Thematic Research Areas of Biotechnology Training Program

Advancing the Analysis of Biological Systems

Research and training in this area aim to develop and advance high throughput quantitative measurements of biological systems, from molecular, and cellular levels, to cellular community and ecosystems. Advanced tools for the analysis of the genome, transcriptome, proteome and metabolome are extensively deployed. Faculty mentors include: Arriaga (Chemistry), Dorfman (CEMS), Griffin (BMBB), Haynes (Chemistry), Hegeman (Horticultural Science), Hu (CEMS), Lipscomb (BMBB), Oh (ECE), Wackett (BMBB).

Designing and Synthesizing Molecules

Structural and functional characterization of macromolecules, and modulation of protein properties and functions are common thread in this area of research and training. The approach encompasses both model-assisted molecular design and high throughput screening upon directed evolution. Faculty trainers include: Distefano (Chemistry), Gralnick (Microbiology), Hackel (CEMS), Kazlauskas (BMBB), Kaznessis (CEMS), Kim (BMBB), Wackett (BMBB), Walters (BMBB).

Designing and Synthesizing Pathways and Networks

Synthetic biochemical pathways and genetic networks are the subject of study in the focal area of research. Novel biochemical pathways and synthetic regulatory structures are modeled, predicted, and constructed. Faculty advisors are: Daoutidis (CEMS), Dunny (Microbiology), Kaznessis (CEMS), Myers (CSE), O'Connor (GCD), Othmer (Mathematics), Sadowsky (SWAC), Schmidt-Dannert (BMBB), Srienc (CEMS), Zhang (CEMS).

Designing and Synthesizing Complex Biotechnological Systems

Future biotechnological applications will involve synthetic organisms and communities of organisms. Research exploring these new frontiers often employs multi-scale computational models, toolboxes of synthetic biology. Students and faculty design, construct, and test synthetic systems with a high degree of complexity. Faculty mentors include: Berman (GCD), Bernlohr (BMBB), Katagiri (Plant Biology), Kaznessis (CEMS), Kokcoli (CEMS), Othmer (Mathematics), Riedel (ECE), Seelig (BMBB), Shen (BME), Tranquillo (BME), Voytas (GCD), Wang (BME).

Interfacing Biological Systems and Materials

Implementation of biochemical and biomedical technologies requires an interface between the scientific and engineering developments listed in research areas above and the targeted systems. Advanced materials such as polymersomes for targeted drug delivery, tailored plastics or elastomers for mechanical application, form key components in the overall system matrix. Faculty trainers include: Barocas (BME), Bates (CEMS), Bond (Microbiology), Karypis (CSE), McIvor (MICB), Shen (BME), Srienc (CEMS), Voytas (GCD), Wackett (BMBB), Wang (BME).