

Big ideas and grand challenges

The US government's initiative to create a national blueprint for a 21st century bioeconomy is too narrowly drawn. A more expansive vision is needed.

If you could come up with ideas with the potential to transform the US bioeconomy in the 21st century, what would you do? This is essentially what the US Office of Science and Technology Policy asked last month when it issued a Request for Information (RFI). The RFI follows President Obama's September 16 announcement that his administration seeks to develop a National Bioeconomy Blueprint that would "harness biological research innovations to address national challenges in health, food, energy and the environment." Given the broad scope of this statement, it is puzzling that the RFI provides a rather myopic view of areas of interest: genomics and personalized medicines, vaccines, diagnostics and protein function prediction; funding and personnel for bioentrepreneurial companies; regulation of healthcare products; and technology transfer and other issues in public-private collaborations.

These all sound like 2011 issues and, although they could still be issues in 2021 or 2091, government agencies and industry associations, such as the National Institutes of Health, Pharmaceutical Research and Manufacturers of America and Biotechnology Industry Organization, don't need *Nature Biotechnology* to help outline the current problems to government officials. Instead, this journal would like to throw out some bolder ideas.

Probably the grandest challenge facing the United States in the coming epoch is overcoming energy dependence. Thus, the US government should continue to fund biofuels and green technologies that can play a role in reducing the country's dependence on fossil fuels and potentially mitigate threats from climate change and extreme weather. But they are only parts of a solution where direct solar or nuclear options will dominate. Similarly, another challenge—feeding the world—is not so much a biotechnological challenge, as it is one of trade and political barriers. So although the US government should deregulate those crop traits where overwhelming evidence suggests a lack of risk and monitor against monoculture practices, we believe there are other areas where government intervention can have greater impact.

One of them is the country's aging population and the problem of shifting patient and physician psychology away from expectations that the later years of life are inevitably a gradual decline into dependence on symptom-quelling pharmaceuticals and heroic and hospital-centered interventions. Arthritis, obesity, diabetes, heart disease, cancer and respiratory diseases—the major expenses in health today—all have strong lifestyle contributing factors. Weaving a safety net of increasingly desperate rescue remedies lulls people into thinking the health problems they ignore early in life can be managed later. They can't.

The government should not be asking what it can do for its citizens, but what its citizens can do for themselves (given the right tools and support). The necessary shift to self-awareness, diagnostic understanding and early intervention requires an unpicking of today's illusory solutions. Fundamentally, the system needs to move away from leveraging current

industry practices and aspirations and instead undertake the kind of initiatives that only a government determined to work for all its people and beyond the next political term could countenance: provide incentives to carry out life-long longitudinal studies mapping biological markers and behavior as well as health outcomes.

As part of this goal, rather than continuing to focus on the sequencing and genomic approaches belabored in the RFI, *Nature Biotechnology* says stop the cataloging! Omics is a commodity, ever cheaper, ever more available—an industrial product. It is the plastic toy in a fast food box that should be left to those who can make it cheaper or faster than US researchers. As a highly advanced bioscience nation, the United States should instead turn its attention to modular biology and the development of technical approaches that facilitate it. It is abundantly clear that biology is more than the sum of its parts, and yet 'systems biology' remains stuck in its conceptual stage. The science needs bridges that span some part of the spatial and temporal disparity between molecules and the timescales for molecular events on the one hand, and those of systems like the cell, the organ and the body on the other. Constructing those bridges will require specific programs aimed at biological subsystems of particular interest that appear tractable. At the moment, US funding predominately feeds two approaches: (i) laboratories working on single proteins and their local pathway or (ii) grand cataloging efforts. What is also needed are bold funding initiatives that bring together experimentalists and computational experts to work on a few well-defined systems problems.

A last apparent preoccupation of the RFI is "moving life sciences breakthroughs from lab to market." This is a legitimate concern considering that billions of dollars have disappeared from US research funding and early-stage venture finance. Much has been made in recent years of pharmaceutical companies reaching back to fund academic work, but this is just a drop in the ocean. Instead, the US government must act to provide another solution: set aside funds, say \$2 billion a year, to provide cornerstone funding for corporate venture investment funds.

These government funds would be contingent on matching funds from US-based corporate venture financing, and any annual returns on investment would be used to pay back the \$2 billion annual outlay. Industry-experienced investors would run the funds and, importantly, seek intellectual property not only from the United States but also from around the world, bringing it, together with the bright inventive minds behind it, to the United States. Locating the projects in the United States would boost expertise and employment, and it would place these exciting opportunities in the country that leads the world in facilitating healthcare innovation.

The United States is already far and away the best place for biotech. The government should leverage the research that US researchers are best placed to pioneer and use US entrepreneurial strength to capitalize on the potential that lies underexploited in the rest of the world. **LB**