Summer 2018 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 Summer 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 40h/week throughout the months of June and July. During this time period you should not be enrolled in a course, work a part-time job (unless it is on weekends only), take a vacation or any other trip unrelated to your project.

Deadline for application is March 30, 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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<tr>
<th>Project Title</th>
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| Investigating Pre-Columbian Native American Occupation and Land Use Dynamics at Kincaid Mounds, IL, using High-Resolution Lake Sediment Archives | The project combines geological and anthropological methods to investigate the relationship between climate change, human settlement histories, subsistence patterns, and land-use in the mid-continental United States during the last 2,000 years. For students majoring in: Any discipline  
Required skill set: None.  
Contact: Dr. Broxton Bird (bwbird@iupui.edu); Dr. Jeremy Wilson (wilsojer@iupui.edu) |
| High Specific Energy Li2MnSiO4/Graphene as Cathode Material for Lithium Ion Batteries | Lithium-ion batteries (LIBs) dominate today's power sources for portable electronics. Current electrode materials are not likely to meet the growing demand for rapidly miniaturizing electronics and large-scale mobile devices. The project focuses on the synthesis of a high performance Li2MnSO4/graphene composite to use as an electrode in LIBs.  
For students majoring in: Mechanical Engineering, Energy Engineering, Chemistry, Material Science and Physics  
Required skill set: Mechanical fabrication, basic chemistry, physics, material science  
Contact: Dr. Jian Xie (jianxie@iupui.edu); Dr. Lei Li (lilei@iupui.edu) |
| Additive Manufacturing of Ceramic Materials for Carbon Dioxide Storage         | Capturing carbon dioxide (CO2) from coal-fired power plants, thereby preventing release into the atmosphere is of fundamental importance. The objectives of this project are to (1) develop new technology to 3D print ceramic components for CO2 storage, and to (2) understand the process-property-performance relations in 3D printed ceramic material.  
For students majoring in: Mechanical Engineering, Chemistry, Physics, Bioengineering  
Required skill set: Materials science/synthesis, Chemistry, Physics  
Contact: Dr. Jing Zhang (jz29@iupui.edu); Dr. Jingzhi Pu (jpu@iupui.edu) |
| Experiential Learning, Reflection, and Technology: User Experience Design     | 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 Information Technology, Computer Science, Computer Graphics Technology, Technical Communication, and/or 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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<th>Cell Spheroids for Scaffold-Free 3D Bioprinting: An Experimental and Computational Study</th>
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| 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 determine the optical spheroid properties for bioprinting through mathematical and computer-assisted modeling. For students majoring in: Computer Sciences, Physics, Engineering, Biology, Pre-Nursing or Pre-Medicine

Required skill set: Basic learning skills, knowledge in discipline commensurate with undergrad year

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

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<th>An Energy-efficient Location Awareness System in Smart Building</th>
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| In smart buildings due to their indoor nature, it is of primary importance to consider the location of the users in order to enable the interaction with various intelligent systems and provide services accordingly. The objective of this proposal is to design an energy-efficient location awareness system, which adapts to environment context change under smart building scenarios.

For students majoring in: Computer information technology, Electrical and Computer Engineering, Computer Science

Required skill set: Computer programming skill (e.g., Android), wireless communication and mobile computing knowledge, some ideas on image processing technology would be a plus

**Contact:** Dr. Xiaonan Guo ([xg6@iupui.edu](mailto:xg6@iupui.edu)); Dr. Xukai Zou ([xkzou@cs.iupui.edu](mailto:xkzou@cs.iupui.edu))
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<th>Description</th>
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<td>Synthesis and Testing of Novel 12-LOX Inhibitors as Potential Small Molecule-</td>
<td>12-lipoxygenase (12-LOX) is an enzyme that generates inflammatory mediators that ultimately lead to the death of pancreatic beta cells. Inhibiting 12-LOX could potentially treat diabetes.</td>
<td>For students majoring in: Chemistry Biology Biomedical Engineering&lt;br&gt;<strong>Required skill set:</strong> Organic Chemistry lab experience; Biology lab experience; Good time management; Good notebook taking skills.&lt;br&gt;<strong>Contact:</strong> Dr. Sebastien Laulhe (<a href="mailto:slaulhe@iupui.edu">slaulhe@iupui.edu</a>); Dr. Sarah Tersey (<a href="mailto:stersey@iu.edu">stersey@iu.edu</a>)</td>
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<td>Based Treatment of Diabetes</td>
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<td>Localization of Magnetic Nano-Particles in Eye Microscopic Surgery</td>
<td>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 mechanically and electrically design magnets that are strong and precise enough to be used in eye surgery.</td>
<td>For students majoring in: ECE ECET BME ME MET&lt;br&gt;<strong>Required skill set:</strong> Electric Machines, Magnetic Fields, Software Analysis, Mechanical System Design&lt;br&gt;<strong>Contact:</strong> Dr. Afshin Izadian (<a href="mailto:aizadian@iupui.edu">aizadian@iupui.edu</a>); Dr. Amir Reza Hajrasouliha (<a href="mailto:amhajras@iu.edu">amhajras@iu.edu</a>)</td>
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<td>Characterization of recycled plastic and plastic blends to assess suitability</td>
<td>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.</td>
<td>For students majoring in: Mechanical Engineering, Chemistry, Biomedical Engineering&lt;br&gt;<strong>Required skill set:</strong> Critical Thinking, Scientific Writing&lt;br&gt;<strong>Contact:</strong> Dr. Amanda Siegel (<a href="mailto:apsiegel@iupui.edu">apsiegel@iupui.edu</a>); Dr. Andres Tovar (<a href="mailto:tovara@iupui.edu">tovara@iupui.edu</a>)</td>
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<td>for extrusion-based additive manufacturing</td>
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<td>Identification of flame motion using high speed imaging</td>
<td>In hot-jet ignition, hot reactive gas from a prior combustion event or from a special pilot combustion pre-chamber, is injected at high speed into the main combustion chamber through one or more small orifices into the main chamber, which contains air-fuel mixture. The objective of this project is to use multidisciplinary expertise to develop image-processing tools capable of tracking the flame front for the combustion rig at IUPUI's Combustion &amp;Propulsion Research Lab.</td>
<td>For students majoring in: Computer Engineering, Physics, Mechanical Engineering,</td>
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### Electrical Engineering

**Required skill set:** Fluid mechanics, Image processing, Programming, General Laboratory skills, Data acquisition & control, Circuit Design and fabrication

**Contact:** Dr. Razi Nalim ([mnalim@iupui.edu](mailto:mnalim@iupui.edu)); Dr. Paul Salama ([psalama@iupui.edu](mailto:psalama@iupui.edu))

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### Real Time Digital Processing of Music for Special Effects

In order to provide special effects during performances, disk jockeys use computer software to delay, time shift and frequency shift music. By transferring the signal manipulation from the computer to a digital signal-processing (DSP) chip, the equipment footprint is reduced, processing time is optimized, and a modular architecture is achieved. The objective of this project is to develop at least two different DSP chips and evaluate their performance.

For students majoring in: Music and Arts Technology, Technical Communication; Computer Engineering, Computer Engineering Technology, Electrical Engineering Technology

**Required skill set:** Audio mixing and disk jockey; User interface evaluation; Digital Signal Processing; Electrical hardware integration; Lean Six-Sigma processes and tools; Technical documentation

**Contact:** Dr. Elaine Cooney ([eccooney@iupui.edu](mailto:eccooney@iupui.edu)); Dr. Scott Deal ([deal@iupui.edu](mailto:deal@iupui.edu))