



FEDERAL RESERVE BANK OF CLEVELAND

RESEARCH CONFERENCE 2006

Universities, Innovation, and Economic Growth

This summary is from the **Universities, Innovation, and Economic Growth** conference held on November 16–17, 2006, in Cleveland, Ohio.

Contents:

- 2 Welcoming Remarks—November 16, 2006**
Mark Sniderman, Senior Vice President and Director of Research,
Federal Reserve Bank of Cleveland
- Summaries of the Presentations**
- Are Elite Universities Losing Their Competitive Edge?*
Adair Morse, PhD Candidate, Ross School of Business, University of Michigan
- 3** *Peer Effects in the Workplace: Evidence from
Professional Transitions for the Superstars of Medicine*
Pierre Azoulay, Assistant Professor, Sloan School of Management,
Massachusetts Institute of Technology; and Faculty Research Fellow,
National Bureau of Economic Research
- Geography and Innovation: Evidence from Nobel Laureate Physicists*
Bruce A. Weinberg, Associate Professor of Economics, The Ohio State University;
Research Affiliate, Institute for Labor Research (IZA); and
Faculty Research Fellow, National Bureau of Economic Research
- 4 Keynote Address**
- Does the Location of Ideas Matter in the Internet Age?*
Richard B. Freeman, Herbert Ascherman Professor of Economics, Harvard University; and
Director, Labor Studies Program, National Bureau of Economic Research
- Academic Entrepreneurs: Social Learning and
Participation in University Technology Transfer*
Maryann P. Feldman, Miller Distinguished Professor of Higher Education,
Institute of Higher Education, University of Georgia
- 5** *The Influence of University Research on Industrial Innovation*
Gerald Marschke, Associate Professor of Economics, University at Albany,
State University of New York; and Research Fellow, Institute for the Study of Labor
- 6** *U.S. Ethnic Scientists and Foreign Direct Investment (FDI) Placement Patterns*
William R. Kerr, Assistant Professor, Harvard Business School; and Research Associate,
National Bureau of Economic Research and the Center for Economic Studies
- Opening Remarks—November 17, 2006**
Sandra Pianalto, President and Chief Executive Officer,
Federal Reserve Bank of Cleveland
- Summaries of the Presentations**
- 7** *From Ideas to Innovations: Moving Technology Toward
the Marketplace Through Universities and National Labs*
Carl F. Kohrt, President and Chief Executive Officer, Battelle
- The Role of Universities and Technology Commercialization in Economic Development*
Donald F. Smith Jr., Vice President of Economic Development,
Mellon Pitt Carnegie Corporation; and Chairman, Carnegie Mellon University's
Economic Development Council
- 8** *A Public Policy Perspective*
Robert K. McMahan, State Science and Technology Advisor, North Carolina; and
Executive Director, North Carolina Office of Science and Technology,
Department of Commerce
- Keynote Address**
- Research Universities: Driving America's New Economy*
Lee T. Todd Jr., President, University of Kentucky
- 9** *Inside P&G's Innovation Machine*
Jeff Davis, Director, Global New Business Development, Procter & Gamble
- 10 Contributor Profiles**



Thursday, November 16, 2006

Welcoming Remarks

Mark Sniderman

Senior Vice President and Director of Research,
Federal Reserve Bank of Cleveland

Dr. Sniderman welcomed guests to this opportunity to learn about knowledge and the creation of economic prosperity.

“Increasingly, we are all looking to our universities for economic growth and innovation,” he said. “Today’s session will help answer what role our universities can play in innovation.”

He noted that attendees represented university and economic development officials, public policy makers, venture capitalists, business leaders, and academic researchers. The focus of the two-day conference, he continued, was to discuss ways to increase and improve collaboration between the higher-education and business communities and to examine how university research and development (R&D) can contribute to innovation and economic development.

Are Elite Universities Losing Their Competitive Edge?

Adair Morse

PhD Candidate, Ross School of Business,
University of Michigan

Ms. Morse examined research productivity in the economics and finance departments of the top 25 schools over the last three decades. She measured individual output (the number of impact-weighted pages published in economics journals) and traced the movement of individuals across universities to determine whether location plays a role in individual productivity in a knowledge-based industry.

In the 1970s, residence at an elite university had a sizeable impact on individual productivity, she noted. During that time, for example, her research found that that “an economic faculty member who moved from a non-top 25 university to Harvard would see her productivity increase by 2.1 *American Economic Review* impact-equivalent pages per year, which is tantamount to almost doubling her research productivity.” This effect weakened in the 1980s and all but disappeared in the 1990s.

During the same period, Ms. Morse found, the productivity of faculty members who worked with researchers at their own universities also declined, whereas co-authorship at a distance rose steadily. This suggests that it is now easier for authors at non-elite universities to gain access to scholars at elite ones.

The Internet and advances in information technology have diminished the importance of cooperation within physical boundaries and greatly facilitated collaboration from distance. As a result, co-authorship between scholars at elite and other universities has grown substantially. Personal interactions, traditionally an advantage of elite universities, have become less important in attracting the most-capable faculty. Elite universities can no longer retain star faculty on the strength of reputation alone. Up-and-coming universities now compete on a more level playing field to attract productive faculty.

These results have implications for knowledge-based industries, she said. If the finding from Ms. Morse’s study, that the importance of production’s physical location has lessened, can be generalized, many industries soon may have little need for locational anchors at all.





Peer Effects in the Workplace: Evidence from Professional Transitions for the Superstars of Medicine

Pierre Azoulay

Assistant Professor, Sloan School of Management, Massachusetts Institute of Technology; and Faculty Research Fellow, National Bureau of Economic Research

Academic medical centers and medical schools play an important role in generating new medical knowledge, which often leads to new medical technologies and treatment protocols that improve patients' lives. Yet surprisingly little is known about how knowledge is generated in these settings.

Dr. Azoulay, in collaboration with Joshua Graff Zivin from Columbia University, is studying the impact that the "superstars" of academic medicine have on their colleagues' research productivity. He defines superstars as top NIH grantees, highly cited scientists, Howard Hughes Medical Investigators, or top patenters. His study cites about 6,400 of these individuals and is examining how their colleagues' productivity changes when the superstar moves to a different institution.

Evidence from Dr. Azoulay's research will answer such questions as, "How long-lasting are the benefits of exposure to superstar talent? If these benefits decay, at what rate? Does academic productivity result primarily from individual effort or teamwork? How important are employers' characteristics in mediating the extent of spillovers? How does geographic distance affect the extent of peer effects?"

The project's data collection is completed, and data analysis is ongoing. Interested researchers may consult <http://scripts.mit.edu/~pazoulay/> for updates on the project.

Geography and Innovation: Evidence from Nobel Laureate Physicists

Bruce A. Weinberg

Associate Professor of Economics, The Ohio State University; Research Affiliate, Institute for Labor Research (IZA); and Faculty Research Fellow, National Bureau of Economic Research

Dr. Weinberg studied Nobel Prize-winning research in physics to find out whether the clustering of innovators enhances creativity. He looked at whether a future Nobel laureate initiates his or her Prize-winning work while geographically near other Nobel physicists. Clearly, innovators cluster from Silicon Valley to the Route 128 Corridor outside Boston, but Dr. Weinberg asks, "Does clustering improve their work" or do "important people seek out other important people for other reasons?" It may seem natural for ideas to "spill over" from one person to another, which would help explain why innovators cluster together, but there is little quantitative evidence that this actually occurs, especially between individuals.

To find out when these future Nobel physicists started their work versus when they actually did it, he examined their institutional affiliations throughout their careers. He focused on the year the researcher started the Prize-winning work and the year it was completed. Having data on individuals' locations enabled him to describe the effects of being in a particular place or around particular people.

Dr. Weinberg showed substantial geographic clustering of physicists. Associating with Nobel laureates seems to help researchers begin their Prize-winning work but does not necessarily help them carry it out. One concern was causality: Being around other important physicists may not be what makes people do more important work; instead, it is possible that prestigious institutions that already have Nobel laureates recruit researchers who are starting or doing Nobel-worthy work. Investigating this question, he showed that the number of Nobel physicists that these researchers are exposed to increases in the years before they start what will become Prize-winning work and declines slightly in the following years. Thus, being around distinguished physicists seems to make researchers more likely to do important work.





Does the Location of Ideas Matter in the Internet Age?

Richard B. Freeman

Herbert Ascherman Professor of Economics, Harvard University; and Director, Labor Studies Program, National Bureau of Economic Research

Academic Entrepreneurs: Social Learning and Participation in University Technology Transfer

Maryann P. Feldman

Miller Distinguished Professor of Higher Education, Institute of Higher Education, University of Georgia

Keynote Address

Dr. Freeman focused on the critical importance of ideas in the global economy. He noted that although India and China continue to increase their educational attainment and access to modern technologies, U.S. universities are still training the world’s best minds.

“The United States is successful in R&D,” he said. “It is a sign of our reputation that we get the best and brightest from around the world.”

Foreign students are not returning overseas with their innovations. If the United States can concentrate its R&D in the disciplines with the greatest chance of increasing the area’s employment, the best jobs will come back to the United States.

Dr. Freeman discussed the development of innovations and their impact on U.S. workers. Formerly, the place where new knowledge was created had an advantage in commercializing it. But, Dr. Freeman argues, modern communications technologies allow new ideas rapid exposure on a world stage, where the ever-growing numbers of technically skilled workers in developing countries are capable of turning them into profit-making opportunities.

He emphasized the need for policies that foster knowledge creation in areas of science where the United States can maintain the home-field advantage. That means investing in areas that have more “stickiness”— that is, areas where the nation has some natural advantage for commercialization. Dr. Freeman also advises that we increase stickiness in the application of knowledge creation for economic purposes (for example, by strengthening the link between universities and industries, developing research consortiums, and modernizing the patent system) and invest in providing U.S. firms with information on research findings worldwide (for example, by translating foreign journals and offering agriculture extension-type services to smaller firms). This will increase the likelihood that U.S. firms are the ones commercializing innovative science.

Dr. Feldman, along with Janet J.L. Bercovitz, College of Business, University of Illinois at Urbana-Champaign, examined faculty participation in university technology transfer as a sign of willingness to engage in new strategic initiatives related to technology transfer. The academic context provides great transparency for studying organizational change and, although universities have unique characteristics, the results suggest that universities’ successful adoption of strategic initiatives requires understanding organization heterogeneity, departmental dynamics, and the factors that influence individuals’ decisions to disclose their inventions.

The study uses data on researchers from the medical schools of two prominent research universities, Duke and Johns Hopkins. Its results suggest that three factors affect the adoption decision: training effects, the influence of leaders, and localized learning from peers. Individuals are more likely to disclose inventions if they trained at institutions with long-established, relatively successful technology transfer operations. In addition, the longer the time elapsed since graduate training, the less likely a faculty member was to actively embrace commercialization. When a department’s chairperson is active in technology transfer, other department members are more likely to disclose. Moreover, her findings suggest that if people observe colleagues at their academic rank disclosing, they are more likely to follow, other things being equal.





Dr. Feldman also noted an alternate explanation: A department's selection of faculty, rather than socialization, drives departmental effects. That is, instead of being influenced by the action of leaders and peers, individuals who are already inclined to disclose their inventions are differentially hired by departments supportive of technology transfer activities. However, econometric tests found no evidence that faculty selection was driving the results.

The study further examines how individuals resolve dissonance—when training norms are not congruent with the localized social norms in the work environment. The findings suggest that individuals conform to the current local norms over prior experience.

**The Influence of University Research on
Industrial Innovation**
Gerald Marschke

Associate Professor of Economics,
University at Albany, State University of New York;
and Research Fellow, Institute for the Study of Labor

Dr. Marschke reported results from a study that used U.S. patent records to examine the role of research personnel in the diffusion of ideas from university to industry. Appearing on a patent assigned to a university is evidence that an inventor has been exposed to university research, either directly as a university researcher or through collaboration with university researchers. Having an advanced degree is another indicator of an inventor's exposure to university research.

Dr. Marschke and his co-researchers found that from 1985 to 1997, industry increased its employment of inventors with university research experience and with advanced degrees. Industry patents increasingly cited university patents as prior art over this period. These trends are observed economywide but also in the pharmaceutical and semiconductor industries, where industrial R&D appears more dependent on university research and training than other industries in the economy. The pharmaceutical industry made greater use of inventors with university backgrounds and cited university patents more often than the semiconductor industry. In both of these industries, the percentage of industry patents that involved inventors with university backgrounds and that cited university patents increased substantially.

He reported that pharmaceutical and semiconductor firms with large research operations are more likely to draw on university research than are firms with small ones. Pharmaceutical firms with higher R&D-inventor ratios are more likely to utilize inventors on their patents who had previous university research experience.

Younger pharmaceutical firms were more likely to use inventors who have university research experience. Evidence suggests that employing such scientists may increase firms' access to university-produced knowledge. Specifically, utilizing inventors with university patenting experience increases the extent to which a firm's patents cite university patents as prior art, evidence that these inventors help firms tap academic research.





U.S. Ethnic Scientists and Foreign Direct Investment (FDI) Placement Patterns

William R. Kerr

Assistant Professor, Harvard Business School; and
Research Associate, National Bureau of Economic
Research and the Center for Economic Studies

Dr. Kerr discussed the effect of immigrant scientists and entrepreneurs working in the United States on the nation's technology development and the subsequent diffusion of new technologies to the immigrants' home countries. R&D and innovation are critical for U.S. economic leadership, and technology diffusion is necessary for widespread economic development. These issues are gaining importance as innovation becomes more global.

Dr. Kerr's past research, which analyzed how ethnic scientific communities in the United States aid technology transfer to their home countries, encompassed more than 40 countries and 30 manufacturing industries. It confirmed that ethnic channels are important for knowledge diffusion, and that a stronger American research presence improves foreign countries' manufacturing development. This effect is particularly strong for high-tech sectors and within the Chinese and Indian networks.

His recent project explores how U.S. ethnic researchers facilitate the foreign sourcing of R&D by U.S. multinational companies. Foreign-sourced R&D is attractive because it provides access to foreign countries' markets and demand, to a larger technology set for innovation, and to a pool of highly trained scientists and engineers. However, the difficulty of transferring knowledge well across long distances could reduce the effectiveness of R&D undertaken abroad. Global firms must also navigate the regulations and conditions of the countries they enter, a process in which U.S. ethnic researchers can help.

Foreign sourcing of R&D by U.S. multinational enterprises increased from \$5 billion in 1987 to \$14 billion in 1998. Although this foreign placement is growing as a share of U.S.-funded R&D, it remains less than the \$20 billion of R&D undertaken by foreign multinationals in the United States. The bulk of foreign sourcing occurs in transportation equipment; computers and electronic products; and chemicals and pharmaceuticals. Dr. Kerr's research describes how the distribution of firms undertaking foreign-sourced R&D is changing and how ethnic scientists working within these firms can help distribute innovation.

Friday, November 17

Opening Remarks Sandra Pianalto

President and Chief Executive Officer,
Federal Reserve Bank of Cleveland

Welcoming the conference attendees, Federal Reserve Bank of Cleveland President Sandra Pianalto explained why the Bank—which is engaged in setting national monetary policy—is focusing on education. She noted that since the last recession, employment in the region served by the Bank (Ohio, western Pennsylvania, eastern Kentucky, and the panhandle of West Virginia) has lagged the U.S. average. To better understand the region's disappointing economic performance, the Bank's researchers have been focusing on the factors that drive economic growth. They found that differences in state income levels over the past 75 years can be explained largely by two factors: innovation and education. Ms. Pianalto said that universities stand at the crossroads of these two factors. Not only do universities educate students and conduct research; they also foster the formation of new business ventures. The goal of the conference is to improve understanding of what it takes to transform creative ideas into bankable companies that can contribute to regional prosperity.



**From Ideas to Innovations:
Moving Technology Toward the Marketplace
Through Universities and National Labs**

Carl F. Kohrt

President and Chief Executive Officer, Battelle

Battelle is a global science and technology enterprise that explores emerging areas of science, develops and commercializes technology, and manages laboratories for customers. Its R&D activity totaled \$3.8 billion in 2005.

Dr. Kohrt noted that many Battelle innovations have occurred through alliances in industry and academia, groups with very different organizational cultures and values. Innovations at national labs and research universities are curiosity-driven, without attention to market needs or costs. Another culture focuses on product development. And yet another is concerned with venturing and commercialization, which values ideas only if they can meet a real market need, in a timely fashion, for someone willing to pay.

Knowing those varied cultures, he outlined some basic “rules of engagement” for laboratories, universities, economic development entities, and others who want to commercialize technology:

- * Recognize the three “engines” of innovation—intellectual, commercial, and venture.
- * Understand that innovations frequently come from unexpected sources. Pay attention to where science and technology, economic development, and the market intersect.
- * Acknowledge that multi-organizational synergy — especially industry–university collaboration — is crucial to the process.

The commercialization process, he said, must include a strategy for any lab-based intellectual property that demonstrates the viability of the concept. Build into the plan a point at which to assess whether you have reached the limit of your expertise and need to ask for help. Also, he suggested, do not underestimate either the importance of experienced leadership in the venture area—to provide objective analysis of market potential—or the ability to attract investors and sell the idea to investors and potential acquirers.

In conclusion, he noted that “[o]ur nation’s leadership, and perhaps even its economic viability, depends on the willingness and ability of businesses, industries, research institutions, and colleges and universities to work together. Collaborative excellence among science, technology, and the marketplace holds the key to our future.”

**The Role of Universities and Technology
Commercialization in Economic Development**

Donald F. Smith Jr.

Vice President of Economic Development,
Mellon Pitt Carnegie Corporation;
and Chairman, Carnegie Mellon University’s
Economic Development Council

Dr. Smith noted, and then debunked, nine common myths involved in technology-based economic development. Myth #1: Traditional roles of universities are becoming less important. False. “Great teaching and great research must still be a university’s highest priorities,” said Dr. Smith. “Those are the activities of greatest economic impact for universities.” He observed that universities are more important than ever. The talent concentrated in universities is what drives all companies in the region and the state. Therefore, universities play a critical role in facilitating the transition from lab to local market.

Another myth: great technology transfer equals regional economic development. Not so. Although Pennsylvania’s top academic institutions—University of Pittsburgh, Pennsylvania State University, and Carnegie Mellon University—are performing at the top of the start-up pack, the commonwealth lags in technology job growth. Research proves that less than 2 to 4 percent of start-up companies are from universities.

Efforts that fail to target and achieve critical mass will not create long-term, sustainable success. Talent is a key to tech-based initiatives, and if the United States is to go from a manufacturing-driven economy to one that is knowledge-based, universities must play a major role.





Relationship-building between universities and companies is essential. To bridge the university–industry gap, Dr. Smith suggests these measures: continue to expand the research base; build local absorptive capacity, such as cluster-based development, anchor/breeder companies, and an entrepreneurial infrastructure; and facilitate the transition from lab to local market.

A Public Policy Perspective

Robert K. McMahan

State Science and Technology Advisor, North Carolina;
and Executive Director, North Carolina Office
of Science and Technology, Department of Commerce

Dr. McMahan began his session with a history of North Carolina’s Research Triangle Park in the Raleigh-Durham area. The RTP was built in the 1950s when state officials and groups of private individuals worked together to leverage local university strengths to diversify North Carolina’s economy. Its formation was facilitated by the cooperation of the three major local research universities located adjacent to it, and it was designed from its inception to provide a bridge between research and commercial sectors and to have a broad impact on the state’s economy. Now North America’s largest research park, the RTP will celebrate its 50th anniversary in 2008.

“North Carolina was one of the first states to recognize that knowledge-based economic development creates high-growth companies and well-paying jobs,” said Dr. McMahan.

It is now the third-ranking U.S. state in biotechnology and is well positioned across a number of technology sectors. To achieve this, the state has invested strongly in the creation of university research capacity, and ranks among the top-performing states in this respect. It is slightly below average in industrial R&D spending. This is an area of concern because industry funds and conducts more R&D than all other sectors combined; thus, strong university R&D activity does not in itself predict an economy with dynamic technology.

Compared to its innovative capacity, North Carolina is less strong in commercializing innovation; and, notwithstanding its emphasis on workforce preparation, structural challenges remain, including a high-school graduation rate that ranks in the lowest quartile of states.

The body of Dr. McMahan’s talk was devoted to a discussion of new thinking on the role of the university in today’s economy. He called into question the distinction between applied and basic research in advancing a state’s economy, and how this distinction demands that we reconsider the Carnegie classifications as organizing principles and the confusion of mission with taxonomy; the implications of university visioning by introspection or by engagement; and how the presumptions embodied in Vannevar Bush’s model of research act as disincentives to universities’ broad economic engagement.

Keynote Address

Research Universities: Driving America’s New Economy

Lee T. Todd Jr.

President, University of Kentucky

Dr. Todd began his presentation by stating: “I have the best job in Kentucky—to change Kentucky.” He noted that many universities need to “let down their walls,” bring people in from industry, work together, and forge deals. “High-tech, low-tech or no-tech—I do not care what type of business it is, we just need to start businesses here,” he said.





To help that along, the University of Kentucky has an on-campus incubator where researchers can start a business on site, instead of leaving their intellectual property lying on the floor. To help others transfer from universities into the community, he offered several suggestions: Universities should hire entrepreneurial professors—teachers who want to go outside the university walls and become part of a business. Universities also need to feel the same sense of urgency as companies have about getting the next great idea to market. Other tips: Set up a network list that includes contacts with service firms and investors. Make deals and build goodwill with industries. This will help companies see the intellectual property that universities offer. He also introduced the idea of “in-shoring”—linking up students with engineers and paying those students for their time.

All these suggestions are designed to take university knowledge to the next level. “We don’t need to assemble cars; we need to design cars,” he said. “We don’t need to paint cars; we need to develop the technology for a better paint.”

He recommended adopting a fresh mindset: A new manufacturing plant opening in a community gets big headlines, although the hundreds of jobs it brings in are usually low-paying jobs. He would rather boast about hiring 40 people at \$60,000 a year—this would not get as big a headline, but in the long run, it is higher-salary jobs that will help sustain the area’s job market.

Inside P&G’s Innovation Machine

Jeff Davis

Director, Global New Business Development,
Procter & Gamble

Mr. Davis took participants inside P&G’s innovation machine, which grew from the realization that although the world’s innovation landscape had been transformed, the company’s model had not changed since the late 1980s. P&G found that important innovation was being done increasingly at small and midsized entrepreneurial companies. Therefore, after years of success, the company was forced to re-examine the way it developed and moved new products to market.

Through its Connect & Develop program, the company switched from developing its products internally to finding good ideas outside P&G and bringing them inside to enhance and capitalize on internal capabilities that mutually benefit P&G and partner companies. The new strategy: 50 percent of new innovation would come from P&G labs and 50 percent through P&G labs from external collaborations. The open innovation model has encouraged P&G to form partnerships and collaborations with manufacturers, retailers, suppliers, academia, and even competitors.

Earlier this year, the company’s pharmaceutical division built on the Connect & Develop program and developed an Acquire, Develop, and Market strategy. It made the strategic choice to partner, license, or acquire all its new drug candidates exclusively. All new drugs were to come from a network of relationships with academia, biotech, and the pharmaceutical industry. The company has restructured its R&D and commercial divisions to excel at identifying, evaluating, negotiating, and managing long-term, mutually beneficial partnerships.

“There is no doubt that the connection between universities, small entrepreneurs, and established companies and the integration of this network will incubate new ideas and innovation that will generate economic growth,” Mr. Davis concluded.





Contributor Profiles



Pierre Azoulay

is an assistant professor at MIT's Sloan School of Management and a faculty research fellow at the National Bureau of Economic Research. He was previously an associate professor at the Graduate School of Business, Columbia University. He investigates the organization and governance of knowledge-intensive firms: What determines their boundaries? What are the mechanisms that prevent knowledgeable insiders from leaving with their human capital at anytime? What are the pitfalls involved in knowledge-production outsourcing? How do internal capital markets operate, and what role do they play beyond resource allocation? Can established firms reproduce market incentives inside the firm? Dr. Azoulay's research combines qualitative and econometric evidence to shed light on these issues.



Jeff Davis

is the recently appointed head of Global New Business Development for P&G Pharmaceuticals. He has been with Procter and Gamble for 20 years, serving in both the consumer and pharmaceutical businesses and drawing experience from working in five different product sectors and five different countries in North America and Europe. For the past nine years, he has worked in the pharmaceutical industry in Germany, Canada, and now in the United States. Mr. Davis most recently served on the Board of Directors of Canada's Research-Based Pharmaceutical Companies and has served on a number of other boards in the pharmaceutical sector and drug retailing. He earned his BS in marketing and his BA in German from the University of Utah.

Procter & Gamble Pharmaceuticals is a research-based global organization dedicated to creating and delivering solutions that improve the health and well-being of people around the world. The department capitalizes by re-applying technologies developed in other research areas within Procter and Gamble and by tapping into key capabilities available in its corporate research and development unit.



Maryann P. Feldman

is the Zell Miller Distinguished Professor of Higher Education at the Institute of Higher Education at the University of Georgia. Dr. Feldman was previously the Jeffery S. Skoll Chair in Technical Innovation and Entrepreneurship and a professor of business economics at the Rotman School of Management, University of Toronto. While at Johns Hopkins University, she was the policy director for the Whiting School of Engineering as well as a research scientist at the Institute on Policy Studies. Dr. Feldman is on the Advisory Panel for the U.S. National Science Foundation's Program on Societal Dimensions of Engineering, Science, and Technology, and her research and teaching interests focus on the areas of innovation, the commercialization of academic research, and the factors that promote technological change and economic growth. She earned her PhD from Carnegie Mellon University.



Richard Freeman

holds the Herbert Ascherman Chair in Economics at Harvard University and serves as faculty co-chair of the Harvard University Trade Union Program. He is also director of the Labor Studies Program at the National Bureau of Economic Research, senior research fellow in Labour Markets at the London School of Economics' Centre for Economic Performance, and visiting professor at the London School of Economics. Dr. Freeman's research interests include the growth and decline of unions, the effects of immigration and trade on inequality, transitional economies, youth labor market problems, crime, employee involvement programs, and income distribution and equity in the marketplace. He received his BA from Dartmouth College and his PhD from Harvard University.



William R. Kerr

is an assistant professor at Harvard Business School and a research associate of both NBER and the Center for Economic Studies. His research focuses on innovation and productivity growth, jointly exploring firm-level decisions and macroeconomic consequences. His most recent work considers the role of immigrant scientists and entrepreneurs in U.S. technology development, as well as the subsequent diffusion of new innovations to the immigrants' home countries. He is also studying the firm-level contribution of R&D to productivity growth, the influence of CVC investments on subsequent parent firm choices, and the voting mechanisms employed by angel and VC investors. Dr. Kerr received his BS in systems engineering from the University of Virginia and his PhD in economics from MIT.





Carl F. Kohrt

joined Battelle as president and CEO after a 29-year career at Kodak, where he most recently served as executive vice president and chief technology officer. His accomplishments include the discovery or commercialization of new color imaging systems, several of which still serve as the basis for current products in the marketplace, and the transformation of R&D from a functional organization to one aligned with specific market-oriented portfolios and the entry into digital and networked businesses. Dr. Kohrt received his BS in chemistry from Furman University and his PhD in physical chemistry from the University of Chicago. He was a postdoctoral fellow at the University of Chicago and received an MMS in management science from the Sloan School of Management, MIT.

Battelle is a global science and technology enterprise that develops and commercializes technology and manages laboratories for customers. It provides solutions and develops innovative products, helping commercial customers leverage technology into a competitive advantage.



Gerald Marschke

is an associate professor of economics with appointments in the Department of Economics and the Rockefeller College at the State University of New York at Albany. He joined the Institute for the Study of Labor as a research fellow in 2005. His current research includes studies of the firm-to-firm and university-to-firm mobility of research scientists and its implications for the diffusion of technology in the economy. He has recently completed research examining the origins of the patent surge in the United States in the 1980s and 1990s and the relation between firm size and innovative productivity. His past and present research interests also include empirical studies of organizational incentives and worker productivity. Dr. Marschke holds a PhD in economics from the University of Chicago.



Robert K. McMahan

is the state science and technology advisor for North Carolina and the executive director of the North Carolina Office of Science and Technology in the Department of Commerce. In this role, he acts as senior advisor to the governor and others on science and technology matters. In addition to his duties with the state, Dr. McMahan also holds the positions of research professor of physics and astronomy at the University of North Carolina at Chapel Hill and adjunct professor of technology and management at the North Carolina State University College of Textiles. He received bachelor's degrees in physics and art history from Duke University, his PhD in physics from Dartmouth, and his postdoctoral fellowship from Harvard University/Smithsonian Astrophysical Observatory Center for Astrophysics.

The North Carolina Office of Science and Technology works to investigate new areas of emerging science and technology, conducts studies on the competitiveness of state industry and research institutions in these fields, and works with the General Assembly and the governor to put into place the infrastructure that keeps North Carolina on the cutting edge of science and technology.



Adair Morse

is a PhD candidate in finance at the Ross School of Business of the University of Michigan. Her papers include work on the academic setting as a platform for productivity and creativity ("Are Elite Universities Losing Their Competitive Edge?" and "What Has Mattered in Economics Since 1970") and work on corporate governance ("Who Blows the Whistle on Corporate Fraud?" "The Nature of Corporate Fraud," and "Are CEOs Rigging Incentive Contracts?"). Her dissertation studies the well-being consequences to the existence of high-interest consumer lending in the form of payday loans. She has been a managing accountant for Browning-Ferris Industries and an entrepreneur working in Poland during the transition years from the Soviet-backed regime.





Sandra Pianalto

is the president and chief executive officer of the Federal Reserve Bank of Cleveland. Before joining the Bank, Ms. Pianalto was an economist at the Federal Reserve Board of Governors and served on the staff of the Budget Committee of the U.S. House of Representatives. She currently serves on the boards of directors of the Cleveland Foundation, the Northeast Ohio Council on Higher Education, and many others. Ms. Pianalto earned a master’s degree in economics from the George Washington University. She is a graduate of the Advanced Management Program at Duke University’s Fuqua School of Business and holds honorary doctor of humane letters degrees from the University of Akron, Baldwin-Wallace College, and Ursuline College.



Donald F. Smith Jr.

is the vice president of economic development at the Mellon Pitt Carnegie Corporation and chairman of Carnegie Mellon University’s Economic Development Council. He has worked on research related to venture capital and technological innovation and has been a technology policy analyst specializing in the financing of new technologies and the development of regional technology clusters. Active in a number of community activities, Dr. Smith serves on the boards of the Redevelopment Authority of Allegheny County, Junior Achievement, and the Economics Club of Pittsburgh. He earned his BA in economics from Harvard University and his PhD from the H. John Heinz III School of Public Policy and Management.

The Mellon Pitt Carnegie Corporation is a joint venture of Carnegie Mellon University and the University of Pittsburgh. The organization’s main purpose is to foster economic development and technology transfer, particularly in engineering and the sciences.



Mark Sniderman

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