Mechanical Design In Organisms

'With admirable clarity, Mrs Peters sums up what determines competence in spelling and the traditional and new approaches to its teaching.' -Times Literary Supplement

Focusing on innovation, these proceedings present recent advances in the field of mechanical design in China and offer researchers, scholars and scientists an international platform to present their research findings and exchange their ideas. In the context of the “Made in China 2025” development strategy, one central aspect of the ICMD2017 was Innovative Design Pushes “Made in China 2025.” The book highlights research hotspots in mechanical design, such as design methodology, green design, robotics and mechanics, and reliability design, while also combining industrial design and mechanical design.

This book deals with an interface between mechanical engineering and biology. Available for the first time in paperback, it reviews biological structural materials and systems and their mechanically important features and demonstrates that function at any particular level of biological integration is permitted and controlled by structure at lower levels of integration. Five chapters discuss the properties of materials in general and those of biomaterials in particular. The authors examine the design of skeletal elements and discuss animal and plant systems in terms of mechanical design. In a concluding chapter they investigate organisms in their environments and the insights gained from study of the mechanical aspects of their lives.

"This book should go a long way towards filling the communication gap between biology and physics in the area of biomaterials]. It begins with the basic theory of elasticity and viscoelasticity, describing concepts like stress, strain, compliance, and plasticity in simple mathematical terms. . . . For the non-biologist, these chapters provide a clear account of macromolecular structure and conformation. . . . Vincent's work] is a delight to read, full of interesting anecdotes and examples from unexpected sources. . . . I can strongly recommend this book, as it shows how biologists could use mechanical properties as well as conventional methods to deduce molecular structure."--Anna Furth, The Times Higher Education Supplement In what is now recognized as a standard introduction to biomaterials, Julian Vincent presents a biologist's analysis of the structural materials of organisms, using molecular biology as a starting point. He explores the chemical structure of both proteins and polysaccharides, illustrating how their composition and bonding determine the mechanical properties of the materials in which they occurincluding pliant composites such as skin, artery, and plant tissue; stiff composites such as insect cuticle and wood; and biological ceramics such as teeth, bone, and eggshell. Here Vincent discusses the possibilities of taking ideas from nature with biomimicry and "intelligent" (or self-designing and sensitive) materials.

The study of coelenterates is now one of the most active fields of invertebrate

zoology. There are many reasons for this, and not everyone would agree on them, but certain facts stand out fairly clearly. One of them is that many of the people who study coelenterates do so simply because they are interested in the animals for their own sake. This, however, would be true for other invertebrate groups and cannot by itself explain the current boom in coelenterate work. The main reasons for all this activity seem to lie in the considerable concentration of research effort and funding into three broad, general areas of biology: marine ecology, cellular-developmental biology and neurobiology, in all of which coelenterates have a key role to play. They are the dominant organisms, or are involved in an important way, in a variety of marine habitats, of which coral reefs are only one, and this automatically ensures their claims on the attention of ecologists and marine scientists. Secondly, the convenience of hydra and some other hydroids as experimental animals has long made them a natural choice for a variety of studies on growth, nutrition, symbiosis, morphogenesis and sundry aspects of cell biology. Finally, the phylogenetic position of the coelenterates as the lowest metazoans having a nervous system makes them uniquely interesting to those neurobiologists and behaviorists who hope to gain insights into the functioning of higher nervous systems by working up from the lowest level.
International interest in nanoscience research has flourished in recent years, as it becomes an integral part in the development of future technologies. The diverse, interdisciplinary nature of nanoscience means effective communication between disciplines is pivotal in the successful utilization of the science. Nanochemistry: A Chemical Approach to Nanomaterials is the first textbook for teaching nanochemistry and adopts an interdisciplinary and comprehensive approach to the subject. It presents a basic chemical strategy for making nanomaterials and describes some of the principles of materials self-assembly over 'all' scales. It demonstrates how nanometre and micrometre scale building blocks (with a wide range of shapes, compositions and surface functionalities) can be coerced through chemistry to organize spontaneously into unprecedented structures, which can serve as tailored functional materials. Suggestions of new ways to tackle research problems and speculations on how to think about assembling the future of nanotechnology are given. Primarily designed for teaching, this book will appeal to graduate and advanced undergraduate students. It is well illustrated with graphical representations of the structure and form of nanomaterials and contains problem sets as well as other pedagogical features such as further reading, case studies and a comprehensive bibliography.
This text introduces and draws together pertinent aspects of fluid dynamics, physical oceanography, solid mechanics, and organismal biology to provide a much-needed set of tools for quantitatively examining the biological effects of ocean waves. "Nowhere on earth does water move as violently as on wave-swept coasts," writes the author, "and every breaker that comes pounding on the shore places large hydrodynamic forces on the organisms resident there." Yet wave-swept coral reefs and rocky shores are home to some of the world's most

diverse assemblages of plants and animals, and scientists have chosen these environments to carry out much of the recent experimental work in community structure and population dynamics. Until now these studies have been hampered because biologists often lack a working understanding of the mechanics of the wave-swept shore. Mark Denny here supplies that understanding in clear and vivid language. Included are an introduction to wave-induced water motions and the standard theories for describing them, a broad introduction to the hydrodynamic forces these water movements place on plants and animals, and an explanation of how organisms respond to these forces. These tools are put to use in the final chapters in an examination of the mechanisms of "wave exposure" and an exploration of the mechanical determinants of size and shape in wave-swept environments. Originally published in 1988. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

This volume explores questions about conceptual change from both scientific and philosophical viewpoints by analyzing the recent history of evolutionary developmental biology. It features revised papers that originated from the workshop "Conceptual Change in Biological Science: Evolutionary Developmental Biology, 1981-2011" held at the Max Planck Institute for the History of Science in Berlin in July 2010. The Preface has been written by Ron Amundson. In these papers, philosophers and biologists compare and contrast key concepts in evolutionary developmental biology and their development since the original, seminal Dahlem conference on evolution and development held in Berlin in 1981. Many of the original scientific participants from the 1981 conference are also contributors to this new volume and, in conjunction with other expert biologists and philosophers specializing on these topics, provide an authoritative, comprehensive view on the subject. Taken together, the papers supply novel perspectives on how and why the conceptual landscape has shifted and stabilized in particular ways, yielding insights into the dynamic epistemic changes that have occurred over the past three decades. This volume will appeal to philosophers of biology studying conceptual change, evolutionary developmental biologists focused on comprehending the genesis of their field and evaluating its future directions, and historians of biology examining this period when the intersection of ev olution and development rose again to prominence in biological science.

Mechanical Design of Structural Materials in Animals explores the principles underlying how molecules interact to produce the functional attributes of biological materials: their strength and stiffness, ability to absorb and store

energy, and ability to resist the fatigue that accrues through a lifetime of physical insults. These attributes play a central role in determining the size and shape of animals, the ways in which they can move, and how they interact with their environment. By showing how structural materials have been designed by evolution, John Gosline sheds important light on how animals work. Gosline elucidates the pertinent theories for how molecules are arranged into macromolecular structures and how those structures are then built up into whole organisms. In particular, Gosline develops the theory of discontinuous, fiber-reinforced composites, which he employs in a grand synthesis to explain the properties of everything from the body wall of sea anemones to spiders' silks and insect cuticles, tendons, ligaments, and bones. Although the theories are examined in depth, Gosline's elegant discussion makes them accessible to anyone with an interest in the mechanics of life. Focusing on the materials from which animals are constructed, this book answers fundamental questions about mechanical properties in nature.

Because vertebrate circulations do not work when shrunk to insect sizes, insects may help us design our smallest machines. Within small bodies, bees separate diffusing substances in an open cavity assisted by locomotion and the beat of the heart. The open arthropod circulation, however, is most efficient when shrunk until its large three-dimensional volume of blood turns into a two-dimensional film of fluid covering only the internal surfaces. This transformation increases the chances to near-certainty that molecules can diffuse from one point to another without getting lost. The Incredible Shrinking Bee expresses mathematics in words so that most readers can compare today's microelectromechanical (MEMS) devices with a honeybee's circulation, introducing ideas of biominiaturization to workers interested in developing compact energy and chemical systems. When it comes to shrinking systems, bees have the edge on human ingenuity. A farrago of ideas and disciplines, The Incredible Shrinking Bee provides a springboard for discussion and research for computer scientists, entomologists, systems biologists, physiologists, mathematicians, engineers and anyone wanting to learn how bees move things around in their bodies to do what we are trying to do smaller and better. Contents: What's in This BookBees and DevicesBeauty Before the BeastYou Can't Shrink a WomanBee's BodyCavity TransportWhere the Hemolymph Meets the WallShrinkingChancy TransportControlGoals and Conclusions Readership: Systems biologists, physiologists, mathematicians, engineers, computer scientists, entomologists and zoologists. Key Features:A generalist's response to the scientific expertise gapUniquely combines disciplinesCompares insects with microdevicesRelies on the Internet for expanding and updating terms, illustrations and conceptsKeywords:Microsystems;Modeling;Biomimetrics;Synthetic Biology;Insects;Microdevices;Microphysics;Systems Biology;Biomedical;Microtechnology

Nature’s Machines: An Introduction to Organismal Biomechanics presents the

fundamental principles of biomechanics in a concise, accessible way while maintaining necessary rigor. It covers the central principles of whole-organism biomechanics as they apply across the animal and plant kingdoms, featuring brief, tightly-focused coverage that does for biologists what H. M. Frost's 1967 Introduction to Biomechanics did for physicians. Frequently encountered, basic concepts such as stress and strain, Young's modulus, force coefficients, viscosity, and Reynolds number are introduced in early chapters in a self-contained format, making them quickly available for learning and as a refresher. More sophisticated, integrative concepts such as viscoelasticity or properties of hydrostats are covered in the later chapters, where they draw on information from multiple earlier sections of the book. Animal and plant biomechanics is now a common research area widely acknowledged by organismal biologists to have broad relevance. Most of the day-to-day activities of an animal involve mechanical processes, and to the extent that organisms are shaped by adaptive evolution, many of those adaptations are constrained and channelized by mechanical properties. The similarity in body shape of a porpoise and a tuna is no coincidence. Many may feel that they have an intuitive understanding of many of the mechanical processes that affect animals and plants, but careful biomechanical analyses often yield counterintuitive results: soft, squishy kelp may be better at withstanding pounding waves during storms than hard-shelled mollusks; really small swimmers might benefit from being spherical rather than streamlined; our bones can operate without breaking for decades, whereas steel surgical implants exhibit fatigue failures in a few months if not fully supported by bone. Offers organismal biologists and biologists in other areas a background in biomechanics to better understand the research literature and to explore the possibility of using biomechanics approaches in their own work Provides an introductory presentation of the everyday mechanical challenges faced by animals and plants Functions as recommended or required reading for advanced undergraduate biology majors taking courses in biomechanics, supplemental reading in a general organismal biology course, or background reading for a biomechanics seminar course

This entertaining and informative book describes how living things bump up against non-biological reality. "My immodest aim," says the author, "is to change how you view your immediate surroundings." He asks us to wonder about the design of plants and animals around us: why a fish swims more rapidly than a duck can paddle, why healthy trees more commonly uproot than break, how a shark manages with such a flimsy skeleton, or how a mouse can easily survive a fall onto any surface from any height. The book will not only fascinate the general reader but will also serve as an introductory survey of biomechanics. On one hand, organisms cannot alter the earth's gravity, the properties of water, the compressibility of air, or the behavior of diffusing molecules. On the other, such physical factors form both constraints with which the evolutionary process must contend and opportunities upon which it might capitalize. Life's Devices includes

examples from every major group of animals and plants, with references to recent work, with illustrative problems, and with suggestions of experiments that need only common household materials.

Mechanical Design in OrganismsPrinceton University Press

This second edition textbook offers an expanded conceptual synthesis of microbial ecology with plant and animal ecology. Drawing on examples from the biology of microorganisms and macroorganisms, this textbook provides a much-needed interdisciplinary approach to ecology. The focus is the individual organism and comparisons are made along six axes: genetic variation, nutritional mode, size, growth, life cycle, and influence of the environment. When it was published in 1991, the first edition of Comparative Ecology of Microorganisms and Macroorganisms was unique in its attempt to clearly compare fundamental ecology across the gamut of size. The explosion of molecular biology and the application of its techniques to microbiology and organismal biology have particularly demonstrated the need for interdisciplinary understanding. This updated and expanded edition remains unique. It treats the same topics at greater depth and includes an exhaustive compilation of both the most recent relevant literature in microbial ecology and plant/animal ecology, as well as the early research papers that shaped the concepts and theories discussed. Among the completely updated topics in the book are phylogenetic systematics, search algorithms and optimal foraging theory, comparative metabolism, the origins of life and evolution of multicellularity, and the evolution of life cycles. From Reviews of the First Edition: "John Andrews has succeeded admirably in building a bridge that is accessible to all ecologists." -Ecology "I recommend this book to all ecologists. It is a thoughtful attempt to integrate ideas from, and develop common themes for, two fields of ecology that should not have become fragmented." -American Scientist "Such a synthesis is long past due, and it is shameful that ecologists (both big and little) have been so parochial." -The Quarterly Review of Biology

The largest seaweed, giant kelp (Macrocystis) is the fastest growing and most prolific of all plants found on earth. Growing from the seafloor and extending along the ocean surface in lush canopies, giant kelp provides an extensive vertical habitat in a largely two-dimensional seascape. It is the foundation for one of the most species-rich, productive, and widely distributed ecological communities in the world. Schiel and Foster’s scholarly review and synthesis take the reader from Darwin’s early observations to contemporary research, providing a historical perspective for the modern understanding of giant kelp evolution, biogeography, biology, and physiology. The authors furnish a comprehensive discussion of kelp species and forest ecology worldwide, with considerations of human uses and abuses, management and conservation, and the current and likely future impacts of global change. This volume promises to be the definitive treatise and reference on giant kelp and its forests for many years, and it will appeal to marine scientists and others who want a better

appreciation and understanding of these wondrous forests of the sea.
The view of nature and technology inhabiting totally different, even opposite, spheres persists across time and cultures. Most people would consider an English countryside or a Louisiana bayou to be "natural," though each is to an extent the product of technology. Pollution, widely thought to be a purely man-made phenomenon, results partly from natural processes. All around us, things from the natural world are brought into the human world. At what point do we consider them part of culture rather than nature? And does such a distinction illuminate our world or obscure its workings? This compelling new book challenges the view that a clear and unwavering boundary exists between nature and technology. Rejecting this dichotomy, the contributors show how the history of each can be united in a constantly shifting panorama where definitions of "nature" and "technology" alter and overlap. In addition to recognizing the artificial divide between these two concepts, the essays in this book demonstrate how such thinking may affect societies' ability to survive and prosper. The answers and ideas are as numerous as the landscapes they consider, for there is no single path toward a more harmonious vision of technology and nature. Technologies that work in one place may not in another. Nature that is preserved in one community might become the raw material of technological progress somewhere else. Add to this the fact that the natural world and technology are not passive players, but are profoundly involved in cultural construction. Understanding such dynamics not only reveals a new historical complexity; it prepares us for coping with many of the most difficult and pressing social issues facing us today. Contributors Peter Coates * Craig E. Colten * Stephen H. Cutcliffe * Hugh S. Gorman * Betsy Mendelsohn * Joy Parr * Peter C. Perdue * Sara B. Pritchard * Martin Reuss * William D. Rowley * Edmund Russell * Joel A. Tarr * Ann Vileisis * James C. Williams * Thomas Zeller
This 1994 book was the first collection devoted to impact of natural sciences on content and form of economics in history.
Dr. Lester A. Gerhardt Professor and Chairman Electrical, Computer, and Systems Engineering Rensselaer Polytechnic Institute Troy, New York 12180
This book is a collection of papers on the subject of Robotics and Artificial Intelligence. Most of the papers contained herein were presented as part of the program of the NATO Advanced Study Institute held in June 1983 at Castel vecchio Pascoli, Italy on the same subject. Attendance at this two week Institute was by invitation only, drawing people internationally representing industry, government and the academic community worldwide. Many of the people in attendance, as well as those presenting papers, are recognized leaders in the field. In addition to the formal paper presentations, there were several informal work shops. These included a workshop on sensing, a workshop on educational methodology in the subject area, as examples. This book is an outgrowth and direct result of that Institute and includes the papers presented as well as a few others which were stimulated by that meeting. A special note is the paper entitled

"State-of-the-Art and Predictions for Artificial Intelligence and Robotics" by Dr. R. Nagel which appears in the Introduction and Overview chapter of this book. This paper was originally developed as part of a study for the United States Army performed by the National Research Council of the National Academy of Science and published as part of a report entitled "Applications of Robotics and Artificial Intelligence to Reduce Risk and Improve Effectiveness" by National Academy Press in 1983.

Understanding materials, their properties and behavior is fundamental to engineering design, and a key application of materials science. Written for all students of engineering, materials science and design, this book describes the procedures for material selection in mechanical design in order to ensure that the most suitable materials for a given application are identified from the full range of materials and section shapes available. Extensively revised for this fourth edition, Materials Selection in Mechanical Design is recognized as one of the leading materials selection texts, and provides a unique and genuinely innovative resource. Features new to this edition * Material property charts now in full color throughout * Significant revisions of chapters on engineering materials, processes and process selection, and selection of material and shape while retaining the book's hallmark structure and subject content * Fully revised chapters on hybrid materials and materials and the environment * Appendix on data and information for engineering materials fully updated * Revised and expanded end-of-chapter exercises and additional worked examples Materials are introduced through their properties; materials selection charts (also available on line) capture the important features of all materials, allowing rapid retrieval of information and application of selection techniques. Merit indices, combined with charts, allow optimization of the materials selection process. Sources of material property data are reviewed and approaches to their use are given. Material processing and its influence on the design are discussed. New chapters on environmental issues, industrial engineering and materials design are included, as are new worked examples, exercise materials and a separate, online Instructor's Manual. New case studies have been developed to further illustrate procedures and to add to the practical implementation of the text. * The new edition of the leading materials selection text, now with full color material property charts * Includes significant revisions of chapters on engineering materials, processes and process selection, and selection of material and shape while retaining the book's hallmark structure and subject content * Fully revised chapters on hybrid materials and materials and the environment * Appendix on data and information for engineering materials fully updated * Revised and expanded end-of-chapter exercises and additional worked examples

In this Second Edition of their landmark text, Authors Jay Friedenberg and Gordon Silverman survey significant theoretical models of the human mind from an interdisciplinary perspective. Unlike other texts for this course which focus solely on classic experiments to illustrate major phenomena, Cognitive Science

introduces students to the theoretical models and ideas underlying such empirical work. While experiments are discussed, they are used primarily to illustrate the specific characteristics of a model. This edition includes two new chapters on emotional cognition and social cognition.

"Amongst animals, diversity of form and of environmental circumstances have given rise to a multitude of different adap tations subserving the relatively unified patterns of cellular metabolism. Nowhere else is this state of affairs better exem plified than in the realm of respiration". Jones (1972). The field of comparative respiratory biology is expanding almost exponentially. With the ever-improving analytical tools and methods of experimentation, its scope is blossoming to fascinating horizons. The innovativeness and productivity in the area continue to confound students as well as specialists. The increasing wealth of data makes it possible to broaden the information base and meaning fully synthesize, rationalize, reconcile, redefine, consolidate, and offer empirical validation of some of the earlier anecdotal views and interpretations, helping resolve the issues into adequately realistic and easily perceptible models. Occa sional reflections on the advances made, as well as on the yet unresolved prob lems, helps chart out new grounds, formulate new concepts, and stimulate inquiry. Moreover, timely assessments help minimize isolation among investiga tors, averting costly duplication of effort. This exposition focuses on the diversity of the design of the gas exchangers and gives a critical appraisal of the plausible or constrained the evolvement of respiration. The factors that have motivated cause-and-effect relationship between the phylogenetic, developmental, and en vironmental factors, conditions, and states which at various thresholds and under certain backgrounds conspired in molding the gas exchangers is argued.

Plants and animals interact with each other and their surroundings, and these interactions—with all their complexity and contingency—control where species can survive and reproduce. In this comprehensive and groundbreaking introduction to the emerging field of ecological mechanics, Mark Denny explains how the principles of physics and engineering can be used to understand the intricacies of these remarkable relationships. Denny opens with a brief review of basic physics before introducing the fundamentals of diffusion, fluid mechanics, solid mechanics, and heat transfer, taking care to explain each in the context of living organisms. Why are corals of different shapes on different parts of a reef? How can geckos climb sheer walls? Why can birds and fish migrate farther than mammals? How do desert plants stay cool? The answers to these and a host of similar questions illustrate the principles of heat, mass, and momentum transport and set the stage for the book's central topic—the application of these principles in ecology. Denny shows how variations in the environment—in both space and time—affect the performance of plants and animals. He introduces spectral analysis, a mathematical tool for quantifying the patterns in which environments vary, and uses it to analyze such subjects as the spread of invasive species. Synthesizing the book’s materials, the final chapters use ecological mechanics

to predict the occurrence and consequences of extreme ecological events, explain the emergence of patterns in the distribution and abundance of organisms, and empower readers to explore further. Ecological Mechanics offers new insights into the physical workings of organisms and their environment.
Solid Biomechanics is the first book to comprehensively review the mechanical design of organisms. With a physical approach and a minimum of mathematics, the textbook introduces readers to the world of structural mechanics and sheds light on the dazzling array of mechanical adaptations that link creatures as dissimilar as bacteria, plants, and animals. Exploring a wide range of subjects in depth, from spider silks and sharkskin to climbing plants and human food processing, this immensely accessible text demonstrates that the bodies of animals and plants are masterpieces of engineering, enabling them to survive in a hostile world. The textbook describes how organisms construct materials from limited components, arrange materials into efficient structures that withstand different types of stresses, and interact mechanically with their environment. Looking at practical and historical aspects of the subject, the book delves into how the mechanics of organisms might be applied to other engineering scenarios and considers the ways structural biomechanics could and should develop in the future if more is to be learned about the form and function of organisms. Solid Biomechanics will be useful to all those interested in how organisms work, from biologists and engineers to physicists and students of biomechanics, bionics, and materials science. The first comprehensive review of the structural mechanics of organisms Introduces the subject using a physical approach involving minimal mathematics Three complementary sections: materials, structures, and mechanical interactions of organisms Links the dazzling array of mechanical adaptations seen in widely differing organisms Practical and historical approach shows how mechanical adaptations have been discovered and how readers can perform their own investigations
The purpose of this book is to present the state of knowledge concerning nutrition and point out directions for future work for the Echinodermata, an ancient group which shows great diversity in form and function, and whose feeding activities can have great environmental impact.
This book provides a clear foundation, based on physical biology and biomechanics, for understanding the underlying mechanisms by which animals have evolved to move in their physical environment. It integrates the biomechanics of animal movement with the physiology of animal energetics and the neural control of locomotion. The author also communicates a sense of the awe and fascination that comes from watching the grace, speed, and power of animals in motion. Movement is a fundamental distinguishing feature of animal life, and a variety of extremely effective mechanical and physiological designs have evolved. Common themes are observed for the ways in which animals successfully contend with the properties of a given physical environment across diversity of life forms and varying locomotor modes. Understanding the common

principles of design that span a diverse array of animals requires a broad comparative and integrative approach to their study. This theme persists throughout the book, as various modes and mechanisms of animal locomotion are covered. Since an animal's size is equally critical to its functional design, the effects of scale on locomotor energetics and mechanics are also discussed. Biewener begins by examining the underlying machinery for movement: skeletal muscles used for force generation, skeletons used for force transmission, and spring-like elements used for energy savings. He then describes the basic mechanisms that animals have evolved to move over land, in and on the surface of the water, and in the air. Common fluid dynamic principles are discussed as background to both swimming and flight. In addition to discussing the locomotor mechanisms of complex animals, the locomotor movement of single cells is also covered. Common biochemical features of cellular metabolism are then reviewed before discussing the energetic aspects of various locomotor modes. Strategies for conserving energy and moving economically are again highlighted in this section of the book. Emphasis is placed on comparisons of energetic features across locomotor modes. The book concludes with a discussion of the neural control of animal locomotion. The basic neurosensory and motor elements common to vertebrates and arthropods are discussed, and features of sensori-motor organization and function are highlighted. These are then examined in the context of specific examples of how animals control the rhythmic patterns of limb and body movement that underlie locomotor function and stability.

Hierarchical structures are those assemblages of molecular units or their aggregates embedded within other particles or aggregates that may, in turn, be part of even larger units of increasing levels of organization. This volume reviews the state of the art of synthetic techniques and processing procedures for assembling these structures. Typical natural-occurring systems used as models for synthetic efforts and insight on properties, unusual characteristics, and potential end-use applications are identified. Suggestions are made for research and development efforts to mimic such structures for broader applications.

This book examines the evolution of self-organised multicellular structures, and the remarkable transition from unicellular to multicellular life. It shows the way forward in developing new robotic entities that are versatile, cooperative and self-configuring.

Addressing general readers and biologists, Mark Denny shows how the physics of fluids (in this case, air and water) influences the often fantastic ways in which life forms adapt themselves to their terrestrial or aquatic "media."

"Full of ideas and well-explained principles that will bring new understanding of everyday things to both scientists and non-scientists alike."—R. McNeill Alexander, Nature Nature and humans build their devices with the same earthly materials and use them in the same air and water, pulled by the same gravity. Why, then, do their designs diverge so sharply? Humans, for instance, love right angles, while nature's angles are rarely right and usually rounded. Our technology goes around on wheels—and on

rotating pulleys, gears, shafts, and cams—yet in nature only the tiny propellers of bacteria spin as true wheels. Our hinges turn because hard parts slide around each other, whereas nature's hinges (a rabbit's ear, for example) more often swing by bending flexible materials. In this marvelously surprising, witty book, Steven Vogel compares these two mechanical worlds, introduces the reader to his field of biomechanics, and explains how the nexus of physical law, size, and convenience of construction determine the designs of both people and nature. "This elegant comparison of human and biological technology will forever change the way you look at each."—Michael LaBarbera, American Scientist

This book describes how the principle of self-sufficiency can be applied to a reconfigurable modular robotic organism. It shows the design considerations for a novel REPLICATOR robotic platform, both hardware and software, featuring the behavioral characteristics of social insect colonies. Following a comprehensive overview of some of the bio-inspired techniques already available, and of the state-of-the-art in re-configurable modular robotic systems, the book presents a novel power management system with fault-tolerant energy sharing, as well as its implementation in the REPLICATOR robotic modules. In addition, the book discusses, for the first time, the concept of “artificial energy homeostasis” in the context of a modular robotic organism, and shows its verification on a custom-designed simulation framework in different dynamic power distribution and fault tolerance scenarios. This book offers an ideal reference guide for both hardware engineers and software developers involved in the design and implementation of autonomous robotic systems.

The relationship between our living body and our soul, our mental expressions of life and our physical environment, are both classical topics for discussion and ones which currently present themselves as part of a truly exciting philosophical debate: are we today still able to speak of a “soul”? And what is meant by a (living) body (German: “Leib”)? Does our brain dictate what we will and do? Or do we have free will? Why are we the same people tomorrow that we were yesterday? Given the discoveries of the modern neural sciences, can human beings still be understood in the context of the unity of body and soul? Or should we rather define ourselves as mind-brain beings (German: Gehirn-Geist-Gestalten)? Marcus Knaup explores these questions and discusses the most relevant approaches and arguments concerning the (living) body-soul debate. His own approach to current chal-lenges presented by modern brain research emanates from his bringing together Aristotelian Hylomorphism and phenomenology of the living body (German: “Leibphänomenologie”).

One of the leading textbooks in its field, Bringing Fossils to Life applies paleobiological principles to the fossil record while detailing the evolutionary history of major plant and animal phyla. It incorporates current research from biology, ecology, and population genetics, bridging the gap between purely theoretical paleobiological textbooks and those that describe only invertebrate paleobiology and that emphasize cataloguing live organisms instead of dead objects. For this third edition Donald R. Prothero has revised the art and research throughout, expanding the coverage of invertebrates and adding a discussion of new methodologies and a chapter on the origin and early evolution of life.

Biomechanics in Animal Behaviour offers a unique approach by integrating fully the fields of animal behaviour and biomechanics. It demonstrates how an understanding of biomechanical issues is an important part of evaluating and predicting animal

behaviour. The book examines how behaviour is determined and/or constrained by biomechanical variables such as hydrodynamics, aerodynamics, kinematics, and the mechanical properties of biomaterials.

Physical (Biological) Anthropology theme is a component of Encyclopedia Of Biological, Physiological And Health Sciences (EOLSS), which is an integrated compendium of twenty one Encyclopedias. Biological anthropology, also known as physical anthropology, is a scientific discipline concerned with the biological and behavioral aspects of human beings, their related non-human primates and their extinct hominin ancestors. It is a subfield of anthropology that provides a biological perspective to the systematic study of human beings. This volume is aimed at the following five major target audiences: University and College Students Educators, Professional Practitioners, Research Personnel and Policy Analysts, Managers, and Decision Makers, NGOs and GOs.