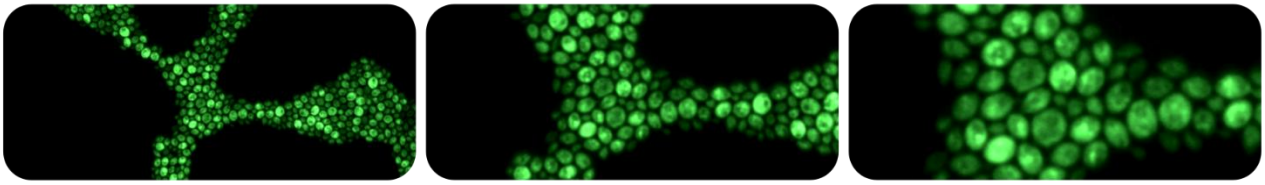
HOS6932 - Advances in Plant Synthetic Biology, Fall 2025



3 Graduate Credits

Meets: 10:40-11:30 am on Mon, Wed, Fri;
Synchronous Classes via Zoom, with materials on Canvas
Join Zoom Meeting Meeting ID: 970 3507 9957 Passcode: 865477

95% Online; 5% of Assignments Require Physical Presence at UF

Instructors (Horticultural Science Department):
Cătălin Voiniciuc (Coordinator) Bldg. 885, 0003B; (352) 273-4782, cvoiniciuc@ufl.edu
Andrew Hanson Fifield Hall, 2143; (352) 273-4856, adha@ufl.edu
Edmar R. Oliveira-Filho Fifield Hall, 2302; (352) 273-4859, ramosdeoli.edmar@ufl.edu

Course Description
This course is designed to introduce graduate students to the basic principles of synthetic biology (SynBio) as well as the latest advances in this emerging field. Topics will include the implementation of Design-Build-Test-Learn cycles for metabolic pathways and regulatory circuits, directed evolution, and biofoundry-driven automation. Emphasis will be on plant systems, with bacterial and yeast systems included when appropriate to accelerate the study of plant enzymes and products. This online class will enable state-wide participation and combine lectures with interactive discussions and activities, but space is limited so register early. As part of the final assignment (5% of course-grade), each student will create a "SynBio in Action" short film at the UF main campus or at one of the UF/IFAS Research and Education Centers. This class will empower students to identify, evaluate, and effectively present SynBio innovations that address agricultural challenges.

Knowledge Prerequisites: There are no strict prerequisites, but basic knowledge of molecular biology such as the flow of information (DNA → RNA → protein) in living organisms is needed.

Learning Objectives:
After successful completion of this course, students will be able to:
- Recognize the origins of SynBio, the state of the art, and emerging opportunities
- Analyze and evaluate the feasibility of proposed solutions to real-world problems
- Compare SynBio successes in microbial systems with recent advances in plants
- Demonstrate how biological cells can be programmed to make designer molecules
- Communicate how SynBio approaches address scientific and societal challenges
- Predict bottlenecks to reaching the desired targets and design alternatives

Office hours: The course coordinator will have office hours from 4:00 to 4:30 pm Wednesdays. Meetings can be arranged by personal appointment via email to the instructors using the contact details above. General questions and discussions can be posted on the Canvas discussion forum. Please follow these UF guidelines for effective online interactions.

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Weekly Schedule (Assignments are marked in bold)

Date	Class	Instructor	Module	Subtopic
Fri, Aug 22	01	Voiniciuc	SynBio and its origins	Scope of SynBio
Mon, Aug 25	02	Hanson		History of (Plant) SynBio
Wed, Aug 27	03	Voiniciuc		DBTL cycle & examples
Fri, Aug 29	04	Voiniciuc		Biofoundries
Mon, Sept 1	Holiday		Labor Day	-
Wed, Sept 3	05	Hanson	Fermi calculations	Worked examples in class
Fri, Sept 5	06	Hanson		**Fermi presentations**
Mon, Sept 8	07	Voiniciuc & Hanson	SynBio solutions to planetary problems	Introduction to Class Projects and Choices
Wed, Sept 10	08	Voiniciuc	Cells as circuit boards	Building logic gates
Fri, Sept 12	09	Voiniciuc		Bacterial logic gates
Mon, Sept 15	10	Voiniciuc		Plant logic gates – part A
Wed, Sept 17	11	Voiniciuc		Plant logic gates – part B
Fri, Sept 19	12	Voiniciuc	Biosensors & optogenetics	Design principles
Mon, Sept 22	13	Voiniciuc		Bacterial biosensors
Wed, Sept 24	14	Voiniciuc		Plant and eukaryotic biosensors
Fri, Sept 26	15	Voiniciuc		Non-plant optogenetics
Mon, Sept 29	16	Voiniciuc		**Plant optogenetics**
Wed, Oct 1	17	Hanson	Directed evolution	Overview
Fri, Oct 3	18	Hanson		Classical enzyme evolution
Mon, Oct 6	19	Hanson		Continuous directed evolution
Wed, Oct 8	20	Hanson		**Directed evolution activity**
Fri, Oct 10	21	Oliveira-Filho	Plant-related Industries	Case 1 - Artemisinin
Mon, Oct 13	22	Oliveira-Filho		Case 2 - Amyris products
Wed, Oct 15	23	Oliveira-Filho		Scale-up & its problems
Fri, Oct 17	Holiday		Homecoming	-
Mon, Oct 20	24	Voiniciuc & Hanson	SynBio solutions to planetary problems	**Class project mid-term evaluation (**Due Diligence)
Wed, Oct 22	25	Hanson	Synthetic metabolism	Going beyond nature
Fri, Oct 24	26	Hanson		*in vitro* metabolism
Mon, Oct 27	27	Hanson		Bacterial metabolism
Wed, Oct 29	28	Hanson		Plant metabolism
Fri, Oct 31	29	Voiniciuc	Making and breaking polymers	Biopolymer engineering
Wed, Nov 3	30	Voiniciuc		Designer polysaccharides
Wed, Nov 5	31	Voiniciuc		Lignin valorization

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Date	Class	Instructor	Module	Subtopic
Fri, Nov 7	32	Voiniciuc		Lignocellulosic challenges
Mon, Nov 10	33	Voiniciuc		**The new bioeconomy**
Wed, Nov 12	34	Voiniciuc		Plants for biofortification
Fri, Nov 14	35	Voiniciuc & Hanson	Future of Plant SynBio	Emerging plant systems
Mon, Nov 17	36	Voiniciuc & Hanson	SynBio solutions to planetary problems	**Class project talks**
Wed, Nov 19	37	Voiniciuc & Hanson		**Class project talks**
Fri, Nov 21	38	Voiniciuc & Hanson		**Class project talks**
Mon, Nov 24	Holiday		Thanksgiving Break	-
Wed, Nov 26	Holiday		Thanksgiving Break	-
Fri, Nov 28	Holiday		Thanksgiving Break	-
Mon, Dec 1	39	Voiniciuc		Transformation barriers
Wed, Dec 3	40	Voiniciuc		**"SynBio in Action" Film Festival**

Student Evaluation and Grading

The class will combine lectures with interactive assignments that will be done primarily in small groups, as well as some individual tasks. Students will have take-home assignments to assess the scale and feasibility of SynBio solutions to global problems using Fermi calculations. The primary semester project (activity 5) will involve research on start-up companies and in-class presentations, with a mid-term checkpoint for written evaluation and critiques. For all assignments, a portion of the grade will be based on professional attitude and active participation in the discussions. As part of activity 6, in addition to regular class participation throughout the semester, students will share key lessons from the course and their research by participating in a "SynBio in Action" Film Festival that requires physical presence at UF. The top film will receive the coveted *Pipette d'Or* award. The assignments align with the **Learning Objectives** (see page 1 of the Syllabus) and the expectations will be detailed in class.

Activity	Points	% of Grade
1. Fermi Calculations and Discussion	60	15%
2. Biosensors and Optogenetics Activity	20	5%
3. Plant Directed Evolution activity	20	5%
4. Lignocellulosic Biomass / Bioeconomy Activity	20	5%
5A. Class Projects: Due Diligence on Biotech	100	25%
5B. Class Projects: Final Presentations	100	25%
6A. Plant SynBio Class Questions and Interactions	60	15%
6B. "SynBio in Action" Film Festival	20	5%
Total	400	100%

Passing letter grades based on %: 93-100 = A; 90-92 = A-; 87-89 = B+; 83-86 = B; 80-82 = B-; 77-79 = C+; 73-76 = C; 70-72 = C-; 67-69= D+; 63-66 = D; 60-62 = D-**.**

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Synchronous Class Attendance
This course will be delivered synchronously online via Zoom, so students will need internet access and are expected to log in prior to scheduled class times to ensure a timely start. Physical presence at UF/IFAS research facilities (https://research.ifas.ufl.edu/research-areas/facilities/) will be required to complete the outreach assignment for the "SynBio in Action" Film Festival. The course coordinator will record the bulk of class activities and post them on Canvas. Sharing of course materials is prohibited without the written consent of the instructors. Since attendance of all classes is expected, contact the coordinator **prior to** the scheduled meeting if you are ill or absent for other reasons. The attendance requirements are consistent with university policies: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Learner Interaction Requirements
Active engagement is essential for success in this course, and students will be prompted with different scenarios to encourage their critical thinking. Students are expected to participate in all synchronous Zoom sessions, contribute meaningfully to small group activities, and engage in class discussions. Interaction will occur through live discussions, Canvas forums, and collaborative assignments. Students should demonstrate professional communication, respect other perspectives, and provide constructive feedback during peer presentations.

To ensure that every student has the opportunity to answer questions and earn participation points, instructors will regularly encourage all class members to contribute to the frequent discussions. Contributions to the Canvas discussion board and responsiveness to instructor or peer messages will also be factored into participation grade. These interactions are designed to foster a collaborative learning environment and deepen understanding of synthetic biology concepts covered throughout the course.

Course Materials
No textbooks are required for this class, since there is no book that fully covers this rapidly developing field. Review and research articles will be provided to students electronically on Canvas. The required and optional reading will be available at least a week before each lecture.

- There are no materials and supplies fees for this course.

Online Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/.

University's Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

- Student Honor Code: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code
- Guidelines for acceptable use of AI Tools: https://go.ufl.edu/edis-ai-v1

Health and Wellness Resources

Students experiencing crises or personal problems that interfere with their general wellbeing are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- University Counseling & Wellness Center, 352-392-1575, www.counseling.ufl.edu/cwc/
- Matter We Care, www.umatter.ufl.edu/
- Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/
- Student Success Initiative, http://studentsuccess.ufl.edu

Students with Disabilities

To request classroom accommodations, please consult the *Disability Resource Center* (0020 Reid Hall, 392-8565, www.disability.ufl.edu). Students requesting classroom accommodation should complete the required registration, obtain documentation and should provide this information to the Coordinator at the start of the course to arrange timely accommodations.

UF Faculty Evaluations (GatorEvals)

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online. Students can complete evaluations in three ways:

1. The email they receive from GatorEvals,
2. Their Canvas course menu under GatorEvals, or
3. The central portal at https://my-ufl.bluera.com

Guidance on how to provide constructive feedback is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.