

**S&TS/B&Soc 3431**  
**Biotechnology and the Economy**  
**Fall 2009, MW 2:55 - 4:10 pm**  
**Rockefeller 187**

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**Office Hours: Thursdays 10 am- noon**  
**and by appointment**

**Introduction**

In this course we will trace the rise of the biotechnology industry and the ways in which it intersects with the economy and—more broadly—with society. Our goal is to understand what is special about biotechnology as an industry and the challenges that this new industry has posed to investors, regulators, universities, and consumers. Our exploration will be guided by analytical tools from science studies, political science, and economics. You may find it useful to review the basic elements of molecular biology which are the scientific basis for the biotechnology industry. Here is a useful website: <http://www.ncbi.nlm.nih.gov/About/primer/index.html>.

The class meets MW from 2:55-4:10 pm in Rockefeller 187. It will be conducted as a mixture of lecture and discussion: you should come to class prepared to discuss the assigned readings for that day. Twice during the term you will be responsible for preparing a written response to an assigned reading and presenting your response in class (these dates and readings will be assigned in class on 7 September). There will be a mid-term exam in class on 21 October; there is no final exam. A term paper (10-12 pages, double spaced) is due by 5 pm on 9 December. An outline of your paper is due in class on 23 November. Late papers will be penalized. Your grade for the course will be based on your reading responses and class participation (1/3); the mid-term (1/3); and the final paper (1/3).

There is a *Course Reader (R)* on sale at the Campus Store. Other readings will be found on the Internet or through CUL's networked resources, as indicated in the syllabus. The URLs for the internet sources were all valid as of 8/18/09. I advise locating and downloading these readings as soon as possible because URLs have a way of disappearing. Note that although many of these readings may be found by a browser search, full access to the text will probably require that you access them through the Cornell library system.

Statement on Academic Integrity

The Cornell Code of Academic Integrity states: "Absolute integrity is expected of every Cornell student in all academic undertakings. Integrity entails a firm adherence to a set of values, and the values most essential to an academic community are grounded on the concept of honesty with respect to the intellectual efforts of oneself and others. . . . A Cornell student's submission of work for academic credit indicates that the work is the student's own. All outside assistance should be acknowledged, and the student's academic position truthfully reported at all times. In addition, Cornell students have a right to expect academic integrity from each of their peers."

In the context of this course, academic integrity includes writing your own reading responses and term paper, faithfully referencing all sources, and using quotation marks to indicate material that is quoted directly. The Arts College has a website on how to use sources correctly at <http://plagiarism.arts.cornell.edu/tutorial/index.cfm>. The library has posted a convenient guide to citation styles at [http://www.library.cornell.edu/newhelp/res\\_strategy/citing/index.html](http://www.library.cornell.edu/newhelp/res_strategy/citing/index.html). The complete student code of academic integrity is at: <http://www.cornell.edu/Academic/AIC.html>.

### Course Outline

Introduction and Early History of Biotechnology (1 week)  
The Business of Biotechnology (4 weeks)  
Doing Science, Making Money: Biotechnology in the University (3 weeks)  
Mid-Term (October 21)  
What Role for Government? (4 weeks)  
The Story of Taxol and Wrap-up (1 week)

### Reading Assignments

#### I. Introduction (8/31-9/2)

Stephen Hilgartner, "Biotechnology," *International Encyclopedia of the Social & Behavioral Sciences* (2001), pp. 1235-1240. The encyclopedia is a CUL networked resource: search for Hilgartner under 'Authors.'

Arthur Kornberg, *The Golden Helix: Inside Biotech Ventures* (1995), ch. 1, "Currents and Eddies in Biotechnology." **R**

Biotechnology Industry Organization (BIO), *Guide to Biotechnology 2008*. Pp. 1-22.

At: <http://www.bio.org/speeches/pubs/er/BiotechGuide2008.pdf>.

"Global financial crisis profoundly strains biotechnology business model."

At: <http://www.ey.com/GL/en/Newsroom/News-releases/Media---Press-Release---Global-financial-crisis-making-biotech-business-model-unsustainable-according-to-Ernst---Young>.

#### II The Business of Biotechnology (9/7-9/30)

##### 9/7 *Commodifying nature*

Stephen Hilgartner, "Making the bioeconomy measurable: politics of an emerging anticipatory machinery," *Biosociety* 2 (2007). Distributed via e-mail.

Martin Kenney, "Biotechnology and the creation of a new economic space," pp. 131-143 in *Private Science*, Arnold Thackray, ed. (1998).

**R**

##### 9/9

Finn Bowring, "Manufacturing scarcity." Ch. 4 in *Science, Seeds and Cyborgs* (2003). **R**

Robert Service, "A growing threat down on the farm," *Science* 316 (25 May 2007): 1114-17.

**CUL e-journal**

Lori Andrews and Dorothy Nelkin, "Biocommerce," ch. 2 in *Body Bazaar* (2001). **R**

##### 9/14 *Finding finance*

Richard Florida and Martin Kenney, "Venture capital-financed innovation and technological change in the USA," *Research Policy* 17 (1988): 119-137.

**CUL e-journal**

- U.S. Congress Office of Technology Assessment, *Biotechnology in a Global Economy*, OTA-BA-494 (October 1991), ch. 4 “Financing.” **R**
- Lawton Burns, Michael Housman, and Charles Robinson, “Market Entry and Exit by Biotech and Device Companies Funded by Venture Capital,” *Health Affairs* 28, 1(2009): w76-w86.  
At: <http://content.healthaffairs.org/cgi/reprint/28/1/w76>.
- Jennifer Van Brunt, “Big biotechs venture forth,” *Med Ad News* 25 (Dec 2006):18. Available through CUL ProQuest.
- Lisa Jarvis, “Sobering BIO,” *Chemical & Engineering News* 87, 21 (May 25, 2009): 7.  
At: <http://pubs.acs.org/cen/news/87/i21/8721notw4.html>.
- 9/16–9/21 *Industry structure and firm behavior*
- Cynthia Robbins-Roth, *From Alchemy to IPO* (2000), ch. 2, “Genentech.” **R**
- John Ransom, “Genentech faces consequences of growth,” *Nature Biotechnology* 25, 4 (2007): 371 **CUL E-journal**
- Lynne Zucker and Michael Darby, “Present at the biotechnological revolution: transformation of technological identity for a large incumbent pharmaceutical firm,” *Research Policy* 26 (1997): 429-446. **CUL e-journal**
- Andrew Ingley, James Pavlik, and Ty Smith, “Pharming factories,” ch. 7 in *Kellogg on Biotechnology*, Alicia Loffler, ed. (2005). **R**
- Rebecca Henderson, Luigi Orsenigo, and Gary Pisano, “The pharmaceutical industry and the revolution in molecular biology,” ch. 7 in *Sources of Industrial Leadership*, David C. Mowrey and Richard Nelson, eds. (1999). **R**
- Kelley Porter, Kjersten Whittington, and Walter Powell, “The institutional embeddedness of high-tech regions: relational foundations of the Boston biotechnology community,” Stanford Working Paper (2005). At [www.stanford.edu/group/song/papers/Porter\\_etal.pdf](http://www.stanford.edu/group/song/papers/Porter_etal.pdf).
- 9/23 *Creating consumers*
- Kenneth Green, “Shaping Technologies and Shaping Markets: Creating Demand for Biotechnology,” *Technology Analysis & Strategic Management* 3, 1 (1991): 57-76. **CUL e-journal**
- David Healey, “Shaping the intimate: Influences on the Experience of Everyday Nerves,” *Social Studies of Science* 34/2 (April 2004): 219-245. **CUL e-journal**
- 9/28 *Biotechnology around the world*
- Margaret Sharp, “The science of nations: European multinationals and American biotechnology,” *Int. J. Biotechnology* 1, 1 (1999) **R**
- Kaushik Sunder Rajan, “Subjects of speculation: emergent life sciences and market logics in the United States and India,” *American Anthropologist* 107, 1(2005): 19-30. **CUL e-journal**
- Peter Newell, “Globalization and the Governance of Biotechnology,” *Global Environmental Politics* 3.2 (2003): 56-71.  
At [http://muse.jhu.edu/journals/global\\_environmental\\_politics/v003/3.2newell.html](http://muse.jhu.edu/journals/global_environmental_politics/v003/3.2newell.html).

9/30 *Can science be a business?*

Michael Hopkins, et al., "The myth of the biotech revolution: An assessment of technological, clinical and organizational change" *Research Policy* 36, 4(2007). **CUL e-journal**

Gary Pisano, "Can science be a business?" *Harvard Business Review* (October 2006): 114-125. **CUL e-journal**

### III. Doing Science, Making Money: Biotechnology in the University (10/5-10/19)

10/5 *Policy Background*

Sheila Slaughter and Gary Rhoades, "The emergence of a competitiveness research and development policy coalition and the commercialization of academic science and technology," *Science, Technology, & Human Values* 21, 3 (1996). **CUL e-journal**

Martin Kinney, "The university and the corporation," ch. 2 in *Biotechnology: The University-Industrial Complex* (1986). **R**

10/7 **Visit to Weill Hall.** Meet at 3:00 pm sharp in the atrium. This is a special opportunity; if for any reason you cannot make it, you must let me know by 2:30 pm that day. Read about Weill Hall at <http://www.news.cornell.edu/stories/June08/WeillHall.kr.htm>. Read also: Margaret L. Eaton, *Ethics and the Business of Bioscience*, ch. 6., "Research Collaborations between Academia and Industry." **R**

10/12 **Fall Break: No Class**

10/14 *Inversion or perversion?*

Daniel Kleinman and Steven Vallas, "Contradiction in convergence. Universities and industry in the biotechnology field," ch. 2 in Scott Frickel and Kelly Moore, ed., *The New Political Sociology of Science* (2006). **R**

Mark H. Cooper, "Commercialization of the University and Problem Choice by Academic Biological Scientists," *Science, Technology & Human Values* 34 (September 2009): 629-653. **CUL e-journal**

10/19 *Novartis at Berkeley*

Goldie Blumenstyk, "A villified corporate partnership produces little change (except better facilities)," *The Chronicle of Higher Education*, 22 June 2001.

At: <http://chronicle.com/cgi-bin/printable.cgi?article=http://chronicle.com/weekly/v47/i41/41a02401.htm>

"Novartis Revisited." *California Monthly* 112, 4, Feb 02.

At: [http://www.cnr.berkeley.edu/~christos/espm118/articles/novartis\\_revisited\\_chapela.html](http://www.cnr.berkeley.edu/~christos/espm118/articles/novartis_revisited_chapela.html)

Andrew Lawler, "Last of the big-time spenders?" *Science* 299, 17 January 2003: 330-333.

**CUL e-journal**

*External Review of the Collaborative Research Agreement between Novartis Agricultural Discovery Institute, Inc. and The Regents of the University of California.* (Skim)

At: [http://www.berkeley.edu/news/media/releases/2004/07/external\\_novartis\\_review.pdf](http://www.berkeley.edu/news/media/releases/2004/07/external_novartis_review.pdf).

## 10/21 Mid-Term

### V. What Role for Government? (10/26-11/23)

10/26 *Promotion: Money, Networks, and Technology Transfer*

Congressional Budget Office, *Research and Development in the Pharmaceutical Industry* (2006), ch 4. At: <http://www.cbo.gov/ftpdocs/76xx/doc7615/10-02-DrugR-D.pdf>.

Barbara Culliton, "NIH, Inc.: the CRADA Boom," *Science* 245 (8 September 1989): 1034-36.

**CUL e-journal**

U.S. Department of Energy, Joint Genome Institute, *JGI Progress Report 2008*.

At [http://www.jgi.doe.gov/howeare/JGI\\_Progress\\_Report\\_2008.pdf](http://www.jgi.doe.gov/howeare/JGI_Progress_Report_2008.pdf). (Skim)

### 10/28-11/2 *Intellectual Property Issues*

Stephen Merrill and George Eliot, "A Patent Primer," Appendix A in Stephen Merrill et al., eds., *A Patent System for the 21<sup>st</sup> Century* (2004). At: <http://www.nap.edu/html/patentsystem/>.

Richard Nelson and Roberto Mazzoleni, "Economic theories about the costs and benefits of patents." *Journal of Economic Issues*, Vol. 32, 4 (1998).

**CUL e-journal**

David C. Mowery et al., "The growth of patenting and licensing by U.S. universities: an assessment of the effects of the Bayh-Dole act of 1980," *Research Policy* 30 (2001): 99-119.

**CUL e-journal**

Michael Heller and Rebecca Eisenberg, "Can patents deter innovation? The anticommons in biomedical research," *Science* 280 (1 May 1998): 698-701.

**CUL e-journal**

Timothy Caulfield et al., "Evidence and anecdotes: an analysis of human gene patenting controversies," *Nature Biotechnology* 24 (September 2006): 1091-1094.

At: <http://www.nature.com/nbt/journal/v24/n9/pdf/nbt0906-1091.pdf>.

Sheila Jasanoff, *Designs on Nature* (2005), ch. 8, "Making something of life."

**R**

### 11/4 *Regulation: The Asilomar Legacy*

Nicolas Wade, *The Ultimate Experiment* (1977), ch. 5, "The conference at Asilomar."

**R**

*Biosafety in Microbiological and Biomedical Laboratories (BMBL) 5<sup>th</sup> Edition*, "Introduction" and Appendix J. At [http://www.cdc.gov/OD/ohs/biosfty/bmbl5/BMBL\\_5th\\_Edition.pdf](http://www.cdc.gov/OD/ohs/biosfty/bmbl5/BMBL_5th_Edition.pdf).

Adam Sheingate, "Promotion Versus Precaution: The Evolution of Biotechnology Policy in the United States," *British Journal of Political Science*, 26, 2 (2006): 243-268.

**CUL e-journal**

Fillipa Corneliussen, "The impact of regulations on firms: a case study of the biotech industry," *Law & Policy* 27, 3 (2005): 429-449.

**CUL e-journal**

Margaret S. Race and Edward Hammond, "An Evaluation of the Role and Effectiveness of Institutional Biosafety Committees in Providing Oversight and Security at Biocontainment Laboratories," *Biosecurity and Bioterrorism* 6, 1 (2008): 19—35.

**CUL e-journal**

### 11/9 *Regulation: GMOs*

Ronald Herring, "Stealth seeds: bioproperty, biosafety, biopolitics," *Journal of Development Studies*, 43:1 (2007): 130 - 157.

**CUL e-journal (Informaworld)**

Joyce Tait and Joanna Chataway, "The governance of corporations, technological change, and risk: examining industrial perspectives on the development of genetically modified crops," *Environment and Planning C: Government and Policy* 25 (2007): 21-37.

**CUL e-journal**

Mark Sagoff, "Third-Generation Biotechnology: A First Look, *Issues in Science and Technology* 2008 (Fall): 70-74. **CUL e-journal**

11/11 *Regulation: Stem Cell Research*

National Academies of Science, *Understanding Stem Cells: An Overview* (2005).

At: [http://dels.nas.edu/dels/rpt\\_briefs/Understanding\\_Stem\\_Cells.pdf](http://dels.nas.edu/dels/rpt_briefs/Understanding_Stem_Cells.pdf).

Judith A. Johnson and Erin Williams, "Stem Cell Research," RL 31015, Congressional Research Service (13 August, 2004). At: <http://www.fas.org/spp/civil/crs/RL31015.pdf>.

Karl Bergman and Gregory Graff, "The global stem cell patent landscape: implications for efficient technology transfer and commercial development," *Nature Biotechnology* 25, 4 (2007): 419-424. **CUL e-journal**

Aaron Levine, "Research policy and the mobility of US stem cell scientists," *Nature Biotechnology* 24, 7 (2006): 865-66. **CUL e-journal**

Signing of Stem Cell Executive Order and Scientific Integrity Presidential Memorandum, 3/09/09. [http://www.whitehouse.gov/the\\_press\\_office/Remarks-of-the-President-As-Prepared-for-Delivery-Signing-of-Stem-Cell-Executive-Order-and-Scientific-Integrity-Presidential-Memorandum/](http://www.whitehouse.gov/the_press_office/Remarks-of-the-President-As-Prepared-for-Delivery-Signing-of-Stem-Cell-Executive-Order-and-Scientific-Integrity-Presidential-Memorandum/).

Ryan Antiel, "Obama and the President's Council on Bioethics: An Insider's View," The Hastings Center, Bioethics Forum, 7/13/2009.

At: <http://www.thehastingscenter.org/Bioethicsforum/Post.aspx?id=3694>.

**Note: Paper topic due in class today.**

11/16-11/18 *Regulation: Biosecurity*

Judith Reppy, "Regulating biotechnology in the age of homeland security," *Science Studies* 16, 2 (2003): 38-51. **CUL e-journal**

Brian Rappert, "The benefits, risks and threats of biotechnology," *Science and Public Policy*, 35, 1 (2008): 37-43. **CUL e-journal**

Frank Gottron and Dana Shea, "Oversight of High-Containment Biological Laboratories: Issues for Congress," R40418, Congressional Research Service (May 4, 2009).

At: <http://www.fas.org/sgp/crs/terror/R40418.pdf>.

Kathleen Carr et al., "Implementation of biosurety systems in a Department of Defense medical research laboratory," *Biosecurity and Bioterrorism* 2, 1 (2004). **CUL e-journal**

Joby Warrick, "The secretive fight against bioterror," *Washington Post*, 30 July 2006.

At: <http://www.washingtonpost.com/wp-dyn/content/article/2006/07/29/AR2006072900592.html>

Yudhijit Bhattacharjee, "Army bans pathogen work at lab after security lapse," *Science* 324 (8 may 2009): 707. **CUL**

**e-journal**

11/23 *Effects of health reform on the biotechnology industry*  
TBA

**Note: Paper outline due today.**

11/25 **Thanksgiving Vacation**

V. It All Comes Together in Taxol (11/30-12/3).

11/30 The Story of Taxol

American Society of Pharmacognosy, "The Story of Taxol,"

At: [http://www.phcog.org/Taxus/Taxus\\_Web.html](http://www.phcog.org/Taxus/Taxus_Web.html).

Vivien Walsh and Jordan Goodman, "Cancer chemotherapy, biodiversity, public and private property: the case of the anti-cancer drug Taxol," *Social Science & Medicine* 49 (1999): 1215-1235. **CUL e-journal**

Thomas Hemphill, "Economic considerations in cooperative research and development agreements (CRADA): The case of Taxol, NIH, and technology transfer," *Technology in Society* 28 (2006): 321-331. **CUL e-journal**

12/3 Wrap-up: Alternative Futures

Judith Reppy, "A Bio-medical Military Industrial Complex?" *Technovation* 28 (2008): 802-811. **CUL e-journal**

Volker Lehmann, "Between Creative Destruction and Disembeddedness: The Political Economy of the 'Biotechnology Revolution.'" Paper presented at the ISA Annual Convention, March 2009. Available through the ISA website at: <http://convention2.allacademic.com/one/isa/isa09/index.php?cmd=isa09>. Log on as "guest" and search on the paper's title.