















Reflections on the Year

It gives me great pleasure to share with you this second annual report, which

reflects on the outcomes and impact from key initiatives over the last fiscal year by Technology Management & Corporate Relations (TMCR), a division of the UC Davis Office of Research. As with our last report, we use this volume to showcase a representative sample of the university's most accomplished inventors, innovators and successful partnerships enabled through the services TMCR provides.

I am pleased to see the tremendous progress our university has made over the past five years to propel technology commercialization, innovation and entrepreneurship at an impressive pace. This last year we enabled the foundation of 14 startups — matching the largest number of new ventures based on UC Davis technologies in a single year. In addition, we exceeded the previous year's research funding received from corporate partners, reflecting the growing trend in industry to advance technology platforms by engaging with UC Davis scientists, engineers and researchers. Effective collaboration between the Office of Corporate Relations, InnovationAccess and Sponsored Programs has contributed to this success. This past year, UC Davis inventors disclosed 230 new inventions and were granted

36 U.S. and 37 foreign patents, supported by the Innovation*Access* team.

This progress is undoubtedly one of the many outcomes achieved under the leadership of Vice Chancellor Harris Lewin over the last five years. This year, Dr. Lewin announced that he will be stepping down from his role as vice chancellor for research to rejoin the faculty in the Department of Evolution and Ecology within the College of Biological Sciences. A member of the National Academy of Sciences and a Wolf Prize winner, Dr. Lewin was responsible for reorganizing the Office of Research to realize operating efficiencies and better alignment with both faculty objectives and the university's public mission of societal impact. I would like to personally thank him, on behalf of the entire TMCR team, for his service, support and dedication to positioning the Office of Research, and all of its components, on a solid foundation that will continue to deliver value to the university and to our stakeholders into the future.

We are thrilled that our colleague, Dr. Cameron Carter, professor in the Department of Psychiatry and Behavioral Sciences and director of the UC Davis Imaging Research Center and Center for Neuroscience, has been appointed the interim Vice Chancellor for Research. Dr. Carter is a leading neuroscientist and has been conducting basic, clinical and translational research using neuroimaging tools for over 25 years. With his experience and passion, he will bring great value to the campus in his new role.

We recognize that creating a rich and collaborative ecosystem supportive of innovation and technology commercialization is critical for translating today's research into tomorrow's successful businesses. And so I would like to thank our many partners within the university and in our community that have had a tremendous impact on our progress.

As always, I encourage you to contact me or anyone in our team to discuss opportunities for collaboration or to answer your questions about innovation and technology commercialization at UC Davis. Thank you for your support and I look forward to working with you in the year ahead.

Sincerely. DUSHYANT PATHAK

Associate Vice Chancellor Technology Management & Corporate Relations



Innovation and Technology **Commercialization at UC Davis**



From life-saving cancer treatments to clean energy breakthroughs, innovations from UC Davis impact everyday life in California communities and around the globe. Problem solving is in our DNA, fueled by a passion to help make the world a better place.

While the personal and societal impact of these innovations are the inspiration for our work, the economic impact in our communities is equally satisfying. Our innovations lead to new products, high-value jobs and new companies.

"Over the last five years UC Davis has seen unparalleled growth in its corporate partnerships, support for campus innovators and development of startups. TMCR's unique approach of engaged collaboration has been a key enabling force behind these outcomes."

> - Harris Lewin Vice Chancellor for Research 2011 to 2016

UC Davis is a global research powerhouse, generating over \$760 million in research funding, 230 records of invention, \$13.5 million in licensing revenue* and 14 new companies in the last year alone.

In 2016, the Association of Public and Land-grant Universities (APLU) designated UC Davis as an Innovation and Economic Prosperity University in recognition of our strong commitment to economic engagement with our local and regional communities. The designation acknowledges public

UC DAVIS IS A GLOBAL RESEARCH POWERHOUSE. GENERATING OVER:

\$760 million *\$13.5 million IN RESEARCH FUNDING

IN LICENSING REVENUE NEW COMPANIES

IN THE LAST VEAD ALONE

*Preliminary value pending final release

WORLD-LEADING RESEARCH | A global leader in impact for the life and earth sciences, UC Davis faculty perform cutting-edge research and offer advanced capabilities to enable technology development

CROSS-DISCIPLINARY EXCELLENCE | As one of the most academically comprehensive campuses in the nation, UC Davis brings together world-leading engineers, scientists, and medical professionals to solve some of the most complex challenges

TECHNOLOGY DEVELOPMENT SYNERGIES | With a nationally ranked medical center, world-class veterinary and agricultural programs and rapidly growing biomedical engineering expertise, UC Davis is uniquely positioned to realize One Health and engineering synergies

FOCUSED ON SOCIETAL NEEDS | Developing technologies and applications that benefit society is core to the mission of UC Davis

research universities in the United States that work effectively with public and private sector partners in their regions and states to support economic development through diverse activities, including innovation and entrepreneurship,

technology transfer, talent and workforce development and community development. UC Davis is the only UC campus to receive this designation.

THE 3 BRANCHES OF TMCR



InnovationAccess: Connects research and innovation to the marketplace TECHNOLOGY MANAGEMENT & CORPORATE RELATIONS

Dushyant Pathak Associate Vice Chancellor



Office of Corporate Relations: Develops and manages strategic relationships with industry partners

Venture Catalyst: Supports the development of new ventures fueled by university resear

OFFICE OF RESEARCH Cameron Carter Interim Vice Chancellor for Research

RESEARCH ADMINISTRATION

Cindy Kiel Executive Associate Vice Chancellor INTERDISCIPLINARY RESEARCH & STRATEGIC INITIATIVES

> Paul Dodd Associate Vice Chancellor

ABOUT TECHNOLOGY MANAGEMENT AND CORPORATE RELATIONS

Technology Management and Corporate Relations (TMCR), one of three divisions of the Office of Research, serves as the primary campus resource for the translation of research and innovation into commercial impact. We enable technology development from conception to commercialization by providing the tools, services, and connections that empower our university's bold and imaginative researchers. Our goal is to transform today's research and development into the foundation for tomorrow's successful businesses. We ensure that nascent technologies emerging from campus research seed new products and services that can drive local economic development and address the needs of the region, state and global community. TMCR is organized in three units that work collaboratively to cultivate

innovation, propel venture formation and energize corporate partnerships.

Our office works closely with entities and stakeholders within and outside the campus. On campus, TMCR works collaboratively with faculty, students, staff, the Sponsored Programs Office, the UC Davis Institute for Innovation and Entrepreneurship, the Office of Development and Alumni Relations as well as other teams and units.

Externally, TMCR engages with industry partners, regional entrepreneurial resources, government and policy stakeholders and stewards of regional economic development.

Fueling Innovation

University of California campuses, including UC Davis, are powerhouses when it comes to innovation. In July, the National Academy of Inventors and the Intellectual Property Owners Association ranked University of California number one in the world based on U.S. patents granted. UC Davis continues to be a strong contributor to this innovative power, contributing eight of the top 25 system-wide revenue-generating

FULL FY 2015-16 DATA FOR THE FOLLOWING CATEGORIES:

AGREEMENTS

| Exclusive Licenses |
|--|
| Non-Exclusive Licenses |
| Letter Agreements/Options 41 |
| Material Transfer Agreements 784 |
| |
| Data Transfer Agreements63 |

INVENTIONS/PATENTS

| Records of Invention 230 | |
|--------------------------|--|
| U.S. Patents Filed | |
| Foreign Patents Filed | |
| U.S. Patents Issued | |
| Foreign Patents Issued | |

inventions in fiscal year 2015, more than any other UC campus.

This past year, UC Davis innovators were issued 36 U.S. and 37 foreign patents. The university also executed 98 copyright licenses, processed 230 records of inventions, filed 210 U.S. and 30 foreign patent applications, and executed 51 licenses and 784 material transfer agreements.

TMCR plays a critical role in enabling innovation by providing campus innovators targeted funding, resources to align technology with market needs, and services to steward and facilitate commercialization of resulting intellectual property (IP).

In 2015, InnovationAccess launched a new program to help researchers maximize impact through technology transfer by providing early engagement and strategic review of potential new IP developing in UC Davis laboratories. The Laboratory-Embedded Attorney Partnership (LEAP™) Program provides researchers IP insights from domain experts in InnovationAccess, supplemented by pro-bono engagement from participating outside patent counsel. The program involves regular consultations between patent attorneys and laboratory researchers to identify areas of technical and commercial promise early in the technology development process, thereby creating a more strategic and orderly approach to addressing the practical and legal considerations involved in developing a robust IP portfolio.

Venture Catalyst also announced an agreement with Technology Acceleration Partners (TechAccel, LLC) to extend funding provided through the university's STAIR grant program, providing access to additional funding for successful STAIR grant recipients. Through the partnership, TechAccel has agreed to invest up to \$400,000 to support the UC Davis STAIR-Plus[™] program for projects that address commercial opportunities in agriculture, animal, or food science. Recipients will also be eligible for a TechAccel Emerging Company investment of up to \$1 million.

"Basic research is fundamentally innovative. It re-shapes our understanding of the world in which we live. It provides a shared knowledge base for all scholars and researchers. And it is often the first step in the journey towards innovative solutions that ease and eliminate global challenges."

- Janet Napolitano, UC President

2016 STAIR AWARDEES:

The UC Davis Science Translation and Innovative Research (STAIR[™]) grant

program, managed by Venture Catalyst, provides funding for proof-of-concept research and development, aimed at demonstrating commercial feasibility of university-generated research and technologies. Embarking on its third year, the STAIR program is another way UC Davis supports its most innovative researchers.



Aijun Wang, Assistant Professor, Department of Surgery

A Sutureless Artificial Graft for Arterial Replacement (UC Case 2014-877)

Wang's team has created VasoFlo, an artificial arterial graft designed to address the complications plaguing existing artificial vascular grafts. The invention allows attachment to the vessel walls without sutures, and protects against turbulent blood flow, thrombosis and intimal hyperplasia. The team will construct a viable prototype using FDA-approved materials and test the efficacy in a large animal bypass model.



John Voss, Professor, Department of Biochemistry and Molecular Medicine

A Novel Approach for Early Detection of Alzheimer's Disease (UC Case 2015-773)

Voss' team is developing technology based on small molecules believed to have potential for the early detection of Alzheimer's disease. The compounds are unique due to their paramagnetic properties, which affect MRI intensities. The technology is expected to enable greater patient access through the development of less expensive diagnostics that do not require radiation exposure.



Tingrui Pan, Assistant Professor, Department of Biomedical Engineering

Wearable Pressure Sensor for the Management of Chronic Venous Disease (UC Case 2015-260)

Pan and his team are developing a wearable pressure sensor for the management of chronic venous disorder, commonly manifested as varicose veins. The sensor allows for wireless data transmission for continuous pressure assessment. The device is ultra-thin with skin-like flexibility, allowing it to be used under compression therapy.



Wenbin Deng, Associate Professor, Department of Biochemistry and Molecular Medicine

A Drug Candidate for the Treatment of Multiple Sclerosis (UC Case 2015-840)

Deng has identified a small-molecule drug candidate with potential therapeutic properties for the treatment of multiple sclerosis (MS). Unlike current therapeutics that only work on the immune system, the identified molecule could prevent neurodegeneration in MS patients. The drug targets a transcription factor that promotes remyelination and reduces neural inflammation and neuropathology.



Richard Levenson, Professor and Vice Chair, Department of Pathology and Laboratory Medicine

Deep UV Surface Excitation Microscopy (UC Case 2014-463)

Levenson's team is developing a device that allows for the assessment of freshly excised tissue specimens using a fast, nondestructive and inexpensive method called Microscopy with Ultraviolet Surface Excitation, or MUSE. The device generates diagnostic-quality images in minutes using conventional LEDs, eliminating the need for glass slides and time consuming tissue preparation. FY 2015-16 UC DAVIS RECORDS OF INVENTION BY CATEGORY





This year, Dubcovsky's lab released the 'Yurok' wheat variety, a semi-dwarf Hard Red Spring variety, which offers a high-yielding plant with high protein content and excellent bread-making quality from the resulting grain.

Innovation that feeds the world

Jorge Dubcovsky, Ph.D., a worldrenowned plant geneticist who leads the UC Davis wheat breeding program, develops genetic resources for improving the yield, disease-resistance and nutritional value of wheat — one of the most widely grown cereal crops on the planet. Global demand for wheat continues to increase dramatically, up nearly 20% from just ten years ago (U.S. Wheat Associates Annual Report).

Wheat is a vital part of the farming economy in California, grown from the Imperial Valley in the south to the Klamath Basin in the north, and from the inland valleys to the coastal agricultural regions. Due to California's large size and diverse climate, wheat can be planted for harvest in both the fall and spring seasons, depending on the region. Dubcovsky's ground-breaking work has enabled researchers and breeders around the world to accelerate the development of more nutritious and better-adapted wheat varieties.

Dubcovsky and his team have released eleven distinct UC wheat varieties, each protected by Innovation*Access* under U.S. Plant Variety Protection, and licensed to 30 commercial entities. Consistent with the land-grant mission of UC Davis, wheat varieties released out of Dubcovsky's breeding program are licensed only to the California wheat industry during the first three years following release, effectively providing an economic advantage for the state. InnovationAccess works closely with the California Wheat Commission in setting up licensing arrangements. After this initial three-year period, licensing is opened to other geographical areas beyond California.

This year, Dubcovsky's lab released the 'Yurok' wheat variety (UC Case 2016-066), a semi-dwarf Hard Red Spring variety, which offers a high-yielding plant and a resulting grain with high protein content and excellent bread-making quality. This variety is resistant to current races of stripe rust disease and is well adapted to the Sacramento, San Joaquin and Imperial Valleys in California.

Helping students succeed in math

"Hands-on math education with computing and robotics is much more effective than traditional instruction with pencil and paper," Cheng says. "Computing and robotics make abstract math concepts come alive."





Harry Cheng, professor of mechanical and aerospace engineering,

was one of two recipients of the inaugural UC Davis Chancellor's Innovator of the Year awards for his work in creating engaging ways to get K-12 students excited about math, especially algebra.

In California, students are required to pass Algebra 1 in order to graduate from high school. Algebra is also essential for entry into any science, technology, engineering and math (STEM) field. Unfortunately, many students fail algebra.

Cheng, who has always had an avid interest in computing and robotics, uncovered a new way to make math fun to help students succeed.

He and his team developed C-STEM Studio, a toolkit for teaching science, technology, engineering and mathematics using computing and robotics for integrated learning (UC Cases 2010-099, 2015-630). "Hands-on math education with computing and robotics is much more effective than traditional instruction with pencil and paper," Cheng says. "Computing and robotics make abstract math concepts come alive."

C-STEM is now used in more than 200 elementary, middle and high schools, positively impacting some 10,000 students. The algebra curriculum is aligned with Common Core standards in mathematics.

Together with UC Davis graduate Graham Ryland, Cheng founded the startup Barobo to begin manufacturing proprietary educational robots for schools and colleges. Recently, Barobo was selected as one of four finalists for the best technology startups in the Sacramento area, a competition called Capitalize that is run by the Sacramento Kings organization and Velocity Venture Capital.

Breeding fruit and nut trees for the world

UC Davis consistently ranks at the top of all agricultural programs around the world.

This is in large part based on the strength, diversity



and longevity of the plant breeding programs at UC Davis, which have fueled agriculture in California and around the globe.

One sector where the program continues to have a critical and growing impact is that of fruit and nut trees, a major crop segment for California. This last year, licensing revenue generated from fruit and nut trees reached an all-time high of over \$3 million, an increase of over 60% compared to the

prior fiscal year. Varieties of pistachio, walnut rootstock, and almond lead the group in revenues from sales.

InnovationAccess supports UC Davis breeding programs by putting in place the appropriate fieldtesting agreements, filing of plant patent applications, and licensing patents and patent applications to farmers, nurseries and producers. Licenses are typically arranged in consultation with the commodity boards for the respective crops. In support of the land-grant mission of UC Davis, California growers are given a head start advantage for initial licensing, after which time licensing is extended to the rest of the country and the world.

Innovation*Access* has filed and maintains plant patent applications for over 34 varieties of fruit and nut trees. Over 300 active license agreements are currently in place for these varieties.

Making drugs safer by virtual drug screening

Colleen E. Clancy, Ph.D., is a professor in the Department of Pharmacology at the UC Davis School of Medicine and a pioneer in the field of biophysics.

Together with her team, Clancy studies the mechanisms associated with electrical disorders of the heart. Unlike traditional research methods that rely on animal models or human clinical testing, her laboratory uses complex computational and mathematical predictive modeling approaches to better understand the mechanisms of disease as well as how they are impacted by treatment options. Cardiotoxicity is one of the most common reasons for drug removal from the market. It often manifests as irregular electrical rhythms with the potential for fatal ventricular arrhythmias, but predicting the beneficial and harmful actions of drugs on the heart's electrical cycle remains imprecise using current methods.

Clancy and her team have identified a better approach for preclinical drug screening that is both specific and sensitive, and that identifies actual "proarrhythmia," rather than substitute markers. The approach involves a computational

pipeline that starts with drug chemistry profiling and extends all the way to predictions of drug effects in virtual cardiac tissue. By building detailed models of drugs and their interactions with targets at atomic resolution, Clancy's approach creates the potential to predict these interactions. These computer-generated data are then incorporated into virtual excitable cells, which can be connected to form functional models of tissues. Once established, the model represents a virtual pipeline through which drugs can be screened prior to clinical studies in order to predict unintended cardiac events. It is expected that this versatile technology, upon commercialization, could help to

Clancy's approach allows

the potential for drug induced cardiotoxicity to be predicted by building detailed models of drugs and their targets at atomic resolution and predicting their interactions. more effectively screen new drugs for efficacy and cardiotoxicity, and also be used to modify drugs that have been removed from the market or failed during clinical testing.

Recently, Clancy's team developed a model system with the potential to prevent cardiac arrhythmias by predicting drug interactions with a specific potassium ion channel in the heart (UC Case 2016-665). Abnormal drug-induced cardiac electrical activity is most often a side effect from an unintended block of the promiscuous drug target hERG1, the pore-forming domain of the delayed rectifier potassium ion channel in the heart. A block of hERG1 results in prolongation of the QT interval on the ECG, a phase of the cardiac cycle that corresponds to ventricular repolarization.

Not all hERG1 block is proarrhythmic. At present, however, there is no way to distinguish unsafe hERG1 blockers from drugs that are safe. Clancy and her team use their integrative approach, scaling from atom to tissue, to predict the structure-activity relationships that determine proarrhythmia for hERG1blocking drugs.



Improving detection of breast cancer

Dr. John Boone is a recognized expert in the field of medical imaging, with a focus on improving breast cancer

detection. He and his team have developed a device with the potential to detect tumors in the breast earlier and with less discomfort.

The American Cancer Society reports that breast cancer is the second most common form of cancer among American women, following skin cancers. It estimates that about 1 in 8 women in the U.S. will develop invasive breast cancer during her lifetime.

Traditionally, mammograms have been used to detect breast cancers as part of a regular screening, but Boone has developed what could be a better approach, hopefully improving both detection and patient outcomes. Boone and his team have designed and developed an innovative computed tomography (CT) scanner designed specifically for imaging the breast (UC Case 2005-543). The intended advantage of this device is that it provides a true three-dimensional, highly-detailed image of the human breast, offering a less obstructed view of potential lesions than the current two-dimensional mammogram.

Unlike mammography, the scanner does not require compression of the breast. Instead, the patient lies face down on a padded table and places the breast in a circular opening. The scanner generates 300 to 500 tomographic image "slices" of the breast, which are then assembled into a three-dimensional digital model. The imaging procedure takes approximately 10 seconds.

Thanks to support from the National Institutes of Health, Boone's team has assembled four scanners that have been used to image over 600 women at the UC Davis Medical Center.

The technology led to the formation of Isotropic Imaging Corporation, which intends to license the technology developed at UC Davis to commercialize a scanner.





The scanner generates 300 to 500 tomographic image "slices" of the breast which are then assembled into a three-dimensional model.

The American Cancer Society reports **that breast cancer is the second most common form of cancer** among American women.

Igniting New Ventures

One of the exciting and increasingly important channels through which new UC Davis breakthrough technologies reach the public is the formation of new companies. The impact of these companies extends beyond the products or services they develop, creating high-value jobs that benefit our regional economy.

Venture Catalyst, within Technology Management & Corporate Relations, provides a range of services, connections and resources to help campus inventors, innovators and entrepreneurs turn their technologies into successful businesses.

Last year, Venture Catalyst assisted entrepreneurs with the foundation of 14 startups — matching the largest number of new ventures based on UC Davis technologies previously enabled in a single year. In total, 51 startups, including the 14 new companies for fiscal year 2015–2016, have been formed at UC Davis during the past five years.

| 51 STARTUPS IN LAST 5 YEARS |
|-----------------------------|
| 2015-16 14 |
| 2014-15 13 |
| 2013-14 14 |
| 2012-13 8 |
| 2011-12 2 |

Venture Catalyst enables campus entrepreneurs through its Smart Toolkit for Accelerated Research Translation, or START[™] program, based on the philosophy that the successful translation of early-stage university technology into a viable company requires developing a strong ecosystem of resources, support, connections and mentoring. The START suite of programs and services includes deferment of patent expenses through the Inventor Advantage program (IAP[™]), incorporation and startup legal support (Venture Catalyst LegalNet[™]), access to networks of experienced industry professionals and mentors (Venture Catalyst MentorNet[™]), a selection of contract and other service providers (Venture Catalyst VentureNet[™]), SBIR/STTR grant submission

workshops and sponsorship and support for participation in the UC Davis Institute for Innovation & Entrepreneurship's Entrepreneurship Academies.

In addition, Venture Catalyst has developed the Distributed Research Incubation and Venture Engine (DRIVE[™]) program, which enables access to a network of lean, thematically oriented startup incubators both on and off campus. The DRIVE program provides university-affiliated startups access to affordable business incubation facilities and administrative services. This year, Venture Catalyst signed agreements to add three new incubators to the DRIVE network, each with a designated emphasis:

BIOMASS

LIQUEFACTION

TECHNOLOGIES

Innovative

process for

high solids

liquefaction

of biomass.

energy-efficient

Area52: a non-profit organization offering advanced manufacturing capabilities and tools to transform ideas into products, especially in the areas of medical devices and instrumentation, agricultural technology, alternative energy, robotics and aerospace.

HackerLab: a non-profit organization that aims to educate people and spark innovation with community-driven resources. Offering co-working space, maker space, classes, meet-ups and events, Hacker Lab enables design- and software-driven startups.

MedCatalyst@UC Davis: a university-based program designed to enable the growth and success of biopharmaceutical and medical technology startups by providing access to laboratory facilities in close proximity of the School of Medicine and UC Davis Health System.

UC DAVIS AFFILIATED STARTUP COMPANIES FOR FISCAL YEAR 2015-16

| A-CHIP | AccenGen THERAPEUTICS | |
|--|--|--|
| Microfluidic-based diagnostic tool for evaluating inflammatory cell activation and assessing a patient's risk for a repeat heart attack. | Novel anti- inflammatories for indications with the highest unmet needs, such as sinusitis, pain, cardio- vascular, respiratory indications and cancer. | More efficient RNA-sequencing library synthesis for diagnostics, pharmaceutical development and food security. |



App that integrates with grocery store purchases to alert users when food is about to go bad and provides a recipe for those items.



Highly effective enzymatic approaches for high-yield and cost-effective production of complex glycans.

INTERNATIONAL REACH

Venture Catalyst expanded its role and impact internationally by signing a five-year agreement with the UC Davis-Chile Life Sciences Innovation Center in Santiago as part of its Worldwide Accelerated Research Partnership (WARP™) program. UC Davis staff at the Life Sciences Innovation Center in Chile is adapting Venture Catalyst's programs and its model of services and entrepreneurial support for the Chilean and Latin American context. As part of the arrangement, the Venture Catalyst team, in collaboration with InnovationAccess and the Office of Corporate Relations, provides consulting services to the center and its staff. The agreement also identifies collaborations for the development and marketing of inventions internationally. It is anticipated that the WARP program will enable startups by

facilitating global IP protection strategies, providing access to both non-dilutive and venture capital and developing an intercontinental network of incubation facilities.

"This last year, we saw Venture Catalyst and our partners support the creation and foundational development of a cohort of exciting new startups based on the exciting and societally transformative research of our faculty, students and staff," said Dushyant Pathak, associate vice chancellor of research, who also serves as the executive director of Venture Catalyst. "Our startups, with their focus on commercializing effective solutions for pressing societal needs, represent one of the ways in which UC Davis fulfills its mission to serve the greater good of California, the nation and the world."

VENTURE CATALYST START SUITE OF PROGRAMS AND SERVICES



MICA[®] Market Intelligence and **Competitive Analysis** reports



Incorporation and startup legal support

Grant Workshops

SBIR and STTR

grant writing and

submission workshops



VentureNet[™] Commercial bank, human resources, business vendors and contract service providers



MentorNet[®] Access to networks of experienced industry professionals and mentors



Academy Support Sponsorship and support for participation in the UC Davis Institute for Innovation & Entrepreneurship's Entrepreneurship Academies

ISOTROPIC IMAGING CORPORATION

Breast computer tomography for early cancer detection and diagnosis.

High-resolution Novel slide-free genetics, genome microscopy and DNA surveiltechnology for lance technologies, research and to be applied diagnostic to precision applications. diagnostics and prognostics.



Beta solenoid proteins as "molecular Legos" for applications in self-assembly of nanoparticle based devices and materials.

sapience St therapeutics

Novel therapeutics for major unmet medical needs, particularly high-mortality cancers.



Microelectro and mechanical based chemical sensors and information systems.



platform for

disorder.

Wearable sensing

management of

chronic venous

V I Z Z A R I 🕑

A non-invasive portable screening methodology for diagnosing traumatic brain Injury.

Changing the way we look at disease

MUSE Microscopy, Inc. (MMI) was founded by Richard Levenson,

UC Davis professor and vice chair for Strategic Technologies in the Department of Medical Pathology & Laboratory Medicine, based on a vision to revolutionize the way pathologists identify disease. MMI's technology (UC Case 2014-463), which was jointly developed through research conducted at UC Davis and Lawrence Livermore National Laboratory, has the potential to save pathologists both time and money. Examining patient tissue under a microscope is critical for clinical research and diagnosing disease, but preparing slides for traditional microscopy is costly and time-consuming, taking hours to days. MMI has developed an alternative: a method that uses short-wavelength ultraviolet light and fluorescent dyes to generate high-definition images of tissue features without all the drawbacks of traditional slide and tissue preparation. Levenson credits his STAIR grant as being pivotal in funding the optomechanical design of the prototypes that he and his team have assembled and which are expected to ship to collaborators for further testing. "Without STAIR funding, we would not have had the resources to move forward as we have," he said.

Examining patient tissue under a microscope is critical for clinical research and diagnosing disease, but preparing slides for traditional microscopy is costly and time-consuming, taking hours to days.



MMI has developed an alternative slide preparation method that uses short-wavelength ultraviolet light and fluorescent dyes to generate **high-definition images of tissue features** *without all the drawbacks of traditional slide preparation.*



Developing solutions for neuropathic pain in diabetics

EicOsis (pronounced "eye-cosis"), LLC, a company founded by Distinguished Professor Bruce Hammock, is developing and testing a novel compound intended to alleviate diabetic neuropathic pain (UC Cases 2012-450,2012-488). The condition is a common and painful complication of diabetes that results in nerve damage, typically in the legs and feet.

Current therapies for diabetic neuropathic pain are ineffective in more than three of four patients. "The EicOsis technology may solve a great need in pain treatment by providing a powerful analgesic that avoids the side effects of opioids (narcotics) and nonsteroidal anti-inflammatory drugs (NSAIDs)," said Dr. Scott Fishman, professor and chief of the Division of Pain Medicine, UC Davis Health System, who is not affiliated with the company.

The company received a \$4 million grant from the National Institutes of Health's Blueprint for Neuroscience Research this year to advance the company's drug candidate through Phase 1 clinical trials. The clinical trials, scheduled to begin in 2017, will target diabetic neuropathic pain, which occurs in an estimated fifty percent of the world's 347 million diabetics, and in 29 million Americans.

EicOsis' lead molecule, designated as EC5026, is an orally active and non-narcotic inhibitor of the soluble epoxide hydrolase (sEH) enzyme, and was developed by Hammock, whose fundamental research on the developmental biology of insects led to the discovery. sEH is a key regulatory enzyme involved in the metabolism of fatty acids and is hypothesized to treat pain by stabilizing natural analgesic and anti-inflammatory mediators. "Our lead molecule and close analogs have already been shown to be effective against naturally-occurring moderate-to-severe pain in dogs, cats and horses," said Hammock.

EicOsis is a privately held company based in Davis, CA. The company has exclusively licensed rights to intellectual property developed at UC Davis and maintains a strong patent position with both method-of-use and composition-of-matter protection. **Professor Bruce Hammock** is developing and testing a novel compound **intended to alleviate diabetic neuropathic pain.** The condition is a common and painful complication of diabetes that results in a type of nerve damage, typically in the legs and feet.



EicOsis received a **\$4 million grant from the National Institutes of Health's Blueprint for Neuroscience Research** this year to advance the company's drug candidate through Phase 1 clinical trials.

Making our food safer

The Astrona team is developing a rapid, efficient, and low-cost method to detect and identify specific microbial pathogens including bacteria, viruses and fungi for a number of critical applications. Astrona Biotechnologies, Inc., founded by Bryce Falk, Paul Feldstein, Josh Hihath, Andre Knoesen, Maria Marco, Erkin Seker, Marc Pollack and Jeremy Warren, recently emerged as a new company based on technology developed at UC Davis.

Astrona's technology arose out of a unique UC Davis Office of Research seed-funding program, Research Investments in Science and Engineering (RISE), designed to address specific global research challenges by assembling teams of experts from multiple disciplines. In Astrona's case, the team focused on the need to develop a rapid, efficient and low-cost method to detect and identify specific microbial pathogens, including bacteria, viruses and fungi, for a number of critical applications (UC Case 2016-148). Current technologies for pathogen detection, such as real-time qPCR, require a relatively large quantity of target material and rely on specific assays to identify individual pathogens.

The Astrona team is developing a hand-held device to detect a broad range of pathogens — including foodborne

pathogens like E. coli — at all stages in the food supply chain, from fields to restaurants. Based on a proprietary technology for capturing and amplifying nucleic acid signals for different organisms, the detector will be applicable to a broad range of pathogens, offering potential for use beyond food safety, such as in the medical arena. A participant in the Venture Catalyst START[™] program, Astrona's founders benefited from company formation, assistance in developing its business plan and help with assessing its commercialization strategy. In 2016, the company was selected for investment and participation in the IndieBio startup accelerator in San Francisco.



ASTRONA BIOTECHNOLOGIES, INC. FOUNDERS Bryce Falk, Jeremy Warren, Marc Pollack, Maria Marco, Erkin Seker, Josh Hihath, Andre Knoesen and Paul Feldstein (not shown).



EVOLVE BIOSYSTEMS INC. FOUNDERS

which includes UC Davis faculty members, David Mills, Bruce German, Daniela Barile and Carlito Lebrilla, have been conducting research at the forefront of infant nutritional health for over a decade.





Promoting infant health with novel probiotics and prebiotics

Evolve BioSystems Inc., a spin-off from the UC Davis Foods for Health Institute, completed a Series A round of funding in 2015, securing \$9 million in investment capital.

Based on research that links the type and diversity of intestinal microflora to several important health conditions in the developed world, Evolve is establishing proprietary microbiome technology (UC Cases 2013-877, 2015-193). The company is licensing the technology from the university to improve infant formula given to babies during their first six months of life. With novel probiotics and prebiotics, the company's formula is expected to normalize microbial imbalances that are known to occur in the infant gut.

The company's founding team, which includes UC Davis faculty members Bruce German, David Mills, Carlito Lebrilla and Daniela Barile, has been conducting research at the forefront of infant nutritional health for over a decade, with a focus on understanding the key role of breast milk in creating a healthy intestinal tract. "Completion of the Series A round ahead of schedule is a reflection of both the importance of the ground-breaking discoveries of the company's founders at UC Davis and a compelling business case that focuses on the improvement of the health trajectory for babies worldwide," said David Kyle, CEO of Evolve, in a written announcement. The financing, "would have been much more difficult without the excellent relationship we established with the university," commented Kyle. The investment was led by Hong Kong-based Horizons Ventures Ltd. and supported by seed stage investors in the company, including London-based Tate & Lyle Ventures and angel investors.

UC Davis Venture Catalyst played an instrumental role in this financing round. Venture Catalyst, which supports entrepreneurial university researchers through the startup phase and beyond, facilitated the match between Evolve and Horizons Ventures in conjunction with the university's Foundation Relations team.

Energizing Corporate Engagement

Identifying and cultivating synergistic partnerships between industry and

the university continues to emerge as a powerful platform for driving innovation and translating breakthrough discoveries. These relationships bring researchers and students together with industry leaders in technology and business, establishing a nexus for productive intellectual exchange. They additionally provide unique experiences for students to engage beyond the classroom, help to advance researchers' careers, and identify and coalesce centers of excellence within the university.

The Office of Corporate Relations serves as the enabling link between industry partners and the university, collaborating across the campus to initiate transformative projects. The team works closely with faculty, staff and campus leadership to proactively facilitate a comprehensive approach to building strategic relationships with industry for mutual benefit.

This year, the Office of Corporate Relations supported over 85 active corporate partnerships and initiated 23 new engagements. These collaborations represent a pipeline of ongoing The Office of Corporate Relations represents the university's research enterprise at industry events and conferences, showcasing the strength of UC Davis research and technology development to industry leaders.

and future opportunities for joint research endeavors. Industry sponsored research represents 8% of overall research awards at UC Davis, topping \$63 million this year, an increase of \$4 million over the previous year.

The Office of Corporate Relations represents the university's research enterprise at industry events and conferences, showcasing the strength of UC Davis research and technology development to industry leaders. As an example, the team worked closely with Venture Catalyst to partner with the California Life Science Association in hosting the California Pavilion at the 2016 Biotechnology Innovation Organization (BIO) International Convention in San Francisco, which drew close to 16,000 attendees in the life science arena from around the world. The team facilitated a keynote feature at the



convention with Dr. Bennet Omalu, from the UC Davis Department of Pathology and Laboratory Medicine, whose seminal and ground-breaking research to identify and describe chronic traumatic encephalopathy in football players was showcased in the film "Concussion." Acclaimed actor Will Smith, who played Dr. Omalu in the film, also participated in the keynote panel.

Partnering with a global leader in chemical applications

Scientists at UC Davis are partnering with industry experts at BASF Corporation to investigate a patent-pending microencapsulation technology that protects and improves the performance and delivery of active compounds for broad applications, including industrial, agricultural and cosmetic (UC Case 2010-695).

The technology, which was developed in the lab of Tina Jeoh, associate professor of biological and agricultural engineering, collapses multiple, energy-intensive processing steps into one industrially efficient and scalable spray-drying step that encapsulates active ingredients in Cross-Linked Alginate Microcapsules, or CLAMs. As part of the project, the teams will tune the physical and chemical properties of the CLAMs to optimize protection and shelf-stability of biologically active compounds.

BASF and UC Davis have a longstanding relationship, dating back nearly 20 years, in areas of mutual interest, such as plant sciences, food science and technology, biological and agricultural engineering and the health system. BASF and UC Davis have also teamed together to help train future scientific leaders through the involvement of graduate students and postdoctoral scholars in these types of collaborative research efforts.

"Innovation and sustainability are the main success factors for BASF's longterm growth. In the highly competitive innovation environments we now face, collaboration with external partners such as UC Davis is crucial," said Michael Pcolinski, Vice President Advanced Materials and Systems Research at BASF. "Our goal is to leverage external expertise to match current and anticipated needs."





Launching centers of excellence

In 2015, UC Davis launched the Innovation Institute for Food and Health (IIFH) in partnership with

Mars, Inc. The institute was conceived to accelerate the innovation cycle by forging uncommon collaborations, bringing together experts in nutrition, agriculture and technology to seek solutions for global issues in food supply and health.

"There are countless problems in the food system, ranging from the staggering lack of local food security to malnutrition in developing countries and obesity in developed nations," states Justin Siegel, interim director of the IIFH and assistant professor of Chemistry, Biochemistry and Molecular Medicine at UC Davis. "Many of these issues stem from a lack of understanding of what people should eat, how to package necessary macroand micro-nutrients into a culturally desirable format, and then how to safely and sustainably generate these products."

Siegel adds, "The IIFH is committed to connecting renowned experts here at UC Davis to organizations and communities around the world for development



"The IIFH is committed to connecting renowned experts here at UC Davis to organizations and communities around the world **for development and commercialization of products and processes** that begin to address these systemic issues."

 Justin Siegel, interim director of the IIFH and assistant professor of Chemistry, Biochemistry and Molecular Medicine at UC Davis



and commercialization of products and processes that begin to address these systemic issues."

As one of their first endeavors to bridge cross-sector gaps, the IIFH hosted a series of workshops with academic, industry, government and community participants to solicit insights on common issues and key challenges in food, agriculture and health. The resulting Solution Summit brought together 250 participants with various backgrounds including entrepreneurs, farmers, policymakers, industry executives, researchers, students and technology developers. The outcomes were captured in an open call for innovation, from which nine interdisciplinary projects were selected for funding.

Over the past year, the IIFH has worked to assemble a consortium to broadly represent organizations across the food, agriculture and health sectors. To date, over 15 partners ranging from multibillion-dollar organizations to earlystage ventures have committed to working with the IIFH to build programs that address related global needs.

Establishing global platforms for nutrition and health

and Health Innovation Partnership.

of Corporate Relations, Sponsored

This agreement, facilitated by the Office

Programs and Global Affairs, marks the

beginning of a collaboration to develop

novel and innovative food systems to

improve nutrition and food health for

During a signing ceremony for

the Memorandum of Understanding,

UC Davis Chancellor Linda P.B. Katehi

consumers, especially in China.

UC Davis' Foods for Health Institute, under the directorship of Professor Bruce German, is among the world's leading research centers for nutrition and food health, with milk-related research garnering international acclaim. The Institute's mission is to bring personalized health to practice by developing



assessment tools and a mechanistic understanding of how diet controls health.

With the increasing importance of food security worldwide, the team's expertise has generated interest in collaboration from organizations around the globe, including Mengniu, a leading dairy product manufacturer in China.

In 2015, UC Davis entered into a formal partnership with the company to establish the Mengniu-UC Davis Nutrition



emphasized the depth and breadth of UC Davis' scientific strengths in agriculture, food and nutrition, and the university's unique role in developing new models to bring science to practice through partnerships in innovation. As a global leader in agriculture and veterinary medicine, the partnership aligns with UC Davis' strategy to solve the issues facing the world in agriculture and food products. This agreement marks the beginning of a collaboration to develop novel and innovative food systems to improve nutrition and food health for consumers.

Specific areas of collaboration are expected to include the exchange of trainees and educators, establishment of sustainable research careers, and development of a shared digital data system in milk research, led by the UC Davis Foods for Health Institute.

Developing a rich ecosystem for regional innovation

UC Davis and HM.CLAUSE, a global leader in the production and sale of vegetable seeds, have developed a productive collaboration that continues to breed innovation in our region.

The launch of the UC Davis-HM.CLAUSE Life Science Innovation Center in 2015 provided a much needed resource to support local startups and accelerate innovation. As a startup incubator, the center provides the facilities, technical services and operational support necessary to turn viable ideas into successful businesses. Since its opening, the incubator has become a launchpad for 7 startup companies.



Dr. Cecilia Chi-Ham. Director of Innovation. Intellectual Property, and R&D Strategy at HM.CLAUSE

"The launch of the innovation center was one of the building blocks necessary for creating a strong innovation cluster in our region," said Dr. Cecilia Chi-Ham, Director of Innovation, Intellectual Property, and R&D Strategy at HM.CLAUSE.

"Through our collaboration with UC Davis, and a growing number of new partners, we aim to cultivate and sustain an innovative environment by capturing synergies

between research excellence, entrepreneurial spirit, and investment capital."

Prior to joining HM.CLAUSE, Chi-Ham held roles at UC Davis as Director of Science and Technology at the Public Intellectual Property Resource for Agriculture (PIPRA) and in the UC Davis Seed Central Corporate Affiliates Partnership Program.

In 2016, HM.CLAUSE received the inaugural UC Davis Chancellor's Innovative Community Partner award. This award recognizes a leader or organization in the UC Davis community that has contributed significantly to driving regional economic impact through innovation, entrepreneurship or support for growing a startup ecosystem in collaboration with UC Davis.

"As a collaborative partner, HM.CLAUSE leaves nothing to be desired," said Dushyant Pathak, executive director of Venture Catalyst and associate vice chancellor of Technology Management and Corporate Relations. "The successful operations of the Innovation Center have been enabled by the dedicated support provided by Cecilia and her colleagues, and this success has served as the impetus for the expansion of the Venture Catalyst DRIVE Network to include three new affiliates with complementary business incubation capabilities."



As a startup incubator, the center provides the facilities, technical services and operational support necessary to turn viable ideas into successful businesses.

UC DAVIS-HM.CLAUSE LIFE SCIENCE INNOVATION CENTER

7 STARTUP COMPANIES

ARIZ Precision Medicine

Biological and small-molecule based therapies for cancer and cancer related diseases

BioMobile

Rapid and easy-to-use field testing system to combat mislabeling of sushi and seafood

Buto Biopharma

Diets, supplements and treatments to Increase functional longevity through altered metabolism

Circularis Biotechnologies

Platform technology to customize transcription control sequences and optimize gene expression for a variety of biotechnology applications

EncapSolutions

Nanoparticle capsules for photonic crystal color display in magnetic field

Inserogen

Use of tobacco plants as a manufacturing platform for rapid, scalable and cost-effective production of therapeutics

Verndari

Proprietary formulation and delivery technology to allow the creation of unique vaccines and dramatically change the cost of delivery

Improving Africa's orphan crops and eradicating stunting in children

UC Davis is partnering with Mars, Inc. in a global plant-breeding consortium that is fighting malnutrition and poverty in Africa by improving the continent's traditional food crops. These "orphan" crops have been largely ignored by science because they are not internationally traded commodities, but are the food crops grown in the back gardens of the 600 million people who live in rural Africa.

The initiative was inspired by a presentation by Christine Stewart, assistant professor of nutrition at UC Davis, which highlighted the global issue of stunting a medical affliction resulting from chronic malnutrition that affects a staggering 39% of children in the developing world, and over 130 million children in Africa alone.

The African Orphan Crop Consortium — conceived by Howard Shapiro, a senior fellow in the College of Agricultural & Environmental Sciences at UC Davis and the chief agricultural officer at Mars — has chartered an ambitious goal to map and make public the genomes of 101 indigenous African food crops. The genomic data gathered on crops will help plant breeders improve the nutritional content, productivity and resilience of Africa's most important food resources. The consortium brings together experts from Mars, UC Davis, and a wide range of researchers, industry groups and policymakers. Together, collaborators have contributed about \$40 million of in-kind support to the program.

UC Davis has developed an intensive, hands-on curriculum for the consortium's African Plant Breeding Academy and its state-of-the art genomics laboratory hosted by the World Agroforestry Centre in Nairobi, Kenya. There Africa's best plant breeding scientists and technicians are being trained to use the latest equipment.

By the end of 2016, more than 50 scientists will have graduated. By July 2016, the group had sequenced 26 whole genomes, resequenced 13, and provided transcriptomes for 21.

"Globally, only 57 plants have ever been genetically sequenced," Shapiro notes. "The African Orphan Crops Consortium is adding another 101. Graduates of the Academy are professors and heads of research institutes at the top of their game. They now have the ability to make decisions about plant breeding faster, which will lead to higher yielding and more nutritious plants. All of this is happening to benefit some of

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Spider plant (Cleome gynandra) is one of the crops sequenced over the past year through the African Orphan Crops Consortium and the African Plant Breeding Academy. This data will be used to **improve nutrition**, **yield, resilience and other traits** in this staple crop.

Workforce Development

Students in this program help to connect faculty with corporate partners, support existing partnerships as well as identify and source new ones.

One of TMCR's most rewarding programs has less to do with research and a lot more to do with the future of UC Davis students. TMCR offers several programs that provide practical hands-on training to help our students, scientists and professionals develop their careers. InnovationAccess offers two programs: an externship for law students and an internship for science students. The law student externship program is a formal UC Davis School of Law program run

student externship program is a formal UC Davis School of Law program run through InnovationAccess, where students interested in pursuing careers in patent law receive official credit toward graduation. The program provides an educational component in addition to real-life projects that benefit from interactions with campus inventors and InnovationAccess staff. Activities include patentability evaluation, prior art searches, market assessments, agreement drafting, and legal research. 2016 marks the achievement of an important milestone — the completion of ten years of the program, graduating a total of 55 externs.

The Innovation*Access* science internship program is designed to allow UC Davis Ph.D. students and postdoctoral scholars to learn the process of technology transfer in a university setting and gain



transferrable real-world business skills by assisting experienced intellectual property officers. Projects include evaluating new inventions for potential patentability in multiple technology areas spanning the life sciences, engineering and agricultural sciences. Each intern gets experience preparing invention descriptions for marketing, conducting market evaluations and identifying potential licensees. The program commenced in spring 2013 and has graduated over 20 interns. The Office of Corporate Relations also offers an internship to UC Davis students interested in exploring career paths outside of the research laboratory. With this program, students explore new ways to apply their strong technical backgrounds to a variety of corporate engagements. In this role, they learn to connect faculty with corporate partners, support existing partnerships as well as identify and source new ones.



Josh McGeorge

The InnovationAccess Externship Program with the UC Davis

School of Law is a unique and rewarding experience, unparalleled in the opportunities it creates for those seeking to practice intellectual property law after graduation.

Josh McGeorge, a JD candidate at the UC Davis School of Law, completed the

externship this past year, learning practical applications of patent law and strategy from a team of experts in the field. During his externship, he was able to branch outside of his area of expertise (electronics) to learn about mechanical systems, the biotech industry and plant breeding.

"Working at InnovationAccess gave me a first-hand view of how the university works with a variety of individuals, including outside counsel, startups, established companies and federal and state governments to make sure new technologies reach the greater public," said McGeorge. "I know that I will continue to draw on these experiences for the rest of my career and am confident other participants will have the same benefit."



immunology provided a strong foundation to develop these discussions.

"One of the most critical skills I learned during my time with corporate relations was the importance of working as part of a team," states Edmiston. "Being successful requires collaboration and effective communications, which can best be learned through hands-on experience such as this type of internship."

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Improving Africa's orphan crops

the poorest people on the planet's most malnourished continent."

Through this program, UC Davis faculty travel to Africa and are expected to train 250 breeders over five years. Graduates are already becoming active partners in the orphan crop effort.

Daniel Adewale, plant breeder with the Ondo State University of Science and Technology in Okitpupa, Nigeria, graduated last year. He is using the skills he learned to improve the African yam bean, increasing its essential amino acid content and reducing its cooking time. "By helping breeders improve these forgotten crops, I believe the African Orphan Crop Consortium will cure malnutrition in Africa," Adewale said.

The group collaborates with researchers all over the world, and all of its sequence information will be posted to the internet and offered free to anyone, on the condition it not be patented. "Because we share all our information, we can build on each other's research," said Allen Van Deynze, professional researcher with the UC Davis Department of Plant Sciences and a founding member of the consortium, who visits Nairobi each year as part of his commitment to teaching in the academy.



Elizabeth Edmiston

Elizabeth Edmiston, a 5th year Ph.D. candidate in the lab

of Professor Judy Van de Water, completed a 9-month internship with the Office of Corporate Relations in 2016.

While it was her fascination and enthusiasm for immunology that attracted her to UC Davis, she found many opportunities on campus beyond research and coursework that would help her obtain the skills needed to achieve her objective of effecting societal impact through her field of study.

Edmiston's research focuses on the maternal humoral immune system during pregnancy and its effects on neurodevelopment, specifically as it relates to autism spectrum disorder (ASD).

During her time with the corporate relations team, Elizabeth worked to advance partnerships with biopharmaceutical companies by helping them to identify and connect with campus experts. Her research training and understanding of

UC Davis Licensing Academy

The UC Davis Licensing Academy is a two-week program, offered annually

since 2012. It provides an intensive curriculum to help international lawyers, technology managers and scientific professionals develop a better understanding of successful IP practices and management models in the United States. Participants learn strategies and tactics to maximize the commercial success and public benefit of investments in research and development.

The academy is hosted by the UC Davis International Law Program and the UC Davis Public Intellectual Property Resource for Agriculture, led by Associate Dean Beth Greenwood and Professor Alan Bennett, respectively. It covers topics such as U.S. and international patent protection, IP management for commercialization, licensing, negotiating international agreements and strategies for establishing startups and spin-offs based on technologies generated by the university.

TMCR provides instructional support during the program, delivering lectures on topics concerning patenting, licensing, technology transfer, marketing and entrepreneurship.

Participants for this year's program included 35 professionals from 19 countries.



TOP Students meet in workgroups throughout the Licensing Academy to complete case studies and exercises

RIGHT 2015 Licensing Academy students and participants





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