

The

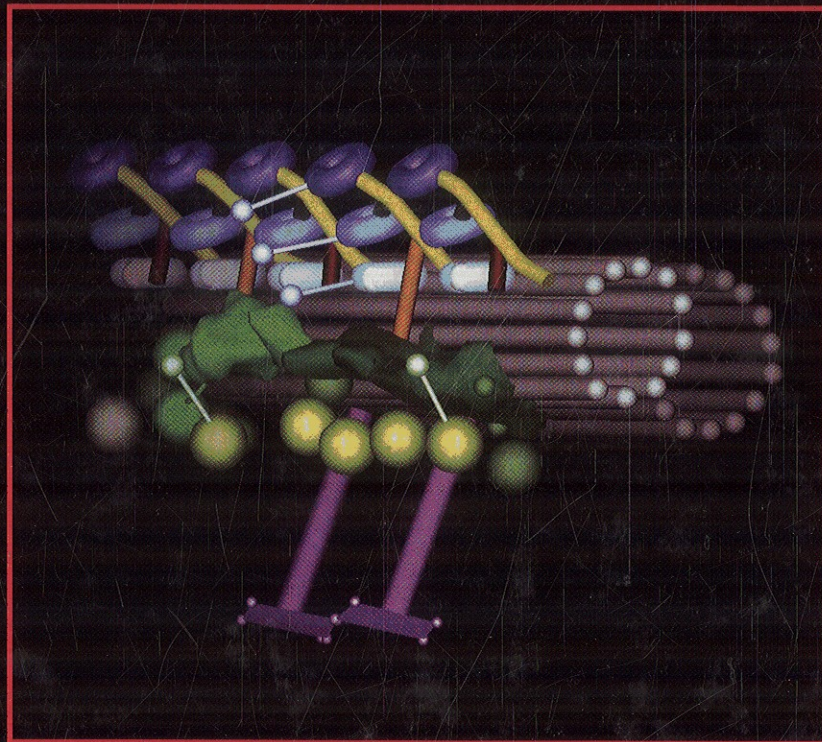
Chlamydomonas

Sourcebook

Second Edition

*Cell Motility
and Behavior*

Volume 3



Edited by George B. Witman



Contents of Volume 3

Preface.....	xi
Acknowledgments.....	xiii
List of Contributors.....	xv
Conventions Used.....	xvii
Abbreviations.....	xix
List of Tables.....	xxi
List of Figures.....	xxiii
Contents of Volume 1.....	xxix
Contents of Volume 2.....	xxx

CHAPTER 1 A Stroll through Time with <i>Chlamydomonas</i>	1
<i>Joel Rosenbaum</i>	

CHAPTER 2 Basal Bodies and Associated Structures	15
<i>Susan K. Dutcher</i>	
I. Introduction.....	16
II. Fibers attached to the basal bodies.....	19
III. Global approaches to the identification of basal body proteins.....	22
IV. Mutations that alter basal bodies.....	23
V. Mutations in basal body segregation.....	28
VI. DNA in the basal body.....	29
VII. Function of basal bodies.....	29
VIII. Duplication of basal bodies.....	34
IX. Genes with connections to human disease.....	36
X. Conclusion.....	37
References.....	37

CHAPTER 3 Deflagellation.....43*Lynne M. Quarmby*

I. Introduction.....	43
II. Deflagellation: key tool of flagellar research.....	44
III. Why do cells deflagellate?.....	46
IV. Signaling pathways to deflagellation.....	48
V. The mechanism of flagellar severing.....	54
VI. Deflagellation and the cell cycle.....	61
VII. Summary and thoughts for future directions.....	63
References.....	64

CHAPTER 4 Intraflagellar Transport.....71*Douglas G. Cole*

I. The identification of intraflagellar transport.....	71
II. IFT machinery.....	75
III. Visualization of IFT.....	89
IV. Functional analysis of <i>Chlamydomonas</i> IFT.....	95
V. Summary.....	104
References.....	104

CHAPTER 5 Flagellar Length Control.....115*Paul A. Lefebvre*

I. Introduction.....	115
II. Genetic evidence for a flagellar length control mechanism.....	117
III. LF4: an unusual MAP kinase.....	119
IV. LF1, LF2, LF3: partners in the Length Regulatory Complex.....	119
V. What other genes are involved in flagellar length control?.....	121
VI. Models for flagellar length control.....	123
VII. Questions about flagellar length control.....	125
VIII. Conclusion and future directions.....	126
References.....	127

CHAPTER 6 Axonemal Dyneins: Assembly, Structure, and Force Generation.....131*Stephen M. King and Ritsu Kamiya*

I. Introduction.....	132
II. Arrangement of dyneins in the axoneme.....	132
III. Dynein genetics.....	136

IV. Composition and physical properties of purified dyneins	142
V. Other components that affect dynein assembly and/or function	183
VI. Preassembly of dyneins in the cytoplasm	186
VII. Molecular mechanism of force generation	187
VIII. Conclusions and prospects	191
Acknowledgments	191
References	191
CHAPTER 7 The Flagellar Radial Spokes	209
<i>Pinfen Yang and Elizabeth F. Smith</i>	
I. Introduction	209
II. Genetic dissection of the radial spokes	210
III. Biochemical characterization of radial spokes and spoke proteins	214
IV. Assembly of the radial spoke complex	221
V. Radial spoke function: part of the control system for regulating flagellar beating	223
VI. Future directions	228
References	229
CHAPTER 8 The Flagellar Central Pair Apparatus	235
<i>David R. Mitchell</i>	
I. Introduction	235
II. Central pair structure	236
III. Genetic dissection of central pair structure and function	239
IV. Biochemical identification of central pair proteins	242
V. Central pair regulation of flagellar motility	244
VI. Future directions	247
References	248
CHAPTER 9 The Regulation of Axonemal Bending	253
<i>Maureen Wirschell, Daniela Nicastro, Mary E. Porter and Winfield S. Sale</i>	
I. Introduction	253
II. Suppressor mutants and the DRC	256
III. The 96-nm axoneme repeat	262
IV. Regulation of flagellar motility by phosphorylation	267
V. Future directions	274
References	275

CHAPTER 10	Microtubule–Membrane Interactions in <i>Chlamydomonas</i> Flagella	283
	<i>William Dentler</i>	
	I. Introduction.....	284
	II. Ciliary bases and transition regions	284
	III. Lateral interactions in the axoneme	289
	IV. Capping structures link the microtubule ends to the membrane	294
	V. Summary.....	301
	Acknowledgment.....	301
	References.....	301
CHAPTER 11	The <i>Chlamydomonas</i> Flagellar Membrane and Its Dynamic Properties	309
	<i>Robert A. Bloodgood</i>	
	I. The flagellum as a membrane-bounded organelle	310
	II. The <i>Chlamydomonas</i> plasma membrane	311
	III. Structure of the flagellar membrane	316
	IV. Composition of the flagellar membrane	324
	V. Assembly and turnover of the flagellar membrane	335
	VI. Dynamic properties of the flagellar membrane.....	340
	VII. Summary.....	358
	References.....	359
CHAPTER 12	Flagellar Adhesion, Flagellar-Generated Signaling, and Gamete Fusion during Mating.....	369
	<i>William J. Snell and Ursula W. Goodenough</i>	
	I. Introduction.....	370
	II. Flagellar agglutination	374
	III. Flagellar-generated signaling.....	380
	IV. Gamete fusion	385
	V. Evolutionary perspectives	389
	References.....	390
CHAPTER 13	Sensory Photoreceptors and Light Control of Flagellar Activity	395
	<i>Peter Hegemann and Peter Berthold</i>	
	I. Behavioral light responses	396
	II. The <i>Chlamydomonas</i> eye.....	401
	III. Photocurrents as rapid light signaling elements	404
	IV. Rhodopsins as photoreceptors for behavioral responses.....	410
	V. Blue-light sensitive flavin-based photoreceptors	418

VI. Summary and future prospects..... 421
 Acknowledgments 422
 References..... 422

CHAPTER 14 Mitosis and Cytokinesis.....431

Wallace F. Marshall
 I. Introduction..... 431
 II. Mitosis..... 433
 III. Cytokinesis 438
 IV. Perspectives 440
 References..... 441

CHAPTER 15 The *Chlamydomonas* Flagellum as a Model for Human Ciliary Disease445

Gregory J. Pazour and George B. Witman
 I. Introduction..... 445
 II. Primary ciliary dyskinesia..... 447
 III. Hydrocephalus 451
 IV. Juvenile myoclonic epilepsy 453
 V. Situs inversus 455
 VI. Polycystic kidney disease..... 457
 VII. Syndromes involving primary cilia 461
 VIII. Retinal degeneration and blindness 465
 IX. Cancer 466
 X. Conclusion 467
 Acknowledgments 468
 References..... 468