

## Contents

Dedication: Werner Callebaut vii

Series Foreword ix

Foreword: The Evolution of Multicellularity xi

John Tyler Bonner

Preface xxi

### **I FUNCTIONAL AND MOLECULAR PREDISPOSITIONS TO MULTICELLULARITY 1**

#### **1 Fossils, Feeding, and the Evolution of Complex Multicellularity 3**

Andrew H. Knoll and Daniel J. G. Lahr

#### **2 Alternative Splicing, Intrinsically Disordered Proteins, Calmodulin, and the Evolution of Multicellularity 17**

Karl J. Niklas and A. Keith Dunker

### **II PLANTS AND RELATED THEORY 41**

#### **3 The Mechanistic Basis for the Evolution of Soma during the Transition to Multicellularity in the Volvocine Algae 43**

Stephan G. König and Aurora M. Nedelcu

#### **4 Physicochemical Factors in the Organization of Multicellular Aggregates and Plants 71**

Juan Antonio Arias del Angel, Eugenio Azpeitia, Mariana Benítez, Ana E.  
Escalante, Valeria Hernández-Hernández, and Emilio Mora Van Cauwelaert

#### **5 Angiosperm Multicellularity: The Whole, the Parts, and the Sum 87**

Ottoline Leyser

|            |                                                                                                                |            |
|------------|----------------------------------------------------------------------------------------------------------------|------------|
| <b>III</b> | <b>AMOEBOZOA, FUNGI, AND RELATED THEORY</b>                                                                    | <b>103</b> |
| <b>6</b>   | <b>Cellular Slime Mold Development as a Paradigm for the Transition from Unicellular to Multicellular Life</b> | <b>105</b> |
|            | Vidyanand Nanjundiah                                                                                           |            |
| <b>7</b>   | <b>Trade-offs Drive the Evolution of Increased Complexity in Nascent Multicellular Digital Organisms</b>       | <b>131</b> |
|            | Peter L. Conlin and William C. Ratcliff                                                                        |            |
| <b>8</b>   | <b>The Paths to Artificial Multicellularity: From Physics to Evolution</b>                                     | <b>149</b> |
|            | Salva Duran-Nebreda, Raúl Montañez, Adriano Bonforti, and Ricard Solé                                          |            |
| <b>IV</b>  | <b>METAZOA AND RELATED THEORY</b>                                                                              | <b>169</b> |
| <b>9</b>   | <b>What Are the Genomes of Premetazoan Lineages Telling Us about the Origin of Metazoa?</b>                    | <b>171</b> |
|            | Iñaki Ruiz-Trillo                                                                                              |            |
| <b>10</b>  | <b>Sponges as the Rosetta Stone of Colonial-to-Multicellular Transition</b>                                    | <b>185</b> |
|            | Maja Adamska                                                                                                   |            |
| <b>11</b>  | <b>A Scenario for the Origin of Multicellular Organisms: Perspective from Multilevel Consistency Dynamics</b>  | <b>201</b> |
|            | Kunihiko Kaneko                                                                                                |            |
| <b>12</b>  | <b>Multicellularity, the Emergence of Animal Body Plans, and the Stabilizing Role of the Egg</b>               | <b>225</b> |
|            | Stuart A. Newman                                                                                               |            |
| <b>V</b>   | <b>PHILOSOPHICAL ASPECTS OF MULTICELLULARITY</b>                                                               | <b>247</b> |
| <b>13</b>  | <b>Integrating Constitution and Interaction in the Transition from Unicellular to Multicellular Organisms</b>  | <b>249</b> |
|            | Argyris Arnellos and Alvaro Moreno                                                                             |            |
| <b>14</b>  | <b>Explaining the Origins of Multicellularity: Between Evolutionary Dynamics and Developmental Mechanisms</b>  | <b>277</b> |
|            | Alan C. Love                                                                                                   |            |
|            | Contributors                                                                                                   | 297        |
|            | Index                                                                                                          | 299        |