Risk and Reward: The Case for Science That Can Destroy Us

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Bill Joy cannot be called a luddite: he is a co-founder of Sun Microsystems, a computer engineer who chaired a presidential commission on IT research, and an early pioneer in computer science. He does, however, predict dire consequences if we continue to develop the three signature technologies of 21st century science: genetic engineering, robotics, and nanotechnology. It is not fear of science or technology that prompts the warning he gives in his piece "Why the Future Doesn't Need Us," but rather a profound understanding of what sets this era and these technologies apart. The heated debate society is having with itself, as Joy sees it, is about whether the promised rewards of modern science are worth the risk of annihilation.

The drastic solution he proposes is to abandon these lines of scientific inquiry altogether as far too dangerous. This is both impossible and counterproductive.

There are dangers we know, predicted in science fiction stories and easily understood as the inevitable result of utilizing the most powerful tools ever conceived to solve problems in medicine, manufacturing, and agriculture. What Joy wants us to consider is that the unknowns are far more dangerous when evaluating genetic engineering, nanotechnology, and robotics (or GNR) because the consequences of these technologies interacting with us and the natural world are unpredictable. Once artificial intelligence is programmed, is it possible to limit what it can learn? In engineering cells to synthesize a needed protein, could a seemingly trivial gene combination produce a toxic, highly contagious antigen for which there is no possible treatment?

Unlike any previous technology that science has produced, GNR technologies are capable of self-replicating. This, Joy emphasizes, is what he calls an "amplifying factor."

Civilization has threatened itself before, but not in such a way as to guarantee its extinction. Nuclear war could bring us back to the stone age, but out of control nanotechnology could extinguish all life on Earth. Where previously these ideas were science fiction, the technology to make these visions reality exists.

Further compounding the problem is how scientific research has changed in the modern era. The Manhattan Project was funded and conducted in secret by the U.S. government, under military control, without public dissemination of the results. The subsequent nuclear power, nuclear weapons, and chemical and biological development was shepherded by both national and international institutions whose purpose was to ensure that this newfound power to destroy was tightly controlled for the safety of all. Today's GNR research is being conducted by independent labs and corporations. The means to develop these technologies for practical uses in the global marketplace have become cheaper, easier to procure, and require less skill to operate. There is a lack of accountability to the public when science is undertaken by private entities.

The conditions and potential dangers Joy brings up are valid concerns. While he rightly insists we need to have a worldwide conversation about both the practical and ethical implications of developing these technologies, he also advocates for something far more radical. The access to these sciences, he believes, represents an existential threat that is so great, we must "limit our pursuit of certain kinds of knowledge." Joy implies that our creative impulse fueling science and technology is inextricably tied to "perpetual economic growth," which must be abandoned for the sake of our continued existence.

Is Joy overestimating the capacity for individuals to do harm? Or at the very least their ability to achieve the scientific knowledge necessary to develop technologies intended to cause harm? This is what science writer Lewis Thomas calls "hubris in reverse." The existing trope that mankind is playing God and, in his arrogance, will accidentally destroy himself is

predicated on the idea that mankind is powerful enough to play God. Bill Joy wrote his piece in the year 2000, and in the two decades since we have made progress. But besides GMO crops, which has been a controversial but hugely beneficial implementation of biotechnology, we have yet to see most of his predicted developments arrive in the consumer marketplace or produce large-scale results. Thomas makes the point in his essay "The Hazards of Science" that it may in fact be impossible to limit knowledge, and that it is in the unknown, where many fear lies our destruction, where we discover essential knowledge. The limitation of knowledge, however that might be attempted, would serve to limit not technological development but our ability to progress in science at all.

Michael Specter, a journalist who has written extensively about industrialized countries grappling with science denialism (a rejection of scientific fact), makes a similar point. He calls Joy's perspective "the precautionary principle," where the potential risk, however unlikely but catastrophic if realized, must be given greater weight than any possible benefit. This, he posits, is far more dangerous for our future. The spoils of the 19th century industrial revolution are obsolete, and it is in biotechnology that the issues we face today as a species are going to be addressed. Genetically engineered crops resist pests and mature faster, ensuring the rising population can be fed. Microbes can be engineered to remove carbon dioxide from the atmosphere. The problem of rising costs and dwindling supplies for treating diseases that kill millions are being solved by engineering cells to produce the necessary medicinal treatments.

Specter cites the rise of science denialism as the result of "blind faith in scientific virtuosity" meeting failed expectations. The current emotional debate over genetic research, AI, and nanotechnology, is the direct result of ignorance and poor communication. What needs to happen next, he concludes, is an inclusive conversation with Americans and the scientific community to "return science to its rightful place in our society." This lofty goal involves practical action such as international conferences to establish regulations for GNR research,

greater investment in science education, and efforts to increase rather than decrease development of these technologies.

Political scientist Francis Fukyama makes the case that we already have existing regulatory bodies that serve to protect humanity from nuclear weapons and nuclear power accidents, cloning, and pharmaceutical and genetic experimentation abuses. The obvious solution, therefore, is political action to regulate GNR in much the same way. Avoiding an all-or-nothing scenario requires political will, which requires a more accurate understanding of the science at work.

We can have this conversation so long as we all know the nature and scope of what is at stake. We must also ensure everyone is taking part in the conversation. Denise Caruso, award winning journalist and author who reports on the risks of biotechnology, has proposed re-defining those very risks. Perception of risk is going to differ for members of a society, let alone for different societies working together on the same science. Can we determine a risk-reward ratio for everyone? Who gets to decide that? Do scientists know all the necessary facts to be able to define what is acceptable risk and what is not? Even in the presence of extinction-level risks, would it not make sense to have a complete understanding of that technology? Here, Caruso, a senior research scholar at Carnegie Mellon University, tells us that despite the applications of biotechnology in the agriculture marketplace already, even among scientists the risks of genetic engineering are largely unknown. Defining risks, and by default, success, is a necessary step on the way to limiting danger and abuse, and it requires more knowledge. In order to responsibly regulate, oversee, and ensure the safety of GNR technology, more scientific research is essential.

There are in fact limits to what we are capable of achieving in genetics, nanotechnology, and robotics, but Bill Joy is absolutely correct in asserting those limits will change. There may not be limits to the amount of harm that one bad actor can do with the right technology, but

there are a limited number of bad actors. What the scientific community must do is be prepared. We can establish as a society the boundaries of technological development and allow scientific knowledge to guide us. Ensuring humanity's future is the reward for managing the risks that are inherent in developing new technology.