

Progress in Botany

Structural Botany Physiology
Genetics Taxonomy Geobotany

50

Fortschritte der Botanik
Struktur Physiologie Genetik
Systematik Geobotanik



Springer-Verlag

A. Structural Botany

I. General and Molecular Cytology: The Plasma Membrane and the Tonoplast

By Udo Kristen

1. Introduction	1
2. The Plasma Membrane (Plasmalemma)	1
a) PM Isolation and Purification	1
b) Lipids	2
c) Proteins	3
d) Exocytosis and PM Recycling	5
e) In- and Evaginations of the PM	6
3. The Tonoplast (Vacuolar Membrane)	6
a) Tonoplast Isolation and Purification	7
b) Lipids	7
c) Proteins	8
d) Vacuole and Tonoplast Origin	10
References	10

II. Cytology and Morphogenesis of the Prokaryotic Cell

By Frank Mayer

1. Cytology and Macromolecular Structure: Technical Aspects	14
a) Artifacts	14
b) Elemental Microanalysis	14
c) Structure Analysis of Isolated Cytoplasmic Enzymes	15
d) Enzyme Localization by Electron Microscope Immunocytochemistry	15
2. New Isolates and Taxonomical Aspects	15
a) New Isolates	15
b) A Bacterium Forming up to Five Endospores per Cell	16
3. Structure-Function Aspects at the Cellular Level	17
a) Vesicle Formation; Cellulose Degradation	17
b) Polysaccharide Storage Material in Methanogenic Bacteria	18
c) The Inclusion Bodies in <i>Bacillus thuringiensis</i> subsp. <i>israelensis</i>	18
4. Structure-Function Aspects at the Macromolecular Level	19
a) The Cellulolytic Enzyme Complex in <i>Clostridium thermocellum</i>	19

b) An Enzyme Complex Involved in Methane Formation	19
c) Organization of the Bacterial Nucleoid	20
5. Location of Bacterial Enzymes	20
6. Morphogenesis and Differentiation	21
a) Septation and Filament Splitting in <i>Methanospirillum hungatei</i>	21
b) Dynamics and Differentiation in Cell Envelope Structure	21
c) Size Variation and Differentiation in Phototrophic Bacteria	21
d) Spore Formation and Germination	22
7. Recognition and Attachment	23
References	24

B. Physiology

I. Plant Water Relations

By Rainer Lösch

1. Water Relations of Cells and Tissues	27
2. Root Water Uptake and Water Movement Through the Plant	29
3. Stomatal Control of Transpirational Water Loss	32
4. Effects of Water Relations on Germination and Growth	35
5. Implications of Water Stress	36
a) Drought Effects on Metabolism	36
b) Drought Resistance	38
6. Implication of Waterlogged Conditions	38
7. Habitat Water Relations and Plant Performance	39
8. Water Relations of Poikilohydric Plants	41
References	42

II. Mineral Nutrition: Potassium

By Ulrich Lüttge and David T. Clarkson. With 1 Figure

1. Introduction	51
2. The Molecular Level: Membrane-Transport Proteins	51
3. The Membrane Level	54
a) Interactions and Exchange of Ions and Energy Coupling	54
b) Potassium Channels	57
4. The Cellular Level	59
a) Transport Kinetics	59
b) Compartmentation and the Regulation of Transport	60
α) Feedback Systems	60
β) Cytosolic Potassium Homeostasis	61
γ) Potassium and Cytosolic pH Homeostasis	62
5. The Physiological Level	63
a) Physiological Processes in General	63
b) Stomatal Guard Cell Movements	63
c) Rhythms	64
d) Growth and Phytohormone Interactions	64
e) Na^+/K^+ -Selectivity and Salinity Responses	65

f) Sugar Translocation in the Phloem	66
6. The Whole-Plant and Nutritional Level	66
7. Conclusions	68
References	69

III. Photosynthesis. Carbon Metabolism: New Regulators of CO₂ Fixation, the New Importance of Pyrophosphate, and the old Problem of Oxygen Involvement Revisited

By Grahame J. Kelly, Joseph A.M. Holtum and Erwin Latzko. With 4 Figures

1. Introduction	74
2. Inorganic Carbon Uptake	75
3. Investigations with Isolated Plastids	75
4. The Return of RuBP Carboxylase	76
5. RuBP Carboxylase and the Limits to Photosynthesis	78
6. The Other Calvin Cycle Enzymes	80
7. Light-Mediated Enzyme Regulation	81
8. Starch Metabolism	82
9. Sucrose Metabolism: Fructose-2,6-P ₂ , and a Role for PP _i ?	82
10. Mitochondrial Respiration in Illuminated Photosynthetic Cells?	84
11. Photorespiration	86
12. The Many Roles of O ₂ in Photosynthetic Carbon Metabolism	87
13. C ₄ Plants	88
a) Transport of Pyruvate	89
b) Transport of PEP	89
c) Transport of Malate	90
d) Transport of Inorganic Carbon	90
e) Enzymes	90
f) Control of Carbon Partitioning	91
14. C ₃ -C ₄ Intermediates	91
15. CAM Plants	92
a) Carbon Partitioning	92
b) Malic Acid Accumulation	95
References	95

IV. Secondary Plant Substances. Nonsteroidal Triterpenoids

By Horst-Robert Schütte. With 9 Figures

1. Introduction	102
2. Oleanane and Ursante-Type Triterpenoids	102
3. Different Triterpenoids	105
4. Limonoids	107
5. Cucurbitacins	111
References	112

V. Growth

By Karl Dörffling and Carmen Crocoll. With 6 Figures

1. General Reviews	116
2. Absciscic Acid	116
a) Reviews	116
b) Methods of Determination	117
c) Occurrence and Biosynthesis	119
d) Metabolism	120
e) Physiological and Molecular Mode of Action	123
3. Ethylene	123
a) Reviews	123
b) Methods of Determination	124
c) Biosynthesis and Its Regulation	126
d) Physiological and Molecular Mode of Action	128
References	

VI. Developmental Physiology

By Berthold Hock. With 4 Figures

1. Gene Expression	133
a) Organ- and Tissue-Specific Gene Expression	134
b) Phytochrome-Regulated Gene Expression	135
c) Heat Shock Responses	137
α) Heat Shock Proteins	137
β) Gene Expression	138
γ) Functions	138
d) Wounding	140
2. Phytochrome	140
a) Serological Properties	141
b) Intracellular Localization	142
c) Ubiquitin	142
α) Electron Microscopic Studies	143
β) Biochemical Studies	145
3. Elongation Growth	145
a) Extensibility of the Outer Epidermal Cell Wall as Growth-Limiting Factor	146
b) Microfibril Orientation as Regulatory Element	147
c) Matrix Components	147
d) Cell Wall Proteins	148
e) Molecular Mechanisms of Growth Induction	150
4. Circadian Rhythm	151
a) Clock Mutants	151
b) The Role of Protein Synthesis	152
c) Temperature Compensation	153
References	

VII. Physiology of Movements in Space Experiments

By Wolfgang Hensel

1. Introduction	158
2. Growth and Orientation of Gravitropic Organs	159
3. Structure of Root Statocytes	159
4. Circumnutation and Epinasty	160
References	161

C. Genetics

I. Replication

By Rudolf Eichenlaub. With 2 Figures

1. Introduction	163
2. Structural Analysis of the Origin of Replication (OriC)	163
3. Proteins and Enzymatic Functions Required for Replication Initiation ..	165
a) DnaA-Protein	165
b) DnaB/DnaC Proteins	165
c) RNA-Priming	166
d) DNA Synthesis by DNA Polymerase III	166
e) Elongation	167
4. Control of the Initiation of Replication	169
5. Termination of Replication	169
6. Outlook	171
References	171

II. Recombination: Recombination of Mobile Genetic Elements from Plants and Cyanobacteria

By Heinz D. Osiewacz and Ute Heinen. With 2 Figures

1. Introduction	174
2. Mobile Elements in Higher Plants	174
a) Transposons	174
α) Transposons Have Been Identified in a Number of Higher Plants	174
β) Transposons Generate DNA Rearrangements	175
γ) Transposons May Influence Plant Gene Expression	176
δ) Plant Transposons Have a Characteristic Structure and May	
Code for Polypeptides	179
b) Plasmids	180
α) Linear Plant Plasmids Contain Terminal Inverted Repeats	180
β) Plasmids S ₁ and S ₂ Generate Genome Instabilities	180
γ) Plasmids Have Been Identified in a Number of Different Plants	180
c) Promiscuous DNA	182
α) Genetic Information May Be Transferred Between Organelles ..	182
β) Mechanisms for Transfer of Genetic Information Between	
Organelles	182

3. Mobile Elements in Cyanobacteria	183
a) In <i>Anabaena</i> a Mobile Genetic Element is Associated with the Regulation of Gene Expression	183
4. Mobile Elements in Fungi	184
a) <i>Ty</i> Elements in <i>Saccharomyces cerevisiae</i>	184
a) Different Strains of <i>S. cerevisiae</i> Contain Transposons with a Common Structure	184
b) <i>Ty</i> Elements Are Transposons Closely Related to Retroviruses	184
c) Transposition of <i>Ty</i> Elements May Influence Gene Expression	185
d) <i>Ty</i> Elements and Other Repetitive Sequences Provide Homologous Sequences for DNA Rearrangements	186
b) Mating Type Switching in Yeast	186
a) Transposition of a Mating Type Cassette Leads to Mating Type Switching	187
c) Plasmids and Introns	188
a) A Linear Plasmid Is Correlated with Senescence in <i>Neurospora intermedia</i>	188
b) A Circular Plasmid Controlling Senescence in <i>Podospora anserina</i> Is Derived from a Mitochondrial Intron	189
c) Some Mitochondrial Plasmids from <i>Neurospora</i> May Be Derived from Mitochondrial Introns	189
d) A Mitochondrial Intron of <i>Saccharomyces cerevisiae</i> Contains the Ability for Transposition	190
d) Promiscuous DNA	191
a) In <i>Neurospora crassa</i> the Expressed Copy of the Gene Coding ATPase Subunit 9 is Located in the Nuclear Genome	191
b) In <i>Saccharomyces cerevisiae</i> , Rearranged Nucleotide Sequences from the Mitochondrial DNA Are Present in the Nuclear Genome	191
5. Conclusions	192
References	192

III. Extranuclear Inheritance: Mitochondrial Genetics

By Wolfgang Ecke, Günter Pannenbecker, Otto Wasmund, and Georg Michaelis. With 2 Figures

1. Introduction	198
2. Organization of the Mitochondrial Genome in Higher Plants	198
3. Chimeric Genes Causing Cytoplasmic Male Sterility	201
4. Recombination of Mitochondrial DNA in Somatic Hybrids	203
5. Mitochondrial Gene Expression: Progress in Yeast	203
6. Import of RNA into Mitochondria	204
7. Prospects	204
References	204

IV. Recognition and Pathogenicity in Bacterial Plant Pathogens

XV

By Friedhelm Meinhardt

1. Introduction	207
2. <i>Agrobacterium tumefaciens</i>	208
3. <i>Pseudomonas syringae savastanoi</i>	209
4. Soft rot <i>Erwinias</i>	210
5. Pathogenicity and Avirulence	210
6. Conclusions	211
References	211

D. Taxonomy

I. Systematics and Evolution of the Algae

By Michael Melkonian

1. General Aspects	214
2. Cyanobacteria	215
a) Reviews and Monographic Treatments	215
b) Molecular Evolution	216
c) Taxonomy	216
d) <i>Prochloron</i> and Other Chlorophyll a and b-Containing Cyanobacteria	217
3. Rhodophyta	217
a) Phylogeny of Rhodophyta	217
b) Books, Reviews	218
c) Systematics and Taxonomy	218
d) Life History	219
e) Cellular Organization	220
4. Dinophyta	221
a) Phylogeny of Dinophyta	221
b) Books and Reviews	222
c) Cellular Organization	222
d) Life History	222
e) Taxonomy	223
5. Cryptophyta	223
6. Chromophyta	224
a) Prymnesiophyceae	225
b) Raphidophyceae	225
c) Pedinellophyceae	226
d) Dictyochophyceae	226
e) Diatomophyceae	226
α) Books, Reviews	226
β) Cellular Organization and Biochemical Phylogeny	227
γ) Phylogeny and Taxonomy	227
f) Synurophyceae	228
g) Tribophyceae	229
h) Chrysophyceae	229

i) Fucophyceae	230
j) Bicosoecophyceae	232
k) Eustigmatophyceae	232
7. Chlorarachniophyta	232
8. Euglenophyta	233
9. Glaucocystophyta	234
10. Chlorophyta	234
a) Books, Reviews	234
b) Prasinophyceae	235
c) Charophyceae	235
d) Ulvophyceae	236
e) Chlorophyceae	236
f) Taxa of Uncertain Affinities	237
References	237

II. Taxonomy and Phylogeny of Fungi

By Walter Gams and Walter Jülich

1. General Topics	246
a) Fungal Development	246
b) Chemotaxonomy and Serology	246
c) Genetics and Molecular Biology	246
d) Regional Treatments and Ecological Groups	247
2. Myxomycota	247
3. Labyrinthulomycota	247
4. Oomycota	248
5. Chytridiomycota	248
6. Zygomycota	248
7. Ascomycota	249
a) Hemiascomycetes	249
b) Euascomycetes	250
8. Fungi Imperfecti (Deuteromycota)	254
a) Coelomycetes	254
b) Hyphomycetes	254
9. Basidiomycota	255
a) General Aspects	255
b) Phragmobasidiomycotina (Heterobasidiomycetes)	256
c) Holobasidiomycotina	257
References	259

III. Systematics, Morphology and Ecology of Lichenized Fungi

By H.M. Jahns

1. Taxonomy	267
a) General Problems of Lichen Taxonomy	267
b) Taxonomic Research on Different Groups	269
2. Evolution	270
3. Morphology	270

a) Morphology of the Thallus	270
b) Ecological Morphology	270
4. Growth Development, Reproduction and Distribution	272
5. Ecology	272
a) Lichens and Abiotic Environment	273
b) Lichens and Biotic Environment	273
c) Phytosociology	274
d) Floristic and Mapping	275
e) Pollution	275
6. Photobionts	276
References	277

IV. Systematics of the Bryophytes

By Jan-Peter Frahm

1. General Aspects	284
2. Taxonomy	284
a) General	284
b) Monographs, Revisions	285
c) Chemosystematics	286
d) Cytosystematics	287
3. Nomenclature	288
4. Floristics	288
a) Checklists	288
b) Regional Floras	289
5. Phylogeny, Evolution	289
6. Geography, Ecology	290
7. Morphology, Anatomy	292
8. Applied Bryology	292
References	293

V. Systematics of the Pteridophytes

By Karl U. Kramer

1. Systematics	295
2. Bibliography, Collections, Nomenclature	297
3. Floristics	297
4. Geography and Ecology	299
5. Morphology and Anatomy	301
6. Chemotaxonomy	303
7. Cytotaxonomy, Biosystematics, Hybridization	304
8. Folklore, Uses	306
9. Fern Allies	306
References	308

VI. Palaeobotany

By Else Marie Friis

1. Phylogeny and Diversification of Fossil Angiosperms	312
a) The Anthophyte Clade	312
b) Radiation and Vegetational Changes	313
2. Description of Floras	315
a) Cretaceous Floras	315
b) Tertiary Floras	316
3. Systematic Studies	317
a) Unassigned Angiosperms	317
b) Magnoliidae	317
c) Ranunculidae	318
d) Hamamelididae	318
e) Caryophyllidae	321
f) Dilleniidae	321
g) Rosidae	322
h) Asteridae	323
i) Monocotyledones	324
References	324

E. Geobotany**I. The History of Flora and Vegetation During the Quaternary**

By Burkhard Frenzel. With 5 Figures

1. Major Problems	327
2. Pleistocene Extinctions in Northern Eurasia	329
Appendix 1	335
References	336

II. Vegetation Science (Sociobiological Geobotany)

By Klaus Dierßen

1. General Trends	341
2. Monographs and Bibliographies	341
3. Methods and General Results	342
a) Vegetation Dynamics	342
b) Vegetation Mapping	343
c) Vegetation Complexes and Biocenological Aspects	343
4. Application to Nature Conservation, Landscape Ecology, and Environmental Control	343
5. Vegetation of the Boreal Zone	344
6. Vegetation of the Temperate and Submeridional Zone	345
a) Forests and Shrublands	345
b) Grasslands and Dwarf Shrub Heaths	345
c) Weed Communities and Ruderal Vegetation	346

d) Cryptogamic Synusia	346
7. Vegetation of the Meridional Zone	347
a) Forests and Shrublands	347
b) Grasslands Including Coastal Vegetation	347
8. Vegetation of Subtropical and Tropical Areas	348
a) Forest Vegetation	348
b) Savanna and Grassland Vegetation	348
References	348

F. Special Topics

I. Floral Ecology

By Gerhard Gottsberger

1. Introduction	352
2. Functional Significance of Flowers and Inflorescences, Flower Longevity, Metabolism and Movements	353
3. Means of Attraction, Rewards	354
a) Visual Patterns and Pigmentation	354
b) Production of Heat and Scent	355
c) Nectaries and Nectar	356
d) Oil Secretion and Resins	357
e) Pollen and Pollen Presentation	357
4. Pollinator Behavior, Pollinator Efficiency, Flower Constancy, Foraging Strategies	358
5. Flower Classes and Their Evolution	359
a) Zoophily	359
α) Evolution and Pollination of Early Angiosperms; Cantharophily, Thrips as Flower Visitors	359
β) Melittophily and Ant Pollination	361
γ) Psychophily, Sphingophily and Phalaenophily	362
δ) Ornithophily	362
ϵ) Mammal Pollination	363
b) Anemophily and Hydrogamy	364
6. Pollination of Particular Groups; Flower Biological Radiation	364
a) Differentiation of Various Angiosperms at the Species, Genus, and Family Level	364
b) Orchids	365
c) Economy of Pollination and Crop Plants	366
7. Populational Aspects, Gender Distribution and Breeding Systems	367
a) Pollen-Pistil Interaction	367
b) Incompatibility Versus Compatibility; Cleistogamy; Apomixis	368
c) Sex Distribution; Monoecism Versus Dioecism	368
d) Heterostyly	370
e) Reproductive Success	370
8. Pollination Studies at the Community Level, Distribution of Flower Types, Flowering Phenology and Nature Preservation	370
References	371
Subject Index	381