

# OVERVIEW

Industry-University Cooperative Research Program

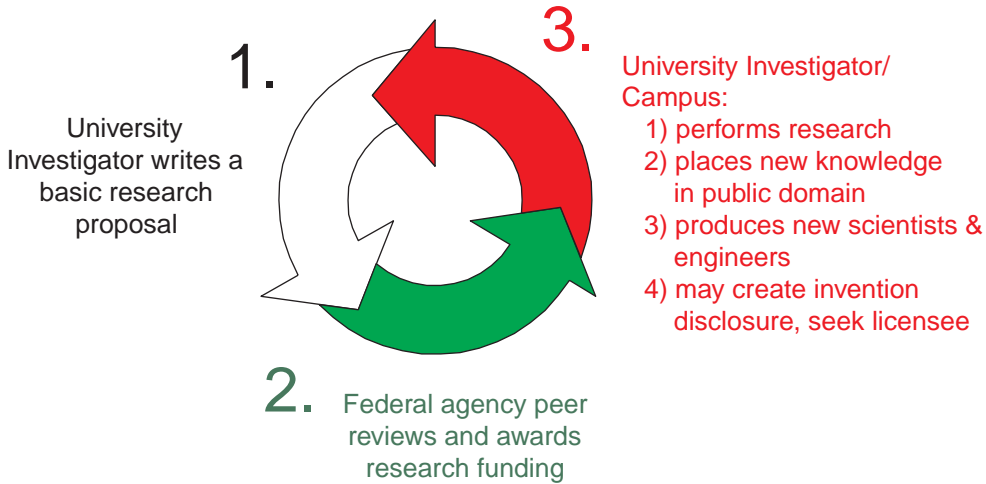
1996 - 2002

*"This is the strategic time to start investing in university-industry partnerships that put the products of university research directly to work in the economy"*

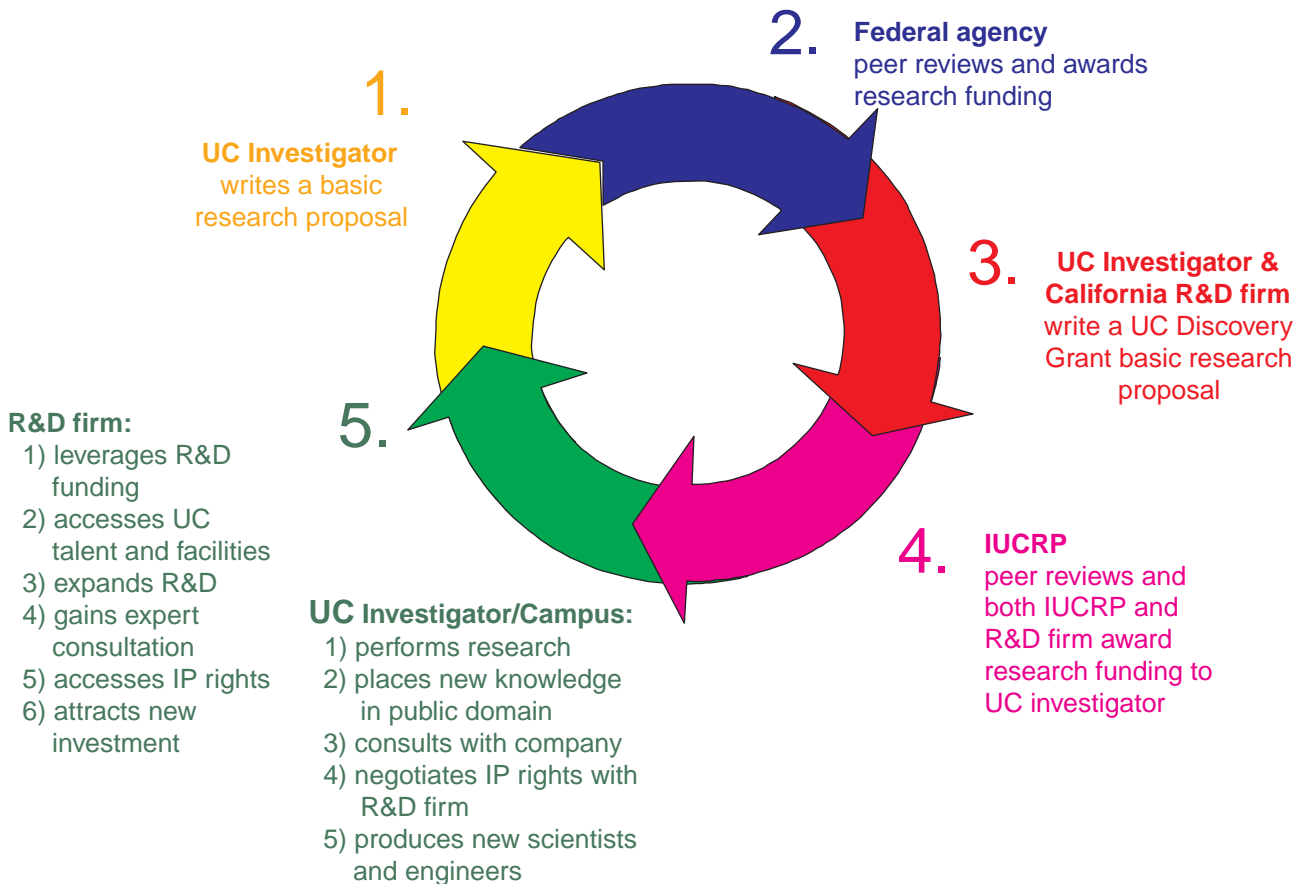
-Richard Atkinson  
University of California President

[www.ucdiscoverygrant.org](http://www.ucdiscoverygrant.org)

# Traditional University-Federal Government Funding Cycle



# The IUCRP Approach: University-Federal Government-R&D Firm Cycle



## Background and Introduction

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California has the fifth largest economy in the world and is viewed by many other states and nations as the benchmark against which to measure competitiveness in the knowledge-driven economy.

California is the home of Silicon Valley, birthplace of the biotechnology industry, and headwaters for new technologies, industries, and markets. Its unique position is the result of an unmatched capacity to transform new scientific knowledge and highly skilled people into business opportunities and economic growth. The state has built a strong foundation: research universities, investment capital, and experienced entrepreneurs.

### *The vision – partnering giants*

UC President Richard Atkinson launched the Industry-University Cooperative Research Program (IUCRP) to intensify California's advantage. The State of California and California Industry quickly joined up. Atkinson's initiative has increased the flow of creative ideas and people between UC and the private sector.

Since 1996, the IUCRP has offered private industry in select market sectors a major hand in performing basic research. The State of California, through use of research funds and tax credits, and by providing access to UC's scientists and students, encourages California-based companies to pursue breakthrough research in UC laboratories. Participating companies provide matching funds.

	California	U.S.
<b>Biotech revenues</b>	\$13.5 B (53%)	\$25.3 B
<b>Biotech R&amp;D</b>	\$ 5.4 B (47%)	\$11.5 B
<b>Biotech public companies</b>	129 (38%)	342
<b>Biotech employment</b>	60,000 (43%)	141,000
<b>High Tech sales</b>	\$145 B (28%)	\$ 513 B
<b>High Tech R&amp;D</b>	\$15 B (26%)	\$58 B
<b>High Tech companies</b>	3,900 (26%)	15,100
<b>High Tech employment</b>	389,394 (24%)	1,644,373

Sources: U.S. Census Bureau, AEA, Ernst & Young, CHI, Burrill & Co., UC IUCRP Research Unit

## Industry-University Cooperative Research Program – IUCRP

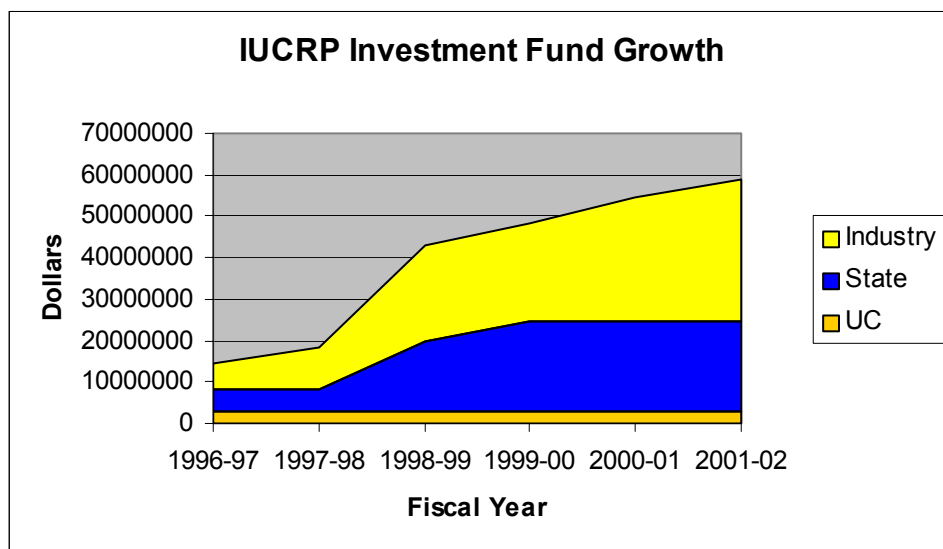
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The objective is expanded R&D, better educational opportunities, successful businesses, a stronger local economy, and higher employment.

The strategy is to accelerate technology transfer in research fields important to California's economy through industry-university research partnerships.

California's strengths are clear. UC accounts for a major share of federal funding for basic research, including 10% of the National Institutes of Health budget for extramural research. California's entrepreneurial companies support R&D programs that define the cutting edge in technological innovation.

With an initial \$3 million investment, President Atkinson seeded a three-way partnership that has grown since 1996 to \$209 million in Industry, State, and UC investments and has built a research collaboration portfolio that now has the capacity to grow at a rate of \$60 million annually.



## The IUCRP:

- promotes early stage research and aims at attracting the best and brightest in academic research and commercial R&D communities in pursuit of research needed for a broad spectrum of technology application opportunities and needs
- creates incentives for seeking research synergies and identifies opportunities that motivate alignment of differing cultures and research performance models
- builds networks of research and R&D leaders and increases awareness of who wants what and who is doing what
- provides disciplined and accountable management and investment decision making that accommodates rapidly changing research opportunities and needs, and ensures quality through expert peer review
- performs research on the role of public investment in basic research and education on the economy and the economic impact of sponsored projects

## The research program: casting a wide net

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Filling a void in the federal approach to research funding, the IUCRP has cast a wide net across the California economy and the most promising fields of science and engineering. The goal is to catalyze a broad spectrum of industry-university research opportunities and attract increasing numbers of industry and UC participants.

The IUCRP currently encompasses *biotechnology, communications, digital media, life sciences information technology, microelectronics, and electronics materials and manufacturing.*

Practical applications span the state's economic landscape, from health care delivery to microchip manufacturing, from software to agriculture and natural resource management, and from arts to homeland defense and cybersecurity. IUCRP partnerships create the foundation of experimental knowledge on which these applications are built.

### ***Building partnerships and networks***

The IUCRP strategy throws open UC's entire science and engineering community and addresses opportunities and needs of California-based R&D-intensive companies. As UC and the private sector converge in joint effort, networks of expertise form and the power and capacity of California R&D grows.

The research program is based on hundreds of partnerships built on investigator-initiated research projects conducted in UC laboratories and developed by individual researchers or multidisciplinary teams drawn from UC's ten campuses, five medical centers, three National Laboratories, and Agriculture Experiment Station.

The catalyst is a matching grant, jointly funded by the State, California R&D firms, and UC -- **the UC Discovery Grant and MICRO Grant.** They support investigator-initiated research projects focused on pre-commercial problems, produce new knowledge, and educate students.

## The Advantages of Research Partnerships

- **California R&D companies** leverage their research dollars, access world class scientific leadership and talent, and can build complex research projects and multidisciplinary teams that would be difficult and costly to create in-house. Start-up firms establish an R&D track record and build relationships with UC experts that impress investors and attract financing. Mature firms explore new directions, expand effective R&D capacity on an as-needed basis, and access expert advice on protocols and prototypes. All firms identify prospective new employees and most negotiate intellectual property rights on research inventions.
- **California venture capital firms**, despite the recent economic downturn, have billions of dollars to invest in promising companies. Leveraged R&D funding coupled to rigorous scientific peer review raises investor confidence.
- **UC faculty and researchers** access critical technological knowhow, equipment, and research materials that would otherwise be too costly or protected by proprietary interests. Research teams are well positioned to compete for major federal center grants, including center competitions that require industry participation.
- **UC students** participate in cutting-edge research projects and get an opportunity to work with industry scientists and learn how science is conducted in the commercial R&D environment.
- **UC's California Institutes for Science and Innovation** access incentives that further increase their ability to attract a full spectrum of R&D firms to their remarkable research programs.

## The education program: building leaders and workforce

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UC Discovery Grants and MICRO Grants provide an excellent educational environment for the knowledge-driven economy. Supported projects provide research assistantships that immerse students and postdoctoral scholars in solving problems at the interface of academic and commercial sciences. Some also participate in research internships in private sponsor laboratories. These students represent the future scientific leaders and R&D workforce.

Students are a major recipient of grant funds. Research assistantships and fellowships account for 62% of personnel costs and 35% of total research expenditures in grants, to date. UC Discovery Grants have invested \$37,553,340 in research assistantships for 866 students and postdocs, since 1996. MICRO Grants and Fellowships invested \$34,543,146 in 1,219 graduate students since 1998-99.

In a recent survey, students participating in UC Discovery Grants report that their experiences in the industry-university collaborations have lead them to take additional courses outside of their graduate degree program, including business and law courses, that better prepare them to enter the commercial R&D workforce.

Students and postdoctoral scholars are enrolling in entrepreneurship programs that have grown up at campuses throughout the UC system. A longitudinal study of the educational and career paths of all students and postdoctoral scholars participating in UC Discovery Grants is underway.

## University and Industry Participants

### UC Discovery Grants

Fiscal Years 96-97 through 01-02

#### Companies (by Employment)

	Number	Percent of Sponsors
1-50	209	33%
51-500	143	22%
501-1000	33	5%
<u>1001+</u>	<u>255</u>	<u>40%</u>
Total	640	100%

#### UC Investigators

	Number	Percent of UC Investigators
Asst. Professors	135	15% (17% of all faculty)
Assoc/Full Profs.	678	73%
<u>DOE/campus non-faculty</u>	<u>111</u>	<u>12%</u>
Total	924	100%

#### UC Students

	Number	Percent of UC Students
Undergraduate	113	13%
Graduate	456	53%
<u>Postdoctoral Scholars</u>	<u>297</u>	<u>34%</u>
Total	866	100%

## The Investment Portfolio

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Since President Atkinson launched the IUCRP with \$3 million in 1996, the investment portfolio – i.e., the collection of university-industry research partnerships supported by matching grants – has grown to \$209 million and 1,020 grants.

High tech and life science investments split roughly 60:40. Research partnerships have been built at all nine established UC campuses and two of the three Department of Energy Laboratories.

*Industry funds* are solely invested in research, with 81% dedicated to direct costs and 19% to indirect costs<sup>1</sup>.

86% of *State and UC funds* are invested in research. 8% is expended for scientific conferences involving industry and university scientists, research development, and industry outreach. 2% is expended for economic research and impact assessment. 4% is expended for administration and management (less than 2% when measured across State, UC, and Industry funds).<sup>2</sup>

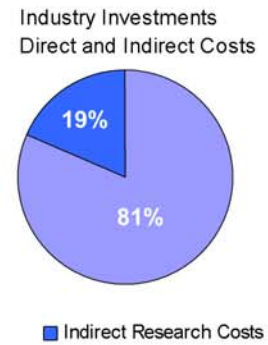
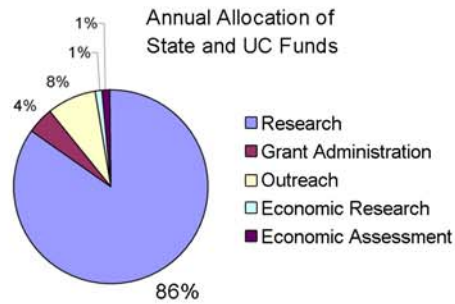
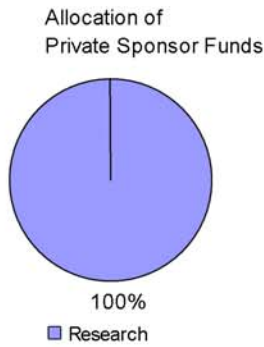
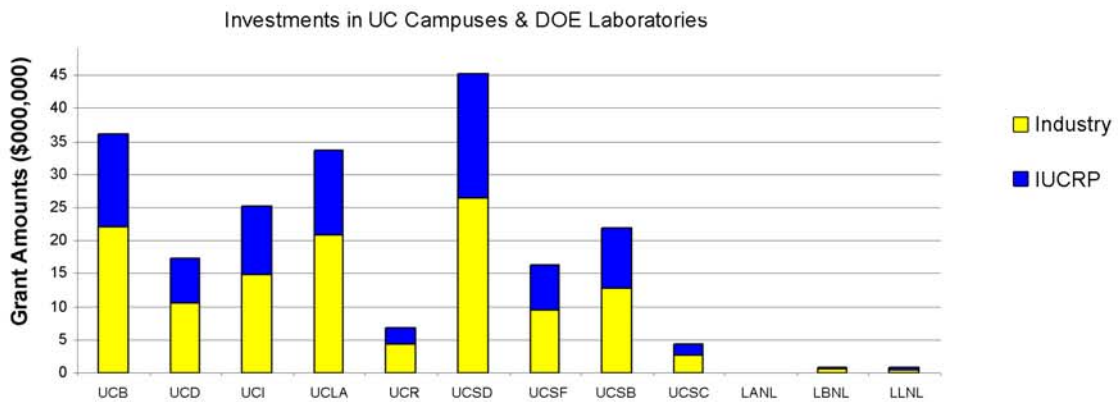
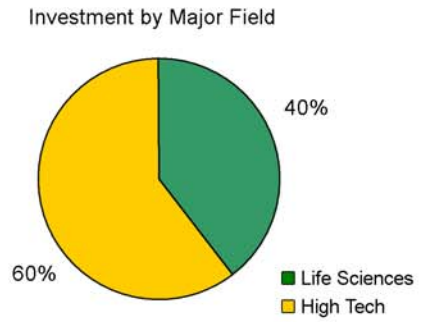
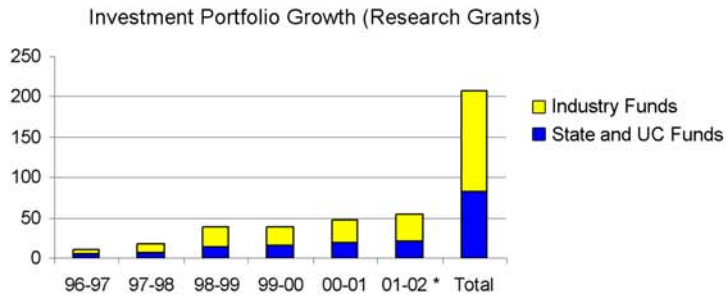
The *typical research grant* (including pooled State, UC, and Industry funds) invests 44% of funds in research supplies, equipment, and related travel, and 56% in personnel. Approximately two-thirds of personnel expenditures are directed to research assistantships for students and postdoctoral scholars.

Each submitted research proposal is rigorously peer reviewed by expert UC scientists and engineers.

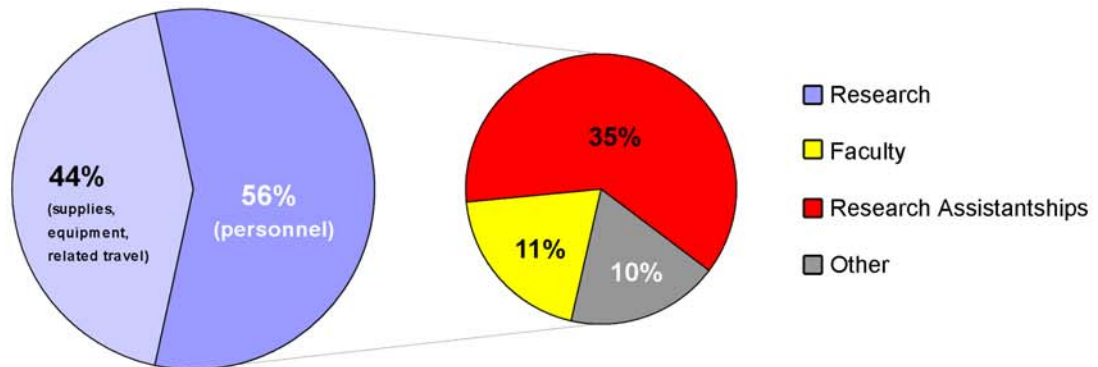
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<sup>1</sup> The standard indirect cost rate is approximately 51%. In IUCRP grants, the figure is substantially lower because sponsor firms often provide in kind contributions of equipment and other valuable research resources that are not levied indirect costs.

<sup>2</sup> Administrative costs have been kept low by intensive development of scalable information systems that support financial, research proposal, and research grant administrative units.



### Typical Research Grant Expenditures



## **The Economic Research Program Creating Meaningful Measures**

An in-house team of economists and students conducts research on the relationships between UC research and sectors of the California economy emphasized in the IUCRP.

This research describes the vectors that carry knowledge from the university into commercial R&D and the California economy. It supports the development of benchmarks and robust measures for analyzing the impact of IUCRP research partnerships.

Their recently (2002) published studies report on UC's contribution to California's R&D-intensive industry sectors:

### **Communications**

1 in 6 firms was founded by a UC scientist

57% of firms employ UC alumni in executive positions

### **Biotechnology**

1 in 4 firms was founded by a UC scientist (1 in 6 nationwide)

85% of firms employ UC alumni with advanced degrees

The team also conducts surveys of IUCRP participants and develops case studies that help characterize the impact of UC Discovery Grants, including surveys of Company Sponsors and of participating students.

In addition, \$250,000/year has been invested in research grants to UC faculty and students who study the impact of public investment in basic research and education from many perspectives, including sociology, management, law, public policy, and economics.

## Return on Investment

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The return on the investment has been analyzed from several perspectives and is grounded in the understanding that the unit investment is made in an early stage, pre-commercial research project that is relevant to the sponsor's R&D and business development goals in a variety of ways, both direct and indirect.

In the high stakes world of economic development, the state-by-state and company-by-company contest is to capture the scientists, research capacity, jobs, and capital investments that are essential for successful growth of entrepreneurial high tech and life science companies.

The IUCRP's investment strategy strengthens the competitive edge for California Industry, UC's research community, and the State. The IUCRP strategy reinvents the federal-university research cycle, creating an intensive federal-UC-industry cycle and an active link from federal basic research investment to commercial R&D investment.

### *Financial leverage:*

The State and participating companies each achieve immediate, substantial leveraging of their research investment:

- o Each State dollar is matched with \$1.57 (on average<sup>3</sup>) from industry and 68 cents from UC
- o Each Industry dollar is matched with \$1 from the State, qualifies for California's 24% Tax Credit on investments in university research, and is further leveraged against significant federal investment in the UC investigator's laboratory facilities and equipment

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<sup>3</sup> IUCRP company sponsors tend to contribute more than the minimum required match.

Companies, particularly startup firms, have reported that the IUCRP research partnerships strengthen their R&D portfolios and impress investors, increasing their competitiveness for investment capital.

UC researchers use the seed grants to develop a research track record that improves their competitiveness in the federal funding arena, including the highly competitive federal centers programs, producing additional funding for subsequent research. They also gain access to proprietary technology and knowhow that is made possible only through the research relationship.

***Expansion of California's commercial R&D capacity:***

In surveys, companies participating in the IUCRP uniformly rated “research of value” as the most significant outcome of their investments.

In the context of their commercial R&D programs, they say IUCRP research projects:

- o answer critical questions, refine and project outcomes of protocols and prototypes, and help define strategic targets for new products and technologies
- o provide expert consultation with UC scientists and engineers on R&D problems
- o provide a rigorous and relevant training environment for prospective recruits
- o enable R&D expansion without bearing the majority of costs and related risk, simply by partnering with the IUCRP to have the research conducted in UC laboratories
- o enable more direct participation in the university-federal funding cycle and much earlier access to new knowledge and breakthroughs

***Creating California's new, R&D-relevant research and education capacity:***

UC researchers have used UC Discovery Grants to organize new, multidisciplinary teams, build consortia of sponsor companies, and compete for federal centers funding to support development and growth of major campus research centers. Examples, include:

- o The UC Irvine Nanosystems Research Facility, lead by Professor G.P. Li, is a case in point that was seeded by UC Discovery grants for research on the use of nanolithography to fabricate designer materials for use in electronics manufacturing and medical devices.
- o The UC San Diego Center for Wireless Communications, led by Professor Larry Larsen, has successfully competed for a series of UC Discovery Grants which have both impressed members of their private sponsor consortium and helped sustain the center's competitiveness in gaining new private sponsors and federal funding.
- o The UC Berkeley Microfabrication Laboratory, led by Professor Costas Spanos, used UC Discovery Grants to create a new research education program for students from many disciplines.

UC Discovery Grants are increasingly figuring in the development of major new research centers, particularly those initiated by the California Institutes for Science and Innovation, as well as other new centers, such as the UC Berkeley Center for Intelligent Systems, launched August 2002.

***Creation of California's R&D workforce and future R&D leadership:***

Participating in a UC Discovery Grant project has already given more than 2,000 students and postdoctoral scholars an opportunity to work in R&D-relevant basic research projects. Most participating students have direct interactions with scientists from sponsor firms. Some do internships at firms.

Students are exposed to the way research is done in the private sector and witness, first hand, the value placed on teamwork and gain an understanding of business development.

They co-author research papers and are involved in patents on inventions stemming from these research projects. They also participate in the many IUCRP-sponsored scientific conferences and workshops sponsored that draw together leading Industry and UC scientists.

***Created value through intellectual property:***

Intellectual property rights enable companies to create additional value in their investments in university research. Every IUCRP research partnership involves a formal Research Agreement between the sponsoring company and the campus or Laboratory of the UC investigator. The vast majority of these agreements include an intellectual property clause that specifies the company's time-limited right to negotiate intellectual property rights, including exclusive licenses,<sup>4</sup> on inventions developed in the course of the supported project.

Intellectual property transactions range from disclosures and secrecy agreements to Material Transfer Agreements and licensing agreements. A study is underway of IUCRP-related intellectual property activities.

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<sup>4</sup> MICRO grants provide rights restricted to non-exclusive, royalty-free licenses.

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