

CONTENTS

A NOTE ON THE REFERENCES ix

1 Introductory Section 1

- 1.1 INTRODUCTION: The Aims and Structure of This Book 3
- 1.2 KEY CONCEPTS IN MORPHOGENESIS 7
- 1.3 THE POWER AND LIMITATIONS OF MACROMOLECULAR SELF-ASSEMBLY 17

2 Cell Shape and the Cell Morphogenesis 31

- 2.1 MORPHOGENESIS OF INDIVIDUAL CELLS:
A Brief Overview 33
- 2.2 THE SHAPES OF ANIMAL CELLS: Tensegrity 41
- 2.3 CELLULAR MORPHOGENESIS IN ANIMALS 59
- 2.4 CELLULAR MORPHOGENESIS IN PLANTS 77

3 Cell Migration 93

- 3.1 CELL MIGRATION IN DEVELOPMENT: A Brief Overview 95
- 3.2 CELL MIGRATION: The Nano-Machinery of Locomotion 103
- 3.3 CELL MIGRATION: Navigation by Chemotaxis 119
- 3.4 CELL MIGRATION: Galvanotaxis 137
- 3.5 CELL MIGRATION: Navigation by Contact 149
- 3.6 CELL MIGRATION: Waypoint Navigation in the Embryo 167
- 3.7 CELL MIGRATION: Condensation 185

4	Epithelial Morphogenesis	197
4.1	THE EPITHELIAL STATE: A Brief Overview	199
4.2	EPITHELIAL MORPHOGENESIS: Neighbour Exchange and Convergent Extension	213
4.3	EPITHELIAL MORPHOGENESIS: Closure of Holes	223
4.4	INVAGINATION AND EVAGINATION: The Making and Shaping of Folds and Tubes	231
4.5	EPITHELIAL MORPHOGENESIS: Fusion of Epithelia	247
4.6	EPITHELIAL MORPHOGENESIS: Branching	259
5	Morphogenesis by Cell Proliferation and Death	289
5.1	GROWTH, PROLIFERATION, AND DEATH: A Brief Overview	291
5.2	MORPHOGENESIS BY ORIENTATED CELL DIVISION	311
5.3	MORPHOGENESIS BY ELECTIVE CELL DEATH	329
6	Conclusions and Perspectives	347
6.1	CONCLUSIONS AND PERSPECTIVES	349

4	Epithelial Morphogenesis	197
4.1	THE EPITHELIAL STATE: A Brief Overview	199
4.2	EPITHELIAL MORPHOGENESIS: Neighbour Exchange and Convergent Extension	213
4.3	EPITHELIAL MORPHOGENESIS: Closure of Holes	223
4.4	INVAGINATION AND EVAGINATION: The Making and Shaping of Folds and Tubes	231
4.5	EPITHELIAL MORPHOGENESIS: Fusion of Epithelia	247
4.6	EPITHELIAL MORPHOGENESIS: Branching	259
5	Morphogenesis by Cell Proliferation and Death	289
5.1	GROWTH, PROLIFERATION, AND DEATH: A Brief Overview	291
5.2	MORPHOGENESIS BY ORIENTATED CELL DIVISION	311
5.3	MORPHOGENESIS BY ELECTIVE CELL DEATH	329
6	Conclusions and Perspectives	347
6.1	CONCLUSIONS AND PERSPECTIVES	349