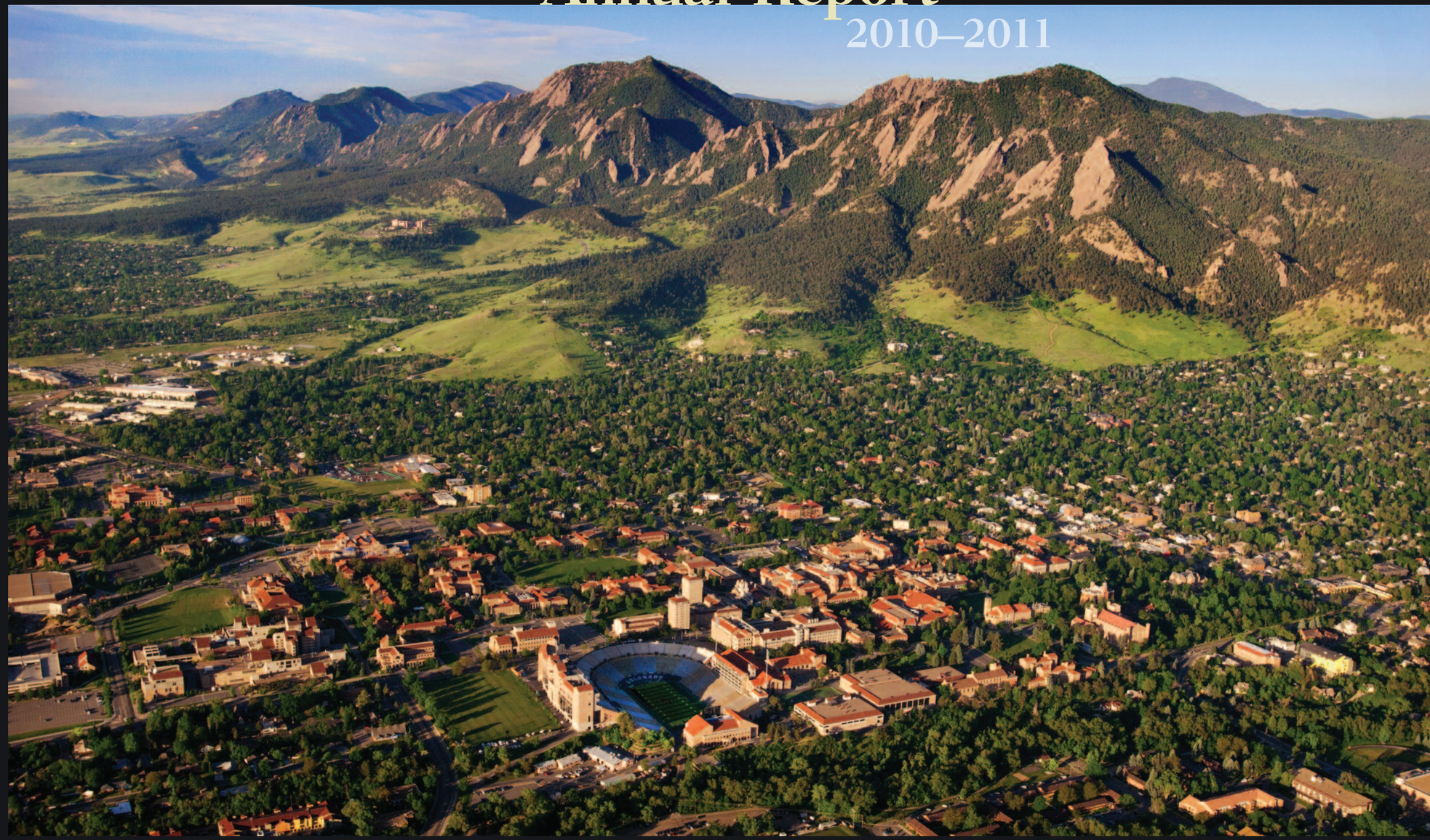
Institute for Behavioral Genetics
447 UCB
University of Colorado Boulder
Boulder, Colorado 80309-0447
phone 303-492-7362
fax 303-492-8063

Institute for Behavioral Genetics

Annual Report

2010–2011



Institute for Behavioral Genetics
UNIVERSITY OF COLORADO **BOULDER**

Institute for
Behavioral
Genetics

Annual Report

July 1, 2010–June 30, 2011

University of Colorado Boulder
John K. Hewitt, Director
Toni N. Smolen, Associate Director

Table of Contents

Institute for Behavioral Genetics
University of Colorado Boulder
447 UCB
Boulder, CO 80309-0447
Telephone 303-492-7362
Fax 303-492-8063

Mission

During the Institute of Behavioral Genetics' last program review, the Internal Review Committee reported that IBG is ". . . among the strongest of the research institutes on campus. The institute has an outstanding faculty and research staff that has established unique and highly successful interdisciplinary research programs." The research record of ". . . the resident faculty members . . . is outstanding in terms of international recognition, publications, and extramural funding." The Extramural Review Committee concurred, referring to IBG as ". . . the leading center for human and animal behavioral genetic studies in the U.S. and, arguably, in the world." In its summary findings, the Program Review Panel stated that the ". . . Institute for Behavioral Genetics is an independent academic enterprise that is peerless in its field and a superb asset to the University of Colorado and to the Boulder Campus."

The mission of IBG, an organized research unit of the University of Colorado Boulder, is to conduct and facilitate research on the genetic bases of individual differences in behavior and to conduct research training in this interdisciplinary area. Throughout its history, IBG has been characterized by the breadth of its interdisciplinary research and training programs. Although the methodology of behavioral genetics is generally applicable to the study of individual differences for any character, current research at IBG is focused on behaviors of obvious societal relevance.

The human research, in addition to studies of drug-related behaviors, includes large-scale family, twin, and adoption studies of cognitive abilities and personality, and of disorders such as learning disabilities and psychopathology. The detection, localization, and identification of individual quantitative trait loci, using both linkage and association methods, is a high priority.

Laboratory animals are used to study drug-related behaviors, particularly those associated with the use of alcohol and nicotine. For these studies, a large number of different strains and genetically selected stocks of mice are maintained in the IBG specific-pathogen-free mouse laboratory. These include inbred and recombinant strains of mice that provide efficient tools for screening behaviors for genetic influence and mapping quantitative trait loci. Selection studies in which mice are bred for certain characteristics provide definitive proof of genetic influence and also yield animal models that are valuable for subsequent research in functional genomics.

From the Director

The Institute for Behavioral Genetics (2001–2011): A decade of excellence in research and training

This annual report provides a snapshot of the institute's activities and accomplishments during 2010–11, focusing on FY 2011 (July 2010–June 2011) for financial, publication, and grant award information. It is the first formally published report since 2006, when we started to rely on our continuously updated website—ibg.colorado.edu—to disseminate this material. This year, however, we are using the occasion of our Institute's program review and planning exercise to summarize and publish an 'old style' annual report again. We hope you enjoy it!

To start off, here is an overview of a decade of excellence in research and training.

Program review

Our last program review was conducted during my first year as director and, because of the university's reorganization of the review process, the next review will be conducted in AY 2011–12. In its summary findings, the Program Review Panel stated that the ". . . Institute for Behavioral Genetics is an independent academic enterprise that is peerless in its field and a superb asset to the University of Colorado and to the Boulder Campus." (Program Review Final Report, May 2002).

Research productivity

Annual external grant awards to IBG have risen from $7,962,881 in FY 2001 to $10,925,336 in 2005, to $13,614,178 in FY 2010, a record in the history of the institute. In FY 2011 our new awards totaled $12,768,341. The indirect costs (ICR) returned to the institute to provide our departmental administrative support (DA-ICR) increased from $464,076 in 2001, to $616,628 in 2005, to $880,772 in FY 2011, reflecting a doubling of total ICR earned from approximately $1.6 milllion to $3.1 million. This represents an astonishing level of productivity in externally funded research, especially when set against the modest increase in the number of graduate school rostered tenured and tenure track (TTT) faculty from six in 2001 to eight currently.

Scholarship

That the productivity in scholarship matches the productivity in funding is evidenced by the fact that in the Office of Planning, Budget, and Analysis' 2010–11 unit profile, IBG ranks first out of all 60 units surveyed at CU-Boulder for the average number of refereed publications per faculty member over the previous seven years. Two major journals in our field are edited out of the institute: *Behavior Genetics* (John Hewitt, editor-in-chief) and *Experimental Gerontology* (Thomas Johnson, editor-in-chief).

Faculty recruitment

Since 2001, there have been four new IBG faculty hires rostered in the Graduate School, and one rostered in Psychology and Neuroscience. Together with two retirements (Jeanne Wehner and Al Collins), half of the Graduate School rostered TTT faculty (four out of eight) are recently appointed.

New faculty fellows

Part of the success of the institute has been through expanding still further its interdisciplinary collaborations; this is reflected in the total number of faculty fellows being increased from 18 in 2001 to 32 currently (28 excluding emeriti) with a broader range of disciplines represented. IBG faculty currently participate in externally funded research in collaboration with Psychology and Neuroscience, Integrative Physiology, Molecular, Cellular and Developmental Biology, Sociology, the Institute for Behavioral Science, the Institute of Cognitive Science, Applied Math, and Science Discovery on the Boulder campus, and numerous departments and universities elsewhere.

Research infrastructure

The addition of 5,700 square feet of new animal testing, wet laboratory, and office space as a second floor above our specific pathogen free mouse colony was completed in 2006. IBG has continued to improve its laboratory space, investing in renovations and improvements for its wet laboratories and the information technology infrastructure that underpins much of the work in biometrical and statistical genetics.

However, we now need a long-range plan for replacing the existing space, which is spread across four different buildings on the East Campus.

Graduate education

In graduate education, of the seven institutional training grants currently awarded by NIH to CU-Boulder, three are held by IBG (from NICHD, NIMH, and NIDA) supporting a total of 13 graduate fellowships and four postdoctoral fellowships. In addition, IBG co-directs an NIAAA postdoctoral grant held at UC Denver that supports an additional seven postdoctoral fellows, one or two typically at IBG. IBG's doctoral student body has increased from 13 in 2002, to 15 in 2005, to 19 currently.

Diversity

Through new faculty recruitment and faculty fellow appointments, we have increased our faculty diversity in age, rank, and gender, making most progress with junior faculty representation.

Summary of the past decade

Since our last program review in 2001, IBG has increased its external funding to record levels, is ranked first across all of CU-Boulder in the number of peer reviewed publications per faculty member, has been a leader in its discipline's scholarship, has expanded its faculty and developed new interdisciplinary collaborations, has increased its number of trainees, and has increased the diversity of its faculty.

The current year

Turning now to the current year, IBG has continued to advance its mission of excellence in graduate education, research training, and the creation of new research knowledge about genetic influences on behavior.

IBG faculty published 95 journal articles, eight books, four chapters, and 68 abstracts during the past year. The total IBG budget during 2010–11 (including general fund support, grants, and gifts) was $16,259,344. Most significantly, of that amount, $13,317,030 represented research expenditures, another record year. We continue to be successful in attracting new research awards and developing new interdisciplinary collaborative research opportunities. We have expanded our research portfolio through such interdisciplinary collaborations with academic units on the Boulder campus, across Colorado campuses, and nationally.

During the past year we were pleased to recognize the promotion and tenure of IBG faculty fellow Marissa Ehringer, associate professor of integrative physiology, and the tenure of IBG faculty fellow Don Cooper, associate professor of psychology and neuroscience. Another IBG faculty fellow, Dr. Toni Smolen, was promoted from assistant to associate director in recognition of her outstanding career of accomplishment, leadership, and service to IBG.

The institute holds three separate training grants awarded by the National Institute on Mental Health, the National Institute of Child Health and Human Development, and the National Institute on Drug Abuse. Together these awards allow the institute to fully support 13 graduate students and five postdoctoral trainees in behavior genetics. Additionally, the director of IBG serves as co-PI on an NIAAA postdoctoral training grant, directed by Paula Hoffman at the Anschutz Medical Campus in Denver; this funds seven postdoctoral fellows.

IBG also hosted the annual one-week training workshop in statistical methods for human genomic studies (formerly the Twin Workshop), supported by the National Institute of Mental Health. This is internationally recognized as one of the premier short courses in human statistical genetics for the study of behavior and complex traits, and in March 2011 IBG brought 22 of the world's leading statistical and behavioral geneticists to Boulder to teach the weeklong workshop. Eighty researchers from Colorado, the United States, and around the world came to Boulder to learn state-of-the-art methods for studying the genetics of health and behavior.

IBG faculty and students earned numerous honors, awards, and recognition during 2010–11. IBG faculty fellow Tom Johnson received the spring 2010 Boulder Faculty Assembly Award for Excellence in Research, Scholarly and Creative Work and he also won the American Aging Association's 2010 Denham Harman Research Award for lifetime achievement in research. IBG director John Hewitt received the 2010 faculty research award from the Department of Psychology and Neuroscience. IBG graduate student Jay Schulz-Heik, supervised by faculty fellow Soo Rhee, received the 2010 Dozier Award for the best graduate student in the Department of Psychology and Neuroscience, and another IBG graduate student, Melissa Munn-Chernoff, supervised by faculty fellow Mike Stallings, received the award in 2011. At this year's meeting of the Behavior Genetics Association, the Fulker Award for best paper published in the journal *Behavior Genetics* during 2010 was presented to IBG faculty fellow Matt Keller (assistant professor of psychology and neuroscience); Sarah Medland of the Queensland Institute for Medical Research; and Laramie Duncan, a graduate student in clinical psychology and the IBG graduate program. *Aging Cell*'s best paper of 2010 was awarded to senior research associate Brad Rikke, faculty fellow Tom Johnson, and their co-authors. Soo Rhee (associate professor of psychology and neuroscience and IBG faculty fellow) and colleagues received the 2011 George A. Miller Award of the Society of General Psychology (American Psychological Association, Division 1).

The record I have summarized is truly outstanding, and I must thank all of the faculty, staff, and students of the institute for their superb professional and scientific performance and for the collegiality that remains a distinguishing and necessary characteristic of the institute. A special thanks also goes to our associate director, Dr. Toni Smolen, and to Ms. Bridget Carey for their work in preparing this report.

John K. Hewitt
Director

Faculty Fellows

Ryan K. Bachtell

Assistant professor, Department of Psychology and Neuroscience, University of Colorado Boulder; member of the Center for Neuroscience; PhD, Oregon Health & Science University, 2004. Professor Bachtell's research focuses on the neurobiology and neurogenetics of drug addiction utilizing behavioral models of addiction such as drug self-administration, place conditioning, and drug sensitivity paradigms. Currently, his lab is interested in the predictive role of dopamine D2 receptor function in psychostimulant sensitivity, reward, and relapse.

Jason Boardman

Associate professor, Department of Sociology, and research associate, Institute of Behavioral Science, University of Colorado Boulder; PhD, University of Texas, 2002. Professor Boardman is currently the associate director of the NICHD funded University of Colorado Population Center. His research focuses on the social determinants of health with an emphasis on the gene-environment interactions related to health behaviors. He teaches undergraduate- and graduate-level courses in statistics, social demography, and the sociology of race and ethnicity.

Michael D. Breed

Professor, Department of Ecology and Evolutionary Biology, University of Colorado Boulder; PhD, University of Kansas, Lawrence, 1977. Professor Breed's research emphasis is the genetics of social recognition systems in animals. His current interests include behavioral and genetic studies of recognition cues used by honeybees to discriminate nestmates from non-nestmates. He is presently engaged in investigating the role of cuticular compounds in recognition, and the patterns of inheritance of chemical cuticular signature.

Gregory Carey

Associate professor, Department of Psychology and Neuroscience, University of Colorado Boulder; PhD, University of Minnesota, 1978. Professor Carey's research interests are in the areas of genetics and human psychopathology. Within these areas, his work concentrates on anxiety disorders and on the development of externalizing behavior (antisocial tendencies, drug abuse, and alcohol abuse) during adolescence. A second major interest is the use of quantitative models to represent mechanisms of assortative mating, development, cultural transmission, and sibling interaction.

Allan C. Collins

Professor emeritus of psychology and pharmacology, Department of Psychology and Neuroscience, University of Colorado Boulder; PhD, University of Wisconsin, 1969; NIAAA Research Scientist Award, 1978–83; NIDA Level V Research Scientist Award, 1993–2003. Professor Collins is a biochemical pharmacologist whose primary research specialization was neurochemistry. His research interests have included neurochemical correlates of nicotine use, tolerance development, and withdrawal; neurochemical bases of alcohol tolerance; biochemical bases of behavior; and utilization of genetics as a tool to determine the mechanism of action of drugs.

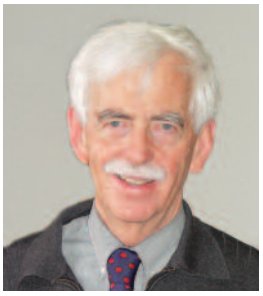
Don Cooper

Co-director of the Neuroscience Undergraduate Program, associate professor, Department of Psychology and Neuroscience, University of Colorado Boulder; adjunct professor, Department of Psychiatry, University of Texas Southwestern Medical Center; National Academy of Science Kavli fellow and co-chair (2008–10); PhD, Finch University of Health Sciences/The Chicago Medical School, 2000. Professor Cooper's neurophysiology laboratory combines behavioral, molecular genetic, and detailed electrophysiological analysis to understand how psycho-

stimulant drugs alter neuronal impulse activity leading to short- and long-term changes in communication within the mesolimbic dopamine system. His approach to this problem utilizes state-of-the-art technology (e.g., DNA microarrays, viral gene transduction, infrared and fluorescence visualized patch-clamp physiology, and intravenous drug self-administration) and complementary levels of analysis (e.g., drug self-administration, *in vivo* and *in vitro* physiology, molecular techniques, and computer simulation) in order to gain insight into how this system functions under normal and pathological conditions.

Marilyn E. Coors

Associate professor, Department of Psychiatry and Center for Bioethics and Humanities, University of Colorado Anschutz Medical Campus. Research interests pursued by Professor Coors include the ethics of human genetic modification, informed consent in genetic research, and the ethical issues in broad data sharing for genetic research on addiction.



Thomas Crowley

Professor emeritus, Department of Psychiatry, School of Medicine, University of Colorado; MD, University of Minnesota, 1962. Thomas Crowley participates in IBG studies that focus on genetic and environmental influences on the development of behavior problems and substance abuse issues among adolescents. He conducts studies on risky decision making in those adolescents, using functional magnetic resonance imaging.

John C. DeFries

Professor, Department of Psychology and Neuroscience, University of Colorado Boulder; PhD, University of Illinois, 1961; president of the Behavior Genetics Association, 1982–83; Distinguished Research Lectureship, Council on Research and Creative Work, University of Colorado Boulder, 2001–02; fellow, American Association for the Advancement of Science (1994) and Association for Psychological Science (2009). Professor DeFries' primary field of specialization is quantitative behavioral genetics. His current research interests include twin and adoption studies of human cognitive abilities and the genetics of learning disabilities.

Richard A. Deitrich

Professor emeritus, Department of Pharmacology, University of Colorado Anschutz Medical Campus; PhD, University of Colorado, 1959; NIGMS Research Career Development Award, 1965–75; NIAAA Research Scientist Award, 1986–2001; president of the Research Society on Alcoholism, 1981–83; co-scientific director of the University of Colorado Alcohol Research Center, 1977–2002; NIAAA Merit Award, 1996–2004. Professor Deitrich is a pharmacologist whose current research concerns the molecular basis of the actions of alcohol. His research uses genetically selected lines of mice and rats to discover mechanisms of central nervous system depression, tolerance, and dependence. These data are used to identify specific genes responsible for these actions in animals, and eventually to identify similar genes in humans at risk for development of alcoholism.

Marissa A. Ehringer

Associate professor, Department of Integrative Physiology, University of Colorado Boulder; PhD, University of Colorado Anschutz Medical Campus, 2001. Professor Ehringer is a molecular geneticist who utilizes genomics and bioinformatics resources to study behavior genetics. Her research is focused on understanding the underlying biological mechanisms that contribute to substance abuse, primarily tobacco, alcohol, and marijuana use, using two approaches. One approach examines candidate genes in human samples to see if variation within these genes is associated with substance-use behaviors. The second approach is examining a possible environmental effect of exercise on alcohol-related behaviors in a mouse model. Both studies employ a behavioral molecular genetics component. Her research has been funded by the Colorado Tobacco Research Program and the National Institutes of Health.

John K. Hewitt

Director, Institute for Behavioral Genetics and professor, Department of Psychology and Neuroscience, University of Colorado Boulder; PhD, University of London, 1978; editor-in-chief, *Behavior Genetics*, 2000–present; president of the Behavior Genetics Association, 2000–01; Dobzhansky Award, 2008. Professor Hewitt conducts cross-sectional and longitudinal studies of twins and families to understand the genetic and environmental influences on behavior. He uses both biometrical and molecular genetic methods to study the development of behavior problems in childhood and adolescence; vulnerability to drug use, abuse, and dependence; and executive functions and cognitive ability.

Christian Hopfer

Associate professor of Psychiatry, University of Colorado Anschutz Medical Campus; MD, Case Western Reserve University, 1992; executive director, Developmental Psychobiology Research Group. Professor Hopfer uses genetically informative designs to study the development of behavior problems in adolescence and young adulthood, in particular substance use and substance use disorders and antisocial/externalizing behaviors. He is currently involved in epidemiological and genome-wide association studies of these disorders.

Thomas E. Johnson

Professor of behavioral genetics, Department of Integrative Physiology, University of Colorado Boulder; PhD, University of Washington, 1975. Professor Johnson saw the potential for the nematode *C. elegans* in developing an experimental approach to studies of aging. He has played a key role in the modernization of aging research. He identified and mapped the first gerontogene (age-1), which doubles the maximum lifespan. He found that this gene and others regulate response to environmental stress and has an integral part of numerous other discoveries. His focus now is on fetal alcohol syndrome and biomarkers for aging. His research has received more than $30 million in NIH funding, almost entirely in RO1s. He received the Kleemeier and Harman Awards for his lifetime contribution to aging research and has been recognized in many other ways, including the Boulder Faculty Excellence in Research, Scholarly and Creative Work Award. In 2010 he was made a fellow of the American Association for the Advancement of Science. He has served as an officer of numerous professional organizations and is currently editor-in-chief of the oldest and largest journal in the field, *Experimental Gerontology*. For more information, visit his website at ibg.colorado.edu/tj-lab.

Matthew C. Keller

Assistant professor, Department of Psychology and Neuroscience, University of Colorado Boulder; PhD, University of Michigan, 2004. Professor Keller uses twin and molecular genetic data to understand the genetic etiology of complex disorders. In particular, his research has focused on understanding the evolutionary causes of genetic variation underlying human disorders.

Kenneth Krauter

Professor, Department of Molecular, Cellular and Developmental Biology, University of Colorado Boulder; PhD, Albert Einstein College of Medicine, 1980. Professor Krauter is a molecular biologist whose research focuses on two aspects of human genomic research. The first is in the area of comparative genome analysis using "high-throughput" mapping and DNA sequence analysis to examine similarities between human and mouse genes including the skeletal myosin heavy chains. By developing high resolution maps and complete DNA sequence of the analogous genes in the two species, it is possible to identify potentially important elements responsible for regulation and the function of the genes. The second area of interest is the use of genetic analysis to identify genes involved in complex traits such as adolescent antisocial behavior. This latter study is done in collaboration with the Center for the Genetics of Antisocial Drug Dependence at the University of Colorado Anschutz Medical Campus and IBG at the University of Colorado Boulder.

Research Highlight: Ehringer Lab

Professor Ehringer is a molecular and statistical geneticist who utilizes genomics and bioinformatics resources to study behavior genetics. Her research is focused on understanding the underlying biological mechanisms that contribute to substance abuse, primarily tobacco and alcohol use, using two approaches. One approach examines candidate genes in human samples to see if variation within these genes is associated with substance-use behaviors. Certain variations within genes that code for the neuronal nicotinic receptor subunits have been associated with risk for smoking and alcohol abuse and dependence. Professor Ehringer's laboratory is studying these genes in human samples and also at the molecular level to determine how the variations might affect gene function. The second project in her lab involves examining an environmental effect of exercise on alcohol-related behaviors in a mouse model. Mice that voluntarily consume high levels of alcohol will drink less alcohol (and more water) when they are given access to a running wheel. Studies in the lab are aimed at identifying the neuronal mechanisms that may contribute to this reduction in alcohol consumption. These projects employ human, molecular, and animal genetics and genomics approaches to study the mechanisms contributing to risk for substance abuse.

Amber Flora and Krista Johnson, Ehringer Lab

Carol Lynch

Professor emerita, Department of Ecology and Evolutionary Biology, dean of the Graduate School, and vice chancellor for research, emerita, University of Colorado Boulder; PhD, University of Iowa, 1971. Professor Lynch's current work is in the area of higher education policy, specifically the promotion nationally of a new degree, the Professional Science Master's (PSM). Support for the project comes from the Alfred P. Sloan Foundation through the Council of Graduate Schools. The PSM is an innovative graduate degree designed to allow students to pursue advanced training in science or mathematics, while simultaneously developing workplace skills highly valued by employers, such as business, ethics, communications, and regulatory affairs.

Matthew B. McQueen

Assistant professor, Department of Integrative Physiology, University of Colorado Boulder; assistant professor (secondary appointment), Department of Epidemiology, Colorado School of Public Health, University of Colorado Anschutz Medical Campus; ScD, Harvard School of Public Health, 2005; director of the Biostatistics Core, University of Colorado Boulder Clinical and Translational Research Center. As an epidemiologist and applied biostatistician, Professor McQueen's research objectives are focused on the development and application of epidemiological and biostatistical methods to advance our understanding of human disease from genes to populations. Areas that broadly define Professor McQueen's research include the epidemiology of behavior (HIV-risk behaviors, obesity), psychiatric disorders (substance use and dependence, conduct disorder, bipolar disorder, schizophrenia) and neurologic disorders (Alzheimer's disease, Parkinson's disease, multiple sclerosis).

Richard K. Olson

Professor, Department of Psychology and Neuroscience, University of Colorado Boulder; PhD, University of Oregon, 1970. Professor Olson is a developmental psychologist whose primary research is on the varieties, etiology, and remediation of learning disorders. His research has examined the component processes in reading and related language skills that are associated with both normal and subnormal development. Heritability of these component processes is being evaluated through twin analyses. Professor Olson currently serves as the director of the Colorado Learning Disabilities Research Center.

Bruce F. Pennington

John Evans Professor, Department of Psychology and Neuroscience, and director of the Developmental Cognitive Neuroscience Program, University of Denver; PhD, Duke University, 1977. Professor Pennington is a developmental neuropsychologist whose research focuses on understanding disorders of cognitive development. The disorders he studies include developmental dyslexia, attention deficit hyperactivity disorder, and several mental retardation syndromes: early treated phenylketonuria, fragile X syndrome, Down's syndrome, and infantile autism. The long-term goal of this work is to understand how different genetic influences alter brain development to produce the distinct profiles of cognitive strengths and weaknesses found in each of these disorders.

Dennis Petersen

Professor of pharmacology and pharmacogentics, School of Pharmacy, University of Colorado Anschutz Medical Campus; PhD, University of Wyoming, 1974; NIAAA Research Scientist Development Award, 1978–92, and recipient of NIAAA Merit Award, 2008–present. Professor Petersen's research focuses on molecular mechanisms of liver injury resulting from chronic alcohol consumption or obesity. Professor Petersen uses mass spectrometry to identify hepatic proteins predisposed to modification through oxidative stress in order to establish molecular signatures of cellular injury and disease progression. His current studies are focused on the use of genetically modified mice to probe the role of certain proteins in protection or susceptibility to alcohol- or chemical-induced liver injury.

Richard A. Radcliffe

Associate professor of pharmacology, School of Pharmacy, Department of Pharmaceutical Sciences, University of Colorado Anschutz Medical Campus; PhD, University of Colorado Anschutz Medical Campus, 1996. Professor Radcliffe's research focuses on the genetic and molecular basis of drug and alcohol addiction with an emphasis on drug-induced behavioral plasticity such as tolerance and sensitization. A variety of neurochemical, behavioral, and genetic effects are studied using primarily genetic and genomic approaches in the laboratory mouse and rat. Current projects include RNA-Seq analysis of CNS systems involved in alcohol tolerance in mice; the genetic basis of the interaction between methamphetamine sensitization and toxicity in mice; QTL mapping of various alcohol-related behavioral traits in mice and rats; and testing specific genes for their role in alcohol-related behaviors in mice and rats.

Soo Rhee

Associate professor of psychology, Department of Psychology and Neuroscience, University of Colorado Boulder; PhD, Emory University, 1999. Professor Rhee's primary research interests are the etiology and development of childhood disruptive disorders, the etiology and development of substance use disorders, and the causes of comorbidity between psychiatric disorders and substance use disorders.

James Sikela

Professor, Department of Biochemistry and Molecular Genetics, Human Medical Genetics and Neuroscience Programs, University of Colorado School of Medicine; PhD, Case Western Reserve University, 1983. Professor Sikela is a genome scientist and has been a key pioneer in the development of EST technology and large-scale human gene mapping. His strategy of developing gene-based STSs to rapidly map human genes was used by an international gene-mapping consortium that determined the chromosomal location for the majority of human genes. He contributed to the discovery of the Presenilin 2 (PSN2) gene that causes Alzheimer's disease. Currently his research involves applying genomics approaches to the discovery of genes involved in neurogenetic diseases such as autism, schizophrenia, microcephaly, and other forms of cognitive disability. His labora-

continued on page 12

Research Highlight: Smolen Lab

The ongoing projects in the Smolen Laboratory involve studies of correlations between complex behavioral traits and loci, which are the sites of specific genes on chromosomes that may influence those traits. As part of these studies, the laboratory maintains an archive of over 45,000 unique human DNA specimens. The archive is supported in part by IBG's Molecular Biology Core Facility, which houses the specimens. The following are brief summaries of three of the six major NIH-funded studies the lab is working on.

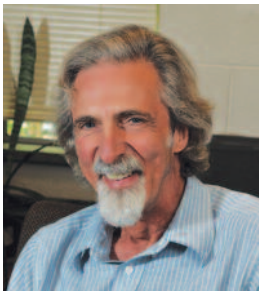
The DNA samples housed in this facility have been used in a number of national studies, including The National Longitudinal Study of Adolescent Health (Add Health) administered by the Carolina Population Center at the University of North Carolina at Chapel Hill. The goal of the overall project is to trace, locate, collect biospecimens from, and re-interview respondents who have participated in the study since its inception in 1994. The Smolen laboratory is responsible for archiving the DNA and genotyping this cohort. To date the lab has collected DNA from 15,249 respondents and genotyped them for seven common DNA variants. Additional ongoing genotyping consists of ascertainments of a small panel of 32 Single Nucleotide Polymorphisms (SNPs) that are proposed to be involved in health-related outcomes. In addition, the lab has supplied purified DNA samples to other laboratories that have assayed panels of 1,536 and 50,000 SNPs to be used in statistical association analyses of health-related behaviors and outcomes concentrating on drug use and abuse, and obesity, respectively.

The Add Health DNA samples are also being used in a second project, Stressors and the Biobehavioral Pathways to Cardiovascular Disease, which is an extension of the National Longitudinal Study of Adolescent Health project. One unique feature of the Add Health sample is that these participants, first interviewed in adolescence, are now being followed into adulthood when they are at greater risk for cardiovascular and other mature onset health problems. For this study the Smolen lab has begun to genotype and contribute to the analysis of SNPs that are proposed to be related to stress effects on cardiovascular disease and type 2 diabetes.

A third and newly funded project involving the Smolen Lab is Social Demographic Moderation of Genome-Wide Associations for Body Mass Index. This also is an extension of the National Longitudinal Study of Adolescent Health project. For this study lab members will genotype a subsample of fraternal twin and full sibling pairs from Add Health using a panel of 1 million SNPs across the entire human genome. They also will perform a genome-wide association study for body mass index, waist circumference, and energy-related behaviors with an emphasis on genome-wide, gene-by-environment, and gene-by-behavior interactions. It is known that there are both genetic and environmental factors that influence each of these health outcomes, and the goal of this research is to determine the possible influences that environmental variables have on these genetic factors, with an emphasis on the transition period from adolescence through early adulthood.

Taylor and Forrest Roy set up genotyping assays.

tory has also made major contributions to the identification of genes and sequences important to human and primate evolution, including those, such as the human-specific hyper-amplification of DUF1220 protein domains, that are specific to the human lineage and related to the structure and function of the human brain.

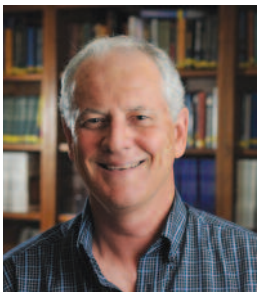


Andrew Smolen

Senior research associate, Institute for Behavioral Genetics, University of Colorado Boulder; PhD, University of Colorado, 1979. Dr. Smolen is a pharmacologist whose primary interests are in the areas of neurochemistry and pharmacogenetics. His current research activities include the assessment of the contribution of specific candidate genes to complex behaviors such as substance abuse and attention deficit hyperactivity disorder.

Toni Smolen

Associate director, Institute for Behavioral Genetics; PhD, University of Colorado, 1981. Dr. Smolen's primary research interests have been in pharmacogenetics and neuropharmacology, and specifically in studies of biochemical and neurochemical mechanisms that underlie the development of drug tolerance and dependence. Her current work, however, is in the area of research administration, specifically the supervision and coordination of the day-to-day administrative, research, and training activities of IBG. She also serves as the chief financial manager, providing oversight and approving authority for all institute business. In addition, Dr. Smolen contributes to the teaching mission of the institute by coordinating and participating in the NIH-mandated training of IBG predoctoral students and postdoctoral fellows in the responsible conduct of research.



Michael Stallings

Associate professor, Department of Psychology and Neuroscience, University of Colorado Boulder; PhD, University of Southern California, 1993. Professor Stallings' research interests include quantitative genetics, substance abuse, and personality. Currently, his primary research program involves studies of twins, families, and adoptive families, utilizing both biometrical modeling and linkage and association methods, to understand genetic and environmental influences on the development of substance use disorders and comorbid psychopathology.

Jerry A. Stitzel

Associate professor, Department of Integrative Physiology, University of Colorado Boulder; PhD, Johns Hopkins University, 1992. Professor Stitzel is a molecular biologist whose primary interest is in understanding the molecular basis through which genetic variation influences risk for drug dependence and comorbid traits. Current projects include the molecular, biochemical, and cellular characterization of naturally occurring variants of neuronal nicotinic receptors and their roles in drug dependence and schizophrenia.

Boris Tabakoff

Professor, Department of Pharmacology, University of Colorado Anschutz Medical Campus; PhD, University of Colorado, 1970; president of the Research Society on Alcoholism, 1983–85; president of the International Society for Biomedical Research on Alcoholism, 1986–90; RSA Award for Scientific Excellence in Alcohol Research and Jellinek Award for alcoholism research, 1988; Florence Rena Sabin Award, 2002; Joseph Addison Sewall Award, 2008, University of Colorado Anschutz Medical Campus; member, National Advisory Council for the National Institute on Alcohol Abuse and Alcoholism. Professor Tabakoff's research concerns physiological, pharmacological, and biochemical correlates of alcohol and opiate/cannabinoid abuse and major depressive disorders. Professor Tabakoff's laboratory makes extensive use of genomic, transcriptome and proteome information and utilizes the genetical/genomic systems approach to structure their research. Current studies focus on genetic/genomic factors mediating tolerance development; the involvement of brain GABA and glutamate systems in addiction; and the interaction of addictive drugs with cyclic AMP signaling in brain. Studies are pursued with both human and non-human subjects.

Jeanne M. Wehner

Professor emerita, Department of Psychology and Neuroscience, University of Colorado Boulder; PhD, University of Minnesota Medical School, 1976; NIAAA Research Scientist Development Award, 1991–96, and NIAAA Research Career Award, 1997–2002. Professor Wehner is a biochemist whose primary research interests are pharmacogenetics and neurobiology. Previous projects included biochemical and genetic studies of learning and memory, as well as studies of initial sensitivity and tolerance development to alcohol.

Erik G. Willcutt

Associate professor of clinical psychology, Department of Psychology and Neuroscience, University of Colorado Boulder; PhD, University of Denver, 1998. Professor Willcutt's current research focuses on the causes and consequences of attention deficit hyperactivity disorder, learning disabilities, and their comorbidity. He uses genetic linkage and association techniques in studies of families and twins to identify genes that increase susceptibility to these difficulties.

James R. Wilson

Professor emeritus, Department of Psychology and Neuroscience, University of Colorado Boulder; PhD, University of California, Berkeley, 1968. Professor Wilson's primary field of specialization is behavioral biology. His research interests have included the endocrinological and genetic bases of maternal behavior, sexual behavior, activity differences, and learning differences in mice; and genetic studies of cognitive functions in humans. Work in the mid-'90s involved genetic selection in mice for alcohol dependence, behavioral genetic studies of alcohol dosing and cigarette withdrawal in humans, and studies of neuroelectric treatment for cigarette addiction and alleviation of migraine headaches. Dr. Wilson is currently teaching online for the University of Colorado Denver.

Research Highlight: Stitzel Lab

Smoking is the leading cause of premature death in the United States. A major contributor to whether an individual becomes addicted to nicotine, the addictive substance in tobacco, is genetics. The major goal of the research in Professor Stitzel's laboratory is to determine the mechanism through which specific genetic differences between individuals alter risk for nicotine addiction. The laboratory uses a wide array of methodologies to determine how the genetic variations affect baseline levels of gene expression as well as cell function, brain activity, and behavioral response to nicotine. The laboratory also is interested in the genetics and neurobiology of the comorbidity between smoking and psychiatric disorders such as schizophrenia.

Jerry Stitzel and graduate student Will Horton discuss results of a western blot to detect nicotinic receptor protein.

Senior Research Associates, Research Associates, and Postdoctoral Fellows

Senior Research Associates

Robin Corley, PhD, University of Colorado Boulder, 1987. Longitudinal analysis of specific cognitive abilities and problem behavior.

Naomi Friedman, PhD, University of Colorado Boulder, 2002. Individual differences in cognitive executive functions and their relations to other cognitive abilities and real-world problems such as attention problems, depression, and sleep problems. Current research projects include a twin study on stability and change in executive control and self-regulation, and computational modeling of genetic associations with multiple components of executive control.

Christopher Link, PhD, University of Massachusetts, 1984. Molecular genetics; modeling of neurodegenerative diseases using transgenic *C. elegans*.

Michael Marks, PhD, University of Michigan, 1974. Genetic influences on molecular, biochemical, physiological, and behavioral factors mediating the responses to nicotine in mice.

Brad Rikke, PhD, University of Texas, 1992. Genetic mapping and identification of genes underlying dietary restriction's ability to retard aging in mice.

Sally Wadsworth, PhD, University of Colorado Boulder, 1994. Genetic and environmental influences on reading difficulties and ADHD in childhood and adolescence, as well as cognition, health, and well-being across the lifespan.

Susan Young, PhD, University of Colorado Boulder, 1998. Genetic and environmental factors influencing behavioral disinhibition, risk taking, substance use disorders, and executive function.

Research Associates

Tanya Button, PhD, Kings College London, 2005. Examination of the relationship between conduct problems and substance use problems, and the interplay of genetic and environmental risks for both conduct problems and substance problems.

Junli Cao, MD, PhD, China Medical University, 2006. Neuroadaptations of dopaminergic neurons in the ventral tegmental area underlying drug addiction and depression.

Nomita Chhabildas, PhD, University of Denver, 2003. Neuropsychological and psychiatric correlates of ADHD, as well as broader comorbidity issues in childhood psychopathology and learning disabilities.

James Cypser, PhD, University of Colorado Boulder, 2002. Discovery and characterization of biomarkers of aging; e.g., psychological or molecular characteristics that predict individual subsequent life span (in the nematode *C.elegans*). Also the demographic patterns of mortality displayed by long-lived nematode mutants, and the relationship between stress resistance and the rate of aging.

Peter Dobelis, PhD, Colorado State University, 1998. Electrophysiological and biochemical investigation of the effects of drugs of abuse in mice.

Maria L. Florez-McClure, PhD, University of Colorado Anschutz Medical Campus, 2004. Genetic and environmental factors that modulate ethanol-induced brain malformations.

Angela Friend, PhD, University of Colorado Boulder, 2009. Analysis of relationship between reading disability, anxiety/depression, and substance use.

Francesc Xavier Gallego Moreno, PhD, University of Barcelona, 2008. Functional and behavioral alterations due to the CHRNA5/CHRNA3/CHRNB4 gene cluster variability associated with early age of initiation for both tobacco and alcohol use.

Sharon Grady, PhD, University of Michigan, 1973. Function of nicotine in the central nervous system of mice, specifically, nicotine-stimulated release of neurotransmitters from synaptosomes.

Brett Haberstick, PhD, University of Colorado Boulder, 2005. Investigation of functional polymorphisms and their contribution to individual differences in substance use disorders (alcohol, tobacco) and other disinhibited behavioral problems.

Christina Hewitt, PhD, Institute of Psychiatry, University of London, 1984. Molecular genetic studies of human behavior.

Helen Kamens, PhD, Oregon Health & Science University, 2007. Characterizing the role of nicotinic acetylcholine receptors in alcohol and nicotine behaviors.

Jeffrey Lessem, PhD, University of Colorado Boulder, 1999. Research into the methodology for detecting quantitative trait loci, particularly in relation to substance use disorders and conduct disorders.

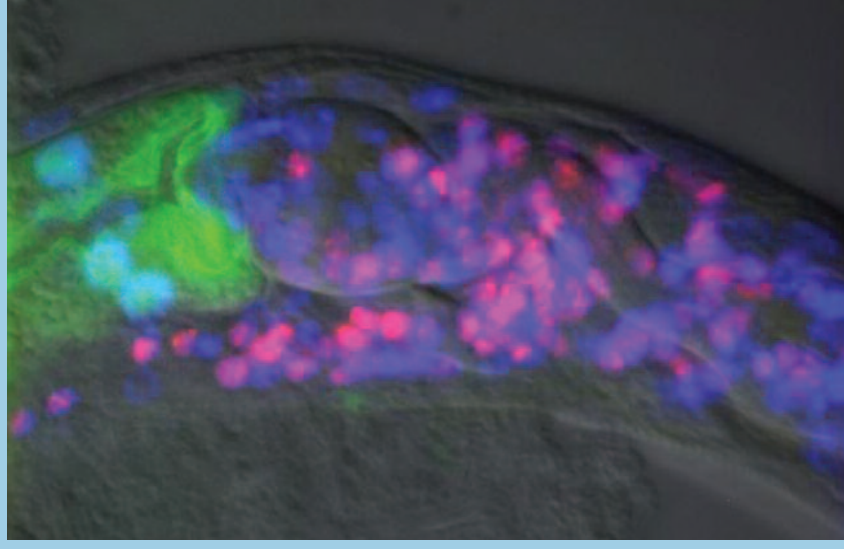
Maureen Muchimba, PhD, University of Alabama at Birmingham, 2010. Substance use and other risky behaviors, and their relationship to HIV/STI risk behaviors.

Shinya Nakamura, PhD, Tohoku University, 2009, Electrophysiological and behavioral studies of the functional significance of neuronal activity transition in the subiculum, as well as prefrontal cortex activity on the change in reward contingency.

Heidi O'Neill, PhD, University of Colorado Anschutz Medical Campus, 2010. Functional characterization of fluorescently tagged nicotinic subunits in mice. Characterization of the role of nicotinic receptor mutations in autosomal dominant nocturnal frontal lobe epilepsy.

Research Highlight: Link Lab

Dr. Link's laboratory uses the simple nematode worm *Caenorhabditis elegans* to study the basic biology of human neurodegenerative diseases, including Alzheimer's disease and amyotropic lateral sclerosis (ALS). The key assumptions are that some of the molecular and cellular events underlying neurodegenerative pathology are likely to occur even in a simple metazoan such as *C. elegans*, and the experimental advantages of this model system will simplify understanding these events. Their general approach is to: 1) construct transgenic *C. elegans* animals expressing human proteins causally associated with neurodegenerative diseases, 2) determine the resulting physiological effects, 3) seek to determine the molecular basis of these effects, and 4) extend these insights to mammalian models and the human disease itself.



Transgenic C. elegans *nematode expressing human ALS-associated protein (TDP-43). Blue, nuclei stained with DNA dye; green, intestinal tissue highlighted with green fluorescent protein; red, human TDP-43 detected with specific antibody.*

Stephanie Schmitz, PhD, University of Colorado Boulder, 1996. Genetic and environmental influences on the development of temperament, personality, and problem behavior; behavior genetics of psychopathology and health behaviors, their correlates, antecedents, and possible outcomes.

Sarah Holly Stephens, PhD, University of Colorado Anschutz Medical Campus, 2008. Genetic analyses of nicotinic receptors CHRNA5/CHRNA3/CHRNB4 as risk factors for substance dependence and adolescent behavioral disorders.

Gary Stetler, PhD, University of Utah, 1980. The application and development of high-throughput methods for the identification of genes involved in human behavior and learning.

Anne Tammimaki, PhD, University of Helsinki, 2008. Impact of human D398N polymorphism of nicotinic receptor alpha5 subunit gene in the function of nicotinic receptor subunits. Role of alpha5 subunit in nicotine-induced behaviors and neurochemical changes.

Juan A. Varela, PhD, Brandeis University 2000. Neuronal and circuit plastic changes induced by behavioral control over stress.

Jun-Gang Wang, PhD, Sapporo Medical University, Japan, 2004. Studying the effects of behavioral control over stress and cocaine on prefrontal cortical plasticity.

Cristian A. Zambrano, PhD, University of Chile, 2007. Study of the regulation of nicotinic receptor expression and cellular distribution in primary neuronal cultures and the development of a nicotine self-administration model in mice.

Joanna Zeiger, PhD, John Hopkins University Bloomberg School of Public Health, 2001. Genetic and environmental factors, particularly gene-environment interaction, that increase risk to common diseases.

Postdoctoral Fellows

Michael Baratta, PhD, University of Colorado Boulder, 2008. Experiential factors that confer vulnerability/resistance to the neural and behavioral impact of prolonged access to drugs of abuse.

Josh Bricker, PhD, University of Colorado Boulder, 2010. Longitudinal and behavioral genetic analyses of disinhibited behaviors such as substance abuse and dependence, and early sexual onset.

Amber Viola Flora, PhD, University of New Mexico, 2004. Elucidating the molecular mechanisms by which SNPS in nicotinic receptor genes influence human tobacco, alcohol, and impulsivity related phenotypes using *in vitro* cell culture techniques, investigating gene/protein interactions, and assessing behavioral differences in mice.

Christine Garver-Apgar, PhD, University of New Mexico, 2008. Biometrical analysis of individual variation in evolutionarily relevant fitness traits including intelligence, psychiatric dysfunction, and developmental instability.

Leah S. Leverich, PhD, University of Texas Southwestern Medical in Dallas, 2009. Dopamine D1 receptor modulation of hippocampal synaptic plasticity.

Alex Mendenhall, PhD, University of North Texas, 2008. Genomic, genetic, and environmental influences on variance in gene expression between isogenic individuals.

Jasmine J. Yap, PhD, Tufts University, 2009. The role of inescapable stress on the reinstatement of morphine seeking and the neuroinflammatory priming effects of stress in response to drugs of abuse in the mesocorticolimbic dopamine system.

Research and Administrative Staff

Researchers

Daphne Baber
Christopher Baddick
Allison Bailey
Allison Barrett
Jill Barrett
Alana Bremers
Amy Burkhardt
Megan Burton
Rick Casey
Leza Clymer
Mark Conner
Kim Corley
Ryan Cox
Vishantie Dostal
Amy Foote
Elizabeth Funk
Patrick Gonzales
Nick Grebe
Andrew Gross
Terry Grupp
Corinne Gunn
Penelope Herder
Dina Huber
Jacqui Hulslander
Anne Johnson
Elizabeth Johnson-Wold
Jennifer Keith
Jaklyn Kraft
James Laughlin
Amy Ledbetter
Elizabeth Mayer
Erin Meyers
Jill Miyamoto-Ditmon
Laura Namovicz
Sherry Nasif
Christina Nelson-Goens
Vivian Nguyen
Nick Ortiz
Alicia Pardo
Natalie Patzlaff
Rose Rahman
Sally-Ann Rhea
Christine Roberts
Forest Roy
Taylor Roy
Lauren Ryals
Dan Ryan
Rakel Salamander
Jerry Salazar
Tassa Saldi
Ingrid Simecek
Patricia Tedesco
William Van Morter
Helen Vernier
Paula Villar
Charles Wageman
Emily Willis
Jean Chang Yu

Student Hourly Employees

Melissa Bailey
Kyle Buckley
Jayna Davis
Hilary Devlin
Allen Fosdick
Bethany Franklin
Lori Fraser
Hanna Gissel
Valerie Grear
Krista Johnson
Esteban Loetz
Ellen MacDonald
Riley McCarthy
Colin Olivier
Kelly Olnowich
Deepika Patel
Cayla Paulson
Sonya Sanchez
Elizabeth Schanuel
Ankit Shukla
Candice Song
Ryan Venor
Brian Wanner
Patricia Wuu
Momo Yoshimura

Administrative Staff

Bobbie Atkinson
Kimberly Barton
Bridget Carey
Melissa Dunivant
Betty Kring
Sean Shelby
Janna Vannorsdel

IBG Administrative Staff: Janna Vannorsdel, Valerie Grear, Betty Kring, Melissa Dunivant, Bridget Carey, Sean Shelby

Research Highlight: Johnson Lab

The Johnson lab is composed of two groups of researchers engaged in two distinct lines of research using two very different model systems: the nematode *C. elegans* in studies of aging; and the mouse *M. musculus* in studies of fetal alcohol syndrome.

Aging

The Johnson laboratory has revolutionized the way that aging research is being done. Twenty years ago Dr. Johnson put forward the idea that a mutation in a single gene could slow the many aspects of aging. This was a revolutionary idea and almost unthinkable at that time. Their discovery of the *C. elegans age-1* mutant, which almost doubled the maximum life span, has revolutionized the basic biology of aging. Now, one can choose from more than one hundred genes where changes have been shown to lengthen life span in the *C. elegans* model organism. These mutations have identified several pathways that coordinately modulate longevity and regulate the ability of the animal to respond to stress. In a collaboration with researchers at the University of Colorado Anschutz Medical Campus, the lab has developed the means to identify mutants directly in mouse stem cells and then turn these stem cells into mice that may have greatly increased life spans. In addition, several environmental stressors such as reduced feeding (dietary restriction) and exposure to moderate levels of oxidative stress (hormesis) can prolong life. The Johnson lab has identified a molecular marker (genetically engineered into a Green Fluorescent Protein, GFP signal construct, that has been integrated into the genome and allows expression and visualization) such that it is a predictor of future life span and health. These observations have been employed to study stochastic variation in length of life and the lab has developed new biomarkers that are early-life predictors of future life span and health. These studies suggest that there are many "aging processes," some of which are co-modulated and some of which are not. It is the collective ensemble of action of these multiple processes that we call "aging."

Fetal Alcohol Syndrome (FAS)

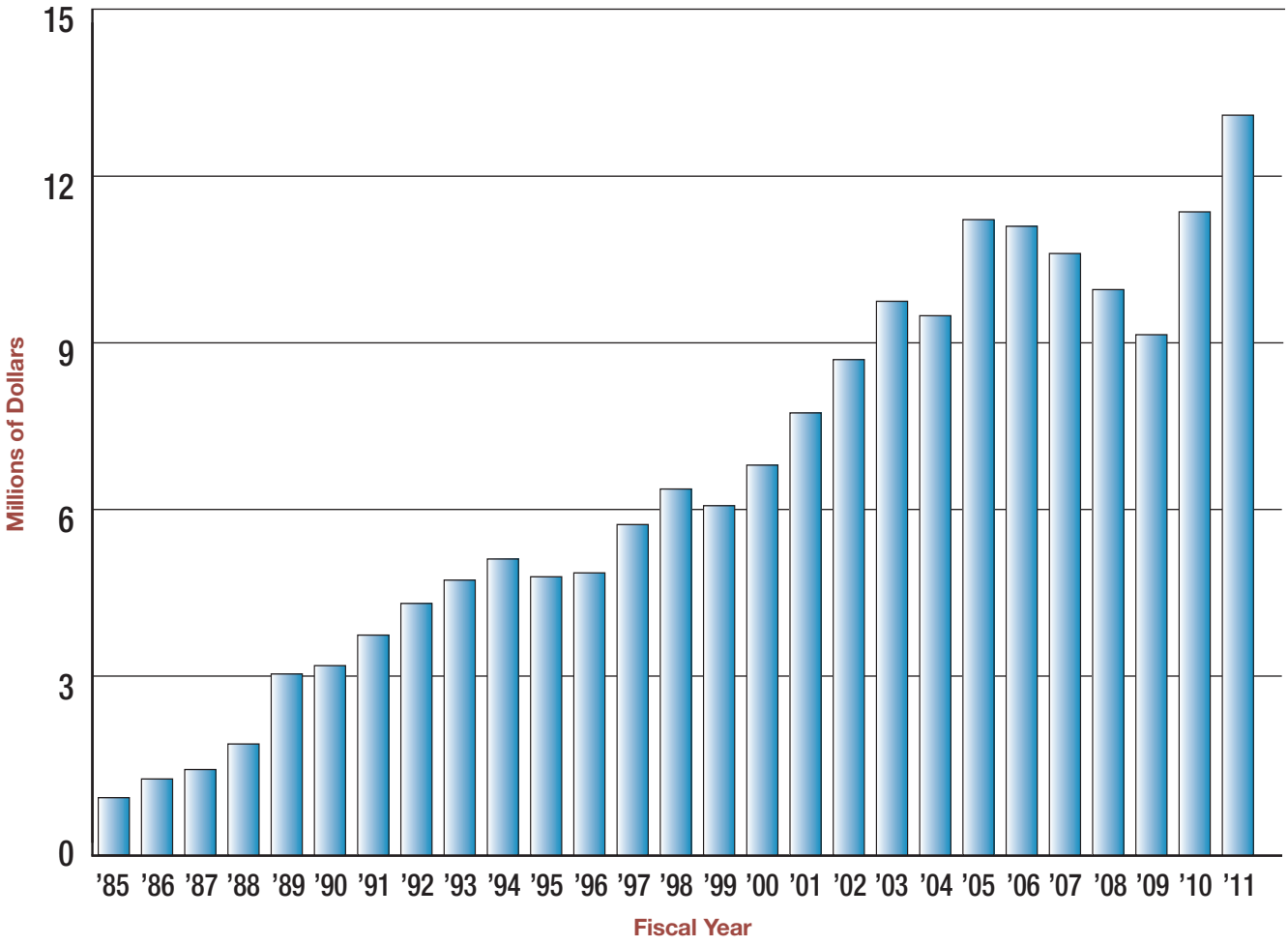
FAS is a debilitating mental disease that results from exposure to "binge-levels" of alcohol, *in utero*. The Johnson Lab has used a fetal mouse model to study FAS. They discovered that some strains of mice are sensitive to alcohol and that other strains are resistant, showing differential effects of exposure to high levels of alcohol during development. One strain of mice is sensitive to many toxins and to multiple alcohol teratogenic effects while another strain is not. The lab is using this mouse model to identify several quantitative trait loci (QTL) for sensitivity to FAS. QTLs are genes that contribute to quantitative (i.e., continuous) variation in an observed characteristic (e.g., FAS) of an individual in a population. The lab is also investigating epigenetic events surrounding FAS. These are DNA modifications that affect gene expression without changing DNA sequence and can be passed on to offspring when fetal cells divide. Their studies have shown there are epigenetic responses to alcohol exposure and that different mouse strains respond quite differently to the same alcohol dose at a given age. One mouse strain responds to alcohol exposure by inducing the expression of hundreds of genes while another strain induces very few. Some of these genes are presumably causally involved with differential sensitivity to alcohol exposure. The lab is trying to sort these out using a variety of genetic and epigenetic strategies including whole genome Expression-QTL (E-QTL), which examines gene expression variation in QTL mapping studies, and by examining the differential methylation of DNA in response to alcohol exposure.

Maria McClure, Johnson Lab

Research, Training, and Education Support 2010–2011

Source of Funding	Number of Awards	Fiscal Year Dollars	Total Grant Dollars
Federal Agencies			
National Cancer Institute	1	269,744	1,342,205
National Heart Lung and Blood Institute	1	391,571	1,183,625
National Institute on Aging	2	406,318	1,770,699
National Institute on Alcohol Abuse and Alcoholism	2	908,042	4,810,075
National Institute of Child Health and Human Development	10	4,119,233	26,998,211
National Institute on Drug Abuse	14	6,179,760	25,363,607
National Institute of Mental Health	3	761,365	3,387,263
National Insitute of Neurological Diseases and Stroke	1	325,742	1,663,245
Non-Federal Agencies and Services			
SRI International	1	33,003	50,000
Genotyping Services	8	72,410	73,292
Training Grants			
National Institute of Child Health and Human Development	1	277,197	1,373,375
National Institute on Drug Abuse	1	272,347	1,365,207
National Institute of Mental Health	1	230,059	1,154,907
Educational Grant Programs and Fellowships			
National Institute of Mental Health	2	177,045	778,907
Total	48	$14,423,836	$71,314,618

Expenditures



"The most accurate way to make year-to-year comparisons of data on research and other sponsored project activity is to look at actual expenditures."

Office of Contracts and Grants
Annual Report Fiscal Year 2004

Research Activities for Fiscal Year 2010–2011

The following lists all new and ongoing projects awarded to the University of Colorado Boulder campus and administered through the Institute for Behavioral Genetics. Dollar figures in parentheses list the total amount for the project period, followed by the amount awarded during fiscal year 2011. The abbreviation "NCE" indicates the project is active and ongoing but in a "no-cost extension" year during which the project does not receive additional funding from the granting agency.

Aging and Neurodegenerative Disease

NIA (RO1-AG012423) **Transgenic *C. Elegans* as Amyloid Disease Model** ($1,555,418; $297,087), 9/1/96–3/31/13. The goal of this project is to understand the cellular and molecular basis of β-amyloid peptide (Aβ toxicity using genetic and molecular genetic analysis of transgenic *C. elegans* animals expressing the human Aβ peptide.

Principal Investigator: Christopher D. Link

NIA ARRA (PO1-AG022500) **The Biodemographic Determinants of Life Span** 9/30/09–8/31/14. The overarching goal of this program (J. R. Carey, PI) is to bring collaborative efforts between demographers and biologists to bear on questions concerned with the evolutionary, genetic, ecological, and social determinants of aging and lifespan. The program involves world renowned researchers at approximately 15 participating institutions with collective expertise from a dozen different scientific disciplines ranging from demography, mathematics, and economics to molecular biology, ecology, and entomology.

IBG Subcontract: **Natural Ecology of Stress and Aging in *C. Elegans*** ($215,281; $109,231). This grant supports collection and study of *Caenorhabditis* species in the wild and will be investigating the role that variable environmental inputs play in modulating the demography of *C. elegans* in a strain-specific way.

Principal Investigator: Thomas E. Johnson

NINDS (RO1-NS063964) **Investigation of TDP-43 Function and Toxicity in *C. Elegans*** ($1,663,245; $325,742), 4/1/09–3/31/14. This project investigates the conserved functions of TDP-43 and progranulin by characterization of *C. elegans* strains containing loss-of-function mutations in these genes. It will also determine why transgenic expression of human TDP-43 in *C. elegans* is neurotoxic, and complement these studies with parallel analyses in cell culture.

Principal Investigator: Christopher D. Link
Co-investigator: Leonard Petrucelli

Alcohol

NIAAA (RO1-AA017889) **Translational Studies of Nicotinic Receptor Genes: Alcohol and Nicotine Behaviors** ($2,714,662; $525,358), 9/1/09–5/31/14. The goal of this project is to identify novel variations in neuronal nicotinic receptor genes. These novel variations, as well as previously known variations, will be tested for association with specific alcohol and tobacco related behaviors in a large Colorado-based mixed sample of community and clinical subjects. In addition, laboratory functional assays will be used to determine whether particular gene variations lead to molecular differences in biological function.

Principal Investigator: Marissa A. Ehringer
Co-investigators: Robin P. Corley, Matthew B. McQueen, Jerry A. Stitzel

NIAAA (RO1-AA16676) **Ethanol Teratogenesis and Genomic Imprinting** ($2,095,413; $382,684), 9/30/06–7/31/11. This grant supported work on the molecular etiology of fetal alcohol syndrome (FAS) using a mouse model in which teratogenic effects of FAS can be associated with epigenetic changes at the DNA and histone level. There is also a therapeutic component allowing possible treatment of FAS.

Principal Investigator: Thomas E. Johnson
Co-investigator: Chris J. Downing

Electrophysiological Studies of Drugs of Abuse

NIDA (KO1-DA017750) **DNA Microarray Analysis of Neuronal Excitability** ($206,748; $36,108), 4/01/09–4/30/11. This study identified the specific ion channels that are important in the neuronal excitability associated with cocaine addiction.

Principal Investigator: Donald C. Cooper

NIDA (RO3-DA023719) **Pathway Specific Ecstasy-induced Plasticity of Excitability in the Subiculum** (NCE $75,750), 7/1/08–5/31/11. The purpose of these studies was to determine how ecstasy leads to long-term changes in serotonin signaling neuronal excitability and dendritic morphology within specific pathways from the subiculum to prefrontal cortex or nucleus accumbens using a model of inbred rats that lack an enzyme to metabolize MDMA.

Principal Investigator: Donald C. Cooper

NIDA (RO1-DA024040) **Plasticity of Excitability in Ventral Subiculum After High Cocaine Intake** ($1,226,019; $350,349), 8/15/09–1/31/13. The purpose of these studies is to study synaptic and intrinsic excitability and dopamine modulation of ventral hippocampal CA1-subicular excitability that is associated with acquisition, maintenance, and withdrawal/extinction of cocaine self-administration.

Principal Investigator: Donald C. Cooper

Genome-Wide Association Studies

NICHD (RO1-HD060726) **Social Demographic Moderation of Genome-Wide Associations for Body Mass Index** ($3,053,202; $651,782), 7/1/10–6/30/15. This project proposes to genotype the fraternal twin and full sibling pairs of the National Longitudinal Study of Adolescent Health across the human genome and perform a genome-wide association study for body mass, waist circumference, and energy-related behaviors with an emphasis on genome-wide gene by environment and gene by behavior interactions.

Principal Investigators: Matthew B. McQueen, Jason D. Boardman
Co-investigator: Andrew Smolen

Research Highlight: Tabakoff Lab

The focus of the Tabakoff Laboratory is systems genetic analyses of complex traits, specifically those related to alcohol and drug dependence and abuse. Their lab has developed both databases and tools to integrate data from different biological intermediates (DNA sequence, transcriptome, proteome) in the pathway from DNA to disease. They currently have extensive data on mRNA expression in brain and other organs for a number of RI panels of mice and rats and inbred strains and selected lines, along with information on DNA sequence for each. These data can be used as a 'predisposition' database to identify genetic profiles and pathways that predispose these animals to a behavioral trait. Both the data and tools are available to the research community through their website, http://phenogen.ucdenver.edu. Using these data and cutting-edge statistical methodology, members of the lab have dissected such complex traits as alcohol preference in several mouse and rat models. Their results indicate that there are several pathways that influence this trait and many of these pathways are conserved across species (mouse, rat, and human). Furthermore, there are multiple ways that these influential pathways can be perturbed to generate differences in alcohol preference. By taking a systems approach, the Tabakoff Lab has been able to map biological processes and their interactions, allowing for a more efficient identification future of therapeutic targets. The modeling techniques established in the lab can also provide insight into possible unintended side effects of targeting a particular molecule and they can evaluate the effect of targeting of multiple biological molecules simultaneously. The goals of the Tabakoff Lab are to expand their knowledge into the area of non-coding RNA transcripts and to further develop the tools for genetical/genomic and systems analysis of biology and therapeutics.

Transcriptional pathways associated with alcohol consumption (Vanderlinden et al. submitted)

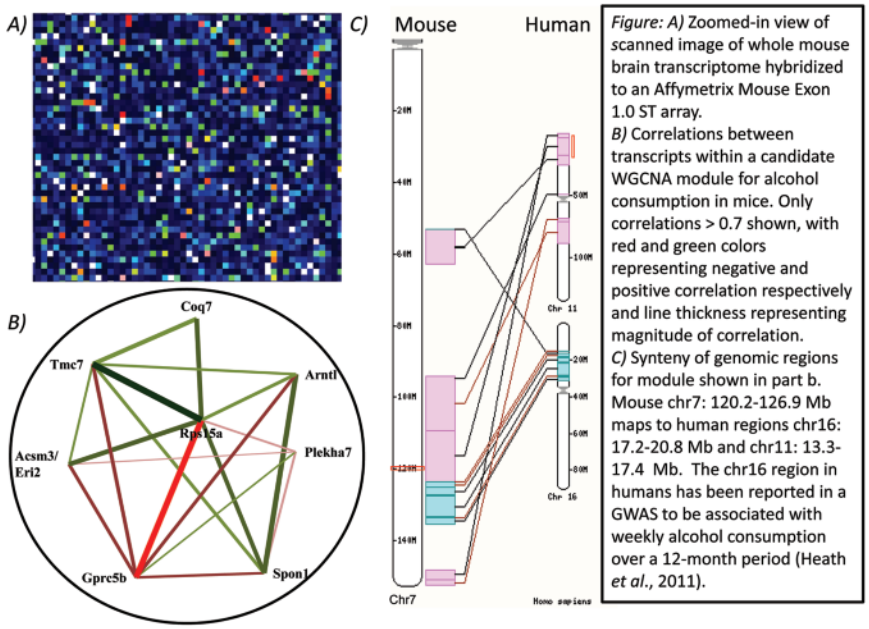


Figure: A) Zoomed-in view of scanned image of whole mouse brain transcriptome hybridized to an Affymetrix Mouse Exon 1.0 ST array. *B)* Correlations between transcripts within a candidate WGCNA module for alcohol consumption in mice. Only correlations > 0.7 shown, with red and green colors representing negative and positive correlation respectively and line thickness representing magnitude of correlation. *C)* Synteny of genomic regions for module shown in part b. Mouse chr7: 120.2-126.9 Mb maps to human regions chr16: 17.2-20.8 Mb and chr11: 13.3-17.4 Mb. The chr16 region in humans has been reported in a GWAS to be associated with weekly alcohol consumption over a 12-month period (Heath *et al.*, 2011).

NIDA (KO1-DA023487) **Genome-Wide Association and the Genetics of Substance Use Disorders** 7/1/09–6/30/14. This five-year project (C. Hartman, PI) includes research and training in genome-wide association methods in order to examine the genetic contributions to substance dependence and impulsive/risky behaviors. The project will recruit subjects with substance use disorders and antisocial behaviors, conduct assessments, and conduct genome-wide association analyses examining alcohol consumption and substance dependence/ impulsive behaviors.

IBG Subcontract ($41,271; $6,640). The Boulder component of this grant provides database support for the information collected as part of the study to examine single nucleotide polymorphisms genotyping of candidate genes for marijuana use behaviors.

Principal Investigator: Robin P. Corley

NIDA-ARRA (RO1-DA024411) **Gene-Environment Interplay in the Development of Drug Abuse and Comorbid Problems** 8/15/09–7/31/11. Tobacco and alcohol abuse and dependence are leading preventable causes of disease and death in the United States. Vulnerability to develop tobacco and alcohol dependence and comorbid problems is influenced by a combination of environmental and genetic factors. This project (K.G. Hill, PI), investigated how genes and environment work together in affecting the development of tobacco and alcohol addiction in adulthood.

IBG Subcontract ($484,890; $317,708). The IBG subcontract was primarily engaged in the genetic analysis of the genome-wide association study. In particular, IBG provided investigator effort, technical support, and resource costs for DNA processing and genotyping, as well as guided the analysis and interpretation of the genetic analyses. IBG also worked closely with Seattle investigators to ensure a smooth harmonization of phenotypic with genotypic data.

Principal Investigator: Matthew B. McQueen
Co-investigators: John K. Hewitt, Andrew Smolen

continued on page 24

Institute for Beh

University of Co

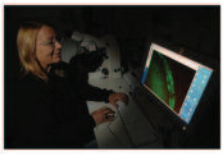
The Institute

Mission

Founded in 1967, the Institute for Behavioral Genetics (IBG) conducts research which examines the genetic bases of individual differences in behavior and provides research training in this interdisciplinary area.

Research

IBG is one of the top facilities in the world for genetic research on behavior. Data collection and analysis are ongoing for several internationally renowned studies including the Colorado Adoption Project, the Colorado Twin Registry, the National Youth Survey Family Study, the Colorado Learning Disabilities Research Center, and the National Longitudinal Study of Adolescent Health. IBG is home to one of the nation's largest DNA repositories for research on human behavior, as well as housing a wide array of behaviorally and genetically defined lines of selected, recombinant inbred, transgenic, and knockout-gene mice.



Throughout its history IBG has been characterized by the breadth of its interdisciplinary research and training programs. Although the methodology of behavioral genetics is generally applicable to the study of individual differences for any characteristic, research at IBG is focused on behaviors of societal relevance.

Current research includes studies of aging, neurodegenerative disease, psychopathology, reading and learning disabilities, cognition, substance abuse, behavioral development, and evolution.

Training

IBG trains graduate students in the study of genetic influences on behavior. This is accomplished by requiring students to obtain a strong training in a primary academic discipline, by instructing them in the interdisciplinary content of behavioral genetics, and by providing an atmosphere that fosters interactions among scholars from different disciplines.

We direct three NIH pre- and postdoctoral training grants (from the National Institutes of: Mental Health; Child Health and Human Development; and Drug Abuse) supporting 13 graduate students and 4 postdoctoral fellows, and we co-direct another training grant supporting 8 postdoctoral fellows from the National Institute on Alcoholism and Alcohol Abuse.

Societa

Drug Abuse

- Center on Antisocial Drug Dependence
- Biology of Nicotinic Receptors
- Biology of Alcoholism

Reading Disabilities

- Colorado Learning Disabilities Research Center

Scientific Impact

50+ peer reviewed scientific papers annually

12 papers published in *Science* by current IBG faculty

Full Profs (3) cited more than 500 times each in 2010

Two major NIH funded research centers: The Learning Disabilities Research Center (P50HD027802) and the Center on Antisocial Drug Dependence (P60DA011015).

Major contributions to the molecular biology of nicotinic receptors, genetics of reading disability, genetic epidemiology of drug and alcohol abuse, identification of genes controlling lifespan and neurodegenerative disease, and genetic influences on behavioral development.

avioral Genetics

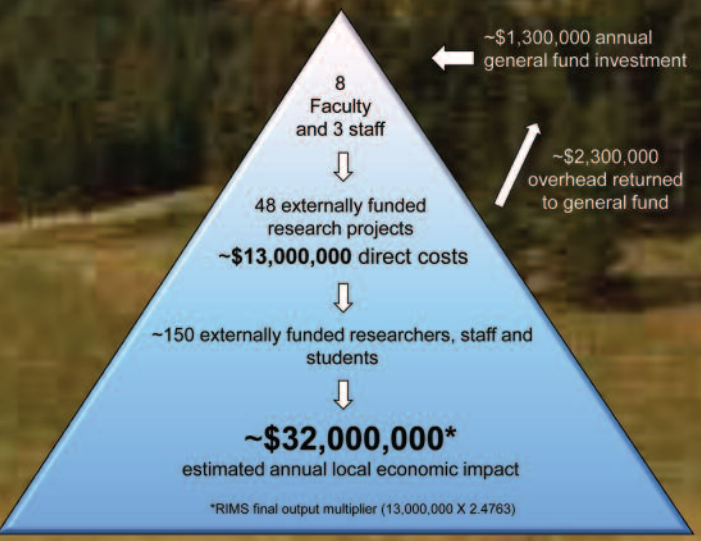
olorado Boulder

l Impact

Aging & Alzheimer's Disease → Molecular Genetics of Lifespan; Neurodegenerative Diseases

Psychopathology → ADHD; Conduct Disorder

Fiscal Impact



Research Highlights

Reading Disability: demonstrated the genetic influence on reading difficulties (DeFries et al., 1987, *Nature*, 329: 537-539) and identified a locus on chromosome 6p which contributes to this genetic risk (Cardon et al, 1994, *Science*, 266: 267-269; Fisher & DeFries, 2002, *Nature Reviews Neuroscience*, 3, 767-780).

Aging: discovered a mutation, *age-1*, that results in a two-fold increase in the life span of the nematode, *C. elegans*, a model organism for biological research (Johnson TE, *Science*, 1990, 249: 908-912). Developed the only existing method for predicting subsequent life span (Rea et al., 2005, *Nature Genetics*, 37:894-898.

Nicotinic receptors: characterized the molecular biology of nicotinic receptors and the behavioral consequences of their genetic variation in animal models, and demonstrated that activation of one of these receptors is important in the development of nicotine dependence (Tapper et al, 2004, *Science*, 306: 1029-1032). Genetic variation in these nicotinic receptors has been associated with drug seeking behaviors in our human study populations (Schlaepfer et al, 2008. *Current Drug Abuse Reviews*, 1:124-134).

Risky behavior: described a heritable trait, behavioral disinhibition, that predisposes individuals to a range of risky behaviors such as substance use and abuse, conduct problems, and impulsive behavior (Young et al, 2009, *Journal of Abnormal Psychology*, 102:78-87). Ongoing twin, adoption, and family studies include brain imaging and genome wide association studies to locate specific brain regions and genes associated with behavioral disinhibition.

Personality: identified chromosomal loci influencing anxiety in a mouse model of neuroticism (Flint et al, 1995, *Science*, 269: 1432-1435).

Cognition: demonstrated that executive cognitive control, associated with frontal cortical function, is genetically influenced independently of general intelligence (Friedman et al, 2008, *Journal of Experimental Psychology: General*, 137: 201-225).

Faculty, Researchers & Students

There are 8 tenured or tenure-track faculty rostered in the Graduate School and based at IBG. In total there are 32 Faculty Fellows, most of whom hold joint appointments in academic units on the Boulder and Denver campuses. Although Behavioral Genetics can be thought of as the intersection between genetics and the behavioral sciences, our faculty comes from a broader range of backgrounds.

On the Boulder campus: Dept of Psychology & Neuroscience (10 +3 emeritus), Dept of Ecology & Evolutionary Biology (2), MCDB (1), Dept of Integrative Physiology (4), Dept of Sociology (1), Graduate School (2)

At the University of Colorado Denver: Departments of Pharmaceutical Sciences (2), Pharmacology (3), and Psychiatry (2), and the Center for Bioethics and Humanities (1). At the University of Denver: Department of Psychology (1).

In addition to our research mission, faculty on the Boulder campus participate in both undergraduate and graduate teaching.

Currently, 21 graduate students mentored by IBG faculty fellows participate in the IBG training program; since we are not a degree-granting institute, all current graduate students are affiliated with academic units on the Boulder campus.

Approximately 32 postdoctoral fellows, research associates, and senior research associates are employed at IBG.

Approximately 58 PRAs, 13 administrative and animal laboratory staff members and 31 undergraduate student employees work on our various research projects.

NICHD (RO1-HD064687) **A Genetic Study of Personal Traits that Promote or Inhibit Individual Well-Being** 7/23/10–5/31/15. The Family Transitions Project is a longitudinal study involving more than 550 target respondents and their families; a total of approximately 3,000 individuals (R. Conger, PI).

IBG Subcontract ($2,585,772; $658,444). This study will add a genetic component to an existing three-generation longitudinal family study. Adding genetic data to this rich archive of contextual and phenotypic data will allow us to conduct a family-based genome-wide association study to investigate genetic and environmental influences on personal characteristics that are associated with competent development and adaptation or with risk for developmental problems such as academic failure, emotional distress, substance abuse, and antisocial behavior.

Principal Investigator: Michael C. Stallings
Co-investigators: Matthew B. McQueen, Jason Boardman, Andrew Smolen

Learning Disabilities

NICHD (P50-HD027802) **Learning Disabilities Center: Differential Diagnosis in Learning Disabilities** ($8,822,085; $1,078,118), 3/10/06–11/30/11. The long-range objectives of this Learning Disabilities Research Center (J.C. DeFries & R.K. Olson, Directors) are the identification, characterization, validation and amelioration of etiologically distinct subtypes or dimensions of learning disabilities.

The following fiscal information includes the primary award plus all subsequent supplements to years 19 and 20.

Administrative Core ($1,677,772; $236,293): The Administrative Core Unit is responsible for coordinating the activities of the five research projects that make up the center; maintaining communication among the participating investigators; ascertaining, scheduling, and paying subjects; obtaining questionnaire data from families of twins; obtaining blood samples from twin pairs with reading disability and/or ADHD and from their biological parents and siblings for the genetic association and sibling-pair linkage analyses described in Research Project IV; preparing subcontracts and consortium agreements; managing the center budget; and administering center expenditures and other fiscal matters.

Principal Investigator: Richard K. Olson
Co-investigators: John C. DeFries, Erik G. Willcutt, Sally Wadsworth

Research Project I: **Twin Studies of Reading Difficulties and ADHD** ($989,990; $122,127). The long-range objectives of the center are the identification, characterization, validation, and amelioration of etiologically distinct subtypes or dimensions of learning disabilities.

Principal Investigator: John C. DeFries
Co-investigator: Erik G. Willcutt

Research Project II: **Reading, Writing and Language Processes** ($1,841,523; $221,231). The objectives of this research project were to assess component processes and knowledge in reading, writing, and related language skills, in twins and siblings selected for deficits in reading and/or ADHD, and in normal-range control twins.

Principal Investigator: Richard K. Olson
Co-investigator: Janice M. Keenan

Research Project III: **Understanding Comorbidity Between Reading Disability and ADHD** ($1,279,007; $158,583). The specific aims of this project are to use multiple methods of analysis to refine our understanding of the nosology, etiology, and neuropsychology of ADHD and to test the etiology of comorbidity between RD and ADHD.

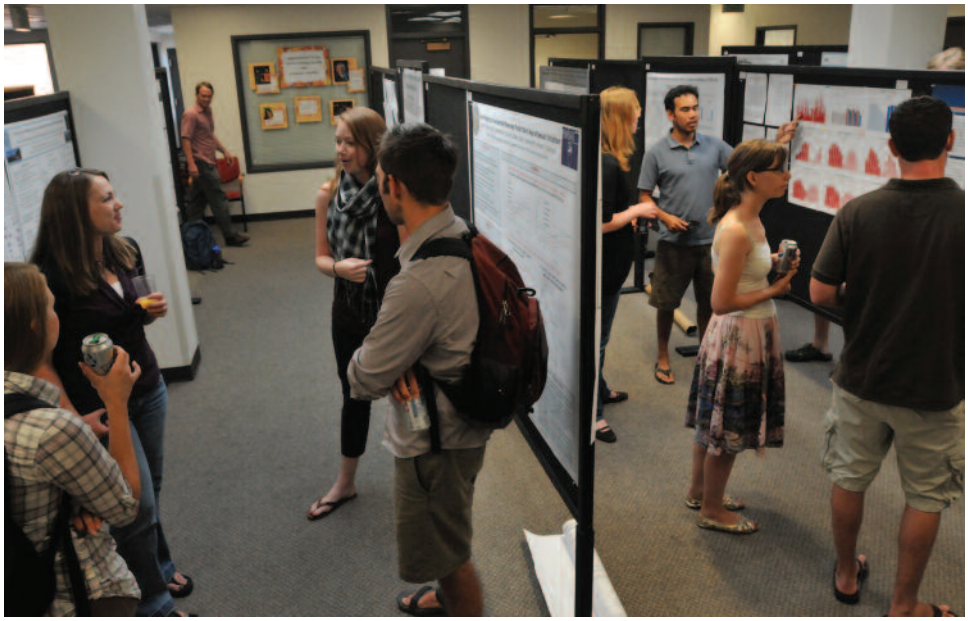
Principal Investigator: Bruce F. Pennington
Co-investigator: Erik G. Willcutt

Research Project IV: **University of Nebraska/Institute for Genetics and Rehabilitation** ($1,085,418; $119,920). The overall goal of Project IV is to identify genes that influence reading disability and ADHD and to elucidate the molecular pathways involved in the reading process.

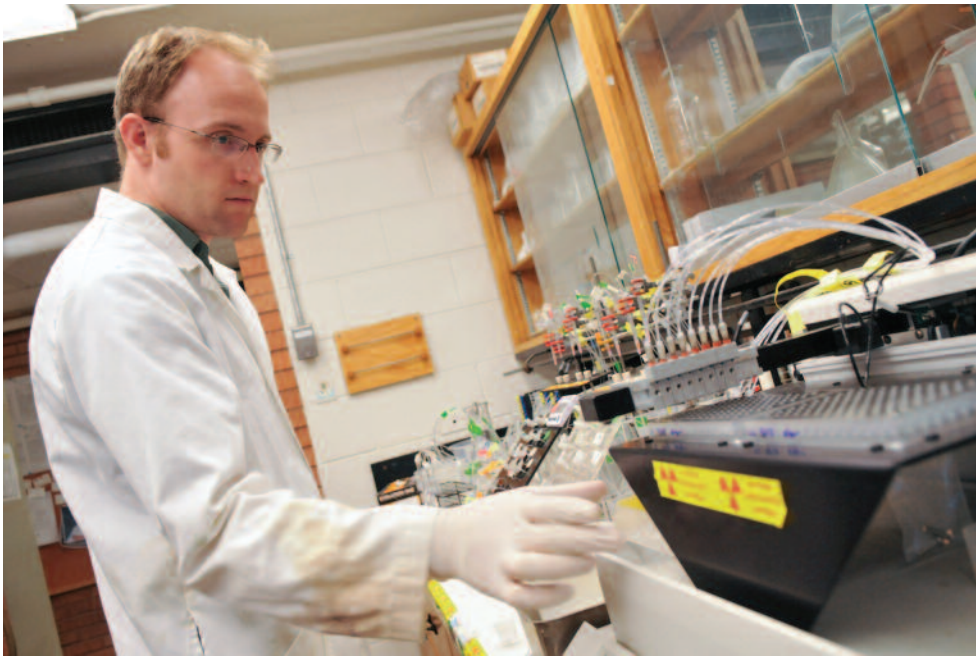
Principal Investigator: Shelly Smith

Research Project V: **University of Colorado Boulder/Institute for Cognitive Science** ($1,791,341; $219,964). Research Project V uses adaptive computer-assisted reading programs to study practical and theoretically interesting questions about a new way to identify and teach children with reading difficulties, called Response to Intervention.

Principal Investigator: Barbara Wise



IBG holds an annual Orientation and Poster Day to celebrate the start of the academic year and to welcome our new graduate students and postdoctoral fellows to our training program. Participants bring research posters they have presented at scientific meetings during the previous year. The posters provide an opportunity for all members of IBG to get together for an afternoon of stimulating conversation, as well as introduce our new students and postdocs to the breadth of research conducted at IBG.



Charles Wageman, Marks Lab, assays nicotine stimulated dopamine release.

NICHD (RO1-HD038526) **Longitudinal Twin Study of Early Reading Development** ($1,853,181; $266,797), 6/1/06–5/31/11. The proposed research assessed the etiology of individual differences in pre-reading and early reading development, and their co-variation with individual differences in attention.

Principal Investigator: Richard K. Olson
Co-investigators: Robin P. Corley, John C. DeFries, Jan Keenan, Bruce F. Pennington, Sally Wadsworth, Erik G. Willcutt

NICHD (RO1-HD047264) **Etiology of Reading Disabilities and Comorbid ADHD** ($2,677,802; NCE), 07/15/05–05/31/12. This is a study that includes a genome-wide screen for quantitative trait loci that increase risk for reading disability and ADHD.

Principal Investigator: Erik G. Willcutt
Co-investigators: Nomita Chhabildas, Robin P. Corley, John C. DeFries, Richard K. Olson, Andy Smolen, Sally Wadsworth

Longitudinal Studies

NICHD-ARRA (RO1-HD010333) **Determinants of Behavioral Development** ($820,269; $399,423), 8/1/09–7/31/11. The primary objective of the Colorado Adoption Project was to assess genetic and environmental influences on individual differences in behavioral development. The study included 245 adoptive families, including birth parents, adoptive parents, and their children (probands and siblings), as well as 245 matched control (nonadoptive) families. The children were tested/interviewed in their homes at ages 1, 2, 3, and 4; in the laboratory at 7, 12, and 16; and by telephone at 5, 6, 8, 9, 10, 11, 13, 14, and 15. In addition, the project included a well-established cohort of 483 twin pairs tested at the same ages. Adopted and nonadopted probands and their siblings are currently being assessed in early adulthood (ages 20–25). The proposed continuation of this grant will provide for a 10-year follow-up of the CAP probands and siblings in their early 30s, resulting in a landmark study of behavioral development from infancy to adulthood utilizing a genetically informative design.

Principal Investigator: Sally J. Wadsworth
Co-investigators: Robin P. Corley, John C. DeFries, Michael C. Stallings, Chandra Reynolds, Stephen Petrill

NICHD (PO1-HD31921) **The National Longitudinal Study of Adolescent Health.** The primary purpose of this study (K.M. Harris, PI) is to increase understanding of how contextual factors in the lives of adolescents influence their health and risk behaviors.

IBG Subcontract—**Project I: Wave IV Data Collection** ($2,769,560; $178,021), 1/1/06–6/30/11. This subproject is responsible for archiving the DNA and genotyping the Wave IV respondents.

Principal Investigator: Andrew Smolen
Co-investigator: Gary L. Stetler

IBG Subcontract—**Project V: Gene by Environment Contributions to Drug Use and Problem Behavior Trajectories** ($736,202; $76,911), 1/1/06–6/30/12. The goal of the proposed project is to trace, locate, and re-interview respondents who participated in Wave I of the National Longitudinal Study of Adolescent Health (Add Health). This data analysis subproject will examine the developmental trajectories of drug use and related behaviors, including conduct problems and risky sexual behavior.

Principal Investigator: John Hewitt
Co-investigators: Marissa A. Ehringer, Susan Young, Jeff Lessem

NICHD (RO1-HD050346) **Testing a Developmental Model of Conduct Problems** ($847,188; $152,497), 9/1/07–6/30/12. The main goal of this study is to examine existing data from the Colorado Longitudinal Twin Study to test the developmental propensity model, which advances specific and testable hypotheses regarding the causes of conduct problems.

Principal Investigator: Soo Rhee
Co-investigator: Naomi P. Friedman

NIMH (RO1-MH063207) **Executive Functions and Self-Regulation: A Twin Study** ($1,760,600; $447,563), 9/1/08–5/31/12. This twin study will assess, during the transition from adolescence to young adulthood, genetic and environmental contributions to stability and change in executive functioning: individual differences in self-regulation; and the relationships between executive functions and self-regulation.

Principal Investigator: John K. Hewitt
Co-investigators: Robin P. Corley, John C. DeFries, Naomi P. Friedman, Akira Miyake, Erik G. Willcutt, Susan E. Young

Research Highlight:
Learning Disabilities Center: Differential Diagnosis in Learning Disabilities

The long-range objectives of the Colorado Learning Disabilities Research Center (CLDRC) are the identification, characterization, validation, and amelioration of reading disabilities and ADHD, the two most prevalent and often comorbid disorders of childhood. To accomplish these objectives, the CLDRC employs a unique approach that assesses the extent to which genetic and environmental influences underlie these disorders, and that uses covariation in etiology to understand whether deficits in component skills of reading are manifestations of a single syndrome or represent separate subtypes.

During the funding period 2005–2011, test batteries that include psychometric measures of cognitive and academic abilities (Project I), reading, writing, and language processes (Project II), and ADHD and executive functions (Project III) are administered to a sample of identical and fraternal twins and their siblings in which at least one member of each twin pair has a reading disability, to an independent sample of twins and their siblings in which at least one member of each twin pair has ADHD, and to a comparison group of twins with no school history of reading disabilities or ADHD. Resulting data are being used to assess the etiologies of reading deficits (including word recognition skills, reading fluency, comprehension, and writing), ADHD, and their comorbidity, as well as their covariation with measures of phoneme awareness, phonological decoding, orthographic coding, vocabulary, listening comprehension, and executive functions. In order to map quantitative trait loci that influence learning disabilities, and conduct association and mutation analyses, DNA samples are obtained from families of all twin pairs (Project IV). Project V assesses response to computer-assisted instruction in early (K–4) at-risk readers. Response to instruction in project V is also studied in the Project IV molecular-genetic analyses. An administrative core unit coordinates the activities of the five research projects, ascertaining and scheduling subjects, obtaining questionnaire data and DNA samples, and administering the center's budget.

The CLDRC has been awarded renewed funding from December 1, 2011, to November 30, 2016, to continue much of the work described above, with additional emphasis on reading comprehension, writing, and the longitudinal outcome for children with reading disabilities and/or ADHD who were tested earlier in the CLDRC.

Reading disabilities and ADHD are important public health problems. The research in the CLDRC will advance our understanding of their etiology and remediation.

NICHD (RO1-HD068728) **Etiology and Neuropsychology of Math, Reading, ADHD, and Their Covariation** ($2,832,950; $657,240), 4/15/11–1/31/16. Reading disability, math disability, and attention-deficit/hyperactivity disorder are common disorders of childhood that often co-occur due to unknown causes. This study will administer measures of neuropsychologcal functioning to two large longitudinal studies of twins to assess the genetic, environmental, and neuropsychological factors that lead to stability and change in each disorder and the specific factors that lead to their frequent co-occurrence.

Principal Investigators: Erik G. Willcutt, Steven A. Petrill
Co-investigators: Robin P. Corley, John C. DeFries, Naomi P. Friedman, Richard K. Olson, Sally Wadsworth

NIMH (P50-MH079485) **IBSC: Determinants of Executive Function and Dysfunction** 4/22/08–1/31/13. The Interdisciplinary Behavioral Science Center (M.T. Banich, director) is designed to understand the computational, psychological, and neurobiological underpinnings of executive function, which broadly defined are those skills that allow for goal-directed behavior. The goal of IBSC is to address two fundamental questions about executive function: What are the component mental processes that contribute to executive control and how does the brain support and enable executive function?

IBG Subcontract—**Project 4: Genetic Mechanisms of Executive Functions** ($974,965; $182,811). The goal of this project is to use molecular genetic analyses in concert with computational modeling to begin to specify in more detail how the dopamine system regulates three correlated but separable executive functions—inhibiting prepotent response, updating working memory, and shifting mental sets. Existing molecular and psychometric data on approximately 800 individual twins who were tested on nine index executive tasks at age 17 and were also tested on general cognitive ability and IQ at age 16 will be analyzed.

Principal Investigator: Naomi P. Friedman
Co-investigators: John K. Hewitt, Akira Miyake, Erik G. Willcutt, Randy O'Reilly, Susan Young, Andrew Smolen, Brett Haberstick

HL (PO1-HL36587-A1) **Genes, Environmental Stressors and the Biobehavioral Pathways to CVD** 4/1/10–3/31/15. The overarching long-range goal of this program project (R.B. Williams, PI) is to carry out translational research leading to the identification of genetic variants that act to increase the expression of endophenotypes that lead over time to the development of cardiovascular disease (CVD) and Type 2 diabetes, a major CVD risk factor.

IBG Subcontract ($1,183,625; $391,571). This study will genotype and contribute to the analysis of single nucleotide polymorphisms that are proposed to be related to stress effects on cardiovascular disease using the Adolescent Health Wave IV DNA samples.

Principal Investigator: Andrew Smolen
Co-investigator: Matthew B. McQueen

Nicotine and Nicotinic Receptor Studies

NCI (PO1-CA089392) **Collaborative Genetic Study of Nicotine Dependence** 7/1/08–6/30/13. The objective of this program project (L.J. Bierut, PI) is to understand the genetics of nicotine addiction using human populations and mouse models.

IBG Subcontract—**Project 3: Role of Chrna5 in Modulating Sensitivity to Nicotine in Mice** ($1,342,205; $269,744). Dr. Stitzel's effort will focus on using mouse models to understand the role of the nicotinic receptor gene Chrna5 in altering individual sensitivity to the effects of nicotine.

Principal Investigator: Jerry A. Stitzel

NIDA (RO1-DA003194) **Genetics of Nicotine Tolerance: Role of Receptors** ($2,685,588; $494,063), 5/1/09–4/30/14. The studies supported by this grant use nicotinic receptor gene knockout (null mutant) mice to establish the subunit compositions of native neuronal nicotinic receptors, determine the effects of chronic nicotine treatment on receptor numbers and function, and identify receptor-related mechanisms that underlie the development of tolerance and/or sensitization to behavioral effects produced by nicotine.

Principal Investigator: Michael J. Marks
Co-investigators: Sharon Grady, Allan Collins

NIDA (RO1-DA012242) **Alpha-Conotoxin MII: Selective Nicotinic Receptor Probe** 9/1/08–8/31/12. Nicotine elicits behavioral effects through a diverse family of nAChR, and nicotine evoked dopamine release is thought to play an important role in the establishment and maintenance of nicotine dependence.The proposed studies (P. Whiteaker, PI) will provide further insights into the nature of three novel, native nAChRs sensitive to inhibition by aCtxMII and may lead to better understanding of the basis of the effects of nicotine.

IBG Subcontract ($836,287; $230,199). The experiments outlined in the current proposal will use ligand binding and functional analyses to further examine the diversity of nAChR that interact with α-Conotoxins. These studies also examine the effects of chronic nicotine exposure on the receptor subtypes that interact with the alpha-conotoxins and use null mutant mice to investigate subsets of these receptors.

Principal Investigator: Michael J. Marks
Co-investigator: Sharon Grady

NIDA (RO1-DA015663) **Studies With Nicotinic Null Mutant Mice** ($2,445,047; $520,271), 9/15/08–4/30/13. This is a project that provides support for the production and maintenance of multiple nicotine receptor knockout mouse strains.

Principal Investigator: Michael J. Marks
Co-investigator: Jerry A. Stitzel

NIDA (U19-DA019375) **Nicotinic Ligands for Smoking Cessation** 9/1/10–8/31/15. This is a cooperative project (H. Lester, PI) with the laboratory of Dr. Henry Lester at Cal Tech and Targecept to develop compounds with selectivity for defined subtypes of nicotinic receptors.

IBG Subcontract ($1,347,986; $259,986). The IBG component will evaluate potential drugs using biochemical measures, determine the responses of mice to chronic exposure to several promising compounds, and to evaluate the effects of promising compounds in mice expressing altered nicotinic receptors.

Principal Investigator: Michael J. Marks
Co-investigator: Sharon Grady

NIDA (R21-DA026901) **Nicotinic Receptor Genes and Substance Abuse: Functional Studies of Associated SNPs** ($871,876; $428,045), 9/30/09–8/31/11. The goal of this project was to examine the putative functional consequences of human genetic variation in the nicotinic receptor genes which have been associated with drug-related behaviors. This was accomplished by examining gene expression, protein levels, and using receptor function assays.

Co-principal Investigators: Marissa A. Ehringer, Jerry A. Stitzel
Co-investigator: Michael J. Marks

Mike Marks and Sharon Grady discuss a poster presentation.

NIDA (R21-DA026918) **Function of the CHRNA5 D398N SNP: Implications for Addiction and Lung Cancer Risk** ($916,594; $449,136), 9/30/09–8/31/11. The goal of this project was to evaluate the effect of a polymorphism in the nicotinic receptor alpha5 subunit gene Chrna5 on brain function. For these studies, they utilized a genetically engineered mouse in which Chrna5 has been modified to possess a mutation that is associated with increased risk for nicotine dependence in humans. Specific experiments include nicotine-induced changes in early responsive genes in the brain between control and mutant mice and electrophysiological assessment of nicotine's effects on dopamine neuron firing in the ventral tegmental area of control and mutant mice.

Principal Investigator: Jerry A. Stitzel
Co-investigator: Donald Cooper

NIDA (RC2-DA028955) **Mice with Functional Fluorescent Nicotinic Receptor Subunits** 9/30/09–8/31/11. This project involved a collaborative effort between Dr. Lester's group at Caltech and Dr. Marks' group at CU-Boulder. The Caltech component (H.A. Lester, PI) made a series of transgenic mouse lines that express modified nicotinic receptor subunits.

IBG Subcontract ($308,087; $308,087). This one-year IBG subcontract determined the effects of these modified receptor subunits on nicotinic receptor binding and receptor function in brain tissue.

Principal Investigators: Michael J. Marks, Allan C. Collins

NIMH (P50-MH086383) **Basic to Clinical Molecular Neurobiology of Nicotinic Receptors in Schizophrenia** 8/1/09–7/31/14. The goal of this Silvio O. Conte Neuroscience Research Center is to understand the role of the nicotinic receptor gene CHRNA7 in schizophrenia from mouse models to potential clinical applications.

Principal Investigator: Robert Freedman

IBG Subcontract: **Project 3** ($651,698;$130,991). The specific goals of the project headed by Dr. Stitzel are to determine the molecular basis for the differences in expression of Chrna7 in mice, evaluate the effect of genetic variability in Chrna7 on brain function in mice, and establish whether perinatal treatment with alpha7 agonist DMXB-A leads to long-term improvement in sensory function in mice.

Principal Investigator: Jerry A. Stitzel

SRI (R2-NS065851) **Nicotinic Receptors as Molecular Targets to Reduce L-Dopa-Induced Dyskinesias** 4/1/10–3/31/11. The goal of this project (M. Quik, PI) was to identify the specific brain nAChRs and mechanisms that underlie nicotine's ability to reduce tardive dyskinesias, as this will allow for the development of selective pharmacotherapies with a minimum of side effects.

IBG Subcontract ($50,000; NCE). The goal of this grant is to identify the subtypes of nAChR that mediate the reduction of L-dopa-induced dyskinesias seen with nicotine treatment, by using mice with nAChR subunit null mutations bred at IBG.

Principal Investigator: Sharon Grady

Substance Abuse Vulnerability

NIDA (P60-DA011015) **Center on Antisocial Drug Dependence: Genetics of HIV Risk Behavior** ($10,945,965; $2,158,500), 5/1/09– 2/28/14. The overall goal of this Comprehensive P60 Center (J.K. Hewitt, Director) is to contribute to our understanding of the etiology of individual differences in behavioral control or behavioral disinhibition, the relationship of this to drug abuse and the development of dependence, and the role that these play in the propensity for risky behaviors that may result in STDs, including HIV/AIDS. (Please note that subcomponents of each core and component are listed with fiscal year dollars only.)

Core A: **Administrative/Educational/Ethics** ($1,957,752; $376,816). The major goal of the administrative and educational cores is to facilitate interactions among an interdisciplinary group of clinicians, behavioral geneticists, and molecular biologists at the Anschutz Medical Campus and Boulder Campus of the University of Colorado. The educational component supports postdoctoral training and K–12 community outreach. A unique feature of the core is the incorporation of an ethicist who will work alongside the other investigators.

Core A: University of Colorado Boulder/Institute for Behavioral Genetics ($257,764).

Principal Investigator: John K. Hewitt
Co-investigator: Andrew Smolen

Core A: University of Colorado Denver/Department of Psychiatry ($100,859).

Principal Investigator: Thomas Crowley
Co-investigators: Robert E. Booth, Marilyn E. Coors

Core A: University of North Carolina/Gillings School of Global Public Health ($18,193).

Principal Investigator: Carolyn Halpern

Core B: **Data Management, Informatics, and Biostatistics** ($1,134,904; $222,452). This core will be responsible for the incorporation of new HIV-relevant risk and impulsiveness measures into existing interview protocols, the integration of new and previously collected data, the dissemination of consolidated data sets to center researchers, the improvement analysis capability, and the development and application of novel statistical methods for analysis of complex phenotypes that are required to meet the specific needs of the component projects.

Core B: University of Colorado Boulder/Institute for Behavioral Genetics ($115,143).

Principal Investigator: Matthew B. McQueen
Co-investigators: Robin P. Corley, Michael C. Stallings, Marissa A. Ehringer

Core B: University of Colorado Denver/Department of Psychiatry ($107,309).

Principal Investigator: Susan K. Mikulich-Gilbertson

Core C: **Molecular** – University of Colorado Boulder/Institute for Behavioral Genetics ($238,064). This core's aims are to extract, catalog, and store DNA from all patient samples provided from all other components and to perform genotyping on selected individuals using standard methods developed by center investigators.

Principal Investigator: Kenneth Krauter

Component I: **Clinical and GWAS Studies** ($1,916,028; $408,464). This component will identify specific genetic loci that influence behavioral disinhibition. To do this, the lab will conduct a genome-wide association study (GWAS) on an existing sample of 1,000 adolescent cases and 1,000 controls with substance dependence, conduct disorder, and HIV-related risk behaviors; and a newly ascertained sample of 600 adolescents recruited from adolescent substance abuse treatment programs and a control sample of 600 adolescents without serious substance or behavioral problems.

Component I: University of Colorado Boulder/Institute for Behavioral Genetics ($31,817).

Principal Investigator: Matthew B. McQueen
Co-investigator: John K. Hewitt

Component I: University of Colorado Denver/Department of Psychiatry ($376,647).

Principal Investigator: Christian J. Hopfer
Co-investigators: Robert E. Booth, Paritosh Kaul, Joseph T. Sakai

Component II: **Clinical Family and Community Twin, Family, and Adoption Studies** ($2,828,375; $551,765). Investigators will collect a third assessment in young adulthood on the clinical families and community family, twin, and adoption samples participating in the center, with detailed assessments of HIV risk behaviors. The combination of three types of unselected sibling groups (biological siblings, monozygotic and dizygotic twins, and adoptive siblings), together with highly selected clinical probands and their siblings, permits a level of triangulation of results that is unique in behavior genetics.

Component II: University of Colorado Boulder/Institute for Behavioral Genetics ($516,459).

Principal Investigator: Michael C. Stallings
Co-investigators: John K. Hewitt, Robin P. Corley, Soo Rhee

Component II: University of Colorado Denver/Department of Psychiatry ($35,306).

Principal Investigator: Christian J. Hopfer
Co-investigator: Robert E. Booth

Component III: **A Neurogenetic Basis for Risky HIV-Related Decisions** ($1,371,092; $273,059). Investigators will conduct brain imaging studies to explore a neural basis for risky behaviors in disinhibited individuals, utilizing a novel assessment (the Colorado Balloon Game) designed for use in fMRI studies. In collaboration with Component 2's twin studies, the heritability of CBG performance and its relationship to behavioral disinhibition and HIV risk behaviors will be determined. SNPs associated with behavioral disinhibition in component 1 will be examined for potential associations with brain regions of interest.

Component III: University of Colorado Boulder/Institute for Behavioral Genetics ($17,084).

Principal Investigator: John K. Hewitt

Component III: University of Colorado Boulder/Institute for Cognitive Science ($12,644).

Principal Investigator: Marie T. Banich

Component III: University of Colorado Denver/Department of Psychiatry ($243,331).

Principal Investigator: Thomas Crowley
Co-investigators: Susan E. Young, Robert E. Booth, Yiping P. Du, Susan Mikulich-Gilbertson

Component IV: **Pilot Studies** – University of Colorado Boulder/Institute for Behavioral Genetics ($458,674; $87,879). Investigators will conduct a series of pilot studies of innovative approaches to the genetics and treatment of HIV risk behaviors. Proposed studies will bring new junior investigators into the center and provide a starting point for innovative new lines of inquiry that can be integrated with and extend the overall theme of the center.

Principal Investigator: Soo Rhee

NIDA (RO1-DA012845) **Genetics of Adolescent Antisocial Drug Dependence** (COMRAD) ($2,971,499; $620,668), 7/15/08–12/31/12. This COMRAD proposal continues a multisite collaboration, initiated under DA 012845, to conduct a prospective study to address critical issues in the genetic epidemiology of adolescent onset antisocial drug dependence. Investigators will complete five-year follow-up assessments, examine drug use and antisocial behavior trajectories and their predictors, and conduct genome-wide association analyses of persistent adolescent-onset antisocial drug dependence.

Principal Investigator: John K. Hewitt
Co-investigators: Robin P. Corley, Marissa A. Ehringer, Kenneth Krauter, Michael C. Stallings, Susan Young, and Matthew B. McQueen

Research Training and Statistical Methodology

NICHD (T32-HD007289) **Research Training–Developmental Behavioral Genetics** ($1,373,375; $277,197), 5/1/11–4/30/16. This training grant (supporting five pre- and one postdoctoral trainee) is for training in the field of developmental behavioral genetics. Developmental behavioral genetics integrates the perspectives of quantitative genetics, molecular genetics, neurobiology and, increasingly, the resources of bioinformatics, into the study of behavioral development.

Principal Investigator: Michael C. Stallings

NIDA (T32-DA017637) **Research Training–Genetics of Substance Abuse** ($1,365,207; $272,347),7/1/09–6/30/14. This grant supports four doctoral students and two postdoctoral fellows to receive training in the methods of behavior genetics research and their application to substance abuse.

Principal Investigator: John K. Hewitt

NIMH (T32-MH016880) **Research Training in Mental Health Behavior Genetics** ($1,154,907; $230,059), 7/1/10–6/30/15. This grant supports four doctoral students and one postdoctoral fellow to receive training in the methods of behavior genetics research and their application to mental health and psychological disorders.

Principal Investigator: John K. Hewitt

NIMH (R25-MH019918) **Workshop on Methodology of Twin Studies** ($716,476; $145,567), 8/27/08–6/30/13. The major goal of this project is to provide five training and information-sharing workshops for researchers involved in twin and family genetic epidemiology studies wishing to learn the latest methodology for data analysis and experimental design.

Principal Investigator: John K. Hewitt

NIMH (F31-MH084466) F31 **Predoctoral Fellowship awarded to Melissa Munn** ($62,431; $31,478), 9/25/09–9/24/11. This project investigated whether there were genetic and environmental relations among disordered eating, alcohol use, and personality; and whether the comorbidity observed among these traits could be explained by genetic variants in the serotonin transporter gene.

Principal Investigator/Faculty Mentor: Michael C. Stallings

IBG Core Facilities

Animal Production

The IBG animal facility includes a 4,000-square-foot specific-pathogen-free laboratory for the development and production of mouse and rat strains and 2,500 square feet of animal testing space.

The IBG animal facility houses the world's most complete collection of mouse strains that have been genetically modified for genes that code for nicotinic receptor subunit proteins. These strains include knock-out, knock-in, and fluorescently tagged alleles. The mice are supported by a P30 grant from the National Institute on Drug Abuse and are used by most IBG investigators as well as distributed to other investigators both nationally and internationally.

In addition to these, IBG currently maintains a wide variety of other mouse and rat strains.

Faculty Director: Jerry Stitzel
Lab Supervisor: Bill Van Morter

Nicotinic receptor subunit knockout strains:
Chrna2
Chrna4
Chrna5 (C57BL/6J)
Chrna5 (C3H/Ibg)
Chrna5 (A/Ibg)
Chrna6
Chrna7 (A/Ibg)
Chrna7 (C57BL/6J)
Chrna7 (C3H/Ibg)
Chrna7 (DBA/2J)
Chrna7 (129Sv/Ev)
Chrnb2
Chrnb3 (C57BL/6J)
Chrnb3 (129SvEv)
Chrnb4

Nicotinic receptor subunit knockin strains:
Chrna4 YFP
Chrna4 L9'A
Chrna4 S247F
Chrna4 T529A
Chrna5 D397N
Chrna6 L9'S
Chrna7 GFP
Chrnb2 GFP
Chrnb2 V287L

Other nicotinic receptor related mice:
Chrnb2 transgenic
C3.D2^{Chrna5} congenic
D2.C3^{Chrna5} congenic
C3.D2^{Chrna7} congenic
D2.C3^{Chrna7} congenic
LYNX1 knockout

Traditional inbred mouse strains
A/Ibg
C3H/Ibg
C57BL6/J
DBA/2J
129Sv/EvTac

Inbred selected mouse lines
Open field activity lines
Inbred long sleep (ILS)
Inbred short sleep (ISS)

Other mouse strains
Mtnr1a/1b double KO
Grm5 KO
arc-gfp
trpc5flx-CamKIIcre
Thy1-Channelrhodopsin2

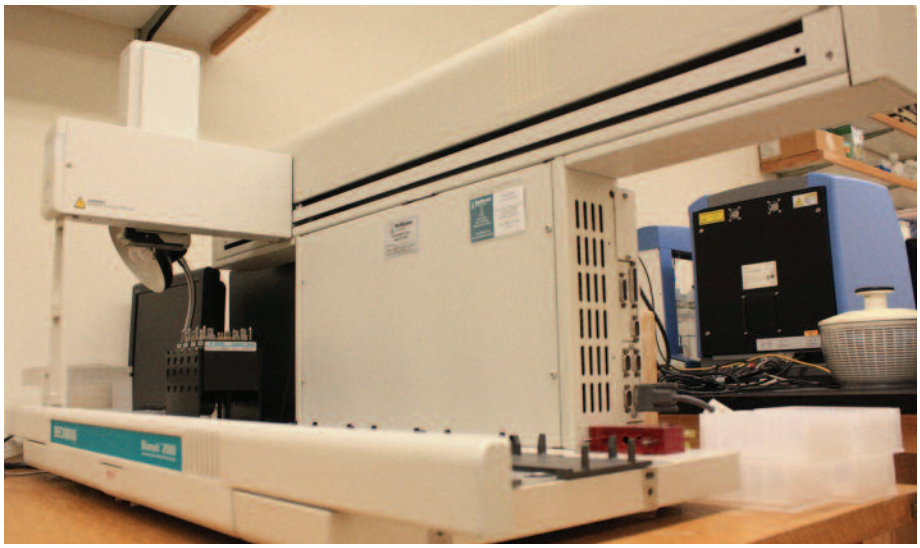
Rat Strains
Trpc4 KO

Human Molecular Genetics Facilities

The molecular and genotyping facilities at IBG for human genotyping include a core facility and the Ehringer and Smolen laboratories. They occupy a total of 1,900 square feet and house state-of-the-art molecular and biochemical equipment that includes an Applied Biosystems (ABI) PRISM 3130 xl Genetic Analyzer; ABI 7000 and 9700 Sequence Detection Systems; an Affymetrix GCS 3000 system; an Illumina BeadXpress system; an ABI OpenArray (Biotrove) SNP genotyping system and Autofill liquid handling system; a Transgenomic WAVE 3500HT DHPLC system; Beckman-Coulter Biomek 2000, 3000, and FX liquid handlers; a Promega Maxwell 16 paramagnetic-particle handling system; an Eppendorf Vacufuge speed-vac; a Tecan Genios fluorescence/absorbance/luminescence plate reader; five PE-Biosystems and three MJ Research thermocyclers; six networked computers (dedicated to the core laboratory); and all associated equipment and supplies required for routine DNA isolations and genetic analyses.

These facilities maintain an archive of over 45,000 unique human DNA specimens. These specimens are used in a variety of studies throughout the United States by researchers studying genetic and environmental factors that influence such variables as adolescent health, risk for cardiovascular disease, drug use and abuse, HIV risk, and eating disorders and obesity.

Faculty Director: Andrew Smolen
Associate Director: Gary Stetler



Graduate Training

IBG provides graduate training that interacts synergistically with the many research projects, both human and nonhuman, conducted under the auspices of its faculty. The research projects emphasize many areas related to behavioral genetics, including developmental psychology, neurobiology, neuropharmacology, pharmacogenetics, quantitative genetics, molecular biology, and evolutionary biology. Complementing intensive research training is a core program of courses in which students learn to apply the principles and techniques of behavioral genetics to the analysis of behavior.

The goal of IBG's Graduate Interdisciplinary Certificate Program in Behavioral Genetics is to train scientists in the study of genetic and environmental contributions to individual differences in behavior. Because IBG is not a degree-granting unit of the Graduate School, each trainee must be a degree candidate in an academic department of the university. The institute has faculty and graduate student liaisons with several departments within the College of Arts and Sciences including the Department of Psychology and Neuroscience, and the Department of Integrative Physiology, and the interdisciplinary Neuroscience program. The institute also has research and training links with the Department of Psychology at the University of Denver and with both the School of Pharmacy and the Department of Pharmacology at the University of Colorado Anschutz Medical Campus.

The training program requires completion of four core courses (physiological genetics, behavioral genetics, statistics, and scientific ethics) and three additional courses from electives including quantitative genetics, molecular genetics and behavior, biometrical methods in behavioral genetics, bioinformatics and genomics, advanced statistical genetics, behavioral neuroscience and other courses in neuroscience (e.g., neurobiology of learning and memory, neuropharmacology, neurobiology of addiction), and seminar courses in behavioral genetics. All trainees and postdoctoral students are required to complete a course in the responsible conduct of research and participate in the weekly journal club/colloquium series. Trainees funded via IBG's NIMH Training Grant must also participate in Grand Rounds through the University of Colorado Anschutz Medical Campus.

Trainees are expected to serve as teaching assistants in a course judged by their advisory committee to be relevant to their professional specialty. This teaching requirement is usually completed during the second year of graduate training. All students are encouraged to ensure breadth of experience by becoming involved in the research of IBG faculty members in addition to that of their advisor. Trainees are expected to conduct their doctoral dissertation research on a topic of relevance to animal or human behavioral genetics under the supervision of an IBG faculty member. Each trainee is expected to have completed the requirements for the PhD degree within four or five years. Upon successful fulfillment of the requirements of the IBG training program, the student will receive a Certificate of Interdisciplinary Study in Behavioral Genetics.

Students wishing to become IBG trainees must submit an application for admission into the program to the director of the Behavioral Genetics Training Program. Excellence of record and promise are the principal criteria for selection of trainees. A further important consideration for acceptance is the diversity of background and training that is essential for the success of an interdisciplinary program.

Acceptance into the training program is contingent on acceptance by the Graduate School and by an academic department of the university. Therefore, application must be made directly to the department of choice as well as to the institute. Applicants are encouraged to write the appropriate department for application information. For application forms for admission into the IBG training program, or for further information, prospective trainees are encouraged to visit our website at ibg.colorado.edu/graduatetraining/certificate-program.html or write to Director, Behavioral Genetics Training Program, Institute for Behavioral Genetics, 447 UCB, University of Colorado Boulder, Boulder, CO 80309-0447. If you prefer to call, the telephone number is 303-492-7362.

Graduate Students

Raven Astrom (PhD program, Psychology and Neuroscience). Genetic and environmental influences on reading ability and disability and the stability for reading difficulties and long-term outcome.

Debra Boeldt (PhD program, Psychology and Neuroscience). Genetic and environmental influences on the development of externalizing behaviors in childhood. Specifically, the effects of parenting and candidate genes involved in postpartum depression and effects on child outcomes. In addition, the investigation of the developmental trajectory of oppositional defiant disorder into later internalizing and externalizing behaviors.

Angela Brant (PhD program, Psychology and Neuroscience). Using twin and computational models to explore factors contributing to individual differences in executive function and IQ during development.

Brian Cadle (PhD program, Psychology and Neuroscience). Psychostimulant induced neuroplasticity with focus on electrophysiological changes in the prefrontal cortex and subiculum.

Todd Darlington (PhD program, Integrative Physiology). The study of behavioral interactions and underlying neurobiology, specifically whether the reward from exercise behaviors can substitute for the reward from alcohol drinking.

Teresa DeCandia (PhD program, Psychology and Neuroscience). Genetic architecture of human behavior and psychopathology, and genetic variation across populations.

Laramie Duncan (PhD Programs, Psychology and Neuroscience). Development of methods to evaluate validity of published research findings. Role of rare variants and gene-environment interactions in psychopathology.

Laura Hink (PhD program, Psychology and Neuroscience). The genetic and environmental influences involved in the covariation of personality constructs and psychopathology.

William Horton (PhD program, Integrative Physiology). The circadian system and its interaction with the pharmacology of abused drugs, primarily nicotine and nicotinic acetylcholine receptors.

Daniel Howrigan (PhD program, Psychology and Neuroscience). Genetic variation and individual differences underlying human behavior, as well as the genetic basis of complex disease.

Daniel Johnson (PhD program, Psychology and Neuroscience). Genetically informed developmental models of psychopathology; genetic and environmental influences on psychopathology and vulnerability factors, with a special interest in the association between stress and depression.

Whitney Melroy (PhD program, Integrative Physiology). Using human statistical genetics to identify candidate genes involved in substance abuse disorders, in particular, focusing on association studies between signals in correlated genes and alcoholism in a young adult sample.

Graduate students from the IBG Training Program. Front row (seated): Raven Astrom, Joanna Vandever, Ashley Smith, Whitney Melroy, Kristin Rasmus, Melissa Munn-Chernoff, Angela Brant. Back row (standing): Debra Boeldt, Brian Cadle, Dan Johnson, Dan Howrigan, Larry Taylor, Todd Darlington, Matthew Simonson, Will Horton.

Melissa Munn-Chernoff (PhD program, Psychology and Neuroscience). Genetic and environmental risk factors for disordered eating and co-occurring traits.

Kristin Rasmus (PhD program, Psychology and Neuroscience). Neural circuitry and genetic influences associated with learning, memory, and reward mechanisms and how they are associated with depression and addiction.

Matthew A. Simonson (PhD program, Psychology and Neuroscience). Biostatistical analysis examining the genetic architecture of complex disease using genome-wide data. Emphasis on the development and application of data-analysis methods and custom software with respect to genetics.

Ashley Smith (PhD program, Psychology and Neuroscience). The genetic and environmental influences on internalizing/externalizing disorders and issues of comorbidity utilizing temperament and neurocognitive measures.

Larry Taylor (PhD program, Integrative Physiology). Variability of small heat shock proteins and their correlation with lifespan in *C. elegans.*

Joanna Vandever (PhD program, Psychology and Neuroscience). Genetic influences on cognitive and personality factors related to substance use disorders and antisocial behavior.

Amanda Wills (PhD program, Psychology and Neuroscience). Using biometrical and molecular approaches to understand the interface between genetics and environmental factors, namely peer relationships, in substance use, addiction, and mental disorders.

Colloquia, Informal Talks, and Special Events

FALL 2010

IBG Orientation and Poster Day Celebration. Faculty, researchers, and students display posters they presented at professional meetings during the previous year. This provides an opportunity to introduce the new members of the institute to the breadth of research at IBG.

Mark Reimers (PhD, Assistant Professor of Biostatistics, Virginia Commonwealth University, Richmond, Virginia). "Making Sense of Small Effects: Dealing with Diversity." (08/13/10)

Chris Link, (PhD, Associate Research Professor, Institute for Behavioral Genetics and Integrative Physiology, University of Colorado Boulder). "TDP-43 and Neurodegeneration: What do You Do after You Have Identified a Human Disease Gene?" (11/05/10)

Yue Wu (PhD, Department of Pharmacology, University of Adelaide, Adelaide, Australia). "Protection from the Acute Effects of Ethanol via Attenuation of Microglial, Interleukin-1 and Toll-like Receptor 4 Signaling." (11/09/10)

Jacqueline N. Crawley (PhD, Chief, Laboratory of Behavioral Neuroscience, Intramural Research Program, National Institute of Mental Health, Bethesda, Maryland). "Behavioral Phenotyping of Mouse Models of Autism: Towards Testing Hypotheses About Causes and Discovering Therapeutics." (12/03/10)

Chris Howerton (Postdoctoral Candidate, Department of Animal Science, University of California, Davis). "From Mad Max to Bro-mancing the Stone: Male Mouse Social Behavior in Variable Environments." (12/08/10)

SPRING 2011

Rebecca Helfand (Postdoctoral Candidate, Department of Psychology and Neuroscience, Baylor University, Texas). "Reducing Adolescent Ethanol Consumption via Dietary Taurine Supplementation." (01/05/11)

Katie Commons (PhD, Assistant Professor, Department of Anesthesiology, Children's Hospital Boston/Harvard Medical School). "The Case of the Mysterious Modulator: Serotonin." (01/21/11)

Mary-Ann Enoch (MD, Laboratory of Neurogenetics, National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health). "GABAergic Gene Expression in the Human Hippocampus after Chronic Alcohol and Cocaine Exposure – How to Distinguish Trait from State Effects?" (03/03/11)

Kelly Klump (PhD, Department of Psychology, Michigan State University, Associate Professor, Co-director of the Michigan State University Twin Registry). "The Genetic Diathesis of Eating Disorders: Critical Roles for Puberty and Ovarian Hormones." (03/17/11)

Courses Taught by Faculty Fellows

Fall 2010

Ryan Bachtell	PSYC 4132, UCB	Neuropharmacology
Ryan Bachtell	NRSC 5132, UCB	Neuropharmacology
Jason Boardman	SOCY 5111, UCB	Data 1: Introduction to Social Statistics
Michael Breed	EBIO 3240, UCB	Animal Behavior
Michael Breed	HONR 1001, UCB	Honors Co-Seminar
Gregory Carey	PSYC 3102, UCB	Behavioral Genetics
Gregory Carey	PSYC 5102, UCB	Behavioral Genetics
Don Cooper	NRSC 2100, UCB Web	Introduction to Neuroscience
Don Cooper	NRSC 2100, UCB	Introduction to Neuroscience
Don Cooper	NRSC 4011, UCB	Senior Thesis and Research Ethics
Thomas Crowley	AMC	Substance Abuse in Human Behavior
Matthew Keller	PSYC 7102, UCB	Seminar—Behavioral Genetics
Matthew McQueen	IPHY 5800, UCB	Advanced Statistics & Research Methods in Integrative Physiology
Bruce Pennington	PSYC 4411, DU	Cognitive Assessment of Children
Richard Radcliffe	TXCL 7323, AMC	Principles of Toxicology
Richard Radcliffe	TXCL 7310, AMC	Fundamentals of Pharmaceutical Sciences
Richard Radcliffe	TXCL 7670, AMC	Methods in Molecular Toxicology
Richard Radcliffe	IPHY 6010, UCB	Applications of Bioinformatics & Genomics
James Sikela	PHCL 7605, AMC	Ethics in Research, 1 Lecture, (Course Director)
James Sikela	M2M, AMC	Molecules to Medicine, 1 Lecture
James Sikela	PHCL 7600, AMC	Frontiers in Pharmacology, 1 Lecture
Michael Stallings	PSYC 5242, UCB	Biometrical Methods in Behavioral Genetics
Michael Stallings	PSYC 7102, UCB	Seminar: Behavioral Genetics
Boris Tabakoff	PHCL 7605, AMC	Ethics in Research, 1 Lecture
Boris Tabakoff	PHCL 7620, AMC	Principles of Pharmacology, 8 Lectures

Spring 2011

Ryan Bachtell	NRSC 2110, UCB	Introduction to Neuroscience 2
Michael Breed	EBIO 6210, UCB	Seminar in Population Biology (Migration)
Michael Breed	HONR 1001, UCB	Honors Co-Seminar
Gregory Carey	PSYC 3102, UCB	Behavioral Genetics
Don Cooper	NRSC 2101, UCB	Topics in Neuroscience
Don Cooper	NRSC 2110, UCB	Introduction to Neuroscience 2
Don Cooper	NRSC 5911, UCB	Teaching of Neuroscience
Marilyn Coors	PHCL 7605, AMC	Ethics in Research (1 Lecture)
Thomas Crowley	PSYCH 8001, AMC	Big Six Substance Dependence Problems in Primary Care Medicine
Marissa Ehringer	IPHY 2800, UCB	Introduction to Statistics
John Hewitt	PSYC 7102, UCB	Seminar: Behavioral Genetics
Thomas Johnson	IPHY 5102, UCB	Molecular Genetic Analysis of Physiology and Behavior
Richard Olson	PSYC 5665, UCB	Proseminar: Advanced Experimental Psychology
Richard Radcliffe	TXCL 7561, AMC	Drug Metabolism and Pharmacogenetics
Richard Radcliffe	PHRD 3750, AMC	Integrated Organ Systems 1: Physiology
Richard Radcliffe	PHRD 4740, AMC	Integrated Organ Systems 8: Central Nervous System
Soo Rhee	PSYC 4521, UCB	Critical Thinking in Psychology
Soo Rhee	PSYC 7102, UCB	Seminar: Behavioral Genetics
James Sikela	HMGP 7620, AMC	Genomics, 3 Lectures (Co-Director)
Jerry Stitzel	IPHY 4200, UCB	Physiological Genetics and Genomics
Jerry Stitzel	IPHY/PSYC 5200, UCB	Physiological Genetics and Genomics
Boris Tabakoff	IDPT 8005, AMC	Personalized Medicine / Pharmacogenomics, 1 lecture
Boris Tabakoff	PHCL 7600, AMC	Frontiers in Pharmacology, 1 Lecture

Summer 2011

Gregory Carey	PSYC 3102, UCB	Behavioral Genetics

The 2011 International Workshop on Statistical Methodology for Human Genomic Studies

In March 2011, IBG hosted its annual NIMH-supported week-long methodology workshop. To remain at the forefront of the rapid developments in genetic methodology applicable to research on complex traits, and to prepare for the next generation of research, this workshop has shifted its focus to place more emphasis on genome-wide association studies and, this year, genomic sequencing. To reflect this, we changed the title of this year's workshop to International Workshop on Statistical Methodology for Human Genomic Studies instead of the previous title, Methodology of Twin and Family Studies: the Advanced Workshop.

To teach the workshop, IBG brought 22 of the world's leading statistical and behavioral geneticists to Boulder. There were 80 registered trainees who came from 14 different states within the United States and from 10 different countries. Professor Pak Sham of the University of Hong Kong's Genome Research Center served as the academic director; IBG's director, John Hewitt, is the local host and PI of the grant that has supported the workshop in Boulder for 20 years; and Bridget Carey served as the administrative coordinator. You can learn much more about the workshop at http://ibg.colorado.edu/workshop2011. In 2012 the workshop will focus on biometrical genetics and structural equation modeling, and will be directed by Professor Mike Neale of the Virginia Institute for Psychiatric and Behavioral Genetics.

Participants in the 2011 Workshop

Science Discovery

During the summers of 2010 and 2011 the Institute for Behavioral Genetics hosted a week-long class for middle and high school students through the university's Science Discovery program. Funded by the Drug Research Center (P60 DA011015; John Hewitt, PI) students came to the institute for a class titled Drugs, Brains, and Behavior. Lead by Dr. Helen Kamens (research associate, Dr. Marissa Ehringer's lab) in 2010 and Whitney Melroy (graduate student, Dr. Marissa Ehringer's lab) in 2011, students learned basic concepts and completed activities such as extracting their own DNA, building brain models, and learning how mice can be used in behavioral research.

Publications

July 1, 2010 – June 30, 2011

Ash, P.E., Zhang, Y.J., Roberts, C.M., Saldi, T., Hutter, H., Buratti, E., Petrucelli, L., & Link, C.D. (2010). Neurotoxic effects of TDP-43 overexpression in *C. elegans*. *Human Molecular Genetics*, *19(16)*, 3206–3218.

Astrom, R.L., Wadsworth, S.J., Olson, R.K., Willcutt, E.G., & DeFries, J.C. (2011). DeFries-Fulker Analysis of longitudinal reading performance data from twin pairs ascertained for reading difficulties and from their nontwin siblings. *Behavior Genetics*, *41(5)*, 660–667.

Backos, D.S., Fritz, K.S., Roede, J.R., Petersen, D.R., & Franklin, C.C. (2011). Posttranslational modification and regulation of glutamate-cysteine ligase by the α,β-unsaturated aldehyde 4-hydroxy-2-nonenal. *Free Radical Biology and Medicine*, *50(1)*, 14–26.

Badesh, D.B., Coors, M.E., McCollister, D.H., Bull, T., & Lakin, A. (2011). The potential for therapeutic misconception in pulmonary arterial hypertension clinical trials: A case-based discussion. *Advances in Pulmonary Hypertension*, *9(4)*, 220–222.

Bennett, B., Saba, L.M., Hornbaker, C.K., Kechris, K.J., Hoffman, P., & Tabakoff, B. (2011). Genetical genomic analysis of complex phenotypes using the PhenoGen website. *Behavior Genetics*, *41(4)*, 625–628.

Bernard, A., Pennington, B.F., Willcutt, E.G., Byrne, B., & Olson, R.K. (2010). What can we gain by measuring good attention? NIMH, Determinants of Executive Function and Dysfunction Center, *Genetic and Experiential Influences on Executive Function Conference*. (Abstract)

Betjemann, R.S., Keenan, J.M., Olson, R.K., & DeFries, J.C. (2011). Choice of reading comprehension test influences the outcomes of genetic analyses. *Scientific Studies of Reading*, *15(4)*, 363–382.

Bhave, S.V., Wu, C., Hoffman, P.L., & Tabakoff, B. (2010). Comparisons of whole brain protein expression using label-free proteomics in inbred mouse strains differing in their behavioral responses to ethanol. Research Society on Alcoholism, *33rd Annual Scientific Meeting*, *Alcoholism: Clinical and Experimental Research*, *34(s2)*, #489, 133A. (Abstract)

Bidwell, L.C., Willcutt, E.G., McQueen, M.B., DeFries, J.C., Olson, R.K., Smith, S.D., & Pennington, B.F. (2011). A family based association study of DRD4, DAT1, and 5HTT and continuous traits of Attention-Deficit Hyperactivity Disorder. *Behavior Genetics*, *41(1)*, 165–174.

Blum, K., Giordano, J., Morse, S., Liu, Y., Tan, J., Bowirrat, A., Smolen, A., Waite, R., Downs, W., Madigan, M., Kerner, M., Fornari, F., Stice, E., Braverman, E., Miller, D., Smith, D.E. & Bailey, J. (2010). Genetic Addiction Risk Score (GARS) analysis: Exploratory development of polymorphic risk alleles in poly-drug addicted males. *The Institute of Integrative Omics and Applied Biotechnology Journal*, *1(2)*, 1–14.

Boardman, J.D., & Alexander, K.B. (2011). Stress trajectories, unhealthy behaviors, and the mental health of black and white young adults. *Social Science and Medicine*, *72(10)*, 1659–1666.

Boardman, J.D., Alexander, K.B., & Stallings, M.C. (2011). Stressful life events and depression among adolescent twin pairs. *Biodemography and Social Biology*, *57(1)*, 53–66.

Boardman, J.D., Blalock, C.L., Corley, R.P., Stallings, M.C., Domingue, B.W., McQueen, M.B., Crowley, T.J., Hewitt, J.K., Lu, Y., & Field, S.H. (2010). Ethnicity, body mass, and genome-wide data. *Biodemography and Social Biology*, *56(2)*, 123–136.

Boeldt, D.L., Haberstick, B.C., Rhee, S.H., Young, S.E., Corley, R.P., Hewitt, J.K., DiLalla, L.F., & Mullineaux, P.Y. (2010). The role of genotype and positive parenting during toddlerhood in the development of externalizing behavior. Behavior Genetics Association, *40th Annual Meeting*, *Behavior Genetics*, *40(6)*, 787. (Abstract)

Bookman, E.B., Wanke, K., Balshaw, D., McAllister, K., Rutter, J., Reedy, J., Shaughnessy, D., Agurs-Collins, T., Paltoo, D., Atienza, A., Bierut, L., Kraft, P., Fallin, M.D., Perera, F., Turkheimer, E., Boardman, J.B., Marazita, M.L., Rappaport, S.M., Boerwinkle, E., et al. (2011). Gene-Environment interplay in common complex diseases: Forging an integrative model—recommendations from an NIH workshop. *Genetic Epidemiology*, *35(4)*, 217–225.

Brant, A.M., Boomsma, D.I., Corley, R.P., DeFries, J.C., Haworth, C.M.A., Hewitt, J.K., Martin, N.G., McGue, M., Petrill, S.A., Plomin, R., Wadsworth, S.J., & Wright, M.J. (2010). Ability and heritability: Investigating the continuous effect of IQ score on IQ etiology in multiple samples. Behavior Genetics Association, *40th Annual Meeting*, *Behavior Genetics*, *40(6)*, 788. (Abstract)

Breed, M.D. (2010). Honeybees. In M.D. Breed & J. Moore (Eds.), *Encyclopedia of Animal Behavior* (Vol. 2, 89–96). London: Elsevier.

Breed, M.D. (2010). Social Recognition. In M.D. Breed & J. Moore (Eds.), *Encyclopedia of Animal Behavior* (Vol. 3, 267–272). London: Elsevier.

Breed, M.D., & Moore, J. (2011). *Animal Behavior*. London: Elsevier.

Breed, M.D., & Moore, J. (Eds.). (2010). *Encyclopedia of Animal Behavior* (Vols. 1–3). London: Elsevier.

Breed, M.D., & Sanchez, L. (2010). Both environment and genetic makeup influence behavior. *Nature Education Knowledge Project*, *1(11)*, 10.

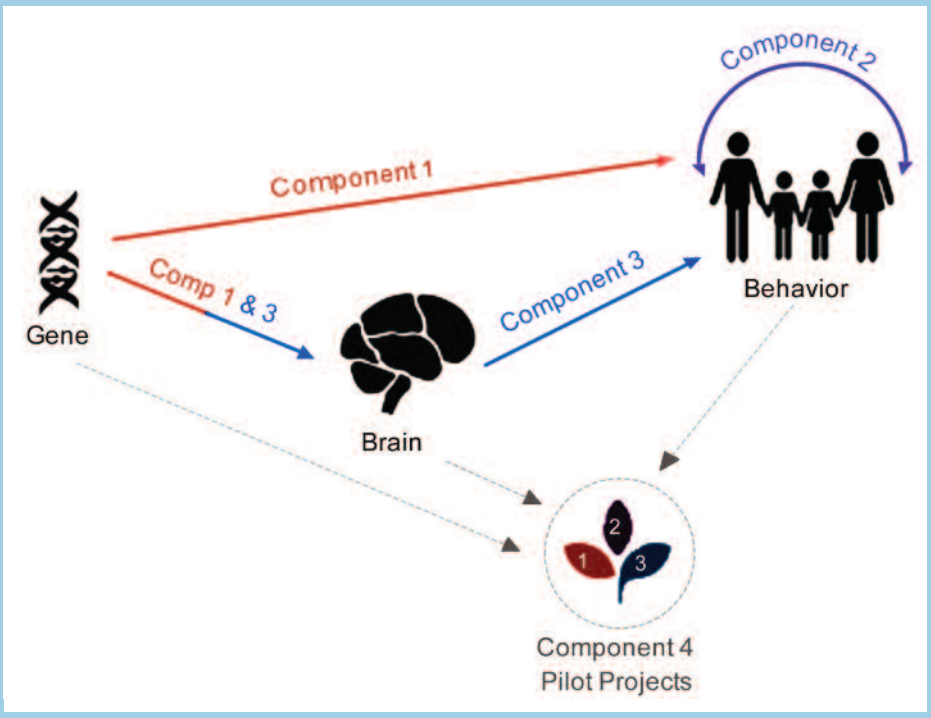
Breed, M.D., & Sanchez, L. (2010). What functions of living systems underlie behavior? *Nature Education Knowledge Project*, *1(8)*, 70.

Bricker, J.B., Berenbaum, S.A., Corley, R.P., Wadsworth, S.J., & Stallings, M.C. (2010). Some pubertal development measures predict early age of sexual initiation. Society for Research on Adolescence, *2010 Biennial Meeting Program Book*, #37, 100. (Abstract)

Brooker, R.J., Bricker, J.B., Corley, R.P., & Berenbaum, S.A. (2010). Pubertal timing as a potential mediator of adoption effects on problem behavior. Society for Research on Adolescence, *2010 Biennial Meeting Program Book*, #80, 111. (Abstract)

Research Highlight:
Center on Antisocial Drug Dependence: The Genetics of HIV Risk Behavior

The Drug Research Center, funded by a grant from the National Institute on Drug Abuse, aims to understand individual differences in a trait called `behavioral disinhibition,' how this trait is related to drug abuse and the development of dependence, and the role that these all play in the propensity for risky behaviors that may result in sexually transmitted diseases, including HIV/AIDS in some circumstances. Our unique focus has been the contribution of genetics, both through linkage and association studies, and biometrical behavior genetic studies. `Behavioral disinhibition' is the name for what we find to be a heritable generalized behavioral disposition that involves excessive pursuit of exciting appetitive stimuli and unusual disregard of aversive consequences for behavior. These characteristics frequently lead to substance abuse or dependence, antisocial behavior, and engagement in risky behaviors. Eventually, we hope that specification of the genetic and environmental factors influencing this behavioral disposition will lead to improved therapies that may reduce the vulnerability to engage in substance abuse, antisocial behavior, and risky behavior. The current center is supporting four major research components. Component I is working on identifying specific genetic loci that influence behavioral disinhibition. We are conducting a genome-wide association study (GWAS) on an existing sample of 1,000 adolescent cases and 1,000 controls with substance dependence, conduct disorder, and HIV-related risk behaviors, and a newly ascertained sample of 600 adolescents recruited from adolescent substance abuse treatment programs and a control sample of 600 adolescents without serious substance or behavioral problems (PI: Christian Hopfer). As part of Component II, we are collecting a third assessment in young adulthood on the clinical families and community family and twin samples participating in the center, with detailed assessments of HIV risk behaviors (PI: Mike Stallings). Component III is conducting brain imaging studies to explore a neural basis for risky behaviors in disinhibited individuals, and to explore the association of single nucleotide polymorphisms identified in the GWAS with activation of brain regions of interest (PI: Tom Crowley). We are also conducting a series of pilot studies of innovative approaches to the genetics of HIV risk behaviors in Component IV (PI: Soo Rhee). These projects are supported by three core components providing administrative, educational, and ethics support (Core A, PI: John Hewitt); data management, informatics, and biostatistics (Core B, PI: Matt McQueen); genotyping and molecular genetics (Core C, PI: Ken Krauter). The Drug Research Center is a collaboration among IBG faculty fellows, researchers, and staff across the Boulder and Denver campuses involving the Department of Psychiatry and the Center for Bioethics and Humanities at University of Colorado Denver; and the departments of Psychology and Neuroscience; Integrative Physiology; and Molecular, Cellular and Developmental Biology; and the Institute of Cognitive Science at the University of Colorado Boulder.



Butler, J.A., Ventura, N., Johnson, T.E., & Rea, S.L. (2010). Long-lived mitochondrial (MIT) mutants of *C. elegans* utilize a novel metabolism. *The Journal of the Federation of American Societies for Experimental Biology*, 24*(12)*, 4977–4988.

Button, T.M., Hewitt, J.K., Rhee, S.H., Corley, R.P., & Stallings, M.C. (2010). The moderating effect of religiosity on the genetic variance of problem alcohol use. *Alcoholism: Clinical and Experimental Research*, *34(9)*, 1619–1624.

Button, T.M., Stallings, M.C., Rhee, S.H., Young, S.E., Corley, R.P., & Hewitt, J.K. (2011). The etiology of stability and change in religious values and religious attendance. *Behavior Genetics*, *41(2)*, 201–210.

Carey, G. (2010). A graphical user interface (GUI) for OpenMx Behavior Genetics Association, *40th Annual Meeting*, *Behavior Genetics*, *40(6)*, 788. (Abstract)

Clapp, P., Procopio, D.O., Walter, H., Kogoj, D., Höfer, P., Lesch, O.M., Hoffman, P.L., & Tabakoff, B. (2010). Genome-wide investigation of genetic markers associated with specific alcoholism subtypes. Research Society on Alcoholism, *33rd Annual Scientific Meeting*, *Alcoholism: Clinical and Experimental Research*, *34(s2)*, #260, 75A. (Abstract)

Clark, R.F., Bierut, L.J., Goate, A.M., Stitzel, J.A., & Johnson, E.O. (2010). Regulators of CHRNA5 gene expression and their association with nicotine dependence: A systems biology approach. American Society for Human Genetics, *60th Annual Meeting*, #2566, 216. (Abstract)

Coors, M.E., Glover, J.J., Juengst, E.T., & Sikela, J.M. (2010). The ethics of using transgenic non-human primates to study what makes us human. *Nature Reviews Genetics*, *11*, 658–662.

Coors, M.E., Moseley, R., & McGooray, S. (2010). Informed consent process in Alpha-1 testing of at-risk children: Views of parents and adults tested as children. *Journal of Chronic Obstructive Pulmonary Disease*, *8(1)*, 1–9.

Cosgrove, V.E., Rhee, S.H., Gelhorn, H., Boeldt, D., Corley, R.C., Ehringer, M.A., Young, S. E., & Hewitt, J. K. (2011). Structure and etiology of co-occurring internalizing and externalizing disorders in adolescents. *Journal of Abnormal Child Psychology*, *39(1)*, 109–123.

Crowley, T.J., Dalwani, M.S., Mikulich-Gilbertson, S.K., Du Y.P., Lejuez, C.W., Raymond, K.M., & Banich, M.T. (2010). Risky decisions and their consequences: Neural processing by boys with Antisocial Substance Disorder. *PLoS ONE*, *5(9)*, e12835.

Crowley, T.J., & Gelhorn, H. (2010). Antisocial Substance Dependence. In G. Koob, R. F. Thompson, & M. Le Moal (Eds.), *Encyclopedia of Behavioral Neuroscience* (101–108). Oxford: Elsevier Science.

Culverhouse, R.C., Saccone, N.L., Stitzel, J.A., Wang, J.C., Steinbach, J.H., Goate, A.M., An, T.H., Grucza, R.A., Stevens, V.L., & Bierut, L.J. (2011). Uncovering hidden variance: Pair-wise SNP analysis accounts for additional variance in nicotine dependence. *Human Genetics*, *129(2)*, 177–188.

Dalwani, M., Sakai, J.T., Mikulich-Gilbertson, S.K., Tanabe, J., Raymond, K., McWilliams, S.K., Thompson, L., Banich, M.T., & Crowley, T.J. (2011). Reduced cortical gray matter volume in male adolescents with substance and conduct problems. *Drug and Alcohol Dependence*, *118(2–3)*, 295–305.

Darlington, T.M., Chitel, B.L., Hoft, N.R., & Ehringer, M.A. (2010). Voluntary alcohol use and exercise, effects on gene expression in dopaminergic reward pathway. Research Society on Alcoholism, *33rd Annual Scientific Meeting*, *Alcoholism: Clinical and Experimental Research*, *34(s2)*, #702, 186A. (Abstract)

Darlington, T.M., Ehringer, M.A., Larson, C., & Radcliffe, R.A. (2011). RNA-sequencing of striatal and whole brain transcriptome: Differences between alcohol sensitive long sleep and short sleep mice strains. Research Society on Alcoholism, *34th Annual Scientific Meeting*, *Alcoholism: Clinical and Experimental Research*, *35(s1)*, #986, 257A. (Abstract)

Darlington, T.M., Ehringer, M.A., Larson, C., & Radcliffe, R.A. (2011). RNA-sequencing reveals striatal transcriptome differences between the Inbred Long Sleep (ILS) and Inbred Short Sleep (ISS) mouse strains. International Behavioural and Neural Genetics Society, *13th Annual Meeting*, *Genes, Brain and Behavior*, *10(4)*, #P-48, 504. (Abstract)

Darlington, T.M., Hoft, N.R., Chitel, B.L., & Ehringer, M.A. (2010). Voluntary alcohol use and exercise influence differential gene expression in mesocorticolimbic dopamine pathway. International Behavioural and Neural Genetics Society, *12th Annual Meeting*, *Genes, Brain and Behavior*, *9(4)*, #P-05, 431. (Abstract)

Deitrich, R.A. (2011). Ethanol as a prodrug: Brain metabolism of ethanol mediates its reinforcing effects—a commentary. *Alcoholism: Clinical and Experimental Research*, *35(4)*, 581–583.

Depue, B.E., Burgess, G.C., Bidwell, L.C., Willcutt, E.G., & Banich, M.T. (2010). Behavioral performance predicts grey matter reductions in the right inferior frontal gyrus in young adults with combined type ADHD. *Psychiatry Research*, *182(3)*, 231–237.

Depue, B.E., Burgess, G.C., Willcutt, E.G., Ruzic, L., & Banich, M.T. (2010). Inhibitory control of memory retrieval and motor processing associated with the right lateral prefrontal cortex: Evidence from deficits in individuals with ADHD. *Neuropsychologia*, *48(13)*, 3909–3917.

Dostal, V., Fonte, G., Roberts, C.M., Gonzalez, P., & Link, C.D. (2011). Testing the "glycine zipper" model for the formation of toxic β-amyloid oligomers. The Genetics Society of America, *18th International* C. elegans *Meeting*, *Abstract Book*, #391B, 102. (Abstract)

Dostal, V., Roberts, C.M., & Link, C.D. (2010). Genetic mechanisms of coffee extract protection in a *C. elegans* model of β-amyloid Peptide Toxicity. *Genetics*, *186(3)*, 857–866.

Downing, C., Balderrama-Durbin, C.C., Kimball, A., Biers, J., Gilliam, D.M., & Johnson, T.E. (2011). Quantitative trait locus mapping and candidate gene identification for ethanol teratogenesis in BXD recombinant inbred mice. *Alcoholism: Clinical and Experimental Research*, *35(s1)*, #637, 170A. (Abstract)

Downing, C., Biers, J., Larson, C., Kimball, A., Wright, H., Ishii, T., Gilliam, D.M., & Johnson, T.E. (2010). Genetic and maternal effects on valproic acid teratogenesis in C57BL/6J and DBA/2J Mice. *Toxicological Sciences*, *116(2)*, 632–639.

Downing, C., Johnson, T.E., Larson, C., Leakey, T.I., Siegfried, R.N., Rafferty, T.M., & Cooney, C.A. (2011). Subtle decreases in DNA methylation and gene expression at the mouse Igf2 locus following prenatal alcohol exposure: Effects of a methyl-supplemented diet. *Alcohol*, *45(1)*, 65–71.

Downing, C., Marks, M.J., Larson, C., & Johnson, T.E. (2010). The metabotropic glutamate receptor subtype 5 mediates sensitivity to the sedative properties of ethanol. *Pharmacogenetics and Genomics*, *20(9)*, 553–564.

Drenan, R.M., Grady, S.R., Steele, A.D., McKinney, S., Patzlaff, N.E., McIntosh, J.M., Marks, M.J., Miwa, J.M., & Lester, H.A. (2010). Cholinergic modulation of locomotion and striatal dopamine release is mediated by alpha6alpha4* nicotinic acetylcholine receptors. *Journal of Neuroscience*, *30(29)*, 9877–9889.

Ebejer, J.L., Coventry, W.L., Byrne, B., Willcutt, E.G., Olson, R.K., Corley, R., & Samuelsson, S. (2010). Genetic and environmental influences on inattention, hyperactivity-impulsivity, and reading: Kindergarten to grade 2. *Scientific Studies of Reading*, *14(4)*, 293–316.

Ehringer, M.A., Darlington, T., & Hoft, N.R. (2010). Gene expression studies of alcohol, wheel running behaviors, and possible interactions. Research Society on Alcoholism, *33rd Annual Scientific Meeting*, *Alcoholism: Clinical and Experimental Research*, *34(6)*, 246A. (Abstract)

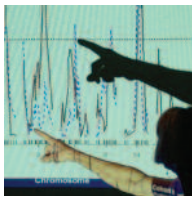
Ehringer, M.A., Funk, E.M., Hoft, N.R., Stitzel, J.A., & Stephens, S.H. (2010). The role of CHRNA5/A3/B4 in early disinhibitory behaviors–Human molecular genetics. Society for Research on Nicotine and Tobacco, *Abstract Book*, SYM5B, 6. (Abstract)

Ehringer, M.A., & Hoft, N.R. (2010). The role of CHRNA6 and CHRNB3 genes in tobacco and alcohol behaviors–Human molecular genetics. Society for Research on Nicotine and Tobacco, *Abstract Book*, SYM1E, 2. (Abstract)

Ehringer, M.A., Hoft, N.R., & Godfrey, J. (2010). The effects of voluntary wheel-running on alcohol consumption: Common responses across different genetic strains of mice. *Genes, Brain, and Behavior*, *9(4)*, 421. (Abstract)

Ehringer, M.A., McQueen, M.B., Hoft, N.R., Saccone, N.L., Stitzel, J.A., Wang, J.C., & Bierut, L.J. (2010). Response to "Dizziness Genes". *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics*, *153B*, 1248–1249.

Ehringer, M.A., Stitzel, J.A., Flora, A.V., Gallego, X., Kamens, H.M., & Zambrano, C. (2011). Which SNPs are functional? Molecular studies of SNPs in human CHRN gene associated with drug behaviors. Wellcome Trust Foundation, *Nicotinic Acetylcholine Receptors Conference*. (Abstract)



Flora, A.V., Zambrano, C., Funk, E.M., Miyamoto, J., Stitzel, J.A., & Ehringer, M.A. (2011). Functional analysis of SNPs in the intergenic region between CHRNA3 and CHRNB4. Society for Research on Nicotine and Tobacco, *Abstract Book,* SYM5B, 9. (Abstract)

Florez-McClure, M.L., Flink, S., Downing, C., Rikke, B.A., Johnson, T.E., & Kechris, K. (2011). Gene expression changes in a fetal alcohol exposure model: Exploring succeptibility mediated by strain differences and maternal effects. *Alcoholism: Clinical and Experimental Research*, *35(s1)*, #636, 169A. (Abstract)

Fowler, C.D., Lu, Q., Johnson, P.M., Marks, M.J., & Kenny, P.J. (2011). Habenular α5 nicotinic receptor subunit signaling controls nicotine intake. *Nature*, *471*, 597–601.

Friedman, N.P. (2010). Genetic influences on the unity and diversity of executive functions. NIMH Determinants of Executive Function and Dysfunction Center, *Genetic and Experiential Influences on Executive Function Conference*. (Abstract)

Fritz, K.S., Galligan, J.J., Smathers, R.L., Roede, J.R., Shearn, C.T., Reigan, P., & Petersen, D.R. (2011). 4-Hydroxynonenal inhibits SIRT3 via thiol-specific modification. *Chemical Research in Toxicology*, *24(5)*, 651–662.

Galligan, J.J., Fritz, K.S., Tipney, H., Smathers, R.L., Roede, J.R., Shearn, C.T., Hunter, L.E., & Petersen, D.R. (2011). Profiling impaired hepatic endoplasmic reticulum glycosylation as a consequence of ethanol ingestion. *Journal of Proteome Research*, *10(4)*, 1837–1847.

Rebecca Helfand, Stitzel Lab

Gonzalez, P.K., & Link, C.D. (2011). Mitochondrial fission protects *C. elegans* from amyloid-beta toxicity. The Genetics Society of America, *18th International* C. elegans *Meeting*, *Abstract Book*, #394B, 102. (Abstract)

Good, R.L., & Radcliffe, R.A. (2011). Methamphetamine-induced locomotor changes are dependent on age, dose and genotype. *Pharmacology Biochemistry and Behavior*, *98(1)*, 101–111.

Grady, S.R., Drenan, R.M., Lester, H.A., Whiteaker, P., McIntosh, J.M., & Marks, M.J. (2010). Nicotinic acetylcholine receptors with the alpha6 subunit: Restricted distribution and role in modulating dopamine release. Society for Research on Nicotine and Tobacco, *Abstract Book*, SYM1A, 1. (Abstract)

Grady, S.R., McIntosh, M.D., Quik, M., Damaj, I., & Ehringer, M.A. (2010). Emerging role for a6 nicotonic receptors in dopaminergic function; link to addiction. Society for Research on Nicotine and Tobacco, *Abstract Book*, SYM1, 1. (Abstract)

Grady, S.R., Ortiz, N.C., Paley, M., Willis, E.A., & Marks, M.J. (2011). Effects of chronic varenicline in mice: Comparison to nicotine. Society for Research on Nicotine and Tobacco, *Abstract Book*, PA18-2, 39. (Abstract)

Grammatopoulos, T.N., Jones, S.M., Yoshimura, M., Hoover, B.R., Das, M., Snyder, E.Y., Larson, G.A., Zahniser, N.R., Tabakoff, B., & Zawada, W.M. (2010). Neurotransplantation of stem cells genetically modified to express human dopamine transporter reduces alcohol consumption. *Stem Cell Research and Therapy*, *1(5)*, 36.

Grucza, R.A., Ehringer, M.A., Smith, R.M., & Stitzel, J.A. (2010). Disentangling the effects of the CHRNA5/A3/B4 gene cluster on various drug-related behaviors using human, molecular, and mouse genetics. Society for Research on Nicotine and Tobacco, *16th Annual Meeting, Abstract Book*, SYM5, 6. (Abstract)

Haberstick, B.C., Ehringer, M.A., Lessem, J.M., Hopfer, C.J., & Hewitt, J.K. (2011). Dizziness and the genetic influences on subjective experiences to initial cigarette use. *Addiction*, *106(2)*, 391–399.

Haberstick, B.C., Lessem, J.M., McQueen, M.B., Boardman, J.D., Hopfer, C.J., Smolen, A., & Hewitt, J.K. (2010). Stable genes and changing environments: Body mass index across adolescence and young adulthood. *Behavior Genetics*, *40(4)*, 495–504.

Haberstick, B.C., Rhea, S.A., Button, T., & Corley, R.P. (2010). Childhood sweet food consumption and problem adolescent alcohol use: is there a genetic relationship? Behavior Genetics Association, *40th Annual Meeting*, *Behavior Genetics*, *40(6)*, 795. (Abstract)

Haberstick, B.C., Zeiger, J.S., Corley, R.P., Hopfer, C.J., Stallings, M.C., Rhee, S.H., Crowley, T.J., & Hewitt, J.K. (2011). Common and drug-specific genetic influences on subjective effects of alcohol, tobacco, and marijuana use. *Addiction*, *106(1)*, 215–224.

Hankin, B.L., Barrocas, A.L., Jenness, J., Oppenheimer, C.W., Badanes, L.S., Abela, J.R., Young, J., & Smolen, A. (2011). Association between 5-HTTLPR and borderline personality disorder traits among youth. *Frontiers in Child and Neurodevelopmental Psychiatry*, *2*, 6.

Hankin, B.L., Jenness, J., Abela, J.R., & Smolen, A. (2011). Interaction of 5-HTTLPR and idiographic stressors predicts prospective depressive symptoms specifically among youth in a multiwave design. *Journal of Clinical Child and Adolescent Psychology*, *40(4)*, 572–585.

Haworth, C.M.A., Wright, M.J., Luciano, M., Martin, N.G., de Geus, E.J.C., van Beijsterveldt, C.E.M., Martels, M., Posthuma, D., Boomsma, D.I., Davis, O.S.P., Kovas, Y., Corley, R.P., DeFries, J.C., Hewitt, J.K., Olson, R.K., Rhea, S-A., Wadsworth, S.J., Iacono, W.G., McGue, M., Thompson, L.A., Hart, S.A., Petrill, S.A., Lubinski, D., & Plomin, R. (2010). The heritability of general cognitive ability increases linearly from childhood to young adulthood. *Molecular Psychiatry*, *15(11)*, 1112–1120.

Heath, C.J., King, S.L., Gotti, C., Marks, M.J., & Picciotto, M.R. (2010). Cortico-thalamic connectivity is vulnerable to nicotine exposure during early postnatal development through $\alpha4\beta2\alpha5$ nicotinic acetylcholine receptors. *Neuropsychopharmacology*, *35(12)*, 2324–2338.

Herd, S.A., Friedman, N.P., Chatham, C.H., Hazy, T.E., Brant, A.M., & O'Reilly, R.C. (2011). Towards neural network models linking genetics to individual differences in executive functions. Cognitive Neuroscience Society, *18th Annual Meeting*. (Abstract)

Hewitt, J.K., Brant, A.M., Corley, R.P., Wadsworth, S.J., & DeFries, J.C. (2010). A closer look at the developmental etiology of high IQ. *Twin Research and Human Genetics*, *13*, 263. (Abstract)

Hewitt, J.K., Hahn, M.E, & Hewitt, C.A. (2010). Yong-Kyu Kim (ed.): Handbook of Behavior Genetics (review). *Behavior Genetics*, *40(4)*, 572–573.

Hicklin, T.R., Wu, P.H., Radcliffe, R.A., Freund, R.K., Goebel-Goody, S.M., Correa, P.R., Proctor, W.R., Lombroso, P.J., & Browning, M.D. (2011). Alcohol inhibition of the NMDA receptor function, long-term potentiation, and fear learning requires striatal-enriched protein tyrosine phosphatase. *Proceedings of the National Academy of Sciences (PNAS)*, *108*, 6650–6665.

Hink, L.K., Rhee, S.H., Schulz-Heik, R.J., Corley, R.P., Cosgrove, V. E., Young, S. E., & Hewitt, J.K. (2010). Personality as common and broadband-specific features of internalizing and externalizing disorders. Behavior Genetics Association, *40th Annual Meeting*, *Behavior Genetics*, *40(6)*, 796. (Abstract)

Hoffman, P.L., Bennett, B., Saba, L.M., Bhave, S.V., Carosone-Link, P.J., Hornbaker, C.K., Kechris, K.J., Williams, R.W., & Tabakoff, B. (2011). Using the Phenogen website for 'in silico' analysis of morphine-induced analgesia: Identifying candidate genes. *Addiction Biology*, *16(3)*, 393–404.

Hoffman, P.L., Jones, J., Bennett, B., Carosone-Link, P.J., Grahame, N., Finger, T.E., & Tabakoff, B. (2010). Does taste influence alcohol preference? Research Society on Alcoholism, *33rd Annual Scientific Meeting*, *Alcoholism: Clinical and Experimental Research*, *34(s2)*, #293, 84A. (Abstract)

Hoft, N.R., Kamens, H.M., Miyamoto, J., & Ehringer, M.A. (2010). The role of CHRNA6 and CHRNB3 genes in alcohol behaviors using mouse models. American Society of Human Genetics, *ASHG Abstract Book,* #2491. (Abstract)

Hoft, N.R., Sakai, J.T., & Ehringer, M.A. (2010). Tobacco and Alcohol Use Behaviors. In K.P. Tercyak (Ed.), *Handbook of Genomics and the Family* (345–367). New York: Springer.

Hoft, N.R., Stephens, S.H., Miyamoto, J., Corley, R.P., Huizinga, D., Menard, S., & Ehringer, M.A. (2010). Longitudinal association of alcohol use behaviors with CHRNA6 gene in independent samples. Research Society on Alcoholism, *33rd Annual Scientific Meeting*, *Alcoholism: Clinical and Experimental Research*, *34(s2)*, #251, 73A. (Abstract)

Hoft, N.R., Stitzel, J.A., Hutchison, K.E., & Ehringer, M.A. (2011). CHRNB2 promoter region: Association with subjective effects to nicotine and gene expression differences. *Genes, Brain and Behavior*, *10(2)*, 176–185.

Horton, W.J. Sheneman, D., Gissel, H., & Stitzel, J.A. (2011). Signaling through Mtnr1a/Mtnr1b melatonin receptors effects nicotine preference drinking. International Behavioural and Neural Genetics Society, *13th Annual Meeting*, *Genes, Brain and Behavior*, *10(4)*, P-59, 508. (Abstract)

Howrigan, D.P., Laird, N.M., Smoller, J.W., Devlin, B., & McQueen, M.B. (2011). Using linkage information to weight a genome-wide association of bipolar disorder. *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics*, *156B(4)*, 462–471.

Huang, L., Grady, S.R., & Quik, M. (2011). Nicotine reduces L-DOPA-induced dyskinesias by acting at beta2* nicotinic receptors. *The Journal of Pharmacology and Experimental Therapeutics*, *338(3)*, 932–941.

Jackson, K.J., Marks, M.J., Vann, R.E., Chen, X., Gamage, T.F., Warner, J.A., & Damaj, M.I. (2010). Role of alpha5 nicotinic acetylcholine receptors in pharmacological and behavioral effects of nicotine in mice. *The Journal of Pharmacology and Experimental Therapeutics*, *334(1)*, 137–146.

Johnson, T.E. (2010). The discovery of longevity mutants. American Aging Association, *39th Annual Meeting*, *Inflamation and Aging: Causes and Consequences*, 28. (Abstract)

Johnson, T.E., Mendenhall, A.R., Cypser, J.R., Seewald, A.K., Tedesco, P.M., Alexanderson, O., Taylor, L., Link, C. (2010). Stochastic processes of aging. American Aging Association, *39th Annual Meeting*, *Inflamation and Aging: Causes and Consequences*, 29. (Abstract)

Johnson, T.E., Mendenhall, A.R., Cypser, J.R., Seewald, A.K., Tedesco, P.M., Taylor, L., & Link, C. (2010). Senescence and aging: Program or stochastic? British Society for Research on Aging, *60th Scientific Meeting, Systems Biology of Ageing*. (Abstract)

Johnson, T.E., Mendenhall, A.R., Cypser, J.R., Seewald, A.K., Tedesco, P.M., Taylor, L., & Link, C. (2010). Stochastic processes lead to heterogeneity in aging. Scottish Bioinformatics Forum, *Discerning Diversity in Ageing*. (Abstract)

Johnson, E.P., Pennington, B.F., Lowenstein, L.H., & Nittrouer, S. (2011). Sensitivity to structure in the speech signal by children with speech sound disorder and reading disability. *Journal of Communication Disorders*, *44(3)*, 294–314.

Kamens, H.M., Corley, R.P., Hoft, N.R., McQueen, M.B., Stallings, M.C., Brown, S.J., Crowley, T.J., Hopfer, C.J., Hewitt, J.K., & Ehringer, M.A. (2011). The role of CHRNA4 and CHRNB2 in alcohol and nicotine behaviors. International Behavioural and Neural Genetics Society, *13th Annual Meeting*, *Genes, Brain and Behavior*, *10(4)*, 480. (Abstract)

Kamens, H.M., Cox, R.J., & Ehringer, M.A. (2011). The CHRNA6 and CHRNB3 genes do not modulate ethanol consumption. *Alcoholism: Clinical and Experimental Research*, *35(s1)*, #249, 73A. (Abstract)

Kamens, H.M., McQueen, M.B., Corley, R.P., Stallings, M.C., Hewitt, J.K., & Ehringer, M.A. (2011). Association of the CHRNB2 gene and DSM-IV nicotine dependence symptoms. Society for Research on Nicotine and Tobacco, *Abstract Book*, NIPA-4, 43. (Abstract)

Kamens, H.M., McQueen, M.B., & Ehringer, M.A. (2010). Association of the CHRNB2 gene and DSM-IV alcohol abuse and dependence criteria. International Behavioural and Neural Genetics Society, *12th Annual Meeting*, *Genes, Brain, and Behavior*, *9(4)*, 434. (Abstract)

Karimpour-Fard, A., Dumas, L., Phang, T., Sikela, J.M., & Hunter, L.E. (2010). A survey of analysis software for array-comparative genomic hybridization studies to detect copy number variation. *Human Genomics*, *4(6)*, 421–427.

Lahey, B.B., & Willcutt, E.G. (2010). Predictive validity of a continuous alternative to nominal subtypes of attention-deficit/hyperactivity disorder for DSM-V. *Journal of Clinical Child and Adolescent Psychology*, *39(6)*, 761–775.

Liao, C.Y., Rikke, B.A., Johnson, T.E., Gelfond, J.A., Diaz, V., & Nelson, J.F. (2011). Fat maintenance is a predictor of the murine lifespan response to dietary restriction. *Aging Cell, 10(4)*, 629–639.

Liao, C.Y., Rikke, B.A., Johnson, T.E., Diaz, V., & Nelson, J.F. (2010). Genetic variation in the murine lifespan response to dietary restriction: From life extension to life shortening. *Aging Cell*, *9(1)*, 92–95.

Liao, C.Y., Rikke, B.A., Johnson, T.E., Diaz, V., & Nelson, J.F. (2010). No evidence that competition for food underlies lifespan shortening by dietary restriction in multiply housed mice: Response to commentary. *Aging Cell*, *9(3)*, 450–452.

Marks, M.J., McClure-Begley, T.D., Whiteaker, P., Salminen, O., Brown, R.W., Cooper, J., Collins, A.C., & Lindstrom, J.M. (2011). Increased nicotinic acetylcholine receptor protein underlies chronic nicotine-induced up-regulation of nicotinic agonist binding sites in mouse brain. *Journal of Pharmacology and Experimental Therapeutics*, *337(1)*, 187–200.

Marks, M.J., Meinerz, N.M., Brown, R.W., & Collins, A.C. (2010). 86Rb+ efflux mediated by alpha4beta2*-nicotinic acetylcholine receptors with high and low-sensitivity to stimulation by acetylcholine display similar agonist-induced desensitization. *Biochemical Pharmacology*, *80(8)*, 1238–1251.

Marks, M.J., Whiteaker, P., Salminen, O., Brown, R.W., Lindstrom, J.M., & Collins, A.C. (2010). Chronic nicotine treatment results in similar changes in nicotinic binding sites and alpha4 and beta2 nicotinic receptor subunit proteins. Society for Research on Nicotine and Tobacco, *Abstract Book*, PA16-1, 36. (Abstract)

McClure-Begley, T., Marks, M.J., Grady, S.R., Ortiz, N.C., & Stitzel, J.A. (2010). In vivo and in vitro models of chronic nicotine exposure show evidence of altered calcineurin phosphatase activity. Society for Neuroscience, *2010 Neuroscience Meeting Planner*, #38.8. (Abstract)

McColl, G., Rogers, A.N., Alavez, S., Hubbard, A.E., Melov, S., Link, C.D., Bush, A.I., Kapahi, P., & Lithgow, G.J. (2010). Insulin-like signaling determines survival during stress via posttranscriptional mechanisms in *C. elegans*. *Cell Metabolism*, *12(3)*, 260–272.

McGrath, L.M., Pennington, B.F., Shanahan, M.A., Santerre-Lemmon, L.E., Barnard, H.D., Willcutt, E.G., Defries, J.C., & Olson, R.K. (2011). A multiple deficit model of reading disability and attention-deficit/hyperactivity disorder: Searching for shared cognitive deficits. *Journal of Child Psychology and Psychiatry*, *52(5)*, 547–557.

McQueen, M.B. (2010). Integrating epigenetics into population-based studies of complex disease. National Hispanic Science Network on Drug Abuse*, 10th Annual International Conference*: *Modeling a Transdisciplinary Approach to Current Research Agendas, Program Book*, 3. (Abstract)

McQueen, M.B. & Willcutt, E.G. (2010). Genetic Vulnerability and Stress in the Onset of Bipolar Disorder. In D.J. Miklowitz & D. Cicchetti (Eds.), *Understanding Bipolar Disorder: A Developmental Psychopathology Perspective* (246–279). New York: Guilford Publications.

Melroy, W.E., Stephens, S.H., McQueen, M.B., Corley, R.C., Stallings, M.C., Crowley, T.J., Hopfer, C.J., Krauter, K.S., Hewitt, J.K., & Ehringer, M.A. (2011). Examination of SNPs in the GABRA2 gene with alcohol behaviors in a young adult sample. Research Society on Alcoholism, *34th Annual Scientific Meeting, Alcoholism: Clinical and Experimental Research*, *35(s1)*, #488, 132A. (Abstract)

Mendenhall, A., Tedesco, P., Brent, R., & Johnson, T.E. (2010). Causes and consequences of stochastic variation in *C. elegans*' gene expression. *Aging, Metabolism, Pathogenesis, Stress, and Small RNAs Meeting*, Madison, WI. (Abstract)

Mendenhall, A.R., Tedesco, P.M., Cypser, J.R., Taylor, L., Lowe, A., Brent, R., & Johnson, T.E. (2011). Factors affecting the mean, variance and predictive power of a lifespan biomarker. The Genetics Society of America, *18th International* C. elegans, *Abstract Book*, #942A, 206. (Abstract)

Mendenhall, A.R., Wu, D., Park, S.K., Cypser, J.R., Tedesco, P.M., Link, C.D., & Johnson, T.E. (2011). Genetic dissection of late-life fertility in *C. elegans*. *Journal of Gerontology: Biological Sciences*, glr089v1–glr089.

Munn, M.A., Palmer, R.H., Rhee, S.H., Corley, R.P., Hewitt, J.K., & Stallings, M.C. (2010). Genetic and environmental relationships among eating pathology and substance use: Can personality explain the comorbidity? Eating Disorders Research Society, *16th Annual Meeting*. (Abstract)

Munn, M.A., Stallings, M.C., Rhee, S.H., Sobik, L.E., Corley, R.P., Rhea, S.A., & Hewitt, J.K. (2010). Bivariate analysis of disordered eating characteristics in adolescence and young adulthood. *International Journal of Eating Disorders*, *43(8)*, 751–761.

Munoz-Lobato, F., Link, C.D., Hamamichi, S., Caldwell, K.A., Caldwell, G.A., & Miranda-Vizuete, A. (2011). Protective role of dnj-27, a thioredoxin family member, on *C. elegans* models of Alzheimer's and Parkinson's Diseases. The Genetics Society of America, *18th International* C. elegans *Meeting*, *Abstract Book*, #404C, 104. (Abstract)

Nesil, T., Kanit, L., Collins, A.C., & Pogun, S. (2011). Individual differences in oral nicotine intake in rats. *Neuropharmacology*, *61(1–2)*, 189–201.

Nittrouer, S., & Pennington, B.F. (2010). New approaches to the study of childhood language disorders. *Current Directions in Psychological Science*, *19(5)*, 308–313.

O'Bleness, M.S., Dumas, L.J., Kehrer-Sawatski, H., & Sikela, J.M. (2010). Genomic reconstruction of the evolutionary history of DUF1220 domains. American Society for Human Genetics, *60th Annual Meeting*, #1721/W, 179. (Abstract)

O'Bleness, M.S., Wyckoff, G.J., Dumas, L.J., & Sikela, J.M. (2010). Genomic reconstruction of the evolutionary history of DUF1220 domains. *UC Denver Post-Doctoral Research Day*, 46. (Abstract)

Olson, R.K., Keenan, J.M., Byrne, B., Samuelsson, S., Coventry, W.L., Corley, R., Wadsworth, S.J., Willcutt, E.G., DeFries, J.C., Pennington, B.F., & Hulslander, J. (2011). Genetic and environmental influences on vocabulary and reading development. *Scientific Studies of Reading*, *15(1)*, 26–46.

Pennington, B.F. (2011). Controversial therapies. *Perspectives on Language and Literacy*, *37(1)*, 7–8.

Peterson, R.L., & Pennington, B.F. (2010). Reading disability. In K.O. Yeates, M.D. Ris, H.G. Taylor, & B.E. Pennington (Eds.), *Pediatric Neuropsychology: Research, Theory, and Practice* (2nd ed., 324-362). New York: Guilford Press.

Power, M., Weuve, J., Gagne, J., McQueen, M.B., & Blacker, D. (2010). The relationship between blood pressure and incident Alzheimer's disease: A systematic review and meta-analysis. *International Conference on Alzheimer's Disease and Related Disorders Abstracts*. (Abstract)

Pronko, S.P., Hoffman, P.L., & Tabakoff, B. (2010). High ethanol preference and consumption in female adenylyl cyclase type 7 knockdown mice. Research Society on Alcoholism, *33rd Annual Scientific Meeting*, *Alcoholism: Clinical and Experimental Research*, *34(s2)*, #475, 129A. (Abstract)

Pronko, S.P., Saba, L.M., Hoffman, P.L., & Tabakoff, B. (2010). Type 7 adenylyl cyclase-mediated hypothalamic-pituitary-adrenal axis responsiveness: Influence of ethanol and sex. *Journal of Pharmacology and Experimental Therapeutics*, *334(1)*, 4452.

Quik, M., Perez, X.A., & Grady, S.R. (2011). Role of α6 nicotinic receptors in CNS dopaminergic function: relevance to addiction and neurological disorders. *Biochemical Pharmacology*, *82(2)*, 873–882.

Radcliffe, R.A., & Phang, T.L. (2010). Quantitative sequencing of mRNA from the brains of ILS and ISS selectively bred mouse strains. Research Society on Alcoholism, *33rd Annual Scientific Meeting*, *Alcoholism: Clinical and Experimental Research*, *34(supp. s2)*, #487, 132A. (Abstract)

Rhee, S.H., Boeldt, D.L., Corley, R.C., Hewitt, J.K., Hink, L.K., Kanfo, A., Lahey, B.S., Robinson, J.A., Van Hulle, C., Waldman, I.D., Young, S., & Zahn-Waxler, C. (2010). Concern and disregard for others as predictors of antisocial behavior. Behavior Genetics Association, *40th Annual Meeting*, *Behavior Genetics*, *40(6)*, 810. (Abstract)

Rhee, S.H., & Waldman, I.D. (2011). Genetic and environmental influences on aggression. In P. R. Shaver & M. Mikulincer (Eds.), *Human Aggression and Violence: Causes, Manifestations, and Consequences* (143–164). Washington, D.C.: American Psychological Association.

Rikke, B.A., Liao, C.Y., McQueen, M.B., Nelson, J.F., & Johnson, T.E. (2010). Genetic dissection of dietary restriction in mice supports the metabolic efficiency model of life extension. *Experimental Gerontology*, *45(9)*, 691–701.

Saba, L.M., Bennett, B., Hoffman, P.L., Barcomb, K., Ishii, T., Kechris, K., & Tabakoff, B. (2011). A systems genetic analysis of alcohol drinking by mice, rats and men: Influence of brain GABAergic transmission. *Neuropharmacology*, *60(7–8)*, 1269–1280.

Saba, L.M., Hoffman, P.L., Carosone-Link, P., Israel, Y., Tampier, L., Colombo, G., Kiianmaa, K., Bell, R., & Tabakoff, B. (2010). What is the alcoholism gene: Comparison of transcriptome defferences in six lines of rats selectively bred for alcohol preference. Research Society on Alcoholism, *33rd Annual Scientific Meeting*, *Alcoholism: Clinical and Experimental Research*, *34(s2)*, #486, 132A. (Abstract)

Saccone, N.L., Culverhouse, R.C., Schwantes-An, T.H., Cannon, D.S., Chen, X., Cichon, S., Giegling, I., Han, S., Han, Y., Keskitalo-Vuokko, K., Kong, X., Landi, M.T., Ma, J.Z., Short, S.E., Stephens, S.H., Stevens, V.L., Sun, L., Wang, Y., Wenzlaff, A.S., Aggen, S.H., Breslau, N., Broderick, P., Chatterjee, N., Chen, J., Heath, A.C., Heliövaara, M., Hoft, N.R., Hunter, D.J., Jensen, M.K., Martin, N.G., Montgomery, G.W., Niu, T., Payne, T.J., Peltonen, L., Pergadia, M.L., Rice, J.P., Sherva, R., Spitz, M.R., Sun, J., Wang, J.C., Weiss, R.B., Wheeler, W., Witt, S.H., Yang, B.Z., Caporaso, N.E., Ehringer, M.A., Eisen, T., Gapstur, S.M., Gelernter, J., Houlston, R., Kaprio, J., Kendler, K.S., Kraft, P., Leppert, M.F., Li, M.D., Madden, P.A., Nöthen, M.M., Pillai, S., Rietschel, M., Rujescu, D., Schwartz, A., Amos, C.I., & Bierut, L.J. (2011). Multiple independent loci at chromosome 15q25.1 affect smoking quantity: a meta-analysis and comparison with lung cancer and COPD. *PLoS Genetics*, *6(8)*, e1001053.

Sakai, J.T., Boardman, J.D., Gelhorn, H., Smolen, A., Corley, R.P., Huizinga, D., Hewitt, J.K., & Stallings, M.C. (2010). Using trajectory analyses to refine phenotype for genetic association: Conduct problems and the serotonin transporter. *Psychiatric Genetics*, *20(5)*, 199–206.

Saldi, T.K., Roberts, C.M., Ash, P.E.A., Petrucelli, L., & Link, C.D. (2011). TDP-1, the *C. elegans* ortholog of ALS-associated protein TDP-43, modulates RNA editing and RNAi. The Genetics Society of America, *18th International* C. elegans *Meeting*, *Abstract Book*, #992C, 216. (Abstract)

Scerri, T.S., Paracchini, S., Morris, A., MacPhie, I. L., Talcott, J., Stein, J., Smith, S.D., Pennington, B.F., Olson, R.K., DeFries, J.C., Monaco, A.P., & Richardson, A.J. (2010). Identification of candidate genes for dyslexia susceptibility on chromosome 18. *PLoS ONE*, *5(10)*, e13712.

Seewald, A.K., Cypser, J.R., Mendenhall, A.R., & Johnson, T.E. (2010). Quantifying phenotypic variation in isogenic *C. elegans* expressing Phsp-16.2: GFP by clustering 2D expression patterns. *PloS One*, *5(7)*, e11426.

Shearn, C.T., Fritz, K.S., Reigan, P., & Petersen, D.R. (2011). Modification of Akt2 by 4-hydroxynonenal inhibits insulin-dependent Akt signaling in hepG2 cells. *Biochemistry*, *50(19)*, 3984–3996.

Shearn, C.T., Smathers, R.L., Stewart, B.J., Fritz, K.S., Galligan, J.J., Hail, N., & Petersen, D.R. (2011). Phosphatase and tensin homolog deleted on chromosome 10 (PTEN) inhibition by 4-hydroxynonenal leads to increased Akt activation in hepatocytes. *Molecular Pharmacology*, *79(6)*, 941–952.

Sikela, J.M. (2010). Gene copy number variation in human and primate evolution. In S. Scherer (Ed.), *Copy Number Variation*, The Biomedical and Life Sciences Collection (online). London: Henry Stewart Talks Ltd.

Simm, A., & Johnson, T.E. (2010). Biomarkers of ageing: A challenge for the future. *Experimental Gerontology*, *45(10)*, 731–732.

Smathers, R.L., Galligan, J.J., Stewart, B.J., & Petersen, D.R. (2011). Overview of lipid peroxidation products and hepatic protein modification in alcoholic liver disease. *Chemico-Biological Interactions*, *192(1–2)*, 107–112.

Smathers, R.L., & Petersen, D.R. (2011). The human fatty acid-binding protein family: Evolutionary divergences and functions. *Human Genomics*, *5(3)*, 170–191.

Smith, A.K., Stasi, S.M., Rhee, S.H., Corley, R.P., Young, S.E., & Hewitt, J.K. (2010). Genetic and environmental covariance between conduct disorder, ADHD, and verbal ability. Behavior Genetics Association, *40th Annual Meeting*, *Behavior Genetics*, *40(6)*, 813. (Abstract)

Smith, S.D., Grigorenko, E., Willcutt, E.G., Pennington, B.F., Olson, R.K., & DeFries, J.C. (2010). Etiologies and molecular mechanisms of communication disorders. *Journal of Developmental Behavioral Pediatrics*, *31(7)*, 555–563.

Smith, A.K., Stasi, S.M., Rhee, S.H., Corley, R.P., Young, S.E., & Hewitt, J.K. (2011). The role of attention-deficit/hyperactivity disorder in the covariation between conduct disorder and verbal ability. *Frontiers in Child and Neurodevelopmental Psychiatry*, *2*, 3.

Stitzel, J.A. (2010). CHRNA5 D398N SNP: Implications for addiction and lung cancer risk. Gene Environment Association Studies, *GENEVA Steering Committee Meeting*. (Abstract)

Stitzel, J.A. (2010). Epigenetics in animal models of addiction: Opportunities and challenges. *National Hispanic Science Network on Drug Abuse Program*, 2. (Abstract)

Stitzel, J.A. (2011). Receptors and Brain Disease. In A. Lajtha (Ed.), *Handbook of Neurochemistry and Molecular Neurobiology Volume 25: Neurochemical Mechanisms of Disease* (757–784). New York: Springer.

Stitzel, J.A., Kim, S. Nguyen, V., Cyboron, A., Hesterberg, K., & Wilking, J.A. (2010). The effect of CHRNA5 selection on nicotine consumption in mice is dependent upon genetic background. Society for Research on Nicotine and Tobacco, *Abstract Book*, SYM5D, 7. (Abstract)

Tammimäki, A.E., Horton, W.J., & Stitzel, J.A. (2011). Recent advances in gene manipulation and nicotinic acetylcholine receptor biology. *Biochemical Pharmacology*, *82(8)*, 808–819.

Tammimäki, A.E., Whittington, K.M., Hesterberg, K., Xu, J., & Stitzel, J.A. (2010). Activity and anxiety in Chrnb2 V287L knock-in mice. Society for Neuroscience, *2010 Neuroscience Meeting Planner*, #758.4. (Abstract)

Vandever, J.M., Miyake, A., Young, S.E., Friedman, N.P., Corley, R.P., Hewitt, J.K., & Stallings, M.C. (2010). Behavioral disinhibition and executive functions: Genetic relations are stronger for substance use than substance dependence. World Congress on Psychiatric Genetics, *18th Annual Meeting*. (Abstract)

Wadsworth, S.J., Olson, R.K., & DeFries, J.C. (2010). Differential genetic etiology of reading difficulties as a function of IQ: an update. *Behavior Genetics*, *40(6)*, 751–758.

Whisman, M.A., Johnson, D.P., & Smolen, A. (2011). Dysfunctional attitudes and the serotonin transporter promoter polymorphism (5-HTTLPR). *Behavior Therapy*, *42(2)*, 300–305.

Willcutt, E.G., Boada, R., Riddle, M.W., Chhabildas, N., DeFries, J.C., & Pennington, B.F. (2011). Colorado Learning Difficulties Questionnaire: Validation of a parent-report screening measure. *Psychological Assessment*, *23(3)*, 778–791.

Willcutt, E.G., Betjemann, R.S., McGrath, L.M., Chhabildas, N.A., Olson, R.K., DeFries, J.C., & Pennington, B.F. (2010). Etiology and neuropsychology of comorbidity between RD and ADHD: the case for multiple-deficit models. *Cortex*, *46(10)*, 1345–1361.

Willcutt, E.G., Pennington, B.F., Duncan, L., Smith, S.D., Keenan, J.M., Wadsworth, S.J., DeFries, J.C., & Olson, R.K. (2010). Understanding the complex etiologies of developmental disorders: Behavioral and molecular genetic approaches. *Journal of Developmental and Behavioral Pediatrics*, *31(7)*, 533–544.

Wu, S., Pennington, B.F., & Willcutt, E.W. (2011). Neuropsychological profiles of ADHD, anxiety, and co-morbid ADHD and anxiety. Society for Research in Child Development, *Biennial Meeting*. (Abstract)

Ybarra, O., Keller, M.C., Chan, E., Garcia, S.M., Sanchez-Burks, J., Morrison, K.R., & Baron, A.S. (2010). Being unpredictable: Friend or foe matters. *Social Psychological and Personality Science*, *1*, 259–267.

Yeates, K.O., Ris, M.D., Taylor, H.G., & Pennington, B.F. (Eds.). (2010). *Pediatric Neuropsychology: Research, Theory, and Practice* (2nd ed.). New York: Guilford Press.

Zambrano, C.A., Flora, A.V., Salamander, R.M., Funk, E.M., Marks, M.J., Stitzel, J.A., & Ehringer, M.A. (2011). Functional study of SNPs in the A5A3B4 nAChR gene cluster expressed in mouse embryonic neuronal culture. Wellcome Trust, *Nicotinic Acetylcholine Receptors Abstract Book*. (Abstract)

Zeiger, J.S., Haberstick, B.S., Corley, R.P., Ehringer, M.A., Crowley, T.J., Hewitt, J.K., Hopfer, C.J., Stallings, M.C., Young, S.E., & Rhee, S.H. (2010). Subjective effects to marijuana associated with marijuana use in community and clinical subjects. *Drug and Alcohol Dependence*, *109(1–3)*, 161–166.

Zhao-Shea, R., Liu, L., Soll, L.G., Improgo, M.R., Meyers, E.E., McIntosh, J.M., Grady, S.R., Marks, M.J., Gardner, P.D., & Tapper, A.R. (2011). Nicotine-mediated activation of dopaminergic neurons in distinct regions of the ventral tegmental area. *Neuropsychopharmacology*, *36(5)*, 1021–32.

Zimatkin, S.M., Oganesian, N.A., Kiselevski, Y.V., & Deitrich, R.A. (2011). Acetate-dependent mechanisms of inborn tolerance to ethanol. *Alcohol and Alcoholism*, *46(3)*, 233–238.

The Institute for Behavioral Genetics with the second floor addition, completed in 2006.