

Book Review

Biomimetics: Nature-Based Innovation

By Dr. Yoseph Bar-Cohen (Ed.), CRC Press, Taylor & Francis Group
Boca Raton, 2011 ISBN 978-1-4398-3476-3 (eBook 978-1-14398-3477-0)
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"Nature is a effectively a giant laboratory where trial and error experiments ... led to an enormous pool of inventions." Yoseph Bar-Cohen, in the Preface

Motivation. Biomimicry is both a long standing design approach and a rapidly emerging field. The book is intended to be a comprehensive review of the state-of-the-art of biomimicry principles, methods, practices, and results across a wide and diverse set of the research and application areas of nature-based solutions. The book is a follow-up to Bar-Cohen's 2005 *Biomimetics: Biologically Inspired Technologies*. The book recognizes the breadth of potential biomimicry areas, and the considerations and challenges within these areas. The book attempts to methodically document progress, issues, and visions across these areas. The stated goal is to serve as reference book for scientists and engineers.



The Editor Dr. Bar-Cohen is a physicist, Senior Research Scientist, and Supervisor of the Advanced Technologies Group at the Jet Propulsion Laboratory in Pasadena, California. He holds 25 patents, has co-edited or coauthored eight books, has coauthored more than 350 articles, and has received numerous awards. He is also the editor of the recently established CRC Press Series in Biomimetics. **The Contributing Authors** include 75 different scholars and leading experts from the United States and five other countries..

The Target Audiences is intentionally broad: scholars, students, scientists, engineers, and inventors—both as individuals and as teams. In other words, the book is for anyone who could potentially benefit from a deeper understanding of data and solution concepts exhibited by 'nature's inventions.'

Structure and Content. Bar-Cohen wraps the 18 topical chapters with an insightful introduction and a concluding, thought-provoking futures chapter. The topical chapters use materials, physics, chemistry, architecture, and other engineering perspectives to discuss: Sensing ♦ Optics ♦ Cell Material Interfaces ♦ Artificial Muscles ♦ Self Repair ♦ Self Reproduction ♦ Composites ♦ Electrostatic Polymer Actuators ♦ Robotics ♦ Swimming ♦ Flying ♦ Medical Implants and Devices ♦ Biomimetic Products. Each chapter is analytic and is data and idea intensive. For example, the products chapter begins with a discussion of the biomimetic product development process—and then proceeds to describe 10 different product categories. The chapter provides insight into a multitude of ways to consider and apply the evolutionary inventiveness achieved by nature.

The book raises a host of interesting questions. e.g.: Is it coincidence that furniture and many animals have four legs? Could fishing nets have been patterned after spider webs? Are umbrellas inspired by the way flowers close up? Are the salad tongs, or the tweezers, we use inspired by bird beaks? What are the technical challenges of mimicking the characteristics and behavior of an octopus?

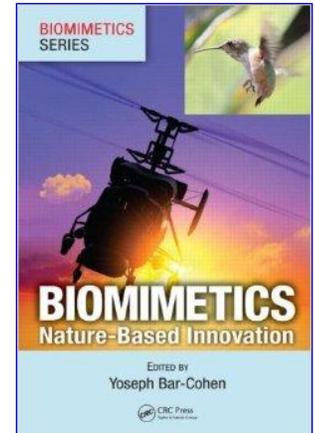
Usability is excellent! The book shows real understanding of how a reference book will be used. Each chapter begins with a third- or fourth-level outline—which will greatly assist *re*-finding specific content. Most chapters (unfortunately not all) have strong introductions and end with a conclusions section. Chapters are rich in references, include numerous images (some in color), and list a set of related web sites. The index is extensive, e.g., more than 140 entries under A alone. The book uses engineering perspectives and terminology throughout. I was most impressed by the range of biomimicry accomplishments and opportunities, and by the level of detail in the discussions.

Availability and Additional Information. This 788-page book is listed at \$180 (eBook: \$126) by CRCPress.com. It is also available from Amazon. The front matter is downloadable from CRC. An 'abstract' [first page] for each chapter is viewable from CRC Press under Other eBook Options.

Should You Buy This Book? Possibly. Look first at the front matter and chapter abstracts, then decide. For the INCOSE community, I would suggest this book for: 1) anyone with a budding interest or assigned responsibilities that are related to biological inspired design or innovation, 2) anyone that has responsibilities for technology assessment or planning, or advanced systems concept development as part of interdisciplinary teams, and 3) members of the INCOSE Corporate Advisory Board—who could/should refer this book to appropriate groups within their organizations.

In Closing. Mr. Spock would state unemotionally: "fascinating." I would say "*fascinating!*" with much more emotion. I like this book! It is inspiring! It is relevant! It is designed to be a repeatedly useful reference. It uses engineering perspectives and terminology. The book can be a continuing source for awareness and appreciation of the diversity of biomimetic opportunities and accomplishments, as well as for the depth of challenges of nature-based innovations. I view it as a useful resource for the SE community, especially for anyone involved with technology assessment and advanced systems concept development.

"The inspiration of nature is expected to continue growing and to enable technological improvements with impacts on every aspect of our lives. However, there are many challenges..." — Yoseph Bar-Cohen



Nature as R&D Lab. What's missing is a systematic way of capturing nature's creativity, says Janine Benyus, a biologist, "innovation consultant" and author. Engineering practices are fractured, Benyus says. Experts in biomimetics study materials; bionics engineers work on prostheses and mechanics. "There was no umbrella term that encompassed everything from agriculture to business," she says. And thus no way to systematize innovation. So she launched what she calls a new discipline, biomimicry, the title of her 1997 book. Benyus has worked since then to popularize and o I see the signs of nature-based innovation everywhere I go now. From Velcro (based on the grappling hooks of seeds) to holistic medicine, people are trusting the inscrutable wisdom of natural solutions. And yet I wonder, why now? Why hasn't our culture always rushed to emulate what obviously works? This is not an idle worry. The last really famous biomimetic invention was the airplane (the Wright brothers watched vultures to learn the nuances of drag and lift). We flew like a bird for the first time in 1903, and by 1914, we were dropping bombs from the sky. Perhaps in the end, it will not be a change in technology that will bring us to the biomimetic future, but a change of heart, a humbling that allows us to be attentive to nature's lessons. Biomimicry or biomimetics is the science that studies nature as a source of inspiration for the design of innovative solutions (technological, architectural, process!) to solve human problems. The main idea behind biomimetics is that nature is millions of years ahead of humans in any field, and for that reason it's very advantageous to be inspired by it or to copy it directly. The term was popularized by scientist and author Janine Benyus with her book "Biomimicry: Innovation Inspired by Nature" in 1997. In the book she talks about a new science that studies the models of nature and then imitates them. Biomimetics: Nature-Based Innovation - Kindle edition by Bar-Cohen, Yoseph. Download it once and read it on your Kindle device, PC, phones or tablets. Use features like bookmarks, note taking and highlighting while reading Biomimetics: Nature-Based Innovation. In order to navigate out of this carousel please use your heading shortcut key to navigate to the next or previous heading. Back. Biomimicry: Innovation Inspired by Nature. Janine M. Benyus. 4.4 out of 5 stars 291. Preview "Biomimetics by Yoseph Bar-Cohen. Biomimetics: Nature-Based Innovation. by. Yoseph Bar-Cohen. 4.33 Rating details. 3 ratings 0 reviews. Mimicking nature - from science fiction to engineering reality. The observation of flying birds and insects leads to innovations in aeronautics. Collision avoidance sensors mimic the whiskers of rodents. Optimization algorithms are based on survival of the fittest, the seed-picking process of pigeon Mimicking nature - from science fiction to engineering reality. Humans have always looked to nature's inventions as a source of inspiration. The observation of flying birds and insects leads to innovations in aeronautics. Collision avoidance sensors mimic the whiskers of rodents.