Approved: February 10, 2004

MINUTES OF THE HOUSE ECONOMIC DEVELOPMENT COMMITTEE

The meeting was called to order by Chairman Kenny Wilk at 3:30 p.m. on February 5, 2004, in Room 526-S of the Capitol.

All members were present except:
Representative Annie Kuether- excused

Committee staff present:
Kathie Sparks, Legislative Research Department
Susan Kannarr, Legislative Research Department
Renae Jefferies, Office of Revisor of Statutes
Helen Pedigo, Office of Revisor of Statutes
Fulva Seufert, Secretary

Conferees appearing before the committee:
William P. Duncan, Ph.D., President, Kansas City Area L:ife Sciences Institute
Harry A. Watts, Managing Director, Kansas Farm Bureau Governmental Relations
Robert J. Vancrum, Government Affairs Specialist, Greater Kansas City Chamber of Commerce
Doug Wareham, Senior Vice President, Kansas Agribusiness Retailers Association

Others attending:
See Attached List.

Chairman Wilk opened the meeting of the House Economic Development Committee on Thursday, February 5, 2004, at 3:30 p.m. He announced that there would be a joint committee meeting with Senate Commerce on Monday, February 9, 2004, at 8:30 a.m. in 313-S where Senator Brownback would address the group.

Vice Chairman Gordon asked the LCA subcommittee to stay a few minutes after the meeting.

Chairman Wilk reopened the Public Hearing on:

HB 2647 - Bioscience authority and development act

The Chair welcomed Dr. William P. Duncan, President, Kansas City Area Life Sciences Institute, who informed the committee that he felt at home because he was raised in a small town and was an undergraduate of Pittsburg State University. He said he has seen first-hand what has happened to small towns in Kansas. He said he was here testifying as a proponent of **HB 2647.** The Kansas City Area Life Sciences Institute is a not-for-profit organization which was formed in 1999 to lead the area's transformation into a center of excellence in the life sciences. Along with the University of Kansas and the Kansas University Medical Center, the Life Sciences Institute fosters research collaborations, attracts funding, facilitates sharing of resources, and advocates for related economic development. Dr. Duncan said, "The expenditures outlined in the Bioscience Authority Act are critical for supporting this growth cycle, from laboratory to innovation to commercialization over the next ten years." He said he was very excited about this legislation because it solidifies the vision for the life sciences and is the critical next step by providing the funding and the future revenue needed to make our region a national leader in the life sciences. (Attachment 1)

Committee members asked numerous questions and were assured that this was more comprehensive legislation than any Dr. Duncan has seen around the country. He compared it to "leap frog" and said this represents "a quantum jump." When questioned about the stem cell research, he said that Kansas operates by using the Presidential guidelines. Members inquired about where he thought the Stowers II would be built, and he responded by sharing the following paragraph provided by the Stowers Institute:

"The Stowers Institute is encouraged by the steps being taken by Kansas and Missouri to provide financial support to enable KU and UMKC to add new researchers in the life sciences to their faculties. The Stowers Institute and Institute founders Jim and Virginia Stowers wholeheartedly applaud these efforts. The

future of the life science initiative in Greater Kansas City depends on increasing the critical mass of research at KU and UMKC. Greater public investments in KU and UMKC will also enhance the potential for fruitful research collaboration between university scientists and colleagues at other research organizations in the community."

Chairman Wilk thanked Dr. Duncan for testifying and making the difficult trip over to Topeka on such a stormy winter day. The Chair welcomed Harry A. Watts, Managing Director, Governmental Relations for the Kansas Farm Bureau, who spoke as a proponent for **HB 2647**. He specifically addressed their support of the Eminent Scholar and Rising Star Scholar programs which would have a significant impact on their bioscience efforts. He said they believe that **HB 2647** and the companion bills will have a great impact on improvement of life for their members. It also has the potential to increase profits for their Kansas Farm Bureau members. He concluded by mentioning the following three thoughts for the committee to consider:

- Would like to see one of the board of directors for the authority be an agricultural entrepreneur knowledgeable in bioscience.
- Believes they already have some very talented researchers that they do not want to lose to other states.
- Eminent domain should not be used in the acquisition of agricultural land.

In closing, Mr. Watts thanked the committee for consideration of the above-mentioned points. (Attachment 2)

Chairman Wilk thanked Mr. Watts and welcomed Mr. Doug Wareham, Senior Vice President, Kansas Agribusiness Retailers Association, who spoke as a proponent for **HB 2647**. Mr. Wareham said their membership includes nearly 750 agribusiness firms that are primarily retail facilities. His testimony also included a copy of Professor Runge's study entitled, "The Economic Status and Performance of Plant Biotechnology in 2003." This report outlines the positive impact plant biotechnology has played in agricultural production and touches on the economic impacts of plant biotechnology beyond the farm gate. Mr. Wareham had the following two concerns:

- The make-up of the 11 member board (New Section 4(c), which governs the Bioscience Authority.
- The second is board related, too, concerning when a vacancy occurs on the board (New Section 4(g). They support the use of a nominating committee that can submit names to the Governor, but believe there should not be restrictions on others that might wish to submit nominations .

He closed by saying this is not only an economic development bill, but will foster greater economic activity resulting in high paying jobs for Kansans and for broadening our tax base. He said, too, this will lead to better crop production tools, healthier foods, and better medicines for Kansas consumers. (Attachment 3)

During questions, members expressed an interest in having an opportunity to have the same tour that the other legislators had.

Chairman Wilk thanked Mr. Wareham and welcomed Mr. Robert J. Vancrum, Government Affairs Specialist, Greater Kansas City Chamber of Commerce, who supports **HB 2647**. He praised the bill saying it would give Kansas the cutting edge infrastructure to build on the nationally ranked Biosciences Foundation already in place. He specifically mentioned the impact it might have on the Stowers II facility. He reported the Greater Kansas City Chamber supports the entire Kansas Economic Growth Act, but specifically mentioned the Rural Entrepreneurship Initiative, Workforce Development Initiatives, Image Campaign, and the Angel Investment Initiative. (Attachment 4)

Chairman Wilk thanked Mr. Vancrum and closed the Public Hearing for **HB 2647**. The Chair asked Ms. Kathie Sparks, Legislative Research, to brief the committee on:

HB 2539 - Kansas development finance authority; authorizing bonds for research facilities.

Ms. Sparks reported that **HB 2539** is a simple bill which provides that the Kansas Development Finance Authority may issue research facilities bonds for not-for-profit or for profit organizations; an agricultural

business enterprises, industrial enterprise or any other commercial enterprise; educational institution or health care institution. If the research facilities bonds are for a state agency, the bonds are subject to the approval process by appropriations (act of the legislature) or State Finance Council. Representative Gordon asked if this change gives KDFA authority to issue bonds for research facilities, and Ms. Sparks said that it minimally expands services that KDFA can offer.

Representative Hill made a motion to approve the minutes of the February 3, 2004, meeting and Representative Brunk seconded. Motion passed.

The meeting adjourned at 5:00 p.m.

HOUSE ECONOMIC DEVELOPMENT COMMITTEE
GUEST LIST
DATE: Thursday, February 5, 2004

NAME	REPRESENTING
Jesse McCurry	Commerce
Kathy Damron	University of Kansas
Christina Collins	Kansas Medical Society
Jeff Bottenberg	Polsinelli, Sd. Hon, Wo Hp
Tom Whitaker	KFB
Doug Wareham	KARA Ks. Agribusiness Retailers Assn.
Bob Vancrum	Greater KC Chamber of Commerce
Sandra Braden	Cure Council of Greater KC
Bill Duncan	Kansas City Area Life Sciences Institute
Dusti Hardison	Little Gaverment Relations

Testimony to House Committee on Economic Development
Government Committee
Kansas House Bill 2647
Thursday, February 5, 2004
Topeka, Kansas

William P. Duncan, Ph.D.
President
Kansas City Area Life Sciences Institute

Thank you Mr. Chairman and members of the House Committee on Economic Development for the opportunity to provide testimony in support of Kansas House Bill 2647. The Bioscience Authority Act outlines a critically important approach to funding life sciences research and related commercialization support in Kansas. My name is Bill Duncan, and I am President of the Kansas City Area Life Sciences Institute — a not-for-profit organization formed in 1999 to lead our region's transformation into a center of excellence in the life sciences. The University of Kansas in Lawrence and the Kansas University Medical Center in Kansas City are two of our key stakeholder institutions.

The Life Sciences Institute, with our key stakeholders, actively fosters research collaborations, attracts funding, facilitates sharing of resources and information, and advocates for related economic development. Our efforts in Kansas City realize the importance of a broad regional vision for life sciences – specifically stated – increasing research focused on humans, animals and plants, translates into more intellectual property, leading to development and commercialization of new products, ultimately benefiting the health and well-being of our citizens and providing significant economic returns to the state of Kansas.

The expenditures outlined in the Bioscience Authority Act are critical for supporting this growth cycle, from laboratory to innovation to commercialization over the next ten years.

- There is $184.5 million earmarked for research that targets the acquisition of critical world-class scientists and the support needed for them to be successful. Such investments will enhance our significant life sciences research base and generate a thriving, creative community capable of attracting other world-class scientists to conduct their research in Kansas and the Kansas City region. The ability to draw premiere researchers to our region is fundamental for the continued growth and

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expansion of Kansas institutions, as well as the Stowers Institute for Medical Research, the Midwest Research Institute and other regional organizations. Similarly, such a dynamic scientific environment within our major universities fosters the creation and growth of life sciences companies.

- Nearly $200 million of this bill is earmarked for research facilities and would allow for some 500,000 ft^2 of new space at our research universities. We must have the essential infrastructure, including additional laboratory and office space at our universities and medical schools, to accommodate the quantity and quality of research necessary to become a center of excellence in the life sciences.
- The $86 million earmarked for commercialization and the $27 million designated for investments fulfills an urgent need in our region. Availability of early capital is absolutely critical for entrepreneurial companies to commercialize intellectual property and take a product to market.

We must repetitively complete this cycle from laboratory to innovation to commercialization. Successful revolutions of this cycle, i. e. this "economic churn" will, at the end of the day, provide a financial increase that fuels our success and sustains our momentum. Commercialization means revenue to invest in more research and scientists, more equipment for research facilities, the creation of revenue to reinvest, the formation of entrepreneurial companies and the jobs they create.

It is difficult to build and maintain momentum in the life sciences business sector without a significant investment in the world-class researchers and facilities needed to drive basic research — this is a market area with significant obstacles that make it very challenging for homegrown ideas to become blockbuster life sciences products.

In the Kansas City region, we have made considerable progress toward achieving our goal of developing a critical mass of life sciences research, as evidenced by:

- Annual increases in life sciences research expenditures at our stakeholder institutions. Expenditures were at $104M when the Life Sciences Institute launched in 1999, and grew to $201M by the end of 2002. While all the numbers are not in yet, we are confident life sciences research expenditures will be near $240M for 2003, with continuing growth anticipated in 2004. And by the way, the U.S. Department of Commerce tells us that 41

jobs are supported by every one million research dollars in our community. Taking that statistic and considering our critical mass goal of $500 million dollars in annual research expenditures by our key stakeholder institutions, we estimate the life sciences initiative will add more than 14,000 jobs which is, I might add, in line with the increase in jobs suggested as a result of this legislation.

- The National Institutes of Health (NIH) funding at our stakeholder institutions, a key measure of the quality and relevance of regional research, has increased at a comparable rate to total life sciences research expenditures from 1999 through 2003.
- $1.5 billion has been invested in ongoing or approved public and private capital improvement projects in the region. And, please note that the $1.5B number does not include the 7 year, ~ $1B expansion planned by the Cerner Corporation.
- The growing ability of our stakeholders to successfully recruit world-class scientific talent, especially the Stowers Institute, who is experiencing an 80% acceptance rate of offers made.
- Our ability to garner $15M in both federal and private funding for the Kansas City Proteomics Consortium, a key initiative focused on building research infrastructure and capacity at our key stakeholder institutions. Such efforts increase our scientists' competitiveness when seeking external funding.
- The formation of several start-up companies from research conducted at our key stakeholder institutions, e.g. Proquest, Crititech, and Deciphera in Lawrence, and Xenotech in Lenexa, and a host of others throughout the state.

Clearly, the life sciences initiative has attained significant regional momentum. To be a truly successful center of life sciences research, however, we must secure funding from several diverse sources to ensure that we achieve our goal. The Bioscience Authority Act being considered here today is an important funding concept. It generates significant dollars for life sciences research and provides important resources for both our universities and our local commercial life sciences entities, which are inextricably linked.

Our success as a region hinges on the strength of our research base. The 25 eminent scholars and 35 rising star researchers to be recruited under this legislation are crucial to our future. While research facilities are definitely a critical component of the equation for

success, the addition of outstanding, world-class people to fill and fully utilize our research facilities is even more so. We recognize that quality science remains the key driver behind our efforts. Life sciences research today requires transdisciplinary approaches to complex problems. Extensive collaborations are the key to sustaining the intellectual and capital resources necessary for this type of research. Indeed, the new NIH roadmap that will provide Federal Funding puts significantly increased emphasis on translational research and requires collaboration across disciplines and research institutions. It is likely that successful institutions will develop collaborative relationships both regionally and nationally.

With the importance of plant and animal science to our life sciences locally and nationally, Kansas State University, with its outstanding agriculture school, stands to be a key contributor to life sciences efforts in the State of Kansas. Further, the medical school at Wichita State University will benefit from this legislation and has the potential to contribute to medical advances that will improve the quality of life for all Americans.

Ideas for new drugs and therapies for humans and animals, the concept of plants as factories ("farmaceuticals" with an "f"), and methods for developing healthier foods, all need a place for inception and incubation. There is no better place than the research laboratories at our state-funded institutions of higher learning. We must create within those institutions, however, an environment capable of sustaining and supporting basic research, bridging the gap between basic and applied science, and then carrying forward commercially viable ideas. I must emphasize that the research universities are best suited for directing, sustaining, and evaluating the strategic course of life sciences research in Kansas.

With all of the positives included in this bill, we must bear in mind one necessary caution. The Biosciences Authority can be an effective facilitator of technology transfer and commercialization and may even play a key accountability role back to the legislature regarding expenditures of funds by researchers and other scholars. However, there should be no question that the universities must have authority over the type of science in which they engage, the collaborations formed to address research opportunities at the national level, and the development of other collaborative proposals necessary in order for them to attract the very best scientists, graduate and post-graduate students, and support personnel. That is, the NIH roadmap will require that institutions are flexible, nimble and opportunistic with regard

to the identification and pursuit of scientific niches and the relationships they form to pursue them.

A colleague of mine in Texas always reminds me..."Vision without funding borders on hallucination." In the Kansas City region, we have witnessed how a solidifying vision for the life sciences has hugely impacted the way institutions have spent their research dollars. This Bioscience Authority Act carries this vision to the critical next step by providing the funding and the future revenue streams we must have if we are to achieve our goal of making our region a national leader in the life sciences.

Thank you for your attention.

"The Stowers Institute is encouraged by the steps being taken by Kansas and Missouri to provide financial support to enable KU and UMKC to add new researchers in the life sciences to their faculties. The Stowers Institute and Institute founders Jim and Virginia Stowers wholeheartedly applaud these efforts. The future of the life science initiative in Greater Kansas City depends on increasing the critical mass of research at KU and UMKC. Greater public investments in KU and UMKC will also enhance the potential for fruitful research collaboration between university scientists and colleagues at other research organizations in the community."

Kansas Farm Bureau
Helping Feed the World

Kansas Farm Bureau

2627 KFB Plaza, Manhattan, Kansas 66503-8155 • 785.587.6000 • Fax 785.587.6914 • www.kfb.org

PUBLIC POLICY STATEMENT

HOUSE COMMITTEE ON ECONOMIC DEVELOPMENT

RE: HB 2647 – Bioscience Authority and Development Act

February 5, 2004

Topeka, Kansas

Presented by:

Harry A. Watts, Managing Director

KFB Governmental Relations

Chairman Wilk and members of the committee, thank you for the opportunity to appear today and share my thoughts regarding this bill that proposes to create a Kansas Bioscience Authority. I am Harry A. Watts and I serve as Managing Director--Governmental Relations for the Kansas Farm Bureau (KFB). As you know KFB is the state's largest general farm organization representing more than 40,000 farm and ranch families through our 105 county Farm Bureau Associations. I stand before you today in support of this bill.

Over the years, our members have supported policy that focuses on developing strong research programs at our colleges and universities, especially our land grant universities like Kansas State. We also support policy that focuses on economic development, in particular for the rural counties and communities where our members reside. In my testimony today, I would like to focus on these two important aspects of our public policy.

For over a century, food and agriculture research, our agriculture extension services, and our higher education system has propelled the U.S. agriculture into world prominence. It has been through research efforts that new commodities have been developed and new uses found for those commodities. This has resulted in an increased demand for our agriculture products here in Kansas and throughout the world. It is imperative that our state continues to support, build and maintain a critical mass of well-trained scientists in the public sector and in

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our higher education institutions to ensure that Kansas remains the leader in agriculture production.

We would like to voice our support of several areas addressed in this bill. The Eminent Scholar and Rising Star Scholar programs would have a significant impact on our bioscience efforts. We believe that this program would attract the very best scientists/investigators from around the country to the state of Kansas. One of the goals of their research and development efforts would need to be to promote effective and efficient transfer of knowledge and technology to benefit agriculture producers and ultimately consumers in Kansas. Obviously, it is the hope of this program that we will see agricultural intellectual property developed through research that will benefit Kansas by the actual manufacturing, licensing and commercialization of products right here in this state. Kansas and our members will benefit from this effort.

We know the bill addresses the fact that these researchers will bring in financial resources from a whole variety of areas to continue to fund their research. We believe that it is imperative that we effectively garner and use federal and state funding for research programs to support basic and applied research and technology transfer for the benefit of our Kansas farmers, agribusiness and ultimately our consumers. Kansas and our members will benefit from this effort.

As you might guess, rural revitalization and renewal is a significant focus of Kansas Farm Bureau. The revitalization of our Kansas rural communities must be a high priority with not only this initiative but for the entire Kansas Economic Growth Act that this bill is a part of. We must enhance the economic, social and cultural climate for our farms and our rural families. We must strengthen activities designed to help rural communities obtain grant and loans for infrastructure improvements. We must improve the general potential of rural communities to attract and retain people, business and industry. We will always stand up in support of legislation that encourages significant rural economic development, particularly legislation that fosters a strong Kansas agriculture economy.

We believe that this bill and the companion bills that are a part of the Kansas Economic Growth Act will have a significant impact on our members by improving their quality of life within their communities and the surrounding rural counties in which they live and work and we firmly believe that this act has the potential to increase the profitability of our Kansas Farm Bureau members.

In conclusion, we have three additional thoughts that we would like to bring to your attention.

- We believe that one of the board of directors for the authority should be an agricultural entrepreneur knowledgeable in bioscience – SB 393 (which is one of the companion bills for the Kansas Economic Growth Act) that

creates the Kansas Center for Entrepreneurship will have a similar board position for agriculture on it.

- Even though we know the intent of this bill is to recruit scholars to Kansas, which we wholeheartedly support, we also have some very talented researchers already in Kansas that are doing some outstanding agricultural research with significant federal grants and other outside funding, let's not lose them to other states.
- Finally, we would also ask that when a Bioscience Development District is formed that eminent domain not be used in the acquisition of agricultural land. As you probably know, we have strong public policy language dealing with property rights and specific language that states we oppose the use of eminent domain for private economic development activities.

We respectfully ask that you consider these points when deliberating on this bill.

Thank you Mr. Chairman for the opportunity to address your committee and I stand ready to answer any questions.

Kansas Farm Bureau represents grassroots agriculture. Established in 1919, this non-profit advocacy organization supports farm families who earn their living in a changing industry.

KANSAS AGRIBUSINESS RETAILERS ASSOCIATION

KARA is *"Committed to Professional Development and Business Viability for the Retail Crop Production Industry"*

Statement of the

Kansas Agribusiness Retailers Association

Presented to the

House Economic Development Committee

Rep. Kenny Wilk, Chairman

February 5, 2004

Presented by

Doug Wareham
Senior Vice President

Kansas Agribusiness Retailers Association
(785) 234-0463

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Chairman Wilk and Members of the House Economic Development Committee I am Doug Wareham appearing on behalf of the Kansas Agribusiness Retailers Association (KARA). KARA's membership includes nearly 750 agribusiness firms that are primarily retail facilities that supply fertilizers, crop protection chemicals, seed, petroleum products and agronomic expertise to Kansas farmers. KARA's membership base also includes ag-chemical and equipment manufacturing firms, distribution firms and various other businesses associated with the retail crop production industry. I appear before you in support of H.B. 2647.

Biosciences, in the form of agricultural plant biotechnology has made a dramatic impact on agriculture production in Kansas and the United States. According to a study published by University of Minnesota Professor C. Ford Runge in December of last year, four commercial biotech crops – corn, soybeans, cotton and canola-represented $20 billion in value in the United States in 2002, half of the total $40 billion value of the four crops. Agricultural plant biotechnology has been embraced by agricultural producers in Kansas, with 47% of our states corn production attributable to biotech varieties and nearly 90% of our soybean production attributable to biotech varieties. Cotton, which is a relatively new crop to Kansas, but becoming more and more prevalent, is also benefiting from biotech traits.

Attached to my testimony today is a copy of Professor Runge's study, entitled, "The Economic Status and Performance of Plant Biotechnology in 2003. This thorough report does an excellent job of outlining the positive impact plant biotechnology has played with respect to agricultural production, but also touches upon the economic impacts of plant biotechnology beyond the farm gate. I would like to share just one paragraph from this report found on the front page of its Executive Summary. We believe this legislation will position Kansas well to capture economic growth associated with advancement of agricultural biotechnology and the other segments that comprise the Biosciences industry.

We do want to ask for this committee's attention to two concerns that we discovered when we reviewed the bill. The first relates to the make-up of the eleven member board (New Section 4(c)), which governs the Bioscience Authority. While the bill states the different fields where board members can be selected from, it does not appear to require diversity from the many stakeholder groups that will have an interest in being represented on the board. Naturally, we are specifically interested in ensuring that there is adequate representation from the Plant Biotechnology Field.

Our second concern also deals with the board, but relates to the process that ensues when a vacancy occurs on the board (New Section 4(g)). While we support the presence of a nominating committee that can submit names to the Governor for consideration, we also believe there should not be restrictions on other parties that wish to submit nominations to the Governor and any other party charged with making an appointment. We hope the concerns we've raised will be seen as constructive, and we are happy to work with other interested parties to achieve mutually agreeable language with respect to these sections.

In closing, I would state that based on my experience, I think it would be a mistake to simply tout this legislation as an economic development bill. Benefits from this effort will include greater economic activity, including high paying jobs for Kansans and a broadening of our tax base. But I also believe this legislation will lead to better crop production tools for our farmers and ranchers, healthier foods and better medicines for Kansas consumers.

I appreciate the opportunity to appear in support of H.B. 2647 and I would be happy to stand for questions.

The Economic Status and Performance of Plant Biotechnology in 2003:

Adoption, Research and Development in the United States

December 2003

C. Ford Runge, Ph.D.
Distinguished McKnight University Professor of Applied Economics and Law
Director, Center for International Food and Agricultural Policy
University of Minnesota

Barry Ryan, M.S.
Research Associate
Department of Applied Economics
University of Minnesota

The study was supported by the Council for Biotechnology Information. Its results are those of the authors alone and not the University of Minnesota.

The full report can be accessed at www.apec.umn.edu/faculty/frunge/plantbiotech.pdf.

Economic Impact Beyond the Farm Gate and the Role of the States

• Looking beyond the farm gate, it is clear that the plant biotech industry is creating jobs unknown a decade ago. The stock of knowledge associated with the R&D leading to the biotech revolution, if the formula developed by analysts of agricultural research is used, is worth at least $200 billion.

Maintaining this stock of knowledge will require high skill levels and will demand high wages.

• The number of biological science degrees, one measure of this trend, rose dramatically in the 1990s. In the U.S. as a whole, the number of bachelor's, master's and Ph.D.'s in the biological sciences rose from 45,000 in 1990 to 73,000 in 2000, an increase of 62 percent.

Public Institution by state	Commodity	Trait in field study
Louisiana State U	Rice	Phosphinothricin tolerant
Louisiana State U	Rice	Hygromycin tolerant
Michigan		
Michigan State U	Potato	Phytophthora resistant
Michigan State U	Potato	Coleopteran resistant
Michigan State U	Potato	Lepidopteran resistant
Michigan State U	Potato	Visual marker
Michigan State U	Potato	Starch level increased
Minnesota		
U of Minnesota	Potato	Late blight resistant
U of Minnesota	Wheat	Phosphinothricin tolerant
Missouri		
U of Missouri	Corn	Gene expression altered
U of Missouri	Corn	Anthocyanin produced in seed
Montana		
Montana State U	Wheat	Starch level increased
Montana State U	Wheat	Yield increased
Montana State U	Wheat	Visual marker
Montana State U	Wheat	Improved bread making characteristics
Nebraska		
U of Nebraska/Lincoln	Soybean	Sclerotinia resistant
U of Nebraska/Lincoln	Soybean	Cyanamide tolerant
U of Nebraska/Lincoln	Soybean	Dicamba tolerant
U of Nebraska/Lincoln	Soybean	Oil profile altered
U of Nebraska/Lincoln	Soybean	Fatty acid level/metabolism altered
U of Nebraska/Lincoln	Soybean	Oleic acid content altered in seed
U of Nebraska/Lincoln	Wheat	Yield increased
U of Nebraska/Lincoln	Wheat	Fusarium resistant
New Jersey		
Rutgers U	Corn	Storage protein altered
Rutgers U	Corn	Visual marker
Rutgers U	Corn	Seed color altered
Rutgers U	Corn	Methionine level increased
New York		
Boyce Thompson Institute	Potato	Kanamycin resistant
Boyce Thompson Institute	Potato	Beta-carotene increased
Cold Spring Harbor Lab	Corn	Development altered
North Carolina		
North Carolina State U	Rapeseed	Visual marker
North Dakota		
North Dakota State U	Potato	Carbohydrate metabolism altered
Ohio		
Ohio State U	Corn	Visual marker
Oregon		
Oregon State U	Potato	PVY resistant
Pennsylvania		
Pennsylvania State U	Corn	Male sterile
Pennsylvania State U	Corn	Visual marker
Pennsylvania State U	Corn	Color sectors in seeds
Texas		
Texas Agricultural Exp Stn	Cotton	Rhizoctonia solani resistant
Texas Tech	Cotton	Carbohydrate metabolism altered
Texas Tech U	Cotton	Environmental stress reduced
Texas Tech U	Cotton	Fiber quality altered
Virginia		
Virginia Tech	Soybean	Phytate reduced
Washington		
Washington State U	Potato	Storage protein altered
Wisconsin		
U of Wisconsin	Corn	Altered maturing
U of Wisconsin	Corn	Visual marker
U of Wisconsin	Corn	Gene expression altered
U of Wisconsin	Corn	Anthocyanin produced in seed
USDA		
ARS	Cotton	Oleic acid content altered in seed
ARS	Potato	Erwinia carotovora resistant
ARS	Potato	Phytophthora resistant
ARS	Potato	PLRV resistant
ARS	Potato	PVY resistant
ARS	Potato	PVA resistant
ARS	Potato	Visual marker
ARS	Potato	Steroidal glycoalkaloids reduced
ARS	Soybean	Visual marker
ARS	Wheat	Phosphinothricin tolerant
ARS	Wheat	Powdery mildew resistant
ARS	Wheat	Smut resistant
ARS	Wheat	Storage protein altered

Source: USDA. APHIS

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Figure 8
Public and Private Sector Institutions Filing for Field Testing Permits for Eight Study Crops Between January 2001 and July 2003*

Public Sector Institutions	Private Sector Institutions
ARS—USDA Agricultural Research Service	Abbott and Cobb
Boyce Thompson Institute (Cornell)	AgReliant Genetics
Cold Spring Harbor Lab	Applied PhytoGenetics, Inc.
Colorado State University	Applied Phytologics
Hawaii Agriculture Research Center	Arcadia Biosciences
Iowa State University	Aventis
Kansas State University	BASF
Louisiana State University	Bayer CropScience
Michigan State University	Betaseed
Montana State University	Biogemma
North Carolina State University	Cargill
North Dakota State University	Dow
Ohio State University	DuPont
Oregon State University	ExSeed Genetics
Pennsylvania State University	Garst
Purdue University	Goertzen Seed Research
Rutgers University	Horan Bros. Agri. Enterprises
Stanford University	Interstate
Texas Agricultural Exp Stn	Interstate Payco Seed
Texas Tech University	J. R. Simplot Company
University of Arizona	Mendel Biotechnology
University of California	Meristem Therapeutics
University of California/Berkeley	Monsanto
University of California/Davis	National Starch & Chemical
University of California/San Diego	Pioneer
University of Connecticut	ProdiGene
University of Florida	Research for Hire
University of Georgia	Shoffner Farm Research, Inc.
University of Hawaii	Stine Biotechnology
University of Idaho	Syngenta
University of Illinois	Targeted Growth Inc.
University of Kentucky	United Agri Products
University of Minnesota	Ventria Bioscience
University of Missouri	
University of Nebraska/Lincoln	
University of Wisconsin	
University of Wisconsin/Madison	
Washington State University	
Virginia Tech	

Source: USDA. APHIS
*Eight biotech crops (corn, soybeans, cotton, rapeseed/canola, wheat, potato, rice, sugar beets)

- The Minneapolis Federal Reserve District Bank estimated the number of R&D firms in engineering, physical and life sciences in Minnesota at 178 in 2001, followed by Wisconsin with 128, Montana with 53, North Dakota with 20 and South Dakota with 17, or 396 in the five states. Employment in these firms grew at least 50 percent from 1998 to 2002 in Minnesota and Wisconsin, adding 1,000 jobs each.

- There is reason to believe that many estimates of plant biotech activity have been substantially understated, even by industry spokesmen. The Biotechnology Industry Organization (BIO), for example, identified only 64 biotech companies in the Midwest. Yet a 2003 survey of Minnesota firms by the state's Department of Employment and Economic Development found 170 firms in scientific biotech in Minnesota alone, of which two in five were in the agricultural and industrial sectors.

- The Wisconsin Association for Biomedical Research and Education (WABRE) in 2001 identified almost 200 Wisconsin bioscience companies, including 56 in the agricultural sector. These companies employed some 21,000 workers, with an additional 5,000 employed in R&D at Wisconsin universities and laboratories. WABRE estimated total industry activity at $5 billion, about 3 percent of gross state product.

- Bureau of Labor Statistics from the U.S. Department of Commerce's Occupational and Employment Survey (OES) were examined for evidence of plant biotech impacts. Plant biotech does not fit neatly into OES categories. We examined three U.S. sectors: crop services (with 128,500 workers in 2001); agricultural chemicals (46,490 workers in 2001); and farm products — raw materials (97,180 in 2001). Apart from these sectors, plant biotech firms employ many of the same skilled workers as other sectors of the economy (managers, computer programmers, legal advisors, etc.).

- What makes plant biotech different is the reliance on life science workers, including food scientists, microbiologists, biochemists and biophysicists. These workers typically require advanced degrees and training, and receive above-average wages. In 2001, the OES estimated 13,470 agricultural and food scientists (AFS) alone employed in public and private institutions with an average salary of $52,310 a year, more than one and one-half times the U.S. average of $34,020.

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• The states which have been the most rapid adopters of biotech corn and soybeans up to 2003 were compared with the size of the AFS job category. Those states with the highest levels of biotech crop adoption had more AFS jobs per 100,000 in 2003 than states with lower levels. (See Figure 10.)

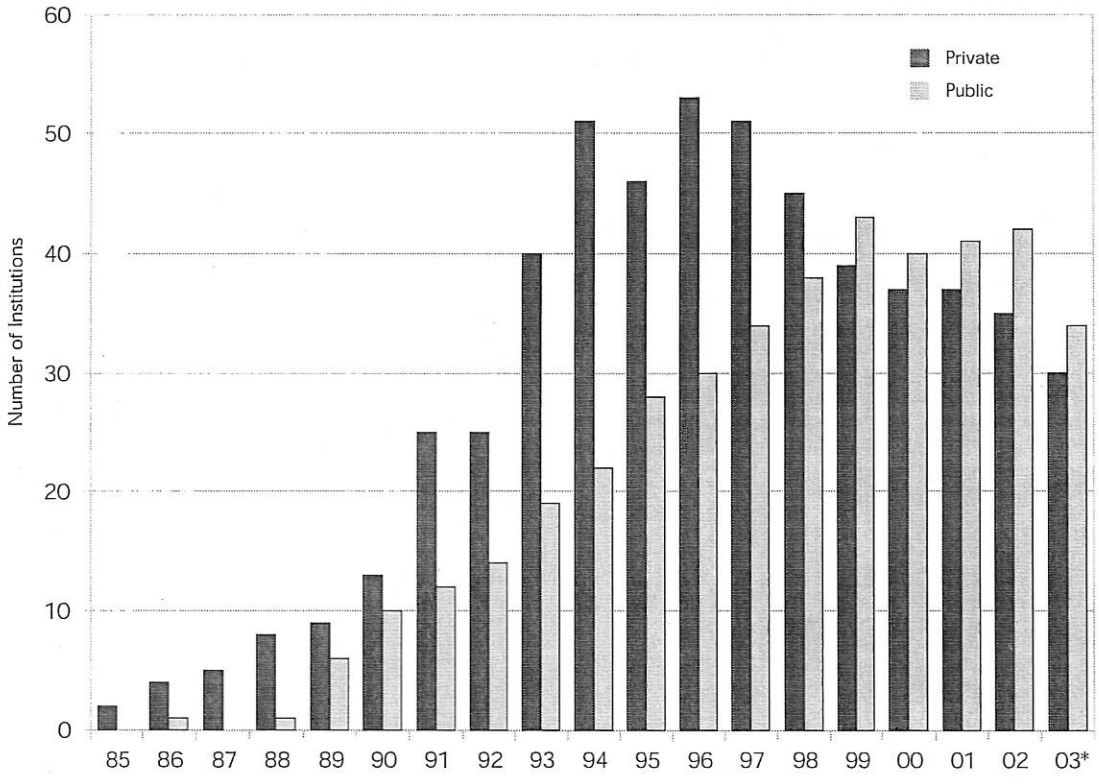
• The distribution of wages in the AFS sector showed that overall, AFS workers in the states with the highest levels of biotech plant adoption made between 1.5 and 2 times the average wage. These wages exceeded averages throughout the career life cycle.

• The states' role in value creation shows that commercial plantings of biotech crops have benefited a wide range of individual state economies. These include especially the corn and soybean producing states of Iowa, Illinois, Minnesota, Nebraska, Indiana, South Dakota, Missouri, North Dakota, Ohio, Wisconsin and Michigan. They also include cotton producing states such as Arkansas, Mississippi, Texas, California, Georgia and others.

• On the research side, state land grant universities and the U.S. Department of Agriculture have been active in plant biotech research. Among the research institutions involved are Universities in Arizona, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Missouri, Montana, Nebraska, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Texas, Virginia, Washington and Wisconsin.

• When private and public institutions involved in field test permits are compared over time as shown in Figure 9, two pictures emerge: first, there has been steady progress in public sector research through the years. Second, it suggests private sector growth expanded rapidly in the early 1990s;

Figure 9
Number of Private and Public Institutions Granted APHIS Field Test Permits, 1985-2003



*Data for 2003 only includes the first 8 months.

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however, the apparent decline in activity since 1996 is likely due to rapid consolidation of firms, leading to fewer private company filings.

Future Directions for Plant Biotechnology

- In conclusion, plant biotech and its future is of growing importance to producers, to the input supply industry, to private research and development investors, to educational and research institutions, to the federal government and increasingly to consumers.

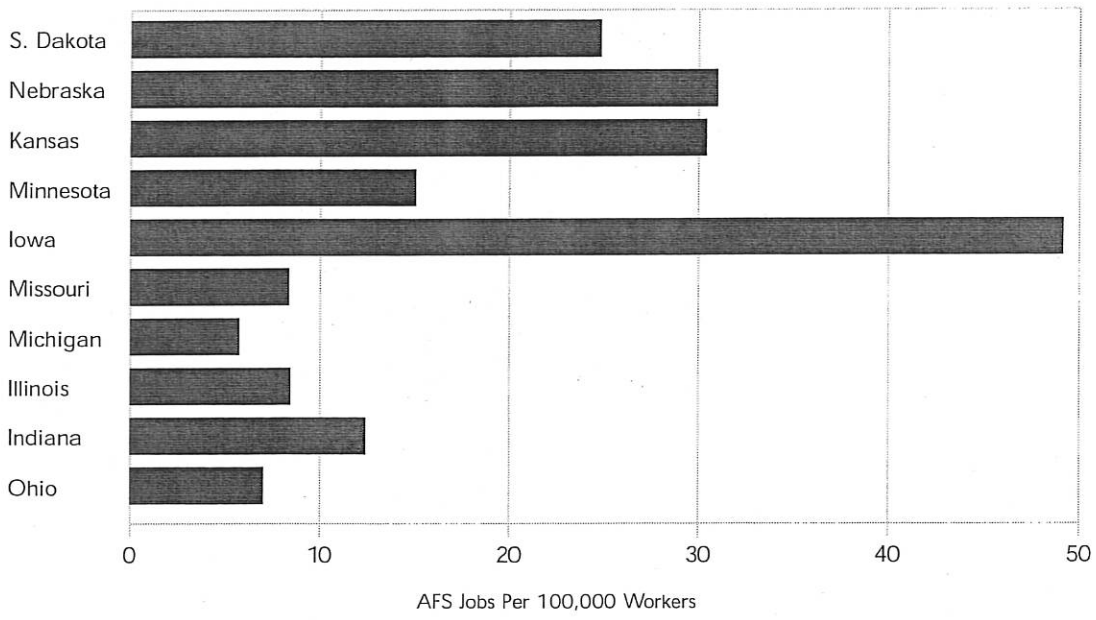
- For producers, valuable benefits conferred by plant biotech since commercial introduction in 1996 reached over $20 billion in 2002. In addition to direct improvements in profits, biotech varieties offer management efficiencies worth almost 65 percent more in economic benefits in some cases. Multiplied times the growing number of acres in biotech varieties nationally, these are significant contributions to farm income, especially in the Corn and Cotton Belt states.

- In the input supply industry, the introduction of biotech varieties has forced changes in the "bundles" of crop protection products, seeds and fertilizers sold to farmers, and promoted rapid consolidation of chemical and seed companies. Biotech varieties have given new impetus to precision agriculture, and offer traits that will yield social rewards not only for productivity but resource conservation and environmental improvements.

- Investors find that high investments are matched by high returns, but that long lags intervene between costs and benefits. These long lags mean that only companies able to commit resources over extended periods will dominate the R&D process. In general, these are larger, well-capitalized firms. Venture capitalists with shorter time horizons will need to find start-ups able to attach themselves to the R&D process of larger companies.

- Public sector R&D will remain important due to the leads and lags in the agricultural research process. Activity will continue to grow in the life sciences as public institutions remain repositories of knowledge worth hundreds of billions of dollars a year. The erosion of funding for land grants and state and federal budget deficits will therefore have negative consequences for the entire plant biotech sector. New directions must maximize the complementarity between private and public science.

Figure 10
Highest Ranking Plant (Corn and Soybean) Biotech Adopting States and Agricultural and Food Scientists (AFS) per 100,000 — 2003



Source: Bureau of Labor Statistics, U.S. Department of Commerce

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- The federal government's role will become even more important as the regulatory scope of plant biotech requires oversight by not only USDA and its sub-agencies, but FDA, EPA and other agencies such as the Small Business Administration or the export-promotion arms of the Department of Commerce. NSF and NIH will also play key roles.

- The ultimate arbiter of market growth and development is the consumer. As consumer confidence grows, it will feed the demand for new biotech varieties, support those who supply them, and build a base for public investments in the plant biotech research base, resulting in more jobs at higher wages.

9-9

C. Ford Runge, Ph.D.

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Director, Center for International Food and Agricultural Policy
University of Minnesota

www.apec.umn.edu/faculty/frunge/plantbiotech.pdf

EXECUTIVE SUMMARY

INTRODUCTION

Plant biotechnology in the United States is a growing industry offering remarkable economic, social and environmental opportunities in the years ahead. The adoption of biotech crops by farmers has been rapid and profitable. Progress on the research front has moved into a new phase, with biotech traits promising an increasingly wide range of consumer and environmental benefits. Plant biotech is also creating new jobs — and good jobs — beyond the farm gate. Sustaining the revolution in plant biotechnology will require a continued commitment to both public and private sector research and development.

- The purpose of this study is to put progress in plant biotechnology in context, and to appraise both its current place and likely future. It is an economic assessment of the status and performance of plant biotechnology and ongoing research and development in the United States.

- The study is focused on eight crops: corn, soybeans, cotton, rapeseed/canola, wheat, potatoes, sugar beets and rice. Given this focus it assesses four fundamental issues:

    1) What is the current level of adoption of plant biotechnology and its value to producers and how have adoption decisions affected farm-level profits in the United States?

    2) What are the main R&D activities in plant biotechnology, by crop and by trait, in both the private and public sector, based on available data?

    3) What are the probable economic impacts of the technology beyond the farm gate in the creation of jobs and new economic opportunities, and what role do individual states play in value creation and research?

    4) What is the future direction of both public and private R&D for the plant biotechnology sector?

- The 2003 levels of adoption of biotech corn, soybeans, cotton and rapeseed/canola in the U.S. were 40 percent for corn, 81 percent for soybeans, 73 percent for cotton and 70 percent for rapeseed/canola. (See Figure 1.) All four crops have shown steady increases in adoption rates. These biotech adoption rates result directly from increases in farm-level profits. Estimates vary by crop and by area, but average profits rose from $5 to as much as $60 per acre for corn, on the order of $15 per acre for soybeans and from $15 to several hundred dollars per acre for cotton.

- The main R&D activities in plant biotechnology are conducted by large private companies such as Syngenta, Monsanto, Bayer CropScience, DuPont, Dow AgroSciences and BASF. Together, these companies spent $2.7 billion on R&D in 2002, much of it on biotech. Scores of smaller start-ups are also engaged in the R&D process. In the public sector, research by the U.S. Department of Agriculture, land-grant universities and other academic research centers resulted in billions of dollars in additional research investment. In 2000, total U.S. public agricultural research spending was $3.5 billion. New biotech traits are now commercialized for corn, soybeans, cotton and rapeseed/canola, especially traits conferring insect and herbicide resistance. Scores of new traits in the pipeline were field tested by both private and public institutions from 2001 to mid-2003.

- The economic impacts of plant biotechnology are also increasingly evident beyond the farm gate, and in individual states active in biotech research and development. Beyond the more than $20 billion in biotech crops grown in 2002, new plant biotech firms and research facilities are being created throughout the U.S. Agricultural and food scientists are increasingly attracted to the biotech sector's

above average wages, and a large number of individual states are reaping the benefits of this investment and job-related economic activity.

- The future direction of both public and private research and development in plant biotechnology will affect and be affected by producers, the input supply industry, private research and development investments, educational and research institutions, the federal government and increasingly consumers.

Current Adoption, Value and Profitability

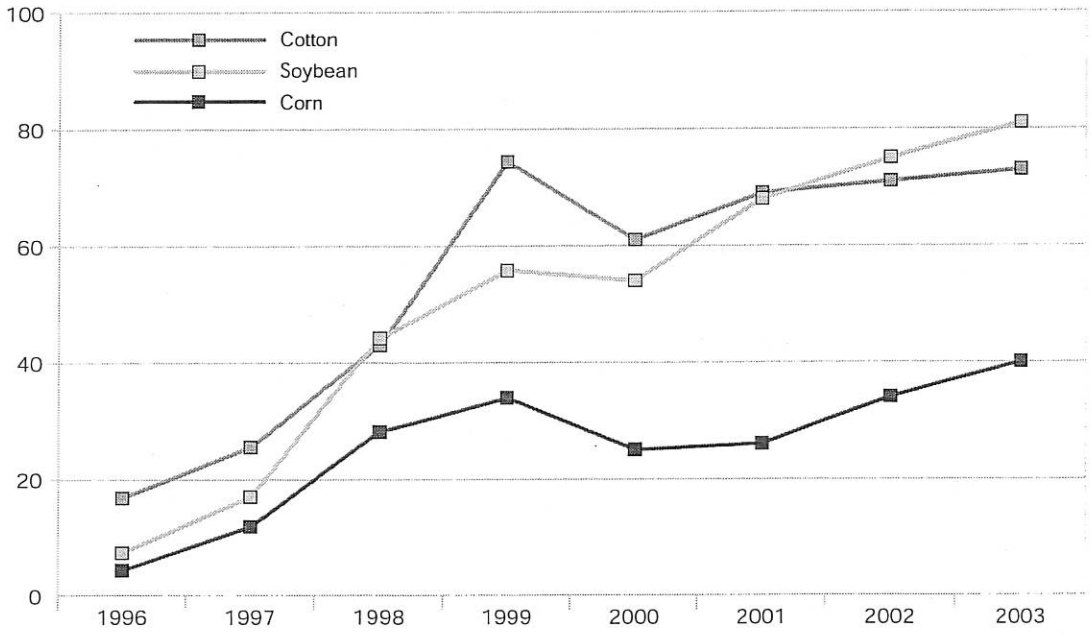
- The growth of value and benefits of plant biotechnology explain producer demand for biotech varieties in the U.S. Adoption rates for corn rose from 4 percent of corn acres in 1996 to 40 percent in 2003, worth $7 billion in 2002. Biotech soybeans rose from 9 percent of planted soybean acres in 1996 to 81 percent in 2003, worth $11 billion in 2002. Biotech cotton rose from 17 percent of planted cotton acres in 1996 to 73 percent in 2003, worth $2.7 billion in 2002. Biotech rapeseed/canola accounted for 70 percent of all acres planted in 2003, worth $115 million in 2002. All told, over $20 billion in crop value was associated with biotech crop varieties in 2002, half of the total value of the four crops.

- When evaluated state-by-state, four states (Iowa, Illinois, Minnesota and Nebraska) accounted for 60 percent of the value of biotech corn production. Four states (Iowa, Illinois, Minnesota and Indiana) accounted for 54 percent of the value of biotech soybean production. Four states (Texas, California, Mississippi and Georgia) accounted for 68 percent of the value of biotech cotton production. Two states (North Dakota and Minnesota) accounted for 95 percent of the value of biotech rapeseed/canola production. (See Figures 2, 3 and 4.)

- In 2003, no biotech varieties of wheat, potatoes, sugar beets or rice were planted commercially, although grower organizations remain keenly interested in ongoing research and development of the technology.

- Numerous studies have estimated the benefits of adopting biotech varieties for producers. A survey of these studies shows widespread improvements in profits and management capacity compared with conventional crops.

Figure 1
Percent of Crop Acres Planted to Biotech Varieties: 1996-2003



Source: USDA, NASS.

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Figure 2
Value of Crops with Biotech Traits by State: 2002 (millions of dollars)*

2002	All Biotech	Soybean	Corn	Cotton	Canola
U.S.	$ 20,889	$ 11,026	$ 7,040	$ 2,708	$ 115
IA	3,816	2,004	1,811		
IL	2,546	1,756	790		
MN	2,154	1,151	995		8
NE	1,841	802	1,039		
IN	1,258	1,057	201		
SD	1,023	581	441		
MO	1,005	661	236	108	
ND	689	275	312		102
AR	670	371		299	
OH	619	562	57		
MS	528	195		334	
WI	498	274	224		
TX	489			489	
MI	427	309	118		
CA	404			404	
GA	329			329	
KS	274	262		12	
TN	138			138	
NC	137			137	
LA	126			126	
AZ	119			119	
AL	101			101	
OK	31			31	
NM	31			31	
SC	21			21	
VA	17			17	
FL	13			13	
Other	1,588	766	816	—	6

Source: USDA, NASS.

*USDA reports only the top 12-14 corn and soybean growing states for biotech varieties, allocating the rest to the "other" category. When these states are paired with USDA data on biotech cotton, the result is to underestimate biotech corn and soybeans in those states growing biotech cotton.

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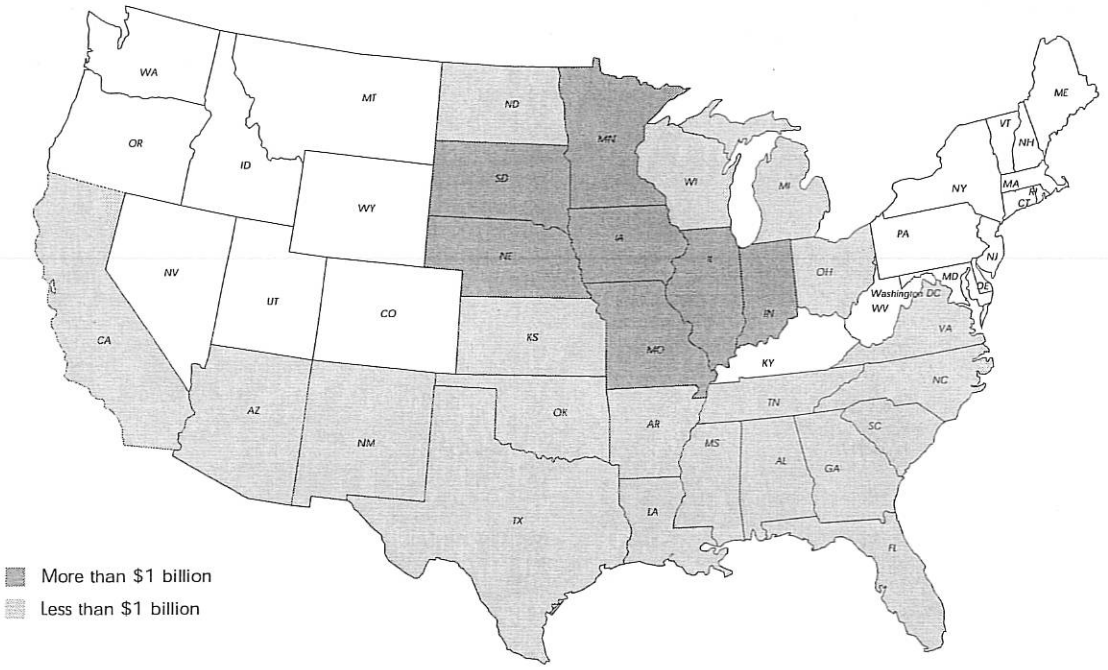
Figure 3
States with Major Biotech Crop Value: 2002*



*Four biotech crops (corn, soybeans, cotton, rapeseed/canola)

Private and Public R&D by Crop and by Trait

- Suppliers of plant biotechnology include numerous private and public sector actors. In the private sector, although hundreds of companies are invested in some aspect of plant biotechnology, six companies lead the sector: Syngenta, Bayer, Monsanto, DuPont, Dow and BASF. In 2002 these six companies together had sales in their agricultural divisions of roughly $28 billion. When research and development investments are calculated as a percentage of these sales, they average about 10.8 percent.

- Despite the dominance of large biotech companies, there are many examples of smaller companies that have found niche markets in the industry. Illustrative examples include Mendel Biotechnology, Arcadia Biosciences and Shoffner Farm Research, which are briefly surveyed.

- Plant biotech research rests on a wider platform of genomics, which is the latest episode in a tradition of modern plant breeding going back over a century. The cumulative nature of the research process means that research and development by both private and public plant scientists has accumulated over more than 100 years. It is the *accretion* of this knowledge, and not just its leading edges, that defines the R&D mission in plant genetics, including plant biotech.

- Estimates of the stock of plant breeding knowledge and its value, compared with the value of agricultural output, show that from 1850 to 1995 (allowing for depreciation of past research) the ratio of value was 10:1. In other words, in 1995, for every $100 of agricultural output there was $1,000 stock of knowledge to draw on.

- The role of the public sector in plant science research relates specifically to this stock of knowledge, which is held in large part in the public domain by universities, experiment stations and federal research facilities. It also relates to the fact that agricultural research investments often pay out only after 20-30 years. The public sector is often the only party willing and able to wait for these payoffs to accrue.

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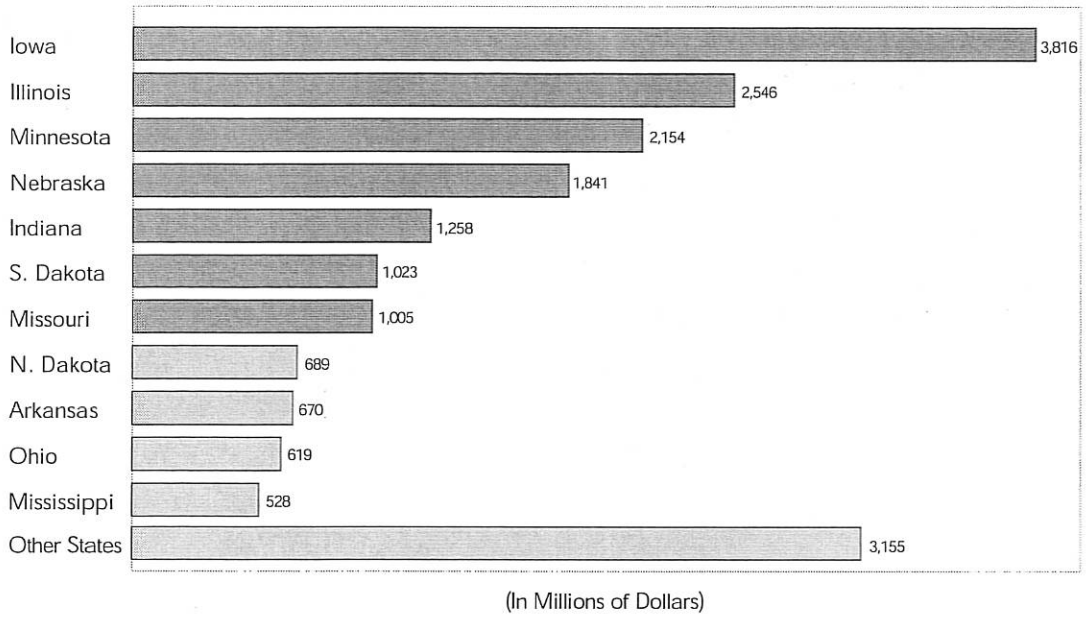
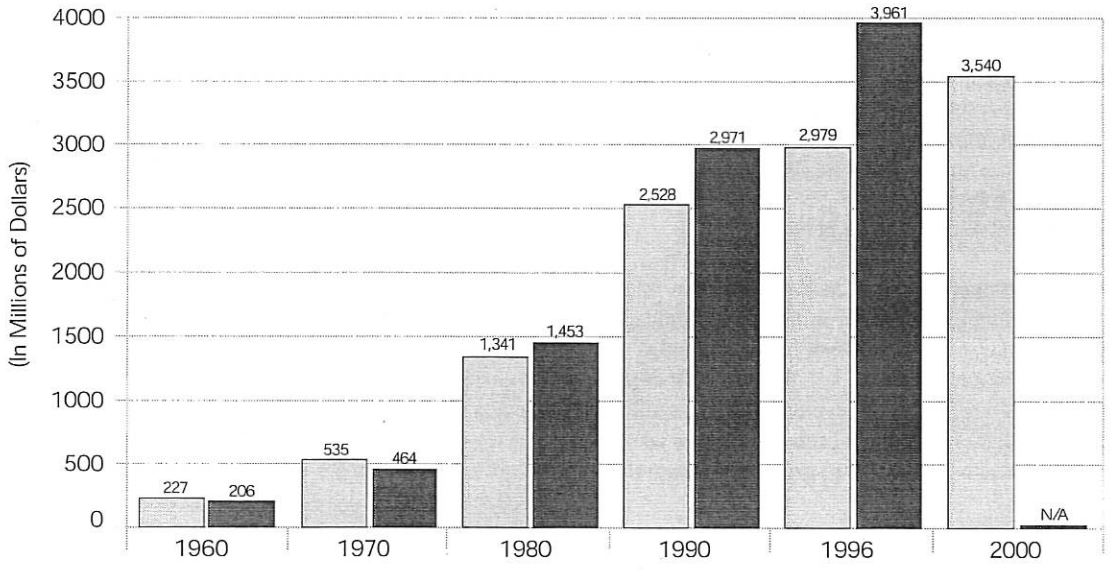
Figure 4
Total Value of Biotech Crops in 2002 in the United States was $20.9 Billion



Source: USDA, NASS.

Figure 5
Public and Private U.S. Agricultural Research and Development Spending in Nominal Dollars, Selected Years



Source: Philip Pardey, University of Minnesota, 1996. Compiled from unpublished USDA data.

Total U.S. Public Agricultural Research (millions)
Total U.S. Private Agricultural Research (millions)

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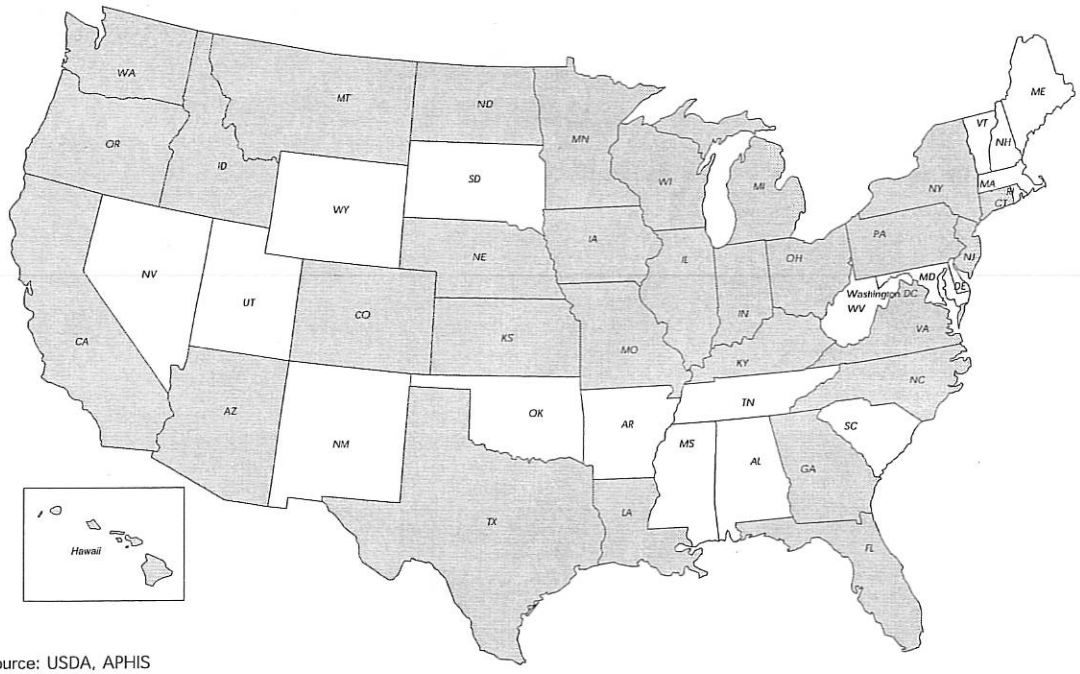
Figure 6
States Where Public Research Institutions Conducted Biotech Field Trials: 2001-2003*



Source: USDA, APHIS

*Eight biotech crops (corn, soybeans, cotton, rapeseed/canola, wheat, potato, rice, sugar beets)

• Despite this long accrual process, the social rates of return to these investments are impressive by any standards. In a 2000 study comparing estimates of rates of return to agricultural research from 292 studies since 1958, the average annual rate of return was an extraordinary 81 percent (77 percent after inflation) compared to 5 percent on U.S. government bonds in 2002. In corn research, the rate of return was 134.5 percent, in wheat 50.4 percent and in rice 75 percent.

• Biotech plants are the latest phase in this effort. The role of the public sector in these and forthcoming biotech innovations should not be discounted, despite substantial increases in the private share of agricultural research and development. If anything, returns to research in plant biotech will exceed the high rates calculated for agricultural research as a whole.

• In 1960, private R&D was 90 percent of public. During the 1970s, private R&D rose to outstrip public spending. By 1980 it exceeded it by 8 percent. In 1990 it exceeded it by 17 percent. By 1996 it was 32 percent higher. (See Figure 5.)

• The growth of private sector R&D in plant science grew most rapidly from 1960-1996 in plant breeding, which increased at an annual rate of 13.7 percent. From 1990-1996, plant breeding research grew at an annual rate of 9.4 percent, more than any other category of private agricultural R&D.

• Public sector research institutions in agriculture have operated largely through connections from USDA to the land grant Universities and their Experiment Stations. Knitting together the system of land grant institutions are various branches of USDA, notably its Agricultural Research Service (ARS), Cooperative State Research, Education and Extension Service (CSREES), Economic Research Service (ERS) and National Agricultural Statistics Service (NASS). USDA expenditures for the four programs in 2002 were $2.3 billion, of which CSREES accounted for nearly half. CSREES is the main federal partner with land grant research, teaching and extension activities. No budget items are designated "plant biotech," but ARS has a $314 million line item for plant sciences, and ERS has a small $1.1 million "genomics initiative."

- The changing emphasis of federally funded research is reflected in National Science Foundation data for 1990-99, which shows major gains in the share of the life sciences as a research category. Life sciences outstripped every other research category in its gains, and exceeded the gains of the next largest category, computer sciences, by more than 10 times. Between 1996 and 2002, nationwide NSF funding increased 70 percent in the biological sciences sector.

- Ongoing commercial activity in plant biotech and R&D in the pipeline were examined by describing all traits and varieties of biotech crops approved for commercial sale, and all plant biotech traits in field trials from 2001 to mid-2003. In the first case, USDA, FDA and EPA information was used to construct tables of commercial activity. In the second case, data from USDA's Agricultural Plant Health Inspection Service (APHIS) was used.

- Ongoing commercial activity shows a growing list of approvals in corn, soybeans, and cotton through 2001, mainly by the largest companies. In the remaining crops in the study, some approved varieties exist but are not being commercially sold.

- Plant biotech R&D in the pipeline as of 2001 through mid-2003 indicates almost a hundred new traits in testing. (See Figures 6, 7 and 8.) Represented in these activities are about 40 universities (mainly land grants) and about 35 private sector companies. Without question, more research and development as measured by field tests has been devoted to biotech traits in corn than to any other crop, attracting scores of public and private institutions. Among the traits in testing for corn were 19 new agronomic properties, four traits for fungal resistance, seven for herbicide tolerance, four for insect resistance, ten trials focusing on some form of marker genes, and over 30 for output and other end-use traits.

- Soybean research, in which the public and private sector are about equally represented, involved three field tests from 2001 to mid-2003 for agronomic properties, three for fungal resistance, eight for herbicide tolerance, one for insect resistance, one for marker genes, and eight for output traits related to product quality or environmental and health benefits to consumers.

- Cotton research was led from 2001 to mid-2003 by the six major private companies, one land grant and the Agricultural Research Service (ARS) of USDA. Testing of biotech traits focused on four agronomic properties, one fungal resistance trait, three herbicide resistance traits and one trait for insect resistance.

- Rapeseed/canola field testing was actively pursued by numerous smaller companies as well as major players such as Monsanto and Cargill and two state universities. Four tests were made on agronomic properties, one each on fungal resistance, herbicide tolerance, insect resistance, and marker genes. Four tests were conducted on output traits for enhanced product quality and alternative uses for canola oil.

- Wheat field testing was quite active despite the absence of marketed biotech varieties, reflecting continued interest in their commercial potential. Testing of agronomic properties related to starch, yield and drought tolerance was pursued at three land grants. Fungal resistance traits were tested by ARS, Syngenta and three land grants. Herbicide tolerance and virus resistance was tested by ARS, Monsanto and the University of Idaho. Marker genes were tested by Montana State. Finally, output traits for digestibility, starch metabolism, and improved bread making characteristics, among others, were tested by several small companies, as well as ARS and Montana State.

- Sugar beets also saw a limited number of field trials from 2001 to mid-2003, notwithstanding the absence of commercial sales. Two herbicide tolerant traits and a virus resistant trait were tested by Syngenta, Monsanto and two small privates.

- Rice was the subject of numerous field tests from 2001 to mid-2003, suggesting the potential opportunities once commercial markets open up. Two agronomic properties were tested by both large and small privates and two states. Bacterial resistance traits were tested by Louisiana State University and the University of California-Davis. Fungal resistance and herbicide tolerance were tested at Louisiana State and by Aventis and Monsanto. Insect resistance traits were tested by Syngenta. Marker genes were tested by the University of California-Davis, Louisiana State University and ExSeed Genetics. Lastly, output traits including heavy metal bioremediation, starch level changes, novel protein production and carbohydrate metabolism changes were tested by two small companies, as well as Aventis (now Bayer) and BASF.

- Potatoes were also the subject of considerable field testing of biotech traits from 2001 to mid-2003.

Traits tested include bacterial resistance by ARS, fungal resistance by Syngenta, ARS and three land grants, and insect resistance by Michigan State University and the University of Idaho. Virus resistance traits were tested at ARS, the University of Idaho and the Oregon State University. Gene marker traits were tested by Syngenta, ARS and two land grants. Last, a number of product quality traits were tested such as increased beta-carotene, starch content and reduced bruising properties. These tests involved major privates like Syngenta, potato producers such as J.R. Simplot, as well as ARS and several land grants.

Figure 7
Public Institutions Engaged in Plant Biotech Field Studies by State, Commodity and Trait: 2001-2003

Public Institution by state	Commodity	Trait in field study
Arizona		
U of Arizona	Corn	Endosperm DNA synthesis altered
U of Arizona	Corn	Visual marker
U of Arizona	Corn	Color sectors in seeds
U of Arizona	Corn	Pigment composition/metabolism altered
U of Arizona	Corn	Gene expression altered
U of Arizona	Corn	Anthocyanin produced in seed
California		
Stanford U	Corn	Visual marker
Stanford U	Corn	Seed color altered
Stanford U	Corn	Anthocyanin produced in seed
Stanford U	Corn	Transposon inserted/movement supressed
U of California	Corn	Fertility altered
U of California	Corn	Environmental stress reduced
U of California	Corn	Visual marker
U of California	Corn	Anthocyanin produced in seed
U of California/Berkeley	Corn	Seed color altered
U of California/Berkeley	Corn	Pigment composition/metabolism altered
U of California/Berkeley	Corn	Gene expression altered
U of California/Davis	Rice	Bacterial leaf blight resistant
U of California/Davis	Rice	Visual marker
U of California/San Diego	Corn	Phosphinothricin tolerant
Colorado		
Colorado State U	Potato	Phytophthora resistant
Connecticut		
U of Connecticut	Corn	Visual marker
Florida		
U of Florida	Corn	Male sterile
U of Florida	Corn	Color sectors in seeds
U of Florida	Corn	Starch metabolism altered
U of Florida	Corn	Seed size/weight increase
Georgia		
U of Georgia	Rapeseed	Lepidopteran resistant
U of Georgia	Rapeseed	Visual marker
U of Georgia	Soybean	Lepidopteran resistant
Hawaii		
Hawaii Agriculture Research Center	Rice	Yield increased
U of Hawaii	Corn	Polymer produced
Idaho		
U of Idaho	Potato	Colorado potato beetle resistant
U of Idaho	Potato	PLRV resistant
U of Idaho	Potato	PVY resistant
U of Idaho	Potato	TRV resistant
U of Idaho	Potato	Kanamycin resistant
U of Idaho	Potato	Bruising reduced
U of Idaho	Potato	Ethylene metabolism altered
U of Idaho	Wheat	BYDV resistant
U of Idaho	Wheat	WSMV resistant
Illinois		
U of Illinois	Corn	Phosphinothricin tolerant
U of Illinois	Corn	Visual marker
U of Illinois	Corn	Gene expression altered
U of Illinois	Corn	Epidermal cells increased on juvenile leaves
U of Illinois	Soybean	Phosphinothricin tolerant
Indiana		
Purdue U	Corn	Color sectors in seeds
Iowa		
Iowa State U	Corn	Male sterile
Iowa State U	Corn	Fertility altered
Iowa State U	Corn	Visual marker
Iowa State U	Corn	Starch metabolism altered
Iowa State U	Corn	Carbohydrate metabolism altered
Iowa State U	Corn	Protein altered
Iowa State U	Corn	Pharmaceutical proteins produced
Iowa State U	Soybean	Phytophthora resistant
Iowa State U	Soybean	Protein altered
Kansas		
Kansas State U	Corn	Color sectors in seeds
Kansas State U	Wheat	Drought tolerant
Kansas State U	Wheat	Fusarium resistant
Kentucky		
U of Kentucky	Soybean	BPMV resistant
U of Kentucky	Soybean	Oil profile altered
U of Kentucky	Soybean	Altered amino acid composition
U of Kentucky	Soybean	Methionine level increased
Louisiana		
Louisiana State U	Rice	Yield increased
Louisiana State U	Rice	Burkholderia glumae
Louisiana State U	Rice	Rhizoctonia solani resistant

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Testimony to the House Economic Development Committee
in Support of House Bill 2647
Robert J. Vancrum, Government Affairs Specialist
Greater Kansas City Chamber of Commerce
February 5, 2004

Chairman Wilk and Honorable Members of the Committee:

1. **HB 2647 gives Kansas the cutting edge infrastructure to build on the nationally ranked Biosciences foundation already in place**
   a. Area Development Magazine reports KC metro area is ranked in top 15 BioTech metros areas in U.S.
   b. MX Magazine (business planning and tech development periodical) ranks KC in top 10 metro areas to consider when starting BioTech companies
   c. Stowers-2nd largest Medical research facility in U.S.
   d. KU Med. Hoglund Brain Imaging Center offers unequaled brain scan technology in entire US. KU also ranks high nationally in cancer, kidney, diabetes and gene research
   e. Demand for medical Technicians so high that JCCC just started Med. Tech program and cannot turn out med. techs fast enough
   f. Over 155 bioscience companies in Biosciences Corridor: Manhattan KS to Columbia, MO

2. **Other states are moving aggressively in the Bioscience area.**

3. **HB 2647 gives Kansas the infrastructure the Stowers Institute is seeking in order to build a Stowers II facility in Kansas or in the Greater KC area**

   a. Potential impact of Stowers II
   - Anderson study shows Stowers II campus will generate $1.4 billion economic impact to region over 10 years
     - $54.9 million per year in direct earnings
     - $49.9 million per year in indirect earnings
   - Stowers not looking for state to invest in its research institute, just seeking commitment from state to support its own university research centers **and HB 2647 does this**

4. **GKCCC support for full KS Economic Growth Act including**
   a. Rural Entrepreneurship Initiative
   b. Workforce Development Initiatives
   c. Image Campaign
   d. Angel Investment Initiative

House Economic Development
2-5-04
Attachment 4