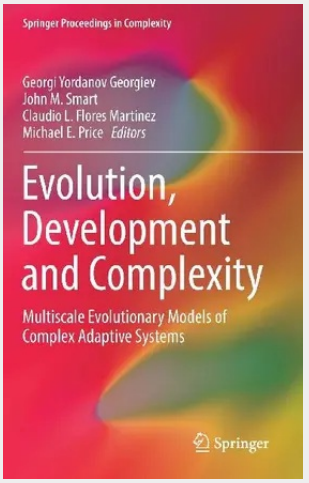
Georgiev / Smart / Flores Martinez

Evolution, Development and Complexity

Multiscale Evolutionary Models of Complex Adaptive Systems



This book explores the universe and its subsystems from the three lenses of evolutionary (contingent), developmental (predictable), and complex (adaptive) processes at all scales. It draws from prolific experts within the academic disciplines of complexity science, physical science, information and computer science, theoretical and evo-devo biology, cosmology, astrobiology, evolutionary theory, developmental theory, and philosophy.

The chapters come from a Satellite Meeting, "Evolution, Development and Complexity" (EDC) hosted at the Conference on Complex Systems, in Cancun, 2017. The contributions have been peer-reviewed and contributors from outside the conference were invited to submit chapters to ensure full coverage of the topics.

This book explores many issues within the field of EDC such as the interaction of evolutionary stochasticity and developmental determinism in biological systems and what they might teach us about these twin processes in other complex systems. This text will appeal to students and researchers within the complex systems and EDC fields.

Section 1- Universe.- Chapter 1- Cosmological Natural Selection and the Function of Life.- Chapter 2- Evolutionary Development: A Universal Perspective.- Chapter 3- Life, the Universe, and almost Everything: Signs of Cosmic Design?.- Chapter 4- Universal Ethics: Organized Complexity as an Intrinsic Value.- Chapter 5- Inductive Probabilities in Astrobiology and SETI: Have Sceptics Retreated?.- Section 2- Multiscale Complexity.- Chapter 6- The Equivalence of Free Energy and Information.- Chapter 7- A Multi-scale View of the Emergent Complexity of Life: A Free-energy Proposal.- Chapter 8- Action and Power Efficiency in Self-Organization: Growth Efficiency as a Cellular Objective in E. coli.- Chapter 9- On the Relation Between Swarm and Evolutionary Dynamics and Complex Networks.- Chapter 10- Universal Darwinism and the Origins of Order.- Section 3- Biology.- Chapter 11- Complexity, Development, and Evolution in Morphogenetic Collective Systems.- Chapter 12- Comparative Genomics of Convergent Evolution.- Chapter 13- Why Functional Genomics is Central Concern of Biology and the Hard Problem of Abiogenesis.- Chapter 14- Synergy and the Bioeconomics of Complexity.- Section 4- Society.- Chapter 15- Disease Surveillance: Design Principles from Immunology.- Chapter 16- Special Operations Forces as a Global Immune System.- Chapter 17- Applying Evolutionary Meta-Strategies to Human Problems.- Chapter 18- Complexity Dynamics in Small Groups.- Chapter 19- Religions as Complex Adaptive Systems.

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