

The background of the cover is a detailed microscopic image of diatoms, showing their characteristic silica-based cell walls and intricate patterns. The diatoms are arranged in various orientations, some showing their elongated, boat-like shapes with internal structures visible.

Fourth Edition

Robert Edward Lee

# Phycology

CAMBRIDGE



# Contents

<i>Preface to the first edition</i>	page ix
<b>Part I Introduction</b>	1
1 Basic characteristics of the algae	3
Structure of the algal cell	3
Nutrition	23
Gene sequencing and algal systematics	24
Classification	24
Algae and the fossil record	26
References	27
<b>Part II The prokaryotic algae</b>	31
2 Cyanobacteria	33
Morphology	33
Cell wall and gliding	33
Pili and twitching	36
Sheaths	37
Protoplasmic structure	38
Gas vacuoles	41
Pigments and photosynthesis	43
Akinetes	45
Heterocysts	46
Nitrogen fixation	49
Circadian rhythms	52
Asexual reproduction	53
Growth and metabolism	55
Symbiosis	56
Ecology of cyanobacteria	59
Cyanotoxins	65
Cyanobacteria and the quality of drinking water	66
Utilization of cyanobacteria as food	67
Cyanophages	67
Secretion of antibiotics and siderophores	68
Calcium carbonate deposition and fossil record	69
Classification	71
References	74
<b>Part III Evolution of the chloroplast</b>	81
3 Glaucophyta	85
References	88
4 Rhodophyta	89
Cell structure	89
Calcification	93

Secretory cells	95
Iridescence	96
Epiphytes and parasites	96
Defense mechanisms of the red algae	98
Commercial utilization of red algal mucilages	99
Reproductive structures	101
Spore motility	106
Classification	107
References	132
<b>5 Chlorophyta</b>	<b>139</b>
Cell structure	139
Phototaxis and eyespots	141
Asexual reproduction	143
Sexual reproduction	143
Classification	144
Prasinophyceae	150
Charophyceae	154
Classification	155
Ulvophyceae	168
Classification	168
Chlorophyceae	189
Classification	191
References	226
<b>Part IV Evolution of one membrane of chloroplast endoplasmic reticulum</b>	<b>239</b>
<b>6 Euglenophyta</b>	<b>245</b>
Nucleus and nuclear division	248
Eyespot, paraflagellar swelling, and phototaxis	250
Muciferous bodies and extracellular structures	253
Chloroplasts and storage products	255
Nutrition	255
Classification	256
References	259
<b>7 Dinophyta</b>	<b>262</b>
Cell structure	263
Resting spores or cysts or hypnospores and fossil Dinophyceae	277
Toxins	279
Dinoflagellates and oil and coal deposits	284
Bioluminescence	285
Rhythms	287
Heterotrophic dinoflagellates	291
Symbiotic dinoflagellates	295
Classification	296
References	303

8	Apicomplexa	310
	References	313
<b>Part V</b> Evolution of two membranes of chloroplast endoplasmic reticulum and the Chlorarachniophyta		
9	Cryptophyta	321
	Cell structure	321
	Ecology	325
	Symbiotic associations	326
	Classification	326
	References	330
10	Heterokontophyta, Chrysophyceae	333
	Cell structure	333
	Statospores	337
	Nutrition	339
	Ecology	339
	Classification	341
	References	346
11	Heterokontophyta, Synurophyceae	349
	Classification	350
	References	353
12	Heterokontophyta, Eustigmatophyceae	354
	References	356
13	Heterokontophyta, Pinguiphyceae	357
	References	358
14	Heterokontophyta, Dictyochophyceae	359
	Classification	359
	References	364
15	Heterokontophyta, Pelagophyceae	365
	References	366
16	Heterokontophyta, Bolidophyceae	368
	References	368
17	Heterokontophyta, Bacillariophyceae	369
	Cell structure	369
	Motility	378
	Resting spores and resting cells	382
	Auxospores	383
	Rhythmic phenomena	386
	Physiology	387
	Chemical defense against predation	390
	Ecology	391

	Fossil diatoms	395
	Classification	398
	References	404
18	Heterokontophyta, Raphidophyceae	409
	References	412
19	Heterokontophyta, Xanthophyceae	413
	Cell structure	413
	Asexual reproduction	415
	Sexual reproduction	416
	References	422
20	Heterokontophyta, Phaeothamniophyceae	424
	References	425
21	Heterokontophyta, Phaeophyceae	426
	Cell structure	427
	Life history	431
	Classification	433
	References	475
22	Prymnesiophyta	484
	Cell structure	484
	Scales and coccoliths	490
	Toxins	496
	Classification	498
	References	500
23	Algae and the environment	504
	Toxic algae	504
	Toxic algae and the end-Permian extinction	510
	Cooling of the Earth, cloud condensation nuclei, and DMSP	511
	Chemical defense mechanisms of algae	511
	The Antarctic and Southern Ocean	513
	The grand experiment	514
	Antarctic lakes as a model for life on the planet Mars or Jupiter's moon Europa	515
	Ultraviolet radiation, the ozone hole and sunscreens produced by algae	517
	Hydrogen fuel cells and hydrogen gas production by algae	517
	References	519
	<i>Glossary</i>	521
	<i>Index</i>	534