2023 Annual Report
Health Research Institute
Dr. Caryn Heldt, Director

Mission Statement

The mission of the Health Research Institute is to establish and maintain a thriving environment that promotes translational, interdisciplinary, and increasingly convergent health-related research and inspires education and outreach activities.

Summary of Activities and Highlights

Governance

The HRI is governed by a Director and a five person executive committee, with four regular members serving two or three year terms, and the current director of the Joint Center for Biocomputing and Digital Health (BDH). The membership and executive committee meet twice per calendar year in the fall and spring. Major decisions are made with member input gathered via surveys, votes, and/or special committees.

Membership

Individuals interested in joining the Institute must submit a one page application form with their Department Chair's signature and a current CV. In FY 23, the HRI added four new members, for a total of 54 members from 12 departments and four colleges. A full member list is included in the Appendix.

Activities

The Institute has several programs available to its members and affiliated students. The Institute builds capacity for its members through a mentoring program, seed grant and cost share funding, various workshops and panels, networking opportunities, and a new faculty travel grant program. In 2023, the research socials were particularly popular and there is significant support for the new travel grant program. The Institute also offers subsidized BioRender software subscriptions to members and the university community and also offers a 10% contribution to members using the Animal Care Facility.

Programs for HRI affiliated students have grown in the past year. The fellowship and student travel grant programs are increasingly popular. The membership voted to increase the amounts for student travel grants, which now operates on a tiered system with total awards of $1000, $750, or $500 possible. There are also workshops, sessions, and a student forum that are held throughout the year.

We had three goals that were set last year and we accomplished two of the three and are working hard on the third.
Goal 1: Obtain an NIH T32 training grant in HRI. Update: We submitted the T32 in January and received a score. We await the final decision in the council meeting in October 2023.
Goal 2: Increase research expenditures in HRI. Update: We have increased research expenditures.

Goal 3: Provide funding for our members to help in research, educational, and outreach Activities. Update: We continue to increase our funding to our members.

Highlights

Q1: In August 2022, the Institute held the first Upper Peninsula Medical Conference at Michigan Tech, which offered 10 continuing medical education credits for health practitioners and featured a poster session and tours of HRI member labs. The second conference will be held in October 2023. Graduate student Bianca Mercado-Velez planned a peer-hosted workshop for first year graduate students in September titled “Tool Box for a Successful PhD”. There were two seminars for members and interested students. Erico Freitas from the Applied Chemical And Morphological Analysis Laboratory presented his seminar “Ex-situ and In-situ STEM for Biological Systems” and Ruben Carbonell of North Carolina State University shared his talk “Scaling Up Your Research from Single PI Grants to Multi-Institute Centers”.

Q2: The Fall Research Social was held in November. Planning also began for the MTU-MSU Research Symposia, with plans for the MTU delegation to travel to Grand Rapids in the spring and MSU researchers coming to Tech in October.

Q3: The NIH T32 was resubmitted in January. The annual Student Research Forum took place in March. The Spring Research Social and the first MTU-MSU symposium were also held that month. The Institute received its first round of applications for the new Summer Undergraduate Research Fellowship program. Of these applications, three students from the University of Central Florida, the University of Puerto Rico Mayaguez, and the University of Puerto Rico Rio Piedras were invited to come to campus.

Q4: In April, there was another graduate workshop planned by Bianca Mercado-Velez. “Jobs in Academia” featured the expertise of HRI members Rupali Datta (Bio) and Smitha Rao (BME). The Summer Undergrad Fellowship program began in late May with the arrival of the three students. They began work in the Heldt, Goetsch, and Minerick laboratories during the first week of June. Grace and some of the graduate students helped coordinate their airport pick-ups and helped them settle in. They also planned activities for the summer, which included beach trips, hiking, and get-togethers. The HRI students were also invited to participate in MiCUP outings. The students returned home in late August. Based on the success of this program and the feedback we received from the participants, we hope to grow this program in FY 24.

Budget Overview

	HRI Budg	HRI FY Total	Budget-Actual	TechFor Budg	TechFor FY Total	Budget-Actual
Income						
Carry over	$ 319,781	$ 319,781		$ 107,843	$ 107,843	-
HRI IRAD generation	$ 160,000	$ 168,063	$ 8,063			-
TF Budget Increase				$200,000	$ 200,000	-
Total	**$ 479,781**	**$ 487,844**	**$ 8,063**	**$ 107,843**	**$ 307,843**	
Expenditures						
Administrative	$ 246,553	$ (264,146)	$ (17,593	$ 35,050	$ (54,187)	$ (19,137)
Wellness Program				$ 16,500	$ (19,176)	$ (2,676)
Direct research support	$ 175,750	$ (49,513)	$ 126,237	$ 152,750	$ (77,103)	$ 75,647
Total	**$ 422,303**	**$ (313,659)**	**$ 108,644**	**$ 204,300**	**$ (150,467)**	**$ 53,833**
Income-Expenditures		$ 174,186			$ 157,376	

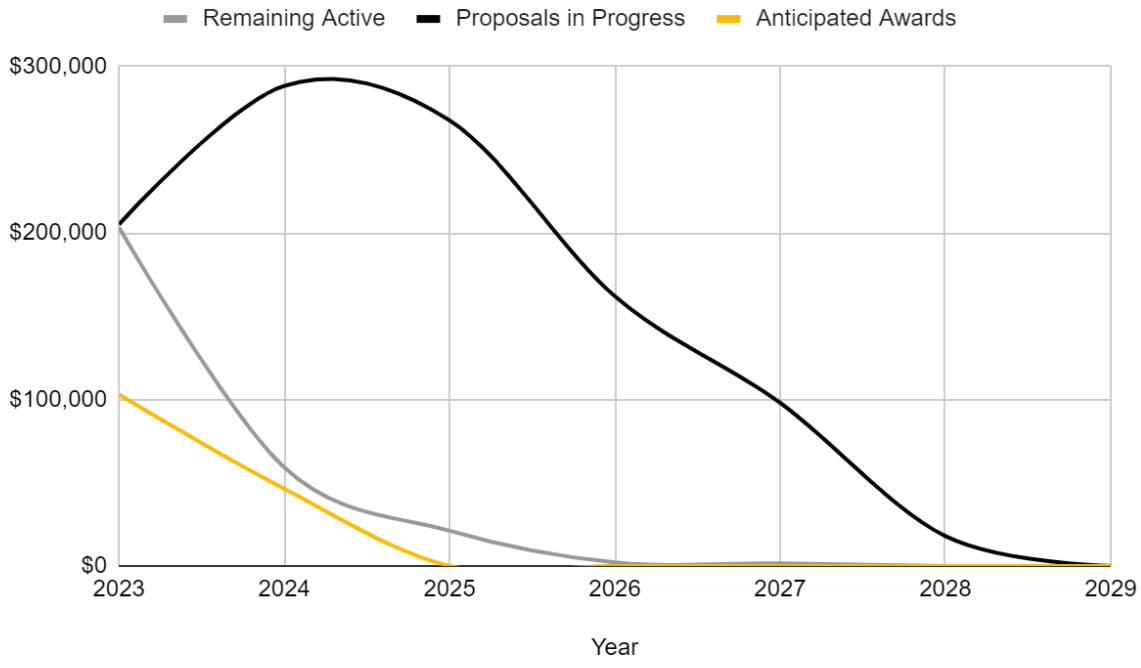

Fig. 1: IRAD Projection
Calculated at 17% 2023 C/I IRAD Return Rate

Future Plans and Goals

We continue to have the goal of increasing membership, research expenditures, and outreach to our members. In addition, we have the following goals for FY24.

Goal 1: Obtain an NIH training grant
Goal 2: Move into H-STEM and provide our members with activities and events that make the new space welcoming

We have long term goals to hire an administrative assistant so that Grace can focus more on research development, and to hire another research scientist/engineer. We need to think strategically on what research area would best compliment our current members.

Challenges and Barriers

Our current challenges are obtaining the NIH T32 and engaging as many members as we can in activities.

Appendix

Table A1: 2023 Members

College	Department	Member
CFRES	College of Forestry and Environmental Sciences	Hairong Wei
CoC	Applied Computing	Weihua Zhou
CoE	Biomedical Engineering	Bruce Lee
CoE	Biomedical Engineering	Chunxiu Yu
CoE	Biomedical Engineering	Hoda Hatoum
CoE	Biomedical Engineering	Hyeun Joong Yoon
CoE	Biomedical Engineering	Jeremy Goldman
CoE	Biomedical Engineering	Jingfeng Jiang†
CoE	Biomedical Engineering	Muhammad Rizwan
CoE	Biomedical Engineering	Roger Guillory
CoE	Biomedical Engineering	Rupak Rajachar
CoE	Biomedical Engineering	Sangyoon Han
CoE	Biomedical Engineering	Smitha Rao
CoE	Chemical Engineering	Adrienne Minerick*
CoE	Chemical Engineering	Caryn Heldt*
CoE	Chemical Engineering	Rebecca Ong
CoE	Chemical Engineering	Yixin Liu
CoE	Material Sciences and Engineering	Jaroslaw Drelich
CoE	Mechanical Engineering-Engineering Mechanics	Hassan Masoud
CoE	Mechanical Engineering-Engineering Mechanics	Parisa Pour Shahid Saeed Abadi
CSA	Biological Sciences	Mark Tang
CSA	Biological Sciences	Paul Goetsch
CSA	Biological Sciences	Robert Larson
CSA	Biological Sciences	Rupali Datta
CSA	Biological Sciences	Thomas Werner

CSA	Biological Sciences	Xiaoqing Tang
CSA	Biological Sciences	Yan Zhang
CSA	Chemistry	Ashutosh Tiwari
CSA	Chemistry	Christo Christov
CSA	Chemistry	Haiying Liu
CSA	Chemistry	Lanrong Bi
CSA	Chemistry	Marina Tanasova
CSA	Chemistry	Momoko Tajiri
CSA	Chemistry	Shiyue Fang
CSA	Chemistry	Tarun Dam*
CSA	Chemistry	Tatyana Karabencheva-Christova
CSA	Cognitive and Learning Sciences	Erich Petushek
CSA	Cognitive and Learning Sciences	Kevin Trewartha*
CSA	Kinesiology and Integrative Physiology	Caroline Gwaltney
CSA	Kinesiology and Integrative Physiology	Carolyn Duncan
CSA	Kinesiology and Integrative Physiology	Kelly Kamm
CSA	Kinesiology and Integrative Physiology	Qinghui Chen*
CSA	Kinesiology and Integrative Physiology	Steven Elmer
CSA	Kinesiology and Integrative Physiology	William Cooke
CSA	Kinesiology and Integrative Physiology	Zhiying Shan
CSA	Kinesiology and Integrative Physiology	Megan Frost
CSA	Mathematical Sciences	Byung-Jun Kim
CSA	Mathematical Sciences	Kui Zhang
CSA	Mathematical Sciences	Qiuying Sha
CSA	Mathematical Sciences	Shuanglin Zhang
CSA	Mathematical Sciences	Xiao Zhang
CSA	Social Sciences	Donald Lafreniere
CSA	Social Sciences	Richelle Winkler
NA	Health Research Institute	Xiaochu Ding

** Executive Committee Member*
† BDH Director

Table A2: Proposals and Award Totals

FY 2023	
Number of proposals	66
Number of PI's who submitted	31
Total requested amount	$44,084,993
Number of awards	21
Number of PIs awarded	14
Total Requested amount	$4,505,666

Table A3: FY2023 Proposal List

Quarter	**PI**	**Title**	**Sponsor**	**Amount**
Q1	Chunxiu Yu	Determining Functional Circuits in Subthalamic Deep Brain Srimulation for Parkinson's Disease	NIH	$ 1,487,701
Q1	Hoda Hatoum	Designing a Novel Transcatheter Mitral Value and Developing a Large Animal Model for Mixed Mitral Valve Disease	NIH	$ 3,464,989
Q1	Nan Mu*	Improving Endovascular Treatment Planning for Intracranial Aneurysms	American Heart Association Inc	$ 151,476
Q1	Paul Goetsch	Establishment of the germline expression program in C. elegans	Marquette University	$ 1,142,733
Q1	Paul Goetsch	CAREER: Priming CUREs to dissect how the DREAM complex protects cell identity	NSF	$ 1,020,800
Q1	Yixin Liu	CAREER: Self-Reporting Epitope Imprinted Polymers for Low-Cost Protein Detection	NSF	$ 500,012

Q2	Bianca Mercado Velez	Single-particle Characterization of Tumor-derived Exosomes to Maintain Crewmembers' Health	University of Michigan-Michigan Space Grant Consortium	$ 5,500
Q2	Caryn Heldt	G-RISE at Michigan Technological University	NIH	$ 1,881,993
Q2	Chunxiu Yu	REF-RS: Exploring Deep Brain Stimulation for the Treatment of Autism	Michigan Technological University	$ 21,000
Q2	Chunxiu Yu	Dissecting Neural Circuit Mechanisms Underlying Pallidal Deep Brian Stimulation	NIH	$ 469,500
Q2	Hoda Hatoum	Development of a data driven probabilistic model to predict leaflet thrombosis risk and occurrence after bioprosthetic aortic valve replacement	NIH	$ 3,332,047
Q2	Hoda Hatoum	ERI: Non-Newtonian blood analogs and effect of their rheology on physiological flow stasis in heart valve applications	NSF	$ 200,000
Q2	Hoda Hatoum	Impact of systematic arterial afterload variations on epicardial coronary flow and valve performance after bioprosthetic aortic valve replacement	NIH	$ 407,623
Q2	Jingfeng Jiang	Radiomic-based textural analysis of Intraluminal Thrombus in Aortic Abdominal Aneurysms	BCBS of Michigan Foundation	$ 3,000
Q2	Kyle Wehmanen†	Human Powered Locomotion on Variable Terrain: Implications for how to Move on Mars	University of Michigan-Michigan Space Grant Consortium	$ 5,000
Q2	Marina Tanasova	Exploring vulnerability of triple-negative breast cancers through inhibition of fructose transport	DoD	$ 1,126,427
Q2	Muhammed Rizwan	Platform of Spatio-temporal Control of Notch Signalling in Organoid Development	NIH	$ 627,986

Q2	Parisa Abadi	Multiscale and Multiphysics Engineering of Cardiomyocytes for Disease Modeling and Drug Testing	American Heart Association Inc	$ 154,000
Q2	Robert Larson	Impact of Excessive Cardiac Sensory and Sympathetic Nerve Activity in Hypertrophic Cardiomyopathy	NIH	$ 467,200
Q2	Sangyoon Han	Elucidation of mechanobiological pathway in classical type of Ehlers-Danlos Syndrome	Wallace Research Foundation	$ 270,000
Q2	Sangyoon Han	Mechanotransduction and signaling pathways in response to subtrate stiffness	San Diego Biomedical Research Institute	$ 406,479
Q2	Shiyue Fang	Synthesis of Senstive Epitranscriptiomically Modified RNAs	NIH	$ 451,542
Q2	Smitha Rao	Isolation of migrating cancer cells using GLUT5-specific molecular probes	NIH	$ 464,791
Q2	Smitha Rao	Using GLUT5-specific molecular probes to isolate and separate breast cancer cells	NIH	$ 449,246
Q2	Weihua Zhou	Integrative analysis of electrical and mechanical dyssynchrony to improve cardiac resynchronization therapy	American Heart Association Inc	$ 154,000
Q2	Yan Zhang	The role of high mobility group box 1-induced NF-kappa B activation in polycystic kidney disease	NIH	$ 469,500
Q3	Ashutosh Tiwari	Acquisition of a Circular Dichroism Spectropolarimeter	NIH	$ 100,000
Q3	Bruce Lee	Biomimetic Bioadhesive as Portable Self-Activated Hemostatic Solution with Antimicrobial Property	DoD	$ 1,595,923
Q3	Caryn Heldt	Mucus penetrating AAV for gene delivery to the lung	NIH	$ 406,949
Q3	Chunxiu Yu	Dissecting Deep Brain Stimulation Circuits for Depressive Symptoms in Parkinson’s Disease	DoD	$ 1,199,655

Q3	Chunxiu Yu	Cortico-Subthalamic Ciruits in Deep Brain Stimulation for Parkinson's Depression	The Michael J Fox Foundation for Parkinson's Research	$ 333,500
Q3	Chunxiu Yu	Neuromorphic Computing for Closed-loop Deep Brain Stimulation in Parkinson's disease	NIH	$ 469,501
Q3	Haiying Liu	Near-infared Fluorescent Probes for Sensitive Detection of NADH in Live Cells	NIH	$ 18,995
Q3	Jingfeng Jiang	Machine learning for the assessment of hepatic perfusion in Fontan associated liver disease	Spectrum Health Foundation	$ 200,000
Q3	Lanrong Bi	Mitochondrial-targeting exosomes for neuroinflammtion	NIH	$ 469,500
Q3	Marina Tanasova	Molecular probes for targeting facilitative sugar transporters (GLUTs) in biochemical and biomedical applications.	NIH	$ 455,432
Q3	Marina Tanasova	Targeting cancer-relevant sugar transport as a strategy to sensitization of cells to therapy	NIH	$ 409,435
Q3	Muhammed Rizwan	Development of Complex Liver Organoids Using Cell-Specific Patterned Biomaterials	NIH	$ 449,712
Q3	Muhammed Rizwan	Cell-matrix interactions to improve the corneal endothelial cell therapy	NIH	$ 449,711
Q3	Muhammed Rizwan	Bioengineered corneal endothelial graft using photodegradable device to induce graft-host integration	NIH	$ 1,775,724
Q3	Parisa Abadi	Nanostructured Actuators for the Navigation of Endovascular Guidewires	Michigan Economic Development Corporation	$ 57,500
Q3	Rudy Luck*	Computationally Guided Approach to Produce Ratiometric Probes Operating in the Red to Near-infrared Region to Accurately Determine pH Levels within Organelles	NIH	$ 469,500

Q3	Weihua Zhou	Virtual quantification of coronary fractional flow reserve using multi-view videos of invasive coronary angiography	Medical University of South Carolina	$ 1,344,706
Q3	Weihua Zhou	Viral quantification of coronary fractional flow reserve using multi-view videos from invasive coronary angiography	Medical University of South Carolina	$ 28,800
Q3	Xiaochu Ding	Resorbable synthetic grafts with sustained hydrogen sulfide release to modulate the graft remodeling in rat models	American Heart Association Inc	$ 396,000
Q3	Yan Zhang	The role of high mobility group gox1-induced NF-kappa B activation in polycystic kidney disease	Polycystic Kidney Disease Foundation	$ 160,000
Q3	Yan Zhang	The role of high mobility group box 1-induced NF-kappa B activation in polycystic kidney disease	Polycystic Kidney Disease Research Resource Consortium	$ 127,000
Q3	Yan Zhang	High urinary phosphate induces TLR4-mediated inflammation and cystogenesis in polycystic kidney disease	NIH	$ 469,500
Q4	Bruce Lee	Film-forming halogenated catechol-functionalized gelatin nanoparticles for hemostasis and wound healing applications	BCBS of Michigan Foundation	$ 3,000
Q4	Caryn Heldt	Continuous Manufacturing of Viral Vectors	University of Michigan	$ 36,656
Q4	Erich Petushek	Research and Quality Improvement Facilitation for MSU CHM Upper Peninsula Education Corporation	Michigan State University	$ 37,006
Q4	Kevin Trewartha	The impact of cognitive impairment on reactive balance control	Alzheimer's Assoc	$ 199,979
Q4	Lanrong Bi	Equipment: MRI: Track I: Acquisition of Fluorescence-Activated Cell Sorter (FACS) to Promote Interdisciplinary Research and Collaborative Education in	NSF	$ 1,017,403

		Rural Michigan		
Q4	Marina Tanasova	Competitive inhibition for fructose transporters GLUTS as a therapeutic strategy for triple-negative breast cancer phenotype	DoD	$ 1,030,214
Q4	Marina Tanasova	Targeting cancer-relevant fructose transport as a strategy to sensitize breast cancer for therapy	NIH	$ 1,406,777
Q4	Qinghui Chen	Role of the ethanol metabolite acetate on neuronal excitability and cardiovascular function	NIH	$ 438,142
Q4	Qinghui Chen	Alcohol consumption sympathetic activation and regulation of cardiovascular function	NIH	$ 3,574,489
Q4	Robert Larson	Impact of Excessive Cardiac Sensory and Sympathetic Nerve Activity in Hypertrophic Cardiomyopathy	NIH	$ 466,098
Q4	Smitha Rao	Localized delivery of GLUT5 targeting small molecules using forced ultrasound release in breast cancer	NIH	$ 416,947
Q4	Smitha Rao	Competitive inhibition of fructose transporters GLUTS as a therapeutic strategy for triple-negative breast cancer phenotype	DoD	$ 1,030,214
Q4	Smitha Rao	Exploring vulnerability of triple-negative breast cancers through inhibition of fructose transport	DoD	$ 1,126,427
Q4	Steven Elmer	Training Students in Science Communication to Promote Health in the Community	American Physiological Society	$ 10,000
Q4	Tarun Dam	Matrix-less purification and tag-free detection of lectins and glycoconjugates	NIH	$ 1,531,419

Q4	Weihua Zhou	Quantitative assessment of coronary fractional flow reserve from multi-view videos of invasive coronary angiography	American Heart Association Inc	$ 300,000
Q4	William Cooke	Autonomic neural control during simulated hemorrhage in humans	NIH	$ 469,134
Q4	Xiaohu Tang	Exploring the Cyclic Nucleotide Degradation Pathway in STK11/LKB1-Mutant Cancers: Implications for Therapeutic Intervention	NIH	$ 469,500
		TOTAL		**$ 44,084,993**

** Non-Member*
† Student

Table A4: FY2023 Awards

Award Quarter	PI	Title	Sponsor	Amount
Q1	Seth Kriz†	Graduate Research Fellowship	NSF	$ 46,000
Q1	Caryn Heldt	Integrated and Continuous Manufacturing of an Influenza Vaccine	NIH	$ 264,999
Q1	Ashutosh Tiwari	Are all Protein Aggregates Toxic?	NIH	$ 439,333
Q2	Bruce Lee	Electro-Responsive Underwater Adhesive based on Mussel Adhesive Chemistry	DoD	$ 111,214
Q2	Xiaoqing Tang	microRNA-483 regulation of pancreatic beta-cell function and identity	NIH	$ 404,303
Q2	Nan Mu*	Improving Endovascular Treatment Planning for Intracranial Aneurysms	American Heart Association Inc	$ 151,476
Q3	Jingfeng Jiang	Personalized Management of Intracranial Aneurysms Using Computer-aided Analytics	NIH	$ 334,056
Q3	Xiaochu Ding	Biodegradable Elastomers and Resorbable Synthetic Vascular Grafts	NIH	$ 469,499
Q3	Hoda Hatoum	ERI: Non-Newtonian blood analogs and effect of their rheology on physiological flow stasis in heart valve applications	NSF	$ 200,000

Q3	Sangyoon Han	Informational flow from mechanosensing to signaling for extracellular matrix stiffness sensing	NIH	$ 449,834
Q3	Zhiying Shan	Contribution of Orexin System to Hypertension	NIH	$ 439,242
Q3	Jingfeng Jiang	Machine learning for the assessment of hepatic perfusion in Fontan associated liver disease	Spectrum Health Foundation	$ 200,000
Q4	Paul Goetsch	CAREER: Priming CUREs to dissect how the DREAM complex protects cell identity	NSF	$ 240,592
Q4	Caryn Heldt	Continuous Manufacturing of Viral Vectors	University of Michigan	$ 36,656
Q4	Caryn Heldt	Structural and chemical changes between empty and full AAV capsids	NIH	$ 228,005
Q4	Bruce Lee	Film-forming halogenated catechol-functionalized gelatin nanoparticles for hemostasis and wound healing applications	BCBS Foundation of MI	$ 3,000
Q4	Yan Zhang	The role of high mobility group gox1-induced NF-kappa B activation in polycystic kidney disease	Polycystic Kidney Disease Research Resource Consortium	$ 160,000
Q4	Chunxiu Yu	REF-RS: Exploring Deep Brain Stimulation for the Treatment of Autism	Michigan Technological University	$ 21,000
		TOTAL		**$ 4,199,209**

** Non-Member*
† Student