

Summer 2019 MURI Research Projects

Below are the **MURI** projects to which full-time IUPUI undergraduate students pursuing their first degree can apply. If you want to be considered for one or more of the projects please update your CV/resumé and make sure it lists your contact email, current GPA, your major and minor, your year of study (first year, sophomore etc.), previous research experiences as well as your skill sets. Note, you are not expected to meet all the skills described for each project. When you have decided on the project(s) follow the application link below. You will be asked to enter some demographic information and to upload your CV. Your CV/resumé will then be forwarded to the corresponding project mentor(s).

To apply for a spot on a MURI team please [click here](#)

If you are accepted to a MURI team please know that you are required to work on the project for 40h/week from June 1 through July 31. You will not be permitted to take time off for vacations, enroll in classes or seek employment during the week.

Deadline for application is March 30, 2019. You can apply for a position on more than one project. However, you will be eligible to work on only one project. Note that project mentors may decide to close applications for their respective project prior to that deadline once they have assembled their project team.

Project Title	Project Narrative
1 Computational and Experimental Assessment for Ischemic Severity of Arterial Stenosis based on Patient's Radiological Images	<p>One of the major cardiovascular diseases is the abnormal narrowing of an artery, called arterial stenosis (AS). A new computational modality, called <i>InVascular</i>, is being developed for non-invasive quantification of the hemodynamic abnormality caused by an AS. The project objective is to collect preliminary data for coronary, cerebral, and iliac stenoses in terms of computational results, experimental validation, interpretation of flow features through visualization, and collection of available medical data.</p> <p><u>For students majoring in:</u> Mechanical Engineering, Computer Science, Pre-Medicine Biomedical Engineering, Biology</p> <p><u>Required skill set:</u> Labview, Matlab, 3-D printing, statistical software, DUI designer software, Database</p> <p>Contact: Drs. Huidan Yu, Alan P. Sawchuck</p>

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| 2 | Complex Shaped Magnetic Materials Fabricated Using Injection Molding Process | <p>Complex near net-shaped Nd₂Fe₁₄B (Nd-Fe-B) permanent magnets are desirable in numerous applications because they enable device miniaturization and weight reduction. A major issue in the magnetic materials is to have mechanical strength while maintaining strong magnetic properties. The project objectives are to (1) develop new injection molding technology to fabricate complex shaped magnetic components, and to (2) understand the process-property-performance relations in the injection molding process.</p> <p><u>For students majoring in:</u> Mechanical Engineering, Electrical Engineering, Physics, Chemistry</p> <p><u>Required skill set:</u> Materials science, chemistry, mechanical system, physics</p> <p>Contact: Drs. Jing Zhang, Jingzhi Pu</p> |
| 3 | IoT-based Smart Safety Monitoring and Evacuation System | <p>High-rise building safety is one of most critical issues in the world. Smart evacuation planning and informing for unexpected situation is critical because the buildings tend to have more occupants and longer exit distances. The research objective is to develop IoT-based smart “exit” signs that integrate wireless communication and sensing technology to provide on-time evacuation routes for occupants.</p> <p><u>For students majoring in:</u> Construction Engineering Management Technology, Electrical and Computer Engineering</p> <p><u>Required skill set:</u> microcontroller and programming, building construction, systems installation</p> <p>Contact: Drs. Dongsoo Kim, Dan Koo, John Lee</p> |
| 4 | Modeling and preparation of materials for 3D-printing | <p>Cell spheroids are microscopic aggregates of cells used as ‘building blocks’ for the creation of higher-order 3D structures, an extremely powerful approach to tissue engineering. The goal is to optimize bioinks and cell spheroids for 3D bioprinting by better understanding selected nutrient (glucose and lactate) diffusion within the spheroids and impact on their post-printing assembling.</p> <p><u>For students majoring in:</u> Physics, Biomedical Engineering, Computer Sciences, Computer Engineering, Biology, Pre-Med or Pre-Nursing</p> <p><u>Required skill set:</u> No specific skills beyond the background provided by the students’ majors.</p> <p>Contact: Drs. Nicanor I. Moldovar, Horia Petrache, Bruce Ray</p> |
| 5 | Infant Mortality in Indiana: Interdisciplinary Archival and Data Research and Analysis | <p>The long-term objective of this project is to work with partners in 13 Indiana communities, which have the highest infant mortality rates in the state in order to create and manage community public health strategies intended to reduce these rates by half within three years. Using a variety of data sources and methodologies, a report will be created that synthesizes the existing knowledge about infant</p> |

mortality in Indiana with an emphasis on the sociohistorical context of each community.

For students majoring in: English (and related majors), sociology

Required skill set: Archival library research & analysis skills, data research & analysis skills

Contact: Drs. Kyle Minor, Kenzie Latham-Mintus

6 Enhancing Data Storage and User Interface of the Online Tool – regSNPs-intron for iSNVs screening

Single nucleotide variants (SNVs) are changes in the DNA that are often involved in the function of heritable diseases. SNVs that occur in the introns (iSNVs), the regions between exons, can impact alternative splicing. A random forest machine learning classifier called regSNPs-intron has been developed to predict the disease-causing probabilities of iSNVs. In this project the RegSNPs-intron tool will be enhanced by using the big data-oriented database MongoDB as backend data storage, reducing computational cost by removing the online calculation, and improving the user interface by adding more functional modules.

For students majoring in: Computer Graphics Technology, Computer Information Technology, Computer Science, pre-Med

Required skill set: Python, MongoDB, PHP, JavaScript, Unit Testing, Database

Contact: Drs. Xiao Lu, Yunlong Liu, Shamima Mithun

7 Developing and testing acoustic panels made of mycelium and other sustainable materials and their impact on musicians

Acoustic materials are widely used in the common built environment. There is motivation for the development of sustainable, environmentally friendly materials that show sufficient absorption or transmission loss. One such material is a mycelium-based material. This project has two major aims 1) to test, develop, and quantify sustainable materials for appropriate acoustic metrics and applications 2) to deploy these materials in music practice rooms and conduct a user study of the effects of sustainable acoustic products compared to conventional acoustic products.

For students majoring in: Music and Arts Technology, Physics, and interested students from Engineering, Earth science, Chemistry, Biology

Required skill set: developing user studies and statistics, experience in acoustics and CAD, hardware data acquisition experience, materials/biology/ chemistry background

Contact: Drs. Timothy Hsu, Horia Petrache

8 Characterization studies of recycled plastics blends with additives for injection molding and additive manufacturing

The most common materials used in injection molding and 3D printing processes are thermoplastics. However, there is a growing concern related to sustainability and the question is on how to assess recycled and recycled blends of plastics for use in injection molding and 3D printing. The long-term objective of this research is to optimize the use of additives to significantly improve the ability to HDPE and

HDPE/PP blends for injection molding and FDM focusing on HDPE/PP/ABS. The goal for this summer is to develop a computational model to predict response based on properties using established response surface methodology.

For students majoring in: Chemistry, Physics, Mechanical Engineering, Math, Electrical Engineering, Biomedical Engineering, Statistics

Required skill set: Critical thinking skills, elementary knowledge of chemistry (Chem 105 or similar)

Contact: Dr. Amanda Siegel, Andres Tovar

9 Magnetic Field Orientation Control in Eye Surgery

Presbyopia is an age-related refractive condition, which results from impairment of accommodation of eye to focus on near objects. A method to remove the existing, defected lens without damaging the tissue around it uses nanoparticles and their plasmonic effect. The project objective is to design strong concentrated magnetic fields oriented to the nanoparticles as close as possible to the eye lens.

For students majoring in: ECE, ME, BME, ECET, MET, Chemistry, Pre-Medicine, Physics

Required skill set: A desire to do Research, Magnetic Fields, Hands-on Approach, ANSYS

Mentors: Drs. Afshin Izadian, Amir Reza Hajrasouliha

10 Research and Implementation of Adaptive Navigation & Personalized Education

As digital educational experiences become more prevalent, the need for designing interfaces with users' demographics, preferences, and capabilities in mind becomes more crucial. EASEL (Education through Application-Supported Experiential Learning) is a recently created platform that needs further design recommendations for a more comprehensive user experience. The object is twofold: conduct usability testing focusing on interface function address usability problems and interface malfunctions, and measure the efficacy of the EASEL program within a personalized learning environment.

For students majoring in: Computer Science, Technical Communication, Computer Graphics Technology, Computer Information Technology, Informatics/New Media, Education

Required skill set:

Computer Information Technology & Computer Science students: Software development focused on Swift and Object-C, problem solving, Computer Programming (Javascript). *Computer Graphics Technology, Technical*

Communication, or Informatics/New Media Students: Human-computer interface design or interaction, graphic design, UX or usability testing knowledge and/or experience. *Education:* Education personalized learning, secondary education, STEM education

Contact: Drs. Corinne Renguelle, Christian Rogers