BMB/PLB and MPS 864, Biotechnology and Plant Biochemistry

Participating Faculty: Björn Hamberger (instructor), Rob Last (instructor), guest lectures by invited MSU Faculty, AgBio Innovation Hub and External Participants

Coordinator: Björn Hamberger (hamberge@msu.edu)

Meeting time: Tuesdays and Thursdays 1:00-2:20

Location: Molecular Plant Sciences 3220

Description: This is an interdisciplinary course for graduate students with interest in biotechnology applications *using* Plant Biology, Biochemistry or Synthetic Biology. Despite building on cases from plant biotechnology, this course explicitly invites students with broad interests outside the field of photosynthetic systems. You will be encouraged to think about, and actively develop concepts and ideas that may have the potential for commercialized.

Perspectives of public perception, investor and scientist will be discussed and shape the course. Examples will highlight plant metabolic pathways that impact human health and nutrition, as well as sustainability in the production of therapeutics, food and biomaterials. Case studies will cover expression hosts, strategies and pitfalls such as emerging resistances. Examples are chosen to explain basic metabolic engineering principles, including synthetic biology approaches to generate, analyze, and optimize transgenic platforms. Some cases will examine regulatory and commercial issues related to genetically modified organisms (GMOs) and the 'share-your-parts' philosophy, as promoted by the international genetically modified machine (iGEM) initiative. To actively participate in the course, you need to have a basic understanding of molecular biology, genomics, or biochemistry. You are expected to read background and original research papers as assigned, and you should be comfortable giving a summary and express your opinion.

You will be guided to develop a 3-page brochure presenting a scientific idea for your biotechnology-based product or process with a recognized need or a new opportunity. You will need to lay out the idea, present reasonable milestones, be aware of potential technical, commercial, or societal hurdles, and articulate how the proposed technology would address the need or opportunity. The course will provide you with tools, i.e., relevant concepts (technology readiness level, societal acceptance, outreach, IP aspects) will be discussed, and a list of topics will be developed together with the students during the course. The instructors will provide guidance and feedback on an individual base as you develop your project. Individual feedback will also be given for both take home assignments.

During the final sessions of the semester, you will present your idea/spin-out in a 10-min pitch. Feedback will include the perspective of Angel Investors. This may involve the MSU Innovation Center.

The course includes a responsible conduct of research module (RCR).

Prerequisites: The following is recommended background: Interest in biotechnology applications using Plant Biology, Biochemistry or Synthetic Biology, basic knowledge in molecular biology, genomics, or biochemistry as demonstrated by having completed at least one of the following, or equivalent graduate level classes: BMB801 molecular genetics or BMB961 genomics or BMB865 plant molecular biology. Enrolled in a graduate program related to plant molecular sciences.

Text: No specific textbook is assigned. Lecture material will come from reviews and primary literature manuscripts assigned throughout the semester. These will be available online through D2L. For general background you are likely to find a biochemistry textbook useful, for example "Principles of Biochemistry by D.L. Nelson and M. M. Cox, W.H. Freeman and Company". In addition, there are some books specific to plant biochemistry that you may want to consult for background on specific topics. The following are available through MSU:

1. ***Buchanan BB, Gruissem W, Jones RL*** *(2015) Biochemistry & Molecular Biology of Plants. American Society of Plant Physiologists, Rockville. Second addition.*
2. ***Heldt H-W*** *(2011) Plant Biochemistry. Fourth Edition. Elsevier Academic Press, Burlington MA.*

Available as e-resource at MSU library
http://www.sciencedirect.com.proxy1.cl.msu.edu/science/book/9780123849861

Limitation: 15 Students

Evaluation of progress and grading:

1. Brochure, 3 pages (25% of grade)
2. Pitch (25% of grade)
3. 1st Midterm exam, take home assignment 24 hours, opinion (25% of grade)
4. 2nd Midterm exam during finals week, take home assignment 24 hours, opinion (25% of grade)
5. Additional credits are awarded for the projects attracting highest capital investments and for the investors with the best sense for innovation.