**BME 4900 Study Proposal**

**This study plan must be submitted to Dr. Ian Schneider (**[**ians@iastate.edu**](mailto:ians@iastate.edu)**), Professor-in-Charge of the Biomedical Engineering (BME) program, prior to enrolling in BME 4900 – Independent Study. This must be done before close of business on the Friday of the first week of classes. Please prepare this plan in consultation with your Project Supervisor, whose approval verifies that the planned effort justifies the number of proposed credits. Typically, you should expect to spend 3 to 4 hours per week per credit hour. Please fill out this form electronically and send it to the Professor-in-Charge and cc the Project Supervisor. Hand-written forms will not be accepted.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Project Title:** | Click or tap here to enter text. | | |
| **Project Supervisor Name:** | Click or tap here to enter text. | | |
| **Student Name:** | Click or tap here to enter text. | **Classification:** | Choose an item. |
| **Enrollment Term(s):** | Click or tap here to enter text. | **Credits Each Term:** | Choose an item. |
|  |  | *Note: 6 cr. Maximum applied to Tech Elects.* | |

|  |  |  |  |
| --- | --- | --- | --- |
| **Intended application of BME 4900 credits:** | BME Major | BME Minor | Other |
| *Note: use of BME 4900 for other majors may require additional approval by your program* | | | |

1. **Topic Description:**

*Describe the topic you plan to study. Projects must be technical in nature and include a significant BME content. Projects cannot simply study an engineered system that can be applied to a BME problem as one of many applications, rather, the project must be motivated by a BME problem, so that the literature base is clearly within BME.*

Click or tap here to enter text.

1. **Course Learning Outcomes:**

*Indicate 3-5 learning outcomes of this independent study. Outcomes such as 'understand how to ...', 'research the ways to ...', and 'know how to ...' are not acceptable.*

Click or tap here to enter text.

1. **ABET Outcomes:**

*Select two or three of the most relevant ABET outcomes:*

*Upon completion of the independent study students must demonatrate:*

*1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics*

*2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors*

*3. an ability to communicate effectively with a range of audiences*

*4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts*

*5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives*

*6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions*

*7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.*

Click or tap here to enter text.

1. **Approach to Independent Study:**

*List the specific activities planned for the semester. Include a tentative timeline showing the anticipated number of weeks you plan to work on each activity during the term.*

Click or tap here to enter text.

1. **Methods for Reporting Progress and Demonstrating Achievements:**

*Describe how you will interact with your Project Supervisor during the term (weekly meetings, e-mail summaries, etc.) and identify the project’s deliverables to be assessed by the Project Supervisor. Examples of deliverables include final report, oral presentations, poster presentations, journal club presentation, standard operating procedures, designs, code. The weighting of each deliverable as well as other grading such as meeting attendance must be explicitly outlined.*

Click or tap here to enter text.

**Approval:**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Project Supervisor

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Professor in Charge of Biomedical Engineering Program

**SAMPLE BME 4900 Study Proposal**

**This study plan must be submitted to Dr. Ian Schneider (**[**ians@iastate.edu**](mailto:ians@iastate.edu)**), Professor-in-Charge of the Biomedical Engineering (BME) program, prior to enrolling in BME 4900 – Independent Study. This must be done before close of business on the Friday of the first week of classes. Please prepare this plan in consultation with your Project Supervisor, whose approval verifies that the planned effort justifies the number of proposed credits. Typically, you should expect to spend 3 to 4 hours per week per credit hour. Please fill out this form electronically and send it to the Professor-in-Charge and cc the Project Supervisor. Hand-written forms will not be accepted.**

**Project Title:** \_Designing a microfluidic chamber to assemble arrayed skin tissue equivalents\_\_\_\_

**Project Supervisor Name:** \_\_Alice Smith\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Student Name:** \_\_Brian Jones\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **ID#:** \_\_\_\_999-99-9999\_\_\_\_\_\_\_\_\_\_\_\_\_

**Classification (Sr/Jr/..):** \_\_\_Jr.\_\_\_\_ **Enrollment Term(s):** \_\_\_\_F23\_\_\_\_\_\_\_\_**Credits Each Term (1-6):** \_\_\_3\_\_\_

*Note: 6 cr. Maximum applied to Tech Elects.*

**Intended application of BME 4900 credits: \_\_\_** BME Major \_x\_ BME Minor \_\_\_ Other  
*Note: use of BME 4900 for other majors may require additional approval by your program*

1. **Topic Description:**

The skin represents an interesting barrier through which to delivery drugs and vaccines. While animal models are useful for understanding delivery through the skin, they can be expensive and difficult to use to understand the mechanisms for transdermal uptake through the skin. In this project, I plan to design, build and test a microfluidic system that contains open wells in which to assemble extracellular matrix and skin cells. The flow beneath the cells will act as an vasculature mimic. I intend to test the affect of geometries and flow rate on skin cell proliferation.

1. **Course Learning Outcomes:**

Demonstrate an ability to compile and synthesize information from the literature.

Design a microfluidic chamber with appropriate sizes

Perform flow calculations to match flow rates in device to physiological flow rates

Measure the diffusion of a dye within hydrogels assembled in wells

Select and apply a proper transport model to explain diffusion of the dye within the extracellular matrix

1. **ABET Outcomes:**

Select two or three of the most relevant ABET outcomes:

Upon completion of the independent study students must demonatrate:

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

1. **Approach to Independent Study:**

Week 1-2: Safety training, background reading, training on Cricut and laser cutter, initial design of device

Week 3-4: Device fabrication, experiments to test leaks, flow calculations, initial presentation

Week 5-6: Assembly of hydrogel, diffusion experiments

Week 7-8: Diffusion experiments, cell proliferation assay training

Week 9-10: Measurments on cell proliferation, modeling of diffusion within the hydrogel

Week 11-12: Measurements on cell proliferation, final report preparation

Week 13-14: Final presentation

1. **Methods for Reporting Progress and Demonstrating Achievements:**

I will meet with my faculty mentor for 30 minutes once a week. I will also attend weekly lab meetings. I will prepare a 20 minute initial presentation, lead one journal club, prepare a 30 minute final presentation and hand in a final report written in the style of a scientific article. In addition, I will hand in all altered or developed standard operating procedures.

15% Initial Presentation

15% Journal Club

25% Final Presentation

25% Final Report

10% SOPs

10% Attendance and Discussion in Weekly Meetings