Gene regulation in cancer and congenital defects for drug target discovery

Drug Discovery from plants and unusual marine and freshwater organisms to treat metabolic syndrome, cancer and infectious diseases
Pharmaceutical Sciences Research Cores

Drug dosing and delivery

Metabolomics and Biomarker discovery

Nanotechnology based drug development with multiple moieties for targeting, imaging and treatment
<table>
<thead>
<tr>
<th>Integrative Biology</th>
<th>Jim Strother</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ben Dalziel</td>
<td>Jaga Giebultowicz</td>
</tr>
</tbody>
</table>
James Strother
Integrative Biology
Cordley 2112
541-737-1800
james.strother@science.oregonstate.edu

Our research explores the neurobiology, physiology, and biomechanics of vertebrate animals.

Thesis topic ideas

- Behavioral studies
- Neural circuit cracking
- Optogenetics
- Calcium imaging
- Fluid dynamics and biomechanics
Benjamin Dalziel
Integrative Biology and Mathematics
Cordley 5006
541-737-1979
Benjamin.Dalziel@oregonstate.edu

Currently
- Forecasting infectious disease risk
- Discovering the origins of animal migration
- Studying viral evolution in animal shelters

We study how populations work

Thesis topic ideas/opportunities
- Find hotspots of flu transmission in US cities!
- Recon the microbiome of dog noses!!
- Track cholera in rural Haiti!!
Jaga Giebultowicz
Integrative Biology
Cordley 4028
541-737-5530
jaga.giebultowicz@oregonstate.edu

We study body **clocks** and circadian rhythms.

**Clocks** regulate molecular and physiological rhythms: *What if they are broken?*

**How gene expression changes during aging***?

Surprise! Some genes become more rhythmic in old flies.

*In collaboration with Dr. Dave Hendrix BB

---

**Thesis topic ideas/opportunities**

- Analyze trends in gene expression during aging?
- How to repair old biological clocks?
- Do strong clocks protect from aging?
- What are the effects of LED lights on clocks and aging?
Malgo Peszynska
Mathematics

Kidder 292a
541-737-9847
mpesz@math.oregonstate.edu

Applied and computational mathematics. Analysis; Algorithms; Modeling; Data.
Applications: Geosciences; (Alternative) Energy; Materials; Environment.

www.math.oregonstate.edu/~mpesz/students.html

Conflicts in Silicio (in computational modeling)

- Data: experiment vs reconstruction
- Computing: accuracy vs efficiency
- Modeling:
  - graphs vs functions
  - reaction vs diffusion
  - linear vs nonlinear
  - discrete or continuum

Ex.: Multiple scales and phases

Thesis topics and opportunities

- “Differential Equations with Graphs”
- “Phase transitions: ice-cream or latte?”
- “Modeling diffusion and aggregation”
- “Network modeling”
- …

NSF-DMS grant 2015-2018
“Phase transitions across the scales”
Symmetry is an observed feature of many physical objects. Group theory is the mathematical study of symmetry.

Sample Problems (Classical)

If an object has symmetries x and y and

\[ x^2 = y^3 = (xy)^r = 1 \]

Is the object finite or infinite? If infinite, how fast does the number of distinct symmetries grow?

Thesis topic ideas/opportunities

- Use computational and number theoretic methods to develop new examples of finite Frobenius Groups.
- Construct new examples of spherical diagrams that are known to exist but are as yet unseen.
Multi-scale Modeling of Disease Spread

Vrushali Bokil
Department of Mathematics

 QGraphics

Kidder 048
math.oregonstate.edu/~bokilv
bokilv@math.oregonstate.edu

NIMBioS

National Institute for Mathematical and Biological Synthesis

Thesis topic ideas/opportunities

- Rosie Leung: between host model
- Carrie Manore: network model
- Need to couple within host with between, and couple between host with network, and couple all three
- Requires ODEs, Linear Algebra, Matlab
College of Science and UHC Thesis Mixer

Biochemistry - Biophysics

Afua Nyarko

Elisar Barbas
Afua Nyarko  
Biochemistry and Biophysics

ALS 2039  
541-737-4486  
nyarkoa@oregonstate.edu

**Structure, Interactions, and Regulation of tumor-causing, and tumor-suppressor proteins.**

How can we modulate these interactions to promote or prevent cell growth?

- Yorkie (Yki): tumor-causing protein
- Mask: promotes the activity of Yki
- Hippo (Hpo): inhibits the activity of Yki

**Thesis topic ideas/opportunities**

- Mapping studies of the Yorkie-Mask complex
- Biophysical characterization of the Yorkie-Hippo interaction

Nuclear magnetic resonance (NMR)  
Isothermal titration calorimetry (ITC)  
Fluorescence
Elisar Barbar
Biochemistry and Biophysics
ALS 2133
541-737-4143
Elisar.barbar@oregonstate.edu

Our primary focus is elucidation of the molecular structure, assembly and regulation of protein interaction networks. The proteins we study are associated with huntingtin disease, mental retardation, and rabies virus.

How Motor Proteins Work?

Thesis topic ideas/opportunities

- Interactions with Ebola and rabies virus
- Database for LC8 interactions
- Aggregation and cataracts
- Multidisciplinary approaches
  - Molecular biology
  - Protein purification
  - Protein NMR spectroscopy
Weihong Qiu  
Physics  
Biochemistry and Biophysics

ALS 2030  
541-737-4155  
Weihong.Qiu@physics.oregonstate.edu  
dyne.physics.oregonstate.edu

Cellular logistics

Cellular force production

Visualize the action of motor proteins at the single-molecule level

- How do cells maintain spindle bipolarity?
- How do plant cells transport materials for the synthesis of cell plates?
- How are motor proteins regulated?
- How do motor proteins coordinate with each other?
- How does the minus end-directed kinesin OsKCH2 move on the microtubule tracks?
Chemistry

Vince Remcho
Our research results in new materials, devices & methods that are greener and more efficient than their conventional counterparts.

Microfluidic Systems:
• for detection of adulterated pharmaceuticals in the developing world
• for diagnostic veterinary & human medicine
• for environmental sensing & analysis

Our research team focus is on DESIGN, FABRICATION & APPLICATION of MICROFLUIDIC DEVICES and SENSORS.

Students learn about and apply:
• device design & hybrid (paper/polymer) chip fabrication – “lab on a chip” – methods
• materials and surface chemistry relevant to bioanalytical chemistry and clinical diagnostics
• chromatography, electrophoresis, electron microscopy, fluid dynamics, app development

Vince Remcho
Chemistry
LPSC 277
541-737-8181
Vince.Remcho@oregonstate.edu