

CONTENTS

Plant Systems

CHAPTER 1 *Plant Structure and Function* 2

What Is a Plant?	2
The Need for Sunlight	2
The Need for Water	3
The Need to Reproduce	4
Plant Structure: From Water to Land	4
Plants Restricted to Wet Environments	4
Plant Life on Land	6
The Vascular Plants	7
Theory in Action: <i>Plants and Medicine</i>	8
Gymnosperms and Angiosperms	9
Plant Organization	9
The Roots: Starting From the Ground Up	10
Root Structure	10
Xylem	11
Phloem	13
Water Movement Into the Roots	14
Theory in Action: <i>Another Use for Phloem Sap</i>	15
Growth Patterns in Roots	16
The Stems: Maintaining the Flow	17
Growth Patterns in Stems	17
Growth Patterns in Tree Stems	18
Reaction to Injury	18
The Leaves: Harvesting Sunlight	20
Regulation of Gas Exchange	20
Internal Leaf Tissue	22

CHAPTER 2 *Reproduction in Flowering Plants* 24

Asexual and Sexual Reproduction	24
Asexual Reproduction	24
Vegetative reproduction in nature • Vegetative reproduction in horticulture	
Sexual Reproduction	26
Alternation of Generations	26
The Principle of Alternation	26
Alternation of Generations in the Angiosperms	27
The Details of Plant Reproduction	28
The Organs of Reproduction	28

Formation of Spores and Gametes	28
The female tissues: megaspores and eggs •	
The male tissues: microspores and pollen	
Pollination and Fertilization	29
Initial events: the growth of the pollen tube •	
Double fertilization—embryo and endosperm	
Embryonic Development	29
Fruits	32
Fruit types	
Current Controversies: <i>Evolutionary Pressure in a Very Small Arena</i>	34
Plants and Animals: Flowers, Pollen, and Seeds	35
Flower Specialization	35
Techniques of Pollination	35
Wind pollination • Insect pollination • Bird pollination • Pollination by other animals •	
Pollination and self-incompatibility	
Theory in Action: <i>The Grand Masquerade: Plants as Mimics</i>	37
Techniques of Seed Dispersal	39
Wind dispersal • Water dispersal • Dispersal by animals	
Current Controversies: <i>Is Sex Doomed? Apomixis</i>	41

CHAPTER 3 *Plant Growth and Nutrition* 43

Germination and Development	43
Dormancy	43
Germination	45
The Beginning of Growth	45
Nutrient Requirements	46
Plant Chemical Composition	46
Plant Nutrients	46
Deficiencies in Mineral Nutrients	47
Fulfilling the Nutrient Needs of Plants	47
Soil and Its Nutrients	47
Soil Fertilization and Management	49
Theory in Action: <i>Solar-Powered Marine Animals</i>	51
Symbiosis and Plant Nutrition	51
Mycorrhizae • Nitrogen fixation	
Meat Eaters	53

CHAPTER 4 *Control of Plant Growth
and Development* 55

Control of Plant Growth Patterns 55

The Nature of Plant Growth 55

Responses to the Environment 56

Geotropism • Phototropism • Thigmotropism

Plant Hormones 57

Theory in Action: *Chemical Defense Mechanisms:*

How Plants Fight Back 58

Auxin 58

Gibberellin 62

Cytokinins 62

Absciscic Acid 63

Ethylene 63

Phytochrome: The Regulation of Plant Growth 64

The Discovery of Phytochrome 64

Photoperiodism 66

Florigen 67

Autumn: A Case Study 67

Tomorrow's Plants 68

Plant Cell Culture 68

Plant Genetic Engineering 68

APPENDIX

Answers A-2

The Metric System A-3

Readings A-4

Illustration Credits A-5

Index A-6