Division of Cognitive Neuroscience

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April 1, 2012 - March 30, 2013

Overview

Using behavioral, cognitive and neurophysiological techniques, we investigate brain-behavior relationships and neurobiological and cognitive mechanisms underlying psychiatric disorders. Our work spans basic and preclinical studies, development and application of laboratory-based assessment, clinical trials and clinical care. Training and research opportunities are available in the laboratories in the Division of Cognitive Neuroscience.

Edward E. Smith, PhD, oversaw research in the division until he passed away on August 17, 2012.

Current Research

Dr. Edward Smith and colleagues NIMH-funded negative symptoms project continued in its 3rd year of funding. This project contrasts patients with schizophrenia and healthy controls on their ability to learn to associate specific stimuli with either positive or negative outcomes. The behavioral results show a striking effect of the kind of outcome on patients' learning: compared to controls, the patients were very impaired in learning when the outcome was positive, but were close to normal when the outcomes were negative. Preliminary fMRI results indicated that the patients' neural responses to positive outcomes are blunted when compared to that of normals.

Dr. Edward Smith and colleagues continued their NIMH-funded Conte-Center research on the neural bases of working memory deficits in patients with schizophrenia. fMRI results provide evidence for the hypothesis of decreased neuronal efficiency in schizophrenia.

Drs. Gerard Bruder, Craig Tenke and Jurgen Kayser, in collaboration with the Depression Evaluation Service (DES), continued their NIMH supported project, in which they are finding evidence that electrophysiologic and neurocognitive measures are predictive of clinical response to antidepressants.

Drs. Gerard Bruder, Craig Tenke and Jurgen Kayser are also heading up the electrophysiologic component of a multi-site NIMH initiative "Establishing Moderators and Biosignatures of Antidepressant Response for Clinical Care" (EMBARC: P. McGrath, M. Weissman & M. Trivedi, Principal Investigators).

The Psychophysiology Laboratory continued participation in Dr. Myrna Weissman's NIMH-funded longitudinal study of individuals at risk for depressive disorders.

Drs. Kayser, Tenke & Bruder found that patients having schizophrenia who experience auditory hallucinations show reduced early brain potentials to visual stimuli.

The Psychophysiology Laboratory is also participating in a multi-site project "Clinical and Biomarker Assessment of Efficacy of Cognitive Remediation in Patients with Schizophrenia Stabilized on Lurasiodone: (J. Lieberman, Principal Investigator), in which they are heading up assessments of auditory perception, memory and ERPs.

Dr. David Friedman's Cognitive Electrophysiology Laboratory is involved in a series of interlocking investigations concerned with cognitive event-related brain potentials (ERPs) recorded from the scalp. Projects include memory, attention and executive function in normal development and aging.

Dr. David Friedman's NIA-funded cognitive aging project, which is currently operating in a 5-year renewal period, is directed at understanding basic executive and memory processes and how they change with normal aging. Findings from this project are consistent with deficiencies in executive processing underlying the well-documented age-related deficit in episodic memory.
Dr. Peter Balsam's NIMH funded project studies how animals learn about time and use it to guide behavior. Additionally, this project examines how temporal information processing is changed by alterations in dopaminergic function.

Dr. Balsam's Lab, in collaboration with the labs of Dr. Eric Kandel and Eleanor Simpson, is conducting projects analyzing the timing and motivational deficits found in a transgenic mouse line that like schizophrenic patients exhibits an increased level of dopamine D2 receptor activity in the striatum.

In an NIMH funded project Dr. Balsam's lab is collaborating with Christoph Kellondonk to examine the role of excitability of thalmo-cortical connections on motivation and cognition.
In a related NIDA funded project Dr. Balsam's Lab is studying how dopaminergic function changes over the course of learning in collaboration with Dr. Jon Horvitz (City College) and Dr. Mark West (Rutgers University).

Dr. Cheryl Corcoran's continue collaboration with Daniel Javitt on clinical trial to evaluate D-serine in its efficacy for prodromal symptoms, including attenuated positive symptoms, negative, symptoms and cognitive deficits.

Dr. David Kimhy continued NIMH-funded clinical trial to investigate the influence of aerobic exercise on cognitive functioning in individuals with schizophrenia. This project, which was developed in collaboration with Drs. Edward Smith, Richard Sloan and Mathew Bartels (and received a Priority Score of 10), is the first study to systematically evaluate the putative impact of aerobic exercise on neurocognitition and functioning in individuals with schizophrenia.

Dr. Kimhy completed his NIMH K23-suported project focusing on mechanism of recovery from psychosis in schizophrenia. This project aims to elucidate the roles of autonomic and emotion regulation during recovery from psychosis in individuals with schizophrenia.

Dr. Kimhy began a project is to evaluate the role of Brain-Derived Neurotrophic Factor (BDNF) in mediating the link between changes in aerobic fitness and cognitive functioning in individuals with schizophrenia.

An additional study by Dr. Kimhy evaluates the feasibility and validity of incorporating mobile devices (i.e., PDAs, cell phones) into research and treatment of individuals with severe mental illness.

Dr. Chara Malapani continued research on time perception and interval timing is ongoing in different patient populations with a recent focus on the effects of 2nd generation antipsychotics on the timing deficits

Dr. Michael Terman developed a dusk-to-dawn simulation protocol and apparatus for sleep management and installation in eldercare homes.

Dr. Terman and Dr. Jonathan Stewart initiated an inpatient protocol for light therapy, wake therapy, and sleep phase advance in patients with major depressive disorder.

Education and Training

Mentors for research training: Drs. Peter Balsam, Gerard Bruder, Cheryl Corcoran, David Friedman, David Kimhy, Chara Malapani, Edward Smith.

Mentees of this group include:

Billur Avlar, Graduate Student, Department of Psychology Columbia University
Teal Eich, Graduate Student, Department of Psychology Columbia University

Gregory Jensen, Graduate Student, Department of Psychology Columbia University
Jenna Reinen, Graduate Student, Department of Psychology Columbia University

Lindsey Casal-Roscum, Research Assistant, RFMH, received her B.A. from Bard College.
Arielle Radin, Columbia University student and SURF and AMGEN awards recipient through the CEPL.

Margaret Haglund, Chief Resident, presented at Adult Psychiatry Grand Rounds on a case report at COPE, and this was just submitted to the American Journal of Psychiatry as a case conference: Diagnosis and Treatment of a Patient with Attenuated Psychotic Symptoms

Arielle Radin, Columbia student and SURF and AMGEN awards recipient through the CEPL
Patricia Kabitzke, Post-Doctoral Fellow at Columbia University

Matt Bailey, Graduate Student, Department of Psychology Columbia University
Ryan Ward continues on a K99 Grant from NIH

Elizabeth Evans, 3rd year resident, is analyzing the correlates and predictive value of behavioral measures of olfaction (smell identification and odor threshold) at COPE

Karen Evans is a psychology intern who has successfully treated a number of patients during her clinical internship at COPE with Winnie Leung

Tiffany Fogelson is a social work intern who has successfully treated a number of patients during her clinical internship at COPE with Mara Eilenberg

Jordan DeVylder, a social work doctoral student at Columbia, has authored three manuscripts based on data at COPE, including one published, and two in reviews: DeVylder JE, Ben David S, Kimhy D, Corcoran CM. Attributional Style among Youth at Clinical Risk for Psychosis. Early Intervention in Psychiatry 2012 Mar 5 (Epub head of print); DeVylder JE, Ben-David S, Schobel SA, Kimhy D, Corcoran CM. A Longitudinal Study of Stress Measures and Symptoms in a Cohort at Clinical High Risk for Psychosis, Submitted to Psychological Medicine; DeVyler JE, Oh A, Ben-David S, Azimov N, Harkavy-Friedman J, Corcoran CM. Obsessive Compulsive Symptoms in Individuals at Clinical Risk for Psychosis: Associations with Social Impairment and Suicidal Ideation. Submitted to Schizophrenia Research.

Gennarina Santotelli, Fordham University, presented a poster on "Hopelessness and defeatist beliefs in cognitive remediation for Alzheimer's disease" at the International Neuropsychological Society in Montreal.

Elaina Montague, CUNY, presented a research symposium on "The relationship between negative symptoms, intrinsic motivation and cognition in enhancing learning outcomes in Schizophrenia" at the CUNY Pipeline Annual Conference.

Carol Pauls, St. John's University, developed a quality of life inventory for depressed patients undergoing ECT.

Niles Drake, M.D., PGY 4 elective in chronotherapeutics
Christina Garza, M.D., PGY4 elective in chronotherapeutics

Honors and Awards

The COPE Director, Cheryl Corcoran, is a faculty member in the Division of Cognitive Neuroscience. In the past year, she was nominated as a fellow in the Development of Novel Methodologies Program in the Irving CTSA program at Columbia.
Dr. David Kimhy was a recipient of an NIMH R21 Award titled “The Influence of Aerobic Exercise on Cognitive Functioning in Schizophrenia.”
Dr. Chara Malapani and Dr. Edward E. Smith were awarded a NIMH R21 grant to study breakdowns of cognitive control in Schizophrenia using fMRI and state-of-the-art tasks called for by the NIH-sponsored CNTRICS initiative to promote translational research on Schizophrenia.

Publications (Selected)

Bruder, G. E., et al. (2012). Relationship of resting EEG with anatomical MRI measures in individuals at high and low risk for depression. Hum Brain Mapp **33**(6): 1325-1333.
Corcoran CM, Smith C, McLaughlin D, Auther A, Malaspina D, Cornblatt B: HPA axis function and symptoms in adolescents at clinical high risk for schizophrenia. Schizophrenia Research 2012; 135(1-3):170-4.

Johnson, R., Jr., Nessler, D., & Friedman, D. (2012, December 31). Temporally Specific Divided Attention Tasks in Young Adults Reveal the Temporal Dynamics of Episodic Encoding Failures in Elderly Adults. *Psychology and Aging*. Advance online publication. doi:10.1037/a0030967
Kayser, J., et al. (2012). "A neurophysiological deficit in early visual processing in schizophrenia patients with auditory hallucinations." Psychophysiology **49**(9): 1168-1178.

Kimhy D, Myin-Germeys I, Palmier-Claus J, Swendsen J: Mobile Assessment Guide for Research in Schizophrenia and Severe Mental Disorders. Schizophrenia Bulletin 2012; 38: 386-395 (invited manuscript).

Terman M, McMahan I (2012) *Chronotherapy: Resetting Your Inner Clock to Boost Mood, Alertness, and Quality Sleep.* New York, Avery/Penguin.
Ward, R.D. Kellendonk, C., Kandel, E.R. & Balsam, P.D. (2012). Timing as a window on cognition in schizophrenia. *Neuropharmacology*, *62*, 1175-1181.

Divisional Highlights

Dr. Edward Smith and Chara Malapani’s research on the neural basis of updating working memory found that behavioral results indicate that patients with schizophrenia are impaired in updating information once it is in working memory but not before the information enters working memory. The fMRI results show a striking confirmation of the selective deficit; and patients’ frontal areas known to be involved in selecting information in working memory show reduced activation only when uploading should be occurring.

In collaboration with Drs. Peterson and Bansal in the MRI unit and Dr. Weissman in Epidemiology, Drs. Bruder and Tenke found evidence that asymmetric reduction of EEG activity over right posterior cortex in individuals at high risk for depression is associated with cortical thinning.

Dr. Kayser and colleagues found that patients with schizophrenia who are prone to auditory hallucinations show a neurophysiological deficit in early visual processing of words and faces.

Dr. Peter Balsam and colleagues have examined how disorders in timing and anticipation mechanisms can contribute to the negative symptoms of schizophrenia as well as the more general consideration of how cognition and motivation interact.

Dr. Cheryl Corcoran and Colleagues have found that predictors of psychosis among prodromal or clinical high risk patients include increased basal metabolism in the anterior hippocampus, increased odor threshold and reductions in amplitude of olfactory event-related potentials.
Dr. Cheryl Corcoran has also found that the profound social impairment seen even in prodromal patients is related to anhedonia, which has neural correlates in terms of reduced basal metabolism in the orbitofrontal cortex.

Dr. David Friedman and colleagues found that older adults as a whole show deficiencies in executive and mnemonic functions, but there is a good deal of variability in older- relative to young-adult samples, which implies that these functions might be amenable to training. Hence, understanding the basis of these individual differences and how to exploit them to enable older adults to age “gracefully” will be important goals in investigations of the cognitive neuroscience of aging.