

Introduction

The Montana Board of Research and Commercialization Technology (MBRCT) was created in 1999 to provide a predictable and stable source of funding for research and commercialization projects in Montana. The purpose of the program is to encourage economic development through investment in research projects that have a clear path to commercialization. The MBRCT is statutorily appropriated.

The mission of the MBRCT is to support the development of research and technology that has commercial potential within Montana by providing leadership and funding resources for those activities. The Board's objective is to award funds to research and commercialization projects with significant potential to improve the state's economy by:

- Supporting clean coal research and development projects, and renewable resource research and development projects;
- Supporting production agriculture projects that improve production capability, value-added opportunity and alternative crop options;
- Supporting projects that have the involvement of private companies;
- Supporting projects that enhance the state's research infrastructure;
- Supporting projects that show a clear path to commercialization in Montana; and
- Providing oversight management of awarded grants.

The six-member Board takes the following criteria into account when making funding decisions:

- Has potential to diversify or add value to a traditional basic industry of the state's economy,
- Shows promise for enhancing technology-based sectors or commercial development of discoveries,
- Employs or takes advantage of existing research and commercialization strengths,
- Has a realistic and achievable project design,
- Employs an innovative technology,
- Is located in the state,
- Has a qualified research team,

- Has scientific merit based on peer review, and
- Includes research opportunities for students.

Impact of MBRCT Funds

- Since the inception of the program, 185 projects have been funded with a total of \$38 million in grants.
- \$270 million in follow-on funding has been funneled into Montana from such sources as federal agencies, educational institutions, private businesses, non-profit associations and other state governments. This has resulted in \$7.08 in follow-on funding for every dollar granted by the program.
 - 87% of the funding is from the federal government with NSF and NIH funding accounting for 61% of federal R & D funds.
 - Grants to fund the National Science Foundation (NSF) Experimental Program to Stimulate Competitive Research (EPSCoR) at the University of Montana and Montana State University have attracted \$74.6 million in follow-on funding.
 - Grants to fund the National Institutes of Health (NIH) Center of Biochemical Research Excellence (COBRE) project at the University of Montana have attracted \$37.6 million to build biomedicine research infrastructure in the state.
- The program has averaged \$1.13 in matching funds for every grant dollar awarded. Matching funds total \$43.1 million.
- 45 projects have been commercialized, ranging from new wheat varieties to sensors and lasers to biofilm reactors.
- 145 of the projects have student participation, providing financial support and training in science and technology academic fields and some of these students have been hired by companies funded by the program. Faculty members are principal investigators for 117 of the research projects conducted at their respective universities.
- 24 start-up companies or expansions have resulted from program research projects.
- More than 225 scientific publications and professional presentations have resulted from program research projects.
- More than 135 patents have been applied for and/or received.
- More than 22 licensing agreements have been completed or are under negotiation.

- 87 Montana companies are program collaborators. These companies are grant recipients, have sold products resulting from program research projects or have otherwise been directly involved in program projects.

Commercialization Successes

Non-Structural Adhesives Requiring No Volatile Organic Compounds – Gill Geesey, MSU Bozeman, and Specialty Biopolymers Corporation, Bozeman – Environmentally-friendly wood adhesive

Value-Added Crop Development for Irrigated and Dryland Production in Eastern Montana – Joyce Eckhoff, MSU/Eastern Agricultural Research Center, Sidney – Release of “Silver” durum by MSU January 2012

Durum with Low-Cadmium Uptake for Production in Montana - Joyce Eckhoff, MSU/Eastern Agricultural Research Center, Sidney – Barilla, the largest pasta company in the world, contracted durum acres in MonDak region beginning 2011

High Value Crop Research and Demonstration Project to Promote Irrigation Development in Eastern Montana – Jerry Bergman, MSU/Eastern Agricultural Research Center, Sidney – Regional effort of growers, economic development groups, agri-businesses, brokers and processors to create new wealth and jobs in MonDak region by improved production management technologies for high-value production of crops such as sugar beets - New red skin, yellow flesh variety of potato, *MonDak Gold*, in test marketing stage - Startup of Enander certified potato seed farm near Westby

High Performance Biobased Motor Oils from Vegetable Oil Estolides – LubriGreen BioSynthetics (formerly Peaks and Prairies), Malta – Biosynthetic base oil described as “most exciting products to enter the lubricants industry since introduction of synthetic lubricants 50 years ago” - Purchasers include an Ohio-based additives company and a manufacturer of premium eco-friendly pet products based in Houston, Texas

Accelerated Development of Solid-Stemmed Wheat Varieties – Luther Talbert, MSU Bozeman – *Sy Tyra*, marketed in 2012, important option for Montana growers faced with wheat stem sawfly infestation

Intelligent Proppant (iProppant) - Hank Rawlins, eProcess Technologies, Butte - Next generation multiphase hydrocyclone

Innovative Fiber Optic Power Meter - Larry Johnson, ILX Lightwave, Bozeman - Next generation fiber optic power meter

Collaborative Research Applications of Innovative Protein Fluorescence Lifetime Spectrometer - Dr. Gregory Gillispie, Fluorescence Innovations, Bozeman - Expansion of commercial applications for fluorescence lifetime spectrometer

Research Support for Standardizing a Comprehensive Biofilm Efficacy Test System - Dr. Darla Goeres, MSU and BioSurface Technologies Corporation, Bozeman - Specialty tools to aid researchers in the manipulation of biofilm samples

Hyperspectral Sensor for Large-Area Monitoring of Carbon-Dioxide Reservoirs and Pipelines - Rand Swanson, Resonon, Bozeman - Airborne hyperspectral imaging systems with applications in agricultural and oil and gas industries

Development of a Nerve Stimulation System for Clinical Use in Regional Anesthesia and Pain Management - Dr. Philip Cory, Nervonix, Bozeman - Peripheral nerve block needle for anesthesia patented to Life-Tech, Inc.

Development of Seed Treatment Procedure for *Carex*, *Scirpus* and *Eleocharis* Species - Tim Meikle, Great Bear Restoration, Hamilton - Seed treatment process for germination of wetland plant species

Autonomous Flow-Through Instrument for CO₂ and pH - Sunburst Sensors, Missoula - Instrument that aids researchers in performing shipboard analysis of CO₂ and/or pH of a sample stream

Acoustic Sensor System for Protection of Borders and Perimeters of High Value Assets - Alex Philp, TerraEchos, Missoula - Adelos S4 sensor system

Unmanned Aerial Vehicle Deployment of Hyperspectral Imaging Spectrometers for Noxious Weed Mapping and Carbon Sequestration Site Monitoring - Kevin Repasky, MSU Bozeman - Flight-based hyperspectral imaging system

Developing a High-Power, Fiber-Coupled, Electro-Optic Amplitude Modulator - AdvR, Bozeman - Advancement of AdvR technology to enable production of commercial products using engineered crystals

OsteoSelect Demineralized Bone Matrix Putty for Orthopedic Bone Grafting Applications - Dr. Gregory Juda, Bacterin International, Belgrade - Allograft based bone void filler for bone grafting applications

Innovative Fluorescence Spectrometers for Life Science Research - Dr. Gregory Gillispie, Fluorescence Innovations, Bozeman - Fluorescence lifetime spectrometer

Immobilized Metal Polyamine Composites (IMPACS) for Removal and Recovery of Negatively Charged Species from Contaminated Waters and Mine Leaches - Dr. Edward Rosenberg, UM/Purity System, Missoula - Commercialization of resins

S2 Material Based Frequency Stable Laser (S2-FSL) Technology Development for Coherent Optical Communications - Dr. Kris Merkel, S2 Corporation, Bozeman - Vibration dampening module for cryo-coolers

Second Stage Field Clinical Trials & Bringing to Market of a Natural OTC (“Kre-Celazine”) to Treat Chronic Inflammation - Jeff Golini, All American Pharmaceutical, Billings - Kre-Celazine anti-inflammatory nutraceutical

Commercialization of Miniature Lasers: Evolving from Research and Development to Production - Christopher Palassis, AdvR Bozeman - Results from this research commercialized in AdvR products

Improving Productivity and Value of Wheat for Montana - Dr. Mike Giroux, MSU Bozeman - Release and deployment of new winter wheat cultivars, *Norris*, *Hyalite*, and *Bynum* licensed by Westbred LLC

Development of Disposable and Reusable Acoustic Bioreactors - Dr. Todd McAdams, Resodyn, Butte - Expansion of Resonant-Acoustic Mixing (RAM) intellectual property and sale of laboratory and production scale mixers

Camelina Sativa: A Low-Input Oil Crop for Omega-3 Culinary Oil and Animal Feeds - Dr. Alice Pilgeram, MSU Bozeman - OmegaDog pet supplement distributed by PetCo, Inc.; two new varieties of *Camelina sativa* released by MSU Foundation Seed Program in 2007

Innovative Native Seed Harvester - Lee Arbuckle, Native Seedsters, Billings - Arbuckle Native Seedster

Research and Development of a Hydraulic Fluid from Montana Grown Oil Seed Crops - Paul Miller and David Tooke, Sustainable Systems, Missoula - *EcoSeal*, sustainable wood product

Improving Productivity and Value of Wheat for Montana - Dr. Mike Giroux, MSU Bozeman - New wheat variety named *Vida*

Biomimetic Floating Islands that Maximize Plant and Microbial Synergistic Relationships to Revitalize Degraded Fisheries, Wildlife Habitats, and Human Water Resources - Frank Stewart, Floating Island International, Livingston/Bozeman/Billings - Biomimetic, self-sustaining floating islands remediate degraded fisheries, wildlife habitats, and human water resources

Biological Treatment of Animal Wastes by Endophytic Fungi and Mycofumigation - Dr. Gary Strobel, MSU Bozeman - *Earthpure*, a composite of endophytic microbes, for use by Phillips Environmental Products, Bozeman, to decontaminate human waste in portable toilets

Lasers Stabilized to Spectral Holes in Rare Earth Doped Crystals - Dr. Rufus Cone, MSU Bozeman - Ultra-stable lasers with purity and stability of 13-digit accuracy - S2 Corporation, Bozeman, contracted by Northrop Grumman as sole-source provider of turn-key stable laser system

Research Support for the Manufacturing and Marketing of the Drip Flow Biofilm Reactor - Dr. Darla Goeres, MSU Bozeman - Drip flow biofilm growth reactor for studying medically important biofilms commercialized by BioSurface Technologies, Belgrade

Deployment of A Real-Time Coal Content/Ore Grade Sensor - Rand Swanson, Resonon, Bozeman - Spectrometer vision device for mining applications

Development of an Oxygen-Consuming Biological Barrier to Prevent Oxidation of Pyritic Mine Tailings - Dr. Al Cunningham, MSU Bozeman - Biofilm barrier technology

Advanced Material for Metal Processing, Recovery and Remediation - Dr. Edward Rosenberg, UM; Purity Systems Inc., Missoula - Development of resins that allow environmentally benign methods for metal processing and recovery

Development of New Products for the Field Detection of Bioterrorism Pathogens - Dr. Brenda Spangler, SensoPath Technologies, Bozeman - Diagnostic point-of-care kits using fluorescent microspheres for home and office use to detect pathogens

Research, Education and Technology Transfer in the Plant Sciences - Dr. Luther Talbert, MSU Bozeman - New solid-stemmed wheat named *Choteau* has excellent yield potential and sawfly resistance

Specialty Mushroom Farming in Montana - Dr. Cathy Cripps, MSU Bozeman - Improved production methods for specialty mushroom farming enabled Garden City Fungi, Missoula, to increase productivity and profitability

A Programmable Frequency Chirped External Cavity Diode Laser Based on KTP Waveguides - Dr. Kevin Repasky, MSU Bozeman. Waveguide lasers commercialized by AdvR, Bozeman

A Real-Time Coal Content/Ore Grade Sensor - Dr. Tom Moon, Montana Tech, Butte - Imaging spectrometers, core technology of Resonon, Bozeman

CDC Biofilm Reactor - Dr. Martin Hamilton, MSU Bozeman - Suspended Coupon Biofilm Reactor, laboratory apparatus for conducting tests of anti-biofilm agent commercialized by BioSurface Technology Corporation, Belgrade

Discovering Important Genes and Deploying New Feed Barley Varieties - Dr. Thomas Blake, MSU Bozeman - *Haxby*, *MT960228* and *Hays* account for significant increases in Montana's \$115 million barley industry

Indian Rice Grass: A Value Added Perennial Crop for Montana Growers - Dr. David Sands, MSU Bozeman - Indian Rice Grass (*Montina*), a source of gluten free flour, sold by Amazing Grains Corporation, Ronan

Autonomous Carbon Dioxide Sensor - Dr. Michael DeGrandpre, UM, and Sunburst Sensors, Missoula - SAMI, an instrument for quantifying sources and sinks of atmospheric carbon dioxide

Value-Added and High-Value Crop Development in Eastern Montana - Dr. Jerald Bergman, MSU Eastern Agricultural Research Center, Sidney - MBRCT grants positive influence on Anheuser-Busch's decision to locate \$6.8 million malt barley handling and storage facility near Sidney