CHAPTER 10

Behavioral Pharmacology of Alcohol

N. K. Mello

A. Introduction

Although alcohol is one of the earliest drugs used by man to change behavior and to modulate subjective states, less is known about its behavioral pharmacology than about many drugs of more recent origin. This is probably due to a complex interweaving of social attitudes and beliefs about alcohol which have evolved from a common familiarity with drinking and the effects of alcohol intoxication. For many years, the assumption that all is known, coupled with denial that alcoholism is a form of drug addiction, and ambivalence about problem drinking, tended to limit experimental interest in the study of alcohol and behavior (Mello, 1976b, 1978b). Gradually, over the past 15 years, an increasing number of studies have examined the behavioral effects of alcohol in normal social drinkers and in alcohol addicts. The early evidence that alcoholism is a form of addiction (VICTOR and ADAMS, 1953; ISBELL et al., 1955; MENDELSON, 1964) has been consistently reaffirmed (Mello and MENDELSON, 1977 for review). As more empirical studies have examined the effects of alcohol during intoxication rather than relying on retrospective self-reports, the limitations of commonly shared expectancies about alcohol's effects have become increasingly evident. The disparities between anticipated and observed effects of intoxication illustrate how far we now are from a comprehensive understanding of the behavioral pharmacology of alcohol (Mello and MENDELSON, 1978a for review).

This review will discuss some methodological issues which continue to affect the interpretation of behavioral data (Mello, 1968). A selective review of clinical research will focus on the effects of alcohol intoxication on those aspects of behavior and subjective states which are often alleged to account for alcohol abuse. The implications of these findings for understanding the way in which alcohol maintains behavior leading to its administration, i.e., alcohol's reinforcing properties, will also be considered. The clinical aspects of alcoholism, i.e., tolerance and physical dependence, the clinical expression and treatment of the alcohol withdrawal syndrome, and theoretical models which attempt to account for alcohol dependence were described in a previous volume of this handbook (Mello and MENDELSON, 1977). Consequently, this review will be restricted to the behavioral pharmacology of alcohol in man and animal models.

Alcohol has now been shown to be an effective reinforcer in primate drug self-administration models. The reinforcing properties of alcohol have been demonstrated in preparations which are not physically dependent on alcohol. Systematic analysis of the variables which influence alcohol self-administration has begun quite recently and illustrative studies will be described. Since these data are best understood in the context of the struggle to develop adequate animal models of alcoholism, the current status of models of alcohol dependence will also be summarized. This review will not
include studies of the effects of alcohol on psychomotor performance or schedule-controlled behavior, since recent descriptions of these data are available elsewhere (Israelstam and Lambert, 1975; McMillan and Leander, 1976; Mello and Mendelson, 1978a).

B. Issues in Measurement and Interpretation

Clinical studies of the behavioral and subjective effects of alcohol have shown that the consequences of intoxication often are not entirely predictable from the dose of alcohol given or from the blood alcohol level achieved. In addition to physiologic factors which influence the rate of alcohol absorption and the effective dose achieved, a number of nonpharmacologic factors, such as expectancy, experience with alcohol, and motivation to perform accurately, may also modulate the behavioral effects of alcohol. Studies of the behavioral effects of alcohol continue to share a series of methodological problems which often limit the generality of the findings obtained. Some frequent common problems are discussed in this section. Several problems are specific to behavioral studies of alcohol, and others apply equally to behavioral studies of any drug.

I. Methodological Issues Specific to Alcohol Studies

1. Blood Alcohol Level Measurement

Alcohol offers a particular advantage over many other psychoactive drugs for behavioral studies in man. The effective dose of alcohol can be rapidly and efficiently measured, at any point in time, by some variant of a breathalyzer device, which measures the concentration of alcohol in expired air (Dubowski, 1970). Consequently, it is not necessary to rely on estimates of effective dosage on the basis of the amount of alcohol administered; the effective blood alcohol concentration can be quantitatively assessed. Direct measures are important because blood alcohol levels are not constant through time, but rather rise to a peak and then fall at a rate which is influenced by all of the factors which affect absorption, distribution, and metabolism. There are now considerable behavioral data which support Goldberg's (Goldberg, 1943) early observation that the greatest impairment in performance occurs during the rising phase of the blood alcohol curve, and there may be no impairment at equivalent blood alcohol levels during the falling phase of the curve (Jones, 1973; Jones and Vega, 1972). In animals, alcohol concentration in small samples of blood can be measured with a variety of enzymatic and gas chromatographic techniques. It is also possible to measure alcohol concentration in urine.

It is unfortunate that many investigators still neglect to determine the effective alcohol concentration, fail to report blood alcohol levels, and occasionally even fail to specify the alcohol dosage. This perpetuates the inconsistent and ambiguous status of behavioral data on alcohol. Without information about alcohol dose and blood alcohol level it is impossible to compare studies and identify the basis for discrepant findings. Some would argue that since alcohol is metabolized at the rate of about 1 oz per hour, it is possible to estimate changes through time, if the initial dose is known. The difficulties involved in the quantitative analysis of blood levels of many other psy-