

## **SP917: Research Seminar in Technology Strategy and Policy**

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### *Course Description:*

This seminar introduces doctoral students to the extensive literature in the strategic management of technological innovation and addresses topics in technology strategy and policy.

The course takes a broad approach to these topics, reviewing studies in the economics of technical change, the sociology of science and innovation, the strategic management of technology. Early course sessions focus on the nature and timing of technological innovations, including manner in which technological innovations alter the competitive landscape and yield new industries. Readings in later sessions address the interaction between incumbents and entrants, commercialization strategies, and other forms of firm heterogeneity. Later readings address issues associated with science and technology policy and economic growth.

The course will be discussion-oriented and will involve a high degree of engagement from all participants. A chief goal of the seminar will be the preparation of students to conduct research on issues associated with the technology strategy. The seminar will conclude with students preparing a research proposal/paper related to course topics.

### *Eligibility:*

The course is open to all students at Boston University and the wider academic community. Students at neighboring schools are very welcome: I would be grateful, though, if non-BU students would check in with me prior to registering. Students who are not enrolled in a doctoral program are also welcome, but should check in with me before registering officially.

### *Requirements & Conduct:*

The two main requirements for the course are (a) regular attendance and participation and (b) a final research paper. There will be both required and optional readings for each session. The set of required and optional readings may vary based on course enrollment; we will discuss this during the semester.

Each participant should be prepared to discuss each of the required readings in each session of the seminar. In addition, each participant will have primary responsibility for making a formal presentation of one of the readings to the class. The presentation should be supported by overhead or PowerPoint slides, along with enough hard copies of the slides for all the seminar participants. We will allocate primary responsibility for papers over the course of the semester.

*Course Overview:*

The intended set of discussion topics appears below. These are discussed in greater detail in the readings/sessions part of the syllabus. The syllabus will be flexible over the course of the semester, and time on the schedule will be reserved include one student research session (in which students will present their own research ideas) and, possibly, one or two guest presentations over the course of the semester.

- I. Introduction
  - A. Issues in Technology & Strategy
  - B. Measuring Innovation
  - C. Research Methods
- II. Patterns of Technological Innovation
  - A. Creative Destruction & Evolutionary Change
  - B. Technological Trajectories
  - C. Diffusion
- III. Technology Competition
  - A. Incumbents & Entrants
  - B. Opportunities & Appropriability
  - C. Commercialization
  - D. Firm heterogeneity - capabilities, knowledge, and organizing for innovation
  - E. Inter-organizational Relationships (tentative)
  - F. Knowledge Spillovers & the Geography of Innovation
- IV. Science, Technology Policy, & Economic Growth
  - A. Economics of Basic Science
  - B. Technical Change & the Sources of Economic Growth
  - C. Institutions & Innovation: National Innovation Systems, the Role of the Government in Innovation, and University/Industry Interactions
- V. Researching Technology Strategy & Innovation

*Readings/Session Details (PRELIMINARY):*

Master copies of all readings will be available at the Strategy & Policy front desk (on the 6<sup>th</sup> floor of the School of Management Building, Commonwealth Ave side). (I will also see about putting copies on reserve at the Pardee Library in the BU School of Management.) Required readings are starred and in bold type. (Note that these are subject to review and change.)

**PART I: Introduction - Issues in Technology & Strategy**

**Session 1: Issues in Technology & Strategy**

- \* **Arrow, K. (1962). "Economic Welfare and the Allocation of Resources for Invention, *The Rate and Direction of Inventive Activity: Economic and Social Factors*, National Bureau of Economic Research, Princeton University Press, Princeton (NJ).**
- \* **Solow, Robert M. (1957), "Technical Change and the Aggregate Production Function,"**

*Review of Economics and Statistics*, 39(3), pp 312-320.

- \* Griliches, Zvi (1998), *R&D and Productivity: The Econometric Evidence*, Chicago: Chicago University Press. Chapter 2, "Issues in Assessing the Contribution of R&D to Productivity Growth."
- \* Nelson, Richard R. (1962). "The Link Between Science and Invention: The Case of the Transistor," *The Rate and Direction of Inventive Activity: Economic and Social Factors*, National Bureau of Economic Research, Princeton University Press, Princeton (NJ). pp. 549-586.
- \* Pavitt, Keith (1990). "What We Know about the Strategic Management of Technology." *California Management Review*, Vol. 32, No. 3 pp. 17-26.

Stephen J. Kline and Nathan Rosenberg "An Overview of Innovation" in Charles Edquist and Maureen McKelvey, *Systems of Innovation: Growth, Competitiveness and Employment* Vol. II, 2000, p. 1-33

Van de Ven, Andrew (1986), "Central Problems in the Management of Innovation", *Management Science*, Vol. 32, No. 5 (May).

## **Session 2: Measuring Innovation & Research Methods**

- \* Griliches, Zvi, "Patent Statistics as Economic Indicators: A Survey," *Journal of Economic Literature*, December 1990, 28:1661-1707.
- \* Scott Stern, "Do Scientists Pay to Be Scientists?" *NBER WP 7410*.
- \* Finkelstein, Amy (2003) "Health Policy and Technological Change: Evidence from the Vaccine Industry January," *NBER Working Paper 9460*.
- \* Watson, James, D., *The Double Helix*, New York: Atheneum, 1968.
- \* Stephen R. Barley and Beth A. Bechky. 1994. "In the backrooms of science: The work of technicians in science labs." *Work and Occupations*, 21: 85-126.

Beth A. Bechky. 2003. "Sharing meaning across occupational communities: The transformation of knowledge on a production floor." *Organization Science*, 14: 312-330.

## **PART II: Patterns of Technological Innovation**

### **Session 3: Creative Destruction, Evolutionary Change, and Knowledge Accumulation**

- \* Nelson, R. and S. Winter (1982), *An Evolutionary Theory of Economic Change*, Cambridge (MA): Harvard University Press, Parts I and II (pp. 1-136).
- \* Schumpeter, Joseph (1942). *Capitalism, Socialism and Democracy*, 2nd ed., London: George Allen & Unwin, Ltd, pp. 61, 81-86.
- \* David, Paul (1985), "Clio and the Economics of QWERTY", *American Economic Review*, Vol. 75(2), pp. 332-337.

\* **Mokyr, Joel. (1990) *The Lever of Riches: Technological Creativity and Economic Progress*. New York: Oxford University Press. Chapters 1, 2, & 11.**

\* **Abernathy, William J. and James M. Utterback (1978), "Patterns of Industrial Innovation", *Technology Review*, Cambridge (MA): MIT Press, pp. 40-47.**

**Mokyr, Joel. (2002) *The Gifts of Athena*. Princeton, NJ: Princeton University Press. Chapters 1 & 7.**

Arthur, W. B. (1988), "Competing Technologies: An Overview", *Technical Change and Economic Theory*, ed. Dosi, et. al., New York: Columbia University Press, pp. 590-607.

Abernathy, William J. and Kim Clark (1985), "Innovation: Mapping the Winds of Creative Destruction", *Research Policy*, No 14, pp. 3-22

Nelson, Richard R. (1995), "Recent Evolutionary Theorizing about Economic Change", *Journal of Economic Literature*, Vol. XXXIII (March), pp. 48-90.

#### **Session 4: Technological Trajectories & Industry Life Cycles**

\* **Foster, Richard. (1986). "The S-curve: A New Forecasting Tool." Chapter 4 in *Innovation, The Attacker's Advantage*, Summit Books, Simon and Schuster, New York (NY). pp. 88-111.**

\* **Utterback, James. (1994). "Dominant Designs and the Survival of Firms", Chapters 2 in *Mastering the Dynamics of Innovation*, Harvard Business School Press, pp 23-55 and pp 79-102.**

\* **Tushman, Michael L. and Lori Rosenkopf (1992), "Organizational Determinants of Technological Change: Towards a Sociology of Technological Evolution", in *Research in Organizational Behavior*, eds. B. M. Staw and L. L. Cummings, JAI Press, Greenwich, CT, pp. 311-347.**

\* **Klepper, S. (1996). "Entry, Exit, Growth, and Innovation over the Product Life Cycle" *American Economic Review*, v86 n3 June 1996, pp. 562-83.**

Abernathy, W. and J. Utterback (1978). Patterns of Industrial Innovation, *Technology Review*. pp. 40-47.

Christensen, Clayton "How can great firms fail? Insights from the hard disk industry" Chapter 1 in *The Innovator's Dilemma*, Harvard Business School Press, 1997, pp 3-28.

Christensen, Clayton, M. and Bower, J.L. (1994) "Customer Power, Technology Investment, and the Failure of Leading Firms," *Strategic Management Journal*.

Christensen, Clayton M. (1992), "The Limits of the Technology S-Curve", Parts I and II, *Production and Operation Management*.

Klepper, S and E. Graddy (1990) "The Evolution of New Industries and the Determinants of Market Structure." *The Rand Journal of Economics*, Spring 1990, Vol. 21, No. 1.

Sastry, M. Anjali (1997), "Problems and Paradoxes in a Model of Punctuated Organizational Changes", *Administrative Science Quarterly*, Vol. 42, No. 2 (Jun), pp. 237-275.

Tushman, Michael L. and Philip Anderson (1986), "Technological Discontinuities and Organizational Environments", *Administrative Science Quarterly*, Vol. 31, pp. 439-465.

Utterback, James M. (1994), *Mastering the Dynamics of Innovation*, Boston (MA): Harvard University Press, chapters 3,4,6,7.

### **Session 5: Diffusion**

- \* **Griliches, Z. (1957), "Hybrid Corn: An Exploration in the Economics of Technological Change", *Econometrica*, Vol. 25, No. 4., pp. 501-522.**
- \* **Ryan, Bryce and Neal C. Gross. (1943). "The Diffusion of Hybrid Seed Corn in Two Iowa Communities." *Rural Sociology* 8:15-24.**
- \* **Rogers, Everett M. (1976), "New Product Adoption and Diffusion," *The Journal of Consumer Research*, Vol. 2, No. 4. (Mar., 1976), pp. 290-301.**
- \* **Gort, Michael and Steven Klepper (1982) "Time paths in the diffusion of product innovations" *Economic Journal*, 92: 630 - 53.**

Coleman, J., E. Katz, and H. Menzel (1957). "The Diffusion of an Innovation Among Physicians." *Sociometry*: 253-270.

David, Paul (1990), "The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox," *American Economic Review*, Vol. 80(2), pp. 355-361.

Jovanovic, Boyan and Glenn MacDonald: "Competitive Diffusion" *Journal of Political Economy*, 1994, Vol 102, No. 1.

Mansfield, Edwin (1968). *Industrial Research and Technological Innovation*, Norton NY.

Rogers, Everett M. "Innovativeness and Adopter Categories", Chapter 7 in *Diffusion of Innovations* (3rd edition), The Free Press, 1983, pp 241-270.

Rogers, Everett: *Diffusion of Innovations*. 3d Ed. New York: Free Press, 1983.

## **PART III: Technology Competition**

### **Session 6: Incumbents vs. Entrants (and the Schumpeterian Hypothesis)**

- \* **Cohen, Wesley M. and Richard C. Levin (1989), "Empirical Studies of Innovation and Market Structure", chap. 18 of *Handbook of Industrial Innovation*, Vol. 2, eds. R. Schmalensee and R.D. Willig, Holland: Elsevier Science Publishers.**
- \* **Henderson, R.M. and K. Clark (1990). "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms," *Administrative Science Quarterly*, Vol. 35. pp. 9-30.**
- \* **Reinganum, J. F. (1983), "Uncertain Innovation and the Persistence of Monopoly", *American Economic Review*, Vol. 73, pp. 741-48.**
- \* **von Hippel, Eric (1988), *The Sources of Innovation*, New York: Oxford University Press, chapters 1-4.**

Acs, Z. J. and David B. Audretsch (1988), "Innovation in Large and Small Firms: An Empirical Analysis," *American Economic Review*, Vol. 78, No. 4 (Sep).

Gilbert and Newbery (1982), "Preemptive Patenting and the Persistence of Monopoly", *American Economic Review*, Vol. 72(3), pp. 314-26.

Henderson, Rebecca M. (1993), "Underinvestment and Incompetence As Responses to Radical Innovation: Evidence From the Photolithographic Alignment Equipment Industry", *Rand Journal of Economics*, Vol. 24, No. 2 (Summer), pp. 248-270.

Henderson, Rebecca and Ian Cockburn (1996), "Scale, Scope, and Spillovers: The Determinants of Research Productivity in Drug Discovery", *Rand Journal of Economics*, Vol. 27, No. 1, Pg. 32-59.

Stern, Scott (1994). "Incentives and Focus in University and Industrial Research: The Case of Synthetic Insulin," *The University-Industry Interface and Medical Innovation*, ed. A. Gelijns and N. Rosenberg, National Academy Press. pp. 157-187 (Chapter 7).

Tripsas, Mary (1997), "Unravelling the Process of Creative Destruction: Complementary Assets and Incumbent Survival in the Typesetter Industry", *Strategic Management Journal Special Issue*.

#### **Session 7: Appropriability and Commercialization**

- \* **Teece, David J. (1987), "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licencing and Public Policy", *The Competitive Challenge: Strategies for Industrial Innovation and Renewal*. ed. David J Teece, Cambridge (MA): Ballinger, pp. 185-219 (chap. 9).**
- \* **Levin, Richard C., Alvin K. Klevorick, Richard Nelson and Sidney G. Winter (1987), "Appropriating the Returns from Industrial Research and Development", *Brookings Papers on Economic Activity*, Vol. 3, pp. 783-831.**
- \* **Levin, R.C., W.M. Cohen, and D.C. Mowery, "R&D appropriability, opportunity, and market structure: New evidence on some Schumpeterian hypotheses." *American Economic Review*, (1985) 75: 20-24.**
- \* **Cockburn, Iain, and Zvi Griliches, "Industry Effects and Appropriability Measures in the Stock Market's Valuation of R&D and Patents," *American Economic Review*, 1988, 78: 419-423.**
- \* **Gans, Joshua and Scott Stern (2003) "The Product Market and the Market for Ideas: Commercialization Strategies for Technology Entrepreneurs," *Research Policy*, 32(2), 333-350.**

Klevorick, Alvin K., Richard C. Levin, Richard R. Nelson, and Sidney G. Winter, "On the Sources and Significance of Interindustry Differences in Technological Opportunities," *Research Policy*, March 1995, 24(2): 185-205.

Gans, Joshua and Scott Stern (2000), "Incumbency and R&D Incentives: Licensing the Gale of Creative Destruction," *Journal of Economics and Management Strategy*.

Hsu, David; Joshua Gans, and Scott Stern (2002) "When Does Start-up Innovation Spur the Gale of Creative Destruction?," *RAND Journal of Economics*, 2002.

Mansfield, Edwin (1961), "Technical Change and the Rate of Imitation", *Econometrica*, Vol. 29, No. 4 (Oct).

Mansfield, Edwin, Mark Schwartz and Samuel Wagner (1981), "Imitation Costs and Patents: An Empirical Study", *The Economic Journal*, Vol. 91, pp. 907-918.

Mowery, David C. and Nathan Rosenberg (1979), "The Influence of Market Demand upon Innovation: A Critical Review of Some Empirical Studies", *Research Policy*, Vol. 8, pp. 102-153.

Schmookler, Jacob and Oswald Brownlee (1962), "The Economics of Research and Development: Determinants of Inventive Activity", *American Economic Review Papers and Proceedings*, Vol. 52, No. 2 (May), pp. 165-176.

### **Session 8: Firm heterogeneity, capabilities, knowledge, and organizing for innovation**

\* **Allen, Thomas J. (1977), *Managing the Flow of Technology*, Cambridge (MA): MIT Press, reprinted 1993, chapters 4-8.**

\* **Henderson, Rebecca and Ian Cockburn (1994), "Measuring Competence? Exploring Firm Effects in Pharmaceutical Research", *Strategic Management Journal*, Vol. 15 (Special Issue; winter), pp. 63-84.**

\* **Cohen, W. and D. Levinthal (1990), "Absorptive Capacity: A New Perspective on Learning and Innovation", *Administrative Science Quarterly*, Vol. 35, pp. 128-152.**

\* **Cohen, W. M. and D.A. Levinthal, (1989), *Innovation and learning: the two faces of R&D*, *Economic Journal* 99(3): 569-596.**

\* **Kogut, Bruce and Udo Zander (1992), "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology", *Organization Science*, Vol. 3, No. 3 (Aug), pp. 383-397.**

Burgelman, Robert A. (1994), "Fading Memories: A Process Theory of Strategic Business Exit in Dynamic Environments", *Administrative Science Quarterly*.

Burgelman, Robert A. and Richard S. Rosenbloom, *Technology Strategy: An evolutionary Process Perspective*, *Research on Technological Innovation, Management and Policy*, Vol 4, pp 1-23. JAI Press, 1989. Reprinted in *Managing Strategic Innovation and Change*, eds. Tushman and Anderson, New York: Oxford University Press.

### **Session 9: Inter-organizational Relationships (*tentative*)**

\* **Argyres, N. 1995. "Technology strategy, governance structure and interdivisional coordination," *Journal of Economic Behavior and Organization*, 28, 337-358**

\* **McGahan, Anita, and Yoffie, David; and Vasdusc Les, (1996) "Creating Value and Setting Standards: The Lessons of Consumer Electronics for Personal Digital Assistants," in *Competing in the Age of Digital Convergence*.**

\* **Katz, Michael (1987), "R&D Rivalry with Licensing or Imitation", *American Economic Review*, Vol. 77, No. 3 (June).**

- \* **Powell, W., K.W. Koput, & L. Smith-Doerr (1996), Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology, *Administrative Science Quarterly* 41 (1): 116-145.**

Freeman, Christopher (1991), "Networks of Innovators: A Synthesis of Research Issues", *Research Policy*, Vol. 20, No. 5, pp. 499-514.

Hagedoorn, John and Geert Duysters (1997), "External Appropriation of Innovative Capabilities: The Choice Between Strategic Technology Alliances and Mergers and Acquisitions", *Academy of Management Meeting*, (TIM Division Best Paper)

Hagedoorn, John and Jos Schakenraad (1994), The effect of Strategic Technology Alliances on Company Performance, *Strategic Management Journal*, Vol 15, 291-309.

Kogut, Bruce (1988), "Joint Ventures: Theoretical and Empirical Perspectives", *Strategic Management Journal*, Vol. 9, pp. 319-332.

### **Session 10: Knowledge Spillovers and the Geography of Innovation**

- \* **Audretsch, David B. and Maryann P. Feldman (1996), "R&D Spillovers and the Geography of Innovation and Production", *American Economic Review*, Vol. 86, No. 3 (June).**
- \* **Griliches, Zvi (1992) "The search for R&D Spillovers," *The Scandinavian Journal of Economics*, Vol. 94, Supplement, pp. 29-47.**
- \* **Jaffe, Adam B., Manuel Trajtenberg and Rebecca Henderson (1993), "Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations", *Quarterly Journal of Economics*, Vol 108, Vol. 3 (Aug), pp. 577-98.**
- \* **Saxenian, A. (1991), "The Origins and Dynamics of Production Networks in Silicon Valley", *Research Policy*, Vol. 20, No. 5, pp. 423-437.**
- \* **Glaeser, E., H. Kallal, J. Scheinkman and A. Shleifer (1992) "Growth in Cities," *Journal of Political Economy*, 100: 1126-1152.**

### **Session 10½: Knowledge Spillovers and the Geography of Innovation (II)**

**Alcacer, Juan and Wilbur Chung, "Knowledge Seeking and Location Choice of Foreign Direct Investment in the United States," *Management Science* 48(12): 1534-1554.**

**Glaeser, E. and G. Ellison (1997) "Geographic Concentration in U.S. Manufacturing Industries: A Dartboard Approach," *Journal of Political Economy* 105: 889-927.**

**Zucker, L.G., M.R. Darby, and M.B. Brewer (1998), Intellectual human capital and the birth of U.S. biotechnology enterprises, *American Economic Review* 88: 290-306.**

### **Session 10¾: Knowledge Spillovers and the Geography of Innovation (III)**

**Ahuja, G. (2000) "Collaboration Networks, Structural Holes, and Innovation: A Longitudinal Study." *Administrative Science Quarterly* 45: 425-455.**

**Almeida, P and B. Kogut (1999) Localization of Knowledge and the Mobility of Engineers in Regional Networks. *Management Sci.* 45 905-917.**

**Florida, R. (2002) "Bohemia & Economic Geography," *Journal of Economic Geography*, 2, 55-71.**

**Owen-Smith, J and W. Powell (2004) "Knowledge Networks as Channels and Conduits: The Effects of Spillovers in the Boston Biotechnology Community," *Organization Science*.**

**Sorenson, O. and T. Stuart, (2001) Syndication networks and the spatial distribution of venture capital investments, *American Journal of Sociology* 106 (6): 1546-1588.**

### **Session 10: Recommended Supplemental Readings – Knowledge Spillovers and the Geography**

### **of Innovation (III)**

Agrawal, Ajay; Iain Cockburn; and John McHale (2003) "Gone But Not Forgotten: Labor Flows, Knowledge Spillovers, and Enduring Social Capital," National Bureau of Economic Research Working Paper 9950, September 2003

Audretsch, D. B. and P. Stephan, (1996), Company-scientist locational links: the case of biotechnology, *American Economic Review* 86(4): 641-652.

Florida, R. L., and M. Kenney (1988), Venture capital, high technology and regional development, *Regional Studies* 22 (1): 33-48.

Gulati, R. and M. Garguilo (1999). "Where do interorganizational networks come from?" *American Journal of Sociology* 104: 1439-1493.

Jacobs, J. (1969), *The Economy of Cities* (Random House, New York).

Jaffe, A. B., (1989), Real effects of academic research, *American Economic Review* 79(5): 957-970.

Krugman, P., (1991), *Geography and Trade*, (MIT Press: Cambridge).

Krugman, P. (1991), "Increasing Returns and Economic Geography," *Journal of Political Economy*, 99: 483-499.

Porter, M.E. (1990), *The Comparative Advantage of Nations* (Free Press, New York).

Porter, M. E., (2000), Locations, clusters, and company strategy, in G.L. Clark, M.P. Feldman and M.S. Gertler (Eds.), *The Oxford Handbook of Economic Geography*, (Oxford University Press, Oxford), 253-274.

Shaver, J. Myles and Fredrick Flyer (2000) "Agglomeration economies, firm heterogeneity, and foreign direct investment in the United States," *Strategic Management Journal*, 21(12), 1175-1193.

## **PART IV: Science, Technology Policy, & Economic Growth**

### **Session 11: Economics of Basic Science**

- \* **Bush, V. (1945). *Science: The Endless Frontier*. National Science Foundation, Washington (DC). 1-40.**
- \* **Dasgupta, P. and David, P. (1994) "Towards a New Economics of Science," *Research Policy*, Vol. 23, pp. 487-521.**
- \* **Nelson, Richard R., "The Simple Economics of Basic Scientific Research," *Journal of Political Economy*, June 1959, 67(3): 297-306.**
- \* **Nelson, R. (1962), "The Link Between Science and Invention: The Case of the Transistor", *The Rate and Direction of Inventive Activity*, NBER, New Jersey: Princeton University Press, pp. 549-583. [Dewey HD69.I75.U59N]**
- \* **Rosenberg, Nathan (1990), "Why Do Firms Do Basic Research (With Their Own Money)?", *Research Policy*, Vol. 19, No. 2 (Apr.), pp. 165-174.**

Allen, Thomas J. "Distinguishing Science from Technology", *The Human Side of Managing Technological Innovation*, ed. Ralph Katz, New York: Oxford University Press, pp. 307-319. [Dewey Reserve HD45.H84 1997 also Katz (1997)]

Hounshell, David A. "The Evolution of Industrial Research in the United States" pp 13-85 in *Engines of Innovation*, R. Rosenbloom and W. Spencer, Eds, Harvard Business School Press, 1996.

#### **Session 12: Technical Change & the Sources of Economic Growth**

- \* **Romer, Paul M., "Endogenous Technological Change," *Journal of Political Economy*, 1990, 98 (5, Part 2--Supplement): S71-S102.**
- \* **Jones, Charles I., "R&D-Based Models of Economic Growth," *Journal of Political Economy*, August 1995, 103(4): 759-784.**
- \* **Mansfield, E. (1972). "Contribution of R&D to Economic Growth in the United States." *Science* 175(4021): 477-486.**
- \* **Abramovitz, Moses, "Catch-up and Convergence in the Postwar Boom and After," in William J. Baumol, Richard R. Nelson, and Edward N. Wolff, eds., *Convergence of Productivity: Cross-National Studies and Historical Evidence*. Oxford, U.K.: Oxford University Press, 1994.**

Romer, Paul M., "The Origins of Endogenous Growth," *Journal of Economic Perspectives*, Winter 1994, 8(1): 3-22.

Grossman, Gene M., and Elhanan Helpman, "Endogenous Innovation in the Theory of Growth," *Journal of Economic Perspectives*, Winter 1994, 8(1): 23-44.

#### **Session 13: Institutions & Innovation: National Innovation Systems, the Role of the Government in Innovation, and University/Industry Interactions**

- \* **Nelson, R. R (1993) *National Innovation Systems*, Oxford University Press. Chapter 1.**
- \* **Rosenberg, N. and R. R. Nelson (1994). "American Universities and Technical Advance in Industry." *Research Policy* 23(323-348).**
- \* **Owen-Smith, Jason, Massimo Riccaboni, Fabio Pammolli, W.W. Powell (2002), "A Comparison of U.S. and European University-Industry Relations in the Life Science," *Management Science*.**
- \* **Furman, Jeffrey L.; Michael E. Porter; and Scott Stern, "The determinants of national innovative capacity," *Research Policy* (2002) 31: 899-933**
- \* **Cohen, Linda R., and Roger G. Noll, *The Technology Pork Barrel*, Washington, DC: The Brookings Institution, 1991, Introduction and Conclusion, pp. 1-16, 363-390.**

Argyres, Nick and Julia Liebeskind (1998) "Privatizing the Intellectual Commons: Universities and the Commercialization of Biotechnology," *Journal of Economic Behavior and Organization* 35: 427-454

Furman, Jeffrey L. and Scott Stern, "Climbing Atop the Shoulders of Giants: The Impact of Institutions on Cumulative Research," Boston University working paper.

Jaffe, A. (2000). "The U.S. Patent System in Transition: Policy Innovation and the Innovation Process." *Research Policy*. 29(2): 531-537

Henderson, Rebecca, Adam B. Jaffe, and Manuel Trajtenberg, "Universities as a Source of Commercial Technology: A Detailed Analysis of University Patenting 1965-1988," *Review of Economics and Statistics*, February 1998, 80(1): 119-127.

Mansfield, Edwin, "Academic Research Underlying Industrial Innovations: Sources, Characteristics, and Financing," *Review of Economics and Statistics*, February 1995, 77(1): 55-65.

Mazzoleni, R. and R. R. Nelson (1998). "The Benefits and Costs of Strong Patent Protection: A Contribution to the Current Debate." *Research Policy* 27(3): 273-284.

Mowery, David, Richard Nelson, Bhaven Sampat, and Arvids Ziedonis. 2001. "The Growth of Patenting and Licensing by U.S. Universities: An Assessment of the Effects of the Bayh-Dole Act of 1980." *Research Policy* 30:99-119.

Mowery, David C. and Nathan Rosenberg, "The U.S. National Innovation System" in Nelson (ed.), *National Innovation Systems: A Comparative Analysis*, Oxford University Press, 1993, p. 29-75.