with limited access to the drug. Intracerebral injections of methylnaloxonium into the nucleus accumbens were more effective in blocking heroin self-administration than injections into the lateral ventricle or the ventral tegmental area. In addition, behavioral data indicate that spontaneous or precipitated withdrawal after chronic administration of psychostimulants and opiates leads to "anhedonic and dysphoric" states respectively. Following prolonged access to intravenous cocaine self-administration in rats, intracranial self-stimulation thresholds were increased reflecting a decrease in reward ("anhedonia") during withdrawal. In morphine-dependent rats, local intracerebral injections of methylnaloxonium into the nucleus accumbens were much more effective in disrupting responding for food, reflecting a "dysphoric" state, than injections into the lateral ventricle, periaqueductal gray, or medial thalamus. These results suggest that changes in the neural circuitry of the nucleus accumbens may be the neurobiological substrate for motivational changes that form the basis of an opponent process during chronic drug use.

INVITED ADDRESS
Chair: *Alice M. Young*, Wayne State University, Detroit, MI.

HOW TO INCREASE AND DECREASE THE STRENGTH OF MEMORY TRACES: THE ROLE OF OPIOIDS. Joe L. Martinez, Jr. University of California, Berkeley, CA.

In this presentation, how opioids affect memory will be considered. Interestingly, a fundamental observation in this area is that opioids make memories both stronger and weaker. Research suggests that opioids do not influence the memory trace directly, but instead influence modulatory systems that in turn regulate associative strength. Remarkably, the primary site of action of opioids appears to be outside the blood-brain barrier and may be in the periphery. It is possible that such a mechanism is general, and that many peripheral neuropeptides and hormones act to modulate memory in this fashion. It will be argued that memory involves two distinct processes. One process is the generation of the memory trace itself. Most scientists agree that memory traces exist between sets of interconnected neurons and that physical changes occur in individual neurons to maintain memory. The second involves associative strength that may be conveyed by the modulatory input.

INVITED ADDRESS
Chair: *James H. Woods*, University of Michigan Medical School, Ann Arbor, MI.

ORAL ALCOHOL SELF-ADMINISTRATION IN THE RAT: ENVIRONMENTAL-GENETIC INTERACTIONS. Herman H. Samson. Alcohol and Drug Abuse Institute, University of Washington, Seattle, WA.

The interaction between environmental factors and genetic variability are considered as key to the control of alcohol consumption. This paper will present current research in which genetically selected alcohol-perferring (P) and -nonpreferring (NP) rat lines have been studied in both acute and chronic alcohol self-administration paradigms. The effects of a variety of environmental procedures, including method of initiation to alcohol self-administration, concentrations of alcohol available, and response contingencies required for both alcohol and food presentation in the P and NP lines as well as heterogeneous nonselected rats will be discussed.

NEW FELLOWS ADDRESS I
Chair: *Stephen C. Fowler*, University of Mississippi, University, MS.

SUBSTANCE ABUSE PREVENTION: ADOLESCENT AND PARENTAL PROBLEM-SOLVING AND EXPLANATORY STATEMENTS. Brenna H. Bry. Rutgers—The State University.

Substance abuse prevention efforts typically target words to change relevant behavior on the part of adolescents and parents, whether in media campaigns, prevention workshops, or psychotherapy. Little systematic research, however, has examined the impact of verbal behavior in determining risk behavior. Early studies and clinical observations suggest that how adolescents and parents respond to and explain daily problems in their lives plays an important role in the development and treatment of adolescent substance abuse. This paper will discuss a series of recent studies by the author into defining and modifying family problem-solving and explanatory statements to reduce adolescent substance abuse.

CONDITIONED TOLERANCE AND DEPENDENCE TO THE OPERANT EFFECTS OF BENZODIAZEPINES. Mary Jeanne Kallman. University of Mississippi, University, MS.

A review of several investigations which explored the role of conditioned factors in tolerance and withdrawal to the benzodiazepines (BZs) will be presented. These studies have compared the effects of repetitive administration of different BZs, the dose of drug delivered chronically, and various operant schedules as important variables in the display of conditioned tolerance. Since the nontraditional assessment of force and duration of responses was used in conjunction with the traditional assessment of response rate, these experiments address changes in the topography of responding as a function of drug experience. When rats are exposed to BZs before the daily operant session they display greater drug tolerance than rats exposed to the drug after the daily session but these findings are dependent upon the level of behavioral disruption produced by the dose of BZ administered chronically. Under some conditions the severity of withdrawal is also enhanced by previous drug experience in the testing situation. (Supported by NIDA DA-05253.)

NEW FELLOWS ADDRESS II
Chair: *Nancy A. Ator*, The Johns Hopkins University School of Medicine, Baltimore, MD.

ETHANOL CONSUMPTION AS A FUNCTION OF SCHEDULE OF ACCESS. Henry Marcucella. Boston University.

A series of studies conducted within a foraging context examined the influence of access schedules on the amount and pattern of oral ethanol self-administration. Ethanol, a commodity which may be sought, handled and consumed like food and water, was consumed as a function of its own access schedule as well as the access schedules of the other available commodities, food and water. The access schedule of a commodity was manipulated in a closed economy by varying either the time that the commodity was available or the number of responses required to gain access to the commodity (procurement cost).

NEURON RESCUE AND PLASTICITY PROMOTION BY PHARMACOTHERAPY AFTER BRAIN DAMAGE: HELP-

FUL, HARMFUL OR NEUTRAL IN RECOVERY OF FUNCTION? Timothy Schallert. Department of Psychology and Institute for Neuroscience, University of Texas at Austin.

The research to be described is concerned with mechanisms of recovery of function after focal brain damage. Novel treatment strategies for affecting anatomical events and influencing the rate of recovery are being developed based on this research. For example, after cortical damage rats were treated with Cl^- ion channel blockers, glutamatergic (NMDA) antagonists or drugs which tend to open Cl^- ion channels. The first two classes of drugs facilitate recovery of function, but by different mechanisms. The latter class, including certain anticonvulsant and antianxiety drugs that currently are being administered to many brain damage patients, can severely and chronically disrupt recovery of function. Depending on the timing of drug administration, remote degeneration secondary to the brain damage may be exaggerated or attenuated. However, it will be demonstrated that only careful behavioral assessment coupled with a comprehensive anatomical analysis permits one to evaluate the potential functional significance of a given manipulation.

YOUNG PSYCHOPHARMACOLOGIST AWARD AND INVITED ADDRESS

Chair: *Larry Byrd,* Yerkes Regional Primate Research Center, Emory University, Atlanta, GA.
Awardee: Robert S. Mansbach, Medical College of Virginia.
"A Startle Response Model of Sensorimotor Gating Deficits in Schizophrenia."

SYMPOSIUM

Commonalities in Stimulus Equivalence and Drug Discrimination Research
Chair: *Warren K. Bickel,* University of Vermont, Burlington, VT.
Discussant: *Chris-Ellyn Johanson,* Uniformed Services University of the Health Sciences, Bethesda, MD.

FUNCTIONAL ANALYSIS OF CONTEXTUAL STIMULUS CONTROL. Richard W. Serna and Gina Green. E. K. Shriver Center for Mental Retardation, Inc.

Behaviors are determined in part by the contexts in which they are emitted. A complete understanding of contextual control requires careful experimental analysis, which in turn requires defining the possible controlling events operationally and manipulating them systematically. Some recent analyses of contextual control of discriminated performances—namely conditional discriminations that may give rise to stimulus equivalence—have raised an important question about the definition and function of contextual stimuli: Are they discrete events that exert conditional control over conditional discriminations, or are they elements of compound stimuli that exert simpler discriminative control? In this paper we discuss the practical and theoretical significance of this question, suggest methodology for investigating these two types of contextual stimulus control, and summarize data from our attempts to address this question experimentally.

CURRENT ISSUES IN STIMULUS CLASS RESEARCH. K. J. Saunders, R. R. Saunders and J. E. Spradlin. University of Kansas.

Accounting for stimulus-stimulus and stimulus-response relations that have not been trained directly provides an important challenge for the science of behavior. The recent explosion of research on stimulus classes has uncovered a range of empirical and theoretical issues that are only beginning to be systemized. The present discussion outlines these issues, with the goal of identifying potentially fruitful areas for future research. Much research is currently being done on stimulus equivalence classes. One reason is an apparent relation with language; the thorough explication of this relation is an important issue for future research. Also at issue is the relationship between stimulus equivalence classes (which involve stimulus-stimulus relations) and functional stimulus classes (which involve stimulus-response relations). Both of these issues may find some resolution in the study of stimulus classes in nonhuman primates and in verbally limited humans. This strategy may also uncover the critical prerequisites for equivalence class formation, the most fundamental unresolved issue.

FUNCTIONALLY EQUIVALENT STIMULUS CONTROL OVER RESPONDING BY INTEROCEPTIVE AND EXTEROCEPTIVE STIMULI. R. J. DeGrandpre, W. K. Bickel, S. T. Higgins and J. R. Hughes. University of Vermont.

Conditional relations between drug (interoceptive) stimuli and visual (exteroceptive) stimuli were taught to 4 normal humans. Following this training, a stimulus equivalence procedure was used to test whether emergent relations between these two types of stimuli would develop. The drug stimulus effects were produced by 0.32 mg/70 kg triazolam and placebo (lactose filled capsules). The emergence of equivalence classes that contained interoceptive and exteroceptive stimuli occurred in all four subjects. Responding was 100 percent correct for three of the four subjects. This experiment provides the first demonstration that interoceptive and exteroceptive stimuli can achieve, without explicit training, equivalent discriminative-stimulus control over behavior. Theoretical and clinical implications are discussed.

FUNCTIONALLY EQUIVALENT STIMULUS CONTROL OVER RESPONDING BY EXTEROCEPTIVE STIMULI AND INTEROCEPTIVE STIMULI FROM STIMULANT AND SEDATIVE DRUG CLASSES. W. K. Bickel, R. J. DeGrandpre, S. T. Higgins and J. R. Hughes. University of Vermont.

In this study, conditional relations between drug (interoceptive) stimuli and visual (exteroceptive) stimuli were taught to normal humans. The drug stimulus effects were those produced by 110–560 mg/70 kg caffeine, 0.10–0.56 mg/70 kg triazolam, and placebo (lactose filled capsules). Following this training, a stimulus equivalence procedure was used to merge the drug effects produced by caffeine with the stimulus effects produced by triazolam via a common visual stimulus. This test assessed whether topographically distinct interoceptive stimuli can gain joint membership with visual stimuli and thus exert functionally equivalent stimulus control over behavior. The implications of such findings are relevant to drug-discrimination research in behavioral pharmacology and more generally to the study of drug-taking.

SYMPOSIUM

Future Directions in the Treatment of Nicotine Addiction
Chair: *Dorothy K. Hatsukami,* University of Minnesota, Minneapolis, MN.
Discussant: *Neil Grunberg,* Uniformed Services University of the Health Sciences, Bethesda, MD.

IS NICOTINE MORE ADDICTIVE THAN HEROIN OR COCAINE? Jack Henningfield, Caroline Cohen, John Slade and Stephen Goldberg. NIDA Addiction Research Center, Baltimore, MD.