Department of Biological Sciences: RESEARCH

Stats

- 14 research-active faculty
- >29 research projects
- 1-6 undergraduate researchers per faculty member
- July 1, 2013-present:
  - Applied for 18 external grants, 4 funded
  - 1 book, 11 papers in peer-reviewed journals, 32 posters/ talks at national conferences

Strengths

- Behavioral Science
- Bioinformatics
- Biomedical
- Ecology
- Evolution
- Molecular and Cellular Genetics
- STEM pedagogy

Matthew T. Bealor

Vertebrate Behavior & Ecology

Research Interests

- Population ecology and behavior of invasive species
- The effects of endocrine disrupting pollutants on sexual development and behavior of aquatic vertebrates
- Vertebrate sensory biology and animal communication

Research Expertise

- Field sampling methods: pitfall traps, drift fences, electro-fishing, mark-recapture methods
- Standard and high speed video capture/analysis for behavioral assays
- Comparative phylogenetic methods for reconstructing character evolution

Collaborators: Michael Tolocka, Environmental Sustainability Institute
Bill Pitts, NJ Division of Fish & Wildlife
Alan de Queiroz, University of Nevada, Reno

Matthew T. Bealor

Project: Ecology & behavior of introduced Italian Wall Lizards

- ***Why is this project novel or innovative?***

  This invasive species has become established in four U. S. cities

- ***Impact***
  - Invasive species cost the U.S. > $120 Billion/year in damages
  - Exotic species one of the top causes of species' extinction
  - Help U.S Fish & Wildlife and local agencies better understand and deal with invasive animals

- ***Potential Partners***
  - Federal: NSF, USDA, US Fish & Wildlife
  - Private: Nat. Geo. & Museums

Introduced Italian Wall Lizards captured in Mt. Laurel, New Jersey. These 16 lizards were captured in about 3 hours on a single day.

Matthew T. Bealor

Project: The effects of environmental estrogens on sexual development and mating behavior in aquatic vertebrates

- ***Why is this project novel or innovative?***

  Estrogen and estrogen-like compounds occur in many rivers and are not effectively removed/degraded by sewage treatment plants

- ***Impact***
  - Can hasten/disrupt the onset of vert. sexual development
  - Can produce behavioral and physiological sterility in males
  - Human exposure can have serious health consequences

- ***Potential Partners***
  - Federal: NSF, NIH, EPA
  - Industry: Pharma, wood/paper industry, Soy processing plants

Patrick Crumrine

Ecology, Environmental Biology

Research Interests

- Impact of size structure on cannibalism and intraguild predation (IGP) in aquatic insects
- Effects of non-host predators on the transmission of amphibian parasites
- Effects of urbanization on aquatic turtle population structure

Research Expertise

- Field, mesocosm, and lab-based aquatic community ecology
- Bioassessment of pond and stream communities

Patrick Crumrine

Project: Effects of size structure on cannibalism and IGP

- ***Why is this project novel or innovative?***

  Incorporate individual variation in size to better understand predation within populations and communities

- ***Impact***

  Refine food web models

  Achieve more precise biocontrol by reducing predator-predator interactions

- ***Potential Partners***

  Industry: Agritech

  Federal: NSF

Patrick Crumrine

Project: Effects of urbanization of aquatic turtle population structure

- ***Why is this project novel or innovative?***

  The landscape continues to be developed at a rapid pace resulting in habitat destruction/degradation. Populations of many taxa are in decline but mechanisms are poorly understood.

- ***Impact***

  Conserve threatened taxa

  Identify problematic patterns of land use

- ***Potential Partners***

  Federal: USFWS, NSF

Gregory B. Hecht

Microbiology; Molecular genetics

Research Interests

- Microbial lead precipitation
- Development of bacterial strains for biofuel production
- Use of bacteria to enhance breakdown of fats, oils, and greases in commercial grease traps
- Use of "classical genetics" approaches to issues in applied microbiology

Research Expertise

- General bacteriological techniques
- Genetic screens and selections
- Genetic manipulation and mapping of microbial strains
- Molecular biology techniques

Gregory B. Hecht

Project: Development of *E. coli* strains for improved biofuel production

- ***Why is this project novel or innovative?***

  Development of bacterial strains with tolerance to biofuel product produced from lignocellulosic feedstocks.

- ***Impact***

  Improved industrial yield of environmentally friendly biofuels.

- ***Potential Partners***

  Industry: Biofuel industry

  Federal: DOE, NSF

Gregory B. Hecht

Project: Microbial sequestration of lead

- ***Why is this project novel or innovative?***

  Freshwater bacteria can sequester soluble toxic Pb^{2+} as an insoluble lead phosphate compound.

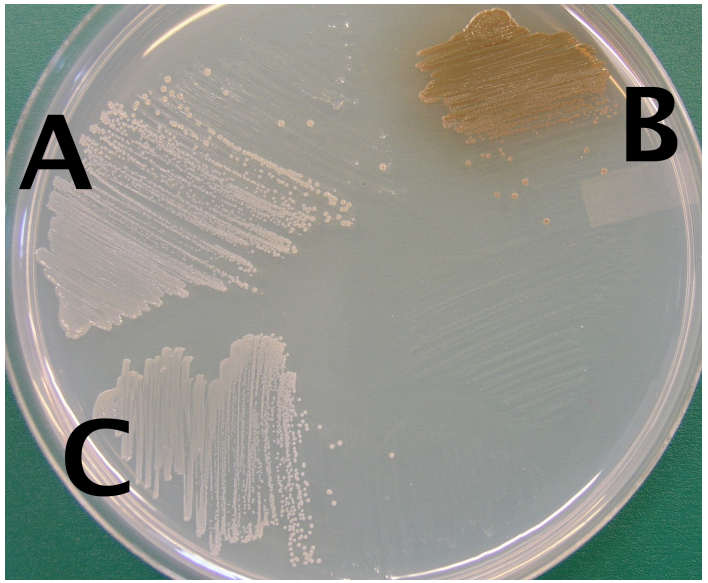
- ***Impact***

  Bioremediation applications in environments contaminated by heavy metals

- ***Potential Partners***

  Industry

  Federal: NSF, DOE, EPA



A & C: non-remediator bacteria
B: efficient remediator bacteria accumulating lead

Mark J. Hickman

Genomics; Bioinformatics; Molecular genetics

Research Interests

- Hypoxic response of cells
- Signal transduction
- Transcriptional regulation
- Cellular metabolism
- Microbial lead precipitation
- Microbial ethanol tolerance
- Identifying causative mutations

Research Expertise

- Next-gen DNA and RNA sequence analysis
- mRNA expression
- Yeast cell phenotypic assays
- Molecular biology and biochemistry techniques
- Bioinformatic computer programming
- Genetic and genomic screens

Mark J. Hickman

Project: Understanding the cellular response to hypoxia

- ***Why is this project novel or innovative?***

  Identifies novel hypoxia signaling pathways that may contribute to cancer or cardiovascular (CV) disease

- ***Impact***

  Better understanding of signaling pathways

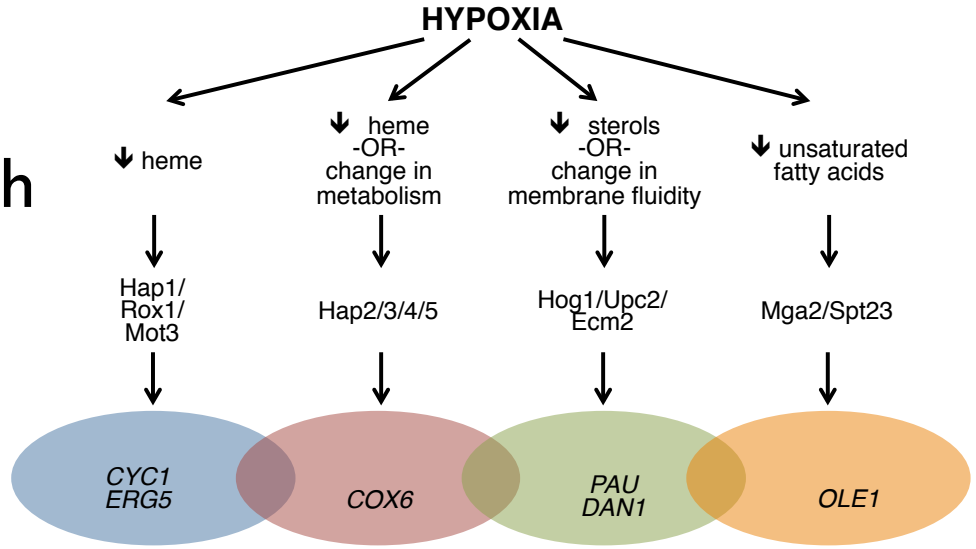
  New drug targets for cancer and CV disease

- ***Potential Partners***

  Industry: Pharma, Biotech

  Federal: NIH, NSF

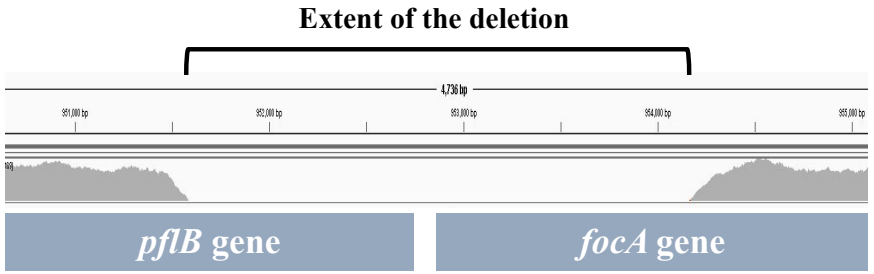
  Private foundations: cancer, CV disease



Mark J. Hickman

Project: Genomic analysis by next-generation sequencing

- ***Why is this project novel or innovative?***
  Comprehensively identifies mutations (SNPs, insertions, deletions, and amplifications) in DNA sequencing data
- ***Impact***
  Identify causative mutations that contribute to disease or drug resistance
  Software package for use by academics, pharma, and clinicians
- ***Potential Partners***
  Industry: Pharma, Biotech
  Federal: NIH, NSF
  Private foundations: genomic, bioinformatic



Luke T. Holbrook

Vertebrate Phylogenetics and Evolution; Paleontology; Morphology

Research Interests

- Phylogenetic relationships of mammals
- Convergent evolution in perissodactyls
- Enamel microstructure and tooth development
- Biogeography
- Combined analysis of morphological and molecular data
- Museums and collections

Research Expertise

- Phylogenetic analysis
- Vertebrate anatomy
- Functional morphology
- Vertebrate Paleontology
- Comparative phylogenetic methods

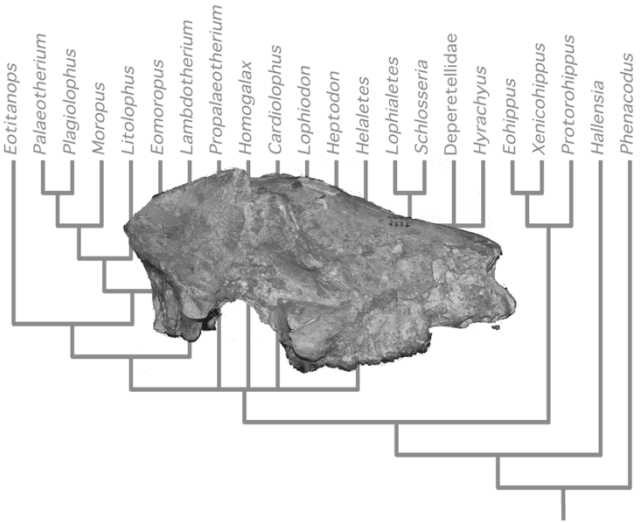
Luke T. Holbrook

Project: Timing and geography of mammal evolution

- ***Why is this project novel or innovative?***
  - Uses fossils and genetic data to understand the timing and geography of the radiation of placental mammals.
- ***Impact***
  - Provides a basis for testing hypothetical causes of mammalian evolution, e.g., the importance of dinosaur extinction.
- ***Potential Partners***

  Federal: NSF

  Private foundations: museums, National Geographic



Luke T. Holbrook

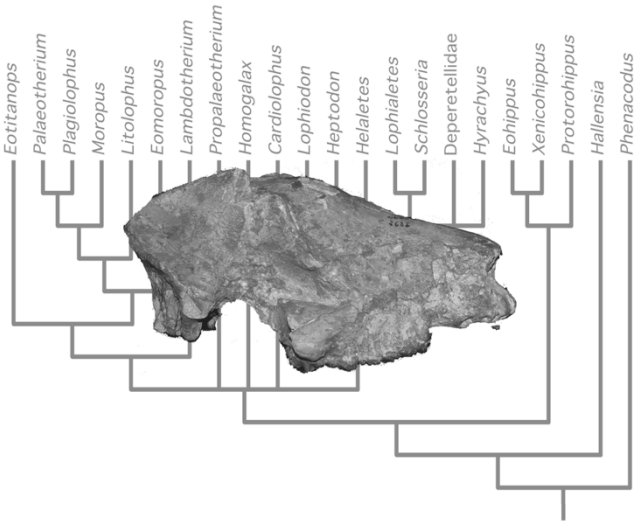
Project: Convergent evolution in perissodactyls

- ***Why is this project novel or innovative?***
  - Uses the fossil record and the phylogeny of perissodactyls (horses, rhinos, and tapirs) to examine correlation in convergent features.
- ***Impact***
  - Relates the repeated evolution of particular traits to climate change.

- ***Potential Partners***

  Federal: NSF

  Private foundations: museums, National Geographic



Gerald E. Hough

Neuroscience; Learning & Behavior; Aging; Communication

Research Interests

- Animal models for aging and spatial memory
- Effects of environmental disturbance on coastal wildlife
- Comparative neurobiology
- Acoustic signal analysis

Research Expertise

- Behavioral and neuroethological experimentation in awake, behaving animals
- DataWave, SciWorks, Programming
- Animal care and use regulations
- Histological analysis
- Bioacoustics signal recording and analysis

Gerald E. Hough

Project: Effects of aging on spatial memory

- **Why is this project novel or innovative?**
  - Homing pigeons selectively bred for spatial memory, similar neurological substrates to mammals
- **Impact**
  - Global cost due to age-related dementia exceeds $600B
  - Decreases in spatial memory seen in old birds
  - Tasks developed can be used for early detection of decreases in spatial memory in humans
- **Potential Partners**
  - Industry: Pharma, Animal organizations
  - Federal: USFWS, USGS, NSF, NIH

Gerald E. Hough

Project: Seaside sparrows as indicator of saltmarsh biodiversity

- **Why is this project novel or innovative?**
  - Prominent saltmarsh species can assess quality of wetland
  - Geographic variation in song gives clues to distribution
- **Impact**
  - 30% of NJ watershed is fully developed
  - Pesticides and introduced species decrease native species
  - Areas of concern can be easily identified and remediated
- **Potential Partners**
  - Industry: Environmental organizations, coastal townships
  - Federal: NSF, USFWS, USGS

Cristina Iftode

Genetics, Molecular genetics, Cell biology, Virology

Research Interests

- Stem cell differentiation
- Cancer cell sensitization
- Regenerative medicine
- Cancer therapies
- Regulation of gene expression
- Replication and transcription of DNA tumor viruses

Research Expertise

- Molecular and cell biology techniques
- Cell culture techniques
- Virology methods
- *In vitro* transcription and translation assays
- Protein purification

Cristina Iftode

Project: Differentiation of hydrogel-encapsulated stem cells for intervertebral disc regeneration

- ***Why is this project novel or innovative?***

  Investigates an improved bioadhesive hydrogel for the ability to support adipose stem cell differentiation to disc-like tissue

- ***Impact***

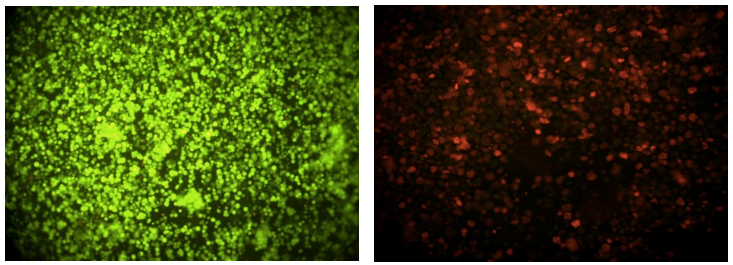
  Development of minimally invasive therapies for the treatment of degenerated discs

  Implanted materials are not dislocated

- ***Potential Partners***

  Industry: Pharma, Biomaterials

  Federal: DOD, NIH, NSF



Cristina Iftode

Project: Cancer cell sensitization to radiotherapy

- ***Why is this project novel or innovative?***

  Discriminates between cell necrosis and apoptosis during irradiation in the presence of gold nanoparticles

- ***Impact***

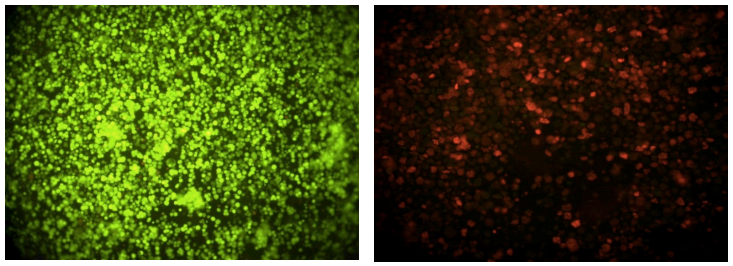
  Development of therapies that specifically target cancer cells

- ***Potential Partners***

  Industry: Pharma, Biotech

  Federal: NIH, NCI, NSF

  Private foundations: S. Komen, ACS



Alison Krufka

Cell Biology, Development, and Evolution

Research Interests

- Urea cycle gene expression and funcztion during fish embryogenesis
- Zebrafish as a model to study urea cycle disorders and hyperammonemia
- Evolution and development of the lateral line sensory system
- Active pedagogies in STEM education

Research Expertise

- In situ hybridization
- Microinjection of fish embryos
- Paraffin embedding and embryo sectioning
- Molecular and cell biology techniques
- Programmatic and learning outcomes assessment

Collaborators: Ljubica Caldovic, Children's National Medical Center
Matthew Travis, Biological Sciences, Rowan University
Sally Hoskins, City College of New York
Kristy Kenyon, Hobart and William Smith Colleges

Alison Krufka

Project: Investigating the urea cycle in zebrafish

- ***Why is this project novel or innovative?***

  Uses the strengths of the zebrafish model system to address cellular and developmental defects caused by high levels of ammonia

  - ***Impact***
    - Urea cycle disorders occur in approximately 1/8000 births casing brain damage, coma, and/or death
    - Adult hyperammonemia has many causes high protein diets, viruses and drugs effects on patients with undiagnosed mild urea cycle disorders and liver failure
    - Effective rodent and cell culture models are limited for the study of urea cycle disorders
  - ***Potential Partners***
    - Industry: Pharma
    - Federal: NIH, NSF (for evolutionary aspects only)
    - Private foundations: National Urea Cycle Disorders Foundation

Alison Krufka and Matthew Travis

Project: Evolution and development of the lateral line

- ***Why is this project novel or innovative?***

  Addresses evolutionary change at the embryonic level using a traditional evolutionary model

- ***Impact***
  - Multiple natural isolated populations of three-spined stickleback demonstrate phenotypic variation producing an excellent system to study evolution
  - Lateral line sensory system variation and the ability to study embryos from distinct populations allows us to understand evolutionary change on a developmental and, ultimately, genetic level

- ***Potential Partners***
  - Federal: NSF, USFW

Alison Krufka

Project: Effective STEM pedagogies

- ***Why is this project novel or innovative?***

  Uses "scientific teaching" principles to develop and study the effectiveness of pedagogies and curricula

- ***Impact***
  - Effective learning pedagogies improve student learning
  - Development of effective curricula and research and other mentoring programs improve student retention including minority students
  - Growing diversity of Rowan students demands testing of existing and new pedagogies and curricula

- ***Potential Partners***
  - Industry: Pharma, biotech, healthcare, and other companies interested in workforce development
  - Federal: NSF and NIH (current funding-NSF TUES and NSF TUES II)
  - Private foundations: Educational foundations; minority serving foundations

Claude F. Krummenacher

Virology, Herpes Infection, Cell Biology, Protein Structure

Research Interests

- Molecular mechanisms of herpes simplex virus (HSV) entry into host cells.
- Cellular and immunological responses to HSV infection and vaccine.
- Effects of human saliva on susceptibility to herpes.
- Antiviral drug development.

Research Expertise

- Virus production, purification and characterization
- Protein expression/purification in recombinant baculoviruses
- Protein interactions using Surface Plasmon Resonance
- Epitope mapping and neutralizing antibodies
- Fluorescence confocal microscopy
- Bioassays for antiviral agents

Claude F. Krummenacher

Project 1: Mechanism of HSV entry and epithelial cell response

- ***Why is this project novel or innovative?***

  Lack of drugs able to prevent herpes simplex virus (HSV) infections.

  Structure-based approach for development of antivirals.

- ***Impact***

  Development of inhibitors to block herpes infections.

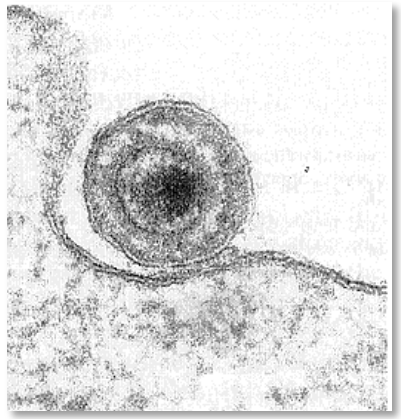
  Identification of novel targets for therapeutic interventions against herpes.

- ***Potential Partners***

  Industry: Pharma, Biotechs

  Federal: NIH

  (project prev. funded by NIAID 2007-2010)



Claude F. Krummenacher

Project 2: Immuno-modulatory activities of HSV.

- ***Why is this project novel or innovative?***

  Characterizes the immuno-regulatory activity of HSV gD, the main component of HSV vaccines in current trials.

  Investigates novel viral immune evasion strategies.

- ***Impact***

  Identification of therapeutic targets against herpes.

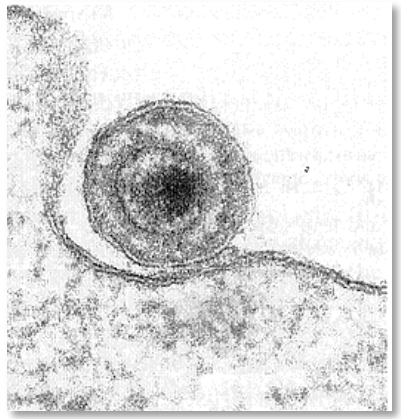
  Improving herpes vaccine development.

- ***Potential Partners***

  Industry: Pharma, Biotechs

  Federal: NIH

  (project prev. funded by NIAID, 2012-14)



Claude F. Krummenacher

Project 3: Effects of saliva on susceptibility to herpes infection.

- ***Why is this project novel or innovative?***

  First study of saliva components enhancing viral infections.

  First functional study of oral cell response to saliva stimulation during infection.

- ***Impact***

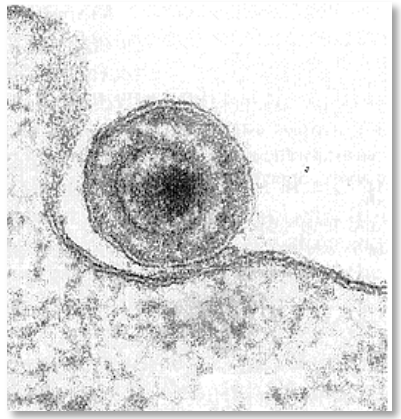
  Identification of biomarkers for susceptibility to herpes.

- ***Potential Partners***

  Industry: Pharma, Biotechs

  Federal: NIH

  (project currently funded by NIDCR, 2012-15)



Claude F. Krummenacher

Participation in current and recent collaborative projects

- ***Characterization of human antibody response to HSV infection and HSV vaccines.***

  Gary H. Cohen, PhD (PENN School of Dental Medicine)
  Roselyn J. Eisenberg, PhD (PENN School of Veterinary Medicine)

- ***Structure determination of viral glycoproteins and receptors.***

  Andrea Carfi, PhD (NOVARTIS Vaccines and Diagnostics)

- ***Effect of oligodendrocyte differentiation on HSV infection.***

  José-Antonio Lopez-Guerrero, PhD (Univ. Autonoma de Madrid)

- ***Spread of HSV in skin.***

  Dagmar Knebel-Moersdorf, PhD (Univ. of Cologne)

Courtney Richmond

Environmental science, marine and estuarine ecology, mathematical biology

Research Interests

- Linking individual, population, and community-level responses to environmental stress
- Variability in individual responses to environmental conditions, and the ecological and evolutionary repercussions
- Conservation and targeted biological control of pest organisms

Research Expertise

- Collection, identification, enumeration and rearing of a wide range of marine and estuarine invertebrates
- Mathematical modeling, including computer programming and working with mathematical software packages
- Life table response experiments, collecting data for mathematical models

Courtney Richmond

Project: Wheat stem sawfly population model

- ***Why is this project novel or innovative?***

  The wheat stem sawfly is a major pest of US wheat crops, causing significant loss of revenue. There is no model that can predict the efficacy of different control approaches

- ***Impact***

  Significant environmental and economic impacts by identifying effective and targeted pest management

- ***Potential Partners***

  Federal: USDA-NIFA (National Institute of Food and Agriculture)

Courtney Richmond

Project: Gelatinous zooplankton impacts in Barnegat Bay

- ***Why is this project novel or innovative?***

  The sea nettle (a jellyfish) has been introduced into Barnegat Bay. The impact of it and its major competitor (and also one of its prey), the comb jelly (a ctenophore), has only begun to be studied

- ***Impact***

  These organisms have huge economic and ecological impacts due to their feeding on larval fish as well as rapidly consuming the prey of fish and other economically important organisms

- ***Potential Partners***

  Federal/State: NJ Sea Grant Consortium

  State: Department of Environmental Protection, Monmouth University, Montclair State University

Nathan Ruhl

Ecology, Evolution, Behavior

Research Interests

- Limnology of reservoirs
- Reservoirs as a model for understanding disturbance in natural lakes and estuaries
- Context-dependent ecology and behavior
- Sex-differences in social behavior of small fish

Research Expertise

- *In-situ* fluorometric optical sensing
- Small boat operation & maintenance
- Sampling techniques in aquatic ecosystems
- Ethological experimental design for small fish
- Statistics: R, SPSS, JMP

Nathan Ruhl

Project: Disturbance-mediated cyanobacterial upwelling

- ***Why is this project novel or innovative?***
  - Reveals an important mechanism by which cyanobacteria can be trapped at the surface of a water-body
- ***Impact***
  - Inform management best-practices to control upwelling, bloom events, and the production and release of cyano-toxins into drinking water
- ***Potential Partners***

  Industry: Water-supply utilities
  Federal: NSF, NOAA, USFWS, USGS
  State: Inland water and fisheries departments

Nathan Ruhl

Project: Zebrafish (Danio rerio) behavior

- ***Why is this project novel or innovative?***
  - Zebrafish are a major biomedical model organism and ethological studies of this species are in their infancy
- ***Impact***
  - Provide important insights on species and individual-level behavioral patterns in order to better inform developmental neurological biologists.
  - Reveal insights into the ecology and evolution of behavior as well as provides baselines for high-throughput mutation screens
- ***Potential Partners***

  Industry: Biotech

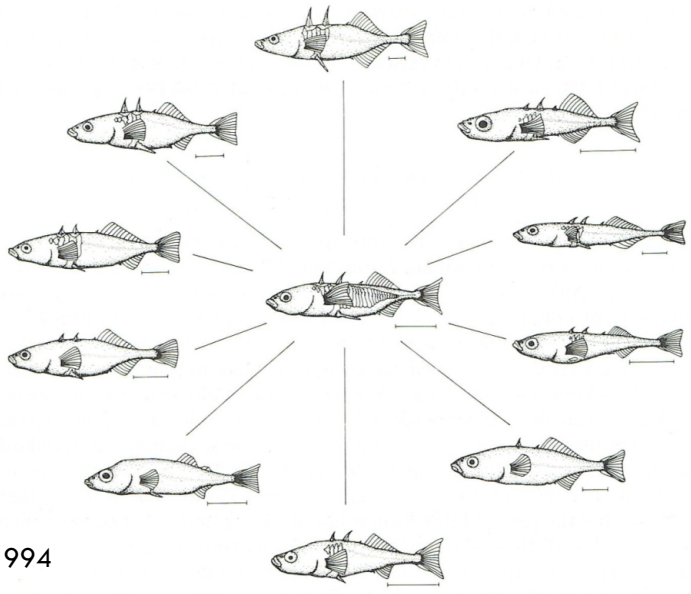
  Federal: NSF, NIH

Matthew Travis

Evolutionary Ecology

- Stickleback exhibit extensive natural variation, evolve rapidly, live in diverse ecological habitats
- This makes them an excellent model for studying the process of adaptation

- I am currently studying the evolution and development of the lateral line, which is used in feeding, schooling, and predator avoidance behavior



Bell and Foster 1994

Lana Vojvodic

Microbial interactions in social insects

Research interests

- Host-pathogen coevolution
- Gut microbiome in social insects
- Epidemiology within social insect networks
- Host disease detection
- Innate immunity
- Social immunity

Research Experience

- Microbiology
- Mycology
- Gut microbiome
- RNA sequencing and RT-PCR
- Fungal-bacterial bioassays
- Behavioral ecology of social insects
- Bioassays with honey bees

Lana Vojvodic

Project: Disease spread and immune priming in social insets

- ***Why is this project novel or innovative?***

  Uses novel approach to study epidemiology

- ***Impact***

  Better understanding of mode of diseases spread and control within societies

- ***Potential Partners***

  Federal: NIH, NSF

  Private foundations: Social networks and diseases

Individually colored ants in the nest, that have been exposed to the fungal pathogen

Lana Vojvodic

Project: Bacterial – fungal warfare in social insects

- ***Why is this project novel or innovative?***

  Investigates novel interactions between beneficial gut microbes and pathogenic fungi

- ***Impact***

  Expands our understanding of the function of gut microbes and the role they have on pathogens, host immunity, and nutrition

- ***Potential Partners***

  Federal: NIH, NSF, USDA

  Private foundations:

  Probiotic gut bacteria