Engines of Creation

by K. Eric Drexler

1986, Anchor Press/Doubleday , 289 pages

One of the watershed books of the life extension movement—or any of half a dozen names given to the rising awareness that we humans are destined to transcend our biological limitations—Engines of Creation by Dr. Eric Drexler lays out the vision for molecular-level engineering. (The approximate dimensions of molecules are in the nanometer—1 billionth of a meter—range, hence the words molecular technology and nanotechnology are synonyms.)

These were heady times in the mid to late 1980s for what I'll refer to here generically as the "transhumanist" movement. In 1960s and 1970s, Dr. Robert Ettinger had laid out some blueprints for how human beings could reach the next level of evolution: The Prospect of Immortality and Man into Superman. Other scientists and humanists were also debating the ramifications of cryogenic preservation, gene therapy, cloning, nutritional enhancement, and so on. In 1982 researchers Durk Pearson and Sandy Shaw came out with a bestselling book Life Extension: A Practical Scientific Approach.

It's no accident the life extension and transhumanist movement coincided with the heyday of the Libertarian Party's impingement on American political consciousness—not to mention the thrust of free-market anarchist, individualist, anticorporatist, Movement of the Libertarian Left, and innumerable variations on the following theme: "We are free agents, beholden to no central political power, and rational self-interest being a good thing, why not stick around as long as we can, vigorously, youthfully?!"

Realizing now that the number of actual people who, back in the 80s, believed in radical human biological enhancement would fit into my local VFW hall, it's rewarding to see real progress: today we occupy at least two VFW halls! Seriously though, the transhumanist concept has spread steadily to the general culture, manifested probably most forcefully with the 2004 release of a book advocating radical life extension to the masses: Fantastic Voyage: Live long enough to live forever, by scientist/inventor Ray Kurzweil and fitness doctor-advocate Terry Grossman. (I was amazed that my local ultra-prosaic Podunk newspaper carried a review of Fantastic Voyage, which cheerfully advocates practical immortality for every Tom, Dick, and Blue Collar.)

Back to the book at hand. Engines of Creation describes the foundations of and the issues surrounding humankind's increasing potential for building molecular machines. (Indeed as we stand here on the verge of 2008, notable accomplishments in nanotechnology continue to be made.) Drexler's "starter kit" comprises what he calls "universal assemblers," which are nanomachines designed for a simple task, such as replacing defective genetic links with healthful ones or bonding one cellular structure to another:

> "[Engineers] will likewise use protein nanomachines to build better nanomachines. Enzymes show the way: they assemble large molecules by "grabbing" small molecules from the water around them, then holding them together so that a bond forms. Enzymes assemble DNA, RNA, proteins, fats, hormones, and chlorophyll in this way—indeed, virtually the whole range of molecules found in living things.
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> "Biochemical engineers, then, will construct new enzymes to assemble new patterns of atoms. For example, they might make an enzyme-like machine that will add carbon atoms to a small spot, layer on layer. If bonded correctly, the atoms will build up to form a fine, flexible diamond fiber having over fifty times as much strength as the same weight of aluminum."

One can see by such possibilities that aerospace and other high-tech firms, as a minimum, will be highly interested in the profit potential offered by new materials. But there are other even more remarkable applications, chiefly in health maintenance/enhancement. Remember the movie Fantastic Voyage (1966) (based on a novel by Isaac Asimov of the same name)? The central idea was to miniaturize people along with a special rescue vessel then insert them into a patient suffering from an incurable ailment.

It was really pretty cool watching the ship having to fight off these big ol' papier-mache white corpuscles and being jumbled about in a sneeze attack. But the message taken by the geek generation is someday we'll be able to create miniature machines to fix things inside us. Moreover, as our technology builds on itself, we'll eventually design small machines to take over the function of organs or to build stronger bones and muscles, quicker brains, longer... well, you get the picture. The entire promise of Watson and Crick (discoverers of DNA) that we now control our own biology may then be realized.

While the first 100 pages or so of Engines introduces the concepts of how molecular technology might develop— prediction of course being more an art than a science—toward the middle of the book Drexler

starts to give us the big picture... where biological advances, robotics, and artificial intelligence (AI) point toward the next stage in evolution of consciousness:

> "From past to future, then, the likely pattern of advancing ability looks something like this: Across eons of time, life moved forward in a long, slow advance, paced by genetic evolution. Minds with language picked up the pace, accelerated by the flexibility of memes [replicating pieces of conceptual information]. The invention of the methods of science and technology further accelerated advances by forcing memes to evolve faster. Growing wealth, education, and population—and better physical and mental tools—have continued this accelerating trend across our century."

Keep in mind Drexler is writing roughly 20 years ago, in the 1980s, when the Internet has not even materialized into a popular vehicle of knowledge. One can see in Drexler's vision the seeds of what Ray Kurzweil will later refer to as the Singularity. The full title of Kurzweil's book is The Singularity is Near: When humans transcend biology. The Singularity is the point at which human biological consciousness and computer "consciousness" combine, or interact, to form a unique new integrated form(s) of intelligence that will launch into the cosmos. Exactly what sort of body this intelligence or consciousness will inhabit is one of the intriguing discussions of our time.

The fact is without humans being able to do engineering at the molecular level, the Singularity cannot materialize; we will not evolve to the next stage of awareness and vitality.

Needless to say, both books are rich in intellectual content. In Engines Drexler seems to have more passion for remedying our ecological and energy issues, and, indeed, suggests some methods that may apply: imagine for instance having all the energy we need drawn from nanobotic solar cells incorporated in, say, our shoelaces. Another special focus of Drexler's is using cryogenic interment as an insurance policy: just in case we don't live long enough to live forever, individuals can be put into biostasis until the technological cavalry arrives to revive and rejuvenate us.

I had read Engines years before, but upon rereading I'm impressed with what the author and his peers have deeply pondered on preventing nanotechnological disasters, either from accident or from conscious intention of some malefactor. When one realizes a technology that can terraform planets can also readily destroy them... and us, one becomes a bit careful in how the technology is handled. The entire Part 3 of Drexler's book, "Engines of Destruction," is devoted to this issue.

Drexler feels the solution to runaway nanobots lies along the lines of "The Scientific Community Metaphor," proposed by William A. Kornfeld and Carl Hewitt of the MIT Artificial Intelligence. That approach spurs reliance on government coercion/systems in favor of sort of a geek neighborhood-watch concept. (I'm reminded of Jane Jacobs epochal work, The Death and Life of Great American Cities, in which she claims cities aren't dying, they're being murdered by Platonic city planners who—through eminent domain, superhighways, and sterile high-rise buildings—are blindly destroying neighborhoods, the chief antibody to social decline.)

Anyway, it's a terrific book, full of passionate insight, a true groundbreaker for the world I hope we'll be around to greet within a few short decades.

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