INTRODUCTION TO SCIENCE AND TECHNOLOGY POLICY ANALYSIS
PUBLIC POLICY 650
WINTER 2023
1110 WEILL
Wednesdays, 8:30-11:20 am

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COURSE DESCRIPTION

Science and technology intersect with multiple areas of public policy. Think of the growing concerns over technological surveillance, the debates over policy for climate change mitigation, the challenges posed by COVID-19, or the fear that American research and development competitiveness is eroding in a globalized economy. These issues reflect important questions about the relationship between science, technology, and public policy. Are scientific and technological developments governable, and if so, how and by whom? Is more and better science always better for policymaking? Who is the best judge of the value of scientific research programs and the policy relevance of scientific findings? Are scientific and technological innovations generally socially beneficial, and who decides?

This course introduces theories and methodologies for science and technology policy analysis. You will learn how science and technology policy is made, with specific attention to the roles of government agencies, expert advisory committees, the private sector, and the public. You will learn analytical tools for science and technology policy analysis, including values analysis, technology assessment, and deliberative democratic design. And you will learn to apply cutting edge theories and approaches for governing science and technology to a number of policy problems. This analytic toolkit will be drawn from literature in a range of disciplines, including political science, philosophy, sociology, history, and the science of science policy.
This course will provide:

- Background on the science and technology policy environment
- An understanding of the "social science" of science and technology policy
- Skills to think critically about how science and technology can be used to help solve social problems
- A multidisciplinary toolkit for analyzing and influencing science and technology policy
- Expertise in conducting S&T policy analysis
- An introduction to career paths in science and technology policy

PubPol 650 is a core course in the Science, Technology, and Public Policy (STPP) Graduate Certificate Program, but is not limited to STPP students. It is designed for graduate students from diverse disciplines, including public policy, public health, law, business, engineering and the social, biological, and physical sciences. No scientific, technical, or policy background is required to take the course.

COURSE REQUIREMENTS

Class participation	*20%*	*Controversy Paper Proposal*	*P/F*
Reading Reflections	*30%*	*Backgrounder*	*20%*
Research Funding Memo	*10%*	*Governance Recommendation*	*20%*

A. ***Class participation*.** This is a discussion-intensive course. Preparation, attendance, and active participation are crucial and will be important parts of your final grade. Each class session includes discussions and activities that require that you have read the week's readings. Active participation involves: 1) coming to class; 2) participating at least once per class; 3) making valuable contributions based on ongoing classroom discussion, the lectures, and readings; and 4) knowing when you've been dominating the conversation and pulling back. In addition, in order to active participation, I reserve the right to "cold call" students (i.e., call on students who have not raised their hand to participate). If you usually have trouble participating in class, please speak with me. I will be happy to give you strategies to increase and improve your participation.

Your preparation for class should not be a passive process of absorbing facts from readings; rather, while reading, you should actively identify (and write down!) questions you have, possible avenues of discussion, and potential points of application of the readings to current events. Along these lines, you should pay attention to current news in science and technology policy, and I encourage you to bring them into class discussion as examples (I certainly will!) Some of my favorite sources are: @NatureNews; @NYTScience; and @guardianscience.

Because this course depends heavily upon discussion and in-class scenarios, I expect students to make every effort to attend all class sessions. **Notify the GSI in advance** if you will miss class; excused absences can be granted for things like illness and family emergencies, but only if we hear from you **in advance**. Unexplained absences will negatively affect your grade. So will repeated tardiness.

Doing the reading: Some of you may be unaccustomed to the amount and types (e.g., social science and humanities research) of reading required for this course. As you will see, I have tried to vary the types (academic, journalistic) and also supplement with podcast episodes and films when appropriate. I have also given you a sense of the amount of reading per week so that can you plan accordingly. Here are a few tips to get the course reading/preparation done and get the most out of it. *First, don't attempt to do it all in one sitting!* Break it up into at least two chunks, so that you are really absorbing the material rather than just getting through it. *Second, read actively!* Take notes as you read, and underline/highlight the text when you find it interesting or important. Note the main arguments, the evidence used to support these arguments, questions that it raises for you, and other things (e.g., world events, examples) that the reading makes you think about. This approach can help you read more quickly; while you need to read everything, you'll know when you can read more quickly and when you should read more slowly. *Third, use the introductory context and discussion questions I've provided!* Together, these strategies will ensure that you extract the important information from the readings (and hopefully it will help you learn to read this type of work faster and more efficiently!)

Guest speakers: You will notice that on occasion, I have invited guest speakers to join the class. Some are graduates of the STPP Program, others are simply important figures in the world of science and technology policy. Each will join us for approximately the first hour of class, and help you connect our classroom discussions and readings to real-world considerations. I will begin the conversation with some introductory questions, and then leave the questions up to you. We will help you prepare by providing short profiles of each speaker and links to additional information. Asking these guests questions will contribute positively to your participation grade.

B. ***Weekly Reading Reflections.*** To assist you in both developing the skills central to the course and fulfilling (A), during the course of the semester you will submit eleven reading reflections on Canvas. These Reading Reflections are designed to encourage you to read actively and to draw connections across readings. We will read them before class and use them to facilitate class discussions. Reflections can vary in length, but are typically around 300 words. They should not simply summarize the reading. These posts are think pieces—opportunities for you to identify the main themes and tools discussed, ask questions, and probe insights you have as you read. Your entries should reflect holistically on **all** the readings assigned for the day, not just one. You can use your Reflection to ask questions of the material, to explore the relationship between the readings and the topics chosen for your class papers, between a particular set of readings and readings from another week, or between the readings and current events. Treat these Reflections as formal pieces of writing. Be clear and succinct. You do not need to provide formal citations for assigned reading, but if you refer to outside material, please provide footnotes/endnotes.

Reading reflections are due Tuesdays by 8 pm Eastern.

The expectation is that most posts will receive a 2 to 3. Late posts will receive a 0. If you choose to submit more than 11 reflections, we will only count the 11 highest scores in our final grading.

Points	4 (A+)	3 (A)	2 (B)	1 (C)	0
Criteria	Accurate, thoughtful, holistic analysis/ response. Evidence of exceptional effort and insight.	Good effort to connect all readings. Demonstrates careful effort and serious thought.	Generally good. But lack of specificity, insight indicates more time was needed to complete the work.	Provides only summary; misses readings; shows little engagement or insight; clear that work was hurried or careless.	Assignment substantially incomplete or not turned in.

Small interdisciplinary cohorts/study groups: This is a uniquely interdisciplinary course, with students coming from a variety of fields and programs and topics ranging across technical sectors and perspectives. To help you make the most out of the opportunity to learn from one another, we will put you into small "cohorts" of 5-6 people each (by the second week of class); these will be deliberately designed to be intellectually diverse. You will share your Reading Reflections with one another each week, via Canvas (We'll do the back-end work, but basically once you submit your Reflection, the Reflections of your group members will become visible to you—under the assignment's submission details—and you should read them. Although this is through Canvas's "Peer Review" function, but you don't actually need to submit any written review.) On occasion we will have you meet in class to discuss them. You are also welcome to share notes on the readings and course requirements with one another, and perhaps ask questions and provide course support to one another (we will share your

emails when we put you into groups, and you are welcome to create text groups or Slack channels etc, we can also set up a Discussion Board for you). All course assessments, however, are on an individual basis.

C. ***Written Assignments.*** The course emphasizes writing for the policy environment, which may be a new skill for some of you. Policy writing requires front-loaded arguments, concision, clarity, and specificity. We'll discuss the genre, individual paper requirements, and tips throughout the term and in advance of assignments. I'm also available to meet with you regarding this, as are the Ford School's Writing Instructors. All students in the course—even if you are not a Ford student—can meet with them. If you want to make an appointment, you can do so here: https://fordschool.mywconline.com/ Note that you must first register with the site (i.e., create a login and password). Plan ahead—they fill up quickly (appointments open up on Fridays for the following week). Also note that we have a number of resources in Files on the Canvas site, under General Writing Resources.

1. Research Funding Written Testimony: Choose an area of research that you believe deserves more government funding, and a stakeholder (e.g., a scientific/professional organization, patient advocacy organization, or civil society group) who is interested in increasing research funding this area. You, on behalf of this organization, have been asked to testify in front of a U.S. Congressional committee (you must find the relevant committee and address your memo accordingly) to make your case. Using no more than 700 words, provide written testimony explaining why Congress should increase funding for your desired area of research. Compelling written testimony will include answers to the following questions: Why is this area of research in the public interest? Why and how will it benefit the country? What is the return on the investment? As you write this memo, you'll need to think hard about how to explain and justify this area of research (and the need for government research funding in particular) to a "lay" audience and the most powerful way to make your case to decisionmakers in this particular venue. (Tip: both the audience and politics matter in terms of how you frame your argument and evidence!) Note that you are purposely making a complex argument in a very limited space. Writing must be clear and concise.

2. Science/Technology Policy Controversy Papers

a) **Topic Choice**. Choose an ongoing controversy related to a specific science or technology policy that you want to focus on for your last two papers. There are a variety of possibilities to choose from, but it is very important that you choose a current, specific controversy that is being actively discussed by stakeholders and policy officials. Controversies are likely to focus on one of three questions: 1) should an area of science or technology move forward (e.g., proposals for developments pertaining to gene editing, geoengineering, small modular nuclear, etc.); 2) (how) should we regulate a particular area of science and technology (e.g., greenhouse gases/fossil fuels, genetically modified organisms, genetic testing); or 3) how we can encourage innovation in the public interest (e.g., intellectual property policies). Choose a local, state, or national context in which an actual controversy is taking place. Answer the following questions: What are the main topics of controversy? What is the evidence of a live, ongoing controversy? Who are the stakeholders involved? Who are the decisionmakers involved? Who are the experts involved? Why is this controversy of interest to you in the context of this course? Is any specific policy or legislation being debated? Your submission for the topic choice doesn't need to be a formal piece of writing, but it should answer all of the above questions.

b) **Backgrounder**. This paper should provide an analytic explanation of your controversy. It should be addressed to a real decisionmaker in the controversy, from you as a science and technology policy analyst. It should use concepts, skills, and analytical approaches from the course to clearly, succinctly, and neutrally explain the issues underlying the controversy. Your memo should include a brief history of the controversy, an overview of the stakeholders involved (who they are, their interests, values, and positions on the issue), the main issues of controversy, the disputes over values, expertise, knowledge, power, etc., at play, and any previous efforts at resolution. Be sure to be specific and cite sources. All of this information should be conveyed in the context of your explanation of what the main issues of the controversy are. This paper should be no more than 1200 words. Be sure to use analytical concepts and tools from the course in your analysis.

c) **Governance Recommendation.** Choose one or more of the approaches that we have discussed in class that you think is/are best suited to help address or resolve your policy controversy. Write a memo to a decisionmaker involved in the controversy (i.e. someone who would be in a position to implement your proposal) that: 1) explains why this approach is the best means to address the controversy; and 2) provides a blueprint for implementing your approach. Be specific: who should be involved and how will the process work? How will you ensure that the mechanism makes a difference in the controversy? Why is this a better approach than previous or status quo approaches in this or similar policy controversies? What political benefits—in the form of transparency, democratization, etc.—does your proposal offer? What kinds of concerns might the decisionmaker have about your proposal, and how will you respond (i.e., address counterarguments)? Be specific! This paper should provide a blueprint for putting your chosen approach into action in your specific controversy. This paper should be no more than 1200 words. Be sure to use concepts from class discussion and the readings in your analysis. You do not need to revisit the background discussed in the "Backgrounder" memo.

COURSE POLICIES:

Paper Submission Guidelines:	• All assignments must be double-spaced. • Do not put your name on the paper. Instead, just write your UM ID# (and, if appropriate, a pseudonym.) • Write down the total number of words you have used. You can calculate this easily by using MS Word's "Word Count" feature, which is listed under the "Tools" tab. The word count does not include the header or references (i.e., endnotes, footnotes, or the bibliography). • Put the assignment in the appropriate folders under the "Assignments" tab in Canvas. • ***Neither Margarita nor I will edit your paper drafts before the due date.*** However, we are happy to speak with you about your paper (this could include answering general questions, skimming your paper and providing general comments, and also helping you understand our comments once papers have been returned to you. Please keep in mind that the Ford School's writing tutors are willing to read and comment on your drafts in advance of paper submission (but as with us, you must plan in advance to make appointments with them).
Late assignments:	Don't do it. The assignments in the class build on one another, and we have set the deadlines to ensure that we can read them and provide comments so that you can incorporate necessary changes into the next assignment.

	However, we understand that extenuating circumstances can occur. If you need an extension, please email the professor well in **advance** of the due date. Late assignments will lose **five points for each 24 hour period**, or fraction thereof, that they are late.
Response to Emails:	Margarita and I will do our best to respond to your emails in a timely fashion. That said, we are not likely to provide immediate responses. Allow 24 hours for a response, and do not expect responses on weekends.
Syllabus:	While the syllabus is fairly stable (especially for the first few weeks), I reserve the right to make slight changes to it. I do not expect, however, the themes, assignments, or even the readings to change significantly. If I do make even a slight alteration, I will update the appropriate Module in Canvas at least a week in advance.
Office Hours:	I encourage you to meet with me at least once, during office hours or by appointment. This is an opportunity to get to know each other better! And of course, these are also important opportunities for you to get help on assignments, go over material covered in class, talk about some connections between class material and your other academic work, employment experiences, and career interests, and so on.
Accommodations for Students with Disabilities:	If you believe you need an accommodation for a disability, please let your instructor know at your earliest convenience. Some aspects of courses may be modified to facilitate your participation and progress. As soon as you make your instructor aware of your needs, they can work with the Services for Students with Disabilities (SSD) office to help determine appropriate academic accommodations. Any information you provide will be treated as private and confidential.
Student Mental Health and Wellbeing:	The University of Michigan is committed to advancing the mental health and wellbeing of its students. We acknowledge that a variety of issues, such as the pandemic, strained relationships, increased anxiety, alcohol/drug problems, and depression, directly impacts students' academic performance. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, contact Counseling and Psychological Services (CAPS) and/or University Health Service (UHS). For a listing of other mental health resources available on and off campus, visit: https://uhs.umich.edu/stressresources. If you feel comfortable, you can also speak with me or Margarita. Any student who has difficulty affording groceries or accessing sufficient food to eat every day or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact Jordan Long in the Ford School's Student Services Office. Furthermore, please notify me if you are comfortable doing so. This will enable me to provide any other resources that I may have or know about.

Inclusivity:	Members of the Ford School community represent a rich variety of backgrounds and perspectives. We are committed to providing an atmosphere for learning that respects diversity. While working together to build this community we ask all members to: • share their unique experiences, values and beliefs • be open to the views of others • honor the uniqueness of their colleagues • appreciate the opportunity that we have to learn from each other in this community • value one another's opinions and communicate in a respectful manner • keep confidential discussions that the community has of a personal (or professional) nature • use this opportunity together to discuss ways in which we can create an inclusive environment in Ford classes and across the UM community.
Academic Integrity:	The Ford School academic community, like all communities, functions best when its members treat one another with honesty, fairness, respect, and trust. We hold all members of our community to high standards of scholarship and integrity. To accomplish its mission of providing an optimal educational environment and developing leaders of society, the Ford School promotes the assumption of personal responsibility and integrity and prohibits all forms of academic dishonesty, plagiarism and misconduct. Academic dishonesty may be understood as any action or attempted action that may result in creating an unfair academic advantage for oneself or an unfair academic advantage or disadvantage for any other member or members of the academic community. Plagiarism involves representing the words, ideas, or work of others as one's own in writing or presentations, and failing to give full and proper credit to the original source. Conduct, without regard to motive, that violates the academic integrity and ethical standards will result in serious consequences and disciplinary action. Additional information regarding academic dishonesty, plagiarism and misconduct and their consequences is available at: http://www.rackham.umich.edu/current-students/policies/academic-policies... For *all* papers, I expect proper sourcing and citation. I do not care which method (e.g., APA, MLA, etc.) you use, so long as you are consistent through the paper. Also, when citing a source over the course of multiple sentences, cite after the first sentence. In addition, *do not use Wikipedia as a direct source*. It is anonymously produced, with un-vetted contributors from all over the world, so the information you find there should *never* be automatically trusted as legitimate. That said, I understand that **Wikipedia** can be extremely useful to introduce you to a particular topic. My suggestion is that you use it to learn the basics about a particular subject, and then follow the links provided there (or the insights you gain) to find a more credible source.

Copyright of Course Materials:	Lectures and materials used in this course, including but not limited to videos, visual presentations, assessments, and assignments, are protected by United States copyright laws. As the instructor of this course, I possess sole copyright ownership. You are permitted to take notes for personal use or to provide to a classmate also currently enrolled in this course. Under no other circumstances is distribution of recorded or written materials associated with this course permitted to any internet site or similar information-sharing platform without my express written consent. Doing so is a violation of the university's Academic Integrity Policy. Similarly, these copyright protections extend to original papers you produce for this course. In the event that I seek to share your work further, I will first obtain your written consent to do so.

COURSE READINGS
All readings are available on the Canvas site in the Modules section.

COURSE SCHEDULE

I. Thinking Critically about Science and Technology Policy

(1) Jan. 4: Themes, Mechanics, and Introductory Discussion
In this first week, we'll introduce ourselves and discuss the basic themes and approach to the course and the assignments and strategies for success.

(2) Jan. 11: Technology, Innovation, and the "Public Good" (~78 pages, ~40 minute film, short pre-class exercise)
In this session, we'll explore how technology both reflects and reinforces political ideology, cultural norms, and social values. We'll also discuss some analytic strategies to understand this relationship between technology and society, including comparative methods and the concept of "sociotechnical architectures". As you do the readings, think about the following questions:

- How do social values and political ideologies shape technology? How might you parse out the different ways values/biases/assumptions/priorities shape tech and technology policy?
- What analytic lenses are useful to you in identifying what and how social values and political priorities shape technology and technology policy?
- If you were advising someone building, implementing, or regulating technology, how might you explain to them that technologies are always political and moral instruments, and advise them on what to do as a result?

Pre-class exercise: After doing the readings, find a specific technology (mundane ones, e.g., a coffee cup, are likely the easiest, but choose whatever you'd like!) and spend 5-10 minutes jotting down how it—in terms of its design, its development, its implementation, its use) both reflects social values and reinforces/imposes them. (One way to make this easier might be to compare two relatively similar technologies). Come to class ready to discuss your example.

Langdon Winner (1986). "Do Artifacts Have Politics?" in *The Whale and the Reactor: A Search for*

Limits in an Age of High Technology, ed. L. Winner. Univeristy of Chicago Press. 19-39.

Subhashish Panigrahi (2021). "Marginalized Aadhaar: How the world's largest digital identification programme led to the exclusion of marginalized communities." Documentary film (watch at least until 40:25).

Shobita Parthasarathy, "Assessing the social impact of direct-to-consumer genetic testing: Understanding sociotechnical architectures," *Genetics in Medicine*, 12.9 (2010): 544-547.

Pagan Kennedy (2020). "There are Many Man-Made Objects. The Rape Kit is Not One of Them," *The New York Times*, June 17.

Amy Moran-Thomas (2020). "How a Popular Medical Device Encodes Racial Bias." *The Boston Review*. August 5.

Sidney Fussell (2020). "How Surveillance Has Always Reinforced Racism." *WIRED*. June 19.

(3) Jan. 18: Science, Social Construction, and Public Policy (~90 pp.+54 minutes podcast episodes)

Last week we discussed how social values and political priorities shape tech policy. This week, we'll turn our attention to science. I've assembled a bunch of short readings and podcasts that I hope are thought provoking. As you dive in, consider the following questions:

- How is science socially constructed and shaped by ideology and values, and what are the consequences especially for public policy?
- What are the implications of assuming that science is separate from politics and society?
- Why is scientific racism a persistent problem?
- Can you think of an example, in the day-to-day conduct of science, of how science is socially constructed or political, reflecting social norms and values?

Daniel Sarewitz, *Frontiers of Illusion: Science, Technology, and the Politics of Progress* (Rutgers, 1996), Chapters 1, 4.

Charles Piller (2022). "Blots on a Field?" *Science*. 377(6604): 358-363.

Abeba Birhane et al (2021). "The Values Encoded in Machine Learning Research." 1-28.

Angela Saini (2019). "The disturbing return of scientific racism," *WIRED*, June 12.

"Stick to the Science: When Science Gets Political." *Nature*. Podcast episode 2.

RECOMMENDED:

Emily Martin, "The Egg and the Sperm: How Science Has Constructed a Romance Based on Stereotypical Male-Female Roles," *Signs* 16.3 (1991): 485-501.

American Association of Biological Anthropologists (2020). "AABA Statement on Race & Racism."

Linda M. Hunt and Mary S. Megyesi, "The Ambiguous Meanings of the Racial/Ethnic Categories Routinely Used in Human Genetics Research," *Social Science and Medicine* 66 (2008): 349-361.

II. Rethinking Science Funding to Solve Social Problems

(4) Jan. 25: Understanding Innovation Policy (~66 pages)

Guest speaker: David Goldston, Director, Washington Office, MIT

This week is designed to introduce you to the US's famous approach to innovation policy (also known as the "Social Contract" for science), and compare it to other approaches. We'll learn about the history of this approach, and talk about the politics of research funding today. We will also discuss limitations in the US approach and proposals to transform it for the future, as well as other countries' approaches. All of this should help set you up for your first memo, in which you'll

advocate for an increase in government research funding in a particular area. As you do this week's reading, think about the following questions:

- How did Vannevar Bush think that innovation policy should serve society? How does this compare to the National Innovation Systems approach?
- What are the limitations in the Bush/US approach to innovation policy, and how might they be addressed?
- How do governments make decisions about how to allocate funding for research? What role does politics play?

Daniel Sarewitz (1996). *Frontiers of Illusion: Science, Technology, and the Politics of Progress*. Rutgers University Press. Chapters 2, 3.

David Goldston (2011). "Science Policy and the Congress." In *The Science of Science Policy: A Handbook*, ed. Kaye Husbands Fealing et al. Stanford University Press.

Fran Visco, National Breast Cancer Coalition (2021). Testimony of Fran Visco Submitted to the House Appropriations Subcommittee on Defense. June 25.

Tim Mazzarol (2012). "Building a national innovation system: What can we learn from Korea?" *The Conversation*. September 9.

William B. Bonvillian (2022). "Encompassing the Innovation Panoply." *Issues in Science and Technology*. Winter.

Mariana Mazzucato (2021). "Industrial Policy's Comeback." *Boston Review*. September 15.

Shobita Parthasarathy (2022). "Innovation as a Force for Equity." *Issues in Science and Technology*. Winter.

Joseph R. Biden, Jr. to Dr. Eric Lander, "In 1944, President Franklin D. Roosevelt…." Letter. January 15, 2021.

RECOMMENDED:

Vannevar Bush, *Science: The Endless Frontier. A Report to the President* (US GPO, 1945), Ch. 6.

Conn, Robert W. et al. (2021). "The Next 75 Years of US Science and Innovation Policy: An Introduction." *Issues in Science and Technology*. July 12.

(5) Feb. 1: Rebalancing Public and Private Interests for Science and Technology (~94 pp.)

Traditionally, those making innovation policy (especially in the United States) tend to think that commercialization and supporting the interests of the private sector will ultimately produce social benefit and economic growth, which will benefit the public interest. After all, this is what Vannevar Bush wrote in his famous 1945 report, and over the last 75 years we have seen growing private enclosure of the public domain. Universities increasingly encourage patenting and licensing, but many worry that this is hurting both accessibility and availability of life-saving technologies. The open source movement has gained steam, powered by the idea that open research and technology will ensure quicker and better development. Meanwhile, there are lots of questions about whether even the category of "patentable subject matter" is too large, diminishes the contributions of non-scientific innovators, and is simply unethical. We'll be discussing these themes this week.

- Why have governments and universities traditionally supported intellectual property in order to achieve the public interest? What assumptions (about markets, citizens, and the public interest) are embedded in this approach?
- What are the limitations in our current approaches to research funding and patent policies? Who is being served by these policies, and who isn't?

- How is the open access movement trying to transform how science and technology serve the public? What are the assumptions embedded in this approach?

If you don't know much about patents, read pp. 3-5 and 10-15 of *Patent Politics*.

Aisling McMahon (2021). "Global equitable access to vaccines, medicines and diagnostics for COVID-19: The role of patents as private governance." *Journal of Medical Ethics*. 47: 142-148.

Matthew Herder, E. Richard Gold, and Srinivas Murthy (2022). "University Technology Transfer has Failed to Improve Access to Global Health Products during the COVID-19 Pandemic." *Healthcare Policy*. 17(4): 1-11.

Sarai Keestra (2021). "Structural violence and the biomedical innovation system: what responsibility do universities have in ensuring access to health technologies?" *BMJ Global Health*. 6: 1-4.

Matthew Rimmer (2022). "Open for Climate Justice: Intellectual Property, Human Rights, and Climate Change."

Amy Maxmen (2021). "The Flip Side of Unrestricted Viral Genome Sharing." *Nature*. May 13. 176-177.

Philip Mirowski (2018). "The future(s) of open science." *Social Studies of Science*. 48(2): 171-203.

Dr. Alondra Nelson to Heads of Executive Departments and Agencies (2022). "Ensuring Free, Immediate, and Equitable Access to Federally Funded Research." August 25.

Brittany Trang (2022). "White House's open-access research directive scrambles long-entrenched models, raising key questions." *STATNews*. October 3.

February 3, Noon: Research Funding Testimony Due!

III. The Politics of Knowledge and Expertise

(6) Feb. 8: Science and Scientists in Policy Controversies (89 pp.)

Guest speaker: Patrick Donovan (PhD Earth and Environmental Sciences and STPP, '15), Chief Policy Officer, Theodore Roosevelt Conservation Partnership

We're now shifting explicitly to the politics of science and technology policy. Over the last couple of years especially, we've heard a lot of cries to "Believe Science" and increase the role of science and scientists in policymaking. What does this mean? What role do scientists traditionally play, and how does this bump up against politics? And what are the risks when scientists play a greater role? As you read for this week, think through the following questions:

- How do science and scientists shape policymaking?
- What are the benefits and drawbacks of having scientists play a larger role in policymaking? Why (and when) might we not want scientists and science to play a central role?
- What social and political work does the "dominant view of popularization" (and accompanying ideas about the complexity and objectivity of science) do for science and scientists? What are the drawbacks of this approach?

Ann Campbell Keller (2009). *Science in Environmental Policy: The Politics of Objective Advice.* MIT Press. pp. 1-14, Chapters 1 and 2 (skim chapter 3).

Daniel Sarewitz (2004). "How Science Makes Environmental Controversies Worse." *Environmental Science and Policy*. 7: 385-403.

"Stick to the Science: When Science Gets Political." *Nature*. Podcast episode 1.

(7) Feb. 15: Complicating the Idea of Expertise (~87 pp. + film + podcast clip)

Discussions about science and technology policy tend to talk about "experts" and the "public", as though each category was clear and precise. But they're not. A focus on science-based policymaking invariably cuts out important experts for solving environmental and social problems. And some of these "experts" are actually "lay" publics who have crucial knowledge based on their lived experience or other non-scientific forms of expertise. This week, we'll try to make sense of these complications and think about the implications of this for science and technology policymaking. As you read, think about:

- What are our traditional understandings of expertise? How do each of these readings complicate this understanding?
- How might our usually narrow understandings of expertise for policy influence public trust in science and policymaking?
- How might we expand our approaches to expertise in science and technology policymaking? What institutional changes might we need to make to accomplish this?
- Can you think of other examples of expertise that goes unrecognized in our customary approaches to science and technology policymaking?

FILM: *How to Survive a Plague* (watch at least the first 45 min.)

Brian Wynne (1996). "Misunderstood Misunderstandings: Social Identities and Public Uptake of Science." in *Misunderstanding Science?* ed. Alan Irwin and Brian Wynne. University of Cambridge Press. 19-46.

Sainath Suryanarayanan and Daniel Lee Kleinman (2013). "Be(e)coming experts: The controversy over insecticides in honey bee colony collapse disorder." *Social Studies of Science*. 43(2): 215-40.

Gwen Ottinger (2010). "Buckets of Resistance: Standards and the Effectiveness of Citizen Science." *Science, Technology, and Human Values*. 35(2): 244-270.

Kristin K. Barker and Tasha R. Galardi (2011). "Dead by 50: Lay expertise and breast cancer screening." *Social Science & Medicine*. 72: 1351-1358.

Michel Martin and Harriet Washington, (2020). "Race and the Roots of Vaccine Skepticism," *NPR All Things Considered*. December 20.

OPTIONAL: Maya J. Goldenberg (2016). "Public Misunderstanding of Science? Reframing the Problem of Vaccine Hesitancy." *Perspectives on Science*, 24(5): 552-581.

February 17, noon: Controversy Papers Topic Choice due!

IV. The Challenge of Regulation

(8) **Feb. 22: The Regulatory Environments of Science and Technology Policy** (~100 pp.)
Guest speaker: Hannah Rosenfeld (MPP and STPP '21), Digital Health Specialist, Food and Drug Administration

We often hear about the term "evidence-based policymaking". This week, we'll learn how this isn't self-evident, but rather highly political, shaped by immediate political circumstances as well as enduring aspects of a country's political structure and culture. We'll read about how bureaucrats and other government decisionmakers determine evidence and expertise for policy (navigating between scientific evidence, deeply-held social values, and political obligations), and how interest groups (e.g, industry, social movements, outside experts) influence the process. As you read, think about the following questions:

- What seem to be the major institutions involved in science and technology policymaking, and what are their roles?
- How are regulatory decisions made? Who is involved, and what do regulators consider?
- How do social values and immediate political circumstances, and longer term aspects of a country's political environment, shape science and technology policymaking?
- How does science and technology policymaking seem to compare across countries?

Susan Kelly (2003). "Public Bioethics and Publics: Consensus, Boundaries, and Participation in Biomedical Science Policy." *Science, Technology, and Human Values*. 28: 339-364.

Stephen Hilgartner (1990). "The Dominant View of Popularization: Conceptual Problems, Political Uses." *Social Studies of Science*. 20(3): 519-539.

Stephen Hilgartner (2000). *Science on Stage: Expert Advice as Public Drama*. pp. 1-11; 20-40; Chapter 2.

Anna Clark, Adriana Gallardo, Jenny Deam, and Mariam Elba (2022). "They Trusted Their Prenatal Test. They Didn't Know the Industry is an Unregulated 'Wild West'." *ProPublica*. December 6.

Aniket Aga (2021). "Environment and its Forms of Knowledge: The Regulation of Genetically Modified Crops in India." *Journal of Developing Societies.* 37(2): 167-183.

Natalie Kitroeff, David Gelles, and Jack Nicas, "The Roots of Boeing's 737 Max Crisis: A Regulator Relaxes Its Oversight." *The New York Times*, July 27, 2019.

Usha Lee McFarling (2022). "Pulse oximeters and their inaccuracies will get FDA scrutiny today. What took so long?" *STAT*. November 1.

(9) Mar. 8: Sociotechnical Breakdowns

Guest speaker: Denia Djokic, Fastest Path to Zero, University of Michigan (~83 pp. + film/docuseries)

Throughout the semester, we've talked about technologies as not just technical, material objects but as sociotechnical systems: humans, norms, values, policies, and processes are all part of what we call "technologies". Too frequently, we forget these human, social, and institutional dimensions of technologies and this can contribute to their failure. We also tend to think of disasters as "natural" when they are social and technical too. This week, we'll be talking about some of these sociotechnical failures, in the context of space shuttle, nuclear, and hurricane disasters.

- In each of these cases, what went wrong?
- How does thinking in terms of sociotechnical systems change the way you might identify what went wrong, and how to plan for disasters in the future?
- When technologies fail, what are the long-term impacts, for technology and society?

Charles Perrow (1984). *Normal Accidents*. Introduction and Chapter 1.

Neil Smith (2006). "There's No Such Thing as a Natural Disaster." *SSRC Forum*. June 11.

Diane Vaughan (1986). "Regulating Risk: Implications of the Challenger Accident." *Law and Policy*. 11(3): 330-349.

Three Mile Island movie/episode (TBD)

Stephen Hilgartner (2007). "Overflow and Containment in the Aftermath of Disaster." *Social Studies of Science*. 37: 153-58.

Aditi Verma, Ali Ahmad, and Francesca Giovannini (2021). "Nuclear energy, ten years after Fukushima." *Nature*. 591: 199-201.

Aya H. Kimura (2019). Citizen Science in Post-Fukushima Japan: The Gendered Scientization of Radiation Measurement, Science as Culture, 28(3): 327-350,

Aditi Verma and Denia Djokić (2021). "Reimagining Nuclear Engineering." *Issues in Science and Technology.* Spring.

V. Rethinking S&T Governance

(10) **Mar. 15: Risk, Uncertainty, Ignorance, and Trust in Policymaking** (~89 pp.)

Science and technology policies always operate under conditions of uncertainty. Science provides important insights, but it can't predict the future. And yet, policymakers need to rely on it to make tough calls, as we saw during the pandemic. Meanwhile, technologies aren't magic bullets either, and sometimes break down completely. Seeing this, particularly in light of their own lived experiences, community trust can erode. This can create real challenges for science, technology, and public policy, as they seek to make social progress and gain public support for their initiatives. How can this challenge be addressed? As you read, think about the following:

- What are the analytical tools that the readings provide to help policymakers manage uncertainty?
- What can policymakers do to maintain public trust even under conditions of uncertainty?
- How does decisionmaking under uncertainty differ across policymaking contexts?

S. O. Funtowicz and J. R. Ravetz (1992). "Three Types of Risk Assessment and the Emergence of Post-Normal Science" in Krimsky and Golding, eds. *Social Theories of Risk* (Westport, Conn.). 251-74.

Sheila Jasanoff (2003). "Technologies of Humility: Citizen Participation in Governing Science." *Minerva*. 41: 223-244.

Sarah A. Vogel (2014). "Of Baby Bottles and Bisphenol A: Debates about the Safety of an Endocrine Disruptor." *Controversies in Science and Technology (Volume 4: From Sustainability to Surveillance*). New York: Oxford University Press.

Linnet Taylor (2020). "The price of certainty: How the politics of pandemic data demand an ethics of care." *Big Data & Society*. July-December: 1-7.

Saltelli et al. (2020). "Five ways to ensure that models serve society: a manifesto." *Nature*. 582: 482-484.

California Ocean Science Trust (2014). *Putting the Pieces Together*.

OPTIONAL: Roberta L. Millstein, "GMOs? Not So Fast," *The Common Reader* May 8, 2015. http://commonreader.wustl.edu/c/gmos-not-so-fast/ (A great model of values analysis for your backgrounders)

March 17, noon: Controversy Backgrounder Due!

(11) March 22: Governance Tools I: Anticipatory Technology Assessment (~102 pp.)

Guest speaker: Tim Persons, Chief Scientist, Government Accountability Office

Over the next three weeks, we'll be discussing different methods developed to improve the development, implementation, and governance of science and technology, to ensure that they fulfill social, equity, and environmental goals. This week's class focuses on methods for technology assessment. Scientists, engineers, and policymakers often argue that we cannot proactively regulate technologies because we can't anticipate their consequences. But over the last few decades, social scientists have developed a variety of approaches to anticipate the consequences of emerging technologies, so they can be developed and regulated to better serve societal goals. We'll talk about

how to conduct these assessment methods—which include assessing responsible research and innovation, analogical case studies, scenario planning, among other things—as well as their benefits and drawbacks. These readings will be key to your final governance recommendations!

- For each of the types of technology assessment, what are the benefits and drawbacks?
- What are the challenges of using these technology assessment methods in contexts other than where they were developed?
- Are some of these methods better at anticipating the consequences of emerging technologies than others?

Timothy Persons (2020). "The Return of Science and Technology Assessment for Congress." *Issues in Science and Technology.* Fall: 23-25.

David Guston and Daniel Sarewitz (2002). "Real-time Technology Assessment." *Technology in Society*. 24: 93-109.

Jack Stilgoe, Richard Owen, and Phil Macnaughten (2013). "Developing a Framework for Responsible Innovation." *Research Policy*. 42: 1568-80.

Aviram Sharma (2020). "'We Do Not Want Fake Energy': The Social Shaping of a Solar Micro-grid in Rural India." *Science, Technology, and Society*. 25(2): 308-324.

Cynthia Selin (2008). "The Future of Medical Diagnostics." Scenario Development Workshop Report. The Center for Nanotechnology in Society. Arizona State University.

Jon A. Leydens, Lucena, Juan C., and Dean Nieusma (2014). "What is Design for Social Justice?" American Society for Engineering Education conference paper.

Johanna Okerlund et al. (2022). *What's in the Chatterbox? Large Language Models, Why they Matter, and What We Should Do About Them*. pp. 16-18, 20-25, 27-29, then skim at least one chapter.

(12) March 29: Governance Tools II: Expanding Notions of Expertise (~97 pp.)

Another way to improve the development and governance of emerging science and technology is to incorporate public perspectives into the process. As we've discussed earlier in the term, citizens often have crucial expertise to bring to science and technology policymaking decisions. It is also important to include citizens in governance processes—even on technical matters—in order to ensure public representation and trust and that decisions are politically legitimate. But science and technology policy decisions are often technical and complex, and require in-depth discussion. How then, can communities engage properly with policymaking on these issues? This week, we'll discuss how this can be done. We'll investigate a variety of exercises in "democratic deliberation", and also focus on an illustrative case: CRISPR gene-editing. CRISPR is a new tool to edit human genes, and there is both hope and concern that it can be used to alter the germline (i.e., future generations) as well as somatic cells (e.g., gene therapy for specific diseases). We'll talk about the role that public deliberation might play in both cases.

- How might you categorize the different models of democratic deliberation that you read about for today?
- What are the benefits of democratic deliberative exercises? What are the drawbacks?
- Why is it important to bring citizen/community knowledge into science and technology policymaking processes?
- Can you think of particular topics where democratic deliberation might be particularly useful? How about topics where it might not be appropriate?

Mark B. Brown (2006). "Citizen Panels and the Concept of Representation." *Journal of Political Philosophy*. 14(2): 203-225.

Daniel Lee Kleinman et al. (2007). "A Toolkit for Democratizing Science and Technology Policy: The Practical Mechanics of Organizing a Consensus Conference." *Bulletin of Science, Technology & Society*. 27(2): 154–169.

Ada Lovelace Institute (2021). *The Citizen's Biometric Council*. March. (focus on the methods and findings).

S. Kathleen Barnhill-Dilling, Louie Rivers, and Jason A. Delborne (2019). "Rooted in Recognition: Indigenous Environmental Justice and the Genetically Engineered American Chestnut Tree." *Society & Natural Resources*. 1-18.

John S. Dryzek et al. (2020) "Global citizen deliberation on genome editing," *Science*, 369.6510: 1435-1437.

Anitra Persuad et al. (2019). "A CRISPR focus on attitudes and beliefs toward somatic genome editing from stakeholders within the sickle cell disease community." *Genetics in Medicine*, 21(8): 1726-1734.

Sandy Sufian and Rosemarie Garland-Thompson (2021). "The Dark Side of CRISPR," *Scientific American*. February 16.

Dhruv Kullar (2022). "Are We About to Cure Sickle-Cell Disease?" *The New Yorker*. March 22.

OPTIONAL: Nicholas Weller, Michelle Sullivan Govani, Mahmud Farooque (2020). "Day One Project: Supporting Federal Decision Making through Participatory Technology Assessment." 1-15.

(13**) Apr. 5: Governance Tools III: New Institutional Forms** (~101 pp.)

Rethinking the governance of science and technology isn't just about new tools like technology assessment or deliberative democratic engagement. It also may require new kinds of institutions, rules, processes, and policies. This week, we'll discuss a variety of proposals made by social scientists and policymakers to ensure that we consider the social, equity, ethical, and ecological dimensions of science and technology in the policymaking process. As you read, think about the following questions:

- What is the problem that each of these proposals is trying to solve?
- How might you categorize the different governance proposals that you read about for today?
- In what way does it try to change bureaucracy to consider the social, equity, ethical, or ecological dimensions of science and technology?
- Are some of these proposals more likely to be successful in some contexts as opposed to others?

D. Yvonne Lewis and Richard C. Sadler (2021). "Community-academic partnerships helped Flint through its water crisis." *Nature*. 594 (326-329).

David E. Winickoff and Mark B. Brown (2013). "Time for a Government Advisory Committee on Geoengineering Research." *Issues in Science and Technology*. 20: 79-85.

Ryan Calo (2014). *The Case for a Federal Robotics Commission*. Brookings Institution.

Shobita Parthasarathy (2018). "Use the Patent System to Regulate Gene Editing." *Nature*. 562 (2018): 486-488.

Osagie K. Obasogie (2012). "The Return of Biological Race? Regulating Innovations in Race and Genetics through Administrative Agency Race Impact Asssessments." *Southern California Interdisciplinary Law Journal*. 22(1): 1-64.

Mark Takano (2020). "Time for a Congressional Office of Technology." *Issues in Science and Technology*. January 31.

(14) April 12: NO CLASS!

Work on your final papers, and Margarita and I will be available for additional office hours!

April 20, noon: Governance Recommendation Due!

More Key Books on Science and Technology Policy

Mark Brown (2009). *Science in Democracy: Expertise, Institutions, and Representation*. MIT Press.

Steven Epstein (1996). *Impure Science: AIDS, Activism, and the Politics of Knowledge*. University of California Press.

Steven Epstein (2009). *Inclusion: The Politics of Difference in Medical Research*. University of Chicago Press.

Yaron Ezrahi (1990). *The Descent of Icarus: Science and the Transformation of Contemporary Democracy*. Harvard University Press.

Goldenberg, Maya (2021). *Vaccine Hesitancy: Public Trust, Expertise, and the War on Science*. University of Pittsburgh Press.

David Guston (2000). *Between Politics and Science: Assuming the Integrity and Productivity of Research.* Cambridge University Press.

Stephen Hilgartner (2000). *Science on Stage: Expert Advice as Public Drama*. Stanford University Press.

Sheila Jasanoff (1997). *Science at the Bar: Law, Science, and Technology in America*. Harvard University Press.

Sheila Jasanoff (1998). *The Fifth Branch: Science Advisers as Policymakers*. Harvard University Press.

Sheila Jasanoff (2007). *Design on Nature: Science and Democracy in Europe and the United States*. Princeton University Press.

Sheila Jasanoff (2011). *Reframing Rights: Bioconstitutionalism in the Genetic Age*. MIT Press.

Sheila Jasanoff (2013). *Science and Public Reason*. Routledge.

Sheila Jasanoff (2016). *The Ethics of Invention: Technology and the Human Future*. W.W. Norton and Co.

Ann Campbell Keller (2009). *Science in Environmental Policy: The Politics of Objective Advice* (MIT Press).

Daniel Kleinman (1995). *Politics on the Endless Frontier: Postwar Research Policy in the United States*. Duke University Press.

Evan Michelson (2017). *Assessing the Societal Implications of Emerging Technologies: Anticipatory Governance in Practice.* Routledge.

Kelly Moore (2008). *Disrupting Science: Social Movements, American Scientists, and the Politics of the Military, 1945-1975.* Princeton University Press.

Benjamin J. Pauli (2019). *Flint Fights Back: Environmental Justice and Democracy in the Flint Water Crisis*. MIT Press.

Roger Pielke (2007). *The Honest Broker: Making Sense of Science in Policy and Politics*. Cambridge University Press.

Steve Rayner, "Uncomfortable knowledge: the social construction of ignorance in science and environmental policy discourses," *Economy and Society*, 41.1(2012): 107-125.

Daniel Sarewitz (1996). *Frontiers of Illusion: Science, Technology, and the Politics of Progress*. Temple University Press.

Daniel Sarewitz, Roger A. Pielke Jr., Radford Byerly, Jr. (2000). *Prediction: Science, Decision Making, and the Future of Nature*. Island Press.

Paula Stephan (2015). *How Economics Shapes Science*. Harvard University Press.

Diane Vaughan (1996). *The Challenger Launch Decision: Risk Technology, Culture, and Deviance at NASA*. University of Chicago Press.