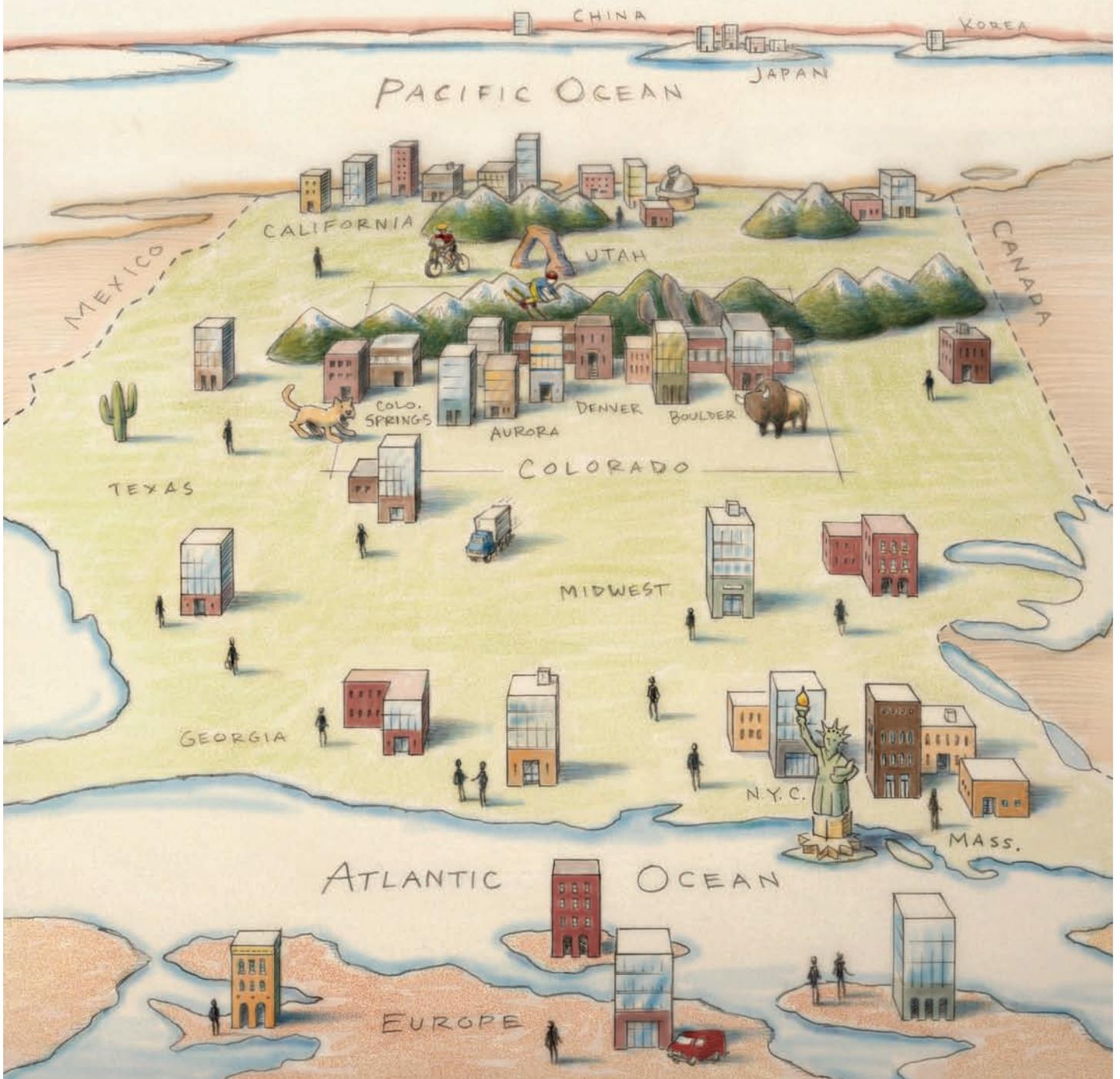


# University of Colorado Technology Transfer Office

Annual Report 2005-06

*Local Impact. Global Reach.*





## The University of Colorado Technology

**Transfer Office** (TTO) is on the move, continuing to turn ideas developed by university researchers into patentable intellectual property and marketable business opportunities. In the past five years, CU invention disclosures, patent applications, and start-up companies have increased dramatically. Revenue has increased tenfold, enabling us to re-invest in the important endeavor of fostering future invention.

Start-up companies have emerged from the work of CU researchers across a variety of fields—developing innovative, more effective cancer treatments; pushing the boundaries of nanotechnology to create miniaturized wireless and batteryless devices with a wide range of applications; and creating orthopedic devices that will help patients recover from anterior cruciate ligament surgery.

The TTO has grown into a sophisticated operation, with an established culture across the university that allows our best minds to discover, to invent, and to apply their work far beyond the university's boundaries. CU researchers continue to find new ways to improve the human condition, and the TTO continues to serve as a vital link between their groundbreaking work and its impact on the world.

Best regards,

A large, black, handwritten signature that reads "Hank Brown". The script is fluid and cursive, with the first letters of "Hank" and "Brown" being significantly larger and more prominent.

Hank Brown  
President

### On the Cover

John Martin is an illustrator and graphic designer who studied at the University of Colorado at Boulder and the Art Institute of Colorado. His clients have included *Westword*, *New Times-Phoenix*, *Zymurgy Magazine*, Rock Bottom Brewery, Love and Logic Institute, Wild Oats, Alfalfas, Celestial Seasonings, and CU-Boulder. The buildings in the cover illustration represent the locations of CU technology licensees.



Founded in 1876 with a campus in Boulder, the University of Colorado includes three unique universities offering more than 300 degree programs. The combined fall 2006 enrollment of the Boulder, Colorado Springs, and Denver and Health Sciences Center campuses was 52,122 (39,207 undergraduate and 12,915 graduate); 41,329 (79 percent) were Colorado residents. CU awarded a total of 12,536 degrees in fiscal year 2005 (8,141 baccalaureate, 3,522 masters, 354 doctorate, and 519 first professional). Nomenclature used throughout this report refers to the fact that, as of July 2004, the two campuses in Denver and Health Sciences Center administratively merged into one.

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# The Maturation of Technology Transfer at the University of Colorado

During the fiscal year starting July 1, 2005 and ending June 30, 2006 (FY 2006), CU research investigators continued their productive endeavors of securing peer-reviewed federal funds to support research. In FY 2006 CU received \$640 million in overall research awards. Of this \$632 million, just under 75 percent was obtained from federal sources. Continual advancement of science, technology, and medicine is essential for technology transfer; without new inventions from research TTO has no assets to protect and subsequently transfer to industry. Commensurate with CU's robust research enterprise, this report chronicles the continued growth of technology transfer at CU.

Research does not translate into IP assets by chance, far from it—for technology transfer to succeed it takes world-class research investigators, a responsive policy and administrative infrastructure, modern research equipment and facilities, supportive administrators, and an overall robust academic environment. All of those internal forces are necessary, but not sufficient for technology transfer success. Strong external forces such as those evident in Colorado's technology-centric entrepreneurial community must be and have been supportive of CU's Technology Transfer Office (TTO) and its programs. In many regards, CU and Colorado's economy are a perfect match—one that will continue to accelerate the production of considerable social and economic benefit derived from successful CU technology transfer.

Just as technology transfer at CU is flourishing, the business of technology transfer at CU is growing and evolving. The fundamental technology transfer mission has not changed—to secure IP and get it into use. What has changed due to a maturing operation are the strategies and tactics. At CU this is due to an increased sophistication of investigators, administrators, and the TTO staff, as well as a favorable technology transfer financial situation. Business leaders in the innovation adoption sector have come to realize that universities are a rich source of new technology, and those that understand and deploy university intellectual assets place themselves at a relative competitive advantage.

These forces internal to CU and externally in the Colorado business community have led to increasingly multifaceted relationships that go beyond the complexity of single license agreements. Today, many university-company technology relationships also involve sponsored research, access to university resources such as facilities and faculty mind share, university ownership stakes in new company licensees, and in a few cases even university investment in new company licensees. In a similar vein, universities have moved beyond the patent and license role to include mechanisms to help mature nascent IP assets. Technology development and pre-clinical research projects, which typically are undertaken with relatively small amounts of money compared to federal basic science research awards, are generally not eligible for federal or industrial funding. Research projects of this type can validate technological ideas, add or reinforce patent application filings, tie scientific findings and inventive perspectives to commercial drivers, and fundamentally reduce early technological risks. In return, universities expect to receive financial benefit for their IP maturation activities through higher financial licensing terms.

Throughout this report you will see many examples of CU research excellence, focused collaboration with the Colorado business community, and deployment of state-of-the-art technology transfer practices—all in a context of entrepreneurial energy focused on delivering value to the university and the communities it serves.

## **Mission Statement**

The mission of the CU Technology Transfer Office (TTO) is to aggressively pursue, protect, package, and license to business the intellectual property generated from the research enterprise and to serve faculty, staff, and students seeking to create such intellectual property.

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## Major CU Technology Transfer Stories, July 1, 2005 to June 30, 2006

**TTO Proof of Concept programs deliver over \$1 million to CU inventors and start-ups.** At research universities a funding gap exists between inventions that exhibit commercial promise and adoption of the technologies by the commercial sector. Given TTO's current good financial resource situation, TTO augmented its Proof of Concept investment (POCi) program started in FY 2004–05 with a new Proof of Concept grant (POCg) program. During FY 2006, TTO directed \$552,550 to CU inventors through the POCg program and \$500,000 through the POCi program to five start-up companies based on CU IP, with the majority of the \$500,000 in POCi funds directed back to CU laboratories as sponsored research. The POCg program was used to support 29 pre-commercial research projects, 14 projects at the \$25,000 level, five projects at the \$20,000 level, and 10 projects at the \$10,000 level.

**State government steps up to address the bioscience funding gap.** The two abovementioned TTO POC programs received a significant boost with the passage of a state of Colorado bioscience bill entitled "Advancement of New Bioscience Discoveries at Colorado Research Institutions through Evaluation and Making an Appropriation." Support for the bill was catalyzed by the Colorado Bioscience Association, the Governor's Office of Economic Development and International Trade, and Colorado's research institutions. This bill provides nearly \$2 million of state funds to be used on a one-to-one matched basis for pre-clinical development research to accelerate commercialization by reducing therapeutic, diagnostic, and medical device inventions to operational practice and validating their ability to address significant market applications. CU's preallocation of the funds is \$1.03 million. Commercialization potential from the selected research projects should be realized by companies operating in Colorado. The research selection process occurs in Fall 2006 with CU's \$1.03 million institutional match provided by TTO and the CU Foundation.

**Two technology business incubators scale-up operations and work with TTO.** Late in FY 2005 two new business incubators were taking shape—the Boulder Innovation Center (BIC) and the Fitzsimons BioBusiness Incubator (FBBi). In the past year both have scaled up operations, in part supported by deal flow from start-up companies that are based on CU IP. The BIC has created a process for assisting TTO to manage CU student intern involvement in business planning, accessing community experts to assess inventions primarily from the Boulder campus for commercial opportunity, and identifying management and early funding for start-ups created from CU-Boulder inventions. For bioscience start-ups, FBBi addresses the same issues in a slightly different manner than BIC, but with the same purpose of helping to launch and initially capitalize sustainable companies. Success from the two business incubators has been clearly evident and both continue to scale-up operations to meet an increasing deal flow.

**Capital continues to flow into companies started based on CU intellectual property.** Four primary sources of investment capital flowed into companies formed based on CU IP. Perhaps most notable was the initial public offering of Replidyne, Inc. in late June 2006, which raised \$45 million. Other CU licensees received capital infusions from three different sources: institutional venture capital financings for four companies, private capital investments for four companies, and Small Business Innovation Research (SBIR) grant funding for 12 companies. Additionally, one of the public companies created based on CU IP, Eyetech Pharmaceuticals Inc., was purchased by OSI Pharmaceuticals, a company with significant operations in Colorado.

# Perspectives on the 2002 Strategic Plan

As reported in the last TTO annual report, the CU technology transfer strategic plan developed in June 2002 remains a viable roadmap for TTO's future. TTO's guiding principles as stated in the plan (*see box*) are enduring and the course of action has served to direct development of new initiatives such as the TTO Proof of Concept programs and relationships with business incubators.

The background context for the 2002 plan was provided by a benchmarking analysis of the eight public universities that are the most similar to CU. Last year we reported that on four of the five major metrics of performance, CU's growth rate is outpacing its peer institutions—invention disclosures, licenses and options, revenue, and start-ups. This growth process for TTO continued for FY 2005 and will likely be the case for FY 2006 (data are not yet available for the peers).

Two areas of CU TTO excellence are noteworthy. CU TTO is the leader in number of start-up companies formed from university IP. Anecdotal evidence also suggests that CU-related start-ups have the highest rate of continued operations, (i.e., lowest percentage of failure). The second area in which CU TTO excels is managing patent costs. Essentially, among the eight peers, CU TTO is the most cost efficient in prosecution of patent applications. The overall theme of CU TTO working with Colorado's entrepreneurial technology-centric business community plays out in many ways—from success in start-up companies to high-quality patent attorneys (most of TTO's legal work is with Colorado law firms). Similarly, TTO's team diligently reviews and employs technology transfer best practices, especially ensuring start-up licensees have a viable business strategy and capable management, and conducting considerable patent analysis prior to engaging patent attorneys.

## **The Guiding Principles for CU Technology Transfer**

- Build confidence among university inventors to increase invention disclosures
- Execute technology licenses and other agreements that protect university interests while being fair and industry approachable
- Ensure public accountability and integrity while operating in an entrepreneurial fashion
- Obtain for CU appropriate economic and social returns on IP
- Support the university research community in all aspects of intellectual property including securing research grants and contracts related to IP they create
- Bring students into the technology transfer process and support the instructional mission
- Contribute to the economic development of Colorado

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## TTO Communicates with the University and the World

It is an understatement that university technology transfer is an esoteric field. Research investigators typically pick up knowledge about technology transfer through experience. Only recently have universities offered courses on the topic. Given this context, CU TTO must assume the responsibility to provide information about technology transfer to many different audiences. This annual report, now in its fifth edition, is one of our primary communication outlets. It will be distributed to over 5,000 people.

Since July 2004, TTO has distributed an electronic newsletter 10 times per year. The newsletter explores stories about CU technology transfer, university technology transfer in general, and news and resources about technological innovation (to subscribe send a message to [ttonews@cu.edu](mailto:ttonews@cu.edu)). The newsletter is augmented by occasional e-mail blasts, mainly to the CU community, and short items in campus electronic bulletins and related outlets. We have also recently updated our website look and feel; visit it at [www.cu.edu/techtransfer](http://www.cu.edu/techtransfer).

TTO's staff gives dozens of presentations to students in the classroom; research investigators in seminars; local, state and national technology audiences; and peers at national association meetings. We convey issues and progress through updates to senior university administrators. Once per year an update on CU technology transfer and University License Equity Holdings, Inc. (ULEHI) is presented to the University of Colorado Board of Regents.

During FY 2006, CU technologies, either available for licensing or licensed to new companies, were presented at technology showcase events. Three of the most notable are the Colorado Software and Internet Association (CSIA) showcase of Colorado's most innovative technology companies; Esprit Entrepreneur, a series of events organized by the Boulder Chamber of Commerce that celebrates entrepreneurship in the Boulder Valley, where eight CU companies were showcased; and Biowest 2005, the only conference and trade show dedicated to the bioscience industry in the Rocky Mountain region. CU technologies were presented at a poster session and CU companies competed in the venture showcase.

The Colorado public has always expected its institutions to function in an open and ethical environment. The new administration's approach to accountability and transparency are creating an increasingly positive reputation for CU. News stories about technology transfer have contributed to favorable recognition of the university. During the past year, CU technologies and technology transfer were covered, and often featured, in all the major newspapers and business press outlets along Colorado's Front Range.

An essential aspect of university technology transfer is marketing IP to companies that are innovative adopters of technology. Invention disclosures that pass an initial internal patentability review are directly marketed to companies in the relevant field. Information on inventions is conveyed via letters, e-mails, phone calls, and visits to companies that have been identified through searching many public and proprietary electronic databases and Internet search engines. TTO markets available CU IP through a search function on the TTO webpage. Among all the marketing approaches used, the most productive leads are provided by inventors. In sum, successful technology transfer today is not just "know-how," it is also "know-who."

## Overview of CU Inventions from Fiscal Year 2006

The disclosure of an invention by a CU research investigator is a key starting point for the technology transfer process. Over the past few years the invention disclosure rate has continued to increase, with 198 inventions reported to TTO during FY 2006. Investigators associated with each campus delivered more invention disclosures than the previous year. In FY 2006, 51 percent of the invention disclosures were inventors from CU-Boulder, 37 percent from CU-Denver and Health Sciences Center, seven percent from CU-Colorado Springs, and six percent were jointly submitted by inventors from CU-Boulder

### Types of Inventions by Major Category

Bioscience %		Physical Sciences/Engineering %	
Therapeutics & Drug Targets	39	Software	36
Diagnostics	17	Chemicals and Materials	16
Devices	10	Mechanical	17
Drug Delivery	12	Optics & Electronics	12
Research Tools	20	Micro/Nanotechnology	4
Other	2	Other	15

and CU-Denver and Health Sciences Center. Of the nearly 200 inventions submitted, 62 percent are bioscience-related and 38 percent are physical sciences/engineering-related. The table on the left identifies the sub areas of invention disclosures by the two major categories.

## A Sampling of CU Inventions from Fiscal Year 2006

Patients who develop head and neck cancers (e.g., tobacco-related cancers in the mouth and throat) undergo extensive radiation treatment. This radiation treatment leads to destruction of salivary gland tissue and development of a syndrome known as xerostomia, or “dry mouth.” **Steve Anderson**, Professor in the CU-Denver and Health Sciences Center Department of Pathology and director of the Biomedical Sciences Program, and **Kirsten Limesand**, formerly of the Department of Pathology and currently an assistant professor in the Department of Nutritional Sciences at the University of Arizona, have discovered that the destruction is actually a cell death mechanism mediated by the protein Akt-1, which is activated by IGF-1. IGF-1 pretreatment of salivary tissue has been shown by Dr. Anderson to protect salivary tissue from radiation-induced damage, thus preventing onset of xerostomia.

**Corrella Detweiler**, Assistant Professor in the CU-Boulder Department of Molecular, Cellular, and Developmental Biology, and graduate student **Sara Symons** have developed *S. Typhimurium* bacterial strains that can potentially be used to deliver cancer therapeutics directly to tumors. *S. Typhimurium* can colonize both large and small tumors, including metastases, and is genetically manipulable, which makes it attractive as a therapeutic drug delivery vehicle.



Online backup of SCSI disk data over Internet SCSI (iSCSI) is emerging as an important cost-effective technique for backing up enterprise data and for disaster recovery in enterprise networks. In the CU-Colorado Springs Department of Computer Science, Professor **Edward Chow** (pictured) and graduate student **Murthy Andukuri** have designed an innovative, efficient asymmetric secure iSCSI system to keep data encrypted on a server and to decrypt data only upon demand. The system is secure since data access requires possession of the hardware itself, and the encryption key is controlled on the client side.



Professor **Kristi Anseth** of the CU-Boulder Department of Chemical and Biological Engineering and postdoctoral fellow **Chuck Cheung** have developed an encapsulation system for isolated pancreatic islets, which may lead to successful transplantation therapy for diabetes by alleviating rejection of grafted insulin-producing tissue. Encapsulation of islets within a semi-permeable polymeric membrane protects islet cells from destruction by autoreactive T cells, but does not protect them from exposure to cytokines and other small, diffusible cytotoxic molecules produced by activated immune cells. By attaching fas receptor binding agents to the encapsulating matrix, the encapsulation system can induce cell death in nearby T cells, thereby protecting encapsulated islets from rejection via localized immuno-suppression.



**Gary Brodsky**, assistant professor in the Division of Medical Oncology, Department of Medicine, CU-Denver and Health Sciences Center, has identified a biological compound that signals stem cell activation and differentiation. Previously shown to promote myoblast activation and differentiation and the growth and repair of cardiac and skeletal muscle tissue, and as a treatment for cardiac and skeletal muscle disorders, this compound possesses

a broad ability to induce the differentiation of other stem cell types. *In vitro* application of the compound to stem cells resulted in their differentiation into striated heart muscle tissue and skeletal muscle fibers, thus creating potential for stem cell-mediated disease therapies and tissue and organ engineering at the molecular level.

**Douglas Gin** and **Richard Noble**, both professors in the CU-Boulder Department of Chemical and Biochemical Engineering, have synthesized surfactants that form nanoporous structures in room temperature ionic liquids (RTILs). RTILs are organic salts that exist as a liquid at or below 100° C. They have very low volatility, relatively low viscosity, high thermal stability, low flammability, high ionic conductivity, and, as such, are excellent candidates as environmentally benign solvents. Potential applications for the resulting nanocomposites include nanofiltration, gas separations, vapor barrier materials, ion conduction, protein anti-fouling, electrochemistry, and catalysis.

Associate Professor **James Goodrich** and his laboratory group in the CU-Boulder Department of Chemistry and Biochemistry have developed a set of assays that can be used to screen for highly specific immunosuppressive drugs. Such drugs, which could avoid the negative side effects associated with non-specific activities of current immunosuppressive drugs, would be powerful tools for treating and improving the lives of transplant or other immuno-compromised patients.

Professor **Josef Michl** in the CU-Boulder Department of Chemistry and Biochemistry has identified a new method for the polymerization of olefins, such as polyethylene and polypropylene. Unactivated terminal alkenes, such as ethylene and propylene, are ordinarily stable indefinitely at room temperature in air, and much effort has been directed at improving their polymerization, such as the use of transition metal catalysts. Professor Michl's research has shown that a lithium carborane catalyst has the ability to prepare polymers and copolymers under milder reaction conditions than are currently possible.



**Karen Newell** (pictured), Associate Professor of Biology at CU-Colorado Springs, and **Ronald Gill**, Associate Professor of Microbiology at CU-Denver and Health Sciences Center, have discovered a novel anti-tumor activity produced by the soil bacterium *Myxococcus xanthus*. The substance has demonstrated the ability to induce cell death in tumor cells, while being relatively harmless to normal human cells. Isolation and identification of the

active compound could lead to a new therapy for cancers that are drug resistant.



CU-Denver and Health Sciences Center Professor of Biochemistry **John Stewart**, Director of the Program in Biomolecular Structure and Professor of Biochemistry and Molecular Genetics **Robert Hodges** (pictured), and Professor of Microbiology and Immunology **Randall Irvin** have isolated a peptide secreted by *Pseudomonas* bacteria that is a potent inhibitor of biofilm formation. Biofilms

are complex aggregations of microorganisms that attach to surfaces through a secreted polymeric matrix that provides protection, adhesion, and communication among the members of the surface-bound microorganisms. Biofilms are problematic in medical situations (contamination of catheters, IV needles, surgical trays, and beds), industrial applications, and the food industry. The isolated peptides bind tightly and perhaps irreversibly to stainless steel, polyvinyls, and other plastics and inhibit adherence of microbes to those surfaces.



**Robin Shandas** (pictured), Associate Professor in the departments of pediatric cardiology at CU-Denver and Health Sciences Center and mechanical engineering at CU-Boulder, in collaboration with Associate Professor **Jean R. Hertzberg** and graduate students **Hariong Zheng** and **Lingli Liu** in the CU-Boulder Department of Mechanical Engineering, created a non-invasive method to measure multiple velocity components of blood flow, technology that could be extremely

useful for hemodynamic diagnostics. Accurate measurement of fluid shear stress in arteries is essential as a prognostic aid and for assessment of disease and treatment progression.



RGD is the single letter code for arginine-glycine-aspartate. Soluble RGD peptides induce apoptosis and may be used as drugs against angiogenesis, inflammation, and cancer metastasis.

**Michael Vasil** (pictured), Professor in the Department of Microbiology at CU-Denver and Health Sciences Center, and his collaborator, Dr. Marcia Moses at the Boston Children's Hospital,

have discovered and characterized a novel RGD molecule with potency at very low (i.e., picomolar) concentrations. The discovery presents the opportunity for low-dose local delivery of antiangiogenic compounds.

**Jun Ye**, JILA Fellow and Adjunct Professor of Physics at CU-Boulder, and co-workers have created a highly sensitive and rapid technique for molecular detection called "Broadband Cavity Ringdown Spectroscopy." Spectroscopic systems have three desired characteristics: (1) large bandwidth, which allows the identification of many molecular species; (2) high resolution, which allows the identification of individual spectral features and trace analysis; and (3) fast data acquisition time. Through use of a femtosecond frequency comb for wide bandwidth coverage, a high-finesse cavity for ultrasensitive detection, and a detection scheme for high-resolution and real-time information recovery, the new instrument is capable of analyzing a wide range of visible or IR spectral bandwidth at high sensitivity and with rapid data acquisition time.

# The TTO Proof of Concept Grant (POCg) Program

In the fall of 2005, a competitive funding program was initiated by TTO—the Proof of Concept Grant Program (POCg). The POCg provides awards to enable the development and validation of promising CU inventions that are, or will become, suitable for commercialization. For example, three categories of disclosures for which a relatively small amount of research funding may yield a dramatic increase in value for the invention are:

- Advancement of hypothesis testing—testing an idea or *in silico* prediction with *in vitro* experiments, extending *in vitro* results with *in vivo* experiments, or building a bench prototype;
- Target validation—screen small molecule libraries, produce antibodies, or select target-binding peptides or aptamers; and
- Pre-commercial research—validating academic software code for commercial application, drug formulation, or alternative applications for technology.

The inaugural solicitation for the POCg, fall 2005, attracted 41 proposals and yielded 13 funded projects across all three campuses. Proposals ranged across scientific disciplines and included therapeutics (four projects), medical devices (three projects), mechanical devices (three projects), and software (three projects).

The second POCg solicitation, Spring 2006, attracted 33 proposals and 15 were funded. Diverse disciplines were represented including therapeutics (two projects), diagnostics (three projects), medical devices (two projects), biotechnology (three projects), mechanical devices (one project), analytical instruments (two projects), and software (two projects).

## Fall 2005 Awards at the \$25,000 Level

### CU-Boulder

**Bryan Pellom**, Center for Spoken Language Research, “Knowledge in Audio.” Web-based audio-to-text and search/indexing engine.

**Carl Koval**, Chemistry and Biochemistry, “Electrochemical Pump.” No-moving-parts pump capable of creating several atmospheres of pressure.

**Tad Koch**, Chemistry and Biochemistry, “Targeted Doxazolidine.” Targeted cytotoxic chemotherapeutic agent. Unique, patented doxorubicin analog and linker attached to a variety of tumor-targeting chemical moieties.

**Garret Moddel**, Electrical and Computer Engineering, “Production of Hydrogen via Water Splitting.” Envisioned is a device for producing energy from electromagnetic radiation through the incorporation of solar cells.

**Kevin Gifford**, BioServe Space Sciences, “BioNet, a Wireless Middleware Architecture,” which connects heterogeneous wireless devices and protocols. The first application is to consolidate data from wireless medical devices and sensors into a unified data management and analysis platform.

### CU-Denver and Health Sciences Center

**Rock Levinson**, Physiology and Biophysics, “Implantable Biogenerator.” Normal physiological processes, such as nerve impulse propagation and maintenance of a cell membrane potential, involve the conversion of chemical energy into an electrical potential, which could power medical devices.

**Jan Kraus**, Pediatrics, “Enzyme Therapy in Hyperhomocysteinemia.” Crystathionine beta synthase (CBS) is important in maintaining optimal physiological homocysteine levels, which are related to a person’s health condition. This work focused on producing large quantities of CBS in a mouse model that mimics elevated homocysteine levels.

### CU-Colorado Springs

**Karen Newell**, Institute for Bioenergetics, and **Ronald Gill**, Department of Microbiology, CU-Denver and Health Sciences Center, “Novel Anti-tumor Compound.” Described earlier in the sample invention disclosures.

## Fall 2005 Awards at the \$10,000 Level

### CU-Boulder

**Rodger Kram**, Integrative Physiology, “Leg Swing Assist.” A simple assistive device for walking rehabilitation. The device is designed to replace a team of physical therapists with a treadmill-mounted device.



**Dale Lawrence**, Aerospace Engineering, “Hoverbird.” A vertical design unmanned aerial vehicle. The vehicle combines a unique vertical take-off design with pusher propellers that can enable forward flight.

**Chris Link**, Institute for Behavioral Genetics, “Probe for Misfolded Proteins.” Heat shock proteins can bind misfolded proteins. An optimized protocol may be useful for diagnosing human diseases that can be characterized by misfolded proteins.

### CU-Denver and Health Sciences Center

**Robin Shandas**, Pediatric Cardiology, “Shape Memory Polymer Stent.” The polymer stent design can be drug-impregnated to a 1,000-fold extent relative to modern polymer-coated metal designs. The shaped memory polymer also allows for a reduced-size design that can expand to full size upon proper positioning, with concomitant heating, in a blood vessel.

### CU-Colorado Springs

**Ed Chow**, Computer Science, “Facilitating the Sharing of Secure Information.” Described earlier in the sample invention disclosures.

## Spring 2006 Awards at the \$25,000 Level

### CU-Boulder

**Dave Walba**, Chemistry and Biochemistry, “Heterogeneous Asymmetric Catalyst Discovery Using Liquid Crystals (LC).” The envisioned system is an array device, similar to recently commercialized LC video microdisplays, in which each pixel comprises a reaction vessel and analysis cell. Stereochemically pure catalysts attached to the surface of each pixel may enable combinatorial discovery of asymmetric catalysts.

**Jun Ye**, JILA, “Broadband Cavity Ringdown Spectroscopy for Rapid and Sensitive Molecular Detection.” Described earlier in the sample invention disclosures.

**Rob Batey**, Chemistry and Biochemistry, and **Jeffrey Kieft**, CU-Denver and Health Sciences Center, “RNA Purification by Nondenaturing Affinity Chromatography.” A method has been designed (and is to be optimized) that is capable of producing extremely pure RNA samples while avoiding denaturation of the native folded state.

**Chris Bowman**, Chemical and Biochemical Engineering, “Redox-initiated Radical Chain Polymerization for the Detection and Amplification of Biological Recognition Events.” This project couples nucleic acid hybridization events with radical chain polymerization, thereby enabling direct (ideally visual) and extremely sensitive detection of target-binding events.

### CU-Denver and Health Sciences Center



**Tom Anchordoquy**, Pharmaceutical Sciences, “New Treatment for Schizophrenia.” This project optimizes a formulation for clozapine that is compatible with intracerebroventricular (ICV) delivery and monitoring efficacy in a mouse model.

## Spring 2006 Awards at the \$20,000 Level

### CU-Boulder



**Natalie Ahn**, Chemistry and Biochemistry, “Mediator of Rho-dependent Invasion (MRDI).” Expression of MRDI is necessary for metastatic cancer cell invasion. This research further characterizes MRDI, and examines the effects of modulating MRDI expression in xenograph models.

**Ron Cole**, Center for Spoken Language Research, “Scalable Internet-based School Delivery Model for Foundations to Literacy™.” This project modifies and optimizes delivery of the Foundations to Literacy program, which is a scientifically based interactive reading program, to be deployable in public school classrooms.

### CU-Denver and Health Sciences Center



**Douglas Graham**, Center for Cancer and Blood Disorders, “Development of a Diagnostic FISH Assay for Mer Cytogenetic Abnormalities in Lymphoblastic Leukemia and Lymphoma.” Fluorescence In-Situ Hybridization (FISH) can be used to detect chromosomal abnormalities. A FISH assay for Mer, which is a receptor tyrosine kinase oncogene, could be used to monitor leukemia and lymphoma, which are conditions associated with Mer overexpression.

**Robin Shandas**, Pediatric Cardiology, “Development of a Cardiovascular Shape-Memory Polymer Stent-Graft for Treatment of Abdominal Aortic Aneurysm.” This project optimizes development of shape memory polymer stents for the designated disorder.

### CU-Colorado Springs

**Zbigniew Celinski**, Physics, “Development of Electrically Controllable Liquid Crystal Phase Retarders Operating in UV.” The project aims to provide a reliable method to orient liquid crystals for their stable operation in UV light, and to develop liquid crystal electrically controllable phase-retarding devices that operate in UV.

## Spring 2006 Awards at the \$10,000 Level

### CU-Boulder



**Ryan Gill**, Chemical and Biochemical Engineering, “Construction of a New Tool for *E. coli* Strain Optimization.” Production of succinate by *E. coli* through identification of genes that increase production and tolerance.

### CU-Denver and Health Sciences Center

**Josh Abram**, School of Education and Human Development, “The Colorado Consortium for Data Driven Decision (C2D3).” This work further develops the system to help classroom teachers develop the skills and dispositions of information-based educational practice through research-based professional development, coaching, online instruction, and the development of professional learning communities.



**Jeffrey Holt**, Pathology, “Defective BRCA2 Signaling in Ovary and Prostate Cancer.” This project focuses on development of a simple diagnostic method to identify BRCA2-like sporadic breast, ovary, and prostate tumors.



**Charles Little**, Emergency Medicine, “The Difficult Airway Tube (DAT), a Novel Endotracheal Tube.” The focus of this work is to develop an expandable endotracheal tube, which is smaller in diameter than conventional ones, thus allowing easy placement.

**Jerome Schaack**, Microbiology, “Development of Improved Adenovirus Gene Therapy Vectors.” This project focuses on creation of adenovirus vectors of limited innate inflammatory potential.

## The Role of License Options in Technology Maturation and Licensing

University technology transfer is a process that starts in the research laboratory with an invention and ends with a patent expiration and consequential termination of a license that generates royalty. Between these two bookends are hard work, time, and money. Although the process is typically described in a linear fashion, it is far from that. The path to commercialization is in reality circuitous, and success is not the norm. Given this environment, TTO is constantly seeking ways to break down the process into manageable steps that add value for the university and reduce risk for prospective licensees. An exclusive option to an exclusive license does precisely that. A company that options CU IP has an opportunity to assess the technical and commercial opportunity without TTO approaching others, and TTO has a chance to work with a prospective commercial partner while that company covers the expenses of the IP during the option period, typically six to nine months. Over two-thirds of options convert to exclusive licenses. Two examples of the 19 options executed in FY 2006 follow.

**Endocyte, Inc.**, a company based in West Lafayette, Indiana, executed an exclusive option with CU for a monoclonal antibody against alpha folate receptor developed in the laboratory of **Wilbur Franklin**, Professor, Department of Pathology, and **Fred Kolhouse**, Professor, Department of Hematology, CU-Denver and Health Sciences Center. If converted to an exclusive license, Endocyte will use the monoclonal antibody to develop and validate a diagnostic test.

**Zenwa, Inc.** of Massachusetts executed an option to exclusively license a patent-pending polymer waveguide array technology developed by **Robert McLeod** in the Department of Electrical and Computer Engineering at CU-Boulder. If converted, the eventual license will be in a field of use that includes Zenwa’s newest product, a personal eyeglass-mounted display, as well as for generic endoscope applications.

## Two Front Range Business Incubators that Connect Entrepreneurs and Business Experts with TTO and CU IP

In FY 2006, TTO's ability to leverage local resources in supporting the launch of successful new companies was greatly enhanced by the creation of two business incubators with close ties to TTO: the Fitzsimons BioBusiness Incubator (FBBi) and the Boulder Innovation Center (BIC). Both have enabled CU start-ups to connect to a network of business advisors and entrepreneurs with extensive new venture creation, product development, and fundraising experience in their relevant technology areas.

The Fitzsimons BioBusiness Incubator (FBBi) was created to accelerate the growth of Colorado's bioscience cluster by identifying the most promising technologies and "incubating" start-up companies formed to commercialize them. **David Drake**, Director of the FBBi, and formerly of the TTO, has worked closely with the TTO to develop a comprehensive program designed to accelerate the success of entrepreneurial bioscience spinouts from the university. FBBi's assistant director is **Adam Rubenstein**, a former CU biological sciences research associate and intern at TTO.

TTO and other FBBi stakeholders have come together because they recognize the potential of bioscience, both as an investment opportunity and as a critical component of building a sustainable bioscience cluster in the state that will have a locus of activity at the Fitzsimons Bioscience Park. FBBi volunteers fall into three areas: Advisors, who meet monthly and help select and advise the clients FBBi serves; Catalysts, who act as mentors to companies seeking to become clients; and Network Volunteers, who are called upon for specific knowledge or expertise needed to evaluate a particular technology, make an introduction, or serve clients pro bono as professional service providers. Approximately one third of the clients in the FBBi portfolio are companies emanating from IP assets created at the University of Colorado.

The Boulder Innovation Center (BIC) advisory group is especially strong in the area of software. **Doug Collier**, President of the BIC, has organized a network consisting of the top serial software entrepreneurs in the Boulder and Denver area, most of whom are interested in working with CU computing and software technologies at the very early stages. Doug is assisted by **Eric Gricus**, a recent CU-Boulder Leeds School of Business MBA graduate and also a former TTO intern.

TTO initiates its engagement with BIC by condensing invention disclosures related to computing and software technologies into a one- or two-page opportunity statement that includes a summary of the new technology, its unique characteristics, and potential applications. The BIC's panel of software experts reviews the statement, provides feedback on the market need for the technology, and recommends potential commercialization options. The TTO then brings that information to the inventor. In selected cases, the BIC will work with the TTO to recruit MBA students from the CU-Boulder Deming Center for Entrepreneurship to develop commercial feasibility assessments for the new technology as part of their educational program. In FY 2007, the BIC will get involved even earlier in the

process by bringing advisors into the research labs to discuss technology opportunities and commercial applications prior to the invention disclosure stage.

Both BIC and FBBi help start-up companies bridge the critical gap between an early concept company that may lack a clear business model for the technology and a commercial venture capable of attracting management expertise and private investment. While their specific approaches differ, both make extensive use of volunteer business advisors who are industry leaders in their fields to provide expert counsel and strategic direction to CU start-up companies. Both organizations have working relationships with the entrepreneurship centers of their proximate CU business schools—in the case of BIC, the Deming Center for Entrepreneurship at the CU-Boulder Leeds School of Business, and for FBBi, the Bard Center for Entrepreneurship at the CU-Denver and Health Sciences Center Business School, downtown Denver campus.

**The BIC Process at Work: Locomotion, Inc.** One notable example of the business incubation process from FY 2006 is Boulder-based Locomotion, Inc., a company founded by Professor **Rodger Kram** in the CU-Boulder Department of Integrative Physiology to commercialize an invention for substantially improving treadmill therapy for patients with gait disorders. The technology was reviewed by a team of MBA students (**Jeanine Lee, Geoff Snyder, and Jeremy Dillingham**) as part of a business class on market feasibility assessments for new technologies. Following this positive review, the same team of students selected Dr. Kram's technology as the basis for a business planning course taught by **Frank Moyes** in CU-Boulder's Leeds School of Business. The Locomotion project was then brought into the BIC advisory process, where the BIC president, Doug Collier, compiled a blue ribbon panel of rehabilitation industry experts to advise the students on their project. The advisors met over the course of the semester to review and unsparingly critique the business plan. This process resulted in substantial revisions to the plan, which may have contributed to the team winning the Leeds School Business Plan Competition and the CTEK Colorado Entrepreneurship Competition—with total winnings of over \$60,000 in cash and services. After their graduation, two of the team members (Lee and Snyder) joined the company as co-founders and are now working with Dr. Kram toward the successful commercialization of the technology.

# Recognizing the Research and Technology Transfer Excellence of CU Inventors

January 10, 2006 marked the University of Colorado Technology Transfer Office's fourth annual awards event at Tivoli Turnhalle on the CU-Denver and Health Sciences Center downtown Denver campus. This event honors CU inventors, licensee companies, and business advisors for their contributions to TTO success. Sponsored by the law firm of Hensley, Kim & Edgington, the evening included an address by CU President Hank Brown and a panel discussion on developing a new company based on university IP. Awards were presented for the best practices of university inventors and business participants in the following categories.

## New Inventors of the Year

**Rodger Kram**, Associate Professor of Integrative Physiology, College of Arts and Sciences, CU-Boulder

**Ching-Hua (Edward) Chow**, Professor of Computer Science, College of Engineering and Applied Science, CU-Colorado Springs

**Douglas Graham**, Associate Professor of Pediatrics, CU-Denver and Health Sciences Center

## Business Advisor of the Year Award

**John Hannon**, for his assistance to Trasona Pharmaceuticals

## Life Sciences Licensee Company of the Year

RxKinetix, Inc., Louisville, CO

## Physical Sciences/Engineering/Information Technology Company of the Year

Phiar Corporation, Boulder, CO

## Inventors of the Year

**Dragan Maksimovic**, Associate Professor of Electrical and Computer Engineering, College of Engineering and Applied Science, CU-Boulder

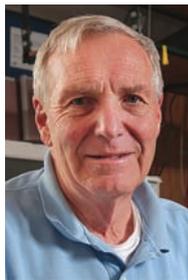
**Regan Zane**, Assistant Professor of Electrical and Computer Engineering, College of Engineering and Applied Science, CU-Boulder

**Terrance Boulton**, Professor of Computer Science, College of Engineering and Applied Science, CU-Colorado Springs



**Robert Garcea**, Professor of Pediatrics, CU-Denver and Health Sciences Center

## Pinnacles Lifetime Achievement Award



**Frank Barnes**, Distinguished Professor of Electrical and Computer Engineering, College of Engineering and Applied Science, CU-Boulder



During FY 2006 numerous CU inventors and start-up companies were recognized for research excellence and commercialization impact. **John L. Hall**, a fellow and senior research associate at JILA, a joint institute of CU-Boulder and the National Institute of Standards and Technology (NIST), leads that list of awardees with his 2005 Nobel Prize in physics. Regrettably, to list each award related to the outstanding work of CU

inventors during the past year requires more space than this report allows. However, empirical studies of research universities reveal that inventors are typically highly productive faculty in terms of research, advising, and instruction relative to their non-inventive peers.

## TTO Denver and Health Sciences Center Office Moves to the Fitzsimons Bioscience Park Center Building

In December 2005 the TTO group that was previously located in Building 500 at the Fitzsimons campus moved across the street to the Fitzsimons Redevelopment Authority's Bioscience Park Center Building. With a staff complement of six professionals and up to as many students, the space at Building 500 became cramped and unsuitable for meetings with inventors and companies. The new location has ample conference room capacity and individual office space for all employees. The new address is:

**CU-Denver and Health Sciences Center  
Technology Transfer Office**

**12635 E. Montview Blvd., Suite 350  
Aurora, CO 80045**

# Updates on CU Licensee Companies and Companies Created from CU IP

**ALD NanoSolutions, Inc.**, located in Broomfield, Colorado, was recognized by Frost & Sullivan with the 2006 Excellence in Technology Award for developing and commercializing path-breaking atomic layer deposition (ALD) techniques. In addition, NanoDynamics, Inc. has received SEMICON West's 2006 Technology Innovation Showcase (TIS) Award for the ALD technology NanoDynamics licensed from ALD NanoSolutions, Inc. for thermal filler particles for the semiconductor industry. In the past year, ALD NanoSolutions received three Phase I small business technology transfer (STTR) grants and one new Phase II STTR grant, bringing the total amount of funding from federal agencies to \$3.1 million for 10 programs since June 2003. ALD NanoSolutions, Inc. was founded in 2002 by **P. Michael Masterson**, **Karen Buechler**, and CU-Boulder Professors **Steven George** and **Alan Weimer**. The company's proprietary technology is based on ALD coating chemistry methods developed by Drs. George and Weimer for depositing ultra-thin films on particulate surfaces.

[www.aldnanosolutions.com](http://www.aldnanosolutions.com)



**AKTIV-DRY, LLC**, located in Boulder, Colorado, reached final agreements with the Foundation for the National Institutes of Health (FNIH) that led to a \$19.5 million grant to develop an aerosol live measles virus vaccine that can be inhaled rather than injected with needles. Such a development would save countless lives in developing countries. Subcontracts were negotiated with leading international research institutions (including CU), bioscience companies, and consultants. During early summer 2006, Aktiv-Dry exercised its option for novel human-powered dry powder inhalers invented by CU-Boulder faculty **Robert Sievers** (pictured) and **Steve Cape** and doctoral student **Jessica Best**. Numerous lectures and posters were presented throughout the year and progress has been made on developing active dry powder inhalers for infants and toddlers and on the thermal stabilization of vaccines. The measles vaccine stabilization has been funded by FNIH, and the Hepatitis B vaccine stabilization was funded earlier by the non-profit organization Program for Appropriate Technology in Health (PATH). In 2006 Aktiv-Dry was awarded a Phase II SBIR to continue that work on a new process for producing nutraceutical phyosterols (used to reduce cholesterol). The company employs 10 people.

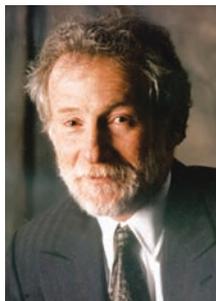
[www.aktiv-dry.com](http://www.aktiv-dry.com)



**ARCA Discovery, Inc.**, a company founded by CU-Denver and Health Sciences Center Professor of Cardiology **Michael Bristow**, is focused on developing and commercializing genetically targeted therapies for heart failure and other cardiovascular diseases. The company's first product is bucindolol, a small-molecule therapeutic for advanced heart failure and other indications, which promises to be the first genetically

targeted cardiovascular drug. In October 2005 the company signed an exclusive license agreement with the university for technology from Dr. Bristow's laboratory, including the genetic markers that will be used as the basis for prescribing bucindolol. In February 2006 the company closed \$15 million in venture capital financing, led by Atlas Venture of Boston and Boulder Ventures of Colorado. The company's corporate headquarters are in Denver and its laboratory facilities are at the Fitzsimons Biomedical Research Park.

[www.arcadiscovery.com](http://www.arcadiscovery.com)



**Archemix Corporation**, located in Cambridge, Massachusetts, is a leading developer of aptamers as a new class of therapeutics for the prevention and treatment of chronic and acute disease. The process for creating aptamers was invented by **Larry Gold**, CU-Boulder professor of molecular, cellular, and developmental biology, and **Craig Tuerk**, currently at Morehead State University in Kentucky. Archemix created an alliance with

Elan Corporation in July to commercialize aptamer therapeutics to treat autoimmune disease. The companies will seek to develop aptamer therapeutics to IL-23, a cytokine that has emerged as a mediator in the chronic autoimmune inflammatory diseases, and additional protein targets. Archemix, in collaboration with OSI Pharmaceuticals, recently selected their first pre-clinical candidate, an aptamer for potential use in treatment of neovascular age-related macular degeneration.

[www.archemix.com](http://www.archemix.com)



**Avigen, Inc.**, located in Alameda, California, is dedicated to developing therapies for chronic neurological conditions including neuromuscular spasms and spasticity, neuropathic pain, and hemophilia. In collaboration with **Linda Watkins**, CU-Boulder professor of psychology, Avigen has been researching glial cells and their potential in the treatment of chronic pain. Glial cell regulation is key in AV411 and AV333, two of Avigen's drugs used to treat chronic neuropathic pain. Avigen will be conducting Phase IIa trials with AV411.

[www.avigen.com](http://www.avigen.com)

**BaroFold, Inc.**, a privately held Colorado-based company, is expanding its staff in response to the demand for its PreEMT High Pressure Technology, a patented protein disaggregation/refolding technology invented by founders **Ted Randolph** and **John Carpenter** at CU-Boulder and CU-Denver and Health Sciences Center, respectively. The company has recently added business development, sales/marketing, and research and development (R&D) staff as it grows in response to market opportunities. Recent publications have reported the value of the technology for refolding "difficult and challenging" target proteins that are commonly encountered in small-

molecule drug development efforts. In addition to the licensing of the technology into biotechnology and pharmaceutical companies, BaroFold has introduced the PreEMT System line of research-scale pressure units, high-pressure spectroscopy cells, refolding reagent kits, and disposable sample caissons for the academic researchers who also face protein-refolding challenges.

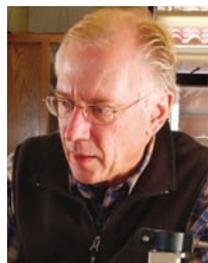
[www.barofold.com](http://www.barofold.com)

**Caveo Therapeutics, Inc.**, is a Colorado-based early-stage biotechnology company creating innovative therapies for cancers and hematologic conditions based on receptor tyrosine kinase (RTK) technologies. The company identifies biological inhibitors that protect or guard receptors on various cell types against excessive or inappropriate activation, which can lead to malignancy or other disease pathologies. The lead drug candidate, CVO-102, is an inhibitor of Mer, Caveo's proprietary RTK target. CVO-102 represents a novel approach to the treatment of blood cancers as well as significantly improved prevention of blood clotting (with no or minimal bleeding risk), a serious condition for which hundreds of thousands of hospitalized patients are at risk. In the past year, the company has generated animal data to validate this approach and optimized the lead compound, which is entering late preclinical development.

[www.caveotherapeutics.com](http://www.caveotherapeutics.com)

**CDM Optics, Inc.**, located in Boulder, Colorado, marked its first anniversary as a subsidiary of OmniVision Technologies, Inc., a world-leading supplier of complementary metal oxide semiconductor (CMOS) image sensors. Developments since the acquisition have proved that combining the two companies was a great match. CDM has been able to combine their WaveFront Coding™ technology with OmniVision's image sensors. In addition, CDM has gone on to expand into infrared cameras and iris recognition applications. The near future will see the Boulder facility expand to accommodate growing employment and new high-precision diamond turning and optical metrology equipment and additional optical laboratories. Since the acquisition in March 2005, CDM has more than doubled its staff and now employs over 30 people.

[www.cdm-optics.com](http://www.cdm-optics.com)



**Geron Corporation**, of Menlo Park, California, has an exclusive license to telomerase discoveries published in 1996–97 by Nobel laureate **Tom Cech**. Geron showed that telomerase is key to cell aging and proliferation processes. Collaborating with Geron scientists, Cech's lab succeeded in cloning human telomerase reverse transcriptase (hTERT). Under Geron sublicenses and research agreements,

hTERT, as well as cell lines immortalized with hTERT, are made widely available to researchers around the world who are investigating therapeutic cancer vaccines and cell aging and repair.

In July 2005 Geron and Merck entered into a collaboration and license agreement that will combine Geron's telomerase expertise and Merck's vaccine platform to develop a cancer vaccine. The agreement includes a Merck option to license Geron's dendritic cell-based

telomerase vaccine based on Geron-CU IP currently in clinical trials. Including patents licensed from CU, Geron prosecutes and maintains an extensive portfolio of international patents covering telomerase and its uses. This summer the company successfully defended vaccine claims against opposition in Europe and will pursue related claims through appeals and new patent filings.

[www.geron.com](http://www.geron.com)

**GlobeImmune, Inc.** is a biopharmaceutical company pioneering the discovery, development, and manufacturing of potent, targeted molecular immunotherapies called Tarmogens™ for the treatment of infectious diseases and cancer. Relocated this year to Louisville, Colorado, the company employs 60 people. This year GlobeImmune raised \$38.4 million in series B financing while employment expanded by 58 percent. Two Phase I Tarmogen trials were completed, and a Phase II cancer treatment trial has been initiated. Currently the company is validating a 6,000-square-foot good manufacturing practice (GMP) facility for producing Tarmogen products.

[www.globeimmune.com](http://www.globeimmune.com)



**KMLabs, Inc.**, located in Boulder, Colorado, is a leading manufacturer of ultra short-pulse lasers for the research market. The company emerged from the optics research of **Margaret Murnane** and **Henry Kapteyn**. Their CU-Boulder research group is a leader in developing new laser technology to generate very intense light pulses between 10–14 femtoseconds. The company has developed the most powerful ultra fast lasers on the market today. With a dedication to cutting-edge R&D and a steadily growing product line, KMLabs Inc. experienced a 75 percent increase in revenues in its 2005–06 fiscal year, after 80 percent growth in 2004–05.

[www.kmlabs.com](http://www.kmlabs.com)



**MedShape Solutions, Inc.** is an early-stage company developing medical devices based on emerging shape memory alloy and polymer materials for use in orthopedics and minimally invasive surgery. MedShape's unique and patent-protected product line includes DynaNail™, a nickel-titanium-alloy-based intramedullary nail for treatment of conditions requiring ankle fusion, and ShapeLoc™, a shape memory polymer device for securing tendon grafts in anterior cruciate ligament repair. The shape memory polymer materials were developed by a team of investigators at CU-Boulder and CU-Denver and Health Sciences Center. These devices take advantage of the unique properties of shape memory materials that make them ideally suited for orthopedic and minimally invasive procedures. They are self-actuating, self-adjusting, able to be compacted outside the body and expand to full size once in place, and can generate the forces needed to secure ligaments to bone. The company was the recipient of a CU TTO Proof of Concept investment award in 2006.

[www.medshapesolutions.com](http://www.medshapesolutions.com)

**Mentor Machines, Inc.**, a Boulder, Colorado start-up company, was formed in February 2004 to commercialize advanced teaching, language, and character animation technologies developed at the Center for Spoken Language Research at CU-Boulder. The company was founded by the co-developers of the Foundations to Literacy program, **Ron Cole**, **Wayne Ward**, and **Sarel van Vuuren**. Foundations to Literacy teaches children the basic skills that underlie reading, and interactively demonstrates these skills in books that use speech recognition to train fluent reading with good comprehension. The program has been tested on over 1,000 children in Colorado schools and has been shown to improve letter and word recognition skills. The company has received two SBIR grants to improve the technology and has several more pending. In January 2006 the company hired **Martin Best** as President and CEO.

**Microsemi Power Products Group (PPG) Boulder** (formerly Advanced Power Technology Colorado) is the R&D arm of Microsemi Power Products Group (PPG), focusing on compound semiconductor technologies. Microsemi PPG Boulder originated from the 2005 acquisition of PowerSicel, Inc., a company that emerged from the research of Professor **Bart Van Zeghbroeck** and associates at CU-Boulder. The company employs 10 scientists and engineers, and its facilities include a three-inch pilot line, complete with fabrication, packaging, and test capabilities for both radio frequency and switching components.

[www.microsemi.com](http://www.microsemi.com)

**Myogen, Inc.**, located in Broomfield, Colorado, is a biopharmaceutical company focused on the discovery, development, and commercialization of small-molecule therapeutics for the treatment of cardiovascular disorders. Myogen is developing two late-stage product candidates, ambrisentan for the treatment of pulmonary arterial hypertension (PAH) and darusentan for the treatment of resistant hypertension. Myogen announced positive results for the second ambrisentan pivotal phase III clinical trial (ARIES-1) in March 2006 and initiated the first of two pivotal phase III clinical trials for darusentan in June 2006. Additional highlights include the extension of Myogen's drug discovery collaboration with Novartis for an additional two years and execution of a two-part collaboration agreement with GlaxoSmithKline in March 2006 involving each party's PAH therapy. Myogen launched commercial operations with a PAH-focused sales force in the second quarter of 2006.

[www.myogen.com](http://www.myogen.com)

**Pearson Knowledge Technologies** was founded in 1998 as Knowledge Analysis Technologies by **Thomas Landauer**, **Darrell Laham**, and **Peter Foltz**. In June 2004 the company was acquired by Pearson Education, a world-leading education company, and became Pearson Knowledge Technologies. The Boulder-based company offers education companies, students, and educators the only automated text analysis technology that evaluates the meaning of whole passages. The Knowledge Analysis Technologies (KAT) engine immediately measures writing and content in a way that simulates a skilled human grader and encourages better subject knowledge through improved writing and comprehension. In addition to serving the education

market, Pearson Knowledge Technologies is funded by multiple government agencies to perform innovative research and development.

[www.pearson.com](http://www.pearson.com)

**Phiar Corporation** (pronounced "fire"), located in Boulder, Colorado, is developing the world's fastest electronic devices for a wide range of applications. Financed by Menlo Ventures, Phiar is engaged with Motorola in a joint development agreement, and has recently been granted a Defense Advanced Research Projects Agency (DARPA) II contract for \$1.4 million. Phiar uses nano-scale stacks of metals and insulators to create ultra-high frequency diodes, antennas, and transistors. The benefits of Phiar's proprietary technology are low cost, integrity, and high performance with supporting electronics. Phiar delivers on these promises at frequencies from direct current (DC) to three THz, enabling their partners to develop new capabilities ranging from wirelessly synchronizing large data files or streaming uncompressed high-definition video, to using radar to help reduce automotive collisions and even detect skin cancer. Phiar recently moved into a new facility, which includes the company's clean room for R&D and pilot manufacturing, as well as test and measurement labs.

[www.phiar.com](http://www.phiar.com)

**PhosphoSolutions, LLC.**, located at the Bioscience Park Center at the Colorado BioScience Park in Aurora, Colorado, was created to manufacture and distribute proprietary research tools, known as phospho-specific antibodies, which are at the cutting edge of proteomics. Founded by three of the world's leading scientists in protein phosphorylation, the company's unmatched expertise makes PhosphoSolutions the most qualified developer of custom-made phospho-specific antibodies. PhosphoSolutions manufactures antibodies in-house and licenses others from research universities. These antibodies are a key enabling technology used by biotechnology companies to greatly accelerate drug discovery and research in many diseases. In the past two years, PhosphoSolutions has grown from two to six full-time employees and revenue has grown more than 80 percent.

[www.PhosphoSolutions.com](http://www.PhosphoSolutions.com)

### **Update on CU Endowments Funded by Technology Transfer**

In the 2005 annual report we identified 15 endowments funded by technology transfer revenue, either as partial funds used as donor challenge matches or as funds from inventors, laboratory, and/or departmental shares of royalties or legal settlement payments. In the past year, a 16th endowment was created in part by technology transfer royalties to support the William P. Arend Endowed Professorship in Rheumatology. Professor of Medicine **William P. Arend** is a renowned rheumatologist who discovered an anti-inflammatory molecule now used to treat arthritis.

**Replidyne, Inc.**, of Louisville, Colorado, is a biopharmaceutical company focused on discovering, developing, in-licensing, and commercializing innovative anti-infective products. Replidyne's lead product, faropenem medoxomil, is a novel oral community antibiotic in the beta-lactam class. Replidyne submitted a new drug application (NDA) to the Food and Drug Administration (FDA) for faropenem medoxomil in December 2005. Replidyne's continued clinical development of faropenem medoxomil includes a Phase III trial at a higher dose for acute exacerbations of chronic bronchitis and a Phase II trial with an oral liquid formulation in pediatric patients with acute otitis media. In February 2006 Replidyne entered into an agreement with Forest Laboratories for the development and commercialization of faropenem medoxomil. Replidyne is also developing a topical treatment addressing the major challenge of methicillin-resistant *Staphylococcus aureus* (MRSA), for which there are few available treatments. Replidyne submitted an investigational new drug (IND) application in May 2006 for its product, REP8839, which has a novel mechanism of action and is being developed in combination with mupirocin for topical use in treating skin and wound infections and for prevention of *S. aureus* infections, including MRSA, in hospital settings. Replidyne also has discovery programs directed to inhibition of bacterial DNA replication and treatment of *C. difficile* infections. Replidyne completed its initial public offering in July 2006.

[www.replidyne.com](http://www.replidyne.com)

**RxKinetix Inc.**, located in Louisville, Colorado, is a specialty pharmaceutical company focused on developing new therapeutics for oncology care. By combining proven drugs with its proprietary, polymer-based drug delivery technologies, the company has accelerated development timelines while significantly reducing the risk of failure. Currently four products are in development, including several that incorporate technology from the CU-Boulder Department of Chemical and Biological Engineering and the CU-Denver and Health Sciences Center Department of Pharmaceutical Sciences. RxKinetix's lead candidate, RK-0202, completed its Phase II clinical trial in cancer patients for oral mucositis, a debilitating disease that occurs as a side effect of radio- and chemotherapies. The trial successfully demonstrated the drug's efficacy and safety. Plans for its Phase III clinical trial are nearly final, and it has fast-track status from the FDA. RxKinetix continues to develop the other products in its pipeline, including products targeting proctitis and oral pain as well as a hematopoietic growth factor formulation and vaccines with improved release and temperature stability characteristics.

[www.rxkinetix.com](http://www.rxkinetix.com)



**Securix, Inc.** has grown its Colorado Springs operation to five employees. In May 2006 Securix was awarded a Phase I STTR grant from the National Science Foundation (NSF), partnered with Terry Boulton's Vision and Security Lab at CU-Colorado Spring and the biometric research group of IBM's T.J. Watson. Their project is addressing privacy/security issues in fingerprint, face, and other biometrics as well as in DNA

matching. Securix's privacy-preserving fingerprint technique, incorporated into a time and attendance application, will begin pilot testing in late August 2006. Securix has been selected by Colorado Engineering, Inc. as a support partner for a Phase I Air Force small business innovation research (SBIR) award on distributed signal processing. Securix has also been selected by the U.S. military to develop a long-distance outdoor facial recognition system incorporating Securix technologies. Securix has submitted two successful SBIR/STTR proposals for R&D funding and anticipates development and submission of several more in the coming year.

[www.securix.com](http://www.securix.com)

**SomaLogic, Inc.**, located in Boulder, Colorado, continues the development of its aptamer array technology as the basis for a new approach to clinical diagnostics. The company focuses on autoimmune and inflammatory diseases, cardiovascular disease, and oncology. In May 2005, SomaLogic announced a strategic collaboration with Quest Diagnostics, the country's leading provider of diagnostic testing and related services. Aptamer arrays are based on discoveries made in the CU-Boulder laboratory of Larry Gold, SomaLogic's Chairman and CEO.

[www.somallogic.com](http://www.somallogic.com)

**Taligen Therapeutics, Inc.**, located at the Bioscience Park Center at the Colorado BioScience Park in Aurora, Colorado, is a development-stage biotechnology company with novel technologies to modulate the complement system. The complement system is a critical component in the initiation of inflammation, which characterizes many human diseases, including asthma, rheumatoid arthritis, macular degeneration, and immune renal disease. Taligen's lead product candidate, TA106, is a fragment of a monoclonal antibody that regulates the complement pathway. The initial clinical application for TA106 is as an inhaled product for the treatment of severe persistent asthma. Since the company's Series A financing in August 2005, it has successfully humanized TA106, initiated manufacturing, and begun to assemble a management team. The company expects to file an IND application for this product candidate in 2007. The company is also developing TA106 for other indications. Taligen's second technology allows targeting of complement inhibitors specifically to sites where inflammation is occurring. This approach provides targeted regulation of complement activation without triggering systemic complement inhibition, potentially allowing broader applications and lower administered dose of product. Taligen has been awarded over \$1 million in SBIR grants and raised approximately \$3.75 million in its Series A financing from Sanderling Ventures, Tango Partners, and High County Venture.

## Building the Instructional and Research Infrastructure

Throughout this report the topics have focused on people, research, inventions, and companies. We would be remiss to not mention the places where all these activities occur—in laboratories, classrooms, and offices across the university. In the past year CU has experienced a resurgence of new and renovated facilities. After a few years' hiatus due to difficult economic

times, new buildings are sprouting up across the campuses. The pictures below highlight building projects that will have a significant future impact on the university's instructional and research activities. Additional university buildings are in the planning and early-construction stages.



El Pomar Engineering Center (rendering), CU-Colorado Springs



ATLAS building, CU-Boulder



Wolf Law building, CU-Boulder



Research towers, Fitzsimons campus, CU-Denver and Health Sciences Center

## Staff Changes at TTO

At the beginning of last year TTO received approval for three part-time positions. These positions were filled based upon national searches.

- **Beverly Gandy** became an administrative assistant at the TTO office on the Fitzsimons campus. Beverly has a bachelor of arts degree from CU-Denver and Health Sciences Center in English and history, in addition to 15 years experience as a senior technical writer in the software industry.
- **Sheri Aajul** became an administrative assistant at the TTO office on the Boulder campus. Sheri has a master's degree in mathematics from the University of Florida and is currently working toward a nursing degree.
- **Karen Gifford** became an assistant patent administrator working directly with Kimberly Merryman. Karen is a 2001 graduate of CU-Boulder with a bachelor of arts degree in humanities. Karen's other half-time position is as an archivist, where she processes all materials from previous CU presidents.

Over the past year TTO lost four permanent staff to other employment opportunities. The four positions were filled based on national searches.

- **Nathan Chen** became TTO's database administrator in December. Nathan previously worked as a database analyst, developer, and software engineer, and he has earned both a bachelor of arts in computer information systems and an MBA.
- **Kimberly Merryman** became TTO's patent administrator. Kim had previously been a CU-Boulder student assistant supporting the work of the previous patent administrator. She earned a bachelor's degree in English and classics in May 2006.
- **Ted Weverka** became TTO's new engineering/physical sciences licensing associate. Ted completed his PhD in electrical and computer engineering at CU-Boulder in May 2006. Prior to returning to CU for his PhD, he was the founder and chief technology officer of Network Photonics, Inc.
- **David Poticha** became a life sciences licensing associate. David's previous work was with Myogen, where he spent three-and-a-half years practicing patent and corporate law. David earned a juris doctorate from the University of Colorado Law School with an emphasis on IP, and passed his Colorado Bar Exam in 2002. David also has a master's degree in medical sciences from CU-Denver and Health Sciences Center.

### TTO Student Employment and Class Projects

A guiding principle of TTO is to bring students into the technology transfer process and support the instructional mission of the university. This objective is accomplished primarily through student employment and class engagement. The value proposition is tangible; TTO receives the benefit of highly trained individuals and students receive an opportunity to apply aspects of their education to actual technology transfer cases and work situations. Student employment is greatest during the summer months. Class work occurs in practicum-

type instructional contexts such as graduate and undergraduate business feasibility and business plan cases, the Colorado Law School Entrepreneurial Law Clinic, and engineering senior design "capstone" courses. Led by Karen Newell at CU-Colorado Springs, a course on bioscience technology transfer has been offered to students across the three CU campuses. As well, TTO staff members are frequent guest lecturers in law, business, engineering, science, public policy, and other courses throughout the academic year.

### TTO Summer Interns, 2005

**Somer Aly**, MBA/MS International Business 2007, CU-Denver and Health Sciences Center  
**Matthew Caton**, MBA 2006, CU-Boulder  
**Eric Gricus**, MBA 2006, CU-Boulder  
**Desiree Liverseidge**, MD 2008, CU-Denver and Health Sciences Center  
**Chris McReynolds**, MBA 2006, CU-Boulder (spring semester)  
**Jason Roosa**, MD 2008, CU-Denver and Health Sciences Center  
**Stanley Sanchez**, MBA 2006, CU-Boulder  
**Blossom Tichenor**, MBA 2006, CU-Boulder  
**Michelle Stoll**, MS Computer Science 2005, CU-Colorado Springs

### Summer Legal Interns, 2005

**Patrick Haines**, JD 2007, CU-Boulder  
**Emily Vandenburg**, JD 2007, CU-Boulder  
**Tony Newville**, BS Mechanical Engineering 2005, CU-Boulder

### TTO Administrative Interns

**Elizabeth Towner**, BA Psychology 2004, CU-Boulder  
**Diana Zakaryan**, PhD Mathematics 2010, CU-Denver and Health Sciences Center  
**Alexandra Lengen**, BS Anthropology 2007, CU-Boulder  
**Anthony Muljadi**, BS Finance 2007, CU-Boulder  
**Ashley Fandel**, BA Accounting 2008, CU-Boulder  
**Nicholas Rising**, BA Physical Geography/Hydrology 2007, CU-Boulder

### TTO Summer Interns, 2006

**Devon Cox**, MBA 2007, CU-Boulder  
**Timothy Casias**, MD 2009, CU-Denver and Health Sciences Center  
**Cecil Manoj Sunder**, MBA 2007, CU-Boulder  
**Carin Twining**, JD 2008, CU-Boulder  
**Elizabeth Lewis**, JD 2006, CU-Boulder  
**Anitha Balachandran**, MBA 2006, CU-Denver and Health Sciences Center  
**Whitney Browne**, BA Marketing 2008, CU-Boulder

## Conclusion and the Road Ahead

This report demonstrates the impact of CU research—in emerging and existing products that educate, entertain, and improve human health and the human condition. Most of these important stories would not be possible without an increasingly vibrant technology transfer operation. IP protection through patenting is essential, and early development through proof of concept research enhances IP viability, thereby improving the university's chances to attract the immense financial investments necessary to develop and commercialize new technology, goods and services, and medical products. Finding and building value propositions for long-term relationships with the right commercial partners complete the process.

During the past five years CU's technology transfer metrics have moved in the right direction with appreciable increases. At the campus level, the past few years have seen CU-Denver and Health Sciences Center become a major contributor to technology transfer. CU-Colorado Springs has also broadened the involvement of investigators, while CU-Boulder remains a powerhouse of inventive activity. This growth has occurred during a time of financial resource constraints and turnover of senior administrators. Although the university's financial situation is better today than in the past few years, the university remains underfunded relative to peer public universities and is a bargain for in-state students. Approximately three-quarters of the university's senior administrators are new to permanent positions in the past 18 months, but to a person, the new leaders have embraced technology transfer as an important part of the university's academic mission. The growth of technology transfer during the recent period of intense fiscal austerity and administrative change speaks to the enduring quality and entrepreneurial spirit of CU research investigators and to strong support from the business community.

Technology transfer at CU is a maturing operation. Over the past few years TTO has completely run through its pre-2002 backlog of inventions and may be approaching an annual carrying capacity for new inventions. TTO is not likely to grow beyond its present staff and budget during the foreseeable future. The TTO team is prepared to address the challenges of increasingly complex and multifaceted relationships with innovative companies. These challenges will be faced with a relatively flat but ample TTO budget for the job at hand. TTO excels at some aspects of technology transfer activity, such as its efficient patent budget process and ability to work with the community to produce sustainable new companies based on CU IP. Continued diligence relative to other aspects, such as continually expanding the inventor base and increasing production of exclusive licenses, is necessary to achieve long-term excellence.

After FY 2007 the next few years will not be as financially fruitful as the preceding years have been for TTO. In university technology transfer operations, usually one or two licenses produce the vast majority of revenue. In CU's case, a patent family will soon expire for one major revenue source and the revenue terms will change for

another major source. These are expected events and TTO is preparing for the resulting financial shortfall that will occur in a few years. TTO will manage through the shortfall period by executing a plan devised a few years ago that provides access to TTO's reserve funds in such a situation. The quality service that investigators and inventors have come to expect from TTO will be maintained. The revenue shortfall will exist for a few years, after which TTO will again be back among the national leaders in licensing revenue.

Overall, the pipeline of CU technologies is expanding and maturing and TTO's long-term financial prospects are solid. More importantly, the impact of CU research and TTO's commercialization activities will grow to the benefit of Colorado and society in general. We at TTO look forward to the challenges and opportunities ahead and invite you to join CU's inventors as together we play a rewarding role in the journey of inventing the future.

### Update on Clinical Trials

In the 2005 annual report a table was used to demonstrate drugs created from CU IP that are undergoing clinical trials. Currently, three drugs based on CU inventions are approved for marketing. On May 26, 2006, the FDA approved Merck's new vaccine ZOSTAVAX® for prevention of herpes zoster (shingles) in individuals 60 years of age and older. At the end of June 2006 there were two drugs in or completing Phase III trials, six drugs in or completing Phase II trials, and eight drugs in or completing Phase I trials.

Phase I trials are the first stage of testing in human subjects. Normally a small group (10 to 30) of healthy volunteers will be selected. The objective of this phase is to assess the safety, tolerability, and effect of the drug on the body. Phase I trials are most often done with healthy volunteers; however, in some Phase I trials patients are enrolled because they have failed to respond to other treatments. Phase II trials are conducted on large groups of people (100 to 300) who have the condition the drug is intended to cure. The objective of Phase II studies is to assess the efficacy of the drug treatment. Phase III trials are large studies (1,000 to 3,000-plus) with the objective of definitively assessing the efficacy of the drug to treat the disease, usually relative to the standard of care of alternative drugs. In the U.S., Phase III data is submitted to the FDA for approval. The cost of full FDA regulatory approval of a drug is estimated to be from hundreds of millions to a billion dollars.

## The CU Technology Transfer Office Staff



*Top row, from left:* Branwynne Bennion, Student Assistant; Rick Silva, Assistant Director; Karen Gifford, Patent Assistant; Andrew Gano, Life Sciences Licensing Associate; Mary Tapolsky, Life Sciences Licensing Associate; David Allen, Associate Vice President; Nick Rising, Student Assistant; Jill Penafiel, IP Manager; Devon Cox, Intern; Nathan Chen, Database Administrator

*Bottom row:* Donna Sichko, Finance Manager; Kristin Diamond, Associate University Counsel; Ted Weverka, Physical Sciences Licensing Associate; Sheri Aajul, Administrative Assistant; Kate Tallman, Assistant Director; Ashley Fandel, Finance Assistant; Kimberly Merryman, Patent Administrator; Tom Smerdon, Director of New Business Development; Lynn Pae, Special Assistant

*Not Pictured:* Beverly Gandy, Administrative Assistant; Ken Porter, Director of Licensing; David Poticha, Life Sciences Licensing Associate; Susana Read, Life Sciences Licensing Associate; Kathe Zaslow, Director of System Operations

# Committee on University Discoveries

The Committee on University Discoveries is composed of nine members chosen from university governance and administration according to Section Six of the “Administrative Policy Statement on Intellectual Property Policy on Discoveries and Patents for Their Protection and Commercialization.” The committee’s primary responsibilities are to review IP policies and procedures, implement them, and serve as a board to hear appeals brought by university inventors concerning TTO actions. To date, no appeals have been brought to the committee.

Carl Edwards, Associate Professor, Dermatology, CU-Denver and Health Sciences Center

Douglas Gin, Professor of Chemical and Biological Engineering and Professor of Chemistry and Biochemistry, CU-Boulder

Michael Holers, Professor, Rheumatology, CU-Denver and Health Sciences Center

Michael Larson, Professor, Mechanical and Aerospace Engineering, CU-Colorado Springs

Clayton Lewis, Professor, Computer Science, CU-Boulder

Robert Melamede, Associate Professor, Biology, CU-Colorado Springs

Paul Ohm, Associate Professor of Law, CU-Boulder

Rafael Sanchez, Associate Professor, Mechanical Engineering, CU-Denver and Health Sciences Center

James Sikela, Associate Professor, Pharmacology, CU-Denver and Health Sciences Center

# CU Technology Transfer Business Advisory Board

A guiding principle of TTO is to execute technology licenses and other agreements that protect university interests while being fair and industry approachable. One way this principle is maintained is through active engagement of a high-level business advisory board. This group meets three times per year and provides TTO insight on strategic issues and new initiatives. To ensure that research investigator perspectives are represented in the discussions, representatives of the university are included on the advisory board.

## **Business Community Representatives**

Chris Bittman, Chief Investment Officer, CU Foundation

Greg Carlisle, Senior Managing Director, Limestone Ventures

Doug Collier, President, Boulder Innovation Center

George Deriso, Serial Software Entrepreneur

Jerry Donahue, Board Member, University License Equity Holdings, Inc.

David Drake, Director, Fitzsimons Bioscience Business Incubator

Bob Goodman, President and CEO, Phiar Corporation

Chris Hazlitt, Managing Partner, Faegre & Benson

Gregory Johnson, Partner, Patton Boggs

David Jilk, CEO, e-Cortex, Inc.

Jim Linfield, Managing Partner, Cooley Godward

Mark Lupa, Partner, Tango, Inc.

Catharine Merigold, Managing Partner, Vista Ventures

John Metzger, CEO, Metzger and Associates

Tim Mills, Partner, Sanderling Ventures

Joey Money, VP Corporate Development, RxKinetix, Inc.

Chris Ozeroff, EVP Business Development and General Counsel, ARCA Discovery, Inc.

Chris Scoggins, Principal, Sequel Partners

Juan Rodriguez, Co-founder of StorageTek and Exabyte

Steve Volk, Chairman and CEO, Vmedia Research, Inc.

## **CU Faculty and Administration Representatives**

David Allen, Associate Vice President for Technology Transfer, CU

Alexander (Sandy) Bracken, Director, Bard Center for Entrepreneurship, School of Business,  
CU-Denver and Health Sciences Center

Michel Dahlin, Interim Vice President for Academic Affairs and Research, CU

Robert Garcea, Professor, Pediatrics, CU-Denver and Health Sciences Center

Paul Jerde, Executive Director, Deming Center for Entrepreneurship, Leeds School of Business, CU-Boulder

Stein Sture, Professor, Civil Engineering, CU-Boulder

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Design and Production by the Office of Publications and Creative Services



Printed on recycled paper



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