

CURRICULUM VITAE

PART I: GENERAL INFORMATION

Date Prepared: 07/16/04
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Education:

8/80-6/84 **Bachelor of Science** Christian Brothers College. Memphis, TN.
8/84-12/90 **Doctor of Philosophy** University of Tennessee, (Anatomy and Neurobiology). Memphis, TN.
8/90-6/94 **Doctor of Medicine** Cornell University Medical College. New York, NY.

Postdoctoral Training:

7/90-6/94 **Research Associate**, Cornell University Medical College.
(Part Time) Department of Neurology and Neuroscience; New York, NY.
(Sponsor: Dr. Virginia M. Pickel).
7/94-6/95 **Intern in Medicine**, Massachusetts General Hospital. Boston, MA
7/95-6/98 **Resident in General Adult Psychiatry**, McLean Hospital. Belmont, MA.

Licensure And Certification:

1994-1996 Limited License **Registration in Medicine**, Commonwealth of Massachusetts
1996-present Full License **Registration in Medicine**, Commonwealth of Massachusetts
2000-present **Board Certified in Psychiatry** (Diplomate), American Board of Psychiatry and Neurology
2001-present **Licensed Medical Doctor**, State of Tennessee

Academic Appointments:

8/84-12/90 **Graduate Teaching Assistant**. University of Tennessee, Memphis. Memphis, TN.
7/94-6/95 **Clinical Fellow in Medicine**. Harvard Medical School. Boston, MA.
7/95-6/98 **Clinical Fellow in Psychiatry**. Harvard Medical School. Boston, MA.
7/98-11/02 **Instructor in Psychiatry**. Harvard Medical School. Boston, MA.
11/02-10/03 **Research Associate, Psychiatry**, Harvard Medical School, Boston MA.
11/02-present **Assistant Professor of Psychiatry, Division of Adult Psychiatry** (Primary), Vanderbilt University Medical Center, Nashville, TN.

- 11/02-present **Assistant Professor of Radiology & Radiological Sciences** (Secondary), Vanderbilt University Medical Center, Nashville, TN.
- 01/03-present **Faculty, Vanderbilt University Institute for Imaging Sciences (VUIIS)**, Vanderbilt University. Nashville, TN.
- 02/03-present **Investigator, Center for Integrative and Cognitive Neuroscience (CICN)**, Vanderbilt University. Nashville, TN.
- 05/04-present **Member, Vanderbilt Kennedy Center for Research on Human Development**

Hospital or Affiliated Institution Appointments:

- 6/82-5/83 **Polysomnographic Technician and Research Assistant.** Baptist Memorial Hospital: Sleep Disorders Center and Regional SIDS and Apnea Center. Memphis, TN.
- 6/83-8/84 **Registered Polysomnographic Technologist and Research Assistant.** Baptist Memorial Hospital: Sleep Disorders Center and Regional SIDS and Apnea Center. Memphis, TN.
- 7/96-7/01 **Psychiatrist.** (Overnight/Weekends), Bayridge Hospital, Lynn, MA. Cambridge, MA.
- 10/99-1/00 **Medical Director, After Hours Program.** Bayridge Hospital, Lynn MA
- 7/98-11/02 **Assistant Psychiatrist.** McLean Hospital, Belmont, MA.
- 7/98-11/02 **Assistant Physiologist.** Brain Imaging Center and Behavioral Psychopharmacology Research Laboratory. McLean Hospital. Belmont, MA.
- 10/01-11/02 **Director, Laboratory of Human Neurophysiology.** Brain Imaging Center, McLean Hospital, Belmont, MA
- 11/02-10/03 **Research Associate,** Brain Imaging Center, McLean Hospital, Belmont, MA
- 11/02-present **Attending Psychiatrist, Consult Liaison Service,** Vanderbilt University Hospital, Nashville, TN

Major Administrative Responsibilities:

- 1999-2001 **Scientific Advisor/Coordinator, Neuroscience Seminar Program,** McLean Hospital
- 2000-present **Medical Director, Depression Section,** Veritas Medicine (veritasmedicine.com) Cambridge, MA.

Other Positions:

- 2002-present **Scientific Consultant, Reconstructors Project.** Center for Technology in Teaching and Learning. Rice Univeristy. NIDA R25, DA 15063.

Major Committee Assignments:

- 1980-1981 **Class Treasurer,** Christian Brothers University

1981-1982	Class Vice-President; Student Senate; Career Peer Counselor; College Assembly Council of Board of Trustees, Christian Brothers University
1982-1983	Peer Counselor, Christian Brothers University
1985-1987	Graduate Student Executive Council, Representative. University of Tennessee, Center for Health Sciences, Memphis
1986-1989	Health Services Advisory Committee, University of Tennessee, Center for Health Sciences, Memphis
1995-1998	Institutional Ethics Committee, Resident Representative, McLean Hospital
1996	Clinical Care Subcommittee, McLean Hospital
1996-1998	Council for Research, American Psychiatric Association
1997-1998	McLean Staff Associates Executive Committee, McLean Hospital
1998-2000	Committee on Gay, Lesbian and Bisexual Issues, American Psychiatric Association
2001-2002	Chair, Brain Imaging Center Safety and Training Subcommittee, McLean Hospital
2003-present	Institutional Review Board, Committee Member. Vanderbilt University Medical Center

Professional Societies:

2000-present	Society for Biological Psychiatry, Member
1993-present	American Psychiatric Association, Member
1993-present	Association of Gay and Lesbian Psychiatrists, Member
1992-present	Gay and Lesbian Medical Association, Member
1985-present	Society for Neuroscience, Member

Editorial Boards and Grant Reviews:

1999, 2000	Ad Hoc Merit Grant Reviewer, Department of Veterans Affairs, Office of External Reviews
2001	Ad Hoc Manuscript Reviewer; <i>Biological Psychiatry</i>
2002	Ad Hoc Manuscript Reviewer, <i>Psychiatry Research</i>
2003	Grant Reviewer, <i>NIDA Special Emphasis Panel</i>
2004	Ad Hoc Manuscript Reviewer, <i>Biological Psychiatry</i>
2004	Grant Reviewer, <i>NIDA Special Emphasis Panel</i>
2004	Ad Hoc Manuscript Reviewer, <i>Science and Practice Perspectives</i>
2004	Editorial Board, <i>Synapse</i>

Awards and Honors:

1980-1981	Christian Brothers Academic Scholarship
1987	IMHOTEP Medical Leadership Society
1984-1986	Anatomy Predoctoral Fellowship
1986-1988	Neuroscience Center of Excellence Predoctoral Fellowship
1989-1990	Snider Scholarship
1988-1990	NIMH Predoctoral Fellowship
1992-1994	Bigelow Scholarship
1991-1994	Astor Scholarship
1993	NIH Summer Research Fellowship
1993-1994	Rock Sleyster Memorial Scholarship
1994	Oskar Diethelm Prize for Excellence in Psychiatry
1996-1998	APA/Glaxo Wellcome Fellowship
1998-1999	Dupont-Warren Fellowship
1998-1999	Livingston Award
1999-2003	Drug Abuse Research Scholars Program in Psychiatry

2001 (NIDA/APA Mentored Research Career Award)
Partners in Excellence Award
2004 Future Leaders in Psychiatry

PART II: RESEARCH, TEACHING, AND CLINICAL CONTRIBUTIONS

A. Major Research Interests

Neurobiology Of Euphoria
MDMA Neurotoxicity
Monoamine Influences On Information Processing
Neurobiology Of Substance Abuse
Functional Magnetic Resonance Imaging
Human Neurophysiology

Funding Information

B.1. Active:

1 RO1 DA15137-01

National Institute on Drug Abuse Pending PI

MR Analysis of Persistent CNS Damage in Human MDMA Users

This project is designed to conduct a comprehensive neuroimaging study of regional brain changes in human MDMA users. The study employs structural (voxel-based morphometry), chemical (magnetic resonance spectroscopy, MRS), and functional (functional magnetic resonance imaging, fMRI) methods to assay CNS neurotoxicity resulting from loss of serotonergic innervation.

1 R03 DA016617-01 (Cowan RL, PI)

National Institute on Drug Abuse 09/03-08/04 65% Effort PI

High-Field Functional MRI of Human Euphoria

This study is a 1-year application under the I/START program to obtain funds to conduct pilot studies examining the neurobiology of euphoria in human subjects using fMRI, following amphetamine administration.

R01-NS33332-05 (Gore JC, PI) 7/1/00 – 6/30/05 **Co-Investigator**
NINDS 20% Effort

Biophysical Basis of Functional Brain MRI

To develop an improved understanding of mechanisms involved in functional MRI of the brain and optimize imaging and data analysis strategies for the detection of neuronal activity.

7 R01 MH 050550 (Mollica R, PI) 6/00-5/04 **Co-Investigator**
National Institute of Mental Health Effort as needed

Brain Injury in Torture Survivors: A Mental Health Impact

This project is a collaborative research study in conjunction with the Harvard Program in Refugee trauma. This study proposes to correlate psychiatric diagnosis and neuropsychological measures of performance with functional and structural neuroimaging measures of neural structures implicated in PTSD and depression in torture survivors.

1 R01 DA 14178 (Renshaw PF, PI) 07/01-06/06 **Consultant**
National Institute on Drug Abuse Effort as needed

High Field MR Research in Drug Abuse: A Bioengineering Partnership

The goal of this BRP application is to develop a consortium of investigators with an interest in the development of those engineering methods which are most important for clinical and preclinical substance abuse neuroimaging research.

2 RO1 DA03994-15A1 (Lukas, SE)

National Institute on Drug Abuse

09/01 – 8/06

Co-Investigator

Polydrug Abuse: Imaging and Behavior

Effort as needed

This project is designed to examine alterations in EEG activity, event-related potential, physiological responses, subjective reports of drug effect and cognitive function during acute intoxication with cocaine, marijuana and ethanol combinations.

B.2. Applied For:

SERT Polymorphisms and Human Cortical 5-HT2A Receptors PI

This project is an exploratory R21 application requesting funds to investigate the effect of altered expression of the serotonin transporter (5-HTT) expression due to biallelic polymorphisms in the 5-HTT gene promoter region (5-HTTLPR). We propose to assay cortical 5-HT2A receptor status and regional brain volume in healthy females with no prior psychiatric illness.

1 R21 DA018170-01

07/04-06-06

PI

National Institute on Drug Abuse

Genetic Factors in Human MDMA Toxicity: a PET Study

This project is designed to determine whether genetic variations in the axon terminal serotonin reuptake transporter are associated with differential serotonin axon toxicity following MDMA use. The study employs a positron emission tomography (PET) assay of post-dennervation 5HT2A receptor upregulation as an indirect marker of serotonin axon loss.

B.3. Completed:

1 RO1 DA09448 (Renshaw, PF)

11/94-05/04

Co-Investigator

National Institute on Drug Abuse

Magnetic Resonance, EEG and Behavior After Cocaine

The goal of this research is to use MRS, fMRI, EEG, behavioral measures and pharmacokinetic data to assess the effects of acute and chronic cocaine administration in men and women.

DA-00366-01 (Cowan RL)

7/99-6/03

75% Effort

National Institute of Drug Abuse &

Awardee

American Psychiatric Association Drug Abuse Research Scholars Program
(Mentored Research Career Award)

Magnetic Resonance, EEG, Amphetamine, and Visual Processing

This project provides research development and salary support for investigating the effects of dopaminergically active agents on functional magnetic resonance fMRI blood-oxygen-level-dependent (BOLD) signal during visual stimulation, and attempts to correlate fMRI BOLD signal changes with EEG changes during visual stimulation following amphetamine administration.

Shervert Frazier Institute (Cowan RL)

7/99-11/02

25% salary

Non-governmental matching salary fund for NIH career awardees.

Report of Current Research Activities

1. Effect of amphetamine on visual sensory processing: This study is a pharmacological fMRI study that was designed as a precursor study to establish baseline parameters prior to studies of euphoria in humans. The design of the study employs a d-amphetamine dose escalation paradigm to systematically evaluate the influence of altered dopaminergic release on visual cortical response to photic stimulation. The initial results from this study have proved intriguing. First, our early findings suggest that using red and blue photic stimulation, fMRI might be successfully employed as a marker for human central nervous system dopaminergic tone, and therefore might have utility in diagnosing or predicting treatment response in dopamine-mediated illness. Second, our early findings additionally suggest that low-dose amphetamine might be useful as an easily-employed method to enhance the sensitivity of the fMRI blood oxygen level dependent (BOLD) method. The initial results from this study have been submitted for publication to *Psychopharmacology*, and are awaiting peer-reviewed commentary. We are planning additional studies to replicate and expand these preliminary findings.

2. Neurobiology of euphoria: The study of the neurobiology of euphoria in humans is part of a long-range effort to employ multimodal techniques to investigate and manipulate neural processes subserving the euphoric response, and to thereby better understand drug use and dependence. We have various paradigms in use at the Brain Imaging Center and the Behavioral Psychopharmacology Laboratory whereby oral, inhaled, or intravenous administration of euphorigenic substances (e.g. cocaine, amphetamine, alcohol, marijuana) are given to human subjects. This study will initially employ the fMRI BOLD method at 4 Tesla to examine dose and time-dependent effects of d-amphetamine on the induction of euphoria. Additional studies are planned to correlate EEG activity with the BOLD response.

3. MDMA Neurotoxicity in human subjects: This project was designed to develop an objective measure of MDMA toxicity in human subjects so that dose-related toxicity could be quantified and so that potential treatment interventions might be monitored. Because MDMA produces primarily a selective dorsal raphe nucleus axotomy in animals, and because serotonergic innervation is particularly dense to visual cortex, we predicted that the fMRI BOLD response to photic stimulation would be reduced in MDMA users compared to matched controls. The initial phase of this study is completed, and preliminary results indicate a significant reduction to some measures of photic stimulation in male subjects, without a similar trend detected in female MDMA users. However, this study suffers from heterogeneity in human subjects, particularly with regard to other polysubstance use. In addition, male and female subjects have different levels of MDMA use. The pilot data from this project was used to submit an R01 grant application to expand and replicate these findings in a larger group of subjects.

4. Brain Injury in Torture Survivors: This project is a collaborative research study in conjunction with the Harvard Program in Refugee Trauma (Richard Mollica, PI). The study is in the pre-neuroimaging stage at the present. The initial stages of this study identify candidate Vietnamese torture survivors and screen them using detailed neuropsychological testing instruments. Most of these subjects have post-traumatic stress disorder, major depression, and many also have physical brain injury. The neuroimaging portion of the study spans 3 years, and attempts to correlate structural and functional measures of brain function with psychiatric diagnosis and neuropsychological measures of performance.

Report of Teaching

Medical/Dental School Courses:

1984-1990 Taught small groups and individuals during a laboratory section in

Medical Microscopic Anatomy and Medical Neuroanatomy.
University of Tennessee, Memphis. Memphis, TN.

- 1997- 2001 Group tutor in Human Nervous System and Behavior Course. Harvard Medical School, Boston, MA.
- Organizer, Magnetic Resonance Imaging Journal Club. McLean Hospital. Belmont, MA.
- 1999 Course Organizer, "Fundamentals of Magnetic Resonance." McLean Hospital, Brain Imaging Center. Fall 1999.
- Lecture "Neuroimaging and Psychiatry". Harvard Medical School/ Cambridge Hospital Residency Training Program, Cambridge MA.
- 2003-present Lecturer, 3rd year medical student course "Psychiatry Clerkship Seminar Series". Vanderbilt University Medical Center.
- 2003-present Small group leader, 2nd year medical student course "Introduction to Clinical Psychiatry". Vanderbilt University Medical Center.
- 2003-present Lecturer, 3rd and 4th year psychiatry resident seminar "Gay and Lesbian Sexuality."

Advisory and Supervisory Responsibilities:

- 1990-1994 Trained postdoctoral fellows in the technique of intracellular neurophysiology. Department of Neurology and Neuroscience. Cornell University Medical College. New York, NY.
- 1994-1995 Supervised medical students during their clinical clerkships and subinternships in Internal Medicine. Massachusetts General Hospital. Boston, MA.
- 1995-1996 Supervised medical students during their clinical clerkships in Psychiatry. McLean Hospital. Belmont, MA.
- Non-Resident Tutor in Medicine. Pforzheimer House, Harvard College. Cambridge, MA.
- 2003-present Supervise medical students and resident physicians during Consult Liaison Psychiatry Rotation. Vanderbilt University Medical Center.

PART III: BIBLIOGRAPHY

Original Articles:

Reimao, R., Akiskal HS, **Cowan RL**, Lemmi H and Belluomini J. Polissonografia da disfuncao sexual masculina dados normativos da impotencia nao-organica. Review of Brazilian Neurology 1985;21(3):105-107.

Cowan RL, Reimao R, Lemmi H, and Vander Zwagg R. Narcolepsia e inicio subito de periodos REM apos despertares noturnos. Arquivos De Neuro-Psiquiatria 1985;43(3):229-233.

Cowan RL, Reimao R, Lemmi H and Belluomini J. Analysis of thermocouples and expired CO₂ monitors in clinical polysomnography. *Journal of the Association of Polysomnographic Technologists*, 1988.

Cowan RL, Wilson CJ, Emson PC and Heizmann CW. Parvalbumin-containing GABAergic interneurons in the rat neostriatum. *Journal of Comparative Neurology* 1990;302:197-205.

Cowan RL and Wilson CJ. Spontaneous firing patterns and axonal projections of single corticostriatal neurons in the rat medial agranular cortex. *Journal of Neurophysiology* 1994;71: 17-32.

Cowan RL, Sesack SR, Van Bockstaele EJ, Branchereau P, Chan J and Pickel VM. Analysis of synaptic inputs and targets of physiologically characterized neurons in rat frontal cortex: Combined in vivo intracellular recording and immunolabeling. *Synapse* 1994;17:101-114.

Cowan RL,. Frederick B de B, Rainey M, Levin JM, Maas LC., Bang J, Hennen J, Lukas SE, and Renshaw PF. Sex Differences in Response to Red and Blue Light in Human Primary Visual Cortex: A BOLD fMRI Study. *Psychiatry Research: Neuroimaging* (2000) 100:129-138.

Cowan RL, IK Lyoo, SW Kong, SM Sung, E Haga, SE Lukas, PF Renshaw (2003) Reduced Focal Cortical Gray Matter Density in Human MDMA (Ecstasy) Users: A Voxel-Based Morphometry Study. *Drug and Alcohol Dependence*, 72:225-235.

Schiffer F, Mottaghy FM, Vimal RLP, Renshaw PF, **Cowan RL**, Pascual-Leone A, Teicher M, Valente E, Rohan M. Lateral Visual Field Stimulation Reveals Extrastriate Cortical Activation in the Contralateral Hemisphere: A BOLD fMRI Study. In Press, *Psychiatry Research: Neuroimaging*

In Progress:

Frederick B deB., **Cowan RL**, Rainey ME, Renshaw PF. Effects of stimulus wavelength and luminance on BOLD fMRI photic response. Submitted, *J Magnetic Resonance Imaging*.

Cowan RL, Frederick B de B, Levin J M, Rohan M L, Villafuerte R A, Nassar L E, Lukas S E, Renshaw P F. A Novel BOLD fMRI assay of Human Central Nervous System Dopamine Function: The Effects of *D*-Amphetamine on Photic Activation to Blue Light. Submitted, *Psychopharmacology*, under revision.

Cowan RL, Haga E, Frederick B de B, Levin JM, Rohan ML, Hennen J, Lukas SE, Renshaw PF. FMRI Analysis of Visual Cortical BOLD Response in Human Male MDMA Users. In preparation.

Nickerson LD, Henry ME, **Cowan RL**, Renshaw PF, Frederick BB. Analysis of fMRI CBV data using scaled-subprofile modeling with principal component analysis and application to mood disorder. Submitted, *Psychiatry Research: Neuroimaging*.

Palmer C, Stull M, **Cowan RL**, Lukas SE. MDMA and polydrug use patterns. Submitted, *Drug and Alcohol Dependence*.

Proceedings of Meetings:

Akiskal HS., **Cowan RL**, Simmons R, Reimao R and Lemmi H. Sleep EEG differentiation of anxiety and depressive disorders. In C. Shagas (Ed.), *Proceedings of IVth World Congress of Biological Psychiatry*. New York: Elsevier Publishing Co., 1986.

Reviews, Chapters, and Editorials:

Faculty Reviewer, "Underground Clinical Vignettes" in Psychiatry and Neurology. Student to Student Publishing. Ed. V., Bushan. 1999.

Cowan RL. Patient's Page: Ecstasy (2000) Journal of the Gay and Lesbian Medical Association, 5(1):25-26.

Cowan RL, Dore S. Toxicity and neuroprotective effects of carbon monoxide: Consequences to suicide and survival. *Encycl Psychol Behav Sci* (In Press), 2003.

Books, Monographs, and Text Books:

Murphy MJ, **Cowan RL**, Sederer LI. Blueprints in Psychiatry. First edition. Malden, MA: Blackwell Science, 1998:80.

Murphy MJ, **Cowan RL**, Sederer LI. Second Edition. Blueprints in Psychiatry. Malden, MA: Blackwell Science, 2000:123.

Murphy MJ, **Cowan RL**, Sederer LI. Third Edition. Blueprints in Psychiatry. Malden, MA: Blackwell Science, 2004:114..

Invited Presentations:

Cowan RL. Invited Discussant, Association of Gay and Lesbian Psychiatrists Annual Symposium. Sexing the Body: Gender Politics and the Construction of Sexuality. May, 2000 Chicago, IL.

Cowan RL, Frederick B deb, Haga E, Rohan ML, Levin JM, Renshaw PF, Lukas SE. Invited Presenter, NIDA Scientific Conference: MDMA/Ecstasy Research: Advances, Challenges, Future Directions, July 19-20, 2001. Bethesda, MD. Abstract Title: Visual Cortex Activation Using The fMRI Blood Oxygen Level Dependent (BOLD) Method In Human MDMA (Ecstasy) Users.

Cowan RL. Invited Speaker, Drug Enforcement Administration: Rocky Mountain Club Drug Conference, Fort Collins, CO. September, 2002. "Neuroimaging in MDMA (Ecstasy) Users"

Cowan RL. Invited Speaker, National Institute of Drug Abuse, American Psychiatric Association Annual Meeting. "Careers in Drug Abuse Psychiatry Research." New York, New York, May 2004.

Dissertation:

Cowan RL. Synaptic Organization of Corticostriatal Neurons. Memphis, TN: University of Tennessee, 1990.

Patents:

2000 Method for Augmenting Sensitivity of Functional Magnetic Resonance Imaging (Application submitted)

Abstracts and Meeting Presentations:

Cowan RL, Reimao R, Lemmi H and Vander Zwagg R. Sleep onset REM periods during the night as a marker for narcolepsy. Southern EEG Society 1984.

Lemmi H, **Cowan RL,** Reimao R, Appavoo S and Vander Zwagg R. Sleep onset REM periods

during the sleep cycle: Are they diagnostic of narcolepsy? Southern Sleep Society 1985.

Reimao R, Akiskal HS, **Cowan RL**, Lemmi H, Belluomini J and Vander Zwagg R. Normative data for nocturnal penile tumescence (NPT) in non-organic impotence. Southern Sleep Society 1985.

Cowan RL and Park MR. Hypothalamic projection to the dorsal raphe nucleus in the rat: an anterograde study using the PHAL method. Neuroscience Abstracts 1986;12(1):38.9.

Cowan RL, Akiskal HS and Lemmi H. Polysomnographic analysis of sleep disturbances in anxiety and depression. Tennessee Academy of Science, Collegiate Division 1984.

Cowan RL and Park MR. Hypothalamic-raphé projection: a retrograde study. Southeastern Regional Neuroscience Meeting 1985.

Lemmi H, **Cowan RL**, Reimao R and Vander Zwagg R. Nocturnal sleep of narcoleptics. World Congress of Neurology 1985.

Lemmi H, Reimao R, **Cowan RL**, Appavoo S and Vander Zwagg R. Sleep onset REM periods after spontaneous awakenings and the diagnosis of narcolepsy. Sleep Research Abstracts 1985: 14:186.

Cowan RL and Mize RR. Anti-serotonin reactive cells in the dorsal raphe nucleus of the cat have varying morphologies: a quantitative immunocytochemical study. Federation Abstracts 1986;45:434.

Cowan RL, Wilson CJ and Emson PC. Parvalbumin is present in GABA containing interneurons of the rat neostriatum. Neuroscience Abstracts 1987;13(3):1573.

Cowan RL and Wilson CJ. Intracellular biocytin staining reveals the complete telencephalic arborizations of rat pyramidal tract neurons in rats. Neuroscience Abstracts 1989;15(1):660.

Cowan RL and Wilson CJ. Synaptic connections between pyramidal tract cells and corticostriatal neurons in rats. Neuroscience Abstracts 1990;16(1):417.

Cowan RL, Sesack SR, Chan J, Van Bockstaele EJ and Pickel VM. Ultrastructure of physiologically characterized cortical neurons and their relation to GABAergic and catecholaminergic terminals in rat brain. Neuroscience Abstracts 1992;18:475.11.

Branchereau P, Van Bockstaele EJ, **Cowan RL**, Chan J and Pickel VM. Evidence for GABA-mediated synaptic responses of cortical pyramidal neurons following stimulation of the locus coeruleus. Neuroscience Abstracts 1994, 20(2):301.12.

Rubin HC, **Cowan RL**, Bialer PA, Townsend MH, Ashley KB. Symposium Participant, Is Homophobia a Mental Disorder? APA Committee on Gay, Lesbian and Bisexual Issues. May 2000 Meeting of the American Psychiatric Association, Chicago IL.

Cowan RL, Frederick B deB, Rainey M, Levin J, Maas LC, Bang J, Renshaw PF, Lukas SE. Photoc activation in cocaine withdrawn subjects: an fMRI BOLD study. Abstract presented at the Annual Meeting of the College on Problems of Drug Dependence, San Juan, PR. June, 2000.

Frederick, B. deB., **Cowan, RL**, Rainey, M., and Renshaw, P., 2000. Effects of stimulus wavelengths and luminance on BOLD fMRI photic response. 6th Annual Meeting of the Organization for Human Brain Mapping. San Antonio, TX.

Cowan RL, Frederick B. deB, Rohan ML, Bang J, Levin JM, Lukas SE, Renshaw PF. Effect of *d*-amphetamine on Response to Red and Blue Light in Primary Visual Cortex of Humans: A

BOLD fMRI Study. November 2000 Meeting of the Society for Neuroscience, New Orleans.

Cowan RL, Frederick B de B, Levin J M, Rohan M L, Vilafuerte R A, Nassar L E, Lukas S E, Renshaw P F. A Novel BOLD fMRI assay of Human Central Nervous System Dopamine Function: The Effects of D-Amphetamine on Photic Activation to Blue Light. Joint Annual Meeting ISMRM/ESMRMB. Glasgow, Scotland, UK. April 21-27, 2001.

Cowan RL, Frederick B de B, Haga E, Nassar L., Rohan M., Levin J, Lukas SE, Renshaw PF. An fMRI BOLD Analysis of Visual Activation in Ecstasy Users. Annual Meeting of College on Problems of Drug Dependence, Scottsdale, AZ. June 16-21, 2001.

Cowan RL, Haga E, Frederick B, Rohan ML, Levin JM, Lukas SE, Renshaw PF. FMRI Analysis of Photic Activation in Visual Cortex of Female MDMA Users. Annual Meeting Society for Neuroscience, San Diego, CA. November 10-15, 2001.

Frederick B de B, **Cowan RL**, Renshaw PF. BOLD fMRI with Multicolor Photic Stimulation: A Potential Assay for CNS Dopamine Function. Presented, Annual Meeting of the Society for Biological Psychiatry, Philadelphia, PA, May 2002.

Cowan RL, IK Lyoo, SW Kong, SM Sung, E Haga, SE Lukas, PF Renshaw. Reduced Focal Cortical Gray Matter Density in Human MDMA (Ecstasy) Users: A Voxel-Based Morphometry Study. Breaking News Presentation, Annual Meeting of College on Problems of Drug Dependence, Quebec City, Canada. June 2002.

Anderson CM, Silveri MM, **Cowan RL**, Diaz CJ, MacNeil J, Maas LC, Madras BK, Lukas SE, Renshaw PF, Kaufman MJ. Activation of lobule VIII of the human cerebellar vermis by oral methylphenidate and cue-induced cocaine craving. Annual Meeting of College on Problems of Drug Dependence, Quebec City, Canada. June 2002.

Frederick B de B, **Cowan RL**, Renshaw PF. Assessment of brain dopaminergic function using two-color BOLD fMRI. Annual Meeting of College on Problems of Drug Dependence, Quebec City, Canada. June 2002.

Lukas SE, Stull M, **Cowan RL**. Polydrug abuse patterns with MDMA (Ecstasy) among young adults. Annual Meeting of College on Problems of Drug Dependence, Quebec City, Canada. June 2002.

Ahmad AS, **Cowan RL**, Dore S. Heme oxygenase 1 (HO1) is neuroprotective against NMDA-induced excitotoxicity. Society for Neuroscience Annual Meeting, San Diego CA, 2004.

Cowan RL. Neuroimaging techniques in MDMA research: challenges in assessing chronic effects of MDMA in human users. Society for Neuroscience Annual Meeting, Mini-Symposium Presentation, San Diego Ca, 2004.

De La Garza R (Chair), **Cowan RL** (Co-Chair), Baumann MH, Bubar MJ, Fantegrossi B, Kalechstein AD. Mini-symposium "Neurobiological Consequences of MDMA Exposure: A Critical Evaluation of Published Findings, Methods, and Conclusions." Society for Neuroscience Annual Meeting, San Diego Ca, 2004.