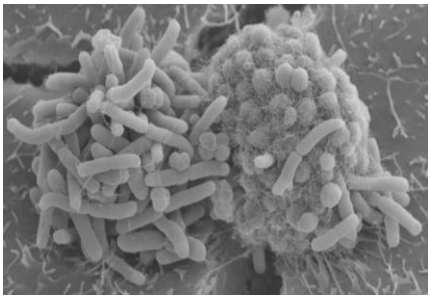
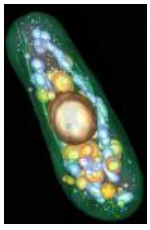
Biology Research at Brooklyn College!

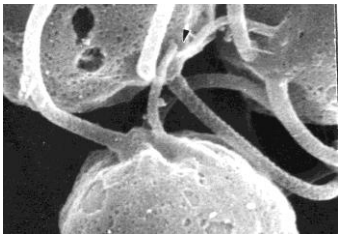
Jennifer Basil: We pursue three interrelated lines of research in my laboratory. First, we investigate learning and memory capabilities in nautilids, a monophyletic group in the cephalopod molluscs that retains many pleisiomorphic features. Comparative study of the complex behavior across all cephalopods may help us to understand the evolution of neural and behavioral complexity in the entire class. We have found evidence of convergence between cephalopod brains and vertebrate brains, despite vast differences in the components comprising the brain (neurons, axons). We pursue studies of Pavlovian conditioning, spatial navigation, tactile learning, chemical learning, and chemical signaling in intraspecific behavior, while also attempting to identify the compounds involved. Second, we investigate the neural underpinnings of these complex behaviors: where does this learning take place, identifying analogous and/or homologous learning centers in cephalopods, labeling of neuronal activity during conditioning, whole-brain recordings, and neuroanatomy and neurochemistry. Third, we use crayfishes as a model for the haptic sense, or guided tactile behavior. Here we pair classical conditioning and open-field methods to measure haptic contributions to learning and memory of the environment in a relatively "simple" neuroanatomical model. These algorithms are then implemented in "Craybot" a tactile robot in development with Tony Prescott's laboratory at the University of Sheffield.



Nicolas Biais: During the last decade, scientists have begun to realize the importance of physical forces on the biological world. We use a broad and interdisciplinary toolkit (optical tweezers, magnetic tweezers, fluorescence and electronic microscopy, molecular biology, genetics, microfabricated substrates...) to dissect and understand the role of physical forces in the biology of piliated bacteria, in particular the human pathogen *Neisseria gonorrhoeae* and the related human commensal *Neisseria elongata*, with both basic and applied goals in mind.



Dan Eshel: Our main interest is to understand how molecular components and signaling pathways affect microtubules and microtubule-dependent processes. We currently test the relations between microtubule structure and MAP kinase pathways that are responsible for maintaining normal function under stress conditions.

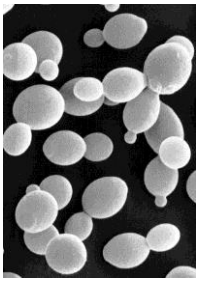


Charlene Forest: Fertilization in *Chlamydomonas reinhardtii,* a novel model system for determining the proteins required for gamete fusion, may help define the basic requirements for sperm-egg fusion in more complex systems. We use genetics, molecular biology, biochemistry and light, electron, fluorescence and confocal microscopy to identify the genes required for fertilization with the goal of understanding the mechanism of fusion used by gametes from algae to humans.

Paul Forlano: Using fish as model systems, we employ a combination of evolutionary/ systems neuroscience with a molecular and cellular approach in order to identify the mechanisms underlying steroid-induced neural plasticity and sex differences in brain and behavior. These studies focus on vocal, auditory and neuroendocrine circuits that are conserved across vertebrates.

Qi He: A main focus of our lab is to elucidate mechanisms regulating axon guidance in the nervous system. We use *Drosophila melanogaster* as a model and apply molecular, cellular and developmental approaches to characterize genes critical for relaying guidance signals.

Amy Ikui: Our lab is interested in cell cycle, an ordered set of processes by which one cell grows and divides into two daughter cells. This process has to be tightly regulated to avoid chromosome instability that could lead to tumorgenesis and cancer in higher eukaryotes. Cell cycle progression is controlled by the protein complex Cyclin/Cyclin Dependent Kinase (CDK). We currently study a DNA replication factor, Cdc6. Our goal is to understand how Cdc6 is regulated during cell cycle by CDK and other kinases to limit DNA replication only once per cell cycle. We use *S. cerevisiae* (baker's yeast) that is an ideal model organism for cancer research; cell cycle control is well conserved from yeast to humans, and it is easy to manipulate genes in yeast.



Peter Lipke: Our lab is interested in how fungi interact with their hosts and environment. Therefore, we study the assembly of their cell wall and the structure of the fungal cell wall proteins that bind the fungi to us (the host organisms) and to each other to form colonies and biofilms. We use molecular biology, bioinformatics, and biochemistry as our primary tools.

Catherine McEntee: Our lab is engaged in understanding the biological impact of ionic liquids (ILs) in the environment. ILs are non-volatile salts that are liquid at room temperature and possess physical properties that make them attractive candidates as green solvents. Using bacteria, fungi, algae and alfalfa we are dissecting the chemical and physical properties of ILs that can make ILs toxic. We have developed a sensitive toxicity assay which has enabled us to identify ILs that were considered benign as toxic. This work is done in collaboration with researchers at Queensborough Community College and Brookhaven National Labs.

Theodore Muth: *A. tumefaciens* causes crown gall disease, a disease affecting several varieties of fruit trees and grapes. *A. tumefaciens* transfers virulence genes and proteins into susceptible host cells. The transferred virulence genes and proteins cause infected cells to form undifferentiated tumors. Recently this unique ability of *A. tumefaciens* to transform plants has been used by researchers to generate important transgenic crops.

James Nishiura: We study genetic and biochemical investigations into mechanisms controlling mosquito larval midgut growth and metamorphosis. I am studying the programmed death of alimentary canal cells of the mosquito, *Culex pipiens*, as it relates to the process of metamorphosis and the mechanism of action of the biological pesticide produced by the bacterium *Bacillus thuringiensis* subsp *israelensis.*

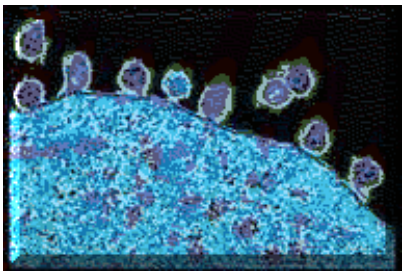
Juergen Polle: My research interests are in the fundamental and applied areas of cellular stress biology. We work with microalgae, which is a term used to describe a very diverse group of tens of thousands of organisms which display a wide spectrum of cellular and metabolic diversity. Our current fundamental research investigates the regulation of isoprenoid and lipid metabolism in unicellular green algae using a systems biology approach including for example genomic, transcriptomic, and metabolomic analysis. One exemplary model alga we investigate is the halo-tolerant species *Dunaliella salina*, known for its stress-induced over-accumulation of beta-carotene. The Polle laboratory was instrumental in the genome and transcriptome sequencing of this alga. Genome annotation of this model alga is ongoing in the Polle lab. In addition, we recently discovered several different green algal strains that are currently under investigation. For some of these algae we now have draft genomes for annotation and to investigate specific pathways involved in isoprenoid and lipid metabolism. This fundamental research is linked with applied research in the area of renewable energy in the context of an algae-to-biofuels program.

Luis Quadri, Zicklin Professor of Biology: Our lab applies multidisciplinary approaches to: (1) investigate the biosynthesis of mycobacterial siderophores (iron-chelating compounds); (2) elucidate the biosynthesis of mycobacterial outer-membrane components called DIMs; and (3) develop compounds with utility as leads for drug development or chemical biology tools. There are over 100 Mycobacterium spp. Some of them cause serious diseases, whereas others play roles in natural attenuation of contaminated sites and represent potential agents for bioremediation. Siderophores are key elements of iron-uptake systems utilized by pathogenic and free living mycobacteria. DIMs are lipidic virulence factors of several clinically relevant mycobacteria. DIMs play roles in pathogenicity by virtue of their immunomodulatory properties or their ability to cause nerve degeneration. Drugs that inhibit synthesis of siderophores or DIMs may have applications in the treatment of mycobacterial diseases.

Anjana Saxena: We study nucleolar stress factors (NSFs) and their role/s in regulating cell cycle under normal conditions and during cellular responses to DNA damage. Nucleolin is an abundant nucleolar phosphoprotein that is overexpressed in variety of cancers. We study how nucleolin regulates mRNA stability/translation via direct binding to target-mRNAs or indirectly through protein-protein interactions in the p53 signaling, DNA damage response and ribosomal biogenesis pathways. Our long-term goal is to define the role/s of nucleolin in regulating gene expression that drives cellular decisions of growth (hence, survival and proliferation) or cell cycle arrest (that can lead to repair or cell death) with the potential to identify molecules of therapeutic values.

Shaneen Singh: Bioinformatics. We use computational approaches to gain insight into cellular signal transduction pathways, and the normal and aberrant functioning of protein domains with a focus on lipid binding domains. The long-term research goal of the lab is to apply computer modeling to gain insight into cellular signal transduction pathways, specifically to provide deeper insight into both the normal and aberrant subcellular targeting of domains contained in proteins which are part of macromolecular complexes and function in various biological processes.

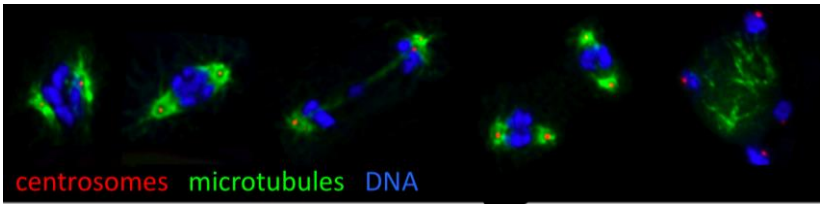
Barbara Studamire: We investigate interactions between retroviral and host proteins using the tools of genetics, molecular biology and biochemistry. The viral integrase protein is required for permanent insertion of the viral genome into the host chromosome, and thus, is required for a productive viral infection. Delineation of the mechanism by which, and analysis of how the viral integrase protein interacts with the host cell has important implications in the development of cancer; the development of gene therapy vectors; and for the progression of retroviral infections, such as HIV-1, the causative agent of AIDS.



Tony Wilson: Our research focuses primarily on the study of the evolution of reproductive complexity in aquatic environments. We study a number of different freshwater and marine model systems using a combination of field, laboratory and experimental approaches to investigate how selective pressures contribute to the evolution of reproductive variation across space and time.

New Faculty member

Mara Schvarzstein: We investigate how the behavior and structure of chromosomes, centrosomes and the microtubule-based spindle cooperate to ensure accurate chromosome segregation during the specialized cell division program that gives rise to the sperm and egg. This cell division program, which is called meiosis, generates complementary gametes in order to ensure that at fertilization the zygote inherits the right chromosomes and other cellular components required for normal embryonic development. We utilize the transparent nematode *C. elegans* as a model system, and we combine molecular, genetic, biochemical and cell biological approaches. Our research is relevant not only to reproduction and the etiology of birth defects, but it is also relevant to genome maintenance in mitotic normal and pathological cell divisions.



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Check faculty emails and office hours on the bulletin board outside the Biology Office (200 NE)