Disease, Disability & Immortality: Hope & Hype Module
Notes and Review Questions for Science The Endless Frontier authored by Vannevar Bush in 1945
By Katayoun Chamany

"As Director of the Office of Scientific Research and Development, Dr. Vannevar Bush has coordinated the activities of some six thousand leading American scientists in the application of science to warfare. In this significant article he holds up an incentive for scientists when the fighting has ceased. He urges that men of science should then turn to the massive task of making more accessible our bewildering store of knowledge. For years inventions have extended man's physical powers rather than the powers of his mind. Trip hammers that multiply the fists, microscopes that sharpen the eye, and engines of destruction and detection are new results, but not the end results, of modern science. Now, says Dr. Bush, instruments are at hand which, if properly developed, will give man access to and command over the inherited knowledge of the ages. The perfection of these pacific instruments should be the first objective of our scientists as they emerge from their war work. Like Emerson's famous address of 1837 on "The American Scholar," this paper by Dr. Bush calls for a new relationship between thinking man and the sum of our knowledge." (Editor Preface of Bush, V. As We Think. The Atlantic. July 1945)

Vannevar Bush was quoted as saying, "Scientific progress is one essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress," in providing the rationale behind his report Science: The Endless Frontier.

In this report, Bush calls for the establishment of a National Science Foundation, coordinated public funding of all science, and unfettered freedom to conduct science and to promote science through education, patents, and publication/dissemination. The proposal is in response to a request from President Franklin D. Roosevelt to Bush, who at that time was serving as the Director of The Office of Scientific Research and Development, a primarily wartime office; the letters are included and appear before the proposed six-chapter proposal.

Bush had previously served as professor and Dean of MIT and president of the Carnegie Institution, so not surprisingly the emphasis is an academic minded one. Bush had the foresight to recognize that in 1945, with the advent of antibiotics, communicable diseases would diminish, but that longer lives would result in more chronic and degenerative diseases such as CVD and diabetes. Chapter 3 Science and the Public Welfare, is the most pertinent to stem cell research. Of note, is that in Bush's original proposal there is a call for a rather autonomous scientific community that would be insulated from the politic process; one that appoints its own Director and Board from the scientific community (Not appointed by the president or confirmed by the Senate), and one that draws from a long term endowment to be replenished at widely spaced intervals such that it would remain immune to dips from the annual budget cycle. His purpose was to emphasize that basic scientific research with no purpose in mind is just as important as applied scientific research. The reception of the report is interesting in that the organizational plan was rejected while the ideology was embraced. Thus, in 1950, the National Science Foundation was established but with a very narrow mission of carrying out scientific research primarily in the academic sector. Disease research was carried out in the newly established NIH, military basic science by the DOD, and energy research by the AEC. (For more information see Donald Stokes. Completing The Bush Model: Pasteur's Quadrant. In Science the Endless Frontier: Learning from the Past, Designing for the Future.) Highlights from that

conference series "*In Science the Endless Frontier: Learning from the Past, Designing for the Future"* held between 1994-1996 include responses and updates to the Bush Report. Cozzens comments on the exclusion and division of social sciences in this context, while Crow asks that we consider social capital when charting out a ten year map for national research.

Bush, was, in fact, moving forward a compromise; that science be unfettered in its direction, yet guided and regulated by government. This compromise is one that responds to a twenty-year debate between J.D. Bernal and Michael Polanyi in Britain at around the same time. Polanyi stressed autonomy and self-governance of the scientific community, while Bernal strongly influenced by Marxist theory, felt that autonomous science was inefficient; that someone needed to be in charge of agenda setting and goals. Eventually the report led to the strong partnership between science and American universities and criticisms have emerged since: Cozzens reminds us that the scope of the funding is myopic and divisive to the social sciences; and Crow reminds us to update the model to assess scientific worth by measuring the amount of social capital generated by research. Following up on these criticisms, In 2010, United States Senators Lamar Alexander (R-Tennessee; former President of the U of Tennessee) and Mark Warner (D-Virginia) and Representatives Tom Petri (R-Wisconsin) and David Price (D- North Carolina) charged the American Academy of Arts and Sciences with the task of considering the role that the social sciences and humanities should play in education, research, and security. On February 2011 a new Commission on Humanities and Social Sciences was formed to address these questions:

What are the top ten actions that Congress, state governments, universities, foundations, educators, individual benefactors, and others should take now to maintain national excellence in humanities and social scientific scholarship and education, and to achieve long-term national goals for our intellectual and economic well-being; for a stronger, more vibrant civil society; and for the success of cultural diplomacy in the 21st century? The American Academy Commission on the Humanities & Social Sciences.

Consider the purpose, advantages, and disadvantages of the Bush plan and those proposed by the Commission on humanities and the Social Sciences. In doing so, analyze how contemporary funding of scientific research is being proposed and enacted today at the international, national and local levels. Pay close attention to the letter exchange between Roosevelt and Bush and Chapter 3: Science and Public Welfare.

Readings:

1. **Report:** Bush, Vannevar. 1945. Science: The Endless Frontier. *Original letter from President Roosevelt to Bush and his report articulating an investment in biomedical research and basic science*. Link
   Chapt 1: Introduction
   Chapt 2: The War Against Disease
   *Chapt 3: Science and Public Welfare: Promotion freedom of inquiry in scientific research and public funding and the role of patents to promote competition
   Chapt 4: Investing in science education: Free graduate school
   Chapt 5: Publication and Open Access to high Security Science
   Chapt 6: National Research Foundation- unity of all sciences

2. **Conference Paper:** Cozzens, S. 2000. Social Sciences: Shunned at the Frontier. *In Science the Endless Frontier: Learning from the Past, Designing for the Future*. Highlights from a conference series held between 1994-1996:101-105. Link
3. **Conference Paper:** Crow, M.2000. Beyond the Endless Frontier. *In Science the Endless Frontier: Learning from the Past, Designing for the Future*. Highlights from a conference series held between1994-1996:114-118. Link

4. **Article:** Dean, W. 2011. The armed forces institute of regenerative medicine: A collaborative approach to department of defense-relevant research. *Regenerative Medicine.* 6(6 Suppl):71-74. Link

Review Questions:

1. When was *Science The Endless Frontier* written, and why was it put forth at that time?

2. What precedent is there to support Bush's proposal?

3. Though Bush makes the argument for funding of basic science research, much of this is based on ensuring a "healthy" American populace. Subsequent administrations have championed this goal of health as reason to invest in STEM (Science Technology, Engineering and Math) as in Nixon's War on Cancer, Clinton's support for the Human Genome Project, and Obama's support for the Precision Medicine Initiative and the Moonshot Cancer Project. Given that health is determined by biological and social factors, does this argument hold true? Are there other ways that we can serve the populace that do not involve medicine or cure? Are these approaches also served by investment in STEM?

4. Consider evidence that supports the idea that investment in STEM has achieved a more "healthy" American population. Consider evidence that challenges this view.

5. Given that health is determined by biological and social factors, does an increased investment in biomedical research resonate with you? Are there other ways that we can serve the populace that do not involve medicine and cure? Are these approaches served by investment in STEM?

6. What evidence is there to support that Bush's proposal, or a version of it, has led to American competiveness in that last four decades?

7. Wendy Dean makes the argument that though our war tactics have shifted from the 1940s, the Army must invest in SCR given the large number of survivable injuries incurred by the military. AFIRM is a $300M investment in SCR with $100M of this total coming from the federal government, and the rest from academic and the private sector. What are your thoughts about this investment at a time when most veterans do not have adequate access to mental health care and states are continuing to decrease disability services funding? Reflect on evidence of success from her article to argue for, or against, continued spending.

8. Who would be an opponent of such a proposal?

9. What criticisms do Cozzens and Crow bring forth in the papers?

10. Are there other criticisms that could be brought to bear?

11. In what ways does the Federal Policy on Stem Cell Research and various states' policies on stem Cell research (SCR) resonate with Bush's Report? Consider the New York NYSTEM and the California CIRM policies.

12. If you were an opponent of this proposal what means do you have available for making this known? What activities might you engage in?