Spring 2020

UMaine Medicine Internal Grant Program: 2020 Update

University of Maine: Office of the Vice President for Research and Dean of the Graduate School

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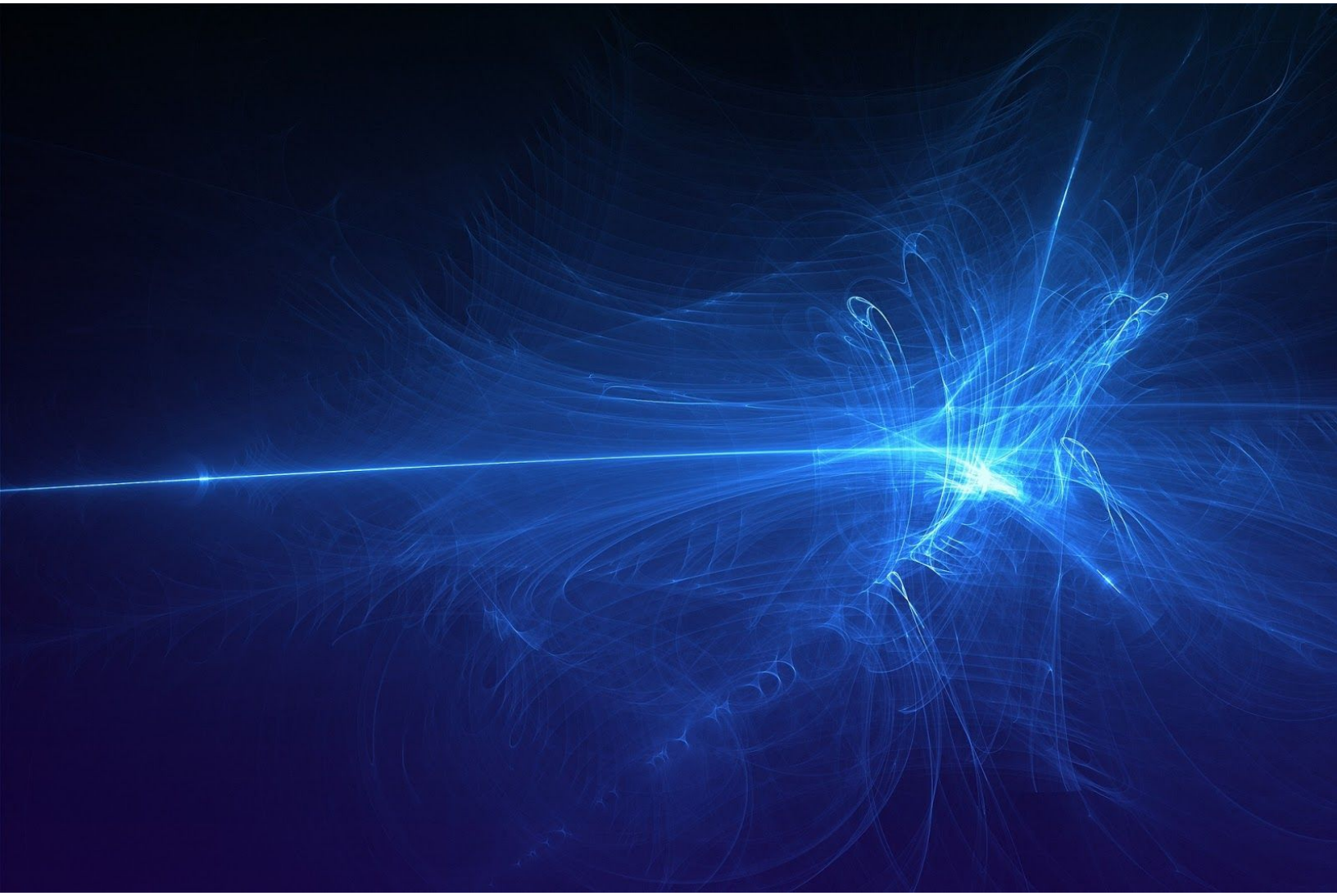

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Executive Summary

Vice President for Research and Dean of the Graduate School, Kody Varahramyan, launched the UMaine Medicine Initiative in November 2018. As part of the launch, internal funding programs were created and the inaugural round of the internal grant programs yielded 12 applications for funding. After a review panel process, a total of six awards were made, comprising: four seed grants, one infrastructure grant, and one NIH proposal development incentive award. Office of Research Development Director, Jason Charland, manages the UMaine Medicine grant program. Activity on these 12-month projects commenced in April 2019 and no cost extensions have been granted through Fall 2020 due to COVID-19 operating conditions. The no cost extensions will enable the research teams to complete deliverables and submit follow-on funding applications over the next several months. The following report provides updates on research highlights, student research engagement, and follow-on external funding success that the internal grant dollars have been able to stimulate.

To date, the initial investment of **$309,769** has resulted in:

- **$1,129,846 in follow-on external grant funding** awarded to UMaine Medicine Internal Grant PIs, resulting in a **2.65:1** return on investment
- **21 presentations** given domestically and internationally (including in Canada, the United Kingdom, and Italy)
- **8 publications** related to research from the funded UMaine Medicine grant projects
- **26 undergraduate and 13 graduate students** participating in research and/or supported by grant funds

Muscle and Healthspan Research Collaborative

PI: Clarissa Henry (Molecular & Biomedical Sciences)

Co-PIs: Ben King (Molecular & Biomedical Sciences), Sam Hess (Physics and Astronomy), Josh Kelley (Molecular & Biomedical Sciences)

Research Focus Area: Immune System

Abstract: This project is centered on the discovery of mechanisms that underlie skeletal muscle plasticity and health, using the zebrafish model. The research on skeletal muscle is important because skeletal muscle quality predicts immune system health, better recovery from illness and injury, and healthy aging.

Key updates:

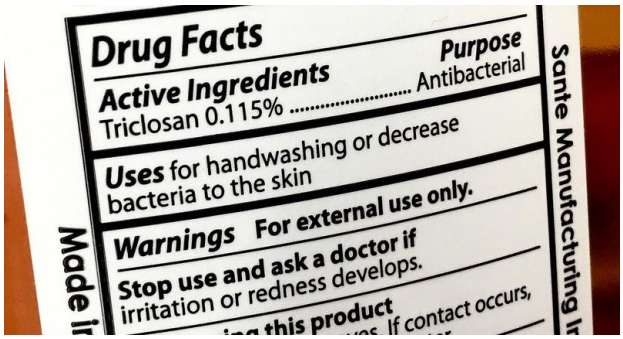
- The Kelley/Henry labs have collaborated to generate a data set that was used to drive machine learning of healthy versus unhealthy muscle. This image analysis is invaluable for the Henry lab and will be used in many future projects.
- The Hess/Henry labs generated the appropriate constructs, injected them into zebrafish, and recently managed to get the first super-resolution image of the myotendinous junction in zebrafish.
- Dr. Henry has been awarded two grants from NIH as follow-on funds from this project: $321,200 (renewable annually for four years) for a grant entitled *Mechanisms of NAD+ action during muscle development and homeostasis* and $431,586 for *Neuromuscular development in a zebrafish dystroglycanopathy model.*

Mast Cell and Mitochondrial Disruption by Triclosan and Related Antimicrobials

PI: Julie Gosse (Molecular & Biomedical Sciences)

Co-PIs: Robert Gundersen (Molecular & Biomedical Sciences), Samuel Hess (Physics & Astronomy)

Research Focus Area: Immune System



Abstract: Triclosan (TCS) is an antimicrobial banned by the USDA from soaps, but still used in other products such as toothpaste. Dr. Gosse has previously discovered that TCS inhibits the function of mitochondria and immune cell type mast cells. In this project, the investigators studied the effects of TCS and TCS substitutes on plasma membrane potential, mast cell function, mitochondria and various cell types. This also helped to generate data for a competitive NIH grant application.

Key updates:

- This team includes nine graduate students and nine undergraduate students who are gaining significant training in lab work, and using this experience as the basis of their capstones and theses.
- Dr. Gosse's students have received a total of seven awards (altogether $23,360) to support their work on this project, including an INBRE Functional Genomics Thesis Fellowship ($3,500), an INBRE/Honors College Comparative Functional Genomics Junior Year Research Award ($1,400), an INBRE Summer Research

Fellowship ($9,660), a Frederick Radke Undergraduate Research Fellowship ($500), and a 2019 Barry Goldwater Scholarship ($7,500).
- Dr. Hess submitted an NIH R15 AREA proposal that is currently pending a funding decision.
- The team has been studying and collecting data on CPC (cetyl pyridinium chloride, a chemical used in oral care products). They are working on a manuscript on CPC for peer review as they prepare an additional NIH R15 AREA proposal to be submitted in June 2020.

Design and in vivo Testing of an Additively Manufactured, Percutaneous Surgical Implant that is Modified to Incorporate Negative Pressure Wound Therapy

PI: James Weber (School of Food and Agriculture)

Co-PIs: Kristy Townsend (School of Biology and Ecology), Anne Lichtenwalner (Cooperative Extension / School of Food and Agriculture), David Neivandt (Chemical and Biological Engineering), Ian Dickey, MD (Orthopedic Surgeon)

Research Focus Area: Diagnostic Medicine

Abstract: The long-term goal of this project was to develop medical implants that reduce the likelihood of post-surgical infection. Similar technology has been shown to reduce the rate of infection after surgery. This was an advancement of these researchers' previous work, in which they did not incorporate vacuum-assisted wound therapy.

Key updates:
- The team has completed the first round of swine surgeries and post-surgical recovery periods. Preliminary results show enhanced wound healing into their trans-cutaneous implants when they were under constant negative pressure from the vacuum-assisted wound therapy devices.
- Dr. Weber established new collaborations with Acelity, Inc. (subsidiary of 3M Corporation), a manufacturer of vacuum-assisted wound management devices, that has led to the in-kind donation of 16 wound management devices for use by UMaine researchers. The team is discussing projects for 2020 with a new industry partner.

Role of Anthocyanin and Phenolic Acid Extracts from Wild Blueberries on Wound Healing as related to Diabetes, Ischemic conditions and Tissue Regeneration

PI: Dorothy Klimis-Zacas (School of Food and Agriculture)

Co-PIs: Kristy Townsend (School of Biology and Ecology), James Weber (School of Food and Agriculture)

Research Focus Area: Immune System

Abstract: The Klimis-Zacas lab has documented in vitro that a chemical compound extracted from Maine wild blueberries increased the speed of wound closure by 38 percent above the control. The purpose of this project was to validate those results and design a patch or spray prototype to be tested on humans, in order to create a life-changing treatment for people with injury-causing chronic conditions, such as diabetes.

Key updates:

- Dr. Klimis-Zacas has been in the press several times about this project (links below):
  - UMaine Research News, March 4th, 2019
  - Channel 5 WABI, January 27th, 2020
  - WMTW 8 ABC, January 28th, 2020
  - CBSN Boston, January 28th, 2020
  - Mainebiz, January 29th, 2020
- The project funded doctoral student Natalie VandenAkker who helped the team complete pre-clinical studies and is presently analyzing these data. Preliminary results show significant increases in wound closure in the experimental groups compared to the control.
- The team has received follow-on funding from a variety of sources: $25,000 from MTI, $30,000 from an RRF Accelerator Grant (MIRTA), $25,000 from the Wild Blueberry Association of North America, and $5,000 from NSF I-Corps.

UMaine Medicine Infrastructure Grant Award: Leveraging the Power of Diffuse Optical Imaging

PI: Karissa Tilbury (Chemical and Biomedical Engineering)

Co-PIs: Andre Khalil (Chemical and Biomedical Engineering), Kristy Townsend (School of Biology and Ecology)

Research Focus Area: Diagnostic Medicine

Abstract: This infrastructure grant requested the acquisition of Reflect RS, a vendor-provided diffuse optical imaging system. Diffuse optical imaging allows for a safer, non-invasive means to study tissue-level alterations in metabolism. This instrumentation is intended for the study of tissue composition. The research team has made it available to other researchers within and beyond the university, as well as for work in future NIH and NSF grant proposals.

Key updates:

- Dr. Tilbury has presented on this project seven times in locations in Maine as well as Boston, MA, and Colombia, SC. Two presentations were led by Wyatt Austin, the M.S. student in her lab.
- The Reflect RS from Modulim arrived in Fall 2019. The students of the Tilbury Lab have created a user-friendly set of instructions to complement the operating manual.
- The team is developing analysis routines that are flexible and shareable with other investigators on campus.

NIH Proposal Incentive Program Award: Diagnosing Breast Cancer through Biophysical Disruptions of Tissue Microenvironment

PI: Andre Khalil (Biomedical Engineering)

Collaborator(s): 1) Dr. Amy Harrow, MD, Radiologist, Section head, Women's Center, Eastern Maine Medical Center and 2) Dr. Ivette Emery, PhD, Translational Scientist and Catalyst, Maine Medical Center Research Institute

Research Focus Area: Diagnostic Medicine

Abstract: The purpose of this award was to support a graduate student to assist the team in generating preliminary data for a grant submission to NIH via the Academic Research Enhancement Award (AREA – R15) program.

Key updates:

- Jeremy Juybari, a Master's student in Mathematics, was supported by funds from this project has been accepted to a UMaine PhD program and plans to continue working with Dr. Khalil.
- The team received a high score on an R15 proposal submitted in February 2019, but it was two points away from making the funding cut. With help from the graduate student last summer as well as working with the NIH program officer, the team improved and re-submitted the proposal. They expect to hear back with confirmation of funding from NIH in May 2020.
- Dr. Khalil recently received a $500 travel award from the Office of the Vice President of Research and Dean of the Graduate School in order to meet the Program Officer of the NIH R15 program to which the team is submitting. This will also contribute to Dr. Khalil's goal of eventually submitting an NIH R01 proposal.

Conclusion

This inaugural round of UMaine Medicine seed funding has allowed researchers to showcase the university's research expertise in the biomedical and health sciences as well as to highlight the potential for continued growth in this area. The external collaborations formed and the equipment acquired will likely contribute to future projects, and the $1.16 million in follow-on grant funding has expanded the scope of researchers' plans. The direct impact of these investments will continue to accrue over the next several years. In addition, the 39 students who worked within these teams have received invaluable and unique experiences that will serve them throughout their educational and professional careers.