IBIEM Training Program Overview

Claudia Gunsch, Dept of Civil and Environmental Engineering, Duke University
Joshua Granek, Dept of Biostatistics and Bioinformatics, Duke University
Joseph Graves, Joint School of Nanoscience and Nanoengineering, NC A&T
John Rawls, Dept of Microbial Genetics and Microbiology, Duke University
Gregory Wray, Dept of Biology, Duke University

IBIEM
Integrative Bioinformatics for Investigating and Engineering Microbiomes
http://www.ibiem.pratt.duke.edu
The NSF Research Traineeship (NRT) program is designed to encourage the development and implementation of bold, new, and potentially transformative models for STEM graduate education training. The NRT program seeks proposals that ensure that graduate students in research-based master’s and doctoral degree programs develop the skills, knowledge, and competencies needed to pursue a range of STEM careers. The NRT program includes two tracks: the **Traineeship Track** and the **Innovations in Graduate Education (IGE) Track**.
The **Traineeship Track** is dedicated to effective training of STEM graduate students in high priority interdisciplinary research areas, through the use of a comprehensive traineeship model that is innovative, evidence-based, and aligned with changing workforce and research needs.
NRT Specific Program Components

• Integration of Research and Education
• Interdisciplinarity
• Professional Development
• Integrating Diversity
• Evaluation
Multi- $\rightarrow$ Inter- $\rightarrow$ Transdisciplinary

- **Integration:** Separated $\rightarrow$ Integrated $\rightarrow$ “Become One”
- **Perspective:** $\geq 2$ disciplinary $\rightarrow$ include stakeholders+
- **Team’s Goals:** Project $\rightarrow$ Learning, New Ideas $\rightarrow$ Problem Oriented
- **Leadership:** Varied Leadership $\rightarrow$ Rotating Leadership?
T-Shaped Talent

• Academia Optimizes
  • I for individual work
  • Individual IQ
  • Disciplines

• Business Optimizes
  • T for team work
  • Team IQ
  • Systems

• Both Important
  • Depth & Breadth
  • Disciplines & Systems
Microbes are essential to human life!

Air Microbiome (www.scelse.sg)

Human Microbiome (www.vitamedica.com)

Food Microbiome (www.realfoodforager.com)

Meta-Omics: exploding the “black box”

Adapted from Del Chierco et al., 2012
Implementation = Team Science!
30+ Faculty with Complementary Expertise

<table>
<thead>
<tr>
<th>Core Area 1: Biological Sciences</th>
<th>Core Area 2: Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biological Sciences (CA1)</strong></td>
<td><strong>Engineering (CA2)</strong></td>
</tr>
<tr>
<td><strong>Biostatistics and Bioinformatics (CA3)</strong></td>
<td>Molecular Interactions (MI) $\leftrightarrow$ Complex Microbial Systems (CMS)</td>
</tr>
<tr>
<td>Identification of key molecular mechanisms of microbial interaction</td>
<td>Study of complex natural communities, and development of model synthetic communities</td>
</tr>
<tr>
<td>Development of strategies for controlling gene expression, activity, and transfer in simple microbial communities</td>
<td>Manipulation of complex microbial community structure and function for a particular environmental or biomedical process</td>
</tr>
<tr>
<td>Statistical design, analysis and modeling of multi-omic datasets for simple microbial communities</td>
<td>Bioinformatics integration and statistical design, analysis and modeling for complex microbiomes incorporating spatial and dimensional heterogeneity</td>
</tr>
</tbody>
</table>
Programmatic Elements

**Boot Camp**
Description: Series of one day workshops on various relevant topics
Goal: Develop common terminology and camaraderie

**Collaborative Science Practicum 1**
Description: Series of diverse short team projects led by targeted academic and industrial partners

**Collaborative Science Practicum 2**
Description: Capstone-like project designed and executed by IBIEM Trainees

**Interactive Seminar Course**
Description: Trainees present their research design and data structure for feedback from peer and faculty mentors

**Professional Skills Workshops**

**Seminar Series and Annual IBIEM Symposium**

**Skill Workshops**

**Required Coursework to satisfy Trainee’s Home Department Requirements**
Current IBIEM Trainees