

Synthetic Biology Research for Undergraduates: SyBR-U

National Science Foundation

Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences

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Abstract

Many of the most profound scientific discoveries of our time are made at the intersections of traditional scientific disciplines by teams of researchers. It is critical that scientists of the future be conversant in multiple disciplines and capable of working collaboratively. Davidson College and Missouri Western State University will train undergraduate students to work at the interface of mathematics and biology by engaging them in the exciting new field of synthetic biology. Synthetic biology offers a rich supply of inherently interdisciplinary research problems, and the international Genetically Engineered Machines (iGEM) competition provides a focal point for undergraduate participation in synthetic biology research. Students and faculty at Davidson and Missouri Western will collaborate on groundbreaking efforts to design, model, and build bacterial computers to solve mathematical problems such as sorting by reversals (the so-called Pancake Problem), the Hamiltonian Path Problem, and the classic Traveling Salesperson Problem. These living computers will be constructed from existing and novel parts in the Registry of Standard Biological Parts, a growing collection of DNA-based elements used by the global synthetic biology community.

The emerging field of synthetic biology combines mathematics with molecular biology to design and construct DNA-based devices with applications in energy, medicine, and technology. By engaging students in original research, the Synthetic Biology Research for Undergraduates (SyBR-U) program will advance this important new interdisciplinary field while addressing the critical need to train future research scientists to work collaboratively at the intersection of mathematics and biology. Students will be recruited in the spring semester of their freshman year, and remain involved with the program through the fall semester of their junior year. Each participant will take courses in both mathematics and biology and attend weekly team meetings in which the two campuses are linked by videoconference. After gaining experience in this collaborative research environment, students will present their work alongside undergraduate researchers from around the world at the iGEM Jamboree. By treating interdisciplinary training as the foundation rather than the pinnacle of undergraduate education, the SyBR-U program creates a new model that the undergraduate educational community can use to attract and train future researchers, the stewards of tomorrow's scientific discoveries.