

Biomimetic Technologies

Principles and Applications

Edited by Trung Dung Ngo

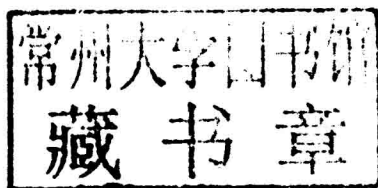
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Preface

Nature has been an unlimited source of inspiration for scientists, technologists, and business men to develop new scientific research methods and innovative technologies and applications that are far from what the human mind could have imagined and simulated. Through billions of years of natural selection, living organisms have evolved to adapt to their living environments. As a result, natural materials and structures over the test of time provide highly efficient and nontolerant solutions for technological development of man-made products.

Over half a century, biomimetics has been emerged to become the research discipline of studying biological characteristics and operational principles of living organisms for refining our knowledge in designing complex real-world systems. The formal method in biomimetics is usually conducted through three approaches of mimicry, replication, and imitation to transfer lessons learned from the biological science to technological solutions. New findings from this research field have successfully promoted technological development of innovative materials, sensors, actuators, and system integrations such as Velcro mimicked from burdock plant, shark skin mimicked nanotechnology materials, self-cleaning materials replicated from the surface of lotus plant, aircraft wings imitated from birds, or neural network-inspired cybernetics, and DaimlerChrysler concept vehicles with high fuel efficiency imitated from the shape of boxfish.

The goal of this edited book is to bring the current state of the art in the biomimetics field to light. The book is organized into 4 parts including 16 chapters. Part One focuses on biomimetic materials with emphases on synthetic methods of molecular biomimetics, fiber composites, and biomachine interface. In Part Two, the latest research results of biomimetic sensor technologies embracing tactile sensors, hair-based inertial sensors, gas sensing systems, and bat-inspired sonar system are extendedly presented. Part Three is dedicated to biomimetic actuators with the development of interpenetrating polymer networks-based actuators for the biological vision system, self-oscillating polymers and gels as materials for soft-actuators, and fabrication of biomimetic artificial muscles for dynamic agile robots. Part Four starts with the comprehensive review of artificial intelligence themes through symbolic connectionism and then extends with a specific example of central pattern generators for the robotic applications. The part is enriched a wide range of bio-inspired applications including biologically inspired coordination of multi-robot systems, up-to-date technologies of climbing robots, and biological rhythm generation of micro-quadruped robot locomotion, and *Ormia*-inspired antenna array design.

Although this book is only a small collection of the up-to-date research activities on biomimetic technologies, it certainly covers the important portion of what have been

recently done in the field. As such, this book can serve as a valuable source for students, researchers, and scientists interested in the emerging interdisciplinary research area.

This book is suitable for graduate students and researchers who have general interests in biomimetic technologies including robotics, cybernetics, design of sensors and actuators, complex system integration, and artificial intelligence. For researchers with some experiences in the field, you can read each chapter mostly independently. However, graduate students are recommended to read through the book to obtain the overview of this growing research field.

This book would not have been done without great contributions of all authors and the well-organized plan of the editorial project management board of Woodhead Publishing Ltd. I would like to express my special thanks to all authors for high-quality chapters contributed to this book. I would like to extend my sincere thanks to all members of the editorial management board involved in this project.

Trung Dung Ngo

Contents

Contributors	xi
Woodhead Publishing Series in Electronic and Optical Materials	xv
Preface	xxi

Part One Principles and Materials for Biomimetic Technologies	1
1 Synthesis of molecular biomimetics	3
<i>F.T.C. Moreira, J.R.L. Guerreiro, L. Brandão, M.G.F. Sales</i>	
1.1 Introduction	3
1.2 Building blocks	4
1.3 Bottom-up arrangement	10
1.4 Supramolecular organization	16
1.5 Conclusions and perspectives	23
References	24
2 Bio-inspired fiber composites	33
<i>C. Santulli</i>	
2.1 Introduction	33
2.2 Biological materials	34
2.3 Sources of bio-inspiration	35
2.4 Multifunctional bio-inspired composites	38
2.5 Difficulties in applying bio-inspiration to composites: the case of superhydrophobicity	45
2.6 Conclusions and future perspectives	45
References	47
3 Solving the bio-machine interface—a synthetic biology approach	53
<i>O. Yarkoni, D.J. Frankel</i>	
3.1 Introduction	53
3.2 Definition of the bio-machine interface	53
3.3 Historical perspective	54
3.4 Cells as biosensors	55
3.5 Difficulties in addressing the bio-electronic interface	57
3.6 Synthetic biology applied to the bio-electronic interface	58
3.7 Genetic programs that perform signal processing	59