Illustration by Shonagh Rae

“There’s a real urgency to be ready when that bioconvergence happens.”

Senator Todd Young shares his vision for how emerging biotechnologies can revolutionize agriculture, industry, and warfighting.

Todd Young, senior Republican senator from Indiana, has long been interested in science and technology policy. He played a key role in the 2022 CHIPS and Science Act, bipartisan legislation aimed at boosting US economic growth and national security by increasing domestic semiconductor production and scientific research. Young is the chair of the National Security Commission on Emerging Biotechnology, which recently delivered a major report to Congress that assesses the current state of biotech research and development and outlines actions the United States should take to maintain its competitive edge.

Young graduated with honors from the US Naval Academy in 1995 and accepted a commission in the US Marine Corps. After training as a rifle platoon commander, he served as an intelligence officer. Later, Young put himself through night school at the University of Chicago, earning an MBA in economics. He also holds an MA from the University of London and a JD from Indiana University. He represented Indiana's 9th district in Congress from 2011 to 2016.

Issues contributing editor Molly Galvin recently sat down with Young to discuss his views on the future role of biotechnology in the US economy and national security, what it takes to pass large-scale bipartisan legislation in Congress these days, and the significance of a "ChatGPT moment" for biotech.

The National Security Commission's report includes a map showing that biotechnology—which was once concentrated on the East and West Coasts—is moving to middle America. Can you share your vision for how you see biotechnology changing the lives of the people and the economy in your home state of Indiana?

Young: We're a major agricultural producing state, a major manufacturing state, and we have a significant life sciences presence in the state. We have the leading pharmaceutical manufacturer and developer in the world, an agricultural bioscience company, and a leading animal health company. We have universities like Purdue and Indiana—and they're doing great work.

We can harness our advantages across the industrial and agricultural Midwest and leverage them in a really meaningful way. Biotechnology will improve our agriculture, create breakthroughs in life sciences, and revitalize our manufacturing sector. We can use the feedstocks from our agricultural sector to manufacture familiar products like medicine, rubber, and critical chemicals using biotechnology. We can leverage the educational institutions we already have across the state to train the next generation of workers. We are not only inventing new products and perhaps even services, but starting to manufacture those products here in the Midwest.

When you were at the School of Advanced Study at the University of London, you wrote your thesis on the history of Midwestern agriculture. How does what is coming with biotech compare to historical transformations of the past?

Young: Agricultural history is filled with moments of transformative technology adoption. The most obvious example of this is when the use of tractors and combine harvesters revolutionized how we plow the land, plant seeds, and harvest crops. Emerging biotechnologies present similar opportunities for agriculture. Using biotech, farmers are already growing crops that require less water and are more resistant to pests. We are also well on our way to developing nitrogen-producing microbes that reduce or eliminate the need for expensive fertilizer. Innovations like this can be harnessed to increase crop yields and improve farming practices, much like mechanization did. Embracing emerging biotechnologies will continue to revolutionize agriculture for American farmers.

What are the implications of biotechnology for the military, and for national security more broadly?

Young: There are many vectors of potential vulnerability to our homeland, to our economic security, and to our national security. There are also opportunities for our warfighters.

For example, we want to make sure that our warfighters don't have extended supply chains, and that their supply chains can be made more resilient so they're not going through the dangerous activity of moving things into and out of a war theater. How might we do that? You could imagine shelf-stable blood, for example, being grown in war theaters through a biomanufacturing process. This would allow blood to be on site for our warfighters when they need it, before bad things happen and without the long wait that often undermines battle plans.

You could also imagine biologically produced propellants, or what we call energetics, that are used to send projectiles—missiles and rockets—through the air. Through biological means, we could figure out how to make our projectiles go farther than our enemies', which would disrupt all kinds of battle plans that our enemies might have. You could imagine us building on innovations of the last generation, such as Kevlar, and

figuring out how to produce even lighter, more resilient materials for the equipment our warfighters use.

All these things are certainly not within the realm of science fiction. In fact, everything I just mentioned exists. This is one area of interest. Another is just the broader biotech vulnerability of the United States to economic disruption if our adversaries have biotech capabilities and use them to gain geopolitical advantage.

One thing we did not contemplate—and will not contemplate unless the American people change their views on this—is creating bioweapons. This is something the United States does not and will not do—but China, or others, might. We need to have defense mechanisms against that, which is something we also discuss in the report.

The report also says that we are in serious danger of falling behind China. How can the United States gain a competitive edge in biotech?

Young: We are up against a country that has a plan, and they've had a plan for a long time. It's part of Made in China 2025, the country's initiative to improve Chinese industry. They have been investing a lot more in workforce development and in research. In fact, more broadly, public research in China has grown 16-fold in all areas since 2000. But in biotech, China is now the number two producer of research in the world, behind the United States. On current trend lines, if we're not careful, they could pass us. They are not just borrowing our ideas and adapting them anymore—they're coming up with new ideas. In fact, many heavily cited biotechnology research papers are being produced in China.

We need to become less reliant on China for the value chain of production and discovery than we currently are. We've seen China, for example, withholding gallium and germanium; these are critical minerals to our economy. In the future, they could withhold essential gene-sequencing technologies, medicines, or laboratory materials that are really important to us.

We need to stay ahead of the Chinese so that our private sector companies can gain market share around the world. If we gain market share, we'll have the leverage to establish standards of use, deployment, and safety that are consistent with our values.

We don't want to be on the receiving end of a large disaster. We don't want to see countries around the world adopt norms of behavior and practice that are inconsistent with our values. In 2019 a Chinese researcher experimented with genetically modifying human embryos. Now that scientist is back in the lab.

Suffice it to say that we need to modify our policies and make modest investments now to avoid much higher costs later.

The report calls for $15 billion in federal support for the bioeconomy. You worked on the CHIPS and Science Act and other large science bills that passed with bipartisan support. How do you see this happening with biotech?

Young: I frankly thought there would be a measure of resistance, maybe even skepticism, in the Senate on the need to invest what is a fairly modest amount amid this resource-constrained environment. I haven't encountered it yet. Now, that's not to suggest that there won't be some principled opposition, or at least reluctance, when it comes to specific line items moving forward. But so far, there's been an embrace of the need to take this threat seriously, of the need to optimize our own system to compete with China, and to make some targeted, modest investments so that our warfighters and our country can stay ahead.

That's given me a whole lot of optimism as we think about legislative opportunities. Once we get through the "Big Beautiful Bill" here in Washington, I do think that many of these measures will begin to be considered in the House and the Senate. It's my hope that the White House will join us in underscoring the importance of these efforts.

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There are many federal agencies that are involved with biotech research and regulation. How should the government organize its biotech efforts in this challenging environment?

Young: There are three big recommendations in the report. The first one is to make sure that we establish an office in the White House that owns this. It can look across the different agencies that are stovepiped in order to coordinate our overall policy.

This will help with the second objective, which is that we need a much better regulatory atmosphere. There are roughly 15 programs or entities in the executive branch that oversee biotech. Three regulators typically play a role, sometimes all at the same time, in regulating particular products or companies: the Food and Drug Administration, the Environmental Protection Agency, and the US Department of Agriculture. We need to optimize our regulatory system so there's a single point of contact—an air traffic controller, if you will, who our entrepreneurs and innovators can deal with so they can get their products through the regulatory process.

The third thing we need is a demand signal, not necessarily for biopharma and ag bioscience, but in terms of bioindustry. Research by the McKinsey Global Institute indicates that 60% of the inputs to the global economy made through conventional manufacturing today can be made with existing technology through biological methods instead. Building bio-based industries would mean we can manufacture more things in the United States, rather than ship them in from overseas. There is a real opportunity for our Defense Department to favor bioproducts and components that work just as well and are already cost effective as compared to traditionally manufactured competitors.

The report also explores a coming "ChatGPT moment" for biotechnology. What does that moment look like? Are we prepared?

Young: The ChatGPT moment is the so-called bioconvergence between artificial intelligence and biotech. This could lead to decades of biotechnology breakthroughs in mere years. There are risks and there are opportunities. The opportunity exists if the ChatGPT moment happens here in the United States—and if it is something we are prepared for. If, instead, we experience a DeepSeek moment in which China makes a huge breakthrough, then China's going to seize the day. China is already well down the road to implementing their biotech plan.

We're not ready. That's why there's a real urgency this year for Congress to act, for the administration to act, and to be ready when that bioconvergence happens.

Reading the report, the scale of change that you're talking about is immense. In particular, the report mentions creating a "bioliterate public." What does that mean? Do we have the educational infrastructure we need to make this happen?

Young: Simply put, bioliteracy is the ability to understand and engage with biology and biotechnology. Our commission envisions a future in which Americans engage with biotechnology the same way they do with cell phones and computers, leading to a more informed, empowered, and resilient society capable of leveraging science and technology to solve a wide range of global challenges. At the same time, boosting public bioliteracy will also help build the future biotech workforce. But to get our nation to that spot, we need to ensure Americans are being equipped with the necessary education, training, and skills.

Our commission recognizes that more needs to be done to support bioliteracy and biotech job creation, which is why we proposed a series of recommendations aimed at building the future biotech workforce. This includes developing a bioliterate federal government, maximizing the impact of biomanufacturing workforce training programs, expanding educational opportunities for students, and being the global destination for the best and brightest in biotechnology. Bold, creative, and driven individuals have propelled the United States' unyielding pursuit of progress, and we should put that ethos to work for biotech.

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