

## BioEnergy & Sustainability School Internship

"Education is not the filling of a pail, but the lighting of a fire."

– William Butler Yeats 1865-1939

### Overview:

The BioEnergy and Sustainability School (BESS) summer internship is a 12-week hands-on, intensive research experience for undergraduate students at the University of Florida. The program is funded by the UF-IFAS internship program through the IFAS Dean of Research office. The summer internship program provides an immersive research experience for highly motivated undergraduates. Research experiences focus on developing critical thinking skills in sustainability. Through a combination of guest lectures, discussions, laboratory practicals, independent and collaborative research projects, formal academic presentations, as well as field excursions, undergraduates gain practical research experiences not typically found in the undergraduate career. Individual and collaborative projects allow students to gain real world experience in the design, execution, interpretation, and communication of scientific methods and discoveries. Critical and creative thinking skills are encouraged within student research projects and presentations. Students develop oral and written communication skills. Collaborative research projects explore applications that go beyond traditional classroom laboratory exercises and engage students in scientific discovery within active research projects in the BioEnergy and Sustainable Technology (BEST) Laboratory. BESS students prepare high-caliber research presentations for the annual Undergraduate Research Symposium and publish articles in the Journal of Undergraduate Research. BESS is a pre-graduate school experience, which strives to inspire students with a holistic research experience and prepare students to be effective in graduate school and contribute positively to the workforce and society.

### Focus Areas:

BESS focuses on the application of biological processes to sustainably remediate wastes, power our civilization, and provide nutrients for agriculture. The myriad forms of bioenergy are addressed through comparing and contrasting current use, production, and potential long-term applications and implications. Critical evaluation of current fossil fuel use is examined and extensively discussed, incorporating the concepts of appropriate use, cultural lifestyles, and the feasibility of replacements. BESS students actively participate in the current research projects at the BEST Laboratory. Current projects include: Algae bioremediation of landfill leachate, combining algae bioremediation with reverse osmosis treatment, synergy between algae cultivation and anaerobic digestion, anaerobic digestion of food waste and other organic wastes, development of anaerobic digestion for small farms and developing countries, as well as the production of biodiesel and biogas from nontraditional and underutilized crops.

Student interns are paid for working 20 hours per week, typically 4 hours per day. However, depending on the current activity, some days may be longer. Generally, the

BESS schedule involves field work in Summer A and laboratory work in Summer B. Field work can involve organic gardening and composting, as well as planting, tending and harvesting a variety of energy crops in the Bioenergy Garden. Note, field work involves working outside in hot sunny conditions. Students gain experience in the use of agricultural biomass for renewable energy production. As student interns develop their individual projects, the focus shifts more to laboratory work in Summer B. Depending on the nature of their research projects, students should anticipate spending extra time to conduct their experiments and complete homework assignments (see FAQ #10 below).

**UF/Gainesville Community Involvement:**

BESS takes pride in being a part of the university and local community and takes advantage of ongoing projects and activities that touch on the various themes of sustainability and bioenergy. Field excursions allow real-world experiences for undergraduate students and a chance to interact with local community leaders. A brief overview of previous excursions is listed below:

***BESS field excursions: Touring Our Community***

**Waste management:**

- On-campus sewage treatment plant
- Active and closed municipal solid waste landfills
- Alachua County waste transfer station
- Alachua County hazardous waste collection center
- Recycling/composting facilities
- Woody waste reuse facility

**Powering our civilization:**

- Deerhaven coal power plant
- On-campus co-gen plant
- Bioethanol pilot plant on campus
- Biodiesel production facilities
- Anaerobic digestion facilities

**Agricultural energy production:**

- Energy grasses/sugarcane field demonstrations
- Oil crops – Jatropha/*Castor/Sesame*

**Professional scientific meetings:**

- Florida State Horticultural Society
- Florida Farm-to-Fuel/Florida Energy Summit

**Volunteering in community projects**

- Community gardens/composting
- On-campus student gardens

What the interns have to say about it:

"The BioEnergy and Sustainability School gave me a unique opportunity to gain scientific knowledge and apply it in the local community. BESS became a highlight of my undergraduate career and a springboard to continue as a researcher."

– **Yelena Granovskaya** – Former BESS intern

Graduate Assistant, Department of Geography, San Diego State University

"My experience with BESS was the defining factor in my pursuit of graduate research. BESS allowed me to apply my chemical engineering background to renewable energy technology, a scientific field I am truly passionate for. The program's interdisciplinary, hands-on approach to energy and sustainability research provides the ultimate learning experience. Dr. Wilkie's vision and guidance has undoubtedly helped me become the researcher I am today."

– **Kyle J. Fricker** – Former BESS intern

Ph.D. Candidate, Columbia University, Earth and Environmental Eng.

"The experience with the bioenergy internship helped me to gain hands-on experience, which helped me to become a Peace Corps Volunteer in the Environmental Education program. Through the internship, I gained very valuable experience working in a team and developing communication and organization skills which are essential in the professional world. Not only was Dr. Wilkie a great guide to our research projects but also a close mentor who shared so many wisdoms. The experience I gained through the internship is still living in my daily work life as a government employee here in Washington D.C.

– **Shunpei Iguchi** – Former BESS intern

Returned Peace Corps Volunteer

**Frequently Asked Questions (FAQ):**

**1. Q: When does the internship start?**

**A:** The internship follows the University of Florida Summer C schedule.

**2. Q: What is a typical day in the life of a BESS intern?**

**A:** There is no typical day for a BESS intern. The daily schedule an intern follows is similar to the life of a research scientist; each day holds new (and often unexpected) experiences and discoveries. Lectures and discussion with the BEST laboratory community are common as are days of field activity, experimental design and data collection. The occasional field excursion may last all day and are usually exciting and inspiring events.

**3. Q: What topics are covered?**

**A:** Topics focus on the application of biological processes to sustainably power human civilization while simultaneously remediating waste and providing nutrients for agriculture. The myriad forms of bioenergy are addressed. Critical evaluation of current fossil fuel use is examined and discussed.

**4. Q:** *Do we get to make our own biofuels?*

**A:** Yes! Interns get to make their own biofuels including biodiesel and biogas.

**5. Q:** *What types of independent projects can I do?*

**A:** Intern projects are designed to complement the current BEST Laboratory research projects. However, a significant degree of freedom is afforded to the student in developing creative and innovative aspects of individual projects.

**6. Q:** *Is group work involved?*

**A:** Throughout the summer, interns work closely with fellow interns from a variety of backgrounds. Team projects are designed to encourage collaborative work and to allow interns to learn from each other. Working as a team helps to develop group-dynamic skills and produce a more robust and developed end product.

**7. Q:** *What are some successful past intern individual projects?*

**A:** Successful projects vary from those focused on controlled laboratory experiments and investigative research, to applied field studies. Interns who truly dedicate themselves to exploring the science of sustainability and bioenergy are rewarded with excellent projects. Some of the most notable BESS projects include investigating methods of cracking algae cells, anaerobic digestion of milk cartons from school lunches, development of a small-scale anaerobic digester for food waste, and a mini-life cycle analysis on algae bioremediation of landfill leachate.

**8. Q:** *Why focus on bioenergy and sustainability?*

**A:** Sustainability of human civilization is a grand challenge of the 21<sup>st</sup> century. The human population has grown exponentially in the past century, fueled primarily by fossil fuel resources. These resources are, by their very nature, limited and prone to depletion. Biologically derived energy sources can play a key role in the ecological integration of human communities by recycling and mitigating society's wastes.

**9. Q:** *How will this internship help in my career?*

**A:** BESS is a pre-graduate school experience, which strives to equip students with a holistic research experience and prepare students to be effective in graduate school and contribute positively to the workforce and society.

**10. Q:** *Can I get class credit for this internship?*

**A:** Yes. Students earn class credit for the internship by registering for SWS4932 – Bioenergy and Sustainable Technology Research. Depending on the nature of the research projects, students should anticipate spending extra time during Summer B to conduct their experiments and complete homework assignments.

**11. Q:** *Is there a final examination?*

A: No, there are no exams per se. Student grades are based on completion of homework assignments, as detailed in the following grading structure:

**Grading Structure**

*BEST Listserve Postings	10%
*Field Trip Reports	10%
Book Report	10%
Literature Review	10%
Individual Project Written Proposal	10%
Individual Project Written Report	20%
Individual Project Oral Presentation	10%
Team Project Report & Oral Presentation	10%
Group Project Report & Oral Presentation	10%
	100%

\* Full marks awarded for submission.

**Grading Scale**

A	$\geq 90$
B	$\geq 80, < 90$
C	$\geq 70, < 80$
D	$\geq 60, < 70$
E	< 60
I	Incomplete