

Book Review

***Molecules and Medicine*, E.J. Corey, Barbara Czako and László Kürti
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Although he undoubtedly meant it in a different context, when Shakespeare wrote, “Let us not to the marriage of true minds admit impediments,” he might almost have had in mind chemistry and medicine. Not that the two fields are opposed, but that for much of their history, the two branches of knowledge ran on unconnected tracks, seeming to have little relationship to one another. Physicians prescribed medications based on their efficacy, established from trial and error, often knowing little more than their chemical composition, if that, but with no idea of how they acted in the body. Chemists, on the other hand, made enormous strides in deciphering the structures of, and finding elegant ways to synthesize, an impressive array of highly elaborate molecules, some of which exhibited remarkable medicinal properties, but they were unable to account for these properties in molecular terms. This disconnect between chemistry and physiology constituted a formidable barrier that has begun to be surmounted only in recent decades, as medicine and biology have become increasingly molecular sciences and as chemists and biochemists have been able to move away from focusing on individual molecules and to begin tackling ever more complex systems of interacting molecules in biological systems. *Molecules and Medicine* is a fascinating introduction to the convergence of these historically disparate disciplines, and to the emergence of the science of molecular medicine.

Molecules and Medicine is organized into six parts. The first part, written with the non-molecularly literate reader in mind, presents a compactly, clearly and densely written introduction to the principles of molecular structure, beginning with basic ideas about bond formation, moving quickly through bond and molecular polarity, hydrogen bonding and solvation, molecular interactions, functional groups, aromaticity, isomerism, molecular shape, and concluding with a discussion of protein structure and the ways in which it will be depicted in the book. Having thus primed the reader with the necessary basic vocabulary and concepts, the book moves into the remaining five sections, each of which is organized by disease types and devoted to a different category of medicinal agents.

The second section of *Molecules and Medicine*, entitled “Inflammatory, Metabolic and Cardiovascular Diseases,” consists of four subsections devoted, respectively, to anti-inflammatory agents, anti-asthmatic and anti-allergic agents, anti-diabetic and cholesterol-lowering agents, and cardiovascular agents. Each subsection highlights several important and widely-prescribed medications, e.g, Naproxen (Aleve™), Loratidine (Claritin™), Atorvastatin (Lipitor™) and Clopidogrel Bisulfate (Plavix™), to choose one from each class. Each drug description includes information on its year of discovery, year of introduction, its main uses, how widely it is used, and what is known about its mode of action. The section also includes some brief but illuminating background discussions (“How Do Antiinflammatory Drugs Work?,” “Other Eicosanoids in Inflammation,” and “An Overview of Inflammation.”) The authors follow a similar pattern in the remaining four subsections, with Part III featuring sections on reproductive medicine, osteoporosis, and glaucoma and antiulcer agents, Part IV covering immunosuppressive agents, antibiotics, antiviral agents, antifungal agents and anti-malarial and antiparasitic agents, Part V surveying drugs used to treat malignant disease, and Part VI devoted to drugs that act on the nervous system.

Each section also includes, as appropriate, background topics, including, “An Overview of Metabolic Syndrome,” “Information Flow into the Cell by Chemical Signaling,” “A Brief Survey of the Immune System,” “On Viruses and Viral Diseases,” “Parasitic Diseases: a Focus on Malaria,” “An Overview of Cancer,” and “The Brain, Neurotransmission, and Molecular Neurotransmitters,” and concludes with a helpful bibliography to serve as a jumping-off point for the reader who wishes to explore further. The book is copiously illustrated with colorful molecular and other diagrams and flow charts to accompany the text, helpfully color-coded to help draw attention to significant molecular features. Finally, it concludes with a fairly comprehensive glossary, which along with all the other features, makes *Molecules and Medicine* an invaluable and enjoyable resource for an introduction to molecular medicine.

One might ask what the target audience is for *Molecules and Medicine*, and in what context might it be used. It is clearly not for the casual non-scientist. While it is well-written and nicely illustrated, the information density is high and the text is replete with technical terms and abbreviations that may require considerable effort to understand. However, for a chemist, physician, advanced undergraduate or graduate student, or post-doctoral fellow interested in gaining an insight into what is currently known about the molecular details of how drugs actually function in the body, *Molecules and Medicine* is a marvelous resource. It can be read from front to back, but this is not obligatory, as the reader can simply begin at whichever section seems most attractive.

The Marriage of chemistry and medicine has clearly come a long way from its birth in the days of Pauling’s famous 1956 paper in which he used electrophoresis to show that the

cause of sickle cell anemia was associated with an alteration in the molecular structure of hemoglobin (later shown to be due to replacement of a single amino acid residue). Together with the elucidation of the structure of DNA, it illustrated how powerful the synergistic combination of chemical and medical researchers in close communication could be. Pauling's prescient statement, in a 1945 lecture in Rome, that "I believe that chemistry can be applied effectively to medical problems, and that through this application we may look forward to significant progress in the field of medicine, as it is transformed from its present empirical form into the science of molecular medicine," may have been at that time more an expression of personal faith than an extrapolation based on a secure foundation of emerging scientific fact. *Molecules and Medicine* is an eloquent and impressive indication of the progress that is rapidly making that dream into a reality, and it deserves a place on the shelf of any biochemist, biologist, chemist or physician.