Unlocking Convergent Potential

Steve Briggs
UC San Diego

Convergent disciplines

The primary goal of biology is to match genes with traits

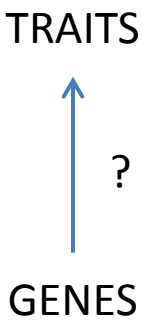
Traits are often observed at the level of an organism but they can also manifest as community, cellular, or molecular properties derived from the action of genes

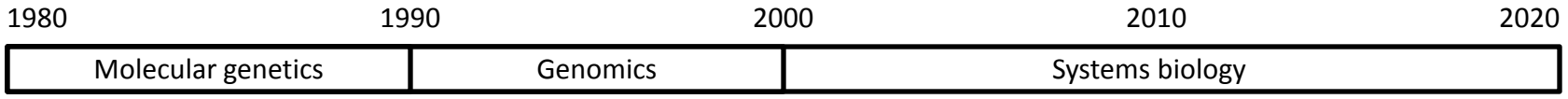
Over the past 35 years new fields of biology have emerged from the convergence of *trait studies* with:

Transposition genetics and *recombinant DNA*
1980s – Molecular genetics

Analytical chemistry (DNA sequencing, microarrays, and peptide mass spectrometry), *computer science* (DNA and protein sequence comparisons), and *engineering* (instruments)
1990s – Genomics

Mathematics (modeling and network analyses)
2000s – Systems biology





Convergent communities

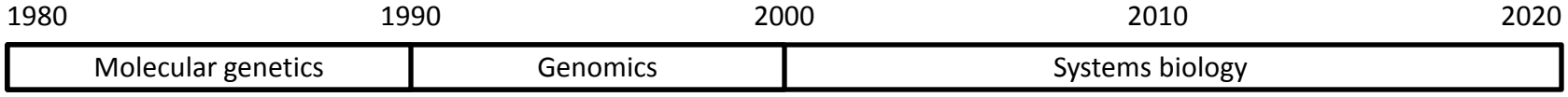
The primary goal of biology is to match genes with traits

The goal wasn't feasible prior to the emergence of molecular genetics. This goal is shared by industrial biologists because success creates opportunities for new products and services (diagnostics, drugs, gene therapy, plant breeding, pesticides, fuels, chemicals, food).

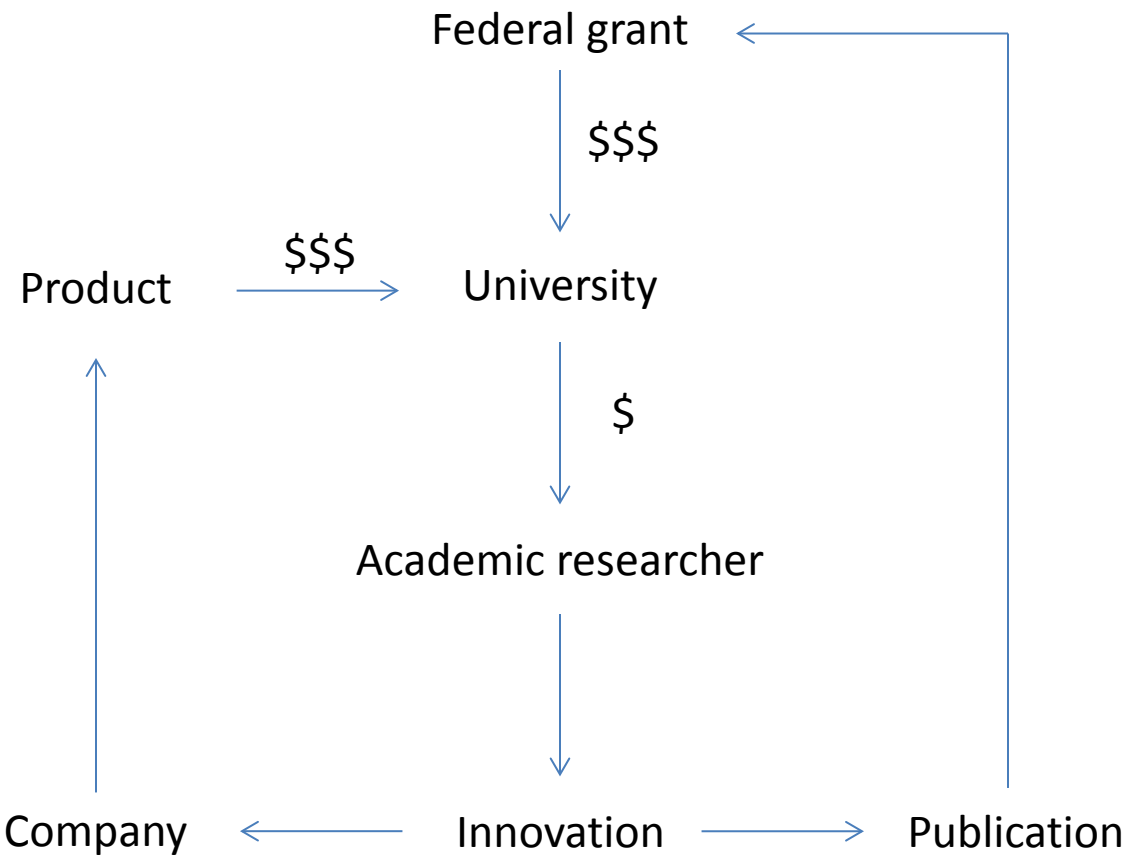
Thus, molecular genetics catalyzed the convergence of academic biology with industrial biology

Industrial biologists created large-scale, robust resources to accelerate the discovery of genes that confer key traits. In most cases, these resources were kept as company secrets. I became convinced that sharing these resources with academic biologists could be mutually beneficial.

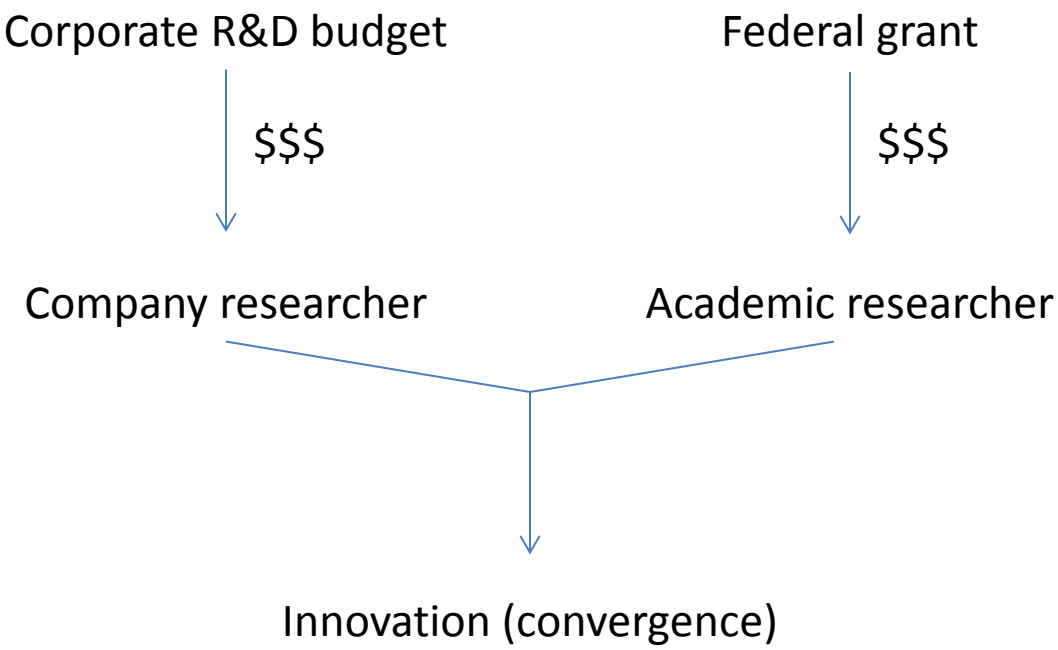
This presentation will summarize my experiences at the convergent interface between industrial and academic biology



Standard university-industry relations



Sharing risk to enable convergence



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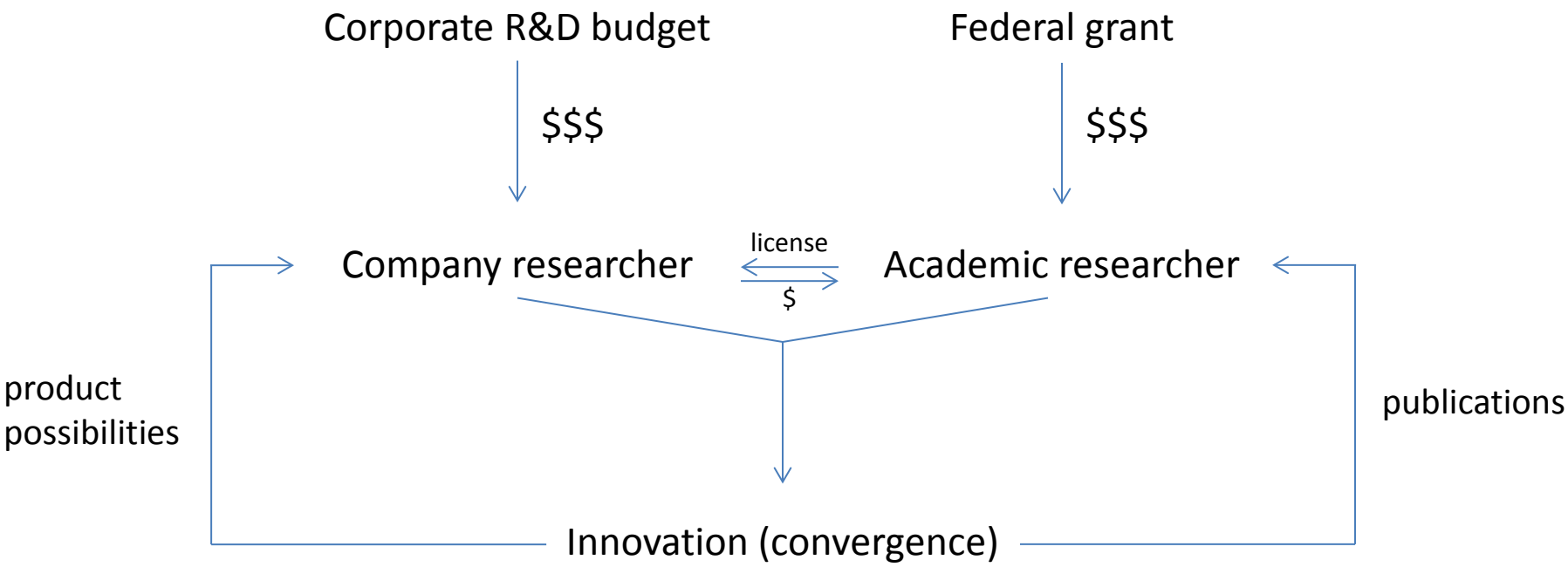

Attempts to catalyze convergence from within industry

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Pioneer Hi-Bred Int'l, Inc. (PHI) funds the establishment of a plant science program at Cold Spring Harbor Laboratory (CSHL)
Collaborations began in 1985 to exploit CSHL expertise in transposition genetics and recombinant DNA
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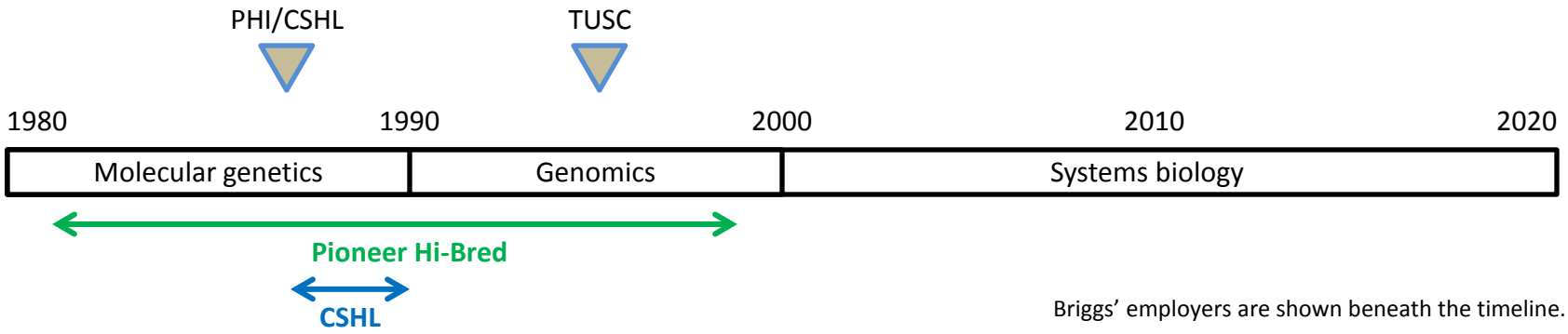
The Trait Utility System for Corn is made available to academic collaborators; it was created by industrializing maize transposition genetics and recombinant DNA. PHI generates maize EST sequence dataset with Human Genome Sciences in 1996; competitors try to catch up. Nearly all crop genome research is taking place in industry. In 1997 Japan announced it will sequence the rice genome and the US federal government launched the Plant Genome Research Program.



Briggs' employers are shown beneath the timeline.

Cold Spring Harbor Laboratory 1988

Art by Marsha Saskia Andreola

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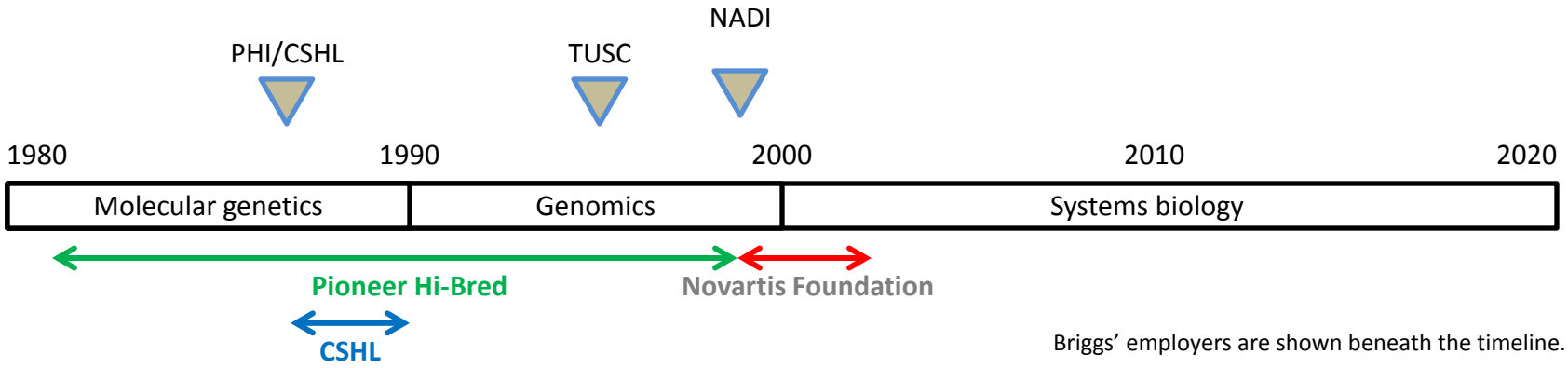
Novartis Agricultural Discovery Institute created (Novartis enters the crop genomics race); NADI genomic technologies developed and made available to academic collaborators.



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The San Diego Union-Tribune.
Wednesday
July 22, 1998
City Final
35¢

Plant genetics to grow here

Swiss company announces $600 million biotech lab

By David E. Graham
STAFF WRITER

In a move that makes it one of the major forces in biotechnology research in the San Diego area, the giant Swiss company Novartis announced yesterday that it is committing $600 million to build and operate a lab here specializing in plant genetics.

Just three months ago, the international pharmaceutical and agribusiness conglomerate announced plans for a $250 million lab in La Jolla devoted to work in human genetics.

The sister labs further the reputation of the established biomedical research community on Torrey Pines Mesa, while standing to provide Novartis with a future pipeline of genetically based products and profits.

The plant genetics lab will employ some 200 scientists and technicians in efforts to develop plants that would have higher yields or resistance to pests, and other plants that could produce medicines or churn out other products, such as plastics or industrial lubricants.

"San Diego is one of the best biotech neighborhoods in the world," said Steven Briggs, the Novartis scientist who will be president of the new lab. "It's easy to attract the best scientists."

Money for the lab, called Novartis Agricultural Discovery Institute, is directed through Novartis' research foundation, with $50 million allocated for a building and $55 million annually over a decade to finance research.

The facility will be built beside the Novartis Institute for Functional Genomics, the human genetics research branch, on a 15-acre parcel on the east side of John Jay Hopkins Drive. The site is just north of The Neurosciences Institute and one street east of The Scripps Research Institute's sprawling campus.

Research is expected to get under way in September with about a dozen scientists working in rented space, Briggs said. Some projects may be contracted out to other labs until the building is finished in mid-2000, he said.

"Novartis has adopted San Diego as a second home," said Richard Lerner, president of The Scripps Research Institute, responding to the announcement.

The New Biology: Genomics Fosters a "Systems Approach" and Collaborations between Academic, Government, and Industry Scientists

Plant Cell 2001;13;725-732

Genomics is changing the face of biology. At first glance, it is largely a change of scale: we move from considering the function of one or a few genes to considering hundreds or thousands of genes at once. The technological advances that brought about this change of scale are leading to the rapid development of still more tools for experimentation and data analysis at the genomic level. We move beyond the genome to consideration of the *transcriptome*, *proteome*, and *metabolome* (all of the transcripts, proteins, and metabolites, respectively, within a cell, tissue, or organism). Looking deeper, we also find that this change of scale is having a dramatic effect on the structure of the scientific community, the manner in which scientific investigation is conducted (and by whom), and how information is disseminated. These topics were the focus of a recent Keystone Symposium sponsored by Monsanto and high throughput technology development. Research presented by Stacey Harmer (see above) is an example of a collaboration between TMRI and academic scientists. Briggs maintained that, so far, the institute has not turned down a single proposal from academic researchers, and it welcomes collaboration with small laboratories and young scientists. TMRI is committed to sharing scientific recognition and commercial benefits with academic collaborators and to rapid patent filing and publication of results. More information can be found at http://www.nadii.com/. TMRI may provide a model for how industry–academic collaborations in genomic research can best proceed in the future.

Nancy A. Eckardt
News and Reviews Editor

Novartis Makes $600 Million Research Investment

Biofuels Journal — Date Posted: July 23, 1998

Novartis Research Foundation today announced the planned investment of $600 million over the next 10 years to fund one of the largest initiatives in plant genomics. The first step will be the creation of the Novartis Agricultural Discovery Institute (NADI), which will be one of the largest single research endeavors dedicated to agricultural genomics research and development. Located in San Diego, CA, the main campus of NADI will have a team of about 180 researchers headed by Dr. Steven P. Briggs. Additional investments will be announced this fall.

NADI will be a spearhead in Novartis' strategic focus on biotechnology research, maximizing cross-sector cooperation between crop protection and seeds, and working in tandem with the Novartis Agribusiness Biotech Research facility at Research Triangle Park, NC, and with numerous Novartis research stations worldwide. The close proximity of NADI to the recently announced Novartis pharmaceuticals genomics institute (Novartis Institute for Functional Genomics), which is being built in La Jolla, CA, will optimize cross-business synergies in genomics research in both agribusiness and in pharmaceuticals.

"We aim to create a powerful technology platform across all of our businesses. In the future, genomics will play an even more important role in our discovery programs. The institute will offer an exciting environment, fostering open scientific exchange with academic institutions, biotech companies and other Novartis research centers for testing new ideas and concepts, and breaking new ground. This unique scientific network will generate a stream of innovative and highly competitive technologies and products," said Daniel Vasella, president of Novartis.

Agricultural genomics is the study of the location and function of groups of genes within crops and their pests. NADI will apply genomics to generate databases that match genes with traits and will provide advanced technologies that can be used widely in agribusiness research for the development of gene-based products.

Steven Briggs, President of NADI, noted: "We will focus on identifying targets for seeds and plant protection. Our funding will allow us to have considerable scope and depth in our discovery efforts, with access to the most advanced research in the industry."

The new Institute will add to Novartis' substantial number of alliances with leading institutions and major universities in the U.S. and overseas. The project will provide a great professional opportunity for scientists in all areas of genomics and functional genomics relevant to agriculture, including gene library construction, sequencing, mapping, and bioinformatics. In a related initiative, Novartis recently announced a USD 3 million agreement with Clemson University targeted at mapping the genome of rice and its pathogens.

Wolfgang Samo, worldwide head of Novartis Agribusiness, said: "Through the application of genomics in agribusiness, great strides can be made to intensify agriculture in a sustainable manner, increasing crop yield and quality, and eventually helping feed the ever-growing world population. We at Novartis, through ambitious endeavors, are dedicated to accelerating the pace of discovery in agricultural genomics."

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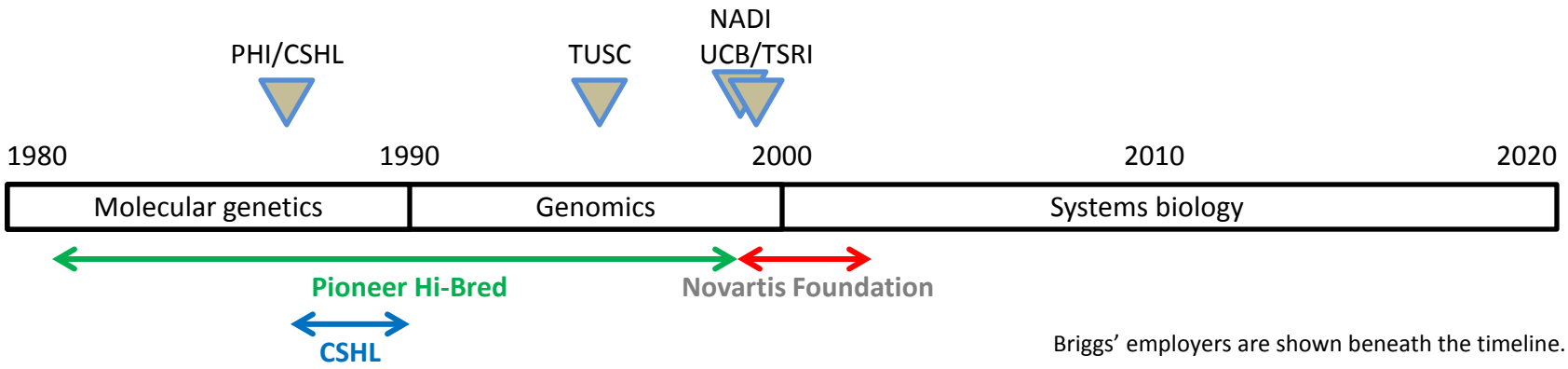
Novartis Agricultural Discovery Institute created (Novartis enters the crop genomics race); NADI genomic technologies developed and made available to academic collaborators.
1998 – UCB/TSRI
NADI partners with Department of Plant and Microbial Biology at UC Berkeley and with The Scripps Research Institute.
Motivators to create broad academic partnerships during the launch of NADI:
(1) Increase the number and diversity of experiments to exploit the technology platforms and discover useful genes
(2) Provide a rigorous academic culture to foster development of young NADI investigators
(3) Receive feedback on strengths and weaknesses of platforms to drive improvements
(4) Create a work environment that attracts and retains the best talent



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DAVID BUTOW—SABA FOR USN&WR

Berkeley dean Gordon Rausser with barley, one of the food crops under study.

Germinating access

Berkeley department's big deal with firm aimed at speeding genetic finds to market

BY CHARLES W. PETIT

BIOTECHNOLOGY

The growing entanglement of biotechnology researchers and university scientists reached a new level last week as the University of California–Berkeley neared completion of an unprecedented deal to sell access to an entire department. For $25 million upfront for new campus laboratories and $25 million in research funds over the next five years, the Swiss-based biotech giant Novartis gets to observe the work of 32 faculty members and nearly 200 graduate students and postdoctoral fellows in the Department of Plant and Microbial Biology. Novartis also gets first crack at negotiating the rights to take the department's discoveries to market.

Novartis, with nearly $22 billion in sales last year in the agricultural and health fields, is the world's second-biggest supplier of seeds for farmers. It is trying to develop crops that are more nutritious, grow faster, and are safer (such as peanuts that don't trigger allergic reactions). Increasingly, Novartis and other biotechnology companies have been striking deals with individual university scientists. But devoting a whole department to a single patron is novel, and it rubs many on the sprawling campus the wrong way. "There is a troubling feeling that this could put broad influence on the department to redirect its academic activity to please a private company," says Robert Spear, a professor of environmental health and vice chairman of the campus's faculty senate. Gordon Rausser, dean of the College of Natural Resources and the man who put the deal together, says that working with one company, rather than with many, is actually easier to do. When many professors are on contract to different companies, "they agree not to share information with colleagues working down the hall . . . . That destroys the kind of synergies that a department like this depends upon."

The partnership, while more audacious than most, is typical of the way biotech research works now. Industry is amassing huge quantities of proprietary data on plant and animal genes, more than firms can analyze themselves. The collaborations give companies the benefit of elite brainpower, while the scholars get access to rich troves of data that they couldn't afford to produce on their own.

Steven Briggs, president of the Novartis division that will work with Berkeley, said he won't meddle in how the campus department is run. He likes it the way it is. "We think they [at Berkeley] are the smartest people around." ■

Novartis – UC Berkeley Agreement

- To UCB Dept of Plant & Microbial Biology
  - $25 million unrestricted research support
    - Faculty member participation is voluntary
    - Grants allocated by joint committee with UCB majority
  - Opportunity to collaborate with Novartis scientists
  - Access to Novartis genome data
- To Novartis
  - Right to license one-third of Department inventions
  - Opportunity to collaborate with UCB scientists

nature

11 January 2001 Volume 409 Issue no 6817

Is the university–industrial complex out of control?

Links between academia and industry are of increasing concern to academics and to society at large. The sectors involved should review their policies in order to sustain universities' public accountability.

In recent years, many universities have thrived on their relationships with industry. In the sciences, academics and their institutions have benefited from contracts, donations and sponsorship, and from the entrepreneurialism of faculty members — a trait now encouraged by government in most scientifically developed countries. Nowhere is this more so than on the west coast of the United States. One third of all the world's biotechnology companies were founded by faculty members of the University of California.

The benefits to researchers and universities are many. They include access to industry facilities and databases, financial support for research that can help the university as well as the company, opportunities for academics to tap into the market's expertise, and the longer-term benefits of experience and contacts.

The downside — for academia at least — of these benefits is becoming increasingly clear. Some of the problems arise in the scientific literature. Recent publications in biomedical journals indicate that researchers sponsored by companies are biased in favour of reporting positive experimental results relating to company products. Undeclared conflicts of interest have occasionally undermined trust in published research and reviews. Other difficulties arise if companies try to restrict academic freedoms or institutionalize industry's influence. For example, in at least one contract offered to a prestigious university by a multinational chemical company, the company took ownership and rights over all data deposited in their database. The academic involved found the company inflexible on this issue and so withdrew.

One controversial example of industrial influence is the deal between the University of California at Berkeley and Novartis. The company is paying about $5 million per year for plant research and providing access to its databases; in return, it gains a seat in university and departmental research committees and restricts academics' freedom to discuss the benefits of the deal. Some students and academics are protesting against the agreement, claiming it undermines Berkeley's status as a publicly funded and publicly accountable institution.

Anti-corporatism vs anti-liberalism

Protests against over-intimate industrial ties are not restricted to Berkeley. Young biologists at a meeting on genetics and society organized by the European Commission lamented their universities' increasing dependence on industrial funding, and one patients' group attacked another for its links to a pharmaceutical company.

Such protests can be seen as the more informed end of the grouping known as the post-Seattle movement. This movement represents an active unease within society: that global corporations have too much unaccountable influence on institutions — including universities — that are meant to act in the public interest. The Novartis–Berkeley deal can all too easily be portrayed as an institution undermining both its motivation and trustworthiness to provide an independent and impartial view of one of the most contentious technologies of our time — genetically modified crops. Although it is unusual in its scope, other universities will recognize the issues it raises.

The chancellor of Berkeley, Robert Berdahl, although standing by the Novartis deal, has expressed his own unease at what he calls the privatization of the public universities. In a recent speech (see www.chance.berkeley.edu/cio/chancellor/sp/privatization.htm), he highlighted two forces that are changing the environment for public universities in the United States: declining public funds, and a systematic, successful and entirely legitimate campaign to develop an anti-liberal, right-wing agenda in universities. These two forces, he implies, are stimulating the growth of the university–industrial complex. And the dangers? Loss of cohesion at the university due to salary differentials and market forces; a downgrading of humanities — while the technology-related ethical and social issues that they should address are burgeoning — and a loss of academic objectivity and consideration of the wider world.

New year's resolutions

So what resolutions are required to maintain public trust in higher education and publicly funded research?

- Vigilance and the ability and determination to speak out. Caught between anti-corporatism and anti-liberalism, academics have to stand up for themselves, with the protection of university constitutions and hierarchies.
- Transparency over conflicts of commitment. There is, for example, a need to prevent the valuable findings of government-funded students and postdocs being inappropriately funnelled into commercial ventures. This could prevent timely publication and lead to commercial ownership of a discovery that was made using public money. There should be limits on, and disclosure of, involvement of faculty members and others in companies.
- Transparency over conflicts of interest. Recent surveys in biomedical journals reveal the pervasive (though highly variable) rules in US universities on disclosure of financial interests. (This journal intends to introduce a disclosure policy of its own in the near future.)
- The issues need to be debated and dangers highlighted at a national level. In this respect the imminent inquiry into university–industrial links by the US national academies' committee on science, engineering and public policy is timely.
- Industry must help sustain public trust. Some companies approach universities and the knowledge they produce in a way that can be best described as predatory. Occasionally this may yield short-term returns, but public distrust of research can have a powerful impact on regulation and on consumers.

And regional and national governments, although encouraging the university–industrial complex, must keep watch over its development. They must above all underpin the social value and accountability of public universities with strong financial support. ■

single voice, other than insist on academic freedom. While laudable, that is not enough.

Where I believe university–industry relations are truly "out of control" is in our dealings with small companies, especially those founded on the basis of discoveries by faculty members where the individual and the institution both hold equity.

The benefits of corporate partnership do not typically flow from deals with small companies. These, especially faculty start-ups, rarely have valuable databases, unique facilities, market access or any assets other than the technology available through a university licence. The driving principle is not to benefit university research, but to benefit the faculty member financially. Conflicts of interest in these cases are most difficult for the university to administer.

Although virtually every university has policies to define acceptable behaviour, policies alone are not sufficient. Biased publications and undeclared conflict of interest are inappropriate actions by individual academics. And what about undeclared consulting benefits, undetected data manipulation, unregistered transfer of university intellectual property, undeclared equity interest, inappropriate use of federally supported students and postdocs on company projects, and so on?

The only "resolution" that will solve these problems is for universities to ban their academic staff from simultaneously holding equity in a company, and to severely discipline those who make corporate relationships on their own.

I am convinced that, done properly, academic–corporate collaborations benefit both partners, enhance the quality of university research and are in the public good. It is expecting too much to suppose that academics and their institutions can always act prudently and responsibly when each holds equity in the same venture. Universities should take equity because that is how they recoup the public's investment in their research. Faculty members cannot realistically be expected to invest simultaneously in the public good and their own private financial interests.

Richard K. Koehn
Department of Biology, University of Utah, Salt Lake City, Utah 84112, USA

… but Syngenta deal is a boon to Berkeley

Sir — The editorial "Is the university–industrial complex out of control?" (*Nature* **409,** 119; 2001) stated that Novartis (now Syngenta) "gains a seat in university and departmental research committees and restricts academics' freedom to discuss the benefits of the deal". As graduate students of Berkeley's plant and microbial biology department, which has made the collaborative agreement with Syngenta, we disagree. We are free to discuss the benefits of the deal, and department committees at Berkeley do not contain members from the company. There is, however, one new committee dedicated solely to awarding research funds from Syngenta, which does include company representatives.

Ironically, Berkeley was the lead player in your Opinion article, but the agreement between Berkeley and Novartis in 1998 is a model for the "new year's resolutions" that the article listed. Information about the agreement is available at plantbio.berkeley.edu/PMB-TMRI, including limits to publication delay, restrictions on licensing, and a list of projects funded. This document illustrates that the basic research mission of the department is promoted by the collaboration.

Matthew Metz
Department of Plant and Microbial Biology, 11 Koshland Hall, University of California, Berkeley, California 94720, USA
Other signatories to this letter:
J. Peter Coppinger, Carolyn Rasmussen, Jinjer Larsen, Michael J. Axtell, Rebecca Middleton, Meredith Johnson, Jennifer Bragg, Jennifer Johnson

'Art' was a load of fluff

Sir — The word 'bollocks' appeared in *Nature* for the first time (*Nature* **392,** 663; 1998) when Martin Kemp quoted the reaction of a lowly Leicester University student to some photographs published in Kemp's 'Art and Science' series.

I was that student, and the remark ended up in Kemp's article because, on seeing Cornelia Parker's photographs of navel fluff and the like, I had exclaimed "What's this bollocks doing in *Nature*?" to his daughter Dr Joanna Kemp, who was also at Leicester at the time. Unfortunately, I was at sea when the second article was published, so was unable to respond to his somewhat scathing comments.

As it is sadly likely that my association with Kemp's article is the closest that I will ever get to a *Nature* publication, I am grateful for this opportunity to have my contribution to advancing the understanding between science and art formally acknowledged by your publication of this letter.

The fact that I am responsible for the word 'bollocks' first appearing in *Nature* is not only a brilliant addition to my CV but may even represent the pinnacle of my scientific career.

Magnus Johnson
Scarborough Centre for Coastal Studies, University of Hull, Filey Road, Scarborough YO11 3AZ, UK

Berkeley dispute festers over biotech deal

[SAN DIEGO] A $25 million plant research contract with the life-sciences company Novartis is continuing to stir controversy at the University of California at Berkeley (UCB).

Some faculty and graduate students at the university's College of Natural Resources are deeply concerned about the arrangement's propriety and its potential impact on academic freedom. They are planning to ask the state legislature to address the issue.

The contract took effect last November (see *Nature* **396**, 5; 1998). Its supporters, and Novartis spokespeople, say the agreement is a great advantage for the college, faculty and students. College officials say they are unaware of any inappropriate activity associated with the contract.

But critics say academic research may already be inappropriately affected. They point out that at least one graduate student has left a doctoral programme in part because of the deal. They claim that both students and faculty members feel intimidated about voicing their concerns.

"Before the Novartis deal, we had a college with diversity of opinion; now we have a divided college," said Ignacio Chapela, an assistant professor of microbial ecology, who is the elected chairman of the executive committee of the college's faculty.

The college's mainstay is research on plants and agricultural and ecological policy, in one of the world's most intensely farmed states. It is divided into four departments, including the department of plant and microbial biology that under the terms of the contract will receive $5 million a year for five years from Novartis.

Two-thirds of the money will go into research, with one-third for indirect costs at the university and department. Much of the Novartis-funded research is expected to involve genetically modified plants and associated fields. Faculty and students are to get access to Novartis's genomic databases of information on plants.

In return, Novartis will have first right to negotiate for licences on a percentage — about 30 per cent in the first year of the contract — of patentable discoveries coming from research carried out by individuals in the participating department. Twenty-nine of 32 faculty in the department have signed up to participate in the agreement. The university will retain ownership of the research results and patents.

Gordon Rausser, the dean of the college and principal architect of the Novartis deal, calls the critics' concern "silly". Regarding any move to have the state legislature examine the deal, Rausser says: "I would be delighted with any scrutiny; it will prove we enhanced and leveraged public resources."

In recent months displeasure over the Novartis deal has erupted in a number of Berkeley campus quarters, including an article in the February issue of the UCB alumni magazine, *California Monthly*, by Robert Berring, the Walter Perry Johnson Professor at UCB's School of Law.

CORBIS/ROBERT HOLMES

Up for sale? Some at UC Berkeley fear business deals may compromise academic freedom.

"We must ask at what point does the university bargain away so much of itself that is ceases to be the university and becomes a partner of the private sector?" wrote Berring in the article. "If the private sector begins to play a role in setting research priorities, if it gets built into the budget, something very fundamental has changed."

The current issue of the magazine includes an article by Rausser, supporting the Novartis deal, that is seen as a sharp response to Berring.

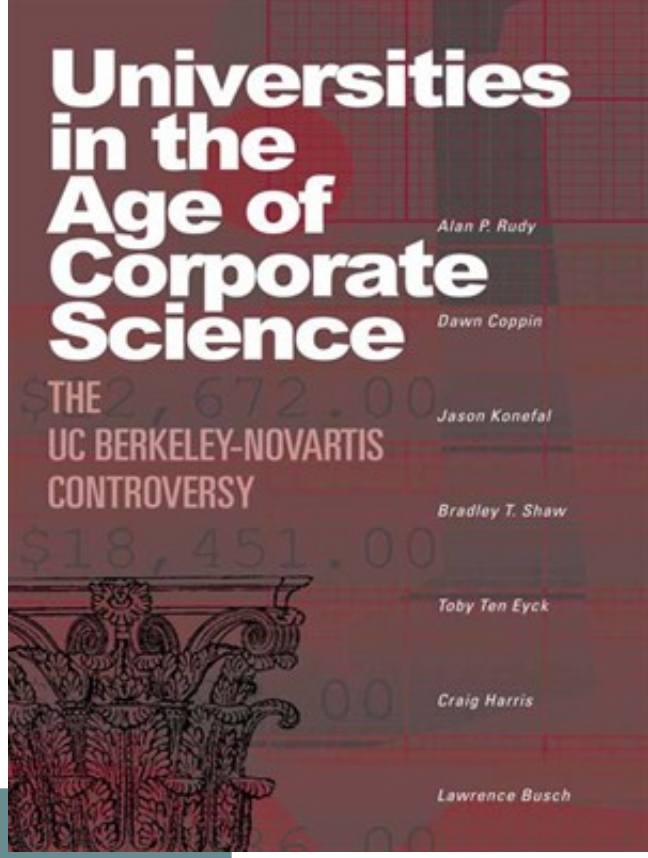
"In the final analysis, (UC) Berkeley is a public asset of immense value," writes Rausser. "So long as our culture is maintained, this value will be enhanced, not diminished, when we work creatively in collaboration with other institutions, including private companies."

There is some evidence that the nascent Novartis deal is already affecting the university culture. Susan West, a doctoral candidate at the college, claims that the Novartis deal was "the clincher" in prompting her to drop out of the programme after completing her first term in December.

"I was uncomfortable with it," says West, who was pursuing research into arctic terns after completing a Fulbright Fellowship in Iceland. "It impugned the entire college. Do they really believe that [$25 million] will not swing the balance?"

There are unconfirmed reports that, during a recent oral exam on a doctoral student's thesis, the student was encouraged to pursue a line of research with Novartis. Several college faculty have said that this sort of intrusion into the academic process, if it did take place as described, was clearly inappropriate. Rausser says that he would be concerned about such an interaction, but that he is unaware of any such report.

Rex Dalton



THE KENAN INSTITUTE FOR ETHICS
at Duke University

Institutions in Crisis

A SYNERGISTIC UNION OR SELLING OUT?

University-Industry Relations, Biotechnology, and the UC-Berkeley/Novartis Partnership

Rebecca Dunning

SEEDS OF DOUBT *BY THE SACRAMENTO BEE*

Report: Five-year deal with Novartis hurt UC Berkeley

By Edie Lau -- Bee Science Writer

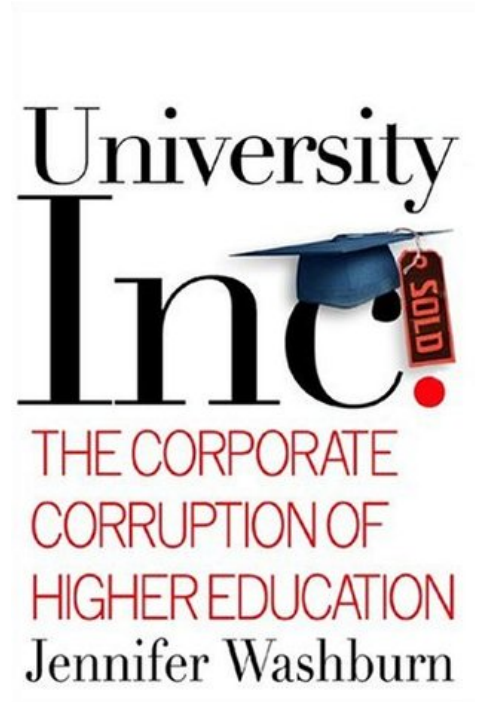
Published Sunday, Aug. 1, 2004

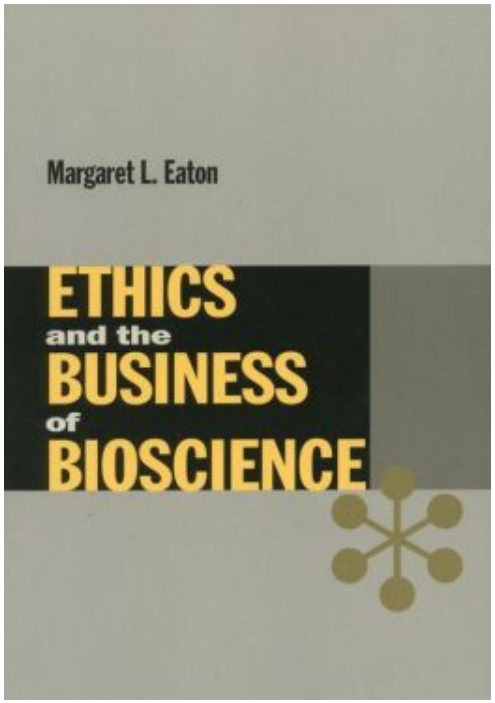
A $25 million, five-year research deal between plant biologists at UC Berkeley and the biotechnology company Novartis was a costly experiment that should not be repeated, outside reviewers conclude in a report being released today.

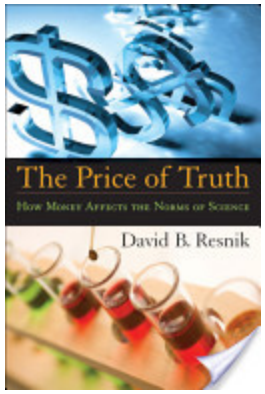
The reviewers, from Michigan State University's Institute for Food and Agricultural Standards, found that damage done to the University of California's premier research campus, from campus infighting to a tarnished reputation, simply wasn't worth the money.

The findings could reverberate far beyond Berkeley. Campuses around the country, including UC Davis, considered the Novartis agreement a possible model for their own arrangements with industry.

"When one looks at the negative publicity that occurred, the enormous amount of time that was spent after the fact trying to justify the agreement, as well as the serious problems it poses for the perceived objectivity of the scientists, this is probably not a good idea to do," said Lawrence Busch, who led the 10-member review team.







MARCH 2000

The Kept University

Commercially sponsored research is putting at risk the paramount value of higher education—disinterested inquiry. Even more alarming, the authors argue, universities themselves are behaving more and more like for-profit companies

EYAL PRESS AND JENNIFER WASHBURN | MAR 1 2000, 12:00 PM ET

IN the fall of 1964 a twenty-one-year-old Berkeley undergraduate named Mario Savio climbed the steps of Sproul Hall and denounced his university for bending over backwards to "serve the need of American industry." Savio, the leader of the Berkeley Free Speech Movement, accused the university of functioning as "a factory that turns out a certain product needed by industry" rather than serving as the conscience and a critic of society. To the modern ear this sixties rhetoric may sound outdated. To many people in the academic world, however, Savio's words ring truer today than ever. Although our national conversation about higher education remains focused on issues of diversity and affirmative action, nothing provoked more debate on many college campuses last year than the growing ties between universities and business—and nowhere was the debate livelier than at Berkeley.

On the afternoon of April 13, a radiant day last spring, the Berkeley campus hardly looked like a site of protest. Students lay on green lawns, soaking in the sunshine. But inside Room 60 of Evans Hall, a concrete building on the northern edge of campus, the lights were dim and the atmosphere tense. There two dozen faculty members, many of them professors in the College of Natural Resources, had gathered to present the disquieting results of a newly released faculty survey.

The focus of the survey was a controversial agreement that Berkeley had signed in November of 1998 with Novartis, a Swiss pharmaceutical giant and producer of genetically engineered crops. Under the terms of the agreement Novartis will give Berkeley $25 million to fund basic research in the Department of Plant and Microbial Biology, one of four departments within the CNR.

The bottom line . . .

Goldie Blumenstyk, in a comprehensive review of the agreement published in the *Chronicle of Higher Education (*June 22, 2001), reported that she was unable to find a single instance in which the Novartis agreement had compromised research at UC Berkeley.

From *California Monthly v.112, n.4, Feb02*:

“As I see it, the benefits to the relevant sectors of the Berkeley campus exceed the return from a typical federal grant in scholarship and overall campus benefit by a wide margin.”
- Bob Buchanan (2002), Former Chair, Dept. of Plant and Microbial Biology, UCB

“In following the path blazed by the Novartis alliance, the pertinent question to ask is not where we have been, but rather where we did not go. Alternative funding sources have gone unexplored, alternative technologies were not developed, and alternative training for future leaders in critical, interdisciplinary thinking and analysis - so much missing and needed today went unimplemented.”
- Ignacio Chapela, Chair, College of Natural Resources Executive Committee

Attempts to catalyze convergence from within industry

1987 – PHI/CSHL
Pioneer Hi-Bred Int'l, Inc. (PHI) funds the establishment of a plant science program at Cold Spring Harbor Laboratory (CSHL) Collaborations began in 1985 to exploit CSHL expertise in transposition genetics and recombinant DNA
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The Trait Utility System for Corn is made available to academic collaborators; it was created by industrializing maize transposition genetics and recombinant DNA. PHI generates maize EST sequence dataset with Human Genome Sciences in 1996; competitors try to catch up. Nearly all crop genome research is taking place in industry. In 1997 Japan announces it will sequence the rice genome and the US federal government launches the Plant Genome Research Program.
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Novartis Agricultural Discovery Institute created (Novartis enters the crop genomics race); NADI genomic technologies developed and made available to academic collaborators.
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NADI partners with Department of Plant and Microbial Biology at UC Berkeley and with The Scripps Research Institute.
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(1) Increase the number and diversity of experiments to exploit the technology platforms and discover useful genes
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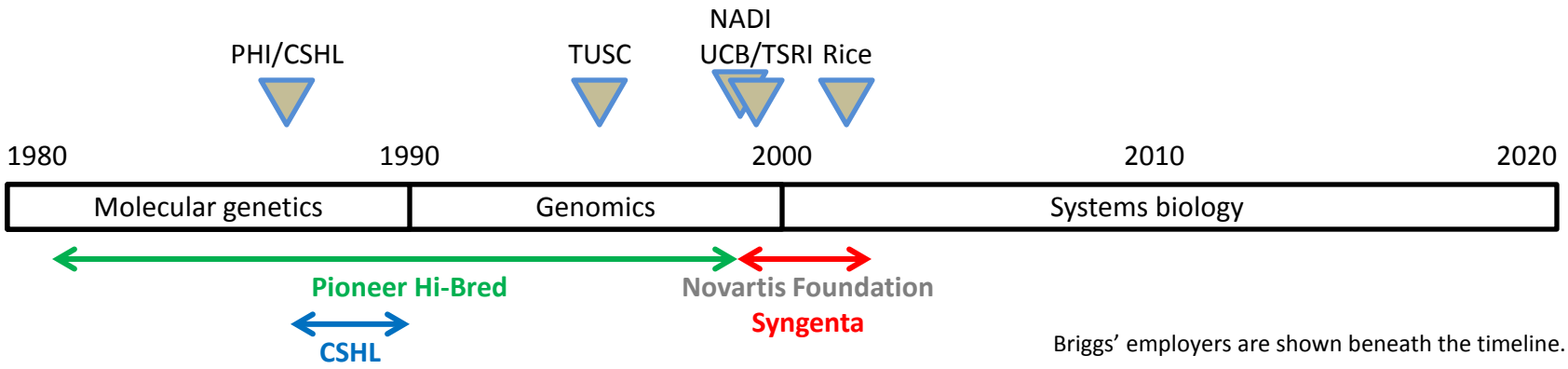


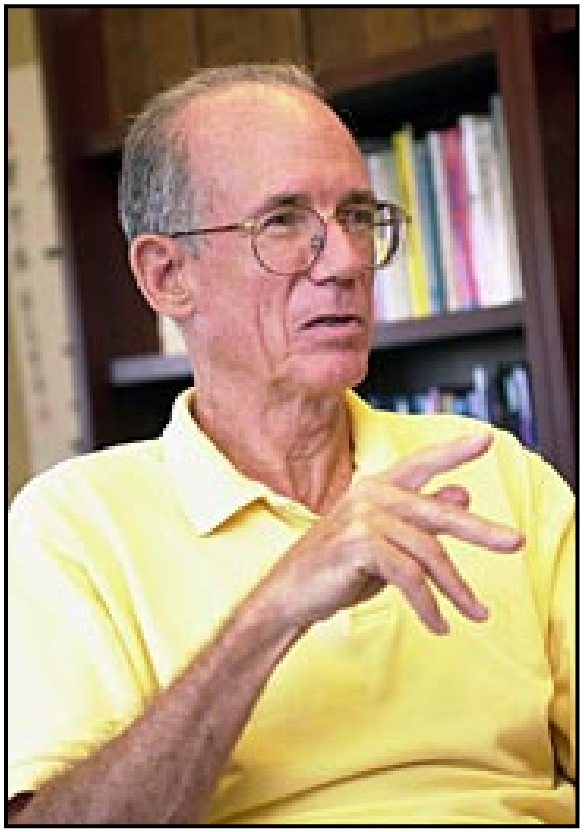
Briggs' employers are shown beneath the timeline.

Donald Kennedy

Commissioner, US Food and Drug Administration (FDA)

President, Stanford University

Editor-in-Chief, Science magazine



"…greater health impact… than will the human genome."

Donald Kennedy

FINANCIAL TIMES
Friday January 26 2001

Syngenta claims genetic map of rice is fast track to better crops

By David Firn

Syngenta, the world's largest agrochemicals company, has beaten its rival Monsanto and the public-sector Rice Sequencing Project in the race to publish the first complete genome of a food crop.

The rice map heralds a new era in crop breeding and the development of pesticides that may be less harmful to the environment.

It will allow Syngenta, which is based in Switzerland, to transfer genes from one variety to another without mixing all the genes from two varieties, as happens in conventional breeding.

Although the new varieties may be a decade away, Syngenta believes crops with the improved nutrient content that this breakthrough enables will prove much more popular with consumers than existing genetically modified crops.

Harvest home: Indonesian farmers reaping their rice crop near Karawang in West Java Picture: AP

These, through their resistance to herbicides, offer advantages to farmers but little benefit to consumers.

David Evans, head of research and development at Syngenta, said the rice map opened the fast track to improved crops. "We can enhance nutrient levels and vitamin content, and make starches easier to process".

It will also give a huge boost to efforts to create new varieties of rice for the developing world. In a move to placate critics of the biotechnology industry, Syngenta has promised to work with research institutes to pass the benefits of the rice genome on to subsistence farmers.

Knowing the locations of key genes will help conventional breeders select the best crosses to improve traditional strains of rice.

Per Pinstrup-Andersen, director of the International Food Policy Research Institute in Washington, an intergovernmental body, welcomed Syngenta's gesture. "We should be clear that there is still a lot of work to do, but the more we know about the functions of the genes the faster traditional breeders will produce new crops," he said.

Demand for rice in Asia, where it provides 80 per cent of the population's energy intake, is expected to increase by 70 per cent over the next 30 years. The gene map, to be published this weekend, has implications not just for rice, the staple crop for over 3bn people, but for all cereal crops.

"By understanding the genome of rice you understand all cereals," says Steve Brigs, head of Syngenta's Torrey Mesa Research Institute in California. It will also help Syngenta discover new targets for pesticides.

Monsanto published a more basic "working draft" of the rice genome last year and is also working with researchers in developing countries.

www.ft.com/healthcare

THE LEX COLUMN

Toeing the line

Alan Greenspan's sudden endorsement of President George W. Bush's tax cutting plans looks like smart politics rather than sound economics. Having argued that the US budget surplus should be used to repay debt rather than cut taxes, the Federal Reserve chairman now claims the surplus will be so enormous the government can do both.

On the face of it, he has a point. The Congressional Budget Office is expected next week to raise its forecast of the cumulative 10-year surplus from $4,200bn to around $5,750bn, more than enough to wipe out publicly-traded government debt of $3,000bn.

Mr Greenspan worries that in six to seven years this debt will have been repaid and the government will be forced either to acquire private assets or go on a spending spree. Faced with those alternatives, he much prefers a tax cut. But there is one huge caveat: basing fiscal policy on the CBO's volatile forecasts – which could easily start falling again – seems dangerous.

Mr Bush, of course, could hardly ask for more. Mr Greenspan's support sweeps away one powerful line of attack against tax cuts in Congress and raises the chances on a bigger package being passed sooner – maybe $1,000bn worth by the summer. The impact on monetary policy, however, should be limited. Mr Greenspan made it clear that he does not believe tax cuts are an effective short-term policy tool. So the Fed is still likely to cut interest rates aggressively to combat current economic weakness. The danger is that by year-end, a combination of easier fiscal and monetary policy

casts of SKr16bn in 2000. Drastic action is unavoidable.

But should Ericsson go one step further and sell the business, rather than just outsourcing production? The exit is not clean, and may result in further restructuring charges. It is hard to make outsourcing work in an industry with rapid product cycles. However, retaining a consumer brand, knowledge of how mobile phones work, and the ability to guarantee supply of handsets may help support the infrastructure business. On balance, sale looks preferable, but not (yet) at any price; and companies are hardly queueing up to bid for the business.

Ericsson's rivals, meanwhile, will no doubt rejoice at the prospect of further disruption to its handset business, and the opportunity that presents to seize market share. But its withdrawal from production suggests a lack of confidence in mobile sales as a whole, which hardly bodes

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Genome Biology
IMPACT FACTOR 10.3

Hubble trouble
Astronomers seek telescopic extension past 2010
p112

Two into one
Manchester's universities may join forces
p114

Insect nation
Ants identified as species database is launched
p115

Poached eggs
Caviar back on the menu for traders at the Caspian Sea
p116

Research news

Syngenta claims ownership of rice - but will give data away

Robert Walgate

Correspondence: Robert Walgate walgate@scienceanalysed.com

Genome Biology 2001, **2**:spotlight-20010201-02 doi:10.1186/gb-spotlight-20010201-02

The electronic version of this article is the complete one and can be found online at:

Published: 1 February 2001

Geneticists get steamed up over public access to rice genome

Declan Butler

Twenty top genome researchers have written to the editorial advisers of *Science* protesting at the way the journal occasionally publishes genome maps without requiring the authors to place the supporting sequence data in public databases.

The letter is signed by such luminaries as Bob Waterston, head of genetics at Washington University in St Louis, Nobel laureate Aaron Klug of the MRC Laboratory of Molecular Biology in Cambridge, UK, and Michael Ashburner, former head of the European Bioinformatics Institute at Hinxton near Cambridge. In it they argue that new genome sequences should be made available in public-domain databases in line with what they term "accepted norms of the field".

"There are strong rumours in the field that *Science* is considering allowing the publication of papers from commercial companies on the rice and mouse genomes, without demanding the submission of the data in GenBank as a condition," their letter says.

Boiling point: disputes about gene data have spilt over to the planned publication of a rice genome.

Several sources confirm that *Science* intends to publish a paper by the Swiss-based agricultural biotechnology company Syngenta on its draft of the rice genome. The supporting sequence data will not be deposited in GenBank, the sources say, but will be available free to academic researchers from Syngenta's website, subject to certain restrictions.

Science drew criticism last year when it agreed to publish the draft human genome assembled by Celera Genomics of Rockville, Maryland, despite the company's restrictions on access to the sequence data.

Donald Kennedy, *Science*'s editor-in-chief, declines to comment on the pending paper. "*Science* is committed to full public access," he says. "But we will consider rare exceptions if the public benefits of removing valuable data and results from trade-secret status clearly exceed the costs to the scientific community of the precedent the exception might create. This was true for the human genome sequence, and for the most important agricultural commodity in the Third World, the case is surely even stronger."

According to several researchers, *Science* also plans to publish a draft sequence of *Oryza sativa* L. ssp. *indica*, the major crop rice cultivar in China, alongside the Syngenta genome. This second rice genome was completed recently by a team led by Huanming Yang, director of the Beijing Genomics Institute, and the supporting sequence

Research news

LONDON The Torrey Mesa Research Institute (TMRI) in La Jolla California, the genomics research centre of Syngenta, has announced that it has sequenced more than 99% of the rice genome to an accuracy of 99.5% in collaboration with Myriad Genetics Inc. Syngenta - which was formed in November 2000 by the merger of Novartis Agribusiness and Zeneca Agrochemicals - has used a whole genome shotgun approach with a 6X coverage. It estimates that rice contains 50,000 genes - in comparison with 20,000 for *Arabidopsis*.

"The biggest surprise has been that about 20% of the genes in *Arabidopsis* we can't find in rice," Steve Briggs, Director of the TMRI, told *BioMed central*. "The thinking was that as flowering plants are only about 200 million years old, essentially they're going to have the same genes, just differently regulated and with some duplication - but that turns out not to be true."

This announcement puts Syngenta way ahead of the International Rice Genome Sequencing Project (IRGSP), led by Japanese and US academics, which so far has only 7.5% of the rice genome sequenced - though Ben Burr at the Brookhaven National Institute, co-director of the project, says the work is "accelerating." The IRGSP is using the 'Bermuda Sequence Agreements' developed for the human genome project, aiming at an accuracy of 99.99% using BAC technology - which is slower than the shotgun approach but will ultimately produce a more accurate sequence. Burr said, "We are not going to attempt to do a hurry-up, draft sequence."

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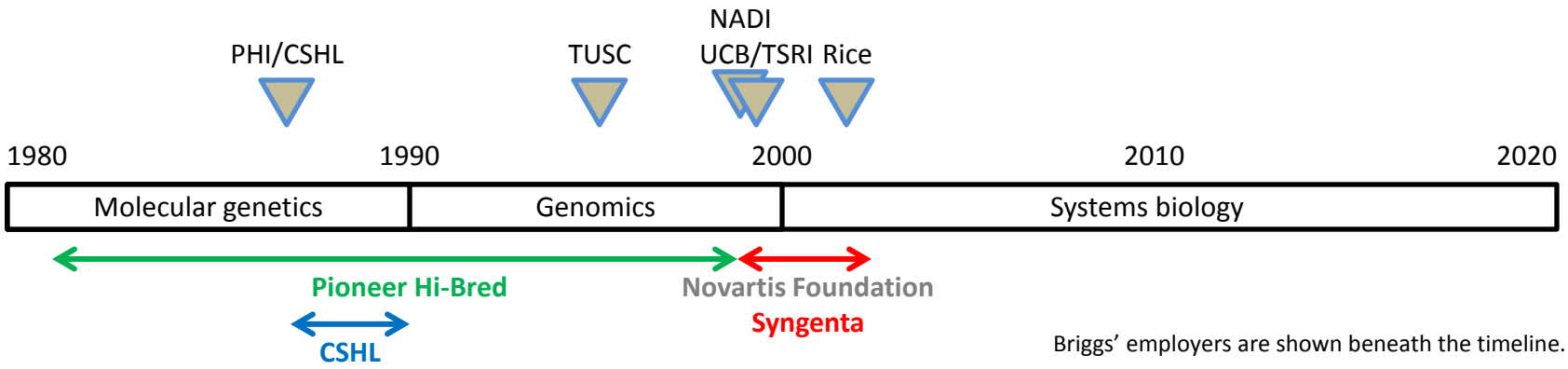
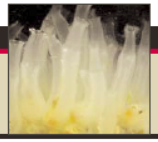
2001 – Rice genome sequence published; rice microarray developed; NADI becomes Torrey Mesa Research Institute (TMRI)
2002 – TMRI closure is announced



Briggs' employers are shown beneath the timeline.

PAGE 2110
Increased Arctic river flow



2111
Sea squirt decoded

BIOTECHNOLOGY

Retreat From Torrey Mesa: A Chill Wind in Ag Research

A pacesetter in plant genomics, the Torrey Mesa Research Institute (TMRI), will close its doors by the end of January, an apparent victim of tightening research budgets. TMRI's owner, the Swiss-based agribusiness giant Syngenta, announced on 4 December that it intends to shutter the 4-year-old San Diego, California, institute, which led the company's efforts to sequence the rice genome and developed the first gene chips for *Arabidopsis* and rice.

Gene transfer. The Torrey Mesa Research Institute's collection of *Arabidopsis* mutants will move to North Carolina.

The closure is part of a restructuring that will bring together Syngenta and Diversa, a San Diego–based biotech company that focuses on isolating genes from microbes in extreme environments. As many as 76 of TMRI's 180 employees will move to Diversa; 30 more will relocate to Syngenta Biotechnology Inc. (SBI) in Research Triangle Park, North Carolina. Steven Briggs, TMRI's chief executive, will go to Diversa as senior vice president of research and development platforms. He sees the new partnership as "an extremely exciting opportunity," given Diversa's experience in prokaryotes and Syngenta's work in eukaryotes and genomics.

The move reflects the "maturity" of TMRI's research, says David Jones, Syngenta's head of plant science in Basel, Switzerland. "The work that has been achieved at TMRI has been quite outstanding. We are very pleased with our investment," he adds. But others see the closure as part of an industry-wide scale back on research funding. "It is a big retraction in Syngenta's apparent willingness to invest in basic research," says Chris Sommerville of the Carnegie Institute of Washington's department of plant biology in Stanford, California. Biologist Alan Jones of the University of North Carolina, Chapel Hill, says he sees similar belt tightening throughout the agbiotech industry: "They are hunkering down."

Plant scientists had long speculated about a reorganization, but many were surprised by the TMRI decision. "Every kind of rumor has been flying around for the past few weeks, and the one that seemed to be completely paranoid was that they would shut down TMRI—and it turned out to be true," says Jeff Harper of the Scripps Research Institute in La Jolla, California. One senior university scientist said he was "flabbergasted" because "Briggs had an academic style of research and was doing powerful work."

TMRI took shape during California's technology boom of the late 1990s. The Novartis Research Foundation recruited plant geneticist Briggs in 1998 to direct its newly formed Novartis Agricultural Discovery Institute. Then in 2000, Novartis spun off its agricultural arm to form Syngenta, which acquired the San Diego institute and renamed it TMRI.

Besides coordinating the sequencing of the rice genome (*Science*, 5 April, p. 32), TMRI developed a collection of 100,000 *Arabidopsis* mutants and made them available—with certain commercial restrictions—to outside researchers. The institute also collaborated with Affymetrix to develop a gene chip containing about half the rice genome—still the only gene chip available for a cereal plant, notes plant physiologist Russell Jones of the University of California (UC), Berkeley. The closure will likely delay the availability of the full-genome chip, which scientists had expected early next year.

Syngenta's Jones says the company will continue its collaborations with academic researchers through SBI in North Carolina, where the *Arabidopsis* mutant collection, the rice genome databases, and the gene chip platforms will move. "There will be no change except geography," he predicts.

Briggs blames the "very somber experience" of TMRI's closing on the agricultural economy. "We've been in a state of contraction for the past 5 years," he says. "There's no indication of a turnaround … and so there's a danger of significant reductions in research budgets—the focus has to be on generating revenues. You sacrifice your research."

Syngenta's troubles could affect other centers. Sources close to the controversial partnership between Syngenta and UC Berkeley say that their 5-year agreement likely will not be renewed in 2003, when the $25 million deal expires. Briggs says no decision has been made, but he adds that if "we had to renew now, we wouldn't."

—GRETCHEN VOGEL

With reporting by Andrew Lawler and Eliot Marshall.

AIR POLLUTION

Counting the Cost of London's Killer Smog

LONDON—In December 1952, an acrid yellow smog settled on this city and killed thousands of people. The catastrophe, known as the "Big Smoke," was a turning point in efforts to clean up polluted air in cities across the Western world. It has taken half a century, though, for some of the fog to clear around the death toll from the roiling sulfurous clouds. New research suggests that the U.K. government might have underestimated the number of smog-related deaths by a factor of 3.

Experts agree that the foul fog, which descended on London for a weekend in December 1952, killed roughly 4000 people that month alone. But researchers are now sparring over the cause of death of another 8000 Londoners in January and February 1953. Fresh analyses, debated at a conference here earlier this week to mark the 50th anniversary of the Big Smoke, suggest that these people succumbed to delayed effects of the smog or

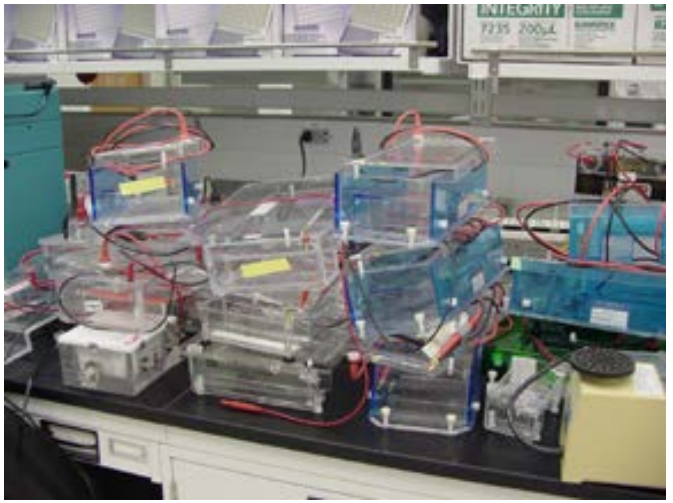
CREDIT: SYNGENTA

Remains of Torrey Mesa Research Institute sold off piece by piece

By JENNIFER McENTEE

The Daily Transcript

Monday, April 14, 2003



Self-assessment of attempts from within industry

PHI

CSHL agreement – success based on renewal through to present

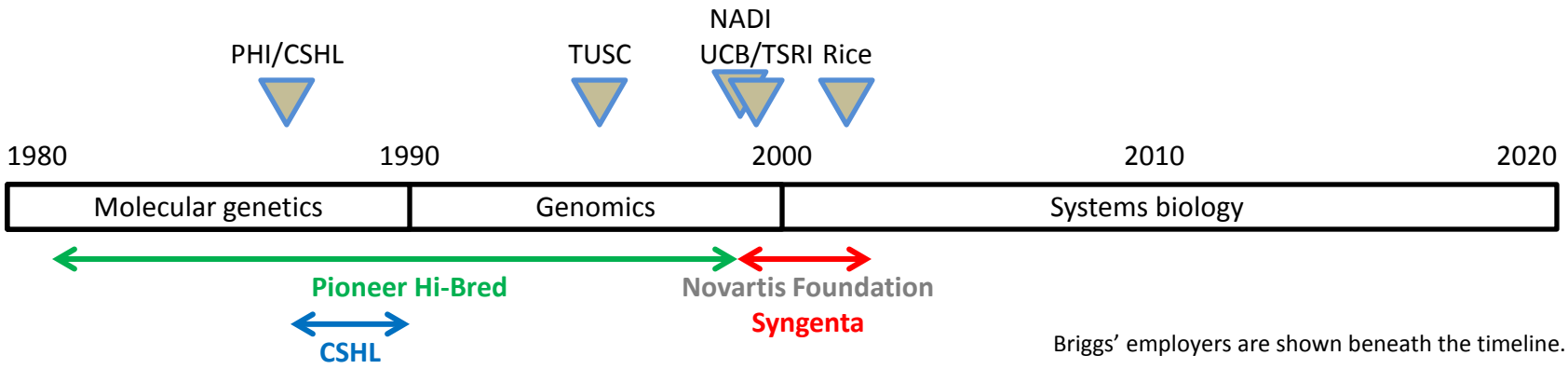
TUSC – success based on numerous patent filings, publications, and continued operation through to present

Novartis/Syngenta

NADI - success based on numerous patent filings, publications, and recreation of TMRI-like center by Syngenta in Beijing

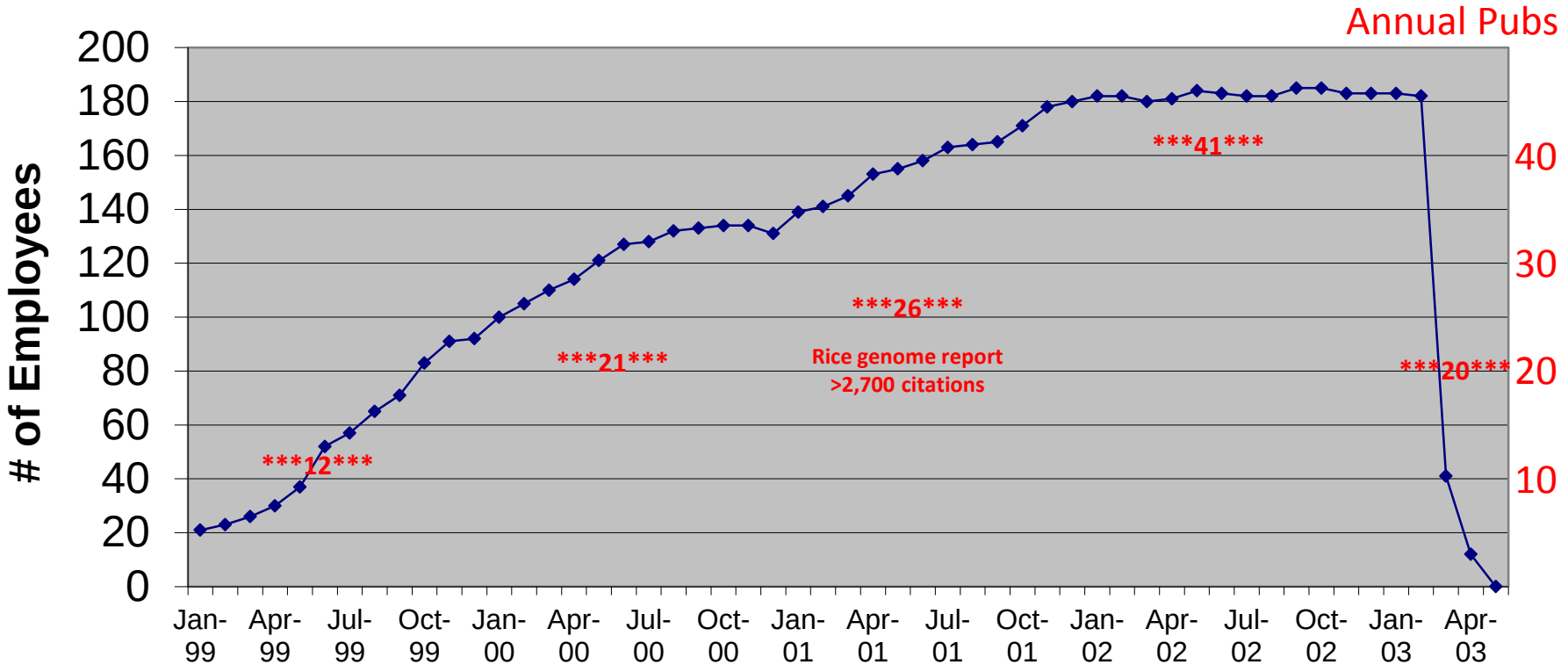
UCB agreement – success based on numerous patent filings and publications but reduced by lack of follow-up

Rice genome – success based on integration with breeding programs



Briggs' employers are shown beneath the timeline.

THE RISE AND FALL OF TMRI



Quarters

Four years of operations

One year operating at full strength

Web of Science

TMRI

Citation Report: 198

(from All Databases)

You searched for: **ADDRESS:** (Torrey Mesa Research Institute) *OR* **ADDRESS:** (nadii) *OR* **ADDRESS:** (Novartis Agricultural Discovery Institute) *OR* **ADDRESS:** (tmri) ...More

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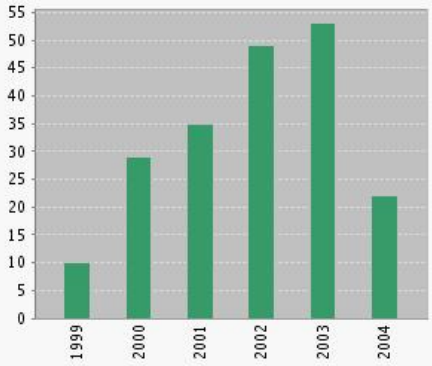
Published Items in Each Year



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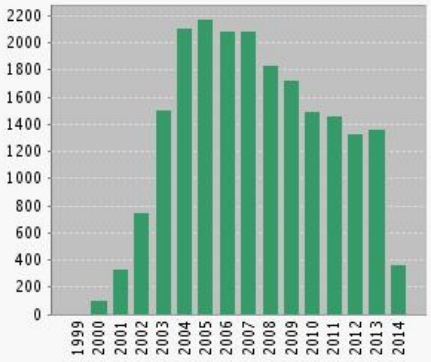
Citations in Each Year



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Citing Articles without self-citations [?] :	16715
Average Citations per Item [?]	104.85
h-index [?] :	70

Sort by: Times Cited -- highest to lowest

Page 1 of 20

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or restrict to items published between 1999 and 2004 Go

	2010 ◀	2011	2012	2013	2014 ▶	Total	Average Citations per Year
	1491	1462	1327	1363	371	20761	715.90
1. **A draft sequence of the rice genome (Oryza sativa L. ssp japonica)** By: Goff, SA; Ricke, D; Lan, TH; et al. SCIENCE Volume: 296 Issue: 5565 Pages: 92-100 Published: APR 5 2002	121	116	110	115	30	1946	149.77
2. **An automated multidimensional protein identification technology for shotgun proteomics** By: Wolters, DA; Washburn, MP; Yates, JR ANALYTICAL CHEMISTRY Volume: 73 Issue: 23 Pages: 5683-5690 Published: DEC 1 2001	77	86	54	67	17	1104	78.86

Web of Science

UC Davis

Citation Report: 1,812

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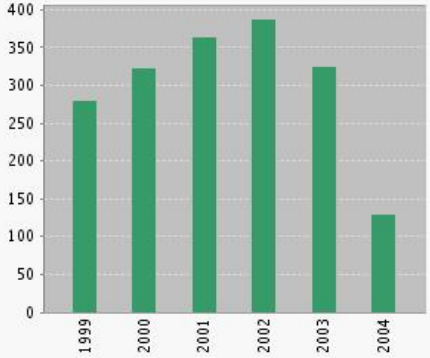

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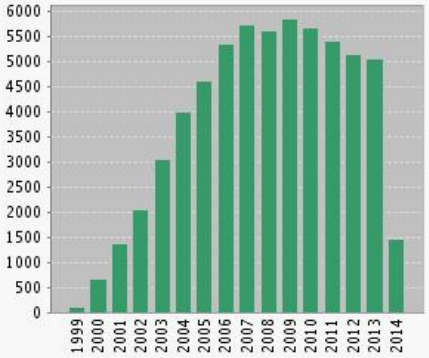
Citations in Each Year



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h-index [?] :	116

Sort by: Times Cited -- highest to lowest

Page 1 of 182

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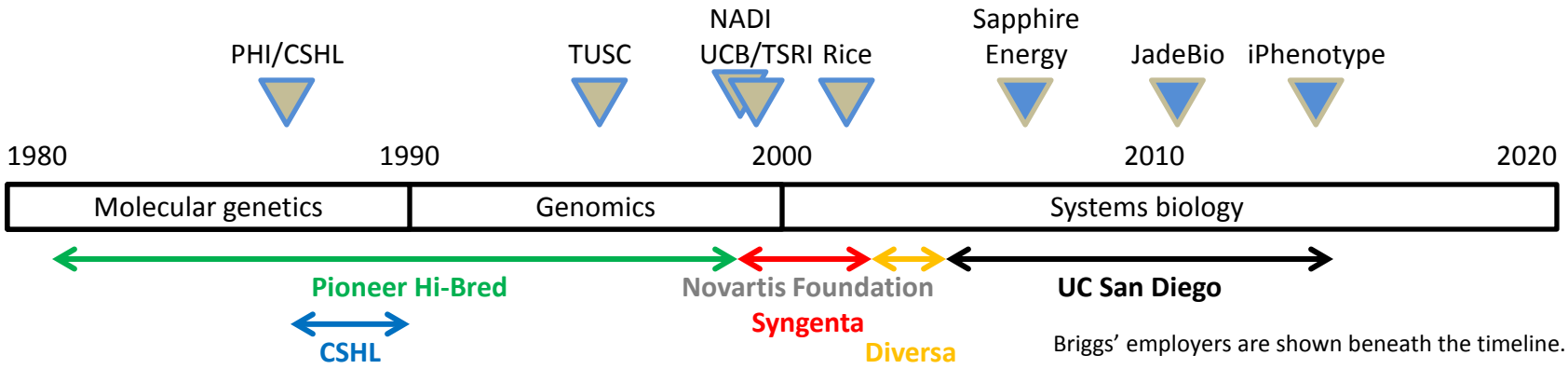
	2010 ◀	2011	2012	2013	2014 ▶	Total	Average Citations per Year
	5678	5414	5147	5038	1445	61105	2546.04
1. **Sequence-related amplified polymorphism (SRAP), a new marker system based on a simple PCR reaction: its application to mapping and gene tagging in Brassica** By: Li, G; Quiros, CF THEORETICAL AND APPLIED GENETICS Volume: 103 Issue: 2-3 Pages: 455-461 Published: AUG 2001	180	163	172	131	30	1136	81.14
2. **Antioxidant activity of pomegranate juice and its relationship with phenolic composition and processing** By: Gil, MI; Tomas-Barberan, FA; Hess-Pierce, B; et al. JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY Volume: 48 Issue: 10 Pages: 4581-4589 Published: OCT 2000	73	97	77	101	30	674	44.93

Attempts to catalyze convergence from within academia

2006 – Sapphire Energy
Created to explore the potential of algae as a carbon-neutral source of biomass and derived biofuels; rapid progress enabled by application of molecular genetics, genomics, and systems biology to undomesticated algae; large-scale feasibility demonstrated
Convergence: biology, farming, and chemical engineering

2011 – JadeBio
Created to provide proteomics services to industry and academia; growing fast; largely unexplored landscapes in clinical and agricultural research
Convergence: biology, chemistry, bioinformatics; opportunities for academic-industrial partnering through shared risk

2013 – iPhenotype
Created to provide consumers with a device to monitor molecular readouts of health; still in startup mode
Convergence: human biology, chemistry, engineering



Summary

- Opportunities for convergent research are obvious and nearly unlimited
- Challenges for academic partnerships with industry include the expectation that industry will take all of the financial risk
- If University leaders can change that expectation then academic research will be accelerated by self-funded collaborations with industry
- Granting agencies should be particularly supportive of proposals that are ahead of the scientific community in their exploitation of convergence