THE NEUROBIOLOGY OF DRUG AND ALCOHOL ADDICTION

Edited by Peter W. Kalivas and Herman H. Samson

The New York Academy of Sciences
New York, New York
1992
CONTENTS

Foreword. By Peter W. Kalivas and Herman H. Samson ................. xi
Acknowledgments .......................................................... xiii

Plenary Address: Cellular Actions of Opiates and Cocaine.
By R. Alan North .......................................................... 1

Part I. Molecular Mechanisms of Addiction

Purification, Reconstitution, and Cloning of an NMDA Receptor-Ion
Channel Complex from Rat Brain Synaptic Membranes: Implications for
Neurobiological Changes in Alcoholism. By Elias K. Michaelis,
Mary L. Michaelis, Keshava N. Kumar, Nanda Tilakaratne,
David B. Joseph, Peter S. Johnson, Kent K. Babcock, Gary L. Astrup,
Richard L. Schowen, Hirotugu Minami, Masao Sugawara,
Kazunori Odashima, and Yoshio Umezawa .......................... 7

Cannabinoid Receptor Localization in Brain: Relationship to Motor and
Reward Systems. By Miles Herkenham .................................. 19

Opioid and Cannabinoid Receptor Inhibition of Adenylyl Cyclase in Brain.
By Steven R. Childers, Lynne Fleming, Chris Konkoy,
Don Marckel, Mary Pacheco, Tammy Sexton, and Susan Ward ...... 33

NMDA Receptors: Role in Ethanol Withdrawal Seizures.
By Paula L. Hoffman, Kathleen A. Grant, Lawrence D. Snell,
Leslie Reinlib, Karen Iorio, and Boris Tabakoff .................... 52

Possible Substrates of Ethanol Reinforcement: GABA and Dopamine.
By R. Andon Harris, Mark S. Brodie, and Thomas V. Dunwiddie ... 61

* This volume is the result of a conference entitled The Neurobiology of Drug and Alcohol
Addiction held by The New York Academy of Sciences on July 23–26, 1991 in Spokane,
Washington.
Part II. Sensitization to Drugs of Abuse

Common Intracellular Actions of Chronic Morphine and Cocaine in Dopaminergic Brain Reward Regions. By Dana Beitner-Johnson, Xavier Guitart, and Eric J. Nestler ......................................................... 70

Electrophysiological Correlates of Psychomotor Stimulant-induced Sensitization. By Douglas J. Henry and Francis J. White .......... 88


Serotonin Neurotransmission in Cocaine Sensitization. By Kathryn A. Cunningham, Joseph M. Paris, and Nick E. Goeders .......... 117

Cellular Mechanisms of Behavioral Sensitization to Drugs of Abuse. By Peter W. Kalivas, Caryn D. Striplin, Jeffery D. Steketee, Mark A. Klitenick, and Patricia Duffy .......... 128

Mesocorticolimbic Dopamine Systems: Cross-Sensitization between Stress and Cocaine. By Barbara A. Sorg .......... 136

Effects of Chronic Ethanol and Benzodiazepine Treatment and Withdrawal on Corticotropin-releasing Factor Neural Systems. By M. Adriana Vargas, Garth Bissette, Michael J. Owens, Cindy L. Ehlers, and Charles B. Nemeroff .......... 145

Alterations in Biodistribution of $^{14}$C-Methamphetamine (MAP), $^{14}$C-MAP, and $^{123}$I-N-Isopropyl-Iodoamphetamine (IMP) in MAP- and Cocaine-sensitized Animals. By Yohtaro Numachi, Sumiko Yoshida, Takao Inosaka, Mitsumoto Sato, Michinao Mizugaki, Katsuhiro Kimura, and Takanori Hishinuma .......... 153

A Lasting Vulnerability to Psychosis in Patients with Previous Methamphetamine Psychosis. By Mitsumoto Sato .......... 160

Plenary Address: Neural Mechanisms of Drug Reinforcement. By George F. Koob ......................................................... 171

Part III. Neural Correlates of Reinforcement


Drug Motivation and Abuse: A Neurobiological Perspective. By Gaetano Di Chiara, Elio Acquas, and Ezio Carboni .......... 207


Alcohol Self-Administration: Role of Mesolimbic Dopamine. By Herman H. Samson, Gerald A. Tolliver, Miki Haraguchi, and Clyde W. Hodge .......... 242
Interaction between Endogenous Opioids and Dopamine within the Nucleus Accumbens. By L. STINUS, M. CADOR, and M. LE MOAL .......................... 254
Cortical Regulation of Self-Administration. By STEVEN I. DWORIN and JAMES E. SMITH .......................... 274

Part IV. Genetics and Clinical Neurobiology of Drug Addiction
Genetic Determinants of Ethanol Reinforcement. By JOHN C. CRABBE, TAMARA J. PHILLIPS, CHRIS L. CUNNINGHAM, and JOHN K. BELKNAP .......................... 302
Chromosome Mapping of Gene Loci Affecting Morphine and Amphetamine Responses in BXD Recombinant Inbred Mice. By J. K. BELKNAP and J. C. CRABBE .......................... 311
Role of Neuronal Calcium Channels in Ethanol Dependence: From Cell Cultures to the Intact Animal. By JOHN LITTLETON, HILARY LITTLE, and RICHARD LAVERTY .......................... 324

Plenary Address: Neurobiology of Conditioning to Drugs of Abuse. By JANE STEWART .......................... 335

Part V. Role of Conditioning in Drug Abuse
Potential Involvement of Anxiety in the Neurobiology of Cocaine. By NICK E. GOEDERS .......................... 357
Behavioral and Pharmacological Determinants of Drug Abuse. By MICHAEL A. NADER, THOMAS A. TATHAM, and JAMES E. BARRETT .......................... 368
Conditioned Sensitization to the Psychomotor Stimulant Cocaine. By ROBERT M. POST, SUSAN R. B. WEISS, DAVID FONTANA, and AGU PERT .......................... 386
Classical Conditioning in Drug-Dependent Humans. By CHARLES P. O'BRIEN, ANNA ROSE CHILDRESS, A. THOMAS MCELLENN, and RONALD EHRMAN .......................... 400

Poster Presentations
Behavioral Sensitization Induced by Psychostimulants or Stress: Search for a Molecular Basis and Evidence for a CRF-Dependent Phenomenon. By M. CADOR, S. DUMAS, B. J. COLE, J. Mallet, G. F. KOOB, M. LE MOAL, and L. STINUS .......................... 416
NMDA Receptor Complex Antagonists Have Ethanol-like Discriminative Stimulus Effects. By GIANCARLO COLOMBO and KATHLEEN A. GRANT .... 421


Behavioral Temperature Regulation during Withdrawal from Ethanol Dependency in Mice. By LARRY I. CRAWSHAW, CANDACE S. O'CONNOR, DAVID L. HAYTEAS, and JOHN C. CRABBE .......................... 428

Methamphetamine-induced Conditioned Place Preference or Aversion Depending on Dose and Presence of Drug. By CHRISTOPHER L. CUNNINGHAM and DeCARLO NOBLE .................... 431

Cocaine and Other Local Anesthetics Block Hippocampal Long-term Potentiation. By T. V. DUNWIDDIE and D. SMITH .......................... 434

Effect of a Benzodiazepine Derivate Ro 15-4513 on Ethanol-Free Selection and CNS Mitochondrial Energetics in Rats. By ENRIQUE EGAÑA, ANTONIO SALINAS, and MARÍA TERESA RAMÍREZ .......................... 437

Effects of Chronic Ethanol Administration on Neurotensinergic Processes: Correlations with Tolerance in LS and SS Mice. By V. GENE ERWIN, A. D. CAMPBELL, and R. RADCLIFFE .......................... 441

Sensitization and Individual Differences to IP Amphetamine, Cocaine, or Caffeine following Repeated Intra-cranial Amphetamine Infusions. By M. S. HOOKS, G. H. JONES, B. J. LIEM, and J. B. JUSTICE, JR. .......................... 444

Solubilization of the Cannabinoid Receptor from Rat Brain Membranes. By DEVIN B. HOUSTON and ALLYN C. HOWLETT .......................... 448

Different Pharmacodynamics for Diazepam and Flunitrazepam? By J. INGUM, R. BJÖRLUND, A. BJÖRNEBOE, and J. MØRLAND .......................... 451

Effects of Withdrawal from Chronic Cocaine Administration on Behavior and β-Adrenergic and Serotonergic Brain Receptors in Rat. By ELIZABETH ANNE JOHNSON, IRVING J. GOODMAN, YVONNE H. SHAHAN, and ALBERT J. AZZARO .......................... 453


Nifedipine Blocks the Development of Tolerance to the Anticonvulsant Effects of Ethanol. By LISA E. KALYNCHUK, SUNITANU DALAL, MICHAEL J. MANA, and JOHN P. J. PINEL .......................... 459


Repeated Injection of Cocaine Potentiates Methamphetamine-induced Toxicity to Dopamine-containing Neurons in Rat Striatum. By MARK S. KLEVEN and LEWIS S. SEIDEN .......................... 464

Effect of Acute and Chronic Ethanol on Nonadrenergic, Noncholinergic Neurotransmission. By EDWARD T. KNYCH .......................... 467
Opioid Modulation of Alcohol Intake in Monkeys by Low Doses of Naltrexone and Morphine. By M. KORNET, C. GOOSEN, and J. M. VAN REE .......................................................... 469

Evaluation of Anxiolytic Action of Ondansetron in Rats during Withdrawal from Chronic Chloridiazepoxide. By S. MEHDI REZAZADEH, PAUL L. PRATHER, MICHAEL W. EMMETT-OGLESBY, and HARBANS LAL .... 472

Seizure Incidence Enhancement with Increasing Alcohol Intake. By RICHARD LECHTENBERG and THERESA M. WORNER .................................................. 474

Effects of Imipramine and Ethanol on the Activity of a Neuronal L-Type Calcium Channel. By JOSEPH J. MCARDLE, JAY J. CHOI, and GUO-JIE HUANG .................................................. 477

Studies of the Mechanism of Inhibition of the Dopamine Uptake Carrier by Cocaine in Vitro Using Rotating Disk Electrode Voltammetry. By JAMES S. McELVAIN and JAMES O. SCHENK ......................... 480

Evidence for a Possible Role of the 5-HT2 Antagonist Ritanserin in Drug Abuse. By T. MEERT and G. CLINCKE ................................................................. 483

Prenatal Neurochemistry of Cocaine. By JERROLD S. MEYER .......................................................... 487

Ingested Ethanol as a Factor in Double Vision. By R. J. MILLER .......................................................... 489

Effect of Haloperidol on Craving and Impaired Control following Alcohol Consumption in Alcoholic Subjects. By JACK G. MODELL and JAMES M. MOUNTZ .................................................. 492

Effects of Cocaine on Evoked Field Potentials in the Rat Striatum. By KWAKU D. NANTWI and EUGENE P. SCHOENER .......................................................... 496

Locomotor Responses of FAST and SLOW Mice to Several Alcohols and Drugs of Abuse. By TAMARA J. PHILLIPS, SUE BURKHART-KASCH, COURTNEY C. GWIAZDON, and JOHN C. CRABBE ......................... 499

GABA and Nucleus Accumbens Glutamate Neurotransmission Modulate Ethanol Self-Administration in Rats. By STEFANIE RASSNICK, ELIZABETH D’AMICO, EDWARD RILEY, LUIGI PULVIRENTI, WALTER ZIEGLGÄNSBERGER, and GEORGE F. KOOB .................................................. 502

Ethanol Produces Rapid Biphasic Hedonic Effects. By FRED O. RISINGER and CHRISTOPHER L. CUNNINGHAM .......................................................... 506

Role of Dopamine Receptors in the Nucleus Accumbens in the Rewarding Properties of Cocaine. By PATRICIA ROBLEDO, RAFAEL MALDONADO-LOPEZ, and GEORGE F. KOOB .................................................. 509

Dramatic Depletion of Mesolimbic Extracellular Dopamine after Withdrawal from Morphine, Alcohol or Cocaine: A Common Neurochemical Substrate for Drug Dependence. By ZVANI L. ROSSETTI, FRANCO MELIS, SUSANNA CARBONI, and GIAN L. GESSA .................................................. 513

System of Aldehyde Metabolism in Brain of Rats During Development of Tolerance to the Hypnotic Effect of Ethanol. By V. I. SATANOVSKAYA ............ 517

Morphine Withdrawal in the Hamster. By P. SCHNUR .......................................................... 519

Assessment of Dopamine Release by in Vivo Microdialysis in the Nucleus Accumbens of Rats following Acute and Chronic Administration of Desipramine. By RONALD E. SEE, LEAH ADAMS-CURTIS, and MARY ANN CHAPMAN ................................. 522
Weak Base Model of Amphetamine Action. By DAVID SULZER, EMMANUEL POTIOS, HELEN MINJUNG SUNG, NIGEL T. MAIDMENT, BARTLEY G. HOEBEL, and STEPHEN RAYPORT ......................... 525

Morphine-induced Downregulation of µ-Opioid Receptors and Peptide Synthesis in Neonatal Rat Brain. By ANN TEMPEL and KATHRYN ESPINOZA ........... 529

Methylxanthines (Caffeine and Theophylline) Blocked Methamphetamine-induced Conditioned Place Preference in Mice but Enhanced That Induced by Cocaine. By DANIL0 BV. TUASON, MIWA MISAWA, TSUTOMU SUZUKI, and SHIGERU WATANABE ........................................... 531

Comparison of Evoked Potentials in Men and Women Admitted for Alcohol Detoxification. By THERESA M. WORNER and RICHARD LECHTENBERG .... 534

Cocaine Administration: D1 Dopamine Receptor Function and Dopamine Clearance/Diffusion in Rat Striatum and Nucleus Accumbens. By NANCY R. ZAHNISER, R. DAYNE MAYFIELD, WAYNE A. CASS, and GREG A. GERHARDT .................................................. 537

Vasopressin System Is Impaired in Rat Offspring Prenatally Exposed to Chronic Nicotine. By VLASTA K. ZBUZEK and VRATISLAV ZBUZEK ........... 540

Index of Contributors ........................................................................... 543

Financial assistance was received from:

Major Funders

• University of Washington
• Washington State University

Supporter

• National Institute on Alcohol Abuse and Alcoholism/NIH

Contributors

• DuPont/Medical Products Department
• Johnson & Johnson Consumer Products, Inc.
• R.W. Johnson Pharmaceutical Research Institute
• Merck Sharp & Dohme Research Laboratories
• Pfizer Central Research
• Syntex Research
• The Upjohn Company

The New York Academy of Sciences believes it has a responsibility to provide an open forum for discussion of scientific questions. The positions taken by the participants in the reported conferences are their own and not necessarily those of the Academy. The Academy has no intent to influence legislation by providing such forums.