Chair: *Maxine L. Stitzer,* The Johns Hopkins University School of Medicine, Baltimore, MD.
Discussant: *George E. Bigelow,* The Johns Hopkins University School of Medicine, Baltimore, MD.

COUNSELING LEVEL EFFECTS IN METHADONE TREATMENT. A. T. McLellan, George Woody, David Metzger and Charles O'Brien. University of Pennsylvania School of Medicine, Philadelphia, PA.

Substance abuse treatment outcome has often been evaluated without sufficient regard to the services actually delivered and received. These service factors vary not only between programs and modalities but within them as well. Data from our prospective, random assignment evaluation of three different levels of methadone maintenance treatment: Minimum (urine monitoring and crisis counseling), Basic (urine monitoring and regular counseling) and Enhanced (vocational, family and psychiatric services included) will be used to highlight the relationship between treatments received and treatment outcome. A new measure of service involvement, the Treatment Services Review, will also be described. Our preliminary findings have identified a strong relationship between treatment components and treatment outcomes.

EFFECTIVE UTILIZATION OF URINALYSIS RESULTS. Donald A. Calsyn. Veterans Affairs Medical Center and University of Washington School of Medicine, Seattle, WA.

Urine monitoring has been a mandated component of methadone maintenance since its inception. However, procedures for utilizing the results vary widely across treatment sites. A brief review of the role of urinalysis in methadone maintenance will be presented highlighting studies in which urinalysis results are linked to behavioral contingencies. The treatment procedures currently utilized by our program, which include a structured contingency contracting system, will be demonstrated. Data supporting the feasibility and effectiveness of the contracting system will be presented. Finally, a prospective NIDA funded research project being conducted by our group to further assess the efficacy of these procedures will be described.

COMMUNITY-BASED CONTINGENCY PROGRAMS FOR METHADONE MAINTENANCE PATIENTS. Michael Kidorf and Maxine L. Stitzer. The Johns Hopkins University School of Medicine, Baltimore, MD.

Clinic-based and community-based contingency programs have been employed to decrease alcohol and illicit substance abuse among methadone maintenance patients. Clinic-based contingency programs have effectively used take-home methadone and other clinic privileges to reinforce drug abstinence; however, drug use typically resumes following termination of these procedures. In response to treatment generalization issues, current treatments have initiated community reinforcement programs. Specifically, patients can earn goods and services in the community as rewards for drug abstinence. Community reinforcement is often used in connection with skills training and employment counseling. These procedures serve to restructure patients' leisure time while engaging them in new and potentially reinforcing activities in the community. In this paper, I will review the advantages and limitations of clinic-based contingency programs and present current data (including data from our laboratory) on the efficacy of community-based interventions. Future directions in the use of clinic-based and community-based reinforcement procedures will also be discussed.

PHARMACOTHERAPY PLUS INTENSIVE OUTPATIENT TREATMENT FOR COCAINE DEPENDENCY. Richard A. Rawson. Matrix Center, Beverly Hills, CA.

There is a great interest in the development of pharmacological agents for the treatment of cocaine dependency. Many of the previous outpatient investigations have involved brief evaluations conducted in poorly defined or nonexistent psychosocial support contexts. This presentation will describe a structured outpatient treatment program, the neurobehavioral model, which provides a standardized format within which medications are being evaluted. Currently, double-blind evaluations of desipramine and gepirone are underway and several other medication evaluations are in preparation. Data will be presented on the value of desipramine and gepirone for the treatment of cocaine dependency within the neurobehavioral model.

TREATMENT OF COCAINE DEPENDENCE WITH DISULFIRAM. Dawn D. Delaney, Stephen T. Higgins, Alan J. Bidney, Lisa M. Kent and Warren K. Bickel. University of Vermont, Burlington, VT.

Persons seeking treatment for cocaine dependence also typically abuse other drugs, the most common of which is alcohol. This presentation will overview the available literature on dual cocaine and alcohol dependence, and report some preliminary results from a study currently being conducted in our clinic investigating the efficacy of disulfiram (Antabuse) in decreasing cocaine use in alcohol-dependence clients receiving behavioral treatment for cocaine dependence. This study is the first reported investigation of the use of Antabuse in the treatment of cocaine dependence. Although the results are preliminary, there is reason to believe that this pharmacotherapy may be an effective adjunct in treating cocaine dependence in those clients who additionally abuse alcohol.

SYMPOSIUM
Caffeine and Human Behavior
Chair: *Mary Z. Mays,* USA Research Institute of Environmental Medicine, Natick, MA.
Discussant: *Harris R. Lieberman,* USA Research Institute of Environmental Medicine, Natick, MA.

EFFECT OF DIETARY DOSES OF CAFFEINE ON HUMAN PERFORMANCE, MOOD AND MEMORY. John D. E. Gabrieli. Northwestern University, Evanston, IL; Harris R. Lieberman.Massachusetts Institute of Technology, Cambridge, MA.

Caffeine is a frequently consumed food and beverage constituent that is widely thought to have a stimulant-like effect on human mood and performance. Many controlled studies of the effect of caffeine on mood and performance have used doses of caffeine that are substantially greater than the amount that is typically consumed in a cup of coffee or a glass of cola. A series of studies have examined the effect of smaller, dietary-level doses on human mood and performance. These studies employed double-blind, placebo-controlled, cross-over designs that used two or more doses of caffeine and involved, in a given session, the administration of a single dietary-level dose of caffeine (or

placebo). Caffeine consistently enhanced performance on auditory vigilance tasks, improving the number of times a target tone was detected without raising the false alarm rate. The improvement was evident in even the smallest of doses (32 mg) and was dose-dependent. Caffeine also improved performance on a four-choice auditory reaction-time task in one study, but failed to significantly influence performance on this task in a second study. Mood state was also affected, with subjects reporting increases in subjective vigor, alertness, and efficiency and reductions in subjective depression and anxiety. Effects on learning and memory were modest, but tended to improve with caffeine, especially the learning of a complex, visuospatial learning task in which a dose of caffeine appeared to enhance learning about as much as did 64 trials of practice. There was no measure of mood or performance that revealed a negative consequence of caffeine administration. Thus dietary doses of caffeine have consistently measureable and positive influences upon vigilance and mood, and milder but also positive influences upon memory performance. With the exception of performance on vigilance tasks, however, the significance of these effects varies from study to study, suggesting that there are important intervening factors, such as personality characteristics, that mediate the effect of caffeine upon performance, mood, and memory.

THE EFFECTS OF CAFFEINE ON SALIVARY CORTISOL LEVELS AND PERFORMANCE DURING SLEEP DEPRIVATION. Larry T. Matteson, Paul Naitoh, Timothy Elsmore, Tamsin L. Kelly, Steven A. Gomez and Robert Rubin. Naval Health Research Center, San Diego, CA; University of California, Los Angeles.

Volunteers from the Naval School of Health Sciences participated in a study of the effects of caffeine on salivary cortisol and caffeine levels, as well as behavioral performance measures, during a 64-hour sleep loss period. Subjects in a double-blind design received low (150 mg caffeine every 6 hours; 7 doses), moderate (300 mg caffeine every 6 hours; 7 doses), high (400 mg caffeine every 12 hours; 2 doses), or placebo (every 6 hours; 7 doses), over a 64-hour continuous work period. Drug administration for all groups commenced at 2320 during the first night of sleep loss. Preliminary results from the assays document the appropriate caffeine levels following the various drug doses, and showed the usual circadian fluctuations in cortisol levels. Further, the data suggest there are no sleep deprivation or drug-related alterations in cortisol levels. Implications of these findings and their relationship to behavioral measures will be discussed.

CAFFEINE AND COGNITIVE PERFORMANCE: DATA AND A THEORETICAL MODEL. Kristen Joan Anderson. Northwestern University, Evanston, IL.

Data regarding the effects of caffeine on human cognitive performance will be reviewed. Results from a series of studies suggest that caffeine reliably interacts with time of day, the personality dimension of impulsivity, and task components to determine the efficiency of cognitive performance. On very easy tasks, caffeine tends to facilitate performance regardless of personality or time of day. On complex tasks, however, caffeine interacts with impulsivity and time of day—in the morning, caffeine facilitates the performance of impulsives but hinders that of nonimpulsives; in the evening, this interaction reverses. This pattern of results can be understood if the following assumptions are made: (a) The cognitive effects of caffeine, impulsivity, and time of day are all mediated by arousal (or activation). In comparison to nonimpulsive individuals, those who are high in impulsivity are less aroused in the morning but more aroused in the evening. Caffeine, a central nervous system stimulant, consistently increases arousal. (b) Performance is an inverted-U function of arousal, with the optimal level of arousal for performance being a negatively monotonic function of task difficulty. In combination, these assumptions allow prediction of the observed high-order interactions between caffeine, impulsivity, time-of-day, and task difficulty, but do not explain the relationship between arousal and performance. Additional research, again employing caffeine as well as other arousal variables, suggests that arousal has different effects upon several components of information processing. Specifically, arousal appears to facilitate the ability to sustain attention and to process information quickly, but to hinder the ability to retain information in available form for brief intervals. In addition, arousal at time of learning may facilitate long-term memory independent of any state-specific learning effects. In summary, caffeine appears to have systematic effects on several aspects of cognitive processing, and these effects appear to be mediated by caffeine's arousing properties.

THE SCIENCE AND REGULATORY STATUS OF CAFFEINE AS A FOOD CHEMICAL. Thomas J. Sobotka. Food and Drug Administration, Washington, DC.

Caffeine is one of the most widely used chemicals in the world stemming principally from its presence in food as a natural constituent (coffee, tea, chocolate) and as an added substance (soda water). In 1959, based on available information, the Food and Drug Administration (FDA) included caffeine in the category of food chemicals "generally recognized as safe" (GRAS). Over the ensuing years, a considerable database has been developed about caffeine, including its effects on the nervous system. Although caffeine is commonly associated with its mild stimulant effects on performance, experimental information has revealed that exposure to caffeine may under certain conditions also be associated with unwanted effects, such as anxiety, tension, disturbed sleep, irritability, withdrawal headache, and neurofunctional effects in the developing organism. In view of the potential health implications of prolonged use of caffeine, the FDA has initiated a process to reevaluate the regulatory status of caffeine as a food additive. Some of the unique scientific issues involved in this process will be discussed.

CAFFEINE CONSUMPTION: RISKS AND BENEFITS. Harris R. Lieberman. U.S. Army Research Institute of Environmental Medicine, Natick, MA.

The unique status of caffeine as a food, drug and food additive will be discussed. Some of the potential risks and benefits of consumption of this substance will be reviewed in the context of the papers presented at this symposium. When appropriate, data from the literature will also be utilized, including information from epidemiologic studies on potential medical risks of caffeine consumption. Dose, mode of administration, prior history of caffeine consumption, and personality type will be considered as factors modulating responsiveness to caffeine. Behavioral methods will be considered with regard to selection of those that are appropriate to reveal effects of caffeine. Deficiencies associated with specific methods will be discussed. Data from laboratory studies will be related to possible practical consequences of caffeine consumption in a variety of operational situations and in daily life.