Colleges of Science, Pharmacy, Vet. Med. & Honors
College Faculty Research Showcase
Fall 2023
Eleanor Feingold
eleanor.feingold@oregonstate.edu
Dean of the College of Science
Finding human disease genes by scanning the genome

1) Collect cases and controls

2) Genotype everyone

3) Test genotype/phenotype association

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<thead>
<tr>
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<th>AA</th>
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</thead>
<tbody>
<tr>
<td>cases</td>
<td>65</td>
<td>133</td>
<td>202</td>
</tr>
<tr>
<td>controls</td>
<td>16</td>
<td>81</td>
<td>316</td>
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</tbody>
</table>

4) Repeat over the whole genome
Genome-wide analysis identifies novel loci influencing plasma apolipoprotein E concentration and Alzheimer's disease risk

M Muaz Aslam, Kang-Hsien Fan, Elizabeth Lawrence, Margaret Anne Baptiste, Beth E Snitz, Steven T DeKosky, Oscar L Lopez, Eleanor Feingold, and Robert D Ruthazer

NAT GENET. Author manuscript; available in PMC 2021 Jun 7. Published in final edited form as: Nat Genet. 2021 Jan; 53(1): 45-53. Published online 2020 Dec 7. doi: 10.1038/s41588-020-00741-7

Insights into the genetic architecture of the human face

Julie D. White, Karlene Indencleeff, Sahin Nazif, Ryan J. Eiler, Hanne Hoskens, Jasmin Roopenboom, Myoung Keun Lee, Jianli Li, Jaayed Mohammed, Stephen Richmond, Ellen E. Quillen, Heather L. Norton, Eleanor Feingold, Tomek Swiput, Mary L. Marazita, Hilde Peeters, Greet Hens, John R. Shaffer, Joanna Wysocka, Susan Walsh, Seth M. Weingberg, Mark D. Shriver, and Peter Claes

A candidate gene analysis and GWAS for genes associated with maternal nondisjunction of chromosome 21

Jonathan M. Chernus, Emily G. Allen, Zhen Zeng, Eva R. Hoffmann, Terry J. Hassold, Eleanor Feingold, and Stephanie L. Sherman


Potential risk factors and genetic variants associated with dental caries incidence in Appalachia using genome-wide survival analysis

Tianyu Zou, Katherine Neiswanger, Eleanor Feingold, Betsy Foxman, Daniel W McNeil, Mary L Marazita, and John R Shaffer
Vrushali Bokil
Mathematics
Kidder 048
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- Applied Mathematics
- Computational Mathematics
- Scientific Computing

APPLICATIONS

Magneto-hydrodynamics
Nonlinear Optics
Micro-Magnetics

Possible Thesis Topics

Modeling of Plasma Dynamics
Numerical Simulation of Solitons
Multi-Scale Modeling of Magnetic Materials

Skills??

Math Modelling with Differential Equations (ODEs, PDEs)
Numerical Methods
Computation: MATLAB, C, Python
Electromagnetics
Nonlinear Waves

APPLICATIONS

Magneto-hydrodynamics
Nonlinear Optics
Micro-Magnetics
Bain Aerosol Research

Understanding the surface tension of atmospheric aerosol

The large surface area-to-volume ratio of aerosol droplet causes surfactants to repartition, leading to differences in surface tension between aerosol and macroscopic solutions, even when the total composition is the same.

We use a combination of macroscopic and droplet measurements with surfactant partitioning modeling to understand the surface tension of atmospheric aerosol and how that surface tension affects the process of aerosol activating into cloud droplets.

Laboratory based (in person) and modeling based (in person or E-campus) projects available.
MATTHEW GRAHAM

graham@physics.oregonstate.edu
We study ‘on-chip’ electronic behavior down to the femtosecond limit using lasers.
Physics of high-field ultrafast microscopy of thin-films and 2D materials.
Dr. Julie Alexander
Assistant Professor of Senior Research
Department of Microbiology
Nash 528
julie.alexander@oregonstate.edu
https://microbiology.oregonstate.edu/directory/julie-alexander

Honors Collaboration Interests

• Host-parasite ecology
• Salmon disease modeling
• Infection experiments

Fig. credit S. Atkinson
Current work and potential topics

Ceratonova shasta ecology
- salmonid fish host
- myxospores
- actinospores
- polychaete worm host

Host-parasite-tools
- salmonid fish host
- myxospores
- actinospores
- polychaete worm host

Laboratory challenges

Modeling

Legend
Predicted Probability of Presence
- 0.00000 - 0.25000
- 0.25001 - 0.50000
- 0.50001 - 0.75001
- 0.75001 - 1.00000

Open to your interests! julie.alexander@oregonstate.edu
Plankton Ecology Lab

Department of Integrative Biology

Hatfield Marine Science Center

MAJOR RESEARCH QUESTIONS:
• What factors influence survival of fish throughout early life?
• How will changes in ocean conditions (temperature, hypoxia, acidification, nutrients) affect planktonic communities?

Environmental conditions

Predation
Prey quality and availability
Survival + recruitment
Otolith microstructure: Age and growth

Record heat in early July 2023
Average daily global temperatures per year, in °C
17.0°C July 4

Source: Copernicus CS/EUMETSAT, data from ERA5
Plankton abundance and distribution in relation to environmental variables

Plankton imagery data: ISIIS

Interested? Contact:
Elena Conser
PhD Candidate
Email: consere@oregonstate.edu

Su Sponaugle
Principal Investigator
Email: su.sponaugle@oregonstate.edu

MOCNESS Video:
Lab Website:

Appendicularian abundance
Many biological functions are inherently mechanical

![Diagram of vascular development and regulation](image1)

- **Osmotic regulation**
  - Hypertonic
  - Isotonic
  - Hypotonic
  - ![Osmosis diagram](image2)

- **Vascular development and regulation**
  - ![Diagram of vascular structure](image3)

- **Hearing**
  - ![Diagram of hearing](image4)
  - [Online resource](https://www.sciencedirect.com/topics/medicine-and-dentistry/hair-cell)

- **Touch sensing**
  - ![Diagram of touch sensing](image5)
  - [Online resource](https://askabiologist.asu.edu/explore/how-do-we-feel-touch)

- **2021 Nobel Prize in Physiology and Medicine**
  - David Julius
  - Ardem Patapoutian
  - [Online resource](https://en.wikipedia.org/wiki/Osmosis)
  - [Online resource](vanegaslab.org)

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**The Molecular Mechanobiology Lab**

Prof. Juan Vanegas
vanegasj@oregonstate.edu
http://vanegaslab.org

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1000 Nobel Prize Winners and Nominations: https://www.valhalla.com/nobel-prize-winners.html
1. How do membrane proteins “sense” external mechanical stimuli?

![Diagram of membrane proteins in closed and open states.](image)

2. How does molecular structure determine elastic/mechanical properties of biomembranes?

![Diagram showing different structures and phase transitions.](image)
State-of-the-art models and theory have major challenges in predicting glacier melt and future sea level rise. We need motivated students and new observations to resolve this conundrum!
creating experiences
real-world challenges
new measurement technologies
millimeter-scale dynamics
critical for climate prediction
The Submarine “Melt Stake”

- thermistor rake
- ADV sample volume 10 cm
- hydrophone
- Signature 1000 1 MHz ADCP
- Vector 2 MHz ADV
- GoPro camera
- acoustic beacon
- ice screw
- motor & gears

Noah Osman

Please reach out to faculty and students in CEOAS for opportunities to work with us on societally-relevant, ocean, climate and geoscience projects.
Tom Osborn Popp  
Department of Chemistry  
LPSC 253  
541-737-7730  
osbornpt@oregonstate.edu

Teaching

Fall 2023: CH464 Experimental Chemistry II  
Spring 2024: CH233H General Chemistry

Research

• Development of novel devices for solid state nuclear magnetic resonance spectroscopy
• Application of these technologies to reveal new insights about complex material and biomolecular systems

Thesis Opportunities

Looking for creative and motivated students to join the lab and participate in cutting-edge NMR research. Ideally either familiar with CAD or eager to learn.

We use stereolithography (SLA) resin 3D printing and other fabrication techniques to develop new devices for NMR spectroscopy, including pneumatically-driven spinning devices for solid state NMR.

Projects at the interface of physics, chemistry, mechanical, electrical, and chemical engineering

Research Website

osbornpopplab.com

Below: a spherical rotor in a 3D-printed stator spinning up to 4 kHz
Protein disorder in regulation of large molecular machines: From dynein motor to coronavirus

Dynein

ASCIZ

RavP

SARS-CoV2

Elisar Barbar
@ElisarBarbarLab
NMR is one of the tools! Multiple techniques are necessary.

- NMR
- SAXS
- Computational modeling
- Negative stain electron microscopy
- Analytical ultracentrifugation
- Size exclusion chromatography
- Microscopy
- Native gel electrophoresis
- Isothermal titration calorimetry
- Native mass spectrometry
- Multi-angle light scattering
- EMSA
- Fluorescence Anisotropy
RNA structure and multiple weak interactions balance the interplay between RNA binding and phase separation of SARS-CoV-2 nucleocapsid

Aidan B Estelle, Heather M Forsythe, Zhen Yu, Kaitlyn Hughes, Brittany Lasher, Patrick Allen, Patrick N Reardon, David A Hendrix, Elisar J Barbar


Modifications to the SR-Rich Region of the SARS-CoV-2 Nucleocapsid Regulate Self-Association and Attenuate RNA Interactions

Patrick N. Reardon, Hannah Stuwe, Sahana Shah, Zhen Yu, Kaitlyn Hughes, Elisar J. Barbar

doi: https://doi.org/10.1101/2023.05.26.542392
SARAH GRAVEM

sarah.gravem@oregonstate.edu
Faculty Areas of Interest
Areas of Interest

**Cardiology & Eyes**
Duncan Russell - Pathology of cardiovascular conditions, ventricular function, therapy
Rachael Gruenwald - Eye diseases of animals

**Global Infectious Diseases**
Manoj Pastey - Influenza virus, HIV-1, diagnose of infections, creation of new tests and assays.
Daniel Rockey - Chlamydia infections, understanding the disease in humans and animals
Mahfuz Sarker - Clostridium infections, sporulation, food poison
Ling Jin - Herpes virus in humans and animals, Koi fish model of latency
Luiz Bermudez and Lia Danelishvili - Tuberculosis, Johne’s Diseases, *M. avium* and *M. abscessus*, hospital infections, antibiotic resistance, phage therapy
Anna Jolles and Brianna Beechler - Ecology of Infectious Diseases, *M. bovis* in buffalos, viral, bacterial and fungal diseases in wildlife
Hong Moulton - Antisense therapy for genetic diseases, influenza virus and toxoplasmosis
Justin Sanders - Fish infections (mycobacteria, Toxoplasma)
Brian Dolan - CD8+ T cells, comparative Immunology, wildlife Immunology, SARS-coV-2
Natalia Shultzenko - Microbiome and the immune response, diabetes and microbiome
Claudia Hase - *Vibrio cholera, V. parahemolyticus*, infection of sea species
Claire Couch - Microbiome and Parasitic Diseases
Areas of Interest

**Cognitive Memory and Aging**
Kathy Magnusson - Neuroscience, memory.
Patrick Chappell – Neuroscience, circadian clock, brain hormones
Fikru Nigussi – Neuroscience, electro-stimulation to study areas of the brain

**Cancer Biology**
Steve Ramsey - System Biology, cancer, cardiovascular diseases
Jennifer Johns - Stem cell biology, exosomes
Christiane Lohre - Sarcomas, feline retrovirus tumor and other tumors

**Nutrition, Metabolism & Inflammation**
Jean Hall – Immunonutrition: selenium as immune stimulation of ruminants. Biomarker for kidney disease in animals

**Imaging**
Susanne Stieger-Vanegas - 3D printing

**Small Animal (dog and cat) Diseases**
Stacie Summers - Microbiome, diet, urinary tract diseases

**Horse Genetics**
Lacy Kamm - MHC and Immune responses

**Intensive Care Projects**
Tandi Ngwenyama - Intensive care medicine
An *in vitro* exploration into the effects of estrogen and endocrine disruptors on neuroendocrine regulation of puberty and reproduction in females

Patrick Chappell, Ph.D.
Biomedical Sciences

The basic mechanisms underlying endocrine control of reproduction; the role of the molecular circadian clock in the brain’s timing of reproduction in female mammals.
Justin Sanders, Ph.D.

Host-parasite interactions and the impacts of ecological and evolutionary factors on these interactions

Toxoplasma

Current projects:

• Production of monoclonal antibodies that recognize a number of zebrafish cytokines and characterization of the zebrafish immune response

• Development and characterization of an elevated temperature zebrafish model, primarily for the study of the apicomplexan parasite, Toxoplasma gondii

• Improvement of diagnostic techniques for the detection of important veterinary parasites such as Giardia intestinalis and the liver fluke, Fasciola hepatica

• Identification and characterization of the transmission dynamics of aquatic pathogens

Mycobacteria
The role of host physiology and immunology in disease transmission in wildlife and domestic animal species (African buffalo, bighorn sheep, walrus, cattle and domestic cats).
Different techniques to assess innate immune function

Hematology:
- Lymphocytes
- Neutrophils
- N/L Ratio
- Monocytes
- Eosinophils
- CBC

Plasma Bacterial Killing Assay (BKA):
Sum total of antibody, complement, and anti-microbial enzyme activity in plasma

Quantitative PCR:
Quantify transcript levels for Toll-like receptors (TLR) 2 and 5, which recognize bacterial pathogen signatures (peptidoglycan and flagellin, respectively)

Generalized Linear Modeling (GLM) to find and understand the trends
Luiz Bermudez MD

Mycobacterial infection of the human and animals. Pathogen interaction with mucosal surface, survival mechanism in the host, biofilm and its role in disease.

Pathology of Lung

Microaggregate formation leading to biofilms

Normal alveolar spaces

Alveolar space compromised by secretion-mucus and infection. Function of the organ is impaired.
Contact:
luiz.Bermudez@oregonstate.edu

Luiz Bermudez, Department Chair

106 Dryden Hall
Department of Biomedical Sciences
Carlson College of Veterinary Medicine
Fred Stevens, PharmD, PhD
fred.stevens@oregonstate.edu

Professor of Pharmaceutical Sciences
Associate Dean for Research, College of Pharmacy
Principal Investigator, Linus Pauling Institute
Guest Professor, University of Antwerp, Belgium

Research focus: Natural products and vitamins for improving human health and preventing/treating metabolic diseases. Tools: natural products/medicinal chemistry, mass spectrometry, metabolomics, cell culture, animal models, human studies

Classes taught: PHAR 714 (Complementary medicine), PHAR 753/754 (Integrated Drug Structure, Action and Therapeutics II/II), PHAR 537 (Natural Products Biosynthesis), VMB 671 (Molecular Tools/Metabolomics)

Mentoring experience: >84 undergraduate and graduate students, foreign exchange students and visiting scholars (13 countries), postdocs, and research professors
Research Opportunities in the College of Pharmacy

**Pharmaceutical Sciences**
- Gene Regulation and Disease
- Targeted Drug Delivery
- Pharmacokinetics and Pharmacodynamics
- Cardiovascular & Metabolic Disease
- Drug Discovery
- Pharmacotherapy

**Pharmacy Practice**
- Infectious Disease
- Drug Discovery
- Pharmacotherapy
- Pharmacy Outcomes Research
- Epidemiology
- Public Health
- Ambulatory Care
What Would I Do in a Lab?

• #1 question received
• Everything!
• Depends on your interests.

You can do *anything* from washing dishes to designing, running, and interpreting experiments.

• #1 comment: "I don't know enough"
  No worries, we are all on the same road
OSU College of Pharmacy 1898-2021
122 Years at the Forefront of Scientific Research
Drug Development in the Stevens Laboratory

- Target Discovery
- Drug Discovery and Screening
- Lead Optimization
- Preclinical Development
- Clinical Trials

Molecular modeling

OH
OH
O
OHO
xanthohumol (XN)
dihydroxanthohumol (DXN)
betahydroxanthohumol (TXN)

OH
OHO
N N
OH
methylxanthopyrazole

Plasma glucose (mg/dL)

0 1 3 9

XN dose (arbitrary)

HOMA-IR (index of insulin resistance)
High-fat diet (HFD) 49.5 ± 18.2
Xanthohumol treatment with HFD 26.7 ± 13.5
Xanthopyrazole treatment with HFD 10.9 ± 1.5 *

*p < 0.05

Provisional patent application filed on February 9, 2021
Patent Cooperation Treaty application filed on February 9, 2022

Xanthohumol microbiome and signature in adults with Crohn’s disease (the XMaS trial): a protocol for a phase II triple-masked, placebo-controlled clinical trial

Studay Protocol
Open Access

Provisional patent application filed on February 9, 2021
Patent Cooperation Treaty application filed on February 9, 2022

Xanthohumol microbiome and signature in adults with Crohn’s disease (the XMaS trial): a protocol for a phase II triple-masked, placebo-controlled clinical trial

Nunm National University of Natural Medicine

Molecular modeling