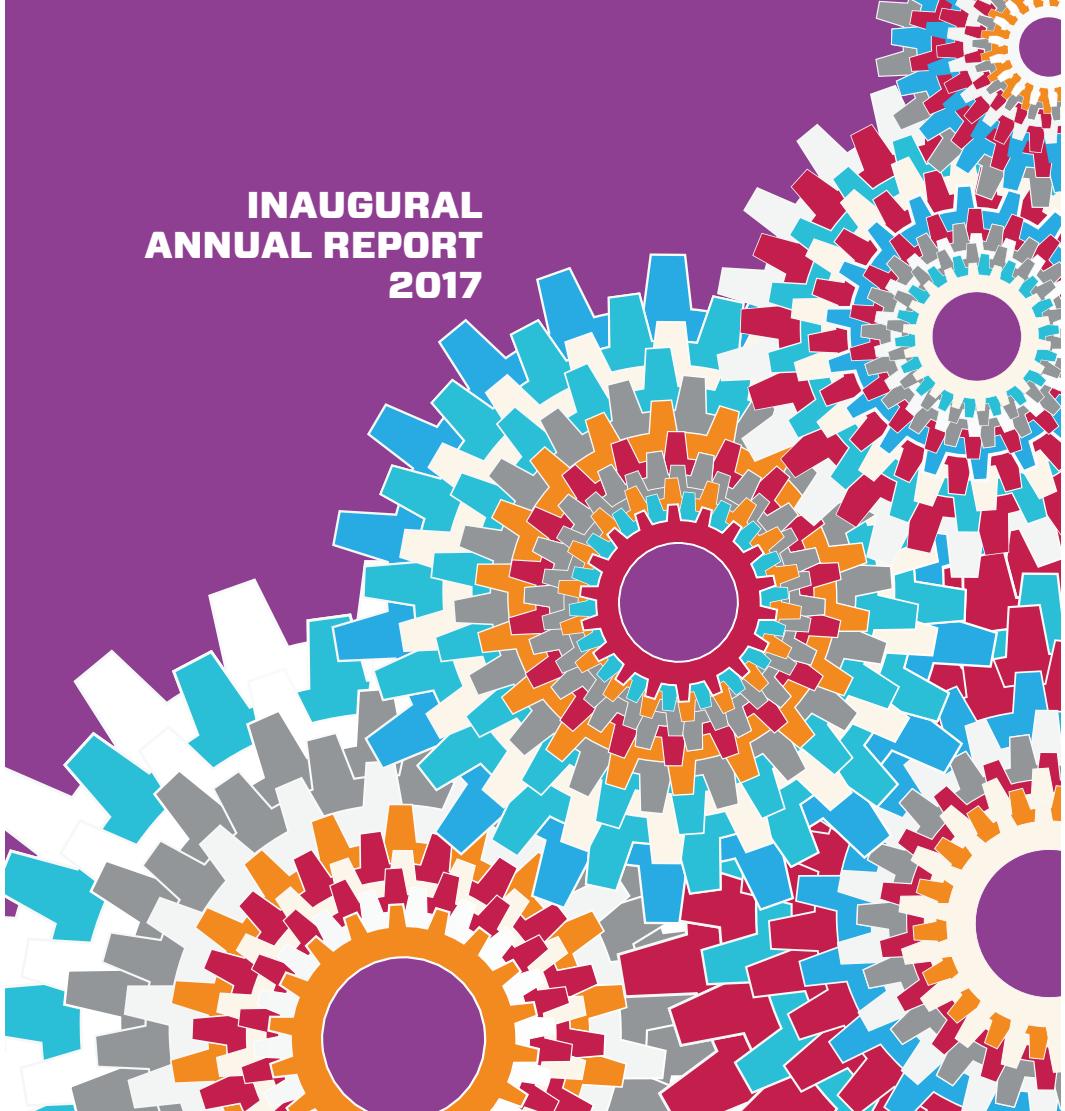


**INAUGURAL
ANNUAL REPORT
2017**



INNOVATION AND
PARTNERSHIPS OFFICE



Dr. Elsie Quaite-Randall
Chief Technology Transfer Officer



To engage and partner responsively
with Berkeley Lab researchers, DOE, industry,
and the broader research community
to create innovative lab-to-market opportunities
and effective research partnerships.

A NEW DIRECTION

In 2014, Berkeley Lab's Innovation and Partnerships Office—IPO—set plans in motion to redefine its vision and restructure operations to better align with the lab's scientific goals and a changing economic environment.

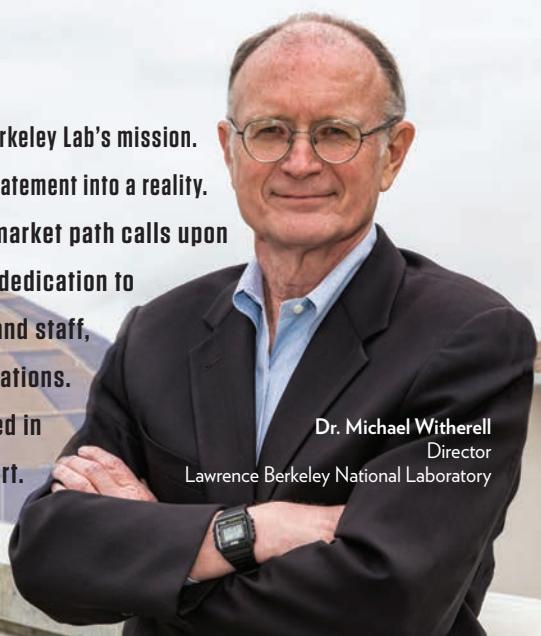
Over the past two years, IPO has advanced initiatives to expand industry partnerships and grow the lab's innovation ecosystem while continuing to handle fundamental technology transfer roles – assessing invention and software disclosures, preparing patent applications, and negotiating licensing and research agreements.

IPO has

- **improved systems to assess and bundle Berkeley Lab research**
- **expanded lab-to-market opportunities and entrepreneurial education**
- **implemented more transparent, standardized and streamlined IPO operations**

This FY16 Annual Report presents IPO's ongoing progress and outlines near-term opportunities. Most importantly, it highlights the many positive outcomes of IPO's engagement and partnership with all stakeholders – internal and external.

Bringing Science Solutions to the World is Berkeley Lab's mission.
IPO plays a critical role in turning that mission statement into a reality.
Shepherding basic science research along the lab-to-market path calls upon
IPO's technology transfer expertise and the office's dedication to
building partnerships – with Berkeley Lab's researchers and staff,
DOE, industry partners, and fellow research organizations.
That spirit of partnership and team building is reflected in
IPO's accomplishments presented in this report.



Dr. Michael Witherell
Director
Lawrence Berkeley National Laboratory

INNOVATION PARTNERSHIP OPPORTUNITIES

The transition from the Technology Transfer and Intellectual Property Management group to the Innovation and Partnerships Office in 2014 was more than a name change.

IPO grew to co-locate all activities related to transferring technology and initiating non-federal partnerships.

IPO reorganized to provide science area-based teams to build researcher relationships and to more effectively advance Lab innovations.

A cross-functional team serves each Berkeley Lab scientific area, namely:

- **Biosciences**
- **Computing Sciences**
- **Earth and Environmental Sciences**
- **Energy Sciences**
- **Energy Technologies**
- **Physical Sciences**



INNOVATION PORTAL

IPO launched the Innovation Portal in 2015 giving Berkeley Lab researchers, division support staff, and Lab leaders the ability to view the status of invention and software disclosures, intellectual property, and agreements handled by IPO.

In 2016, the Innovation Portal expanded to handle online Non-Disclosure Agreement (NDA) and Material Transfer Agreement (MTA) requests.

In early 2017, the Portal added an online system for New Reports of Invention and New Software Disclosures, completing the transition to a consistent, paperless, and transparent process for handling Lab intellectual property and agreements.



IPO TEAM STRUCTURE: Collaborative, Science Area-based Teams

Each science-based team has established office hours throughout the Lab, including satellite locations, for easy access to IPO services by Lab researchers and their support staff. Team members include IPO staff expert in Partnerships, IP Protection, Technology Assessment, and Licensing.

IPO's Operations Team supports all scientific areas, manages financial, data and communications systems, and serves as a first point of contact for stakeholder inquiries.

IP PROTECTION

IP Protection, Assignments, Legal Terms in Agreements



TECHNOLOGY ASSESSMENT

Business Case and Commercial Interest Assessment, IP Bundling, Targeted Partner Outreach

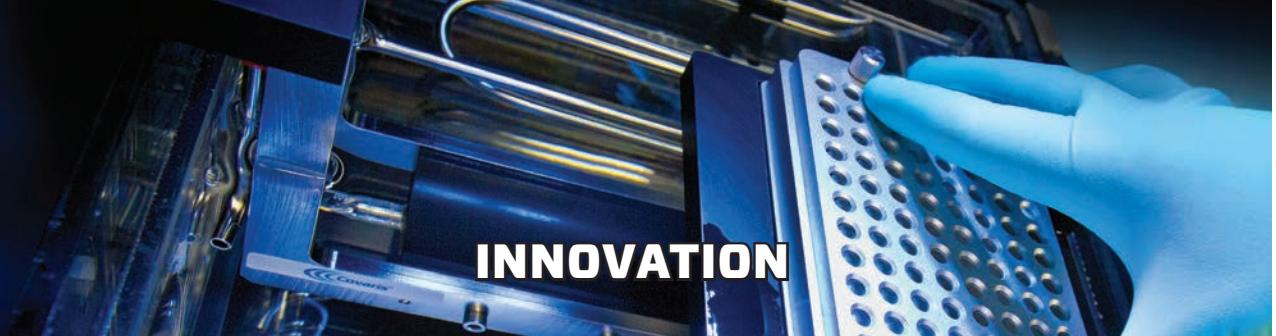
PARTNERSHIPS

User Facility Agreements, Gifts, and Pre-contract Award Management for SPPs and CRADAs



LICENSING

Licenses, Options, Non-Disclosure and Material Transfer Agreements and IIAAs



INNOVATION



New Reports of Invention and New Software Disclosures kick off a significant and coordinated effort by IPO to move Berkeley Lab technologies out of the lab and into the hands of a society seeking innovation.

A technology commercialization associate (TCA) and patent attorney assess disclosures, with input from the inventors/developers, for patentability and commercial potential. If a patent application is filed, the TCA seeks out likely markets and industry partners for the invention. The TCA can also suggest developments to prove commercial potential and training in customer discovery through programs such as the National Science Foundation's I-Corps™ or DOE's Energy I-Corps (formerly Lab-Corps).

When Berkeley Lab Molecular Foundry researchers co-invented hydrogen storage and thermo-electric technologies with scientists from other institutions, IPO's Energy, Physical and Environmental Sciences Area team **developed inter-institutional agreements** to protect Berkeley Lab's right to license the clean energy inventions so they could one day be developed to benefit society.

Believing current industry standards inadequate for the long-term market, Joint BioEnergy Institute (JBEI) researchers have proposed using ionic liquids (ILs) for breaking down plant-based biomass to create green fuels and chemicals. Although met with skepticism due to the high cost of ILs, the IPO Biosciences Team **protected the intellectual property** in JBEI's ever-expanding portfolio. Today, JBEI offers less costly ILs including some produced from lignin, the waste product of biomass deconstruction. Startups and other industry partners have shown interest in the performance and economy at scale of JBEI's IL technologies.

IPO's Biosciences Team **devised a licensing template** making OpenPET, which supports development of imaging prototypes, available for two-year, non-exclusive use. This licensing strategy makes OpenPET more widely available to enhance imaging applications serving cancer and HIV patients, among others.



PARTNERSHIPS

Partnerships – with industry and other research institutions – are vital to moving technologies from the lab to the marketplace. The agreements that strengthen innovation partnerships include

- ▷ **Non-Disclosure and Material Transfer Agreements**, enabling research or commercialization partners to explore Berkeley Lab technologies and capabilities
- ▷ **Options and Licenses to Berkeley Lab technologies**
- ▷ **Collaborative research agreements** for Berkeley Lab and partners advancing technologies together
- ▷ **User Agreements** giving access to Berkeley Lab's one-of-a-kind research facilities such as the Advanced Light Source and Molecular Foundry

IPO's licensing associates and contracts officers guide agreements from first draft to completion. They also help researchers understand licensing or contracting options and tailor partnership models.

111

companies, institutions, and venture capital firms visited Berkeley Lab in FY16 to discuss potential partnerships.

2,557

projects were conducted by research institutions, small businesses, and other industry partners at Berkeley Lab User Facilities in FY16.

IPO's Contracts staff **facilitated a materials project** for PepsiCo utilizing Berkeley Lab's Molecular Foundry and Chemical Sciences Division expertise.

IPO's Computing Sciences team guided PPG Industries, Carbon, Inc., ACS Green Chemistry Institute, Alzeta Corporation, and Sepion Technologies **from start through execution of collaborative research agreements** as part of DOE's High Performance Computing for Manufacturing (HPC4Mfg) Program, which connects industry with supercomputers and scientific expertise at Berkeley Lab and other DOE national labs.

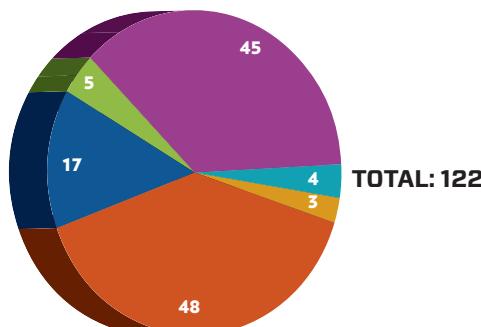
To support Oakland-based Lucid Design Group's goal to enhance building energy efficiency analysis, IPO's Energy Technologies Area team **executed a commercial use license** for specialized Berkeley Lab software and a **research agreement for DOE's Small Business Voucher (SBV) program**, which enables small companies to advance technologies by engaging with experts and state-of-the-art facilities at DOE national labs.

Berkeley Lab researchers who believe they have invented something unique

disclose their inventions to the lab's Innovation and Partnerships Office (IPO).

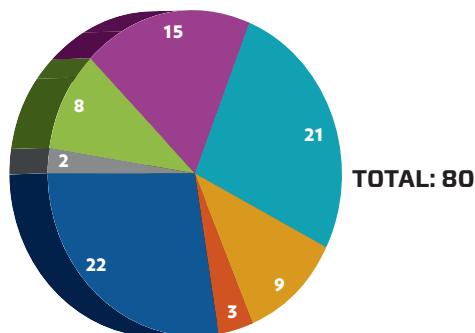
Computer software intended to be distributed outside the lab is also disclosed to IPO.

**FY16 Invention Disclosures
by Research Area**



- Biosciences: 45
- Computing Sciences: 4
- Earth and Environmental Sciences: 3
- Energy Sciences: 48
- Energy Technologies: 17
- Physical Sciences: 5

**FY16 Software Disclosures
by Research Area**

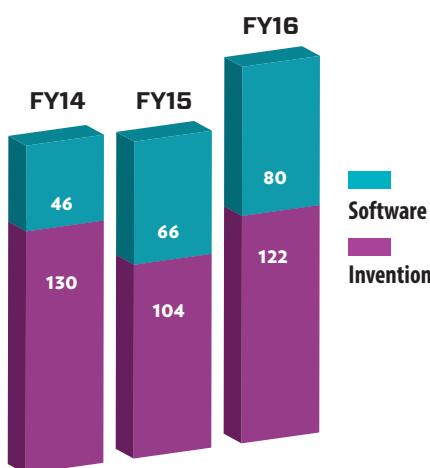


- Biosciences: 15
- Computing Sciences: 21
- Earth and Environmental Sciences: 9
- Energy Sciences: 3
- Energy Technologies: 22
- Operations: 2
- Physical Sciences: 8

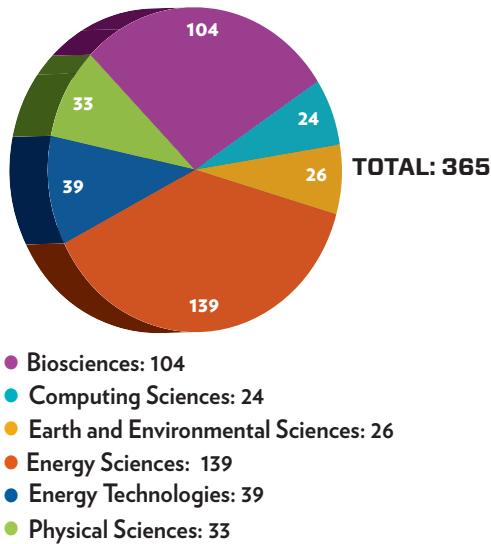
IPO's patent attorneys and technology commercialization associates work

together to identify potential markets and partners for new inventions and software and to determine next steps for patent or copyright protection.

**Disclosures:
3 Year Trend**



**FY16 Technologies Assessed
by Research Area**

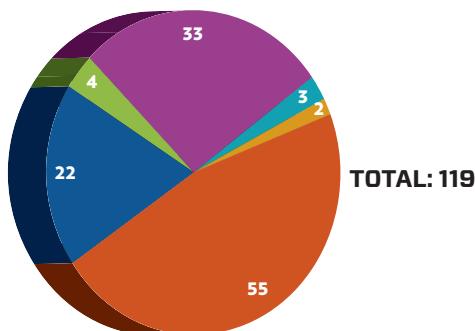


- Biosciences: 104
- Computing Sciences: 24
- Earth and Environmental Sciences: 26
- Energy Sciences: 139
- Energy Technologies: 39
- Physical Sciences: 33

Filing patent applications on novel, useful, and non-obvious inventions makes

them more attractive to potential industry partners and ensures Berkeley Lab and its researchers receive credit and a fair return once inventions are commercialized.

FY16 Patent Applications Filed by Research Area

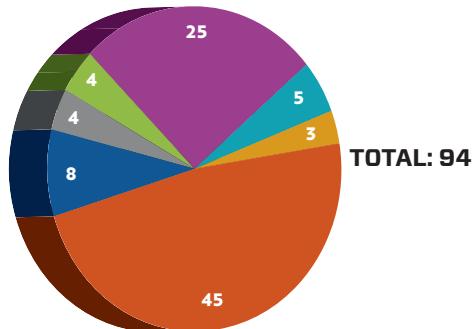


- Biosciences: 33
- Computing Sciences: 3
- Earth and Environmental Sciences: 2
- Energy Sciences: 55
- Energy Technologies: 22
- Physical Sciences: 4

In keeping with its mission of transferring technologies to benefit society, Berkeley Lab makes some of its **software available at no cost or through non-exclusive licenses for the greatest possible impact** and to play an active role in the open source software community. Software applications include high performance computing, genomics, subsurface modeling, imaging, and building energy efficiency, among many others.

IPO's expertise in software licensing models **enabled distribution of Singularity throughout the Linux community**. The open source software allows legacy software to be run on updated systems.

FY16 Patents Issued by Research Area



- Biosciences: 25
- Computing Sciences: 5
- Earth and Environmental Sciences: 3
- Energy Sciences: 45
- Energy Technologies: 8
- Operations: 4
- Physical Sciences: 4

The Institute for Transformative Technologies licensed an infant warmer that operates where power is unreliable or unavailable.

MiTegen licensed Berkeley Lab's diode beamstops for real time measurement of X-ray beam intensity to enhance beamlines used for research in potentially lifesaving discoveries in medical, biological, and materials sciences.

Industry partners from small businesses and startups to multinational companies license Berkeley Lab technology and software to commercialize for the marketplace.

FY16 License Agreements

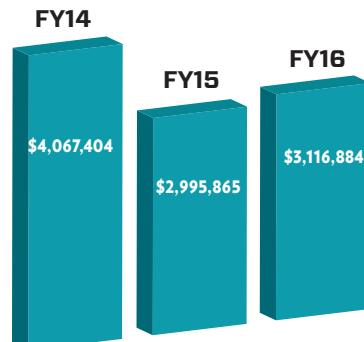
LICENSE TYPE: TOTAL 176

Bailment	3
License - Exclusive FOU*	2
License - Non-exclusive FOU	4
CRADA Option	1
Option Agreement	5
Software License - Exclusive	1
Software License - No Cost	78
Software License - Non-exclusive	82

*FOU = Field of Use

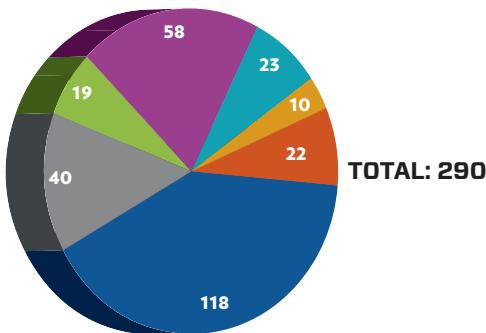
Licensed technologies generate royalties for Berkeley Lab. For inventions disclosed after September 30, 1997, 35% of the net income from royalties—after reimbursing patenting costs or copyright registration fees—goes to the inventors, 15% goes to the research division where the invention originated, and 50% supports future lab research.

Royalties: 3 Year Trend



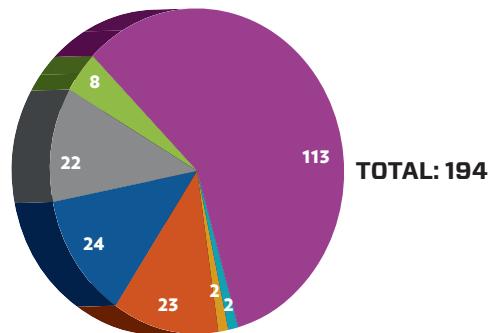
Non-Disclosure Agreements are requested by lab researchers and / or potential industry partners to protect information they may discuss. **Material Transfer Agreements** are required when Berkeley Lab and its partners **share research materials** for evaluation.

FY16 Non-Disclosure Agreements by Research Area



● Biosciences:	58
● Computing Sciences:	23
● Earth and Environmental Sciences:	10
● Energy Sciences:	22
● Energy Technologies:	118
● Operations:	40
● Physical Sciences:	19

FY16 Material Transfer Agreements by Research Area



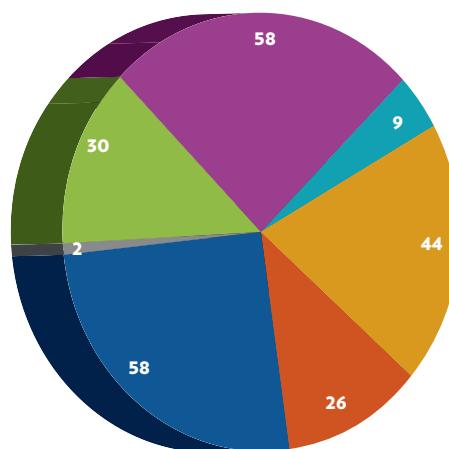
● Biosciences:	113
● Computing Sciences:	2
● Earth and Environmental Sciences:	2
● Energy Sciences:	23
● Energy Technologies:	24
● Operations:	22
● Physical Sciences:	8

Industry partners perform defined projects using Berkeley Lab's unique facilities and expertise
under an agreement called a Strategic Partnership Project (SPP).

FY16 Strategic Partnership Projects (SPPs) by Research Area

● Biosciences:	58	\$ 21,968,562
● Computing Sciences:	9	\$ 4,915,912
● Earth and Environmental Sciences:	44	\$ 7,517,268
● Energy Sciences:	26	\$ 12,176,195
● Energy Technologies:	58	\$ 22,966,816
● Lab Directorate:	2	\$ 225,000
● Physical Sciences:	30	\$ 7,422,166

TOTAL: 227
TOTAL: \$ 77,191,919

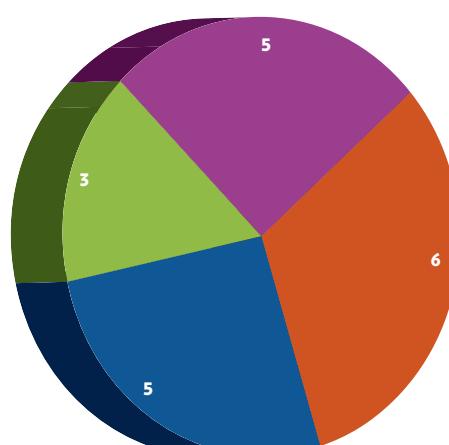


Berkeley Lab and industry partners jointly sponsor research for shared benefit under a Cooperative Research and Development Agreement (CRADA).

FY16 Cooperative Research and Development Agreements (CRADAs) by Research Area

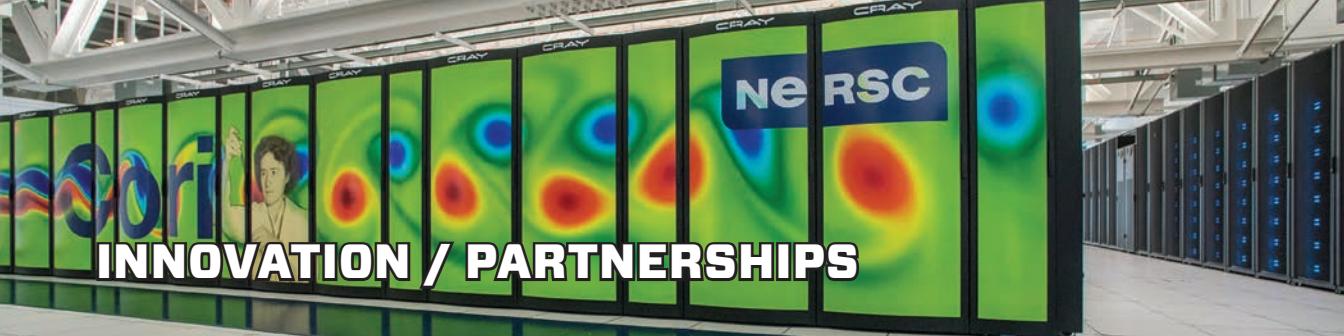
● Biosciences:	5	\$ 1,728,447
● Energy Sciences:	6	\$ 1,556,027
● Energy Technologies:	5	\$ 703,299
● Physical Sciences:	3	\$ 7,236,660

TOTAL: 19
TOTAL: \$ 11,224,433



IPO's Partnerships Group supports small businesses using Berkeley Lab's Advanced Biofuels Process Demonstration Unit (ABPDU) to advance industry innovations in bio-based chemicals, materials, and fuels by executing sponsored research agreements. In 2016, over 30 industry projects were executed.

An IPO Contracts Officer turned a forward-looking research proposal into reality for Toyota and the Berkeley Lab-led Joint Center for Artificial Photosynthesis (JCAP), marking JCAP's first Cooperative Research and Development Agreement (CRADA).



IPO SUPPORTS BERKELEY LAB RESEARCHERS SEEKING TO MOVE TECHNOLOGIES FROM LAB TO MARKET

The Berkeley Lab Innovation Corps (BLIC) was launched in FY16 to provide entrepreneurial resources and technology commercialization training for all Lab staff. BLIC hosts expert speakers on topics such as legal issues for startups and early stage funding opportunities.

Intensive customer discovery programs such as **DOE's Energy I-Corps (formerly Lab-Corps)** and the **National Science Foundation's I-Corps™** teach researchers how to transition their discoveries into technologies that benefit society. IPO supported 16 researchers participating in these programs in FY16 to advance inventions from biotech screening tools to a better stove burner to subsurface modeling software.

IPO technology commercialization associates worked with researchers in Berkeley Lab's Energy Technologies Area and Material Sciences Division to secure **Technology Commercialization Funds** from DOE's Office of Technology Transitions.

“Customer discovery principles are influencing all aspects
of my research at Berkeley Lab. I’m using them on a daily basis now,
and they will influence the rest of my career.”

Peter Therkelsen, staff scientist, on DOE Lab-Corps training

WHISKERLABS



 HEARTSENTRY

Two **startups** based on Berkeley Lab technology were founded in FY16. Berkeley Lab researchers spun out **Whisker Labs**, formerly Wattstick, which licensed an energy monitoring device that will be adapted for home use. **Lexington Biosciences** licensed a cuff-like device, developed at Berkeley Lab, that assesses plaque buildup for more advanced testing and monitoring of cardiovascular health. Lexington Biosciences is refining the **Heart Sentry**'s design and will initiate the Food and Drug Administration approval process.

OPPORTUNITIES

Industry Consortia enable companies with common research interests to join forces and innovate using Berkeley Lab's scientific expertise and unique research equipment. IPO prepares and executes contracts and licenses to ensure broad, beneficial participation from industry partners, navigating issues such as confidentiality and shared intellectual property.

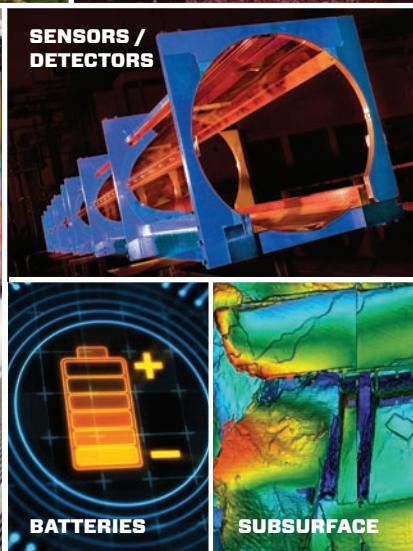
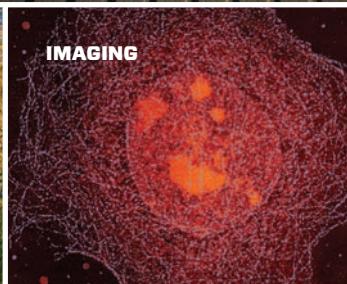
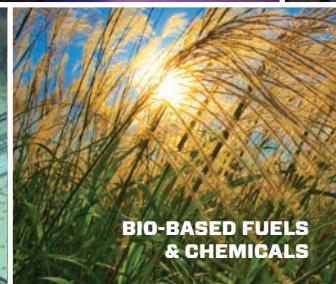
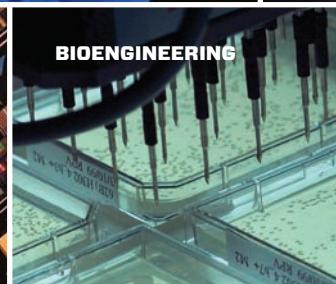
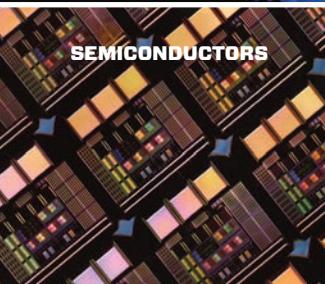
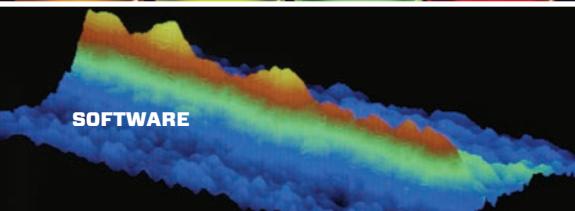
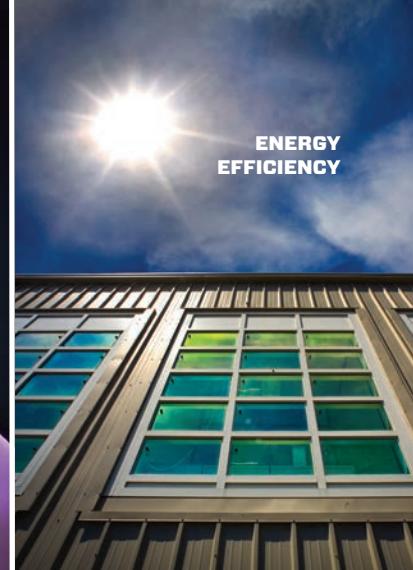
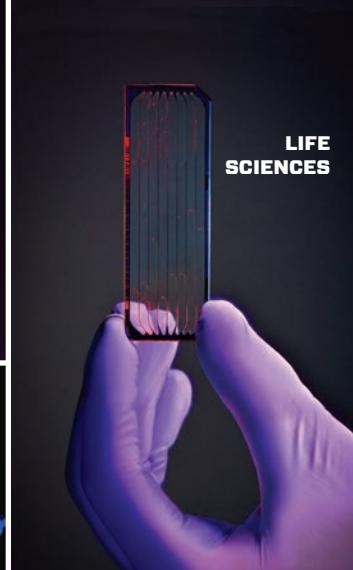
- More than 30 pharmaceutical and biotech research institutions license Berkeley Lab's **PHENIX** software to speed drug development and to participate in an **industry consortium addressing drug research challenges**.
- Berkeley Lab participates in **CalCharge**, a public-private partnership of small and large companies and research institutions, to accelerate the development, commercialization, and adoption of **energy storage technologies**.
- **EUREKA** brings together members of the **semiconductor industry** to advance new technologies and maintain competitiveness.
- DOE EERE's Lab-Embedded Entrepreneurship Program (LEEP) offers a home base for researchers to develop products and entrepreneurial skills. LEEP includes **Berkeley Lab's Cyclotron Road** as well as Argonne National Laboratory's Chain Reaction Innovations and Oak Ridge National Laboratory's Innovation Crossroads.



IPO facilitates research by industry consortia, multi-institutional research centers, fellow DOE labs, and public-private partnerships seeking biotech and energy science solutions.

IPO is looking ahead to more opportunities to partner with industry through programs such as **DOE EERE's Lab-Bridge** and the **Clean Energy Investment Center's Lab Partnering Service**, which seek to match intellectual property and scientific expertise to the needs and interests of small businesses, startups, larger companies, and technology investors.

IPO staff and the **Joint BioEnergy Institute** collaborated with bio-based chemical companies, the GreenChemistry and Commerce Council, Scienomics, and PolyOne to identify **green chemical alternatives** for flame-resistant and other materials for improved public safety and lower environmental impacts.



LAWRENCE BERKELEY NATIONAL LABORATORY EXPERTISE



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