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Editor's Journal

The Science Policy We Deserve

On May 21, 2020, a bill was introduced in Congress to pour \$100 billion into technology development to “catalyze United States innovation.” Exactly 10 days later, the University of Colorado shut down its Center for Science and Technology Policy Research. The juxtaposition of these two events is not some bitter irony, but it does bring into sharp focus the essence of American science politics.

The science policy center, founded in 2001 by the political scientist Roger Pielke Jr., didn't cost the university much, and did everything universities want: generated lots of research (and indirect cost) dollars, publications, citations, and media attention, while delivering interdisciplinary curricula and graduating well-trained students and putting them into the workforce. Pielke, with whom I've collaborated closely for 25 years or so, is a well-known troublemaker, meaning he has a penchant for recognizing and calling out bad arguments, misuse of data, and so on. He got crosswise with the climate science community years ago, but bought some time for the center by leaving it in 2015, after his university investigated him at the request of a member of Congress. (The request was scurrilous; the investigation revealed nothing.) It took the university another five years to close the center down.

Science policy centers such as Pielke's have come and gone over the past few decades, all aimed at providing analysis that can support decision-making about a variety of issues in science and technology. The \$100 billion technology bill is pertinent to the story because it demonstrates why such centers are expendable: no one really cares about science policy analysis unless it provides more reasons for getting more money into the research system.

The idea that money is the variable that really matters in

science policy can be sustained by two widely held beliefs. First, as Vannevar Bush taught the world in *Science, the Endless Frontier*, science policy is easy: if you add more money, you'll get more science, and the world will get better. Second, because more science delivers more truth, as long as politicians and policy-makers listen to what scientists are saying, they'll make the right decisions about how to deal with the many challenges facing the world today, and tomorrow. Science policy isn't only easy, it's unnecessary.

Never mind that the state of the nation today amounts to a comprehensive and dispiriting falsification of those two beliefs. I'll dispense with the second one first. Spend a couple of hours reading up on the science of COVID-19 and you'll quickly see that whatever truth's virtues, there's an awful lot of it floating around, enough for pretty much everyone to have a version on their side. And if you think it's just about good scientists and rational citizens on one side, and bad politicians and know-nothings on the other, then I double dare you to dig into the literature on cloth mask efficacy, or hydroxychloroquine and COVID. Decision-making is really easy when the truths are self-evident; it's when they are contested, mired in uncertainty, intermingled with competing interests, and implicated in urgent problems that the connection between science and decisions gets difficult. (If you'd like some help thinking through that difficulty, I'd recommend Pielke's engaging and accessible book *The Honest Broker*. If you don't trust him, go to Herbert Simon's 1982 gem, *Reason in Human Affairs*.)

As for more money for more science making the world better, the problem is that science doesn't drift down onto the world like cosmic (or fairy) dust; it comes via economic, social, and institutional arrangements, often transported

by technological innovations. The new knowledge and capabilities science helps to create insinuate themselves into a world already structured in particular ways. Science in textbooks and technology in patent applications might be abstract and value-neutral, but they exist in the real world only when they are incorporated into that world. The view of progress that moves smoothly from frontier science to innovation to economic growth to benefit for all, which Vannevar Bush articulated so influentially in *Endless Frontier*, is from this perspective meaningless. Economists have sanitized the societal consequences of this supposedly inexorable catalysis of progress-from-science through the idea of creative destruction, with the emphasis always on creation—of new technologies, industries, and economic possibilities. The destruction—of jobs, livelihoods, industries, entire cities—is swept aside as mere collateral damage.

So, here we are with a proposed infusion of \$100 billion for science and technology, in a new piece of legislation—S. 3832, introduced by Senator Charles E. Schumer (D-NY)—called ... wait for it the Endless Frontier Act. As the bill explains: “For over 70 years, the United States has been the unequivocal global leader in scientific and technological innovation, and as a result the people of the United States have benefitted through good paying jobs, economic prosperity, and a higher quality of life.”

But wouldn't it be just as accurate to say: “For over 70 years, the United States' global leadership in scientific and technological innovation has been matched by a gradual loss of high-paying, secure jobs; a continual rise of income, wealth, and health inequality; and a worsening of quality of life for increasing numbers of Americans living in deindustrializing regions or dependent on dead-end service sector jobs”?

Whatever. Now, the bill continues, America's “leadership position is being eroded and challenged by foreign competitors, some of whom are stealing intellectual property and trade secrets of the United States and aggressively investing in fundamental research and commercialization to dominate the key technology fields of the future.”

What is one to make of this assertion of foreign menace amid the social, political, and economic fissures currently wracking the nation, fissures greatly amplified by COVID-19, the pandemic everyone knew was coming at some point even as we were somehow powerless to hold it off? Could all this really be China's fault?

Whereas a full analysis of the bill's strengths (there are several) and weaknesses (there are many) is beyond the scope of this essay, I'll just mention one central incoherence. The bill does recognize (without quite saying so) the extreme imbalances in wealth and opportunity

that characterize America today, and seeks to address those inequities through a regional approach to science and technology investment, to increase the innovative and wealth-generating capacities of areas of the country that are economically disenfranchised. In doing so, it adopts a position championed by West Virginia Senator Harley Kilgore in the famous World War II-era debate with Vannevar Bush about the social purpose of government-funded research. Bush won that debate—science funding would go to the best scientists, not the most urgent social problems or beleaguered regions—but Kilgore's perspective has been partly resurrected in this legislation.

The bill thus tacitly acknowledges *the truth that cannot be spoken*, that science and technology actually aren't neutral, precisely because they enter society through social and economic systems, taking on the strengths and the pathologies of those systems. If science and technology created the innovation that made America great, they also helped make possible the deindustrialization of many regions of America. The bill apparently aims to redress the costs of past science and technology by catalyzing new sources of regional innovation capacity.

Fair enough.

On the other hand, the expenditures in the bill are entirely directed toward 10 technological frontiers—artificial intelligence, quantum computing, robotics, among the usual roster—a list that will be reviewed and honed by a board of 12 advisers “representing scientific leaders and experts from industry and academia.” Nothing at all about prioritizing research to directly address the problems that divide society today. Nothing about including voices from within and across society to help determine those priorities.

The bill would also import the approach of everyone's favorite technology development agency, DARPA, the Defense Advanced Research Projects Agency, to guide how specific projects will be selected and funds disseminated, but seems unaware of why DARPA was able to succeed: it's a mission agency, pursuing technologies to solve actual problems directly relevant to national defense, technologies that would then be tested and deployed by the Department of Defense. The Directorate for Technology that the bill would establish at the National Science Foundation would lack those essential attributes. Rather than being driven by specific problems in response to an agency mission, it would be driven by scientific research and technology development, mostly centered at universities, and aimed at creating new sources of economic opportunity in regions of the country that have been left behind by past innovation and growth. So the bill adopts the Vannevar Bush approach, where progress originates from government funding for university research. But it promises to achieve the goals of a mission-oriented agency such as DOD. This won't work.

Advancing science and technology without regard to outcomes is relatively straightforward; advancing it in a way that helps to address the knowledge and innovation needs of the nation—for affordable, high-quality health care, for decent, well-paying jobs, for clean air and water, for cheap and clean energy, for fresh, nutritious, inexpensive food, safe homes and streets, great education—that's more difficult. But these are the sorts of challenges that today's civil and political disquiet (and the legacy of neglect on which they build) tell us should be at the center of how we organize our public investments in science and technology.

So why aren't they? In our *Issues* interview, Margaret Hamburg and Victor Dzau, leaders in the national effort to fight COVID-19, make clear the urgency of applying science policies to reverse inequity and injustice in the nation's health system. As Hamburg explains, the crisis has brought the scientific community together to move "in ways that we never thought possible in terms of the speed of development," and Hamburg and Dzau propose models of collaborative innovation that are entirely outside the restricted domain of science and technology policy allowed by *Science, the Endless Frontier*. So if escaping the constraints of *Endless Frontier* on science policy thinking is okay for dealing with COVID-19, why isn't it okay for dealing with other challenges to our national well-being?

Maybe it is not just okay but necessary. As Barry Bozeman explains in "Public Value Science," a continuation of our series marking the seventy-fifth anniversary of *Science, the Endless Frontier*, the undiminished influence of that report on science policies can now be seen as a regressive force multiplier in the American economy and society. Bozeman proposes a five-step policy program that could help steer science toward the "grand challenge" of contributing to reduced economic and social inequality. None of these ideas are reflected in the Endless Frontier Act.

Also part of our *Endless Frontier* series is Bhaven Sampat's historical analysis of the debate around patenting of publicly funded research. This was a little-known dimension of the science policy debate in the 1940s between Vannevar Bush and Harley Kilgore. It is directly relevant to today's need to make sure that any drugs developed to respond to the COVID-19 pandemic are both affordable and widely available. Sampat suggests consideration of a DOD-like end-to-end government role in making new drugs accessible for all—the sort of approach to linking publicly funded innovation to societal outcomes that the Endless Frontier Act ought to be proposing, but isn't.

None of this is to argue in the least that economic growth should not be one of the central motivations for America's science and innovation policies. As David Sainsbury explains in "Race to the Top," common macroeconomic wisdom, applied in a world of globalizing science and markets, has led to a decline in the high-value-added sectors of the US economy that fuel both productivity increase and high-quality job creation. Innovation policies must focus on reversing this decline. To succeed, however, they will have to be designed with socioeconomic conditions in mind. For example, declining postindustrial cities are central to America's problems of economic and social inequality. The Endless Frontier Act notes that "more than 90 percent of the Nation's innovation sector employment growth in the last 15 years was generated in just 5 major cities." Appropriately, then, its programs focus on "partnering with the private sector to build new technology hubs across the country." But as Carl Schramm shows in "Save America's Dying Cities," such programs are unlikely to take hold unless cities are well-managed, have good public education, and aggressively foster local entrepreneurship capacity and opportunity.

There's still more in this issue. Why are science and values often so hard to tease apart? Check out "The Great Fish Pain Debate," and you'll get it. How can we be sure that robots will be safer drivers than you and me? Why is the world revealed by COVID so different from the one we thought we were living in? Does naming things in nature change how we see nature? In our book reviews and our spectacular art features, more questions raised and explored: about truth and politics, data, feminism and power, China and technology, and technology and self-understanding.

Given the complexity, ambiguity, and uncertainty of the world that humans continually create through their scientific and technological genius, it's really quite unbelievable that models of the democratic governance of science could still be largely captured by the simple thinking in *Science, the Endless Frontier*. We all deserve better. Universities may find it uncomfortable to support science policy centers that question the fundamental assumptions behind the post-World War II science policy system. But as the articles here show—as, I hope, *Issues in Science and Technology* always shows—a rich array of experts are challenging the contradictions and incoherence of the *Endless Frontier* model, and offering positive new policy ideas and options. What's needed is an energetic, informed, and courageous debate about these alternatives. The Endless Frontier Act, mired in the old money-plus-science-equals-progress view of science policy, is nonetheless also an invitation to begin that debate in earnest, at long last.