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**Genes, the environment, and experience interact to shape an animal's behavior. *Caenorhabditis elegans*, a roundworm with just 302 neurons, shows considerable sophistication in its behaviors, and its defined neuronal wiring and genetic accessibility make it an ideal subject in which to study these interactions. Using *C. elegans* as a model, Bargmann's laboratory characterizes genes and neural pathways that allow the nervous system to generate flexible behaviors.**

How do genes and the environment interact to generate a variety of behaviors? How are behavioral decisions modified by context and experience? The Bargmann lab is studying the relationships between genes, experience, and behavior in the nematode *C. elegans*, whose nervous system consists of only 302 neurons with reproducible functions, morphologies, and synaptic connections. Despite this simplicity, many of the genes and signaling mechanisms used in the nematode nervous system are similar to those of mammals. The ability to manipulate the activity of individual genes and neurons in *C. elegans* makes it possible to determine how neural circuits function and change over time.

*C. elegans* has a rich olfactory sense; it detects hundreds of different odors and pheromones, discriminates among them, and generates a variety of responses to the odor cues. Each sensory neuron has dynamic responses that reflect both the identity and the history of the odor, enabling it to perform a set of computations that are stereotyped in a single neuron, but differ among neurons. The sensory neurons synapse onto integrating neurons, which also use stereotyped cell type-specific computations to combine sensory inputs. Finally, groups of integrating neurons coordinate their activity to generate reliable systems-level dynamics coupled to behavior. The lab characterizes the effects of specific molecules, neurons, and circuits across these levels of integration, asking what functional properties arise at each level of analysis.

In addition to the fast processing of sensory information by fast neurotransmitters, behavior is reversibly modified over longer timescales by neuromodulators such as serotonin, dopamine, and neuropeptides. Neuromodulators are highly conserved in evolution, and implicated in human as well as animal motivational and emotional states. The lab has identified roles for neuromodulators in spontaneous behaviors, learned behaviors, and age-specific behaviors of *C. elegans*, and determined the mechanisms by which they act. Their results indicate that wireless, distributed neuromodulatory signals rapidly rewire the functional properties of the fixed *C. elegans* nervous system, dynamically changing the flow of information across synapses and circuits. Neuromodulatory systems also provide a substrate for genetic variation in behavior within and between species. Current experiments explore how neuromodulatory signals are coupled to context and behavioral states, and how they affect the flow of information between neurons at different timescales.

## EDUCATION

B.S. in biochemistry, 1981  
The University of Georgia

Ph.D. in cancer biology, 1987  
Massachusetts Institute of Technology and the Whitehead Institute

## POSTDOC

Massachusetts Institute of Technology, 1987–1991

## POSITIONS

Assistant Professor, 1991–1996  
Associate Professor, 1996–1998  
Professor, 1998–2004  
University of California, San Francisco  
Professor, 2004–  
Co-director, Shelby White and Leon Levy Center for Mind,  
Brain and Behavior, 2005–2016  
Vice President for Academic Affairs, 2023–  
The Rockefeller University  
Investigator, 1995–2016  
Howard Hughes Medical Institute  
Head of Science, 2016–2022  
Chan Zuckerberg Initiative

## AWARDS

Kemali International Prize for Basic and Clinical Neuroscience, 2004  
Richard Lounsbery Award in Biology and Medicine, 2009  
Perl-UNC Neuroscience Prize, 2010  
Dart/NYU Biotechnology Achievement Award, 2012  
Kavli Prize in Neuroscience, 2012  
Breakthrough Prize in Life Sciences, 2013  
Benjamin Franklin Medal in Life Sciences, 2015  
Edward M. Scolnick Prize in Neuroscience, 2016  
Salk Institute Medal for Research Excellence, 2021

## HONORARY SOCIETIES

National Academy of Sciences  
National Academy of Medicine  
American Academy of Arts and Sciences  
American Philosophical Society  
Fellow, American Association for the Advancement of Science  
Associate Member, European Molecular Biology Organization

## SELECTED PUBLICATIONS

Sordillo, A., and Bargmann, C.I. Behavioral control by depolarized and hyperpolarized states of an integrating neuron. *Elife* 10, e67723 (2021).  
López-Cruz, A. et al. Parallel multimodal circuits control an innate foraging behavior. *Neuron* 102, 407–419 (2019).  
Liu, Q. et al. *C. elegans* AWA olfactory neurons fire calcium-mediated all-or-none action potentials. *Cell* 175, 57–70 (2018).  
Stern, S. et al. Neuromodulatory control of long-term behavioral patterns and individuality across development. *Cell* 171, 1649–1662 (2017).  
Greene, J.S. et al. Balancing selection shapes density-dependent foraging behaviour. *Nature* 539, 254–258 (2016).