

Book Review

Travels to the Nanoworld

by Michael Grass (Perseus Books; 2001) ISBN 073820444, 272 pp.; \$16.00 (paperback)

Reviewed by Maryann C. Kenney

Unbelievably tiny robots, infinitesimal levers, wheels and switches producing the microminiature machines of the future — is this the nanoworld? Well — yes, no and maybe. Commonly held visions of this landscape might conjure up a speck of machinery on a fly's wing, or a tiny capsule rocketing through the body on a mission of health. The travels of this book, however, start in a different landscape. Michael Gross first takes us to the smallest units of life's machinery, the molecules that so masterfully run our body processes.

He starts from an appreciation of the accomplishments of biological evolution, and the elegant, compact living “factories” that have been at work for more than a billion years. Intricacies of molecular interactions such as chemical assembly lines, protein folding and molecular transport are laid out in extensive detail in the first several chapters. While the overall concepts are easy to grasp, a reader without a background in biochemistry may find the specifics slow going and difficult to follow. Unfortunately, the drawings presented to accompany key ideas are minimal at best, and fail to clarify the idea or excite the reader.

As Gross moves through the biological concepts, he points out various machine functions these reactions could ultimately fulfill. In one case he describes G-Proteins, which allow signals to be received and translated across membranes by changing the protein between active and inactive forms. The reader is persuaded to think of these molecules as tiny machine on/off switches — in essence, a “nanomachine” component.

Another more complex example is that of the biological protein shredder that disposes of damaged or unneeded proteins, allowing the building blocks to be recycled back to new proteins. The proteins are first labeled with a marker and unfolded before going into the “machine”. The marked protein moves through a tiny molecular shredding tube along with a chaperone protein. The chaperone protein is around to be sure that only the marked protein is disposed of and the surrounding environment is safe. The analogy to an industrial line with safety guards is quite apparent.

In addition to advances in nanotechnology, throughout the book Gross provides profiles and sidelines on the techniques and, people involved in the underlying fundamental studies that have made progress possible. For example, the determination of molecular structure, so necessary to understand and explain the functioning of these tiny factories, has only resulted from years of dedicated, and often interdisciplinary work.

Gross moves the discussion on to larger molecules — branched polymers, DNA, self-assembling proteins, and perhaps the most commonly referenced nanostructure in the popular press, the nanotube. Here the reader can begin to appreciate some of the current and potential real world applications for these “nanomachines.” As the technology advances, many of the first applications will be for nanocomponents within already miniaturized machines. For example, the ability to uniquely tailor the conductive properties of nanotubes, and form these tubes into extremely strong, minute fibers opens opportunities in transistor and wire technology. Additional nanoscale electronic components can lead to faster, more powerful computing.

The book closes with a view toward the fixture nanoworld, including the sweeping utopian changes forecast by Eric Drexler, “Mr. Nano”, but this discussion seems more: a philosophical diversion, and far less credible in its predictions

Travels to the Nanoworld provides an encompassing tour of this tiny landscape. Some readers will undoubtedly appreciate the broad scope. But, other readers may find the wanderings through the small back roads of biological detail leave them hoping for more of the big city excitement of this emerging technology. Those interested in additional information on applications may also enjoy reading an excellent review, “Nanotech Goes to Work,” in the January/February 2001 issue of *Technology Review*.