Academic Year 2018/19 MURI Research Projects

Below are the MURI projects to which IUPUI undergraduate students can apply. Before you contact one or more project mentors to express your interest in a research position make sure that you meet all the eligibility criteria, which include a cumulative GPA of 3.0 or higher and being a fulltime student pursuing your first undergraduate degree at IUPUI.

When emailing the project mentors use the following subject line “2018/19 Academic Year MURI project application”. In the text box list your GPA, your major and your year of study (first year, sophomore etc.) You may consider attaching your resume to the message.

**Note:** You can apply for a position on more than one project. However, you will be eligible to work on only one project. Once you have been accepted to a project please inform the mentors of other projects that you have applied to.

If you are accepted to a MURI team please know that you are required to work on the project a minimum of 25h/month from the start of October through the end of April. In addition, you are **required to attend the Student Research Orientation Day on Friday, October 5** from 3-5 pm in the Lilly Auditorium (UL-basement room 0130)

**Deadline for application is September 17, 2018.** However, project mentors may decide to close applications for their respective project prior to that deadline once they have assembled their project team.
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<th>Project Title</th>
<th>Project Narrative</th>
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<tr>
<td>High-resolution lake sediment archives of climate-society linkages in the midcontinental United States</td>
<td>This multidisciplinary project seeks to develop high-resolution paleoclimate records that span the last 2000 years in order to investigate the timing, duration, and impact of pluvials and droughts on Mississippian and related cultures. For students majoring in: Any discipline Required skill set: None. Contact: Dr. Broxton Bird (<a href="mailto:bwbird@iupui.edu">bwbird@iupui.edu</a>); Dr. Bill Gilhooly (<a href="mailto:wgilhooll@iupui.edu">wgilhooll@iupui.edu</a>); Dr. Jeremy Wilson (<a href="mailto:wilsojer@iupui.edu">wilsojer@iupui.edu</a>)</td>
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<td>High Specific Energy and Long Cycle Life V2O5-SiO2/Graphene as Cathode Material for Lithium-ion Batteries</td>
<td>Lithium-ion batteries (LIBs) dominate today's power sources for portable electronics. The goal of this project is to develop a high-performance cathode material for Li-ion batteries including designing and preparing V2O5-SiO2/graphene hybrid materials, optimizing the synthesis process and conditions, assembling coin cell type Li-ion batteries and characterizing their performances. For students majoring in: Mechanical Engineering, Energy Engineering, Chemistry, Physics, Material Science Required skill set: basic mechanical fabrication, chemistry, physics Contact: Dr. Jian Xie (<a href="mailto:jianxie@iupui.edu">jianxie@iupui.edu</a>); Dr. Lei Li (<a href="mailto:lilei@iupui.edu">lilei@iupui.edu</a>); Dr. Yadong Liu (<a href="mailto:yadoliu@iupui.edu">yadoliu@iupui.edu</a>)</td>
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<td>Additive Manufacturing of High-Temperature Ceramic Materials for Structural Applications</td>
<td>The objectives of this project are to develop new technology to 3D-print Mullite ceramic components, and to understand the process-property-performance relations in 3D-printed ceramic materials. For students majoring in: Mechanical Engineering, Electrical Engineering, Energy Engineering, Ceramics, Physics, Chemistry Required skill set: Materials science, Chemistry Contact: Dr. Jing Zhang (<a href="mailto:jz29@iupui.edu">jz29@iupui.edu</a>); Dr. Jingzhi Pu (<a href="mailto:jpu@iupui.edu">jpu@iupui.edu</a>)</td>
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<td>Creating and Evaluating Virtual Reality for STEM Laboratories</td>
<td>The objectives of this project are to develop Virtual Reality Instructional Laboratory Environments (VRILE), which will effectively replace physical labs and compare the learning outcomes of the VRILE with real-life (RL) labs.</td>
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For students majoring in: Programming (Computer Science, Applied Computer Science etc.); Graphic Design (Computer graphics technology, media arts and science etc.); Engineering/Science (Mechanical/Energy/Electrical Engineering, Physics etc.); Assessment (Education, Psychology, Business, Market Research etc.)

Required skill set: C programming (scripting); 3D modeling and texturing; data assessment; scientific modeling; good communication skills for working with groups

**Contact:** Dr. Alan Jones ([alsjones@iupui.edu](mailto:alsjones@iupui.edu)); Dr. Patrick Gee ([pgee@iupui.edu](mailto:pgee@iupui.edu))

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**Preparation of Bioinks and Cells for 3D Bioprinting**

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 of this project is to determine the optimal bioinks and spheroid properties for successful bioprinting.

For students majoring in: Computer Sciences, Physics, Engineering, Biology, Pre-Nursing or Pre-Medicine

Required skill set: No specific skills beyond the background provided by the students’ majors.

**Contact:** Dr. Nicanor I. Moldovan ([nimoldov@iupui.edu](mailto:nimoldov@iupui.edu)); Dr. Horia Petrache ([hpetrach@iupui.edu](mailto:hpetrach@iupui.edu))

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**An Enhanced Mixed-Reality (MR) Virtual Environment for Advanced Manufacturing**

With the advent of VR (Virtual Reality) and MR (Mixed Reality)-based technologies, an opportunity exists to create immersive experiences that mimic physical machines in advanced manufacturing. The goal of this project is to make significant improvements to a AVLM-MR device developed by students this summer.

For students majoring in: Mechanical Engineering, Education, Computer Science, Computer Information Technology (CIT), Computer Graphics Technology (CGT), and/or Engineering Technology

Required skill set:  
- **Mechanical Engineering student:** Design, problem solving, statistical analysis, and CAD.  
- **Computer Science student:** Computer programming (Unity, Java, C, and C++), Software development, iOS development environment experience, Computer Graphics, Virtual reality, Computer interface, and Human-machine interface.  
- **CIT student:** Computer programming (C, C++), Computer graphics, Virtual reality, and computer interface.  
- **Education student:** Learning theory, STEM education, assessment, and statistical analysis.  
- **Computer Graphics Technology student:** Visualization, and human-computer interface.
On the Application of Carbon Fiber/Carbon Nanotube Reinforced Composites for Stealth Aerospace

Different composites are utilized in the structure of both the civil/military aircrafts based on their structural and functional properties. This project addresses the simulation and fabrication of multiple phase nano-composite materials that can be applied to stealth aerospace structures.

For students majoring in: Mechanical Engineering; Electrical and Computer Engineering

Required skill set: contact mentors

Contact: Dr. Hazim El-Mounayri (helmouna@iupui.edu); Dr. Chris Rogers (rogerscb@iupui.edu)

Bone Conduction Audio Monitoring Hardware for Musicians

The goal of this project is to develop a bone conduction audio monitoring device for professional musicians through a head-worn enclosure of appropriate miniaturization and stability, and further exploration into transducing electrical audio signals for extended use periods with sufficient amplification and fidelity.

For students majoring in: Music and Arts Technology; Electrical Engineering Technology; Mechanical Engineering; Mechanical Engineering Technology

Required skill set: MAT student performer experienced in using technology on stage; EE or EET student with strong analog circuits and signals experience; ME or MET student with 3-D modeling and design

Contact: Dr. Robin Cox (robcx@iupui.edu); Elaine Cooney (eccooney@iupui.edu); Paul Yearling (pyearlin@iupui.edu)

Repurposing recycled plastics via blends and additives for extrusion-based additive manufacturing: Optimization studies

The overall objective of this project is to find the optimal recycled material blends and processing parameters that maximize the quality of additively manufactured parts and, ultimately, assess the suitability of recycled plastic for extrusion-based additive manufacturing.

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

Required skill set: Critical thinking skills, elementary knowledge of chemistry (Chem 101 or 105)

Contact: Dr. Amanda Siegel (apsiegel@iupui.edu); Dr. Andres Tovar (tovara@iupui.edu)
**Evaluation of a Comprehensive Learning Curriculum & Training Framework for School Personnel working with Individuals with Autism Spectrum Disorder (ASD)**

The HANDS in Autism® Model provides a comprehensive learning curriculum and training framework to school personnel serving individuals with autism spectrum disorder (ASD). The study focuses on measuring change in school personnel who attend an intensive week-long summer training by assessing all data collected.

*For students majoring in:* Biology, Psychology, Pre-Nursing, Pre-Medicine, Education, Social Work, Health Sciences

*Required skill set:* Critical thinking, Scientific writing, Time management, Organization, Oral and Written presentation skills, Analytical skills, Attention to Detail, Familiarity with Excel and SPSS

*Contact:* Dr. Naomi Swiezy ([nswiezy@iupui.edu](mailto:nswiezy@iupui.edu)); Dr. Patrick Monahan ([pmonahan@iu.edu](mailto:pmonahan@iu.edu)); Dr. Tiffany Neal ([nealtiff@iupui.edu](mailto:nealtiff@iupui.edu))

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**Research and Development of Adaptable Platforms to Support Experiential Learning**

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 to develop new designs for EASEL.

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

*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

*Contact:* Dr. Corinne Renguette ([crenguet@iupui.edu](mailto:crenguet@iupui.edu)); Dr. Christian Rogers ([rogerscb@iupui.edu](mailto:rogerscb@iupui.edu))

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**Optimizing aerosolized intranasal drug delivery at the preclinical level using multifunctional nanocarriers and advanced neuroimaging**

Many drugs that could potentially treat central nervous system diseases are not available orally or intravenously. The purpose of this project is to create and test a small animal aerosolizer capable of delivering precise, nanomolar concentrations of drugs while the animal undergoes real-time imaging.

*For students majoring in:* Mechanical engineering; Biomedical engineering; Chemistry

*Required skill set:* Microsoft Office skills (Excel, PPT, and Word); Basic chemical,
### Design, Build, and Test Nanoparticle Delivery System

The application of radiation and chemotherapy in head and neck cancer often results in damage to the surrounding tissue during passage of the beams and agents, respectively. The goal of this project is to develop customized tagged nanoparticles to deliver diffusible cytotoxic agents directly into tumors.

**For students majoring in:** Mechanical Engineering Technology; Radiation Oncology

**Required skill set:**
- **Mechanical Engineering:** Good CAD skills; some machining and fabrication skills; ability to work as part of a team
- **Radiation Oncology:** Ability to work as part of a team; good laboratory skills

**Contact:** Dr. Paul Yearling ([pyearlin@iupui.edu](mailto:pyearlin@iupui.edu)); Mark Langer ([mlanger@iuhealth.org](mailto:mlanger@iuhealth.org))