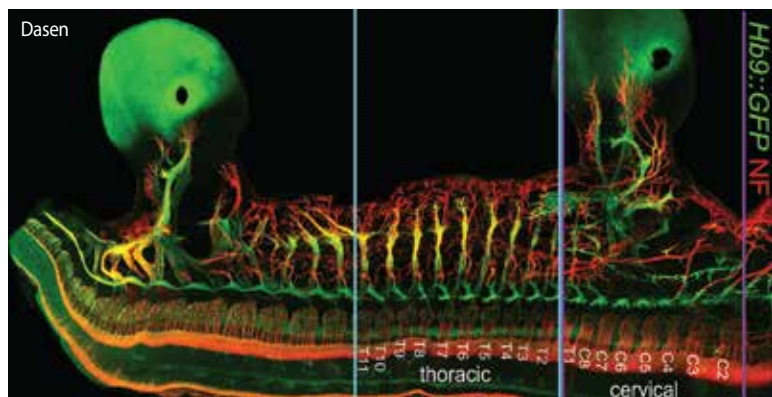
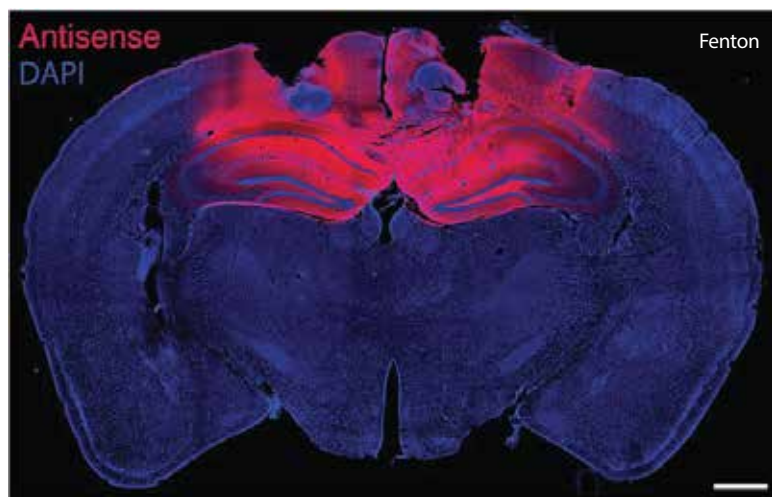




**NYU**   
**NEUROSCIENCE**

2018-19

[neuroscience.nyu.edu](http://neuroscience.nyu.edu)



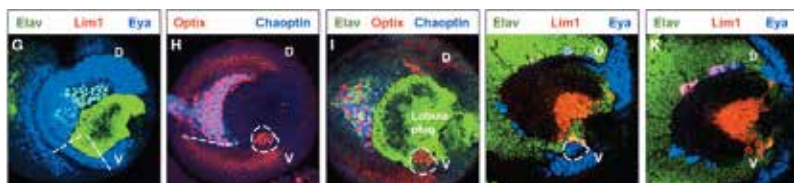
## NYU Neuroscience Doctoral Education

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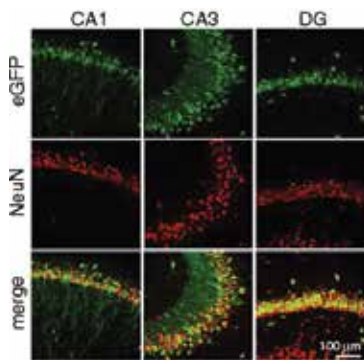
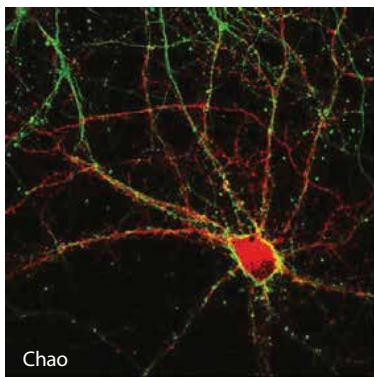
At NYU, neuroscience graduate education provides integrated training that encompasses molecular, cellular, developmental, systems, cognitive, behavioral, and computational approaches to address the most important questions in the field. Doctoral training in neuroscience at NYU builds on the diversity and strength of research throughout many interrelated departments and multiple campuses, especially among those within the Center for Neural Science, the Neuroscience Institute, and NYU Shanghai.

Students receive a comprehensive, interdisciplinary neuroscience education, and they have the opportunity to sample different research experiences before they commit to a topic area and laboratory. Training strongly emphasizes research at the highest level and faculty are dedicated to mentoring and career development throughout graduate school. Students also benefit directly from an interactive, collegial community and become active participants in shaping the rich, intellectual environment that complements their formal training.

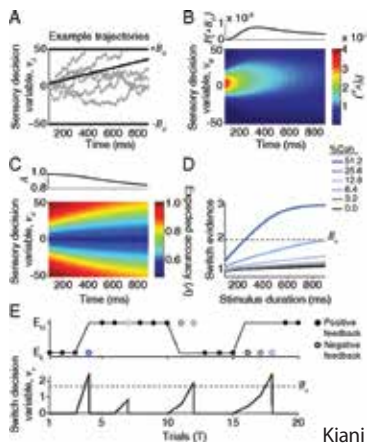
This brochure will introduce you to NYU's wide array of cutting-edge neuroscience research, our faculty and graduate students, and their most recent and exciting discoveries.



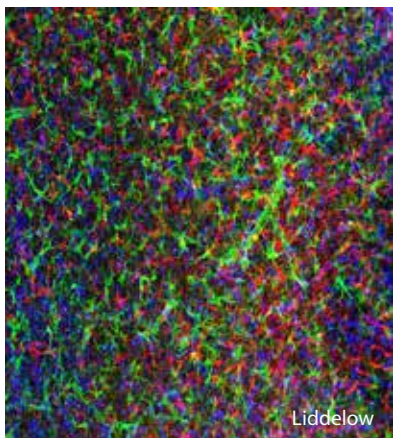
Desplan



Alberini



Kiani



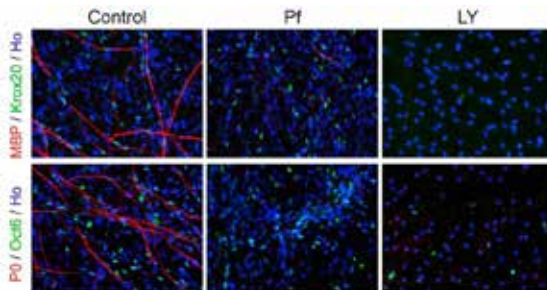
## Key Components and Timeline of Study

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# Cell and Molecular Biology of Neurons and Glia

Researchers at NYU use cutting edge techniques, including two-photon microscopy, *in vivo* labeling of individual molecules and neurons, and RNA sequencing analysis, to investigate the electrical, biochemical, and genetic properties that underlie the function of the healthy and diseased brain at the cellular and molecular levels.



Akt inhibition blocks myelin formation *in vitro* without affecting Krox20 levels (Salzer lab)

## Faculty

Cristina Alberini

Chiye Aoki

Justin Blau

Richard Bonneau

Steven Burden

Thomas Carew

Kenneth Carr

Adam Carter

Aravinda Chakravarti

Moses Chao

Mitchell Chesler

Jeremy Dasen

Claude Desplan

Andre Fenton

Wen-Biao Gan

Jorge Ghiso

Stephen Ginsberg

Eric Klann

Joseph LeDoux

Efrat Levy

Shane Liddelow

Dayu Lin

Arjun Masurkar

Paul Mathews

Ralph Nixon

Simon Peron

Dimitris Placantonakis

Margaret Rice

Niels Ringstad

James Salzer

Dan Sanes

Neville Sanjana

Helen Scharfman

Einar Sigurdsson

Nicholas Stavropoulos

Greg Suh

Daniel Tranchina

Dirk Trauner

Nicolas Tritsch

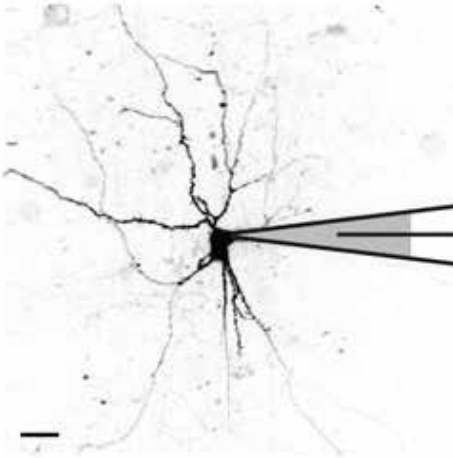
Richard Tsien

Jing Wang

Thomas Wisniewski

# Cell and Molecular Biology of Neurons and Glia

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Two-photon image of somatostatin interneuron during whole-cell recording (Carter lab)



Motor axon projections in control (top) and PbxMND (bottom) mice (Dasen lab)

## Select Recent Publications

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Trauner lab (2018). Optical control of L-type  $\text{Ca}^{2+}$  channels using a diltiazem photoswitch. *Nature Chemical Biology*.

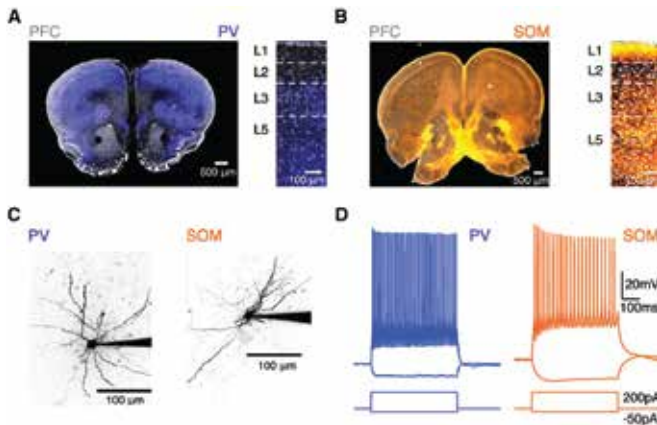
Salzer lab (2018). Localized myosin II activity regulates assembly and plasticity of the axon initial segment. *Neuron*.

Desplan lab (2018). Phenotypic convergence: distinct transcription factors regulate common terminal features. *Cell*.

Burden lab (2018). Preserving neuromuscular synapses in ALS by stimulating MuSK with a therapeutic agonist antibody. *eLife*.

# Physiology of Cells and Synapses

Behavior arises as a result of cellular and synaptic activity. NYU neuroscientists are at the forefront of this research aiming to elucidate the underlying neural circuitry, using a wide array of technologies.



PV and SOM interneurons in the infralimbic PFC. (A) Labeling of PV interneurons in the PFC of a PV-Cre mouse. (B) Similar to (A) for SOM interneurons in the PFC of a SOM-Cre mouse. (C) Two-photon images of PV and SOM interneurons. (D) Response to 200 pA and -50 pA current injections (Carter lab)

## Faculty

Chiye Aoki  
Jayeta Basu  
Steven Burden  
Gyorgy Buzsaki  
Thomas Carew  
Adam Carter  
Moses Chao  
Mitchell Chesler  
Dmitri Chklovskii  
Christine Constantinople

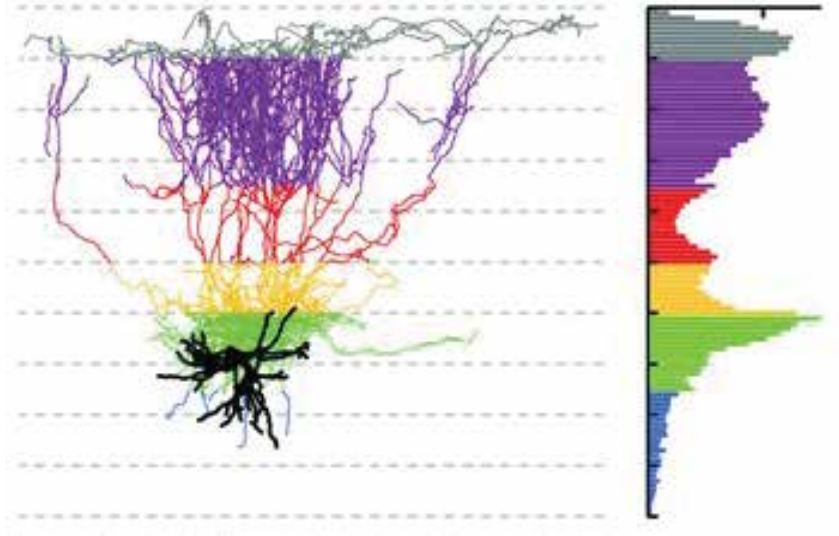
Robert Froemke  
Wen-Biao Gan  
Eric Lang  
Shane Liddelow  
Michael Long  
Katherine Nagel  
Simon Peron  
Alex Reyes  
Margaret Rice  
Dmitry Rinberg

Niels Ringstad  
John Rinzel  
Bernardo Rudy  
Dan Sanes  
James Salzer  
Helen Scharfman  
David Schoppik  
Shy Shoham  
Nicolas Tritsch  
Richard Tsien



# Physiology of Cells and Synapses

---



Digital reconstruction of an in vivo recorded and labeled L5/6 fanning-out Martinotti interneuron. Histogram shows average axonal length color coded by layer of reconstructed cells (Rudy lab)

## Select Recent Publications

---

Sanes lab (2018). Developmental deprivation-induced perceptual and cortical processing deficits in awake-behaving animals. *eLife*.

Buzsaki lab (2018). Transformation of a spatial map across the hippocampal-lateral septal circuit. *Neuron*.

Carter lab (2018). Reciprocal circuits linking the prefrontal cortex with dorsal and ventral thalamic nuclei. *Neuron*.

Tsien lab (2018). Calmodulin shuttling mediates cytonuclear signaling to trigger experience-dependent transcription and memory. *Nature Communications*.

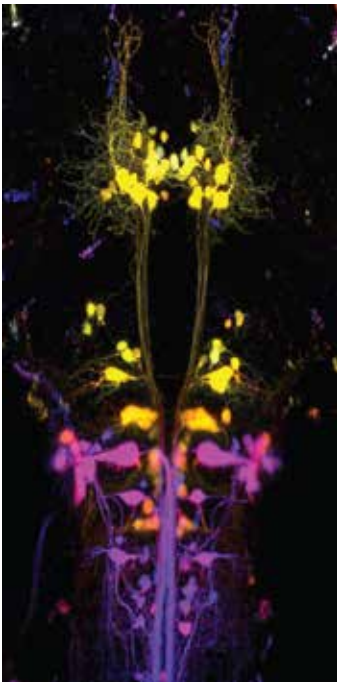
# Sensation, Perception, and Movement

---

Neuroscientists across NYU are working to understand the processes of sensing, interpreting, and acting on stimuli in the environment. Using cutting-edge techniques and novel tools, our scientists ask how we decode odors, learn to balance, perceive texture and faces, and learn vocalizations.

## Faculty

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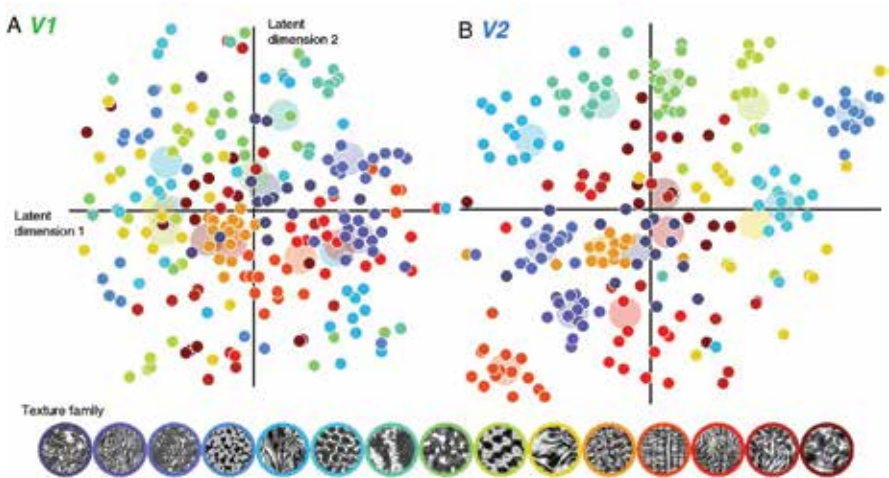


Neurons that project to the spinal cord, color-coded by depth (Schoppik lab)

Dora Angelaki	Arjun Masurkar
Jayeeta Basu	Anthony Movshon
Gyorgy Buzsaki	Katherine Nagel
Thomas Carew	Denis Pelli
Marisa Carrasco	Simon Peron
F. Xavier Castellanos	Bijan Pesaran
Christine Constantinople	David Poeppel
Jeremy Dasen	Alex Reyes
Claude Desplan	Margaret Rice
Zoe (Xiaowei) Dong	Dmitry Rinberg
Jon Freeman	Bernardo Rudy
Robert Froemke	Dan Sanes
Esther Gardner	David Schoppik
Davi Geiger	David Schneider
Marc Gershow	Robert Shapley
Michael Hawken	Shy Shoham
Biyu He	Eero Simoncelli
David Heeger	Greg Suh
Roozbeh Kiani	Regina Sullivan
Lynne Kiorpes	Xing Tian
Michael Landy	Daniel Tranchina
Li Li	Jing Wang
Michael Long	Donald Wilson
Wei Ji Ma	Jonathan Winawer
Larry Maloney	Yongdi Zhou

# Sensation, Perception, and Movement

---



Visualizations of neural population responses in V1 and V2 to visual texture stimuli (Movshon and Simoncelli labs).

## Select Recent Publications

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Nagel lab (2018). Elementary sensory-motor transformations underlying olfactory navigation in walking fruit-flies. eLife.

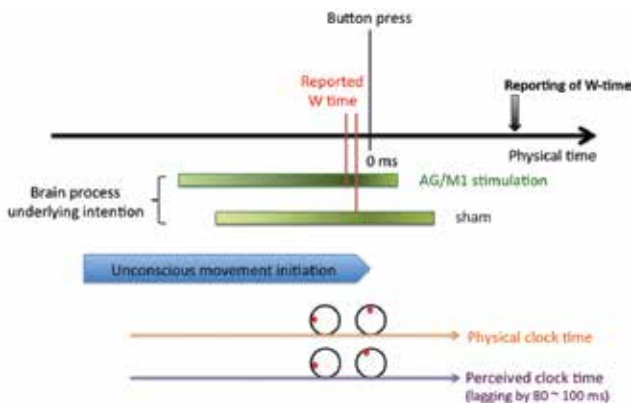
Rinberg lab (2018). Single olfactory receptors set odor detection thresholds. Nature Communications.

Simoncelli and Movshon labs (2018). Contextual modulation of sensitivity to naturalistic image structure in macaque V2. Journal of Neuroscience.

Kiani lab (2018). Psychophysical reverse correlation reflects both sensory and decision-making processes. Nature Communications.

## Executive Function and Cognition

The brain gives rise to our thoughts, decisions, and sense of self. At levels of analysis ranging from molecules to humans, researchers at NYU reveal the neural substrates that underlie higher order mental processes such as consciousness, judgement and decision making, attention, working memory, inhibitory control, and cognitive flexibility.



Using tDCS to create a computational model of the neural underpinnings of conscious movement intention (He lab)

## Faculty

Cristina Alberini

Dora Angelaki

Jayeeta Basu

Gyorgy Buzsaki

Xinying Cai

Marisa Carrasco

F. Xavier Castellanos

Christine Constantinople

Clayton Curtis

Zoe (Xiaowei) Dong

Jeffrey Erlich

Andre Fenton

Jon Freeman

Paul Glimcher

Todd Gureckis

Catherine Hartley

Biyu He

Wei Ji Ma

Roosbeh Kiani

Michael Landy

Li Li

Sukbin Lim

Larry Maloney

Denis Pelli

Bijan Pesaran

David Poeppel

David Schneider

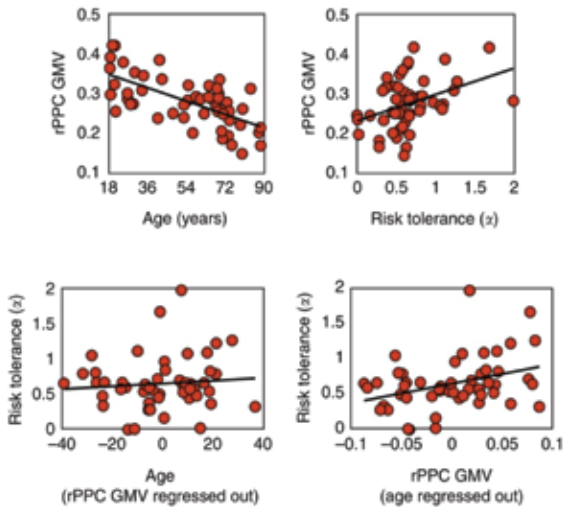
Xing Tian

Xiao-Jing Wang

Jonathan Winawer

# Executive Function and Cognition

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Decreased grey matter volume (GMV) in the right posterior parietal cortex (rPPC) is associated with increased age and decreased risk tolerance (top). When controlling for age, only decreased GMV in the rPPC modulates risk preference (bottom; Glimcher lab)

## Select Recent Publications

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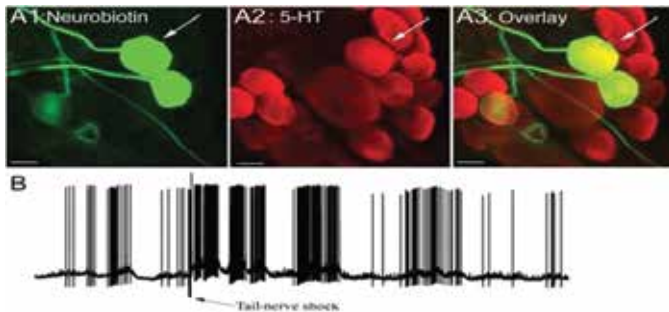
Ma lab (2018). A resource-rational theory of set size effects in human visual working memory. *eLife*.

Glimcher lab (2018). The computational form of craving is a selective multiplication of economic value. *PNAS*.

He lab (2018). Neural integration of stimulus history underlies prediction for naturalistically evolving sequences. *Journal of Neuroscience*.

# Learning, Memory, and Development

Neuroplasticity can account for much of learning, memory and development. Neuroscientists at NYU are studying how we learn and remember information over time using a myriad of approaches, including electrophysiology, imaging, and genetic sequencing and manipulations.



Intracellular recording from serotonergic (5HT) neurons that respond to sensitizing stimuli that induce memory formation (Carew lab)

## Faculty

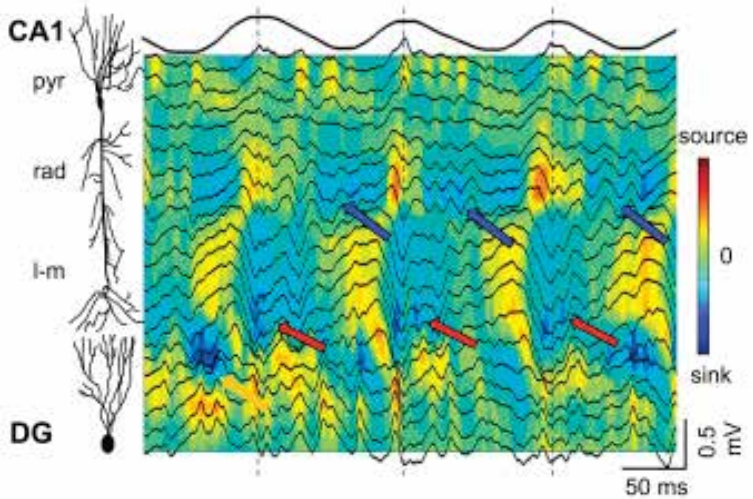
Karen Adolph  
Cristina Alberini  
Dora Angelaki  
Chiye Aoki  
Jayeeta Basu  
Gyorgy Buzsaki  
Thomas Carew  
Kenneth Carr  
Adam Carter  
F. Xavier Castellanos  
Moses Chao  
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Sukbin Lim  
Michael Long  
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Cristina Savin  
David Schoppik  
Greg Suh  
Regina Sullivan  
Wendy Suzuki  
Xing Tian  
Richard Tsien  
Xiao-Jing Wang  
Donald Wilson  
Jonathan Winawer  
Yongdi Zhou

# Learning, Memory, and Development

---



Depth profile of theta-nested gamma oscillations (Buzsaki lab)

## Select Recent Publications

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Fenton lab (2018). On how the dentate gyrus contributes to memory discrimination. *Nature Neuroscience*.

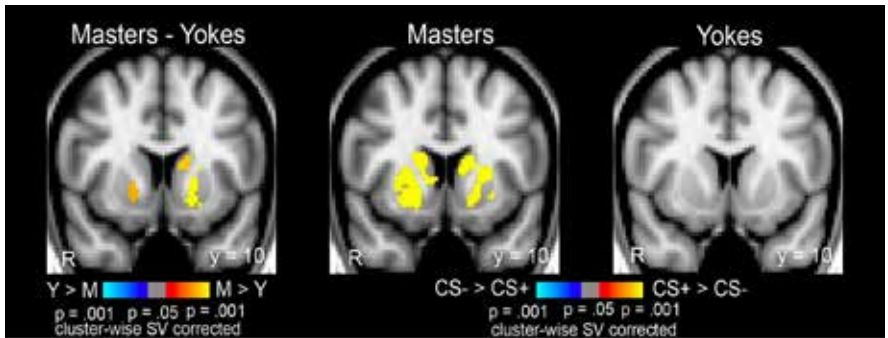
Dasen and Schoppik labs (2018). The ancient origins of neural substrates for land walking. *Cell*.

Long lab (2018). Stable sequential activity underlying the maintenance of a precisely executed skilled behavior. *Neuron*.

Alberini lab (2017). Direct dorsal hippocampal-prelimbic cortex connections strengthen fear memories. *Nature Neuroscience*.

## Emotions and Behavioral States

Emotions are complex physiological and psychological states that drive many of our actions and behaviors. Researchers at NYU investigate how emotions arise and impact behavior using many different approaches, including genetic engineering, tracing, and functional magnetic resonance imaging techniques.



fMRI BOLD responses during late Avoidance/Extinction (Hartley lab).

## Faculty

Cristina Alberini  
David Amodio  
Chiye Aoki  
Jayeeta Basu  
Justin Blau  
Gyorgy Buzsaki  
Kenneth Carr  
Marisa Carrasco  
Adam Carter  
F. Xavier Castellanos  
Zoe (Xiaowei) Dong

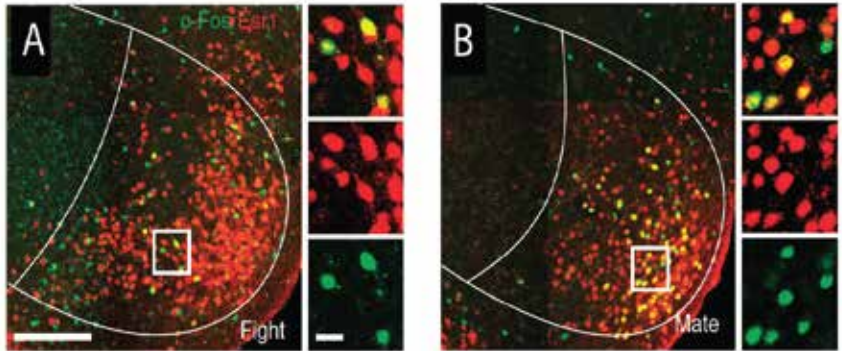
Jeffrey Erlich  
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Catherine Hartley  
Biyu He  
Eric Klann  
Joseph LeDoux  
Dayu Lin

Katherine Nagel  
Margaret Rice  
Helen Scharfman  
Nicholas Stavropoulos  
Greg Suh  
Regina Sullivan  
Wendy Suzuki  
Nicolas Tritsch  
Jing Wang  
Donald Wilson



## Emotions and Behavioral States

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Esr1+ neurons in the VMHvl region of the hypothalamus are preferentially activated during (A) fighting and (B) mating in female mice. (Lin lab).

### Select Recent Publications

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LeDoux lab (2018).  $\beta$ -Adrenergic enhancement of neuronal excitability in the lateral amygdala is developmentally gated. *Journal of Neurophysiology*.

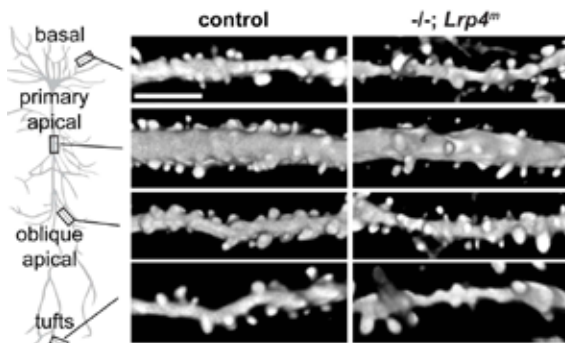
Sullivan lab (2017). Freezing suppression by oxytocin in central amygdala allows alternate defensive behaviours and mother-pup interactions. *eLife*.

Buzsaki lab (2018). Cocaine place conditioning strengthens location-specific hippocampal coupling to the nucleus accumbens. *Neuron*.

Carrasco lab (2018). Emotion and anxiety potentiate the way attention alters visual appearance. *Science Reports*.

## Disorders

In addition to normal behavior, it is important to understand disorders of the nervous systems, such as neurodegenerative and neurodevelopmental disorders. Researchers at NYU are investigating these questions at various systems levels and with different models.



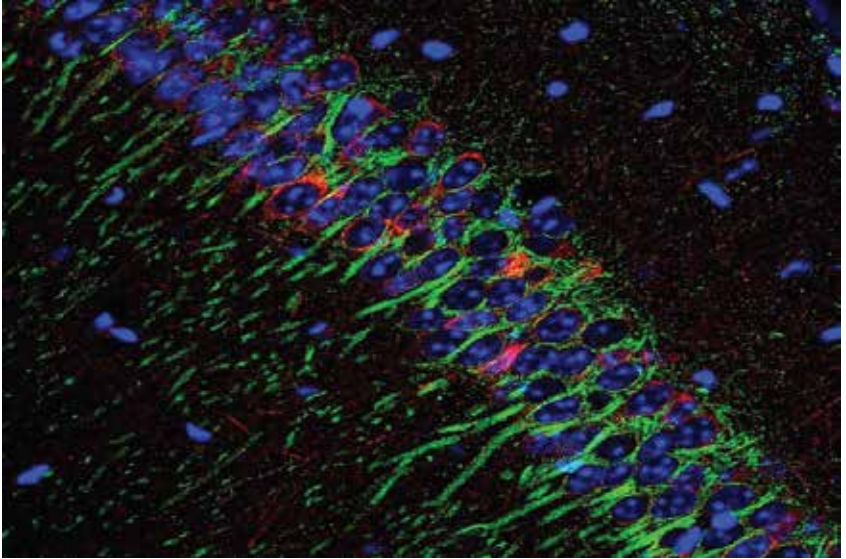
Spine density is decreased in select regions of the dendritic tree in *Lrp4* mutant mice, a model of neuromuscular disorders (Burden lab)

## Faculty

Chiye Aoki	David Heeger	James Salzer
Steven Burden	Lynne Kiorpes	Neville Sanjana
Gyorgy Buzsaki	Eric Klann	Helen Scharfman
Kenneth Carr	Joseph LeDoux	Einar Sigurdsson
F. Xavier Castellanos	Efrat Levy	Nicholas Stavropoulos
Moses Chao	Li Li	Regina Sullivan
Aravinda Chakravarti	Shane Liddelow	Dirk Trauner
Andre Fenton	Arjun Masurkar	Nicolas Tritsch
Wen-Biao Gan	Paul Mathews	Richard Tsien
Jorge Ghiso	Ralph Nixon	Daniel Turnbull
Stephen Ginsberg	Dimitris Placantonakis	Jing Wang
Paul Glimcher	Margaret Rice	Donald Wilson
Donald Goff	Niels Ringstad	Thomas Wisniewski

## Disorders

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Phosphorylated ribosomal S6 protein (red) in the hippocampus of fragile X syndrome model mice (Klann lab)

### Select Recent Publications

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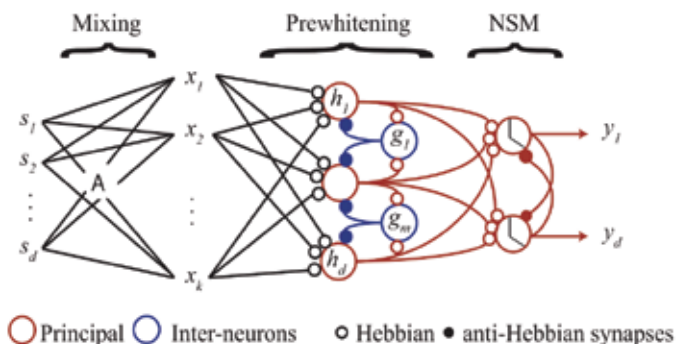
Fenton lab (2018). Normal CA1 place fields but disorganized network discharge in a *Fmr1*-null mouse model of Fragile X Syndrome. *Neuron*.

Sigurdsson lab (2018). Tau antibody structure reveals a molecular switch defining a pathological conformation of the tau protein. *Science Reports*.

Ringstad lab (2018). Antagonistic regulation of trafficking to *Caenorhabditis elegans* sensory cilia by a retinal degeneration 3 homolog and retromer. *PNAS*.

# Computation

Computational modeling can help us to understand and make predictions about molecules, cells, circuits, systems, cognition, and behavior. Often working in parallel with experimentalists, computational neuroscientists continually refine their models and make testable predictions about how the brain works.



Biologically plausible network for blind source separation (Chklovskii lab)

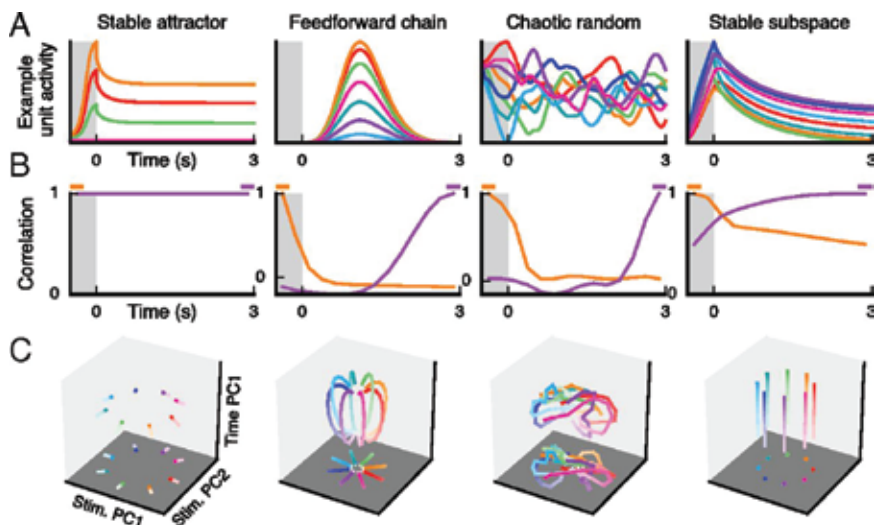
## Faculty

Dora Angelaki  
Richard Bonneau  
Gyorgy Buzsaki  
Dmitri Chklovskii  
Christine Constantinople  
Andre Fenton  
Davi Geiger  
Paul Glimcher  
Todd Gureckis  
Biyu He

David Heeger  
Yann LeCun  
Sukbin Lim  
Michael Long  
Wei Ji Ma  
Anthony Movshon  
Katherine Nagel  
Bijan Pesaran  
Charles Peskin  
Alex Reyes

Dmitry Rinberg  
John Rinzel  
Cristina Savin  
David Schoppik  
Robert Shapley  
Michael Shelley  
Eero Simoncelli  
Daniel Tranchina  
Xiao-Jing Wang  
Lai-Sang Young

# Computation



Distinguishing four theoretical model network mechanisms for population coding and dynamics. A) Example activity for one neural unit. (B) Correlation of population state (sensory is orange, memory purple) over time. (C) Delay-activity state-specific trajectories (Wang lab)

## Select Recent publications

Heeger lab (2018). Stimulus vignetting and orientation selectivity in human visual cortex. eLife.

Rinzel lab (2017). Signatures of somatic inhibition and dendritic excitation in auditory brainstem field potentials. Journal of Neuroscience.

He lab (2018). Beyond trial-based paradigms: continuous behavior, ongoing neural activity, and natural stimuli. Journal of Neuroscience.

## The NYU Neuroscience Community

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The NYU Neuroscience community comes together for a wealth of scientific events that encourage interdisciplinary, cross-campus interactions to ensure a stimulating environment for graduate training.

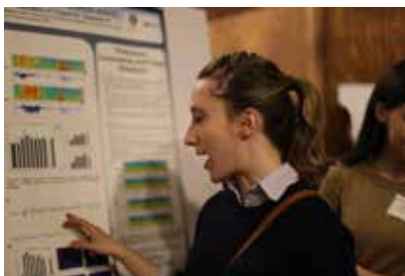
Weekly **Joint Neuroscience Colloquia** are a fundamental component of the community, featuring esteemed neuroscientists from around the world. Students have the opportunity to informally meet with invited speakers.

The **Swartz Seminar Series** promotes the theoretical neuroscience community at NYU by inviting distinguished computational and theoretical neuroscientists to speak about their research.

**Annual Neuroscience Retreats** bring together faculty and students for a multi-day scientific meeting focused on fostering new collaborations and showcasing the cutting edge work of the neuroscience community.

Other events like **Weekly Group Meeting and Fellows' Seminars** highlight our students' research in progress, giving them an opportunity to present their research and receive valuable input.

In the **Growing up in Science** series faculty members share their stories about becoming and being scientists to foster an open dialogue about the often unspoken human factors in academia.



## The NYU Neuroscience Community

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**NOGN: The Neuroscience Outreach Group at NYU** brings the brain to the city by visiting classrooms, hosting public events, and partnering with local educational and cultural institutions.

**NeuWrite** integrates the Scientific and Science Communication communities through events, talks, and a monthly workshop in order to create excellent and compelling science journalism and art.

The **NYU Biotech Association** hosts events that focus on applications of biomedical science in industry, business, law, and translational research.

The **NYU STEP** program is an NIH-funded series that helps graduate student and postdoc trainees identify career goals and provides resources needed to pursue them.

**ScAAN: Scientist Action and Advocacy Network** is a NYU-based group of scientists that partners with organizations that are creating positive social change.



## A Selection of Current NYU Neuroscience Students

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**Rachel Kim** (BA, Barnard College) is a 2nd year student in the Liddelow lab studying molecular mechanisms of A2 reactive astrocyte induction and function.



**Nikhil Parthasarathy** (BS/MS, Stanford University) is a 2nd year student in the Simoncelli lab using computation and theory to build better models of mid-level visual processing



**Billy Broderick** (BA, Oberlin College) is a 3rd year student in the Winawer and Simoncelli labs using fMRI and computation to study low-level vision in the human brain.



**Margot Elmaleh** (BS, Brown University) is a 3rd year graduate student in the Long Lab investigating song production circuitry during sleep.



**Janelle Miranda-Fajardo** (BS, UPR - Rio Piedras) is a 4th year student in the Alberini Lab investigating the mechanisms of memory formation during early development.



**Andrew Matheson** (BSc, McGill University) is a 4th year student in the Nagel Lab and is investigating the neural circuits underlying olfactory navigation in *Drosophila*.



**Daniel Levenstein** (MS, Cornell University) is a 5th year student in the Buszaki and Rinzel Labs creating dynamical models of how neural activity is coordinated during sleep.



**Katie Eyring** (BA, Wellesley College) is a 5th year graduate student working in the Tsien Lab on the mechanisms and functions of short-term plasticity.



# NYU Neuroscience Students By the Numbers



## 2018 Incoming Class

**61%** female

**22%** international

## Graduate Student Publications



**1.4**  
first author papers

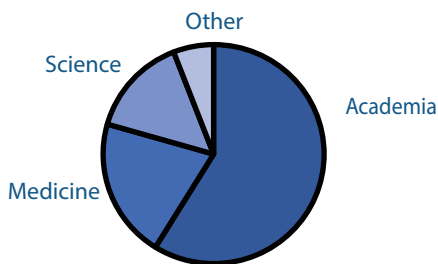


**3.0**  
publications

**12%**

students who publish rotation work

## Alumni Placement



## Training Program Stats

**116** training faculty

**121** students

**38** current students with fellowships

**5.5** years to degree

## A Selection of NYU Neuroscience Alumni

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**Emre Aksay**, PhD '01, is an Associate Professor at Weill Cornell, and he investigates the molecular, cellular, and circuit mechanisms of temporal integration in neurons.



**Nicole Rust**, PhD '04, is an Associate Professor at the University of Pennsylvania studying how the brain stores visual memories and recognizes objects.



**Jonathan Pillow**, PhD '05, is an Associate Professor in Psychology and the Princeton Neuroscience Institute at Princeton University. His research focuses on neural coding and statistical analysis methods for large neural datasets.



**Alexander Jaworski**, PhD '06, is an Assistant Professor at Brown University studying how the complex wiring pattern of the brain is established during embryonic development.



**Mehrdad Jazayeri**, PhD '07, is an Assistant Professor at MIT. He is interested in the neural bases of complex behaviors such as flexible timing and sensorimotor integration.



**Bianca Jones Marlin**, PhD '14, is a postdoctoral fellow with Richard Axel at Columbia University, where she investigates the role of cognitive flexibility in innate behaviors.



**Thu Huynh**, PhD '15 is a postdoctoral fellow with Conor Liston at Weill Cornell Medicine investigating prefrontal microcircuit mechanisms underlying extinction memory formation using novel methods of calcium imaging.



**Georg Kosche**, PhD '16, is a postdoctoral fellow with Botand Roska at the Friedrich Miescher Institute investigating the structure and function of neural circuits.



## A Selection of NYU Neuroscience Alumni

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## NYU and Living in NYC

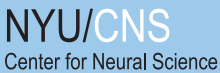
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Neuroscience faculty can be found in more than a dozen academic departments at NYU. Labs are located on both the School of Medicine campus and the Washington Square campus (see the map below) as well as at the nearby Nathan S. Kline Institute for Psychiatric Research. Free shuttles provide easy access to both campuses and other areas of the city. NYC public transportation is also very convenient, and Citibikes are easy to find on both campuses.

Labs working in all areas of neuroscience are well-equipped with state-of-the-art research facilities that support basic, translational, and clinical neuroscience.



 NYU School of Medicine

 NYU/CNS  
Center for Neural Science

## NYU and Living in NYC

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Students receive full support throughout their tenure in graduate school so that they can devote themselves full time to their studies. Support comes from the University, a number of training grants, as well as research grants. The program also trains students in the art of grant writing, and many successfully secure fellowships from the NIH, NSF, and other sources.

To assist students, NYU provides housing benefits that offset the cost of living in New York City. Neuroscience students have access to subsidized apartments, either through the School of Medicine's Housing Services or through the MacCracken program.







## Apply to NYU Neuroscience

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Applications for the Doctoral Program in Neural Science (based in the Graduate School of Arts and Science's Center for Neural Science, and NYU Shanghai's Institute of Brain and Cognitive Science) and Graduate Program in Neuroscience & Physiology (based in the School of Medicine's Sackler Institute) are jointly reviewed by a single admissions committee. To learn more about NYU Neuroscience and to access our application, visit us online.

To apply, visit **[neuroscience.nyu.edu](http://neuroscience.nyu.edu)**.

The application deadline for Fall 2019 is **December 1, 2018**.

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