

# Contents

## Chapter 1

Introduction	1
Fundamental Terms and Concepts	1
Patterns and Kinetics of Growth in Cells, Tissues, Organs, and Whole Plants	3
Mathematical Analyses of the Time Course of Growth	12
Discontinuities in Growth, Growth Periodicities, and Problems of Relative Growth Rate	15
Mechanisms Controlling Cellular Differentiation	17
Introduction to Plant Hormones	27
References	28

## Chapter 2

Auxins	32
Brief History of Discovery	32
Went's <i>Avena</i> Coleoptile Curvature Test	35
Early Isolations of IAA	37
Synthetic Auxins	37
Controversy Surrounding the Use of Certain Chlorophenoxy Acids as Herbicides and Defoliants	39
Natural Occurrence of Auxins	43
Auxin Biosynthesis	44
"Free" and "Bound" Auxin	46
Destruction of IAA	48

Auxin Transport	50
Relationships between Auxin Content and Growth	55
Correlative Differences in Auxin Relations between Etiolated and Light-Grown and Dwarf and Normal Plants	60
Mechanism of Auxin Action	62
References	85

### Chapter 3

<b>Gibberellins</b>	<b>90</b>
Brief History of Discovery	90
Chemical Characterization of GAs	92
Natural Occurrence of GAs	97
GA Biosynthesis in Seeds	99
GA Biosynthesis in Systems Other Than Seeds	101
Effects of Light on GA Biosynthesis	105
Interconversions of GAs	107
Role of GAs in Dwarfism	107
Other Aspects of GA Metabolism	113
Quantitative Changes in GA Content during Development	116
Sites of GA Biosynthesis in Seed Plants	127
Transport of GA	129
Anatomical and Biophysical Basis of GA-Induced Growth	129
Mechanism of Action of GA	131
References	142

### Chapter 4

<b>Cytokinins</b>	<b>147</b>
History of Discovery	147
Terminology	148
Isolation of Kinetin and the Search for Other Naturally Occurring Cytokinins	149
Discovery of Natural Cytokinins	151
Effects of Cytokinins and Other Hormones in Organisms Other Than Seed Plants	156
Structure/Activity Relationships of the Cytokinins	157
Biosynthesis and Metabolism	160
Mechanisms of Origin in tRNA	162
Metabolic Consequences of the Presence of Cytokinins in tRNA	166
Hormonal Activity of Free Cytokinins	167

Effects on Moss Protonemata	168
Some Physiological Effects on Seed Plants	170
Translocation	175
References	176

## Chapter 5

### Abscisic Acid and Related Compounds 181

Introduction	181
History of Discovery	182
Chemical Characterization	185
Biosynthesis and Other Features of Metabolism	186
Natural Occurrence of ABA	192
Physiological Effects	192
State of Chromatin in Dormant Tissues and the Mechanism of Action of ABA	202
References	203

## Chapter 6

### Ethylene 208

Historical Background	208
Ethylene and Fruit Ripening	210
Interaction between Auxin and Ethylene	215
Inhibition of Root Growth and Role in Root Geotropism	218
Role in Emergence of Dicot Seedlings	219
Effects of Ethylene on Planes of Cell Expansion	221
Other Effects of Ethylene	222
Ethylene Biosynthesis and Mechanism of Action	225
References	226

## Chapter 7

### Phytochrome 230

Introduction	230
History of Discovery and Modern Description	230
Occurrence, Distribution, and Intracellular Localization	236
Induction-Reversion versus High Irradiance Responses	238

Non-Phytochrome Mediated Photoresponses to Blue Light	239
Introduction to Mechanism of Phytochrome Action	239
Phytochrome Action in Nonphotoperiodic Photoresponses	240
Phytochrome and Photoperiodic (Flowering) Responses	248
References	261
 Index	 265