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The Dust Bites Another One

From Michael Crichton's *Prey* to the Department of Nanotechnology

For all the efforts at careful analytical arguments about our scientific future, the most lasting images and notions of that future have always come from fiction. Our treasury of metaphors, both dreams and nightmares, draws not on articles in *Nature* but the imaginative works of writers like Aldous Huxley, Isaac Asimov, Philip Dick, and Michael Crichton.

Crichton, in particular, has put *images* in our mind, with a series of best-selling techno-thrillers, many of which have been transformed into blockbuster motion pictures. His theme of choice is hubris—usually careless human intervention in the workings of the natural world and the disaster that follows. His villain is not technology or scientists; indeed his heroes more often than not are the geekiest of techno-geeks, and the pictures he paints of technological possibilities are often thrilling. He clearly has a warm place in his heart for human curiosity, creativity, and artistry. His villain is the other side of man: stupidity, greed, and the reckless pursuit of power.

Crichton's latest thriller, *Prey*, certainly follows this pattern. The book's message, expressed repeatedly by its hero, is that "things never turn out the way you think

they will." The recipe is Crichton's familiar favorite: Take our current technological advances, add some myopic *Homo sapiens*, and you have chaos—a purple baby, a *ménage a trois* with nanoparticles, kisses that kill—in other words, one terrifying future.

Our hero, Jack, is a stay-at-home dad, having been fired from a Silicon Valley firm for blowing the whistle on the owner's unethical behavior. His wife, Julia, works for Xymos Technology, a biotech firm on the cutting edge of nanotechnology. The story gets moving with a series of peculiar incidents: the couple's infant daughter develops a mysterious full body rash, which vanishes in an MRI, leaving the child purple. Their son claims men in space suits vacuumed his room in the middle of the night. Julia and her colleagues suddenly seem to look remarkably attractive and physically fit.

Jack's first employment nibble in months comes, surprisingly, from his wife's company, which finds itself in need of his computer expertise. He quickly learns that Xymos is in the throes of a Frankensteinian disaster for which his wife is largely to blame. The company has made use of one of Jack's computer programs in its nanotechnology project, and the result is the book's monstrous antagonist: a swarm of black dust that surrounds its prey, enters the respiratory system, and causes suffocation. Programmed to function outside the lab, the swarm evolves by the hour, growing stronger and smarter with each generation of particles, killing a snake and a rabbit, and eventually taking human form.

Prey is intentionally cinematic, aching to hit the big screen. One scene even conjures up a Crichton déjà vu, as Jack and his team find themselves cowering in SUVs, *à la* "Jurassic Park." This time, though, it's not dinosaurs stomping on the roof of their Explorer—it's nanotech swarms sneaking through the AC vents.

Lest we miss the point of the story, Crichton explains in his preface: "Sometime in the twenty-first century, our self-deluded recklessness will collide with our growing technological power." He warns that we too often fail to act upon plausible threats until it is too late: "We put the stoplight at the intersection after the kid is killed."

And the target of Crichton's specific concern in this book—nanotechnology—is well timed, even if his worries are deliberately overblown. Nanotechnology involves the manipulation of matter at the atomic or molecular level. Early uses might take the form of very precise treatments for certain medical conditions, supremely efficient tools and devices, and highly accurate and effective weapons. In theory, techniques could eventually be developed to construct objects, or even living things, from the bottom up, atom by atom, by manipulating matter at nearly its most basic level, thus allowing for tremendous control over the material world.

Although nanotechnology is still in the early stages of development, progress in basic techniques has already been fairly rapid. The nanotech industry is growing and organizing, with a trade association and a lobbying arm (the NanoBusiness Alliance). Three years ago, the U.S. government began the National Nanotechnology Initiative, with the promise of half a billion dollars in research funds, and at least eleven government agencies in this country are currently funding nanotech research, as are more than two dozen other countries.

While the potential benefits are clear, so are the potential dangers. Accidents in the application or design of nanotechnology could spell disaster. The risk of an out-of-

control, powerful, yet invisible technology, which replicates itself and learns from its environment, makes for some frightening scenarios—like the swarm in *Prey*.

Even more likely, however, is intentional misuse. If molecule-sized machines can be programmed to repair individual cells of the body, they can also be programmed to harm and destroy them. If they can manipulate matter at its most basic level, they can wreak barely imaginable destruction at every level of our lives. Nano-weapons would make germ warfare look positively crude by comparison.

All the potential uses and risks, and all the unknowns surrounding nanotechnology, seem to call for reflection and potentially for regulation, even at this early stage—both to avert disaster and to avoid uninformed panic.

Crichton is of course not the first to warn about the potential risks of nanotechnology. At least since the 1980s, experts have worried about a horrific scenario called the "gray goo problem," in which self-replicating nanotech runs amok and devours everything living on Earth. More recently, Bill Joy, the chief scientist at Sun Microsystems, argued in *Wired* magazine in 2000 that nanotechnology—along with robotics and genetic engineering—may threaten the future of the human race.

A small public interest group called ETC (pronounced "et cetera") has for years been publishing dire warnings about potential horrors—particularly environmental harms—stemming from new technologies. In an 80-page report released in January 2003, ETC warned of "horrendous social and environmental risks" from atom-sized machines. The report called for an "immediate moratorium on commercial production of new nanomaterials," and the creation of a new "transparent global process" for assessing the risks of nanotechnology.

Another call for government action on nanotechnology came from the San Francisco-based Pacific Research Institute last November. In an instructive paper entitled "Forward to the Future: Nanotechnology and Regulatory Policy," law professor Glenn Reynolds—best known for his InstaPundit.com website—argues that the potential benefits and dangers of nanotechnology make some form of regulation unavoidable. He outlines three potential scenarios for the development of such regulation: total prohibition, restriction to military use, and carefully regulated civilian use.

Reynolds argues quite plausibly that only the last of these truly makes sense, and he proposes a scheme that combines modest government regulation (including export controls and some restrictions on access to nanotechnology) with a strong regime of self-regulation among scientists and researchers.

The substance of the proposal probably does not go far enough, and Reynolds errs in suggesting that nanotech regulation be modeled on the "Asilomar" approach—the development of self-regulation of recombinant DNA (rDNA) technology in the early 1970s. In fact, the Asilomar scheme was by design insufficient, since it intentionally ignored many of the possible misuses of rDNA technology (for weapons, for reckless genetic manipulation, etc.) and because Asilomar ignored the ethical questions beyond safety.

Nevertheless, Reynolds's proposals are sober and serious, and the paper offers a valuable early step toward an effective public policy on nanotechnology—one that could avert the greatest dangers and calm public concerns, while not giving up

on the positive potential of the technology.

It is certainly Crichton's swarm, and not Reynolds's policy paper, that will spark the public imagination and give form to our first impression of what nanotech might be and might do. But in the end, neither one quite gets at what might be the most important effect of nanotechnology. Nanotech stands not only to provide us with immensely powerful tools, but to radically alter our conception of the material world. The ability to build things one atom at a time will fundamentally change our relationship with living matter, both human and non-human. We are only beginning to imagine the consequences.