL GENETICS

A course book

LYNN BURNET



---

# ***Contents***

---

|                                                             |           |
|-------------------------------------------------------------|-----------|
| Preface                                                     | v         |
| <b>1 <i>Monohybrid inheritance (1)</i></b>                  | <b>1</b>  |
| 1.1 Mendel's experiments and conclusions                    | 1         |
| 1.2 Particulate inheritance explained in modern terms       | 5         |
| 1.3 The standard monohybrid cross                           | 7         |
| 1.4 The monohybrid backcross or testcross                   | 8         |
| 1.5 The physical basis of the Law of Segregation            | 9         |
| 1.6 Summary                                                 | 12        |
| Key words                                                   | 12        |
| Answers                                                     | 13        |
| Problems 1–12                                               | 13        |
| <b>2 <i>Monohybrid inheritance (2)</i></b>                  | <b>16</b> |
| 2.1 The origin of new alleles                               | 16        |
| 2.2 Phenotypic effects of mutant alleles                    | 17        |
| 2.3 Multiple alleles                                        | 20        |
| 2.4 Incomplete dominance and codominance                    | 23        |
| 2.5 Lethal alleles                                          | 25        |
| 2.6 Mendelian ratios and probability                        | 26        |
| 2.7 Pedigrees                                               | 28        |
| 2.8 Summary                                                 | 29        |
| Key words                                                   | 30        |
| Answers                                                     | 30        |
| Problems 13–25                                              | 31        |
| <b>3 <i>Dihybrid inheritance</i></b>                        | <b>35</b> |
| 3.1 Mendel's experiments and conclusions                    | 35        |
| 3.2 The dihybrid testcross                                  | 37        |
| 3.3 The physical basis of the Law of Independent Assortment | 38        |
| 3.4 Interaction between genes at different loci             | 40        |
| 3.5 Characters controlled by more than two gene loci        | 43        |
| 3.6 Summary                                                 | 46        |
| Key words                                                   | 47        |
| Answers                                                     | 47        |
| Problems 26–40                                              | 47        |

## **4 Sex determination and sex linkage**

4.1 Sex determination

4.2 Sex linkage in *Drosophila* and humans

4.3 Inactivation of X-chromosomes

4.4 Summary

Key words

Answers

Problems 41–50

## **5 Genes and chromosomes**

5.1 Linked genes

5.2 Crossing over

5.3 The dihybrid backcross involving linked genes

5.4 The chi-square test

5.5 Chromosome mapping

5.6 The history of the chromosome theory of heredity

5.7 Chromosome mutations

5.8 Summary

Key words

Answers

Problems 51–65

## **6 Population genetics**

6.1 Genes in populations and the Hardy–Weinberg equation

6.2 Applications of the Hardy–Weinberg equation

6.3 The Hardy–Weinberg equilibrium

6.4 Disturbances of the Hardy–Weinberg equilibrium

6.5 Selection against deleterious recessive alleles

6.6 Effects of human activity on allele frequencies in natural populations

6.7 Polymorphism and evolution

6.8 Summary

Key words

Answers

Problems 66–75

Tests A–H

Answers to problems

Answers to tests

Appendix: table of chi-square values

Index