
Contents

Introduction	x ⁱ
Philippe GRANDCOLAS and Marie-Christine MAUREL	
Chapter 1. Symmetry of Shapes in Biology: from D'Arcy Thompson to Morphometrics	1
Sylvain GERBER and Yoland SAVRIAMA	
1.1. Introduction	1
1.2. D'Arcy Thompson, symmetry and morphometrics	2
1.3. Isometries and symmetry groups	4
1.4. Biological asymmetries	5
1.5. Principles of geometric morphometrics	6
1.6. The treatment of symmetry in morphometrics	8
1.7. Some examples of applications	12
1.8. Conclusion	13
1.9. References	14
Chapter 2. Impact of a Point Mutation in a Protein Structure	17
Mathilde CARPENTIER and Jacques CHOMILIER	
2.1. Composition	17
2.2. Folding	18
2.3. Substitution(s) in protein structures	20
2.4. Effect on overall structure and function	20
2.5. Effect on stability	22
2.6. Effect on the peptide backbone	23

2.7. Conclusion	28
2.8. References	28

Chapter 3. The Role of Taxonomy and Natural History in the Study of the Evolution of Eneopterinae Crickets 33

Tony ROBILLARD

3.1. Introduction	33
3.2. Taxonomy in modern comparative approaches	35
3.3. A model group	37
3.4. Contribution of taxonomy for phylogenetic reconstructions and classification	40
3.4.1. Monophyly	40
3.4.2. Recent taxonomic contributions	41
3.4.3. Phylogeny and taxonomy	42
3.5. Contribution of taxonomy to biogeography	44
3.5.1. New Caledonia	44
3.5.2. Southeast Asia	45
3.6. Taxonomic exploration and evolution of species traits	48
3.7. Conclusion	52
3.8. Acknowledgments	54
3.9. References	54

Chapter 4. Systematics in the (Post)genomic Era: A Look at the Drosophila Model 61

Amir YASSIN

4.1. Drosophila: a star of genetics but a systematic nebula	61
4.2. Subspecies: identification of “genomic islands of divergence”?	63
4.3. Species complexes: congruence between species trees and gene trees	67
4.4. Supraspecific ranks: phylogeny, genome and morphome	70
4.5. Conclusion	73
4.6. Acknowledgments	74
4.7. References	74

Chapter 5. Dealing with Multiple Environments: The Challenges of the Trypanosome Lifecycle 79

Estefanía CALVO ALVAREZ and Philippe BASTIN

5.1. Human African trypanosomiasis, the disease	79
5.2. Cell biology of <i>Trypanosoma brucei</i>	80

5.3. Survival and maturation of <i>T. brucei</i> in the tsetse vector	84
5.4. Adaptations of <i>T. brucei</i> to the mammalian host	92
5.5. Conclusion	99
5.6. References	99
Chapter 6. Challenges Inherent in the Systematics and Taxonomy of Genera that have Recently Experienced Explosive Radiation: The Case of Orchids of the Genus <i>Ophrys</i>	113
Joris BERTRAND, Michel BAGUETTE, Nina JOFFARD and Bertrand SCHATZ	
6.1. Introduction	114
6.2. Speciation in <i>Ophrys</i> : an evolutionary divergence seen as a reticulated continuum	115
6.2.1. Difficulty in applying the biological concept of the species in the case of <i>Ophrys</i>	115
6.2.2. Causes of reproductive isolation in <i>Ophrys</i>	117
6.2.3. Consequences of the implementation of reproductive isolation in the particular case of the genus <i>Ophrys</i>	118
6.3. Current state of knowledge on <i>Ophrys</i> systematics	121
6.3.1. Molecular systematics: overview of current knowledge	121
6.3.2. Molecular systematics in the age of phylogenomics	124
6.4. Integrative genomics and taxonomy: perspectives and issues	125
6.4.1. Moving towards a generalization of data sets at the genomic scale	125
6.4.2. Integrative taxonomy approach	127
6.5. Conclusion	129
6.6. Acknowledgments	130
6.7. References	130
Chapter 7. Exploration and Origins of Biodiversity in Madagascar: The Message of Ferns	135
Germinal ROUHAN and Myriam GAUDEUL	
7.1. Introduction	135
7.2. Madagascar: a complex biogeographical context	136
7.2.1. An insular continental territory that is not so isolated	136
7.2.2. Gradients, ecosystem diversity and biodiversity	138
7.3. Ferns and lycophytes: an ideal model for the biogeography of Madagascar	140
7.4. Origins of the lineages of ferns in Madagascar	140
7.4.1. Multiple long-distance dispersions	140
7.4.2. The Neotropics: a non-exclusive but preponderant role	141

7.4.3. Africa: a truly minimal role or an underestimated role?	141
7.5. The example of <i>Rumohra</i> : dispersions to Madagascar and around the world	142
7.6. Conclusion	144
7.7. References	144
Chapter 8. Mediterranean and Atlantic Algae, a Fraternal Relationship?	147
Line LE GALL, Delphine GEY and Florence ROUSSEAU	
8.1. Introduction	148
8.1.1. Seaweeds	148
8.1.2. The systematics of algae	148
8.1.3. Algae distribution on a global scale	149
8.1.4. Seaweeds on the Atlantic and Mediterranean coasts	150
8.1.5. Challenge of the study	151
8.2. Materials and methods	152
8.2.1. Sampling strategy	152
8.2.2. Acquisition of molecular data	158
8.2.3. Analysis of phylogenetic relationships between Atlantic and Mediterranean specimens	158
8.3. Results	159
8.4. Discussion	163
8.5. Acknowledgments	164
8.6. References	165
Chapter 9. Ontogeny and Evolution of the Hyperorgan of Delphinieae	171
Florian JABBOUR, Julie ZALKO, Antoine MOREL, Samuel FRACHON and Isabelle BOUCHART-DUFAY	
9.1. Introduction	171
9.2. Synorganization: a concept, definitions	172
9.2.1. Adolf Remane and the synorganization of animal structures	172
9.2.2. A concept adopted by botanists, and by flower specialists in particular	173
9.2.3. A concept to be limited organically, and to be placed in a phylogenetic framework	173
9.3. Ontogeny and evolution of the hyperorgan of Delphinieae	174
9.3.1. Disparity of the hyperorgan in the tribe	174
9.3.2. Ontogeny of the synorganized structure	177
9.3.3. Evolving trends and convergences	177

9.4. The study of synorganization in evolutionary biology	178
9.4.1. Lessons learned from the synorganization study	178
9.4.2. Scientometrics to measure the impact of the concept of synorganization in evolutionary biology	179
9.4.3. Synchronization, integration, co-adaptation, redundant concepts?	179
9.5. Conclusion	181
9.6. Acknowledgments	181
9.7. References	182
Chapter 10. Identification of Interspecific Chromosomal Homologies: Chromosomal Microdissection and Chromosomal Painting in Antarctic Teleosts Nototheniidae	185
Juliette AUVINET, Agnès DETTAI, Olivier CORITON, Catherine OZOUF-COSTAZ and Dominique HIGUET	
10.1. Introduction	185
10.1.1. Homologies, painting and chromosomal microdissection	185
10.1.2. ICH research in Nototheniidae	189
10.2. Materials and methods	191
10.2.1. Materials	191
10.2.2. Methods	192
10.3. Results	195
10.3.1. Microdissection	195
10.3.2. Painting	197
10.4. Discussion	199
10.4.1. Technical aspects developed and prospects for improvement of the painting signal	199
10.4.2. The largest pair of chromosomes of <i>T. pennellii</i> , the product of two chromosomal fusions (roberstonian and tandem)	202
10.5. Conclusion	204
10.6. References	205
List of Authors	215
Index	221