

HOUSE FINANCE COMMITTEE

SENATE FINANCE COMMITTEE

**BIOSCIENCE DISCOVERY EVALUATION GRANT
PROGRAM UPDATE**

as of

June 30, 2014

**Legislative Report to House and Senate Finance Committees
per CRS 24-48.5-108
Bioscience Discovery Evaluation Grant Program
By the Colorado Office of Economic Development and International Trade**

The Bioscience Discovery Evaluation Grant Program (BDEGP) and Cash Fund was first created in statute in 2006 and the program will terminate in January 2015. The mission for supporting the development of novel technologies and commercializing those in Colorado will be continued under the new Advanced Industry Accelerator Program which will combine support with the Bioscience sector and the six other Advanced Industry sectors. In its eighth year, Fiscal Year 2013-14, the program continued to offer three targeted grant programs to support the Colorado bioscience industry. The BDEGP has been praised for its effectiveness in leveraging a limited state investment to move promising commercial technologies to market and for supporting the development of the biotechnology industry in Colorado.

Commercialization Infrastructure grants support joint efforts of industry and academia to create resources that are essential to industry growth. BDEGP Commercialization Infrastructure funds have funded 4 organizations over a number of years. Two new organizations, The Colorado Institute for Drug, Device and Diagnostic Development and The Colorado Center for Drug Discovery were started to address needs identified by the industry. The BioFrontiers Institute at the University of Colorado Boulder, and the School of Pharmacy at the University of Colorado Anschutz Medical Campus have developed Core Facilities that offer new critical technologies to advance drug discoveries. Grantees identify and manage technologies, and support collaboration to bring necessary expertise together to advance novel Colorado biotechnologies to commercialization.

The Colorado Center for Drug Discovery (C2D2) based at Colorado State University is a resource to faculty at Colorado research universities, bringing biology and chemistry faculty together to use chemical libraries, computational resources, bioinformatics, cheminformatics, database support, virtual high throughput screening, and Computer Aided Drug Design to pharmacologically validate drug candidates with patent-protected chemical matter and innovative therapeutics for unmet medical needs. C2D2 supports several inter-institutional projects with funding and resources. C2D2 offers compounds to investigators through its screening library and medicinal chemistry services that are critical in the drug discovery process.

The Colorado Institute for Drug, Device and Diagnostic Development (CID4) is managing life science discoveries from Colorado research institutions and Colorado start-ups and early-stage businesses with the goal of creating bioscience jobs in Colorado. Grant funds support operations of the CID4 and the development and management of life-science discoveries adopted as Projects of the CID4. The CID4 has 8 early stage companies under its guidance supporting their operational development and attracting additional investment to meet their needs.

The BioFrontiers Institute is a state-of-the art research and education facility that links the basic sciences, engineering, clinical practice, and industry at the University of Colorado's Boulder campus to support breakthrough developments in areas such as engineering human tissues, RNA enzyme and aptamer based pharmaceutical, biorefining, and genetics. Grant funds support

equipment, resources and personnel costs to develop the core facilities of the institute. With grant support, the institute has developed one of the largest repositories of shRNAs in the world at the Functional Genomics Facility. Colorado companies partner with the institute to improve their products.

The University of Colorado, Skagg's School of Pharmacy at Anschutz developed an HTS/HCS (high throughput/content screening) Core Facility for drug discovery. This resource has been utilized by more than 100 researchers and companies advancing the science and helping to secure intellectual property.

Proof of Concept (POC) grants substantiate research at Colorado research institutions with commercial applications. Since the first grants were made in mid-to-late 2007 through fiscal year 2014 the program has awarded 192 grants to researchers at Colorado research institutions to bring their cutting-edge technologies closer to market. These grants are usually matched by funds from the technology transfer offices to allow the investigators to reach commercialization milestones. The table below shows how these have flourished by attracting additional capital resources, firming up intellectual property rights, and either being licensed out to companies or having companies formed around the commercial potential of the technology.

Early-Stage Company (ESC) grants provide needed funding to companies commercializing technologies from Colorado research institutions by backing research, testing, and business development activities that will prepare them for additional third-party financing. Under the Early-Stage Company program 49 grants have helped companies further advance biotechnologies coming out of Colorado research institutions. BDEG grants allow early-stage businesses to complete studies, secure intellectual property, and develop their business models to bring their products to market.

The program's statute requires an allocation of at least 30% of the funds to Proof of Concept grants, 30% of the funds to Early-Stage Company grants, and up to 40% of the funds to Commercialization Infrastructure. The table below summarizes all grants awarded by June 30, 2014. The metrics are grouped by active and closed. As bioscience technologies generally have a long development time-line we often see few commercialization metrics in the near-term. We track developments following the close of these grants to better understand the impact. The Company SBIR/STTR grants were offered per statutes in fiscal year 2008; these required that the applicant have an active federal Small Business Innovation Research or a Small Business Technology Transfer grant and two-times the BDEG award sought in order to apply. The statutes were amended to offer the ESCR program in fiscal year 2009.

Status	Program	Number	\$ Awarded	\$ Spent to date	\$ Matched to date	Jobs Created	Companies Created	Follow-on Capital	Intellectual Property Advancements	Licenses Issued
Closed Grants	Proof of Concept	134	\$ 8,314,479	\$ 7,659,255	\$ 8,267,179	144	38	\$ 294,415,264	63	42
	Company Grants									
	SBIR/STTR	12	\$ 755,073	\$ 755,073	\$ 2,128,497	19.0		\$ 19,509,849	6	0
	Early Stage Company	50	\$ 5,890,325	\$ 5,713,057	\$ 8,405,204	118	4	\$ 68,208,503	25	5
Active Grants	Infrastructure ²	4	\$ 10,242,090	\$ 8,170,991	\$ 20,875,767	111		\$ 35,319,740	2	2
	Proof of Concept	58	\$ 3,409,525	\$ 842,923	\$ 661,454	17.8	4	\$ 1,327,000	9	2
	Early Stage Company	16	\$ 1,595,880	\$ 1,176,112	\$ 1,494,948	19.2		\$ 7,199,000	4	1
	TOTALS	274	\$30,207,372	\$24,317,411	\$ 41,833,049	409.8	46	\$ 418,624,299	109	52

The State leverages this investment in the industry by requiring a one-to-one match for both Proof of Concept and Early-Stage Company grants. The economic benefit is realized near-term in the strengthening of our research institutions, the jobs required to fulfill the grant work, and the products and services purchased to complete grant work. Longer-run payouts come in the form of additional capital investment into the technologies and companies, the creation of new companies, and growing businesses adding high quality jobs. Approximately \$32 million from the BDEGP Cash Fund has been granted and garnered more than \$38 million in matching funds. Of 274 grants awarded under the program by the end of fiscal year 2014, 196 have completed work while the others are in process. The chart above shows returns realized during the grant term, and those that continue to accrue as the technologies become closer to and actually enter the market-place. To date, the program successes include the creation of 46 new Colorado companies and the direct creation of approximately 429 jobs. Additionally, these funds have helped the technologies acquire an additional \$418 million dollars in grants and investments to further commercialize these bioscience technologies.

The BDEGP has provided critical gap funding to many technologies in early development. Sometimes the grant projects reveal that a technology is ineffective, or has hurdles to overcome. Many evolve into viable products and services. Below are a few case studies.

KromaTiD, Inc:

In 2009, Colorado State University scientists Andrew Ray and Susan Bailey were awarded a Proof of Concept Grant to develop fluorescently-labeled probes for identifying specific recurrent point mutations in cancer cells. By the close of the grant, a patent had been filed and KromaTiD was formed in Fort Collins. KromaTiD later sought funding from the ESC Program for development of their novel chromosomal inversion detection technology, but were directed by the review committee to first focus their business offering before progressing further with scientific work. The business plan helped the company target the research and development market. KromaTiD then gained the guidance of the Colorado Institute for Drug, Device and Diagnostic Development – a BDEG funded commercialization infrastructure asset – and is now earning revenues on their assays for detecting chromosomal rearrangements. In 2013 KromaTiD was awarded an ESC grant to develop a new medical R&D product. In 2014, they were awarded an additional grant and are positioned to receive a \$2.4 million investment in quarter 1 of 2015.

Flashback Technologies, LLC:

The company received an Early-Stage Company grant in 2010 and negotiated an exclusive license agreement with the University of Colorado for a high speed patent-pending software technology (developed by the company's founders) that enables continuous vital sign data analysis for predictive patient management. Flashback has applied this technology to the analysis of human and porcine vital sign data and discovered several previously hidden hemodynamic relationships that are predictive of: 1) acute blood loss volume, 2) individual specific risk for cardiovascular collapse, 3) fluid resuscitation effectiveness, and 4) intracranial pressure. The work accomplished with BDEG funding resulted in substantial improvements to the product material, and positioned the company to close on their first round of financing for over \$ 1.2 million.

Thirty-five projects were approved for funding in Fiscal Year 2013-2014. Total grant funds awarded to these projects exceed \$4 million. The table summarizes these awards.

Program	Grantee	Associated Research Institution	PI	Subject	Award \$
INFR	Colorado Institute for Drug, Device and Diagnostic Development		Smith	Support the development of CO's biotechnology, life-science sector through technology enhancement and/or new company formation, creating jobs in CO.	900,000
INFR	CSU - Colorado Center for Drug Discovery		Miknis	C2D2	500,000
INFR	CU - BioFrontiers Institute		Capson-Watts	Biofrontiers	416,501
INFR	CU - Skaggs School of Pharmacy and Pharmaceutical Sciences		Ross	Skaggs School of Pharmacy and Pharmaceutical Sciences	273,499
ESC	BaroFold Inc	CU	Seefeldt	PreEMT High Pressure Refolding of Biosimilar Insulin Glargine - Scale, Purification, and Activity Confirmation	127,000
ESC	EnteroTrack LLC	CU	Shandas	Next generation monitoring of gastrointestinal allergic diseases	250,000
ESC	Aurora Oncology		Wolach	DT-EGF Fusion protein for bladder cancer	146,880
ESC	Nanoly Bioscience, Inc	CU	Sridhar	We hypothesize that NanoShield can protect vaccines from spoiling when stored outside of the 2-8 °C cold chain currently required	100,000
ESC	KromaTiD, Inc	CSU	Tompkins	Development and launch of dGH commercial assay services for the worldwide disease research market	100,000
POC	National Jewish Health TTO	NJH	Dai/Kappler	Structural maturation of therapeutic monoclonal antibody targeting autoimmune diabetes	35,960
POC	National Jewish Health TTO	NJH	Marrack	Generation of biospecific antibodies for targeting autoimmune-associated B cells	35,960
POC	National Jewish Health TTO	NJH	Saavedra/Knight	Utility of a CD64 assay to diagnose acute pulmonary exacerbations in cystic fibrosis	35,960
POC	National Jewish Health TTO	NJH	Riches	Therapeutic targeting of PTPN13 in pulmonary fibrosis	35,960
POC	National Jewish Health TTO	NJH	Strong	Development of a pulmonary microbiome diagnostic test to monitor chronic respiration diseases including cystic fibrosis and non-CF	35,960
POC	Colorado State University Research Foundation TTO	CSU	Khetani	Micro-engineered liver tissues for drug development	71,000
POC	Colorado State University Research Foundation	CSU	Kipper	Co-culture of Endothelial and Mesenchymal Cells to Vascularize Bone Allografts	47,500
POC	Colorado State University Research Foundation	CSU	Popat/James/Bailey	Novel silicone-based materials for ocular lenses	47,500
POC	Colorado State University Research Foundation	CSU	M Reynolds/Fisher	Plasma-treated NO-releasing materials for antibiotic medical devices	47,500
POC	Colorado State University Research Foundation	CSU	Reynolds	Develop and evaluate a novel modification to bioaerosol samplers to enable efficacious detection of the influenza virus in poultry operations	20,000
POC	Colorado State University Research Foundation	CSU	Vivanco	Developing the first generation of pre-biotics in agriculture	52,725
POC	Colorado State University Research Foundation	CSU	Wallenstein	Commercialization of advanced soil-based microbial solutions for agriculture management	50,000

POC	Colorado State University Research Foundation	CSU	Li/Suter	Smart Wound Dressings for the Detection and Colormetric Indication of Bacterial Infection	19,999
POC	Colorado State University Research Foundation TTO	CSU	Kipper	Electrospun Bone Matrix Scaffolds to Improve Bone Healing	48,449
POC	University of Colorado TTO	CU	Neville	Toxicity and efficacy studies on peptide targeting claudins in tumor cells	98,500
POC	University of Colorado TTO	CU	Hankiewicz	Development of Contrast for Magnetic Resonance Imaging for Non-Invasive in vivo Temperature	100,000
POC	University of Colorado TTO	CU	Wang	Development of Novel Resistance-Modifying Agents for the Treatment of MRSA	100,000
POC	University of Colorado TTO	CU	Wagner	Testing a Drug in EAE as a potential treatment for Multiple Sclerosis	88,900
POC	University of Colorado TTO	CU	LaBarbera	Marine derived antineoplastic agents for the treatment if drug-resistant and invasive cancer	100,000
POC	Colorado School of Mines TTO	CSM	Cox/Voorhees	Pre-Commercial POC and Validation of Rapid Listeria Detection and Screening Technology	103,364
POC	University of Colorado TTO	CU	Olson	Wave Mini-shunt laser activated Device to regulate Intraocular Pressure	51,500
POC	University of Colorado TTO	CU	Liu	Development of Proprietary Highly Potent Selective Histone	100,000
POC	University of Colorado TTO	CU	Yin	Optimizing TLR3 Inhibitors as Potential Therapeutics for Treating Inflammatory Diseases	100,000
POC	University of Colorado TTO	CU	Johnson	Pharmacological Abrogation of Injury Associated with Cryopreservation	100,000
POC	University of Colorado TTO	CU	Cech	Screening for small molecules targeting the TEL patch of TPP1 to modulate telomerase recruitment to telomeres	52,000
POC	University of Colorado TTO	CU	Park	Antimicrobial reverse thermal gel for surgical coating	44,000