

NIDA Potential Mentor Listing

1. Laura J. Bierut, M.D.

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Research Interest

I am a physician scientist with significant experience in genetic studies of smoking behaviors, addiction, and other psychiatric and medical illnesses. My research goal is to work to incorporate genetics into clinical care with a focus on how genetic information can change smoking behavior and substance use. I am an active member in the National Institute on Drug Abuse (NIDA) Genetics Consortium, a national group of scientists who are leading NIDA's efforts to understand genetic causes of substance dependence. I also have considerable experience in the management of large, collaborative projects. I have led the Collaborative Genetic Study of Nicotine Dependence (COGEN) for the past 9 years. I am a national co-principal investigator of the Collaborative Study on the Genetics of Alcoholism (COGA), which involves long-term follow-up assessments and is currently in year 25. As part of COGEN and COGA, thousands of research subjects have been successfully recruited and interviewed and have submitted blood samples for genetic analysis. As one of 14 investigators who has received funding through the National Human Genome Research Institute's Genes, Environment and Health Initiative, I led the effort to understand the interplay of genes and environment in the development of addiction. These datasets, along with data generated by collaborators around the world, lay the foundation for my studies. (approved 10/2016)

2. Congwu Du, Ph.D.

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Research Interest

Cocaine affects both cerebral blood vessels and neurons in the brain. Imaging technologies such as functional magnetic resonance imaging (MRI), positron emission tomography (PET), optical microscopy, and near-infrared imaging have been used to assess the acute and chronic effects of cocaine. However, the mechanisms underlying cocaine's neurotoxic effects are still not fully understood, partially due to the technical limitations of current techniques to differentiate vascular from neuronal effects at sufficiently high temporal and spatial resolutions.

To solve this problem, we have developed cutting-edge optical/fluorescence imaging techniques that permit simultaneous detection of cerebral blood flow (e.g., capillary flows), blood volume, and tissue oxygenation, as well as intracellular calcium *in vivo* and over a large field of view. We apply these methods to separate the vascular versus the neuronal effects of the brain in response to a stimulant (e.g., cocaine) by combining transgenic and self-administration models, thus to explore the insights of brain functional changes induced by a drug of abuse. ^{updated 10/2016}

3. Satoshi Ikemoto, Ph.D.

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Research Interest

We study neurobiological mechanisms underlying motivation, affect, and reinforcement. We are particularly interested in defining brain reward circuitry with respect to neurotransmitters, regions, and connectivity. We also seek to elucidate theoretical (conceptual) issues on the roles that dopamine and related systems play in motivated behaviors. Our behavioral procedures include instrumental and Pavlovian conditioning with optogenetic manipulations, intracranial and intravenous drug injections, and food in mice and rats. We also conduct electrophysiological recordings of neuronal spikes and local field potentials during motivated behavior. ^{updated 01/2017}

4. Marta Filizola, Ph.D.

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Research Interest

Our laboratory uses a variety of computational structural biology tools, including molecular modeling, bioinformatics, cheminformatics, simulation, and rational drug design approaches, to achieve a detailed mechanistic understanding of signal transduction processes mediated by G protein-coupled receptors involved in drug abuse, with a special emphasis on opioid receptors. The recent availability of high-resolution crystal structures of all opioid receptor subtypes offers an unprecedented opportunity to discover novel chemotypes selectively targeting these proteins that might eventually be developed into more efficacious therapeutics. We are actively working toward this goal, with a special focus on the rational design of allosteric modulators and biased agonists. ^{updated 10/2016}

5. Robert E. Kass, Ph.D.

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Research Interest

Much drug abuse research uses neurophysiological measurements to describe the way neural activity within and across brain regions is related to behavioral function and dysfunction. One kind of signal, known as spike trains, comes from individual neurons. Other signals, including local field potentials (LFPs), electroencephalography (EEGs), and magnetoencephalography (MEG), are based on activity from large numbers of neurons within specified parts of the brain. With all of these sources of data, scientifically rigorous statistical analysis must accommodate unstable fluctuations associated with movement or thought, known in statistics as nonstationarity. Our continuing research program is to develop methods for analyzing nonstationary neural data.

The number of neural signals that can be recorded simultaneously has been increasing rapidly. Because neural network dysfunction is widely considered to be associated with psychopathology, improvements in recording technologies offer exciting opportunities. They also create big statistical challenges due to greatly increased complexity. Our research aims to provide methods for analyzing the ways that network structure may change with particular variables, including those that help characterize behavior, which involves the transmission of neural information at multiple timescales. Fast timescales include oscillations and neural synchrony, which could provide an essential mechanism of neural network information flow and may be a marker that distinguishes normal from diseased states. At slower timescales, there is considerable redundancy in the recorded signals, which suggests dimensionality reduction. New methods investigated in this research program can accommodate both faster and slower timescales, and they can also accommodate relationships arising from the spatial configuration of electrodes that record neural signals. These methods are tailored to handle spike trains, LFP, and MEG data. Because a neural spike train is a set of times at which a neuron fired, it is common to consider it to be a point process, which is the statistical model set up to handle sequences of event times. Our research concerns development and investigation of statistical techniques involving both multidimensional continuous time series (for LFP, EEG, and MEG data) and multi-dimensional point processes (for spike trains). ^{new 01/2017}

6. Paul J. Kenny, Ph.D.

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Research Interest

Research in our laboratory is focused on understanding the molecular neurobiology of drug addiction and other neuropsychiatric disorders. We take a multidisciplinary approach that includes mouse behavioral genetics, gene editing, and protein and RNA biology. We combine these techniques with complex behavioral procedures to better understand the mechanics of addiction. ^{new 01/2017}

7. Wei Ji Ma, Ph.D.

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Research Interest

The Ma lab studies the behavioral and neural computations underlying perception, working memory, and decision-making. The information that reaches the brain through the senses is often imperfect and incomplete. The brain has evolved efficient solutions to make the best of this deficient information. We investigate these solutions using behavioral experiments in humans, mathematical models, and computer simulations. We also collaborate with laboratories that do electrophysiology and functional magnetic resonance imaging. Specific topics we work on include the limitations of working memory, decoding uncertainty from neural activity, confidence in decision-making, the allocation of visual attention, detecting microsaccades in eyetracker data, the neural implementation of probabilistic inference, causal inference in multisensory perception, exploration/exploitation trade-offs, and decision-making in strategy games. Our neural modeling work falls into a tradition that takes psychophysical data and the problems faced by the organism as starting points, and uses the language of probability theory and machine learning. This contrasts with a second tradition, rooted in physics, in which neural measurements and, in particular, temporal dynamics are central, and theories are formulated in terms of differential equations and dynamical systems. Both traditions are strongly represented at New York University. ^{new 01/2017}

8. Robert Christopher Pierce, Ph.D.

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Research Interest

Currently, there are no effective therapies for cocaine addiction, which directly affects over 2 million people in the United States alone. This reality is the driving force for our research program. The major hurdle for abstaining from abuse of cocaine is intense drug craving, which can be triggered months and even years following the cessation of drug use. The most widely accepted model of craving in animals involves self-administration followed by extinction and the subsequent reinstatement of drug seeking. Using this animal model, our research team pursues a strategy to identify novel neurobiological adaptations produced by cocaine and then uses this information to formulate potential cocaine addiction therapies. We are currently funded by NIDA to pursue three research programs, which are summarized below. We recently established a rat model to examine the influence of paternal cocaine self-administration on the behavior of progeny. In our paradigm, male rats self-administered cocaine for 60 days; controls were administered saline. The day after the last self-administration session, they were paired with naïve females. The offspring of these matings were tested for acquisition of cocaine self-administration. Our results indicated that the male offspring, but not the female offspring of cocaine-experienced sires, acquired cocaine self-administration more slowly and had decreased levels of cocaine intake relative to controls. Moreover, control animals were willing to work significantly harder for single cocaine infusions than the cocaine-sired rats, suggesting that the rewarding effect of cocaine was decreased. The cocaine-sired rats did not have generalized learning deficits, as there was no difference in acquisition of food self-administration. We next looked at protein expression in the prefrontal cortex of naïve littermates. The male offspring had increased brain-derived neurotrophic factor (BDNF) levels in the prefrontal cortex, which is known to blunt the behavioral effects of cocaine. In our experiments, the mothers interacted with the fathers only long enough to become impregnated; the fathers played no role in rearing their offspring. This raises the question of how paternal cocaine exposure influenced the behavior of the male offspring. Intriguingly, our results indicated that there were changes in regulators of DNA structure associated with the BDNF gene in the sperm of cocaine-experienced fathers, which might increase BDNF protein expression in the brains of the offspring. This finding indicated that cocaine causes epigenetic changes in sperm, which may alter the physiology and behavior of offspring in the absence of changes in DNA sequence. Taken together, these results indicate that paternal exposure to cocaine can have profound effects on gene expression and behavior of the offspring. ^{new 01/2017}

9. Bruce Rosen, M.D., Ph.D.

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Research Interest

My research for the past 30 years has focused on the development and application of physiological and functional nuclear magnetic resonance techniques—including the introduction and continued advancement of functional magnetic resonance imaging (fMRI)—as well as new approaches to combine fMRI data with information from other modalities such as positron emission tomography, magnetoencephalography, and noninvasive optical imaging. The integration of these modalities has dramatically advanced our capabilities to address complex neuroscientific questions, allowing us to more closely examine and better understand the human brain. The tools my group has developed to measure physiological and metabolic changes associated with brain activation and cerebrovascular insult are used by research centers and hospitals throughout the world to study and evaluate patients with stroke, brain tumors, dementia, and neurologic and psychological disorders.

10. Scott Saccone, Ph.D.

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Research Interest

We have a biodata management project that is part of a NIDA contract in review. The research is on developing methods for integrating whole-genome genetic datasets, such as genome-wide association studies, with public genomic databases for functional interpretation. We will be developing web applications for exploring, integrating, and querying whole-genomic datasets and applying these to the NIDA genetic repository (<http://nidagenetics.org>). {approved 10/2016}

11. Yavin Shaham, Ph.D.

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Research Interest

Our group investigates neuronal mechanisms of relapse to drug and aggression reward seeking, as assessed in rat models developed in our lab. Current projects include: (1) role of epigenetic mechanisms in incubation of methamphetamine craving; (2) brain circuits of context-induced relapse to cocaine seeking after punishment-imposed abstinence; (3) brain circuits of context-induced reinstatement of opioid (oxycodone) seeking after extinction; (4) brain circuits of incubation of drug craving after choice-based voluntary abstinence; and (5) brain circuits of relapse to operant aggression reward. Our experimental approaches include traditional neurobiological, neuropharmacological, and neuroanatomical methods, in combination with newer Daun02 inactivation of activated neurons, DREADD inactivation of neuronal projections, and FACS methods. {updated 10/2016}

12. Sanjay S. Shete, Ph.D.

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Research Interest

Our projects involve statistical modeling of genetic data to elucidate genetic contributions to smoking-related phenotypes and risk prediction models for smoking cessation using data from (1) dbGaP (particularly SAGE, Study of Addiction: Genetics and Environment); (2) a Cancer Prevention Research Institute of Texas-funded grant titled "Using Deep Sequencing Technology To Study Genes and Behavioral Phenotypes Related to Smoking Cessation, Negative Affect, and Nicotine Withdrawal (Principal Investigator [PI] Cinciripini and Co-PI Shete); and (3) smoking experimentation in Mexican American youth data on 1,300 longitudinally followed kids (with genetic data on select candidate genes). {approved 10/2016}

13. Dardo G. Tomasi, Ph.D.

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Research Interest

Along the years, my work has shifted from nuclear and astroparticle physics to MRI gradient coil design, functional MRI, and PET imaging. Recently, I developed functional connectivity density mapping, an ultra-fast graph theory method to compute short- and long-range functional connectivity maps from “resting-state” echo-planar imaging time series, which revealed pronounced gender and aging effects on the brain’s functional architecture when used in large public image databases. Currently, my interest is in data analysis and computational neuroscience to assess the dynamics and energetics of brain functional connectivity. I use these sophisticated computational methods to assess normal brain function as well as the effect of neuropsychiatric disorders such as drug/alcohol addiction in the brain. {approved 10/2016}