

Yael Helfman Cohen · Yoram Reich

Biomimetic Design Method for Innovation and Sustainability

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Yael Helfman Cohen
Tel Aviv University
Tel Aviv
Israel

Yoram Reich
Faculty of Engineering
Tel Aviv University
Tel Aviv
Israel

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Preface

Biomimicry is captivating. It evokes and attracts the interest of people around the globe, from various disciplines, ages, and professions. It is made of the right ingredients: colorful images, nature, inspiration, innovation, and success stories. In technology, biomimicry provides us with amazing materials and structures and suggests solutions beyond our regular thinking patterns. It is a promising path to address some of the major sustainability challenges of humanity today. In science, biomimicry is a fascinating area for study. It is still in formation and therefore leaves ample space for creation and contribution. It involves many disciplines that should be integrated wisely and consequently challenges the disciplinary nature of science.

I (Yael) was exposed to biomimicry as a child during the eighties, when I got as a present the fascinating book “Bionics-Nature’s patents.” At that time, the prevailing term was bionics. The book waited on my shelf for almost 25 years until it became the beginning of my new career, as biomimicry researcher and consultant. As an adult, already experienced engineer, I discovered again the biomimicry field, this time under the name biomimicry, during one of my design projects. At that time, biomimicry was brand new in Israel with zero information in Hebrew. I was captivated by the endless inspiration that nature could provide to technology. Next, I became a cofounder of Biomimicry IL, a not-for-profit organization that spread the biomimicry seeds in the industrial, academic, and educational sectors in Israel. Not much later, I associated with Prof. Yoram Reich, and we began our biomimetic journey: Yoram as a supervisor and myself as a Ph.D. candidate. This book is the result of this journey, and it is mainly based on my doctoral thesis but includes also additional insights from our backgrounds in design theories and biomimicry practice.

When we first approached the field few years ago as scientific researchers and practitioners, we realized that below the appealing magic, there was almost no scaffolding to lean on. It was not clear what knowledge bases could support the conjunction of distant disciplines and what language should be used for this purpose.

Motivated by the appeal of biomimicry, and by the lacuna of practical biomimetic design methods, we aimed to develop a new biomimetic design method. We wanted to promote the scientific understanding of the field on one hand, but to provide useful method for practitioners on the other. It was clear that we first needed to develop the missing scaffolding: some solid knowledge bases and multidisciplinary language. Inspired by the theory of inventive problem solving (TRIZ), based on identification of recurring patterns in various disciplines, we intuitively believed that patterns may be the basic words of the missing language. We went out for our patterns journey and became “patterns hunters,” looking for design patterns that emerge from a large number of biological design solutions: structure–function patterns and sustainability patterns. From this moment, the patterns were the missing scaffolding and the new language to sustain the development of the new design method: the structural biomimetic design method. We invite you to join this journey and share with you our enthusiasm and insights.

Scientists in the field of biomimicry will find an extensive literature review about the biomimicry discipline including detailed review of current biomimetic design methods and tools, and a mapping of research gaps and challenges. Scientists in the field of design theories will find a unique documentation of design method formation accompanied with a detailed model for “Designing a design method.”

Practitioners will find a comprehensive design algorithm and practical tools to lead biomimetic design processes, including detailed case studies. Practitioners with special interest in sustainable design will find a bioinspired sustainability tool, the ideality tool, which can be integrated within biomimetic design processes or stand-alone as a sustainability tool.

The book could be used in an undergraduate or graduate course on biomimicry, design theory, product design, or sustainability to provide in-depth material on the subject.

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I thank my parents Jacob and Dorit Helfman for providing me the seeds of curiosity; my husband Eytan for the support, confidences, and patience; and my beloved children, Maya, Gili, Aviv, Daniel, and Eyal for being my source of love and motivation.

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Yael Helfman Cohen

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Yoram Reich

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