

Contents

- 1 What Is the Outcome of Evolution? 1**
- 2 The Problem of Macroevolutionary Trends..... 7**
 - 2.1 The Epistemological Problem..... 11
 - 2.2 The Ontological Problem 14
 - 2.3 A Biological Dilemma?..... 16
- 3 The Concept of Biological Autonomy 19**
 - 3.1 Systems Biology 19
 - 3.2 Autopoietic Systems..... 20
 - 3.3 Philosophical Description of Organismic Autonomy 22
 - 3.4 Robustness 23
 - 3.5 Homeostasis 26
 - 3.6 Time Autonomy 27
 - 3.7 Organisms as Hierarchically Ordered Systems..... 28
 - 3.8 Autonomy and Evolution 32
 - 3.9 Definition of Increasing Autonomy 36
- 4 The Major Transitions in Early Evolution 41**
 - 4.1 The First Cells 41
 - 4.2 From Prokaryotes to Eukaryotes..... 44
 - 4.3 Origin of the Metazoa 50
 - 4.3.1 The ECM..... 52
 - 4.3.2 The Epithelial Boundary 53
 - 4.3.3 Internalized Cells 55
 - 4.3.4 Cell Differentiation 56
 - 4.3.5 Formation of Interior Cavities 57
 - 4.3.6 Size Increase 58
 - 4.4 Comparison of Presumed Early Stages..... 59
 - 4.4.1 Sponges..... 60
 - 4.4.2 Placozoans 61

4.4.3	Cnidarians	62
4.4.4	The Triploblastic Organization	64
4.5	Closing Remarks	65
5	The Cambrian Explosion and Thereafter	69
5.1	Body Size and Movement Capacity During the Cambrian Explosion.....	71
5.2	Size and Movement in Extant Animals	74
5.3	Skins.....	78
5.4	Respiratory Organs	85
5.5	Circulatory Systems	88
5.6	Body Cavities.....	92
5.7	What Is Special About Chordates?	96
5.8	Adjustments for Movement on Land	100
6	Fluid Management in Animals.....	111
6.1	Vertebrates.....	116
6.2	Amniotes	117
6.3	The Kidney as an Organ of Autonomy	120
7	Reproduction	123
7.1	The Origin of the Amnion.....	124
7.2	Evolution of Viviparity.....	126
8	Nervous Systems and the Flexibility of Movements	131
8.1	The Uncoupling of Central Pattern Generators.....	135
8.2	Increasing Flexibility via Differentiation of the Motor System.....	137
8.3	Increasing Control of Movements via the Brain	140
8.4	The Pyramidal Tract.....	143
9	Endothermy	149
9.1	Theories of the Evolution of Endothermy.....	150
9.2	The Functional Complex.....	152
9.3	A Functional Complex for Autonomy	155
10	The Evolution of Brains and Behavior: Is There a Trend?	161
10.1	Allometric Studies of the Brain of Vertebrates	163
10.2	The Relation Between Brain Organization and Flexible Behavior	169
10.3	Learning	171
10.4	Play	175
10.5	Imitation	179
10.6	Tool Use	183
10.7	Insight	186
10.8	Empathy	188
10.9	Self-Awareness.....	191
10.10	Language.....	192

10.11	Brain Size and Flexibility of Behavior	194
10.12	Humans	196
10.13	A Bridge Between Motoric and Mental Play?.....	202
10.14	Emotions	205
11	The Evolution of Man	209
11.1	Special Features of Autonomy in Humans.....	211
11.2	Neuronal Specialties	215
11.3	Animals and Man	220
11.4	A Final Look at Animals.....	223
12	Conclusion and Implications	225
12.1	Questions for Further Research	229
12.2	The Present Situation of Evolutionary Theory	232
12.3	New Concepts in Genetics	233
12.4	Epigenetic Inheritance	235
12.5	Developmental Plasticity	236
12.6	Facilitated Variation	237
12.7	“Bernard Machines”.....	241
12.8	Evo-Devo	243
12.9	Niche Construction	244
12.10	Increasing Diversity and Complexity.....	245
12.11	Symbiosis and Horizontal Gene Transfer	246
12.12	Patterns and Factors of Evolution	248
	References	253
	Author Index	279
	Subject Index	287

On the Origin of Autonomy

A New Look at the Major Transitions in Evolution

Rosslenbroich, B.

2014, XII, 297 p. 61 illus., Hardcover

ISBN: 978-3-319-04140-7