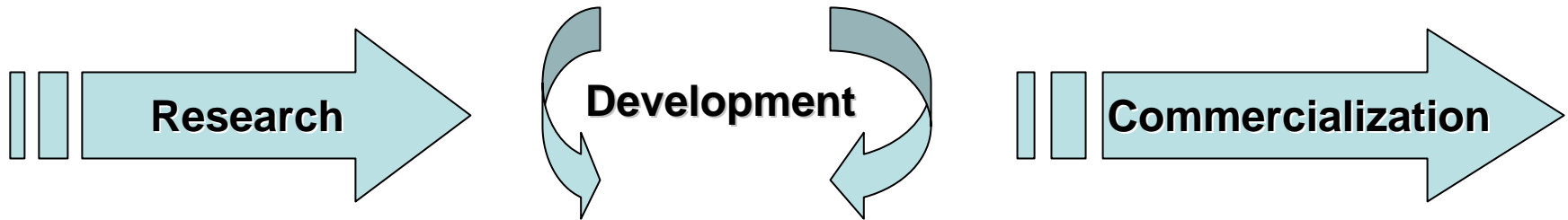


Intellectual Property Research as a Tool for Innovation



IP Management Models: Tailoring a System for Chile

**Jorge Rojas
Kyle Jensen
Cecilia Chi-Ham**

Why do universities get involved in technology transfer?

Government alone has never developed the new advances in medicines and technology that become commercial products.

For that, our country relies on the private sector.

The purpose of... *technology transfer* is to spur the interaction between public and private research so that patients and the public would receive the benefits of innovative science sooner.

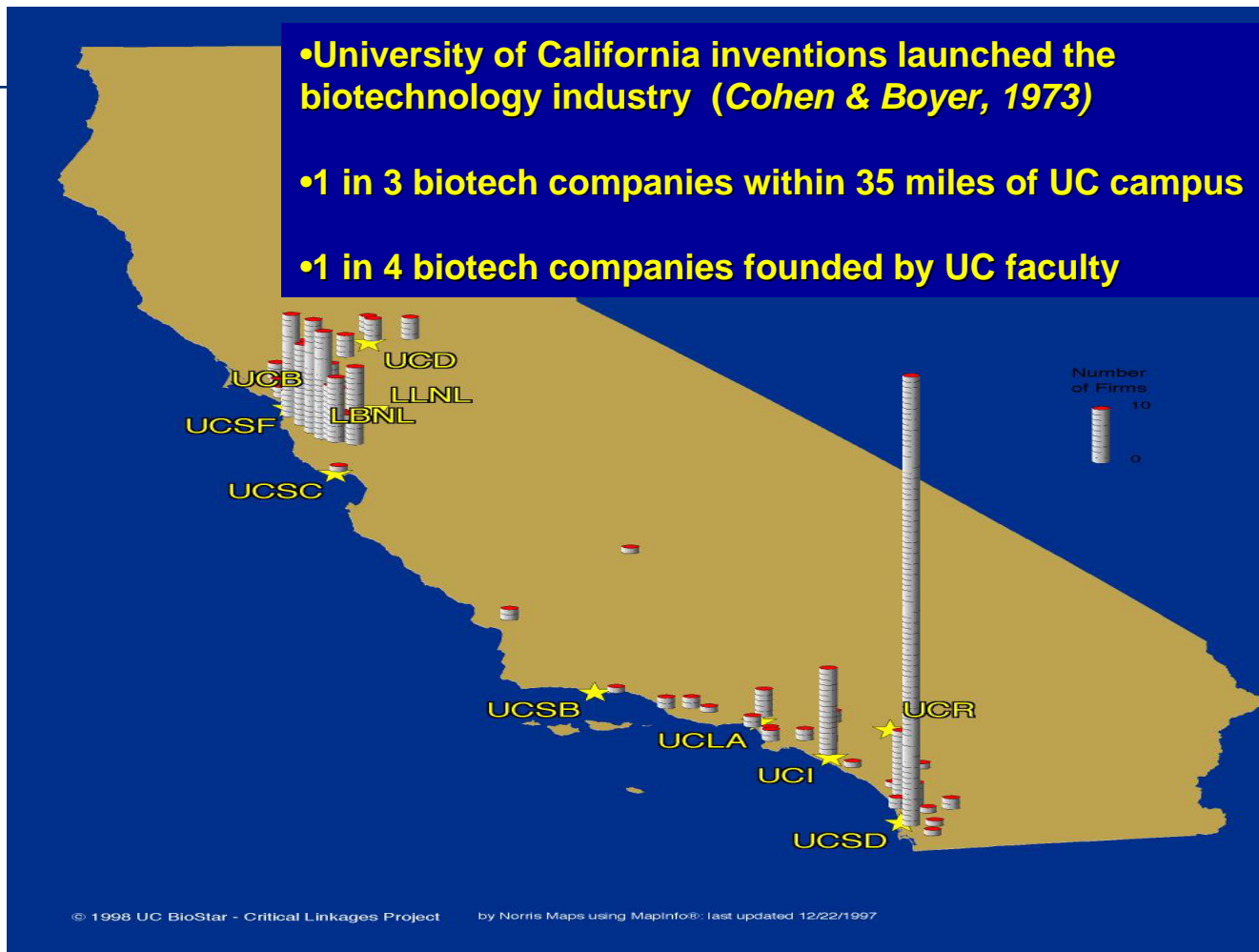
For every \$1 spent in government research on a project, at least \$10 of industry development will be needed to bring a product to market.

Birch Bayh and Bob Dole, Washington Post, April 2002

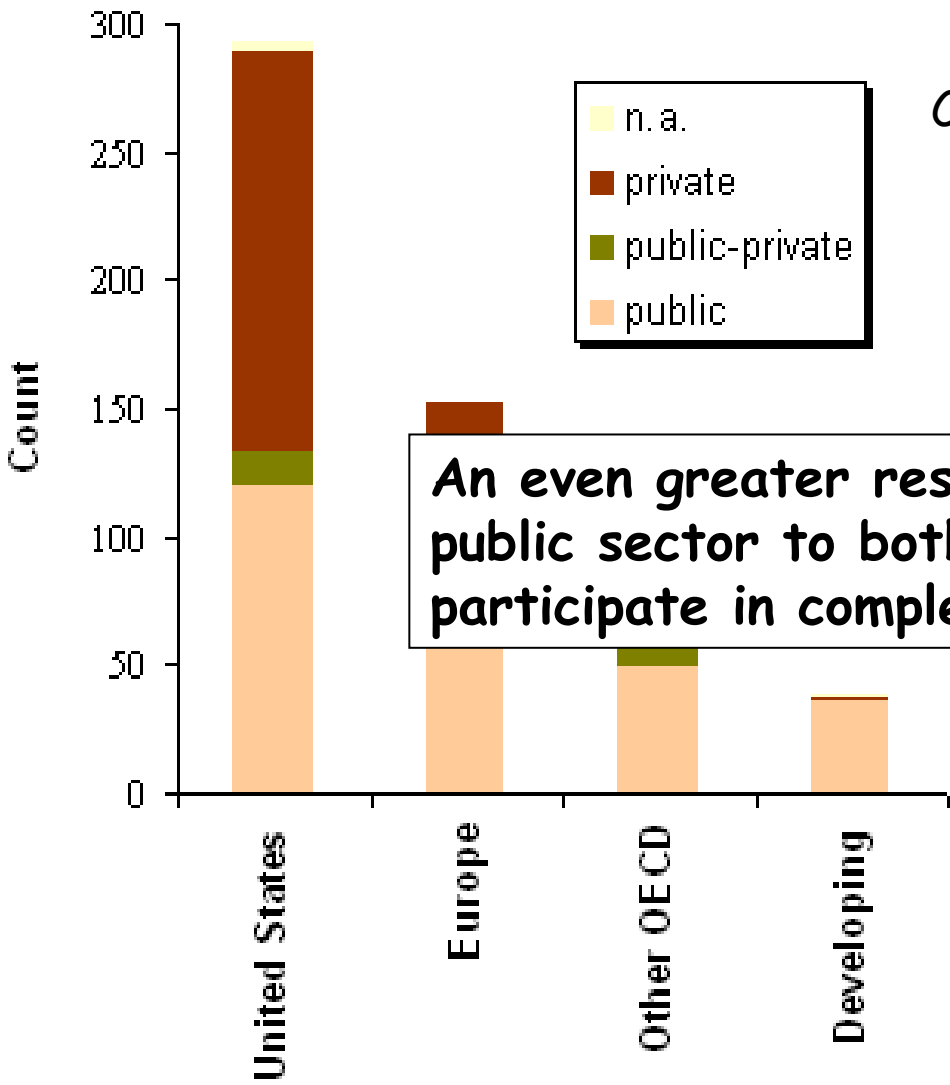
Focus on intellectual property

The public sector can be an important source of innovation and intellectual property

- University of California inventions launched the biotechnology industry (*Cohen & Boyer, 1973*)
- 1 in 3 biotech companies within 35 miles of UC campus
- 1 in 4 biotech companies founded by UC faculty



Outside the US and Europe there is little private sector innovation activity.



Chile 2004 - 82% of R&D is public

An even greater responsibility for the public sector to both initiate and participate in completing the R&D pipeline

Table 5—Estimated global public and private agricultural R&D investments, circa 2000

Region/country	Expenditures (million 2000 international dollars)			Share (percent)	
	Public	Private	Total	Public	Private
Asia-Pacific	7,523	663	8,186	91.9	8.1
Latin America and the Caribbean	2,454	124	2,578	95.2	4.8
Sub-Saharan Africa	1,461	26	1,486	98.3	1.7
Middle East and North Africa	1,382	50	1,432	96.5	3.5
Developing-country subtotal	12,819	862	13,682	93.7	6.3
High-income country subtotal	10,191	12,086	22,277	45.7	54.3
Total	23,010	12,948	35,958	64.0	36.0

SOURCE: Calculated by authors based on Agricultural Science and Technology Indicators (ASTI) initiative data and data presented in OECD (2005).

Public Sector Investment in Agricultural R&D accounts for:

~90% in Latin America and Caribbean

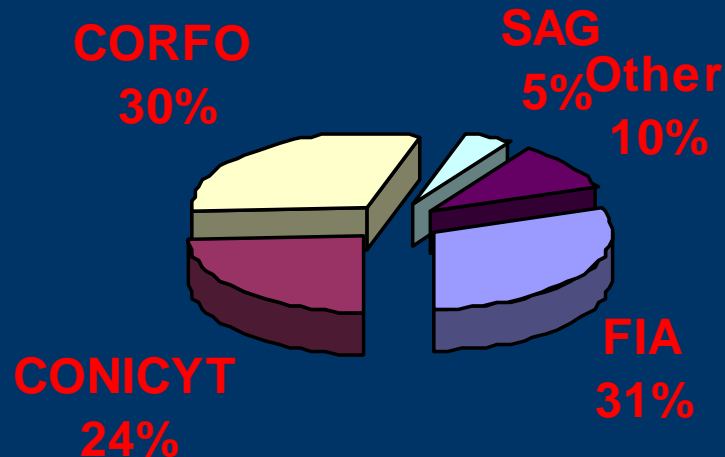
~50% in Industrialized Countries



Chilean Research Funding-Ag

	0%	up to 25%	up to 50%	up to 75%	100%
Chilean public funds	1%	15%	22%	54%	9%
Chilean industrial funds	17%	62%	13%	7%	2%
Foreign public funds	54%	40%	6%	0%	0%
Foreign industrial funds	60%	40%	0%	0%	0%

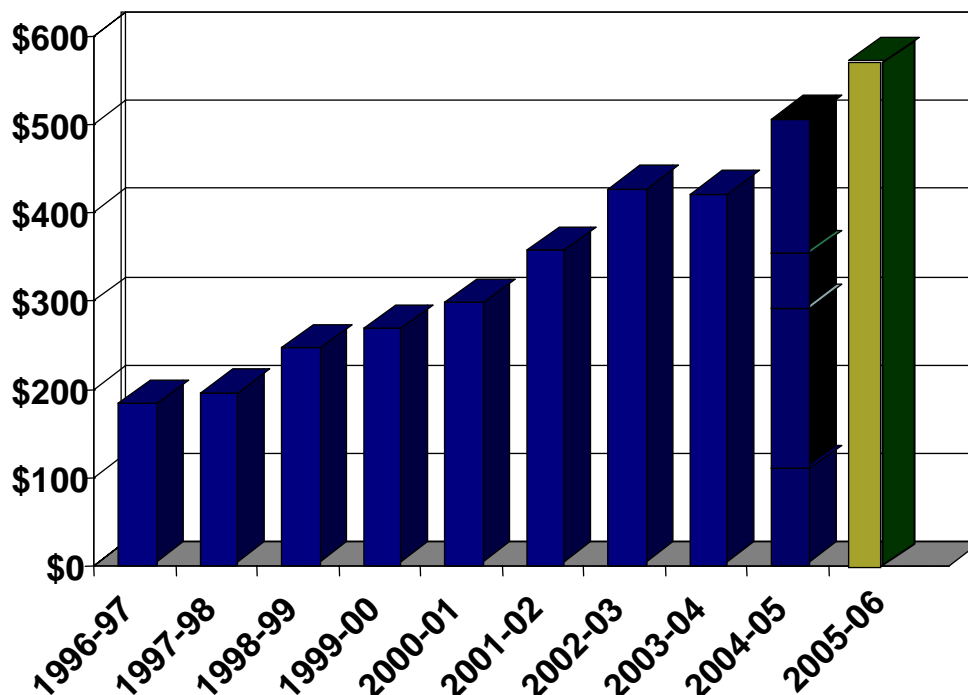
Research Funded primarily by Chilean Public Funds



UCD's Research Funding 1996-2006

in millions

FY 1996-97	\$183.6
FY 1997-98	\$195.5
FY 1998-99	\$246.3
FY 1999-00	\$268.6
FY 2000-01	\$298.3
FY 2001-02	\$356.9
FY 2002-03	\$426.3
FY 2003-04	\$420.7
FY 2004-05	\$505.3
FY 2005-06	\$544.0



Chile's I&D ~ approx 500 million/year



Some figures of the US University System

- 1969 - 1980 Total Royalties of USD 4 millions
- 1981 - 1990 Total Royalties of USD 40 millions
- 1991 - 2000 Total Royalties of USD 400 millions
- However, essentially all of the USD 400 millions came from inventions disclosed in the 1970s



HARVARD UNIVERSITY
THE OFFICE OF TECHNOLOGY DEVELOPMENT

VERI
TAS

The Landscape:
**Invention Disclosures and Research Expenditure
FY 2006**

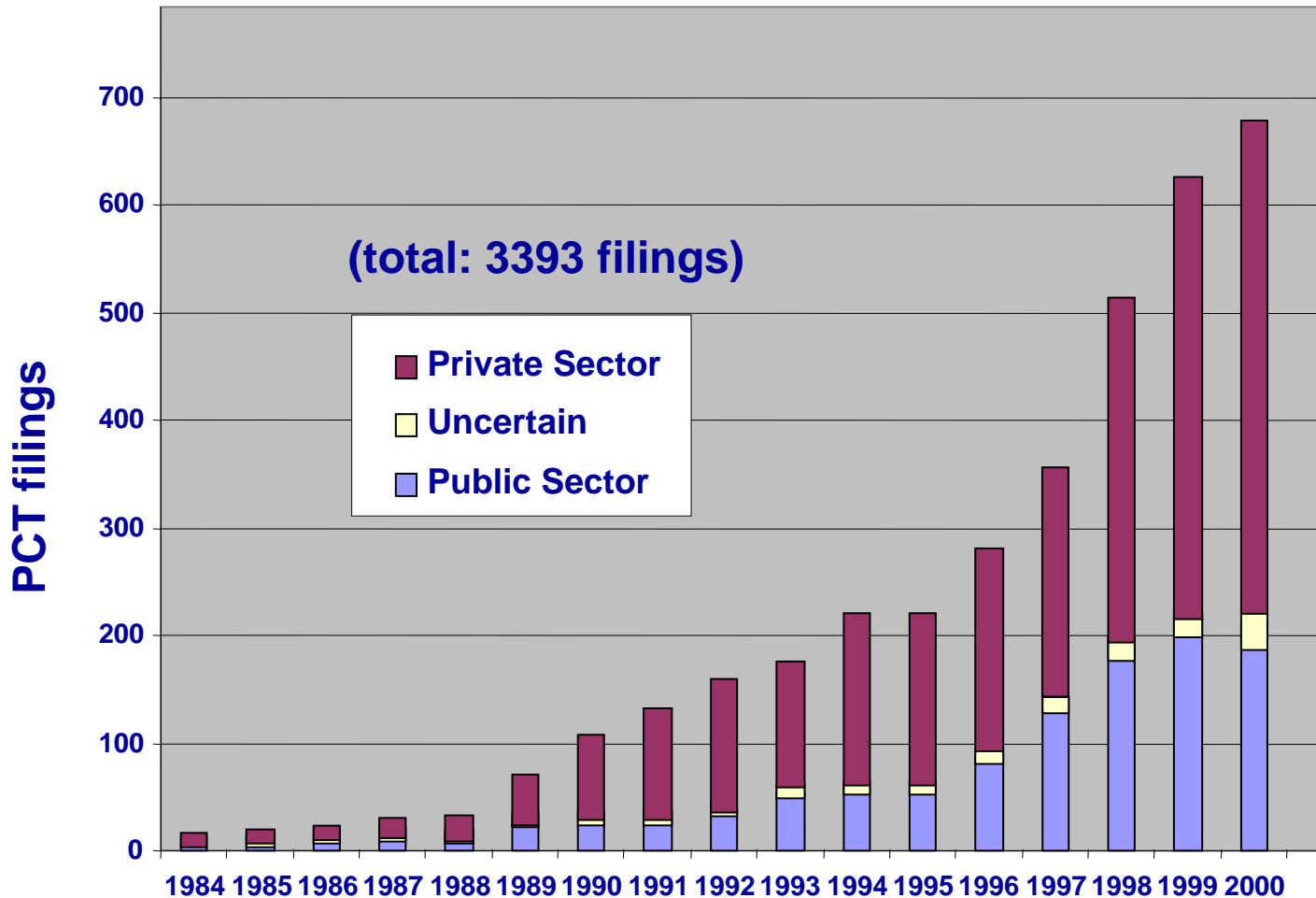
	Total Research Expenditures (A)	Invention Disclosures Received (B)	B / A per \$1MM
U. California System	\$3,035,949,000	1,308	0.43
Johns Hopkins	\$1,757,268,191	363	0.21
MIT	\$1,212,800,000	523	0.43
Stanford	\$699,211,807	518	0.74
U Pennsylvania	\$640,224,563	306	0.48
Harvard	\$630,100,000	180	0.29
Cornell	\$605,341,000	237	0.39
Columbia*	\$600,000,000	272	0.45
Avg 0.5 Invention Disclosures per \$1MM			.30 .48

Source: AUTM; *Columbia University Science & Technology Ventures Annual Report 2005

*Slide Courtesy:
Eduardo Bitran*



Research is increasingly a Private Asset



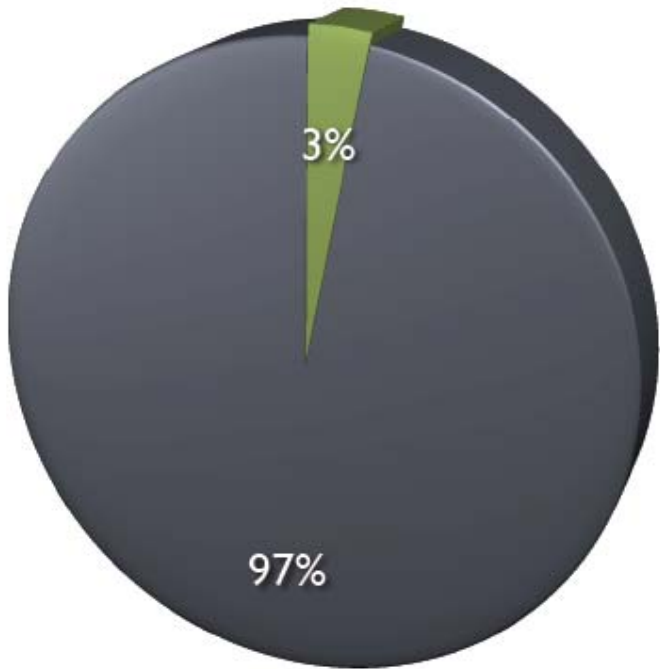
Annual PCT filings for plant biotechnologies, 1984-2000

Source: PIPRA

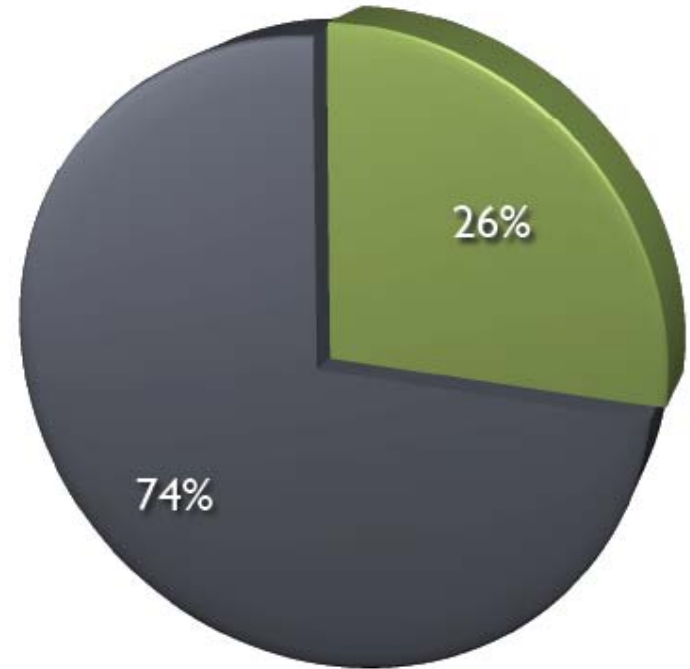


Public Universities and Research Institutions have a “ROBUST” AG-BIOTECH Portfolio

● Private ● Public

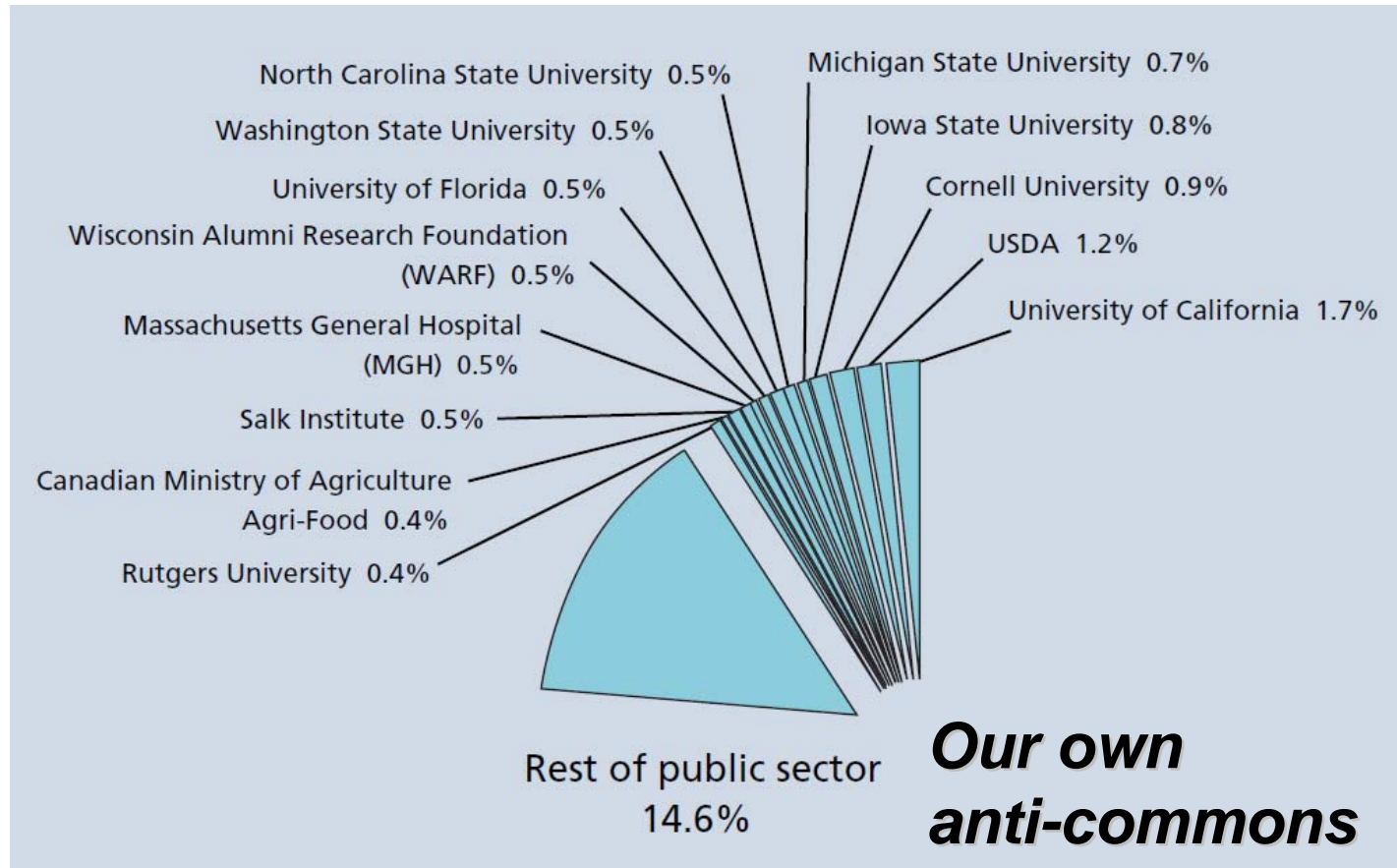


All US patents



Ag-biotech patents

US public sector ag-IP Portfolio Highly Fragmented



PIPRA represents the collaborative efforts of universities and non-profit research institutions to create a “commons” of intellectual property to meet neglected commercial and humanitarian applications.



PIPRA As a Model of Collaborative IP Management In 2003, Establishing Inter-Institutional Partnership

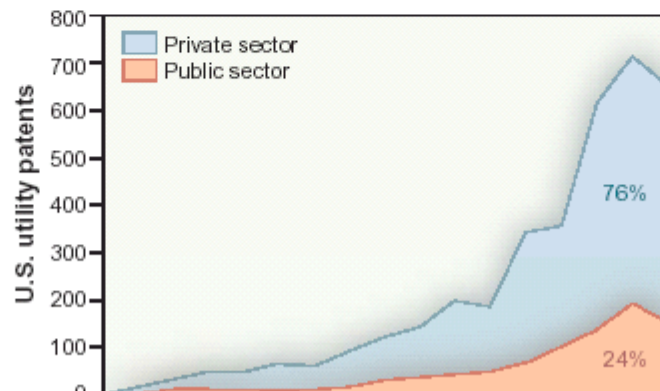
POLICY FORUM

INTELLECTUAL PROPERTY RIGHTS

Public Sector Collaboration for Agricultural IP Management

Richard C. Atkinson, Roger N. Beachy, Gordon Conway, France A. Cordova, Marye Anne Fox, Karen A. Holbrook, Daniel F. Klessig, Richard L. McCormick, Peter M. McPherson, Hunter R. Rawlings III, Rip Rapson, Larry N. Vanderhoef, John D. Wiley, Charles E. Young

The impact of public-sector research is evident in many technology sectors, and this is particularly true in agriculture. Dating back to the establishment of the Land Grant College system in 1862, universities and other public-sector institutions have been the leaders in developing improved crop varieties that were transferred to farms and to the agricultural industry through cooperative extension services in the United States or equivalent organizations internationally. However, this model is changing rapidly because of increased intellectual property (IP) protec-



Annual grants of U.S. utility patents in the area of plant biotechnologies.

(3). However, these practices are not universally applied across institutions, with the net result that, although many significant discoveries and technologies have been generated with public funding, these discoveries are no longer accessible as “public goods.”

Our institutions have found that the public research sector finds itself increasingly restricted when wishing to develop new crops with the technologies it has itself invented, including so-called “enabling technologies”—the research tools necessary for further experimentation and innovation. In agricultural research, applied research and genetic improvement of crops are derivative processes based on pre-existing plant material, and each incremental improvement now brings with it a number of IP and germplasm constraints that have accumulated in the plant material. When IP rights for agricultural materials and technologies are held by multiple public- and private-sector owners, this fragmenta-

40 Institutions, Affiliates 12 Countries



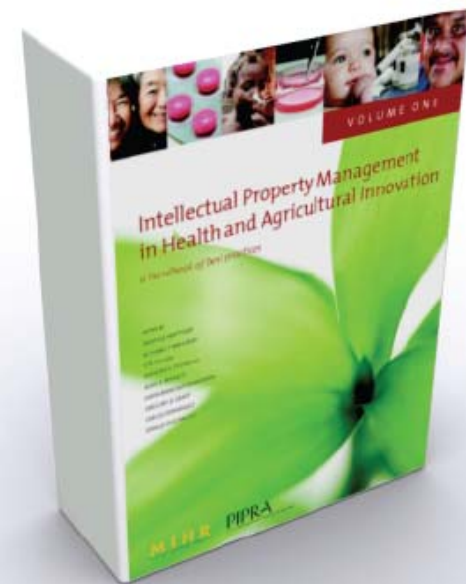
Supporting Innovative Agriculture World Wide

We teach about IP management

This Handbook... is a valuable guide in helping to navigate the complex—but rewarding—world of an increasingly global innovation system.

— Norman Borlaug
Nobel Peace Prize Laureate

www.IPHANDBOOK.org

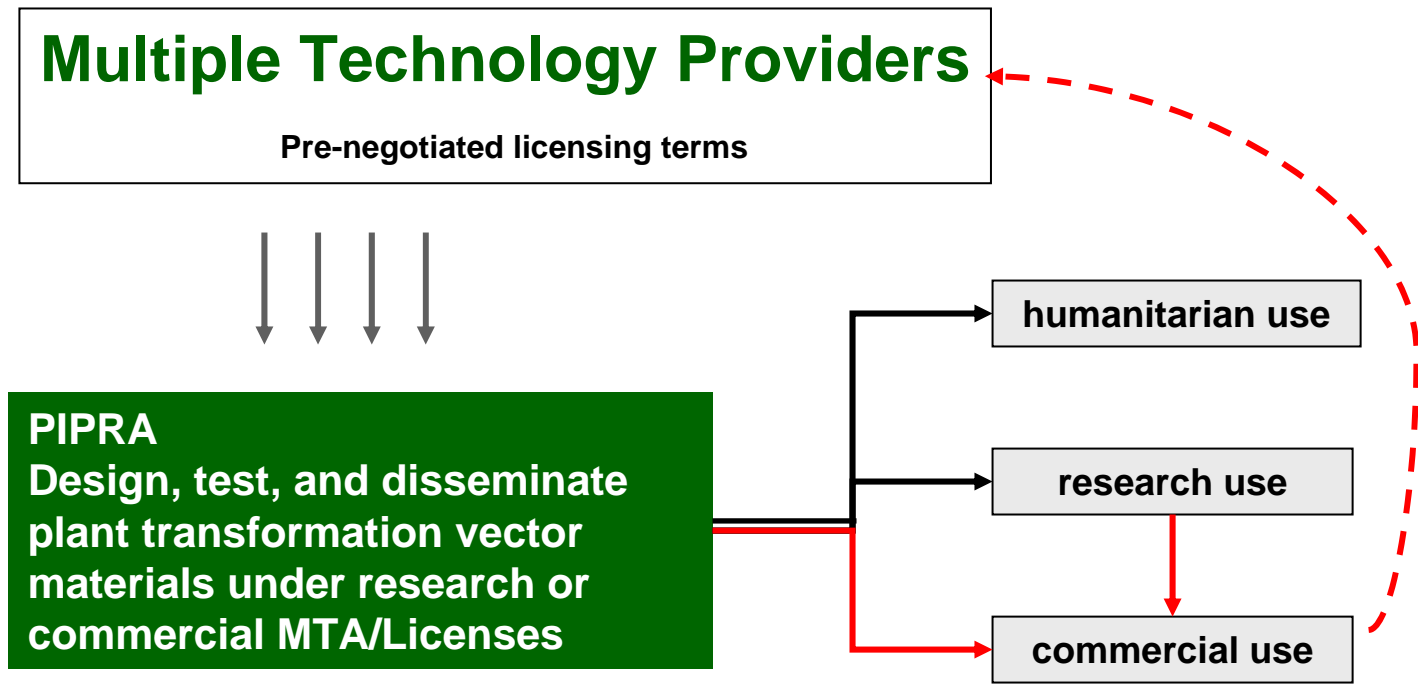




Research laboratories

We develop Enabling Technologies for Plant Transformation & Consolidated Licenses to Distribute Multiple-Party Materials

IP Clearinghouse - Licensing Model



—————> Free transfers —————> Fee based transfers - - - - -> Revenue flow



We Foster Public-Private Partnership... Ag Technology for SE Africa

Public-Private-Partnerships for the Development and Delivery of Nitrogen-Use Efficiency, NUE and Salt tolerance rice to small holder farmers in Africa

- **Arcadia Biosciences**, provides trait technologies
- **PIPRA**, provides marker-free transformation technology under humanitarian, royalty-free terms
- **WARDA** (African Rice Center), African Rice Germplasm & Researcher
- **AATF** (African Agricultural Technology Foundation), facilitates collaboration
- **USAID-Funding**

Publish IP Issues

Bayh-Dole: if we knew then what we know now

Sara Boettiger & Alan B Bennett

More than 25 years after the US Bayh-Dole Act¹, enacted 25 years ago, are a frequent topic of scholarly articles and conferences, as well as the topic of regular legislative forays designed to modify the Act's terms to achieve a variety of social or economic goals². In addition to its importance as a component of the US innovation system, Bayh-Dole-like legislation is being adopted in other countries³, providing an impetus to ask the question: If we were to write similar legislation today, what issues would be addressed differently, given our experience with the Bayh-Dole Act over the past quarter century?

The controversies surrounding the US Bayh-Dole Act¹, enacted 25 years ago, are a frequent topic of scholarly articles and conferences, as well as the topic of regular legislative forays designed to modify the Act's terms to achieve a variety of social or economic goals². In addition to its importance as a component of the US innovation system, Bayh-Dole-like legislation is being adopted in other countries³, providing an impetus to ask the question: If we were to write similar legislation today, what issues would be addressed differently, given our experience with the Bayh-Dole Act over the past quarter century?

The track record

The range of immediate answers to the above question would likely reflect the now entrenched camps of opposing opinions. Supporters believe Bayh-Dole's nationally uniform framework is critical for the successful transfer of technology from university to industry, and that it serves as a catalyst for economic growth⁴. Critics argue that the Act has brought about deleterious consequences for the US innovation system and altered the nature of the public research enterprise⁵. A third camp in the debate believes that Bayh-Dole has had little impact, viewing the upswing in university technology transfer as the result of other, concurrent events, such as US Supreme Court decisions permitting the patenting of novel organisms, increased government investment in biomedical research, and the emergence of research-intensive companies in information technology and

Sara Boettiger and Alan B. Bennett are at the Public Intellectual Property Resource for Agriculture, University of California Davis,

The global stem cell patent landscape for efficient technology development

Karl Bergman & Gregory D Graff

Characteristics of the complex and growing stem cell patent landscape in the public sector research institutions could improve the efficiency of technology transfers in stem cells.

The debate over access to research tools essential for stem cell research and development has been waged most strongly over patents granted in the United States to the Wisconsin Alumni Research Foundation (WARF) for work done at the University of Wisconsin on embryonic stem cells^{1,2}. Although those WARF patents are now being widely licensed, the concerns that they raised³⁻⁷ may soon be overshadowed by a more subtle but more chronic problem. Patent filing activity in stem cells has been growing steadily since the late 1990s. Given the particular characteristics of stem cells as a broadly enabling technology, many expect the field to be particularly susceptible to the emergence of a patent thicket⁸⁻¹³, also known in property rights theory as an 'anti-commons'¹⁴. In a patent thicket, the existence of many overlapping patent claims can cause uncertainty about freedom to operate, impose multiple layers of transaction costs and stack royalty payments beyond levels that can be supported by the value of single innovations. By blocking pathways to market and dampening investor interest in commercialization, a patent thicket has the potential to slow and

skew the overall development of applications.

Proposals that attempt to solve the problem by altering the granting of patents beforehand are ill-suited, because they do not address the long-term efficiency of the patent system. This approach is often criticized for being overly broad in scope and for being short on details. Patent administration short to medium term changes in law tend to require support. Second, the existing patent landscape in stem cells has already been altered, and practice continues to open up in the next two decades.

A second approach to the problem is to alter the exchange, transfer and grant of property rights. This approach is often criticized for being overly broad in scope and for being short on details. Patent administration short to medium term changes in law tend to require support. Second, the existing patent landscape in stem cells has already been altered, and practice continues to open up in the next two decades.

INTELLECTUAL PROPERTY

Intellectual Property Landscape of the Human Genome

Kyle Jensen and Fiona Murray*

Gene patents are the subject of considerable debate and yet, like the term "gene" itself, the definition of what constitutes a gene patent is fuzzy (1). Nonetheless, gene patents that seem to cause the most controversy are those claiming human protein-encoding nucleotide sequences. This category is the subject of our analysis of the patent landscape of the human genome (2).

Critics describe the growth in gene sequence patents as an intellectual property (IP) "land grab" over a finite number of human genes (3, 4). They suggest that overly broad patents might block follow-on research (5). Alternatively, gene IP rights may become highly fragmented and cause an anticommens effect, imposing high costs on future innovators and underuse of genomic resources (6). Both situations, critics argue, would increase the costs of genetic diagnostics, slow the development of new medicines, stifle academic research, and discourage investment in downstream R&D (7-11).

In contrast, the classic argument in support of gene patenting is that strong IP protection provides incentives crucial to downstream investment (12, 13) and the disclosure of inventions. Patents are also regarded as the cornerstone of vibrant markets for ideas (14) and central to the biotech boom

and distinguishing patents on the human genome from those on other species (23).

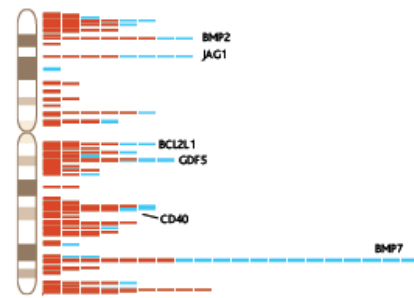
Our detailed map was developed using bioinformatics methods to compare nucleotide sequences claimed in U.S. patents to the human genome. Specifically, this map is based on a BLAST (24) homology search linking nucleotide sequences disclosed and claimed in granted U.S. utility patents to the set of protein-encoding messenger RNA transcripts contained in the National Center for Biotechnology Information (NCBI) RefSeq (25) and Gene (26) databases. This

method allows us to map gene-oriented IP rights to specific physical loci on the human genome (27) (see figure, right). Our approach is highly specific in its identification of patents that actually claim human nucleotide sequences. However, by limiting the search to patents using the canonical "SEQ ID NO" claim language we do not consider claims on genes defined through amino acid sequences. (See table S1 for a sensitivity analysis.)

Our results reveal that nearly 20% of human

California, Isis Pharmaceuticals, the former SmithKline Beecham, and Human Genome Sciences. The top patent assignee is Incyte Pharmaceuticals/Incyte Genomics, whose IP rights cover 2000 human genes, mainly for use as probes on DNA microarrays.

Although large expanses of the genome are unpatented, some genes have up to 20 patents asserting rights to various gene uses and manifestations including diagnostic uses, single nucleotide polymorphisms (SNPs), cell lines, and constructs containing the gene. The distribution of gene patents was nonuniform (see figure, page 240, top right): Specific regions of the genome are "hot spots" of heavy patent activity, usually with a one-gene-many-patents scenario (see figure, below). Although less common, there were cases in which a single patent claims many genes, typically as complementary DNA probes used on a microarray (see figure, p. 240, bottom).



Physical mapping of patent activity on chromosome 20, divided into 300-kb segments. Each horizontal bar represents a unique patent claim on a gene sequence located in that region. Orange represents the number of unique patent families in a region (28). Labels

POLICY FORUM

IP Services

IP Negotiations

Monday, March 24, 2008

Water-Efficient Maize for Africa: PIPRA Supports CIMMYT in Negotiations

[PIPRA](#) and [Morrison & Foerster, LLP](#) played a key role supporting public sector interests on behalf of [CIMMYT](#) in recent negotiations surrounding [CIMMYT](#)'s role in a \$47 million dollar project to deliver drought-tolerant maize to sub-Saharan Africa.

The [Bill & Melinda Gates](#) and Howard G. Buffett Foundations announced their support this week for a project, led by Nairobi-based [AATF](#) (The [African Agricultural Technology Foundation](#)), in collaboration with Monsanto Company and [CIMMYT](#) (The [International Maize and Wheat Improvement Center](#)) that will work to provide new varieties of water-efficient, locally-adapted maize for small-scale African farmers.

Maize is the staple food for more than a quarter of a billion Africans and, according to 2008 estimates produced by the [USAID](#) Famine Early Warning System Network, climate change could decrease rainfall in eastern and southern Africa by up to

Libertad para Operar
Analysis del Estado del Arte-
cientifico y de PI
Acuerdos de Transferencia de
Materiales
Estrategias General de PI

Etc.

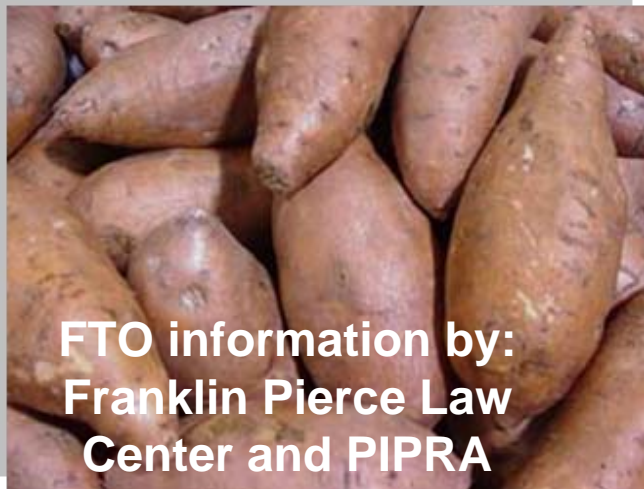
FTO For Project Implementation

Preliminary Intellectual Property Landscape on Core Technologies for Sweet Potato Nutritional Enhancement

PIPRA provides FTO information to enable project development and deployment.

Patent landscapes consider project's technical needs, contractual agreements, and relevant geographical areas.

IP plan identifies possible patents and patent applications that may affect the development and commercialization of the technology of interest and identifies technology substitutions.



FTO information by:
Franklin Pierce Law
Center and PIPRA

**Howard G. Buffet Foundation
makes \$3 Million Grant
to Danforth Center
to Enhance Sweet Potato for Africa**

HỘI THẢO
QUYỀN SỞ HỮU TRÍ TUỆ VÀ THƯƠNG MẠI HOÁ KẾT QUẢ
NGHIÊN CỨU CỦA CÁC CƠ SỞ NGHIÊN CỨU TRONG
LĨNH VỰC NÔNG NGHIỆP VÀ SINH HỌC NÔNG NGHIỆP

WORKSHOP
INTELLECTUAL PROPERTY RIGHTS AND
COMMERCIALIZATION OF RESEARCH RESULTS
OF THE INSTITUTIONS IN THE FIELD OF AGRICULTURE AND BIO-AGRICULTURE

18/11/2007



**DEVELOPING COUNTRY LINKAGE AND SUPPORT
IP Resources for Vietnam**

*Phase I: Assess needs for IP support in public agricultural
research institutions*

Aug, 2008

- *Goal:* To identify the strengths, opportunities, and challenges of existing IP management system.
- *Strategy:* Assess current IP management practices in Chile and to identify IP needs in support of the national ag-sector.
 - Online survey, and phone and personal interviews to assess
 - Key agricultural stakeholders from public and private R&D entities

Phase II: Consider IP management models and structure to support national, regional, and global IP management capacity (Nov-Dec, 08)

- *Goal: Develop recommendations for the implementation of IP management models functional in the context of institutional, national, and international policies.*

Quality of Current IP Services

Answer Options	Not Offered	Poor	Good	Excellent
Outreach training	54%	38%	8%	0%
Patent evaluation & Application filing	33%	43%	19%	5%
Research Agreement	34%	30%	30%	6%
Material Transfer Agreement	37%	31%	27%	5%
In Licensing	56%	27%	13%	4%
Out Licensing	51%	30%	16%	4%
Marketing Technology	52%	37%	10%	2%
Business Development Services (Start-Up Companies, networking)	48%	32%	14%	6%

Few IP Services offered to Scientists

IP Services & Resources Wanted

- IP strategies and pre-defined policies
- Patent and IP Protection Management
- IP Licensing and tech transfer negotiation
- Updated and free access online databases
- Institutional IPM support through OTTs
- Funding for IPM
- Business development
- Value-assessment of IP \$\$\$\$\$
- Education, hands-on training

www.pipra.org