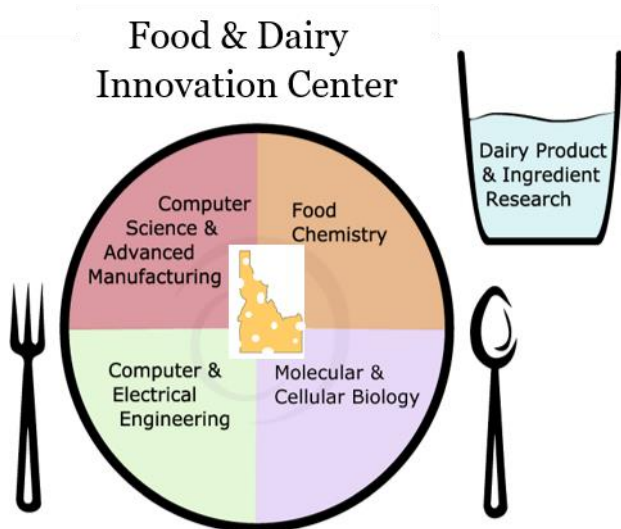




BOISE STATE UNIVERSITY

ID-SBOE HERC IGEM22-002

Boise State University Food & Dairy Innovation Center



Year 1 Progress Report: July 1, 2021 – December 31, 2021

Contributors:

Owen McDougal, PI: BSU Professor and Chair of Chemistry and Biochemistry

Julie Oxford, Co-PI: BSU Distinguished Professor of Biological Sciences

Lisa Warner, Co-PI: BSU Assistant Professor of Chemistry and Biochemistry

JoAnn Lighty, Co-PI: BSU Dean of College of Engineering, Mechanical & Biomed. Engineering

Jim Browning, Co-PI: BSU Assoc. Dean of Engineering, Electrical & Computer Engineering

Prepared for IGEM HERC by Diane Smith and Owen McDougal

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1.0 Project Overview

A. Project Information

Funding Agency: Idaho Global Entrepreneurial Mission Higher Education Research Council

Awarded Institution: Boise State University

Grant Number: IGEM 22-002

Project Title: Boise State University Food and Dairy Innovation Center

Principal Investigator: Owen McDougal, Ph.D., Professor and Chair

Co-Principal Investigators: Assistant Professor Lisa Warner, Distinguished Professor Julie Oxford, Professor and Assoc. Dean, College of Engineering, Jim Browning, Professor and Dean of the College of Engineering, JoAnn Lighty

Report Type: 1st semi-annual progress report: July 1 – Dec. 31, 2021

B. Executive Summary

Since notice of award and IGEM HERC grant fund availability of \$684,000 in July 2021, \$243,456 has been spent, \$250,000 has been encumbered, and the remaining \$190,544 will be expended prior to the first annual report in June 2022. The primary expenditures include \$205,040 for an instrument to conduct food chemistry research (LC-DAD-RI/MS), and \$38,416 for personnel and supplies. The encumbrance of \$250,000 will provide architectural design necessary to construct lab modules in the Micron Center for Materials Research building where the Food and Dairy Innovation Center will be located. The remaining \$190,544 will be used to pay personnel, purchase supplies, initiate collaboration across the state, and promote activities of the Food and Dairy Innovation Center to prospective customers.



2.0 Introduction

Our vision is to create a Food and Dairy Innovation Center (FDIC) at Boise State University. The FDIC will utilize science and technology to transcend the normative standards of fundamental and applied science in food and dairy sectors. This shift is required to catalyze the transition in Idaho's food and dairy processing industries by creating innovative technologies, providing food safety and food security training, and educating the next generation of workers to be prepared to lead in a high-tech, artificial intelligence (AI) dominated work environment. The FDIC will be a public-private lightning rod to spark economic development for all of Idaho. The FDIC builds on existing strengths at Boise State University, and will aim to strengthen collaboration with the University of Idaho and Idaho State University, with the goal of becoming a nationally-recognized resource for research and development, for student research and internship programs (e.g. VIP), and for driving economic success for Idaho industry. The objectives of the FDIC are to advance and create new processing technologies, establish a robust employee pipeline from university to private sector, and generate know-how and implementation of modern technology aimed at reducing usage of critical natural resources.

Tasks for Year 1:

- 1) Construct Module 1
- 2) Hire technicians or postdocs
- 3) Recruit students (Ph.D., M.S., Undergraduate)
- 4) Purchase instrumentation
- 5) Fundraise for Module II

3.0 Summary

A. Project accomplishments for the reporting period

- 1) **Construct Module 1:** IGEM HERC funds (\$250,000) have been encumbered for use in laboratory space construction architectural design and planning for the third floor of the Micron Center for Materials Research (MCMR). IGEM HERC funds will be complemented by BSU funds to build labs on the third floor of the new building once the architectural design is completed, and contractors are secured. Utilizing the IGEM HERC funds (3 yr. total = \$650,000) and state funds, two 650 sq. ft. modules will be completed and dedicated to the FDIC project. The laboratory completion date is projected to be Fall of 2023. The IGEM HERC funds are being used to pay the State Division of Public Works (DPW) for interagency billings they send to Boise State Architectural and Engineering (A&E) Services for this project. Since the State holds the contracts, they will pay the vendors directly and then bill Boise State for what has been authorized for them to spend for this construction project. IGEM HERC Council permission was sought on August 17, 2021 to use grant funds to pay the State entity for consulting and construction services, advertising, plan check and building permit fees, and other miscellaneous expenses associated with construction on the billings. Approval of this request was provided on August 31, 2021. An image of the future site of the laboratories for the FDIC is provided in **Figure 1**. At this point in time, DPW has approved moving forward and A&E Services needs to send a letter to start the design and milestone dates.



Figure 1. IGEM HERC project team member, Dr. Jim Browning, describing the proposed laboratory layout of the FDIC to participants of the 2021 annual BUILD Dairy meeting.

- 2) **Hire technicians or postdocs:** Several employees have been hired to initiate activity associated with the FDIC. Co-PI Browning has used HERC funds to support engineering activity conducted by postdoctoral researcher, Dr. Marcus Pearlman, in food safety and machine learning. Co-PI Warner used HERC funds to support the effort of research technician, Jayden Brandt, and PI McDougal used funds to support the effort of research technician Rose Saxton. PI McDougal conducted a search for a full-time postdoc, which identified an exceptional candidate, but after several months of negotiation, Dr. Heather Keefer pursued employment in industry instead. Another postdoctoral search will begin in early 2022. Funds were also used to support the effort of Diane Smith, a grant administrator who recorded the minutes of meetings and gathered reporting data for this IGEM HERC report. Tracy Yarnell was similarly compensated for one month of salary to establish the FDIC web site and manage news and correspondence surrounding center activity (**Figure 2**).

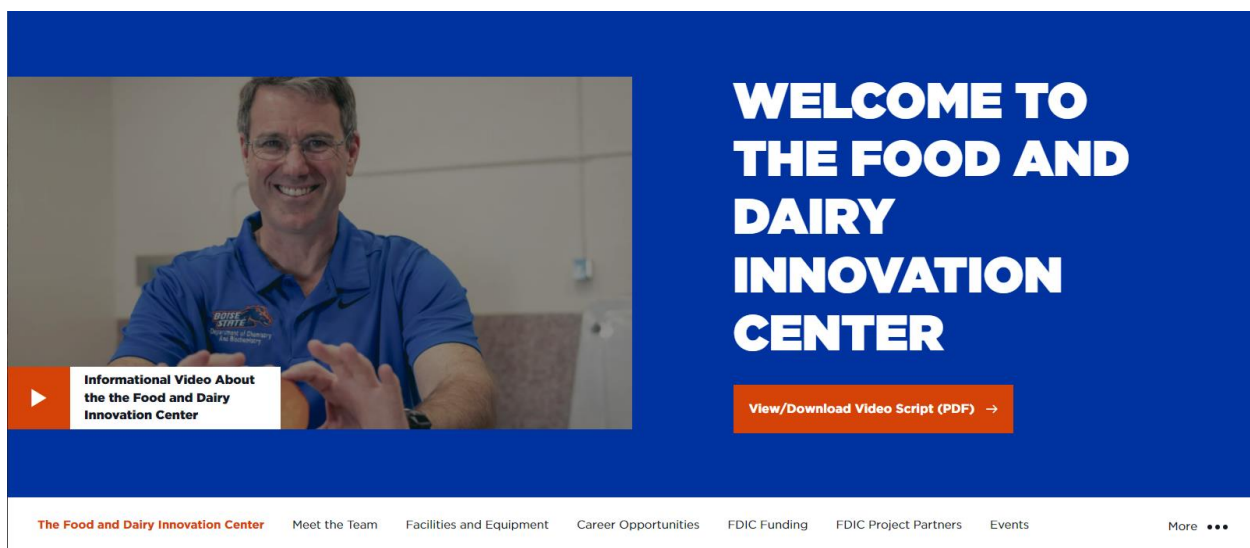


Figure 2. Home page for the FDIC web site (<https://www.boisestate.edu/fdicenter/>).

- 3) **Recruit students (Ph.D., M.S., Undergraduate):** The FDIC has generated considerable interest from students at Boise State University and from around the region. Two Biomolecular Science (BMOL) Ph.D. students have committed to the McDougal lab beginning Spring 2022. Madison Dirks will work on a dairy protein project focused on glycomacroprotein. She will pursue BUILD Dairy funding to support her work, which will utilize instrumentation, equipment and supplies provided by IGEM HERC. Elizabeth Ryan will work on projects that utilizes pulsed electric field (PEF) application to potatoes, wine and barley. These projects, in collaboration with Food Physics Group, engage industry partners including Cinder Wines and Anheuser Busch. Three prospective BMOL Ph.D. students have also



reached out to PI McDougal to discuss joining the lab to work on FDIC themed projects in FY23. Jonathan Cronmannon, a Navy veteran, Idaho native, and nutrition major, seeks to complete his BS degree at East Carolina University and pursue his Ph.D. at Boise State University. He has expressed interest to work on the PEF barley project. Maiah Woodring will be applying to the BMOL Ph.D. program and seeks to study the biochemistry and molecular biology of food. She will graduate from Southeastern Louisiana University this spring, 2022. Two additional Boise State University students have similarly expressed interest in the BMOL Ph.D. program to work on food and dairy projects in the FDIC. Anthony Scaife will get his BS in Chemistry this spring and Jared Seale will complete his MS in Chemistry this summer. In regard to Master's students, PI McDougal has recruited Ms. Rianat Olabisi into the Chemistry MS program to work on a PEF starter culture project associated with cheese.

The undergraduate student recruitment into food and dairy projects is a very exciting initiative made possible due to FDIC funding. Co-PI Warner and research technician, Jayden Brandt, have designed a Vertically Integrated Project (VIP) course to be offered in fall of 2022. The VIP course will be called *Food Systems*, and the audience will consist of chemistry, biology, engineering, and computer science students seeking to explore independent work into all aspects of food systems. The new postdoc to be hired by PI McDougal spring 2022 will take the lead on VIP course management alongside McDougal and Warner. It is the goal of this year-round initiative to establish a student training pipeline leading to good career jobs in Idaho. This program will begin with an introduction to *Food Systems* at the VIP 200 level, which we estimate will serve a student population of around a dozen students initially. As the VIP grows more senior students take on leadership roles in the project at the VIP 400 level. The academic year will provide context and training to the students for the projects and the summer will provide in-depth summer research experiences both at Boise State and through student exchange opportunities at sister institutions in Idaho and internships with industry partners. The *Food Systems* program will draw on expertise from academic and industry professionals to provide students with relevant, real world examples of emerging threats to food supply chain resilience, and provide a networking platform from which internship partnerships can be explored.

- 4) **Purchase instrumentation:** For this reporting period, two capital equipment expenditures have been made. We purchased an Agilent 1260 Infinity II liquid chromatography system equipped with a diode array detector, refractive index detector, and single quadrupole mass spectrometer (Product: SYS-LM-QUAD-E) for \$205,040. The other capital expenditure provided complex mixture filtration



capability prior to separations of milk by an Äkta Protein Chromatography System (\$10,174). This accessory has been used to support work in collaboration with High Desert Milk and Hyacinth Proteins where separation of proteins of interest from milk were optimized at Boise State to provide additional information for on-site installation of a plant-scale chromatography-based isolation system at High Desert Milk.

- 5) **Fundraise for Module II:** PI McDougal has been working with Melanie Bannister, Senior Director of Development, College of Arts and Sciences, Boise State University to initiate an FDIC fund raising campaign to build out lab modules, purchase instrumentation, and sponsor student fellowships. Co-PI Browning is planning submission of a major USDA grant in Sustainable Agricultural Systems (SAS) to construct additional lab modules. These efforts are ongoing. A report of fund-raising successes will be provided in the annual report.

B. Plans for 2nd half of year 1 reporting period

- 1) **Collaboration plan implementation:** PI McDougal will coordinate the effort of newly recruited BMOL Ph.D. student Madison Dirks to draft and submit a BUILD Dairy proposal to evaluate the bioactivity of various forms of glycomacroprotein (GMP) isolated from milk. This project will be developed in concert with University of Idaho Assistant Professor in the School of Family and Consumer Sciences, Dr. Yimin Chen. Madison will perform quantitative and qualitative analysis of GMP isoforms that will be evaluated for bioactivity in inflammation models available in Dr. Chen's lab. In a second collaboration, Dr. McDougal will work with newly recruited Chemistry MS student, Rianat Olabisi, to draft and submit a BUILD Dairy proposal aimed at evaluating the influence of PEF on starter cultures used to make cheese. This project will be conducted in collaboration with University of Idaho Associate Professor of Animal, Veterinary and Food Sciences, Dr. Gulhan Unlu. Rianat will conduct PEF studies and prepare starter cultures for cheese production and product evaluation by Dr. Unlu. Additional projects involving University of Idaho personnel will begin in 2022. Director of the Food Technology Center, Josh Bevan, will work together with PI McDougal on an Idaho State Department of Agriculture funded project to process potatoes into French fries, and a second project to evaluate the influence of PEF treatment of barley on beer production and product quality. PI McDougal will further engage with University of Idaho Professor Mike Thornton to conduct potato growth studies, and University of Idaho Emeritus Professor Joe Guenther to conduct economic analysis of the impact rangeland and forest fire smoke has on the value of processed potato product in Idaho. Additional engagement with the University of Idaho occurs through extensive engagement by



IGEM HERC

FDIC

the FDIC project team (Oxford, Warner, McDougal) and University of Idaho Idea Network of Biomedical Research Excellence Distinguished Professor Carolyn Bohach and Professor Sam Minnich.

- 2) **Personnel and equipment investment:** In spring 2022, a new postdoc search will be initiated for a Ph.D. scientist that can interface with industry and academic professionals to facilitate access to resources within the FDIC. The postdoc will provide training and mentorship of students, and lead VIP course activities. Student recruitment will remain a priority for 2022 and summer fellowship opportunities will be made available. Equipment purchases for the second half of the grant funding cycle may include a higher capacity centrifuge, wine and beer analysis devices including a Brix meter and conductivity meter, and potato color evaluation device, like an Agtronix. Prior approval will be sought from the IGEM HERC Council to purchase items not specifically identified in the proposed budget.



4.0 Summary of Budget Expenditures

Table 1 shows the IGEM HERC budget expenditures from July 1, 2021 – December 13, 2021.

Table 1. Budget summary of funds spent from IGEM HERC to support the FDIC during the first reporting period.

	Year 1 Budget Summary Updated 12/13/2021								
	Year 1 Budget	Year 2 Budget	Year 3 Budget	BAR Rebudget 1	Revised Budget	Total Expenses	Balance	Encumber	Available Balance
Salary	119,006.00			5,301.00	124,307.00	(21,525.84)	102,781.16	(17,979.15)	84,802.01
Fringe	44,833.00				44,833.00	(8,783.47)	36,049.53	(6,784.42)	29,265.11
OE	45,101.00			(10,174.91)	34,926.09	(1,678.87)	33,247.22	(8,833.20)	24,414.02
Travel	9,900.00				9,900.00	\$ (675.52)	9,224.48	0.00	9,224.48
Capital	455,040.00			10,174.91	465,214.91	(10,174.25)	455,040.66	(205,040.66)	250,000.00
Student	10,120.00			(5,301.00)	4,819.00		4,819.00	(4,819.00)	0.00
Sub Total	684,000.00	0.00	0.00	0.00	684,000.00	(42,837.95)	641,162.05	(243,456.43)	397,705.62
Indirect 0.0%	0.00				0.00	0.00	0.00	0.00	0.00
Total Costs	684,000.00	0.00	0.00	0.00	684,000.00	(42,837.95)	641,162.05	(243,456.43)	397,705.62

5.0 Collaboration Outreach

Summary Statement: PI McDougal and Co-PI Lighty visited higher education institutions across the state with the intent to draft a collaboration plan. The details of this effort were provided to the IGEM HERC Council in an October 1, 2021 progress report (see **Appendix A**). Three site visits were scheduled and conducted between July 1 – October 1, 2021, at the UI Food Technology Center in Caldwell, UI main campus in Moscow, and College of Southern Idaho / UI Extension office in Twin Falls. On November 16, 2021, PI McDougal and BSU Interim VPRED Nancy Glenn met with UI VPRED Chris Nomura and CALS Assoc. Dean Mark McGuire to review three specific research projects that could inspire collaborative activity between FDIC personnel and UI faculty in Moscow, Idaho within the College of Agriculture and Life Sciences. The meeting was productive and identified two projects for further development between PI McDougal and UI faculty Yimin Chen and Gulhan Unlu. PI McDougal outlined projects and sought partnership from Yimin Chen and Gulhan Unlu on December 11, 2021. Both UI faculty responded favorably. PI McDougal will develop proposals together with Dr. Chen and Dr. Unlu in early 2022 to pursue funding, student support, and collaborative activities aligned with the FDIC (see above pg. 6).

A. Leverage existing infrastructure and expertise

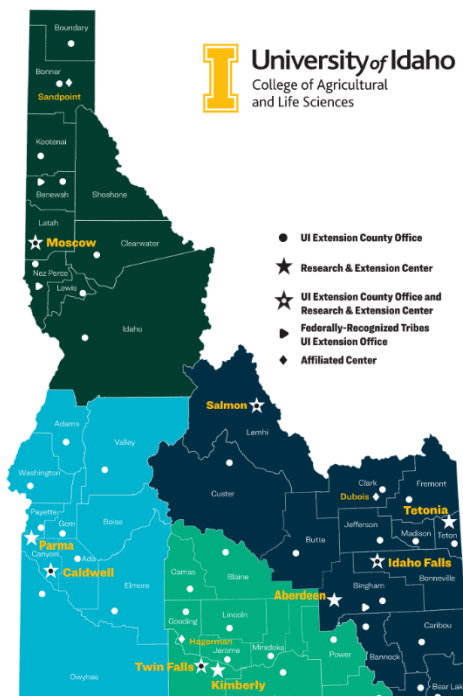


Figure 3. UI extension sites in Idaho.

The initial round of outreach has focused on University of Idaho extension offices, which represent the vast majority of infrastructure (see **Figure 3**) and expertise associated with agriculture. Food and dairy projects that utilize the resources made available by the FDIC will be conducted in 2022 together with the following existing facilities and professionals.

- UI Parma Research and Extension Center with Professor Mike Thornton
- UI Food Tech. Center with Director Josh Bevan
- UI Moscow with Emeritus Prof. Joe Guenther
- UI Moscow with Assistant Prof. Yimin Chen
- UI Moscow with Assoc. Prof. Gulhan Unlu
- UI Moscow with Dist. Prof. Carolyn Bohach
- UI Moscow with Prof. Sam Minnich



Efforts in 2022 will be made to expand the sphere of influence of the FDIC to Idaho State University facilities, faculty and students. Prior work by PI McDougal and Idaho State University Professor Jim Groome has been supported through the Idaho INBRE program, and utilization of the Molecular Research Core Facility was sponsored by BUILD Dairy and Gossner Foods Co. As the FDIC gains resources and personnel, the opportunities for engagement will continue to expand. McDougal plans to meet with ISU faculty to discuss opportunities made available through the FDIC in the first half of 2022.

B. Lab availability

The FDIC is still in the early stages of development. Recent estimates on construction of laboratory spaces in the Micron Center for Materials Research building identify fall 2023 as a viable move-in date. The first year of IGEM HERC funds provided a core instrument, the LC-DAD-RI/MS, and the second year of funds will provide a second essential instrument, a GC-MS. These instruments will be located in about 1,000 sq. ft. of lab space that PI McDougal manages. In year 2 of the IGEM HERC funded project, work will be conducted as follows: McDougal's lab will conduct quantitative and qualitative analysis, optical spectroscopy, and analyte characterization, Warner's lab will focus on protein biochemistry, Oxford's Biomolecular Research Center will provide an environment for cell culture work, advanced mass spectrometry analysis, and confocal microscopy to image cells, Browning's lab will conduct studies involving engineering, food safety and machine learning, and Lighty will consult regarding heat and mass transfer, and kinetics of food processing. Once the FDIC labs are completed in fall 2023, essential instrumentation will be consolidated into the Center to facilitate external user access.

The sustainability plan for FDIC instrumentation and personnel includes the establishment of a recharge center through Boise State University. The FDIC recharge center will operate in concert with other core facilities at Boise State University to provide easy access to internal and external customers at a reasonable cost. Internal customers include members of Boise State University and faculty co-investigators from other institutions, while external customers are those at academic or industry settings outside of Boise State University. The vision for lab availability is to rely on research faculty, postdocs/research technicians and graduate students to facilitate sample preparation and data acquisition for customers. The FDIC recharge center will be modeled after the successful Biomolecular Research Center (BRC) for which project team member, Distinguished Professor Julie Oxford, serves as the BRC Director. Co-PI Oxford has graciously provided guidance to PI McDougal to ensure the foundation is well established to secure FDIC sustainability and availability to all.



6.0 Demonstration of Economic Development/Impact

A. Patents, copyrights, plant variety certificates

Not available

B. Technology licenses signed, start-up businesses created, and industry involvement

- Food Physics Group in Boise, ID, has been involved in personnel training associated with pulsed electric field (PEF) system treatment of potatoes, collaboration for the pursuit of external funding through IGEM Commerce, and access to their applications laboratory.
- Anheuser Busch in Idaho Falls, ID, has partnered for a successful IGEM Commerce grant to begin in 2022 associated with PEF treatment of barley to accelerate germination rates.
- Glanbia Nutritionals in Twin Falls, ID, has provided facility tours and research priority projects that they will sponsor.
- Agropur USA in Jerome, ID, has discussed research priority projects that they will sponsor, student internship opportunities, and hiring of former students (Tyson Hardy).
- High Desert Milk and Hyacinth Proteins in Burley, ID have sponsored therapeutic drug development from agricultural sources, which has supported student research experiences (Joseph Collins).
- Lactalis American Group of Nampa, ID, has provided student internship opportunities associated with cheese quality assurance evaluation (Siomara Escobar).
- Cinder Wines of Garden City, ID, has partnered for a collaborative research project to explore the use of PEF to make better wine.
- DuBois Chemical of Nampa, ID, has provided student internship opportunities associated specialty chemical formulation quality control (Delaney Odell).
- 1,4-Group Inc. of Meridian, ID, has provided student internship opportunities associated potato sprout inhibitor quality control (Alex Whittington).
- J. R. Simplot Co. of Boise, ID, has provided employment for a former student (Kyle Meyer).



C. Private sector engagement

The private sector has been very engaged with the FDIC and offered support for continued development of infrastructure on behalf of food and dairy research. Letters of support were provided by private sector leaders in October 2021 on behalf of Boise State University to amplify the impact of the FDIC that included Glanbia Nutritionals, Agropur USA, Lactalis American Group, Darigold, High Desert Milk, Hyacinth Proteins, and Dairy West.

D. Jobs created

Since the time of FDIC funding, two students have obtained full time employment at J.R. Simplot Co. (Kyle Meyer) and Agropur USA (Tyson Hardy). Another three students have earned internship opportunities through Lactalis American Group, DuBois Chemical and 1,4-Group.

E. External funding – Food and Dairy

PI - McDougal

NAME (List/PI #1 first)	SUPPORTING AGENCY AND AGENCY ACTIVE AWARD/PENDING PROPOSAL NUMBER	TOTAL \$ AMOUNT	EFFECTIVE AND EXPIRATION DATES	% OF TIME COMMITTED	TITLE OF PROJECT
McDougal - PI	Dairy Management, Inc. Active: Sponsor Award Number: 9133	\$151,685	6/5/2020 - 8/6/2022	8% (0.08FTE)	Cost Effective Dairy Protein Certification Method
McDougal – PI	Idaho Department of Commerce: Active: Sponsor Award Number: 004504	\$291,770	3/31/2021 – 8/23/2022	8% (0.08FTE)	PEF Potato Processing Advantage
McDougal - PI	Idaho State Board of Education: Active: IGEM22-002	\$2,098,774	7/1/2021 – 7/1/2024	15% (0.15FTE)	Boise State University Food and Dairy Innovation Center
McDougal – PI	Western Dairy Center, BUILD Dairy: Active	\$137,400	2/1/2021 – 5/15/2023	0 FTE	Spectroscopic Investigation of Bioactive Protein Constituents in Whey



McDougal – PI	Idaho State Department of Agriculture: Awarded	\$125,000	1/15/2022 – 9/30/2023	8% (0.08FTE)	Impact of smoke on potato growth, storage and profitability
McDougal – PI	Idaho State Department of Agriculture: Awarded	\$164,784	1/15/2022 – 8/15/2023	8% (0.08FTE)	Improving Grape Extraction with PEF to Make Wine Better
McDougal - PI	Idaho State Department of Commerce: Awarded	\$192,757	1/15/2022 – 12/31/2022	8% (0.08FTE)	Economic benefit of PEF treated barley for breweries
McDougal – Co-PI	National Institute of Food and Agriculture/USDA: Pending	\$57,489	5/15/2022 – 1/15/2023	4% (0.04FTE)	mRNA vaccine technology adapted for delivery of novel gene/protein to strawberries

F. Other pertinent information

A current tenure track faculty search has identified a physical chemist that studies ice nucleation and proteins that inhibit ice formation. His prior work has involved such things as the fundamental understanding of freezer burn in ice cream. We are in the final stages of negotiation for employment at Boise State University, and this candidate appears to be a strong potential contributor to the BUILD Dairy program and the FDIC.

Co-PI Lighty has been asked to join a working group of a Task Force initiated by American Society of Agricultural and Biological Engineers (ASABE) President Paul Heinemann and led by Jim Jones. The Task Force is to recommend mechanisms to create alliances that connect and bring together ASABE with other professional societies and public-private sectors with expertise and tools to address complex and diverse issues associated with Transforming Food and Agriculture in Circular Systems (TFACS) initiative. This is a result of one of the recommendations from an earlier envisioning session which Lighty participated where alliances that connect and bring together ASABE with leaders of other professional societies and public-private sectors was addressed as an important step to contribute disciplinary expertise to address complex issues associated with TFACS.



7.0 Faculty and Student Participants as a Result of Funding

Table 2 shows the faculty, staff and students that are involved in research that benefits from the facilities available in the FDIC.

Table 2. FDIC participant listing.

Person	Title/Position	Project/Topic
Owen McDougal	PI - Prof. Chemistry	FDIC / food and dairy research
Lisa Warner	Co-PI – Assist. Prof. Chemistry	Protein biochemistry & structural biology
Julie Oxford	Co-PI – Dist. Prof. Biology	Matrix Biology; protein biochemistry
Jim Browning	Co-PI – Prof. Comp. Elect. Engineering	Food safety / food security
JoAnn Lighty	Co-PI – Prof. Mech. Biomed. Engineering	Chemical engineering – kinetics
Priscila Santiago	Postdoc – Food Engineering	PEF treatment of food & beverage
Joseph Collins	BMOL Ph.D. student	Dairy proteins / BUILD Dairy
Jared Seale	CHEM MS student	Food toxicity / poisonous plants
Sam Robinette	CHEM BS student	Potato chip acrylamide reduction
Madison Dirks	BMOL Ph.D. student	Dairy protein bioactivity / BUILD Dairy
Elizabeth Ryan	BMOL Ph.D. student	PEF treatment of food & beverage
Rose Saxton	Research Technician	Dairy protein & PEF wine
Jayden Brandt	Research Technician	Food System VIP course coordination
Hayley Shuagis	CHEM BS student	Food toxicity / poisonous plants
Mady Tyndall	CHEM BS student	Dietary supplement safety
Olivia Brown	CHEM BS student	Food toxicity / poisonous plants
Nick Franklin	CHEM BS student	PEF treatment of food & beverage
Ajay Atkinson	CHEM BS student	Smoke potato quality assessment
Diane Smith	Grant Administrator	Meeting minutes and progress reports
Tracy Yarnell	Website Designer	Creation of FDICenter website
Eric Baggs	Postdoc – Protein Biochemistry	Protein biochemistry/Isolation
Yimin Chen	UI Assistant Professor	Inflammation bioactivity evaluation
Gulhan Unlu	UI Associate Professor	Dairy microbiology
Josh Bevan	UI Director Food Technology Center	Potato processing and barley malting
Mike Thornton	UI Professor	Potato growth trials
Joe Guenther	UI Emeritus Professor	Potato economic analysis
Carolyn Bohach	UI Distinguished Professor	INBRE student fellowship support
Sam Minnich	UI Professor	INBRE network meeting coordination



8.0 Future Plans for Project Continuation or Expansion

The near-term plans in the second half of year 1 are to hire a postdoctoral researcher, continue to work with industry and academic partners to secure external funding to sustain operations, obtain external funding for collaborative projects with UI faculty Chen and Unlu, and recruit additional students into food and dairy research and internship programs. Outreach to ISU will be conducted in 2022 with the goal of identifying collaborative activities that draw upon the resources available in the FDIC. Until the FDIC labs are constructed in the MCMR, work will be carried out across FDIC team members individual spaces. Goals for year 2 include tangible collaborative projects with faculty at UI and ISU, and a continued focus on addressing the needs of Idaho industry. A driver for the FDIC activities is the research experiences for students that provide essential skills for employment. The fall 2022 VIP course will be the primary mechanism to build student competency.

9.0 Expenditure Report

Table 3 shows the expenditure report from July 1 – December 13, 2021, including a burn rate calculated at \$57,000 per month. Due to two capital expenditures resulting in \$465,214.91 of the total budget of \$684,000.00 the burn rate is based on total expenditures and the remaining budget in each category. Capital will be expended in early 2022 and other categories will be expended prior to the first annual report in June 2022.

Table 3. IGEM HERC FDIC expenditures.

GRANT: **IGEM22-002**
 Project Title: *Boise State University Food and Dairy Innovation Center*
 Reference: 70700 - 3742016 - 2000002086
 Financial Period: 07/01/21 - 12/13/2021

	Total Budget	Total Expenditures	Remaining Budget	Burn Rate
Salary & Wages	\$124,307.00	\$21,525.84	\$102,781.16	17%
Fringe Benefits	\$44,833.00	\$8,783.47	\$36,049.53	20%
Other Expenses	\$34,926.09	\$4,678.87	\$30,247.22	13%
Travel	\$9,900.00	\$675.52	\$9,224.48	7%
Capital Outlay	\$465,214.91	\$215,214.91	\$250,000.00	46%
Subcontractors	\$0.00	\$0.00	\$0.00	
Student Costs	\$4,819.00	\$0.00	\$4,819.00	0%
Total Direct Costs	\$684,000.00	\$250,878.61	\$433,121.39	37%
Indirect Costs	\$0.00	\$0.00	\$0.00	
Total Costs	\$684,000.00	\$250,878.61	\$433,121.39	37%

10.0 Commercialization Revenue

Nothing to report.



Appendix A

IGEM HERC October 1, 2021

Boise State University Food and Dairy Innovation Center

Report prepared by Owen McDougal

IGEM HERC Request: A detailed plan of the collaborations that will be engaged in with other higher education institutions in Idaho to ensure that this effort is in concert with other efforts across the state. This plan shall include an explanation showing how this effort will leverage existing infrastructure and expertise across the state. The plan shall also include the process for making the lab available during viable periods to further drive, in concert, other advancements that would benefit from the grant investment. **This plan shall be delivered to HERC by October 1, 2021.**

Background: IGEM HERC funds were made available July 1, 2021. A timeline of project planning, outreach and networking activity since funds were obtained is provided below in **Figure 1**.

IGEM HERC FDIC ACTIVITIES

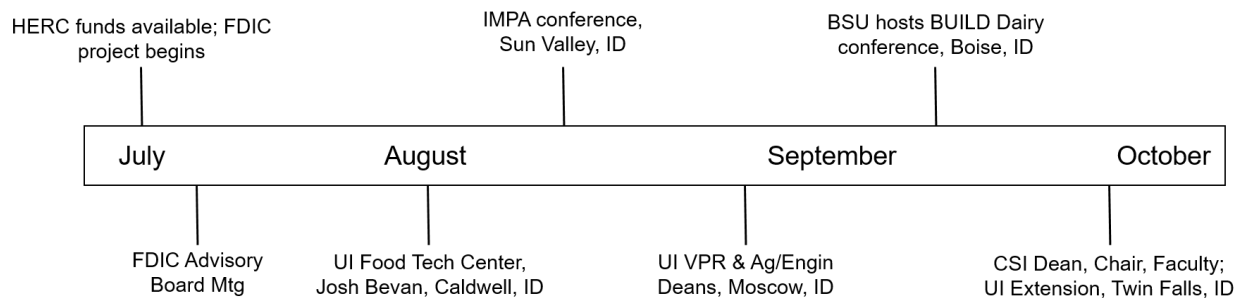


Figure 1. Timeline for Food and Dairy Innovation Center planning and outreach activity to network with industry and connect with higher education institutions in Idaho. For each activity listed in the figure, a report was generated and attached as supplemental to this collaboration plan.

Approach: The project team set out to clearly define the vision and goals for the Food and Dairy Innovation Center. To do this, a half-day retreat was hosted on July 15, 2021 between the project team (McDougal, Lighty, Browning, Warner and Oxford) and the advisory board (Gilton, Bastian and Gratzek). The group generated the vision and goals stated below.

Vision: *We envision a center that uses a transdisciplinary science, engineering, and technology systems approach to drive innovation for the food industry.*

Goal 1: Infrastructure - *Establish a core center that is complementary to Idaho institutional facilities for collaborative industry projects.*

Goal 2: Sustainability - *Generate sponsorship for collaborative industry focused projects aimed at workforce training and innovative product solutions.*

Outreach: With the FDIC vision statement and goals, PI McDougal and Co-PI Lighty set out to visit higher education institutions across the state with the intent to detail a plan for collaboration.

Within the time available, three site visits were scheduled and conducted at the Caldwell UI Food Technology Center, UI main campus in Moscow, and College of Southern Idaho / UI Extension office in Twin Falls.

Caldwell UI Food Technology Center: The first stop on August 4, 2021 was the University of Idaho (UI), Food Technology Center (FTC), based in Caldwell, ID. McDougal and Lighty toured the facility with Director Josh Bevan and listened to him describe his good laboratory practice (GLP) work and the limitations of the FTC. A report was drafted for this trip, and subsequent site-visits, as a supplemental to this collaboration plan. Director Bevan oversees a tremendous commercial kitchen operation with extensive food process capabilities. He runs a lean operation, where McDougal and Lighty learned that personnel, equipment, and externally funded collaborative projects could potentially be of value to the facility. McDougal and Lighty left on good terms and surmised that collaborative activity would be very likely given the proximity and capabilities of the FTC. **PLAN –** *Seek external funding for research projects in collaboration with Director Bevan that support the FTC and activities conducted at the facility. An example is an Idaho State Department of Agriculture grant that was recommended for funding, where McDougal is the PI and Director Bevan is a Co-PI. Grant funds will pay for Director Bevan to process potatoes into fried French fries that will be chemically characterized by McDougal.*

Idaho Milk Processor Association: McDougal and Collins went to the two-day Idaho Milk Processors Association conference to attend presentations and network with dairy professionals. McDougal met a variety of academic and industry leaders. Those that provided letters of support for the Food and Dairy Innovation Center at Boise State University were informed that the grant was funded, and were invited to the Building University-Industry Linkages through Learning and Discovery (BUILD) Dairy conference at Boise State on September 7-10, 2021. McDougal's networking resulted in understanding what needs exist in the dairy food industry. **PLAN –** *Conversations at this meeting led to new research project ideas that will lead to internship opportunities for students and careers in Idaho dairy processing.*

UI main campus in Moscow: McDougal and Lighty met with VPR Chris Nomura, Dean Mike Parrella, Interim Dean John Crepeau, Assoc Dean Mark McGuire, and Chair Bob Collier on August 31, 2021. The purpose of the meeting was to identify collaborative opportunities and learn about initiatives being put forth by UI that may complement the activity of the FDIC. Dean Parrella provided an overview of the four components of the Center for Agriculture, Food and the Environment (CAFÉ). Of these four "pillars", the food process program at College of Southern Idaho seemed to provide the greatest opportunity to leverage curriculum in a way that may lead to students obtaining a micro-credential. A request was made by Lighty for clarity on what UI infrastructure and expertise existed within the state, because the discussion centered on infrastructure that will be built and expertise by faculty that will be hired. At time of this report submission, no further clarification has been provided to identify existing opportunities for collaboration directly with UI. Following this meeting, McDougal and Lighty met with UI Food Science faculty Carolyn Bohach and Sam Minnich with whom they work through the Idaho Idea Network for Biomedical Research Excellence (INBRE) program. The meeting went very well, and provided a recommendation to pursue collaborative activities directly with faculty at UI. A follow up meeting was held between McDougal and UI Associate Professor Gulhan Unlu in the Department of Veterinary and Food Sciences. **PLAN –** *Based on the UI visit, collaboration in dairy food research with UI faculty, Gulhan Unlu, a fellow participant in the BUILD Dairy program will be pursued, and continued engagement with Carolyn Bohach and Sam Minnich, through the*

INBRE program, will lead to mentorship of students at BSU from institutions across Idaho (e.g., CSI, CWI, etc.).

BUILD Dairy Annual Meeting: Boise State University hosted the annual BUILD Dairy meeting from September 7-10, 2021. McDougal served as the BSU liaison for the meeting and hosted a tour of the future site of the Food and Dairy Innovation Center on the third floor of the Micron Center for Materials Research. Networking with Idaho dairy process industries has led to several emerging projects where funds will support student research activity to address industry priorities. **PLAN –** *McDougal plans to engage in research activities, targeting industry challenges, to educate students in relevant research, leading to career opportunities in Idaho for the students. Specific industry partners that expressed interest to pursue research collaborations with McDougal at BSU, include Lenny Bass of Lactalis, Anand Rao at Agropur, and Loren Ward, Dave Perry, and Emily Stout at Glanbia. Examples of what this looks like include a conversation at the BUILD Dairy annual meeting between McDougal and Bass that led to a student internship that began September 20, 2021. Conversations at BUILD Dairy and Idaho Milk Processor Association meetings, between McDougal and Rao, have led to internships for BSU students Tyson Hardy and Rose Saxton. In August of 2021, Agropur hired Hardy into a career position. Multiple conversations between McDougal and Ward, Perry, and Stout will lead to grant submission to explore the use of pulsed electric field system utilization in cheese production.*

College of Southern Idaho / UI Extension office in Twin Falls: On September 29, 2021, McDougal and Professor of Materials Science and Engineering, Scott Phillips, traveled to Twin Falls to meet with Chair of Agriculture, Matt Quesnell to discuss the Food Processing Technology Associate of Applied Science program with concentrations in either controls or quality assurance/quality control, and an automation engineering technology two-year degree program. There was general interest expressed by Mr. Quesnell to create opportunities for students beyond a two-year degree regardless of where that additional education was achieved. CSI chemistry faculty Megan Jacobson and Joshua de Groot, and Lab Manager Steve Korecki, meet with McDougal and Phillips to promote student opportunities at BSU through the Idaho INBRE program. McDougal and Phillips also met with UI Food Processing Specialist Janna Hamlett. Hamlett promoted training opportunities for students available through the TechHelp program run by Steve Hatten that include HACCP (Hazard Analysis and Critical Control Points), PCQI (Preventive Controls Qualified Individual), GMP (Good Manufacturing Practice), and others. In summary, collaborative opportunities are available with CSI and TechHelp. **PLAN –** *McDougal will work with the IGEN HERC project team (Lighty, Oxford, Browning, and Warner) to construct a training program, in concert with CSI and the statewide TechHelp center, for students interested to pursue food/dairy processing jobs in Idaho.*

FDIC availability – The Food and Dairy Innovation Center at Boise State University, will be set up as a university recharge center, modeled after the Biomolecular Research Center that Distinguished Professor Julie Oxford serves as Director. To learn more about how recharge centers operate at BSU, please visit the website at <https://www.boisestate.edu/brc/>. The program ILAB will be used for external or internal users to survey resources, schedule testing, and arrangement payment for services rendered. There will be trained scientists available in the FDIC that can either run samples for external customers or provide assistance for outside users to access the facility to conduct work themselves. The Food and Dairy Innovation Center is in the formative stages, but we have begun by creating the website that will be updated as the center comes to fruition (<https://www.boisestate.edu/fdicenter/>). It is our intent to make the Food and

Dairy Innovation Center an open access facility for all university and industry partners to conduct research pertaining to the capabilities of the center.