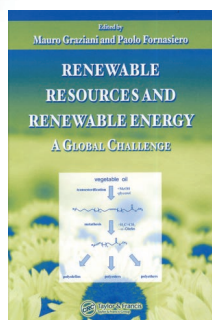




## Renewable Resources and Renewable Energy



A Global Challenge. Edited by **Mauro Graziani** and **Paolo Fornasiero**. CRC Press/Taylor & Francis, Boca Raton 2007. 368 pp., hardcover £ 74.99.—ISBN 0-8493-9689-1

In the opening chapter of this book the author, Ramani Narayan, explains rightly that: “*Discussions on sustainability and environmental responsibility center on the issue of managing carbon-based materials in a sustainable manner, as part of the natural carbon cycle*”. Recently, Cuba’s president protested against the use of land for growing sugar cane for the production of bio-ethanol. It is true that 93% of the world’s annual biomass production is unused, and so is the enormous amount of waste from the agrofood industry that might easily be used as feedstock for the production of plastics (Chapter 6).

The book originates from a conference held in Italy in 2004 under the auspices of the UN Center for Science and High Technology. However, its title is too ambitious, as the book’s 16 chapters do not address the scientific aspects of renewable energy sources, but instead deal mainly with conversion of renewable resources into valued-added products, and the generation of hydrogen as an energy carrier.

As the world’s population is rapidly learning, climate change due to human activities is not merely an opinion—it is

a reality that in America has already hit entire cities (New Orleans), and in southern Europe has recently hurt people and the whole ecosystem with temperatures close to 50°C in mid-June. We need to curb CO<sub>2</sub> emissions soon; thus, we need to switch to renewable materials and renewable energy on a massive scale. In this sense, despite its limitations, this book is a timely teaching and research resource.

In general, however, the book would have been considerably improved, in both form and content, by more careful editing. For example, Chapter 4 discusses the production of 5-hydroxymethylfurfural and levulinic acid from sucrose in five pages, whereas Chapter 5, in 55 pages, details even the “respirometric” tests carried out on biopolymers. As another example, Dr. Narayan refers us to a standard for quantifying biologically based carbon content, but the code for it that is given in the related Figure caption is wrong (Figure 1.4).

I recommend reading Chapter 12 on molten carbonate fuel cells, including the generator that supplies heat and electricity at Magdeburg’s university hospital in Germany and achieves 70% efficiency. This account shows neatly how, in Europe, we could make far better use of the valuable methane imported from Russia and Africa, instead of simply burning it. Eventually, this technology will make it possible to supply power to hospitals, public buildings, schools, factories, and houses with high efficiency.

The last chapter, which describes the effective marketing of photovoltaic technologies in developing countries, is especially interesting. We learn that in the state of Punjab (India), the solar-powered water-pumping program for farmers, which at first relied heavily on state subsidies, has been able to establish a market for photovoltaic devices where there was none before. The key to success was the setting-up of an ESCO (energy service company) to provide an integrated energy service. In return for a periodic payment from users, it installed a solar-powered pump and trained users in its operation and maintenance. As a result, 98% of the installed power was in place after one year, and farmers switched to efficient crop irrigation,

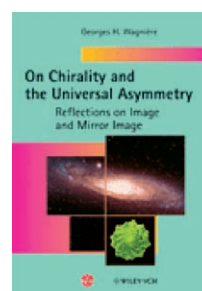
growing high-value plantation crops instead of marginal field crops.

An estimated 1.64 billion people worldwide, mainly in developing countries, are not connected to an electricity supply grid. As this will barely change in coming years, programs of the kind described above can be seen to be very relevant for social welfare and development. They are closely related to the similarly important “One Laptop per Child” program currently led by Nicholas Negroponte.

In conclusion, it is worth pointing out that the major risk that confronts this and related scientific books—that of rapid obsolescence—might have been avoided by using the Internet. If, instead of producing this book, the publishers had posted the authors’ contributions on-line one month after the 2004 conference, and printed only a general summary of the book’s contents, they would have given their subscribers exclusively up-to-date information. Authors would update their chapters at intervals of, say, 18 months, and readers would benefit from using a truly “living”—and continuously useful—book.

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## On Chirality and the Universal Asymmetry



Reflections on Image and Mirror Image. By **Georges H. Wagnière**. Helvetica Chimica Acta, Zürich 2007. 247 pp., softcover € 82.50.—ISBN 978-3-906390-38-3

Thousands of scientists worldwide regularly embrace the magical words chiral, chirality, and asymmetry in research projects, paper titles, and grant applications. Hardly a day passes without

witnessing this chirocentric discourse, even though such words are sometimes of secondary importance when examined in their proper context. However, the multifaceted field of asymmetry is dimensionally transcendental; after all, life on Earth (and perhaps on Earth-like exoplanets of our visible universe) makes and uses only one enantiomeric form, which is thought to be because anything else would complicate key biochemical processes. Thus, along with the origin of life itself, the search for the origin of the homochiral homogeneity in nature has become one of the most important tasks in science. Before you say anything—yes, it is both a scientific and a philosophical question. But this one is not only close to home and has a chance of yielding answers in our lifetime, it also involves chemistry as a central tool. Since the early 1990s in particular, attempts to solve this often noted conundrum of nature have been summarized in numerous research papers and reviews, which discuss experimental and theoretical models and formulate hypotheses. Certainly some are plausible within an environmental perspective, while others are bizarre enough and most likely flawed.

Against that background, it is gratifying to see the release of this monograph authored by a serious scientist, Georges Wagnière, who is an expert in physical chirality with an emphasis on magnetochiral phenomena. Probably, there is a need for this survey, as the search for homochirality has become a subject of common discussion, which is growing at a tremendous pace. As recognized by the author in the introductory remarks, the book is intended to be an excursion through the many ways in which asymmetry manifests itself. This eclectic treatment inevitably produces pluses and minuses, as the lack of comprehensiveness implies that some scenarios have been overlooked. Overall, this journey is valuable and remarkable in numerous aspects.

The book opens with a concise chapter on enantiomorphism at a molecular level, dealing with the discovery of natural optical activity and the birth and evolution of stereochemistry and asym-

metric reactions (19 pp.). That is followed by nine chapters that focus on different aspects of subatomic and molecular chirality. As one might expect, Wagnière describes in detail the influence of physical phenomena (Chapters 2–4) and astrophysical phenomena (Chapters 5–6), with an emphasis on parity violation as the essential ingredient. These sections could be disappointing to a chemical audience. This reviewer has often expressed the view that a discussion of the violation of discrete symmetries is required in this context, but there should be a compromise in the depth of treatment to maintain one's interest at a reasonable level. Some scientists hold firmly to the deterministic model, according to which the macroscopic asymmetry of the world is a direct and inevitable consequence of the weak interactions. Fortunately, Wagnière, who raises the question at the very beginning (p. 1), is rightly skeptical throughout the book (especially in Chapters 9 and 10), as theoretical calculations and experimental data do not lead to conclusive statements. Clearly, parity nonconservation is a universal phenomenon, which, unlike noise, always works in the same direction. As a result, that tiny energy shift manifests itself in both atoms and molecules, and one should recall here that all of the asymmetry measurements of the electro-weak interactions are sensitive to the difference between the left- and right-handed fermion couplings, thereby giving consistency to the Standard Model. There should be something acting to break the symmetry, but we do not know its origin and purpose, which could be completely disconnected from the subsequent (bio)chemical evolution. The Russian physicist Andrei Sakharov was the first to suggest that the differences between matter and antimatter could be explained in terms of the differences observed during the decay of *K* and *B* mesons. Modern cosmologists point to more complex arguments, which would involve the appearance of massive elementary particles or to origins in dark matter and energy.

Most chemists will doubtless be especially interested in Chapters 7–10, where Wagnière, in a concise but rigorous style, discusses chirality of materials (crystals, liquid crystals, surfaces, and nanotubes, Chapter 7, 18 pp.), theoretical and mathematical models of chirality (e.g., helices, Moebius strips) with potential chemical applications (Chapter 8, 34 pp.), and, in two unifying chapters, the sources and prebiotic evolution of homochirality. The former (Chapter 9, 29 pp.) focuses largely on stereodiscriminating interactions and homochiral polymerization. A valuable epilogue (Chapter 10, 25 pp.) concentrates on absolute asymmetric transformations in the context of geological and biological evolution, including the always controversial topic of extraterrestrial sources. An 18-page glossary at the end provides explanations of many common terms used in the book.

The outstanding strength of the book lies in its didactic character. The text is informative and readable, and Wagnière writes in an engaging manner, often using a Socratic style, formulating questions that arise from previous answers. I must confess that once I picked up the book I found it hard to put down. Also, the book is recommended for students with interests in a broad range of disciplines, such as organic and bio-(in)organic chemistries, physical chemistry, materials science, and astrobiology. Scientists active in this multidisciplinary field would have liked to find a more comprehensive account (neither the contents list nor the bibliography is exhaustive). One might disagree with Wagnière about the arrangement and coverage of each chapter, but it is fair to say that there is nothing to be learned about asymmetry that you cannot learn from this book. The author reminds us of the complex path that brought us to this point.

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