

History 297A - SEM2: Graduate Seminar, spring, 2007

Science and Commercialization in the 20th and 21st Century

T. 2:00pm – 4:50pm Rolfe 3123

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Office hours: Thursdays 10:30–12.00

Course description:

It is widely argued that in the late 20th century the sciences in industrialized societies have entered a new interdisciplinary and dispersed mode of production and that the universities as the traditional sites of scientific research are undergoing a deep transformation due to the commercialization of research. Critics have argued that these phenomena are nothing new and that commercial interests have always been an integral part of scientific pursuits. In the seminar we will analyze these claims and counterclaims by studying the relationships of science, government and industry in historical perspective. We will also use the debates to reflect on the images of science that guide, and are produced by, historical investigations to explain why science-industry relationships have come into the purview of historians of science and science and technology studies only rather recently. Topics discussed will include the formation of the research universities in the 19th century; university - industry relationships in the 19th and 20th century; changing funding patterns for science; the distinctions and politics of pure, basic and applied sciences; the rise of the biotech industry; the role of patents in the commercialization of research and challenges to the patent system; the formation of science regions and the emergence of knowledge based economies. Several of these topics have recently become the focus of intense historical and sociological work on which we will be able to draw. Students from history and other social sciences as well as natural scientists are welcome to enroll.

Course requirements

This course is the first part of a two-term graduate seminar, meeting for 3 hours once a week. The main aim of the seminar is to introduce participants to academic research and writing. In the first term we will be reading and discussing papers relating to the general topic of the seminar. Students will prepare for each session reading a set of papers and writing a one-page response. Each week one or two students will introduce the readings and lead the class discussions. In this term students will also settle on a topic for their research papers and present a first general outline of their projects to the other participants. Regular and active participation in the seminar is an absolute requirement of the course. The second term (autumn 2007) will be dedicated to research and writing and regular presentations of work in progress to the other seminar participants. The final essay will be 35-40 pages long and ideally of publishable quality.

Grading

There will be no grade for the first part of the course, although active participation is essential and will form part of the final grade.

Readings

Generally readings will be available either as pdf files or via links to relevant websites through the course website. The reading list giving below is provisional. We will discuss alternative or additional readings as we go on. The search and study of additional literature will be encouraged.

Weekly program

This is flexible and can be changed to accommodate the interests of the participants.

April 3 - session 1: Mode 2, the Triple Helix and their critics

We will start by familiarizing ourselves with the thesis, brought forward by various authors under various headings, that science has undergone a radical change in the late 20th century. We will study the different forms this thesis has taken, the evidence on which it relies and the critiques leveled against it.

Readings

Gibbons, M., C. Limoges, H. Nowotny, S. Schwartzman, P. Scott and M.Trow. 1994. [*The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*](#). London: Sage Publications; introduction and chapters 1 and 2.

Etzkowitz, H., and L. Leydesdorff. 1998. [*The endless transition: a “triple-helix” of university-industry-government relations*](#). *Minerva* 36:203-8.

Shinn, T. 2002. [*The triple helix and new production of knowledge: prepackaged thinking on science and technology*](#). *Social Studies of Science* 32(4):599-614.

[Letter by Richard R. Nelson](http://www.schwartzman.org.br/simon/reviews_newproduction.htm) (http://www.schwartzman.org.br/simon/reviews_newproduction.htm)

April 10 - session 2: The rise of the research universities

To put ourselves in a better position to judge how the sciences and the universities have changed in the latter part of the 20th century, we will engage in a historical study of science-industry-government relationships. We will start by looking at the rise of the research university in 19th-century Germany that became the model for developments elsewhere well into the 20th century. We will discuss the interests of the German states in investing in expensive research laboratories. Focusing on the case of chemistry, we will explore the links between the creation of chemistry as an academic discipline and the rise of the chemical industry in Germany. We will also look at the perceived limitations of the university research system and at attempts to create new research institutions with closer links to industry. Finally we will discuss the reasons why historians of science have turned their attention to science-industry relationships only rather recently.

Readings

Tuchman, A. M. 1993. [*Science, Medicine, and the State in Germany: The Case of Baden, 1815-1871*](#). New York and Oxford: Oxford University Press. Introduction, pp. 3-13.

Brock, W. H. 1981. [*Liebigiana: old and new perspectives*](#). *History of Science*, 19:201-218 (esp. from p. 207).

Brock, W. H. 2003. [*Breeding chemists in Giessen*](#). *Ambix* 50:25-70.

Johnson, J. A. 1990. [*The Kaiser's Chemists: Science and Modernization in Imperial Germany*](#). Chapel Hill: The University of North Carolina Press, chapter 1.

For those reading German:

Borscheid, P. 1976. [*Naturwissenschaft, Staat und Industrie in Baden, 1848-1914*](#). Stuttgart: Klett, pp. 7; 16-71; 111-135 (best available account on state policies, the rise of chemistry as an academic discipline and industrialization in one of the German states).

April 17 - session 3: Research and commerce in the early twentieth century

In this session we will discuss some recent studies that highlight the close interactions of scientists and industrialists in the early 20th century. We will investigate the different forms these interactions took; the interests involved in both sides, and the ways in which intellectual property was secured. Examples include the field of nuclear physics, hormone research and the search for new drugs, in the UK, US and Germany respectively.

Readings:

Lenoir, T. 1988. [A magic bullet: research for profit and the growth of knowledge in Germany around 1900](#). *Minerva* 26:66-88.

Rasmussen, N. 1999. [The forgotten promise of thiamin: Merck, Caltech biologists, and plant hormones in a 1930s biotechnology project](#). *Journal of the History of Biology* 32:245-61.

Hughes, Jeff. 1998. [Plasticine and valves: industry, instrumentation and the emergence of nuclear physics](#). In *The Invisible Industrialist: Manufactures and the Production of Scientific Knowledge*, ed. J.-P. Gaudillière and I. Löwy. Houndsmill: Macmillan Press, pp. 58-101.

April 24 - session 4: World War II and the Cold War: the academic-military-industrial complex

World War II brought a large infusion of government and military funding into scientific research. Equally crucial for the large wartime projects from the bomb to penicillin was the involvement of industry. Despite attempts to untangle science from commercial interests after the war, the cold war led to the relentless growth of the military-industrial academic complex. Different but parallel developments in the biomedical field led to the formation of the biomedical complex with its inextricable links of laboratory science, the clinic and industry. We will investigate both these developments, paying particular attention to the different ways in which the industrial links played out for academic science. The focus in this and the next sessions will move to the US that became a leading power in science and technology developments.

Readings

Hughes, T. 1989. [American Genesis: A Century of Invention and Technological Enthusiasm 1870-1970](#). New York: **Press**, pp. 381-442 (most useful brief account of the Manhattan Project).

Rasmussen, N. 2002. [Of 'small men', big science and bigger business: The Second World War and biomedical research in the United States](#). *Minerva* 40:115-46.

Bush, V. 1945. [Science - the Endless Frontier](#) (repr. Washington: National Science Foundation, 1960), pp. 1-22 (the preface by Daniel Kevles, pp. ix-xxxiii, offers some background and a useful assessment of the report).

Leslie, S. 1993. [The Cold War and American Science: The Military-Industrial-Academic Complex at M.I.T. and Stanford](#). New York: Columbia University Press. Introduction and chapter 1.

Additional

Turchetti, S. 2006. [‘For slow neutrons, slow pay’: Enrico Fermi’s patent and the U.S. atomic energy program, 1938-1953](#). *Isis* 97: 1-27.

Bud, R. F. 1978. [Strategy in American Cancer Research after World War II](#). *Social Studies of Science* 8:425-459.

May 1st - session 5: The rise of the biotech industry

The rise of the biotech industry around the new recombinant DNA technologies in the 1980s is often seen as a new convergence of academic, commercial and economic interests. We will investigate the broader developments that contributed to the rise of the new biotechnologies and its implications for science, industry and the economy. We will also discuss the claims, brought forward by various historians, that the biotechnology of the 1980s was nothing new except for the late arrival of a new science, molecular biology, to a longstanding enterprise. Finally, we will look at alternative histories of the human genome project that stress the role it played for national economies.

Readings

Thackray, A., ed. 1998. *Private Science: Biotechnology and the Rise of the Molecular Sciences*. Philadelphia: University of Pennsylvania Press. See especially chapters by Bud on [the long-term history of biotechnology](#); Wright on [molecular politics in a global economy](#); and Kenney on [biotechnology and the creation of a new capital market](#).

Smith Hughes, S. 2001. [Making dollars out of DNA: The first major patent in biotechnology and the commercialization of molecular biology, 1974-1980](#). *Isis* 92:541-75.

Beatty, J. 2000. [Origins of the U.S. human genome project: Changing relationships between genetics and national security](#). In *Controlling our Destinies: Historical, Philosophical, Ethical, and Theological Perspectives on the Human Genome Project*, ed. P. R. Sloan. Notre Dame, Indiana: University of Notre Dame Press, pp. 131-153.

Additional

[Rheinberger, Hans-Joerg, "Beyond Nature and Culture: A Note on Medicine in the Age of Molecular Biology," *Science in Context* 8, 1 \(1995\), pp. 249-263.](#)

May 8 - session 6: Diamond vs Chakrabarty and the Bayh-Dole Act

In this session we continue the discussion of biotechnology, focusing on changes in patent law and its implications for the commercialization of life and the role of the universities.

Readings

McSherry, C. 2001. [Who Owns Academic Work? Battling for Control of Intellectual Property](#). Cambridge, Mass: Harvard University Press; chapter 4.

Kevles, D. J. 1998. [Diamond v. Chakrabarty and beyond: the political economy of patenting life](#). In *Private Science: Biotechnology and the Rise of the Molecular Sciences*, ed. A. Thackray. Philadelphia: University of Pennsylvania Press; pp. 66-79.

Mowery, D. C., R. R. Nelson, B. N. Sampat, and A. A. Ziedonis. 2001. [The growth of patenting and licensing by US universities: An assessment of the effects of the Bayh-Doyle act of 1980](#). *Research Policy* 30:99-119.

Additional

Mowery, D. C., and B. N. Sampat. 2001. [University patents and patent policy debates in the USA, 1925-1980](#). *Industrial and Corporate Change* 10(3):781-814.

May 15 - session 7: More on patents, IP and cultural change

In this session we discuss challenges to the patenting of life forms and biological knowledge from a variety of perspectives. We will also look at critical studies of the commercialization of academic work more generally.

Readings

Shiva, V. 2001. [Democratizing biology: Reinventing biology from a feminist, ecological, and Third World perspective](#). In *The Gender and Science Reader*, ed. M. Lederman and I. Bartsch. London and New York: Routledge, pp. 447-65.

Weatherall, D. 2003. [Problems for biomedical research at the academia-industrial interface](#). *Science and Engineering Ethics* 9:43-48.

Sulston, J. 2002. [Heritage of humanity](#). *Le Monde Diplomatique*

Editorial. 2001. [Is the university-industrial complex out of control?](#) *Nature* 409(6817), 11 January:119.

Bok, D. 2003. [Universities in the Marketplace: The Commercialization of Higher Education](#). Princeton, N. J.: Princeton University Press, chapters 6 and 11.

Kleinman, D. L., and S. P. Vallas. 2001. [Science, capitalism, and the rise of the "knowledge worker"](#): The changing structure of knowledge production in the United States. *Theory and Society* 30(4):451-92.

Additional

Haraway, D. J. 1997. [FemaleMan Meets Oncomouse: Feminism and Technoscience](#). New York and London: Routledge, chapter 2.

Jaszi, P. and Woodmansee. 2003. [Beyond authorship: refiguring rights in traditional culture and bioknowledge](#). In *Scientific Authorship: Credit and Intellectual Property in Science*, ed. M. Biagioli and P. Galison. New York and London: Routledge, pp. 195-223.

May 22 - session 8: Science regions and knowledge parks: economies of knowledge and scale

Retracing some of our earlier discussions, in this session we will focus on the integration of universities in regional networks of knowledge-based industries. We will investigate what models of science and technology development these sites incorporate. Our main example will be Silicon Valley.

Readings

Kargon, R., S. W. Leslie, and E. Schoenberger, eds. 1992. [Far beyond big science: Science regions and the organization of research and development](#). In *Big Science: The Growth of Large-Scale Research*, ed. P. Galison and B. Hevly. Stanford: Stanford University Press, pp. 334-54.

Lenoir, T., et al. [Undated]. [Inventing the entrepreneurial university: Stanford and the co-evolution of Silicon Valley](#). Downloaded 20 February 2007. Siepr.stanford.edu/programs/SST-Seminars/Lenoir.doc

Lécuyer, C. 2006. [*Making Silicon Valley: Innovation and the Growth of High Tech, 1930-1970.*](#) Cambridge, MA: MIT Press, introduction (pp. 1-12).

Additional

Massey, D., Quintas, P. and Wield, D. 1992. [*High-tech Fantasies: Science Parks in Society, Science and Space.*](#) London and New York: Routledge, chapter 3 (on the export of the science park model to the UK).

May 29 - session 9: Writing the history of recent science; wrapping up

In this session we will come back to our initial discussion and reflect on possible long-term trends and changes in university-industry relationships and the practice and norms of science as they appear from our historical studies. We will also consider what (new?) tools might be appropriate for writing the history of recent science.

Readings:

Bucchi, M. 2004. [*Science in Society: An Introduction to Social Studies of Science.*](#) London and New York: Routledge, pp. 126-141.

Mowery, D. C., and N. Rosenberg. 1998. [*Paths of Innovation: Technological Change in 20th-Century America.*](#) Cambridge: Cambridge University Press, pp. 257-273.

Hevly, B. 1992. [*Reflections on big science and big history \(afterword\).*](#) In *Big Science: The Growth of Large-Scale research*, ed. P. Galison and B. Hevly. Stanford: Stanford University Press, pp. 355-363.

Samuels, H.W. 1993. [*Documenting modern chemistry: the historical task of the archivist.*](#) In *Chemical Sciences in the Modern World*, ed. S. H. Mauskopf. Philadelphia: University of Pennsylvania Press, pp. 237-253.

June 5 – session 10: Presentation of research projects.