

Contents

Part I Social Evolution 2

- 1 The Morality of the Gene 3
- 2 Elementary Concepts of Sociobiology 7
 - The Multiplier Effect 11
 - The Evolutionary Pacemaker and Social Drift 13
 - The Concept of Adaptive Demography 14
 - The Kinds and Degrees of Sociality 16
 - The Concept of Behavioral Scaling 19
 - The Dualities of Evolutionary Biology 21
 - Reasoning in Sociobiology 27
- 3 The Prime Movers of Social Evolution 32
 - Phylogenetic Inertia 33
 - Ecological Pressure 37
 - The Reversibility of Social Evolution 62
- 4 The Relevant Principles of Population Biology 63
 - Microevolution 64
 - Heritability 68
 - Polygenes and Linkage Disequilibrium 70
 - The Maintenance of Genetic Variation 70
 - Phenodeviants and Genetic Assimilation 72
 - Inbreeding and Kinship 73
 - Assortative and Disassortative Mating 80
 - Population Growth 80
 - Density Dependence 82
 - Intercompensation 89
 - Population Cycles of Mammals 90
 - Life Tables 90
 - The Stable Age Distribution 92
 - Reproductive Value 93
 - Reproductive Effort 95
 - The Evolution of Life Histories 96
 - r and K Selection 99
 - The Evolution of Gene Flow 103
- 5 Group Selection and Altruism 106
 - Group Selection 106
 - Interdemic (Interpopulation) Selection 107
 - Kin Selection 117
 - Reciprocal Altruism 120
 - Altruistic Behavior 121
 - The Field of Righteousness 129

Part II Social Mechanisms 130**6 Group Size, Reproduction, and Time-Energy Budgets 131**

The Determinants of Group Size 132

Adjustable Group Size 137

The Multiplication and Reconstitution of Societies 138

Time-Energy Budgets 142

7 The Development and Modification of Social Behavior 144

Tracking the Environment with Evolutionary Change 145

The Hierarchy of Organismic Responses 151

Tracking the Environment with Morphogenetic Change 152

Nongenetic Transmission of Maternal Experience 152

Hormones and Behavior 153

Learning 156

Socialization 159

Play 164

Tradition, Culture, and Invention 168

Tool Using 172

8 Communication: Basic Principles 176

Human versus Animal Communication 177

Discrete versus Graded Signals 178

The Principle of Antithesis 179

Signal Specificity 181

Signal Economy 183

The Increase of Information 185

The Measurement of Communication 194

The Pitfalls of Information Analysis 199

Redundancy 200

9 Communication: Functions and Complex Systems 201

The Functions of Communication 202

The Higher Classification of Signal Function 216

Complex Systems 218

10 Communication: Origins and Evolution 224

The Sensory Channels 231

Evolutionary Competition among Sensory Channels 240

11 Aggression 242

Aggression and Competition 243

The Mechanisms of Competition 244

The Limits of Aggression 247

The Proximate Causes of Aggression 248

Human Aggression 254

12 Social Spacing, Including Territory 256

Individual Distance 257

A "Typical" Territorial Species 259

The History of the Territory Concept 260

The Multiple Forms of Territory 261

The Theory of Territorial Evolution 266

Special Properties of Territory 270

Territories and Population Regulation 274

Interspecific Territoriality 276

13 Dominance Systems 279

History of the Dominance Concept 281

Examples of Dominance Orders 282

Special Properties of Dominance Orders 286

The Advantages of Being Dominant 287

The Compensations of Being Subordinate 290

The Determinants of Dominance 291

Intergroup Dominance 295

Interspecific Dominance 296

Scaling in Aggressive Behavior 296

14 Roles and Castes 298

The Adaptive Significance of Roles 299

The Optimization of Caste Systems 300

Roles in Vertebrate Societies 309

Roles in Human Societies 312

15 Sex and Society 314

The Meaning of Sex 315

Evolution of the Sex Ratio 316

Sexual Selection 318

The Theory of Parental Investment 324

The Origins of Polygamy 327

The Origins of Monogamy and Pair Bonding 330

Communal Displays 331

Other Ultimate Causes of Sexual Dimorphism 334

16 Parental Care 336

The Ecology of Parental Care 336

Parent-Offspring Conflict 341

Parental Care and Social Evolution in the Insects 344

Parental Care and Social Evolution in the Primates 346

Other Animal Ontogenies 348

- Alloparental Care 349
Adoption 352
- 17 Social Symbioses 353
Social Commensalism 354
Social Mutualism 356
Parabiosis 358
Mixed Species Groups in Vertebrates 358
Trophic Parasitism 361
Xenobiosis 362
Temporary Social Parasitism in Insects 362
Brood Parasitism in Birds 364
Slavery in Ants 368
Inquilinism in Ants 371
The General Occurrence of Social Parasitism in Insects 373
Breaking the Code 375
- Part III The Social Species 378**
- 18 The Four Pinnacles of Social Evolution 379
- 19 The Colonial Microorganisms and Invertebrates 383
The Adaptive Basis of Coloniality 386
General Evolutionary Trends in Coloniality 387
Slime Molds and Colonial Bacteria 387
The Coelenterates 393
The Ectoprocts 394
- 20 The Social Insects 397
What Is a Social Insect? 398
The Organization of Insect Societies 399
The Prime Movers of Higher Social Evolution in Insects 415
The Social Wasps 418
The Ants 421
The Social Bees 428
The Termites 433
- 21 The Cold-Blooded Vertebrates 438
Fish Schools 438
The Social Behavior of Frogs 442
The Social Behavior of Reptiles 444
- 22 The Birds 448
The Crotophaginae 450
The Jays 451
- 23 Evolutionary Trends within the Mammals 456
General Patterns 468
The Whiptail Wallaby (*Macropus parryi*) 469
The Black-tail Prairie Dog (*Cynomys ludovicianus*) 472
Dolphins 473
- 24 The Ungulates and Elephants 479
The Ecological Basis of Social Evolution 484
Chevrotains (Tragulidae) 486
The Vicuña (*Vicugna vicugna*) 486
The Blue Wildebeest (*Connochaetes taurinus*) 490
The African Elephant (*Loxodonta africana*) 491
- 25 The Carnivores 499
The Black Bear (*Ursus americanus*) 502
The Coati (*Nasua narica*) 502
The Lion (*Panthera leo*) 504
Wolves and Dogs (Canidae) 504
- 26 The Nonhuman Primates 514
The Distinctive Social Traits of Primates 514
The Ecology of Social Behavior in Primates 518
The Lesser Mouse Lemur (*Microcebus murinus*) 526
The Orang-utan (*Pongo pygmaeus*) 526
The Dusky Titi (*Callicebus moloch*) 527
The White-Handed Gibbon (*Hylobates lar*) 528
The Mantled Howler (*Alouatta villosa*) 529
The Ring-Tailed Lemur (*Lemur catta*) 530
The Hamadryas Baboon (*Papio hamadryas*) 531
The Eastern Mountain Gorilla (*Gorilla gorilla beringei*) 535
The Chimpanzee (*Pan troglodytes*) 539
- 27 Man: From Sociobiology to Sociology 547
Plasticity of Social Organization 548
Barter and Reciprocal Altruism 551
Bonding, Sex, and Division of Labor 553
Role Playing and Polyethism 554
Communication 555
Culture, Ritual, and Religion 559
Ethics 562
Esthetics 564
Territoriality and Tribalism 564
Early Social Evolution 565
Later Social Evolution 569
The Future 574
- Glossary 577
Bibliography 599
Index 665