Effects of Nicotine on Biological Systems
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EFFECTS OF NICOTINE GUM ON SHORT-TERM MEMORY

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SUMMARY: To investigate the effects of nicotine on memory function, 20 subjects (10 non-smokers and 10 smokers who had been allowed to smoke normally until testing) attended the laboratory at their "preferred nicotine level" and completed a short-term memory task (memory scanning) at set points for 4 hours after the administration of 2mg or 0mg (placebo) nicotine polacrilex gum. The results suggest that nicotine enhanced memory reaction time performance ($P<0.01$) when subjects were probed for information already present in short-term memory (correct positive responses) but had no effect on reaction time when the information was absent from memory (correct negative responses). It is suggested that nicotine facilitates the processing of stimulus information in short-term memory.

It has been suggested that the cholinergic system may be involved in certain aspects of human memory (Squire & Davies 1981) and that nicotine, as a cholinomimetic, may impinge upon this activity. Further speculation has centred on the possibility that the facilitation of memory by nicotine may contribute to the reinforcing nature of cigarette smoking.

Studies of the effects of nicotine on memory have commonly used habitual smokers as subjects (Houston 1978, Mangan and Golding 1983). Usually there has been a period of abstinence prior to the experiment and subjects have been in a state of partial or complete deprivation compared to their preferred everyday nicotine level when they reached the laboratories. As such it remains impossible to attribute the results as being due to deprivation in the control condition, the effects of an acute dose of nicotine after a period of abstinence, or a more

general action related to the long-term use of cigarettes.

The methodology used in the present study follows that of Hindmarch et al. (1990). Their design allowed subjects to attend the laboratories at their preferred nicotine level. For smokers this meant that they were not required to abstain from smoking at any time beore testing and therefore could not initially be considered to be deprived. Nicotine gum was then administered double-blind, producing an absolute rise in systemic nicotine levels against which performance effects could be gauged.

METHOD

20 healthy female volunteers aged 21-45 years (mean 28 years) participated in the experiment. 10 were smokers who had smoked ten or more cigarettes a day for a minimum of five years prior to the start of the study. The remaining volunteers were all non-smokers, abstinent for a minimum of five years if ex-smokers. All were in good health and underwent a full medical examination before they were accepted as study volunteers.

Nicotine was administered orally as 2mg or 0mg (placebo) nicotine gum. Smoker subjects were not required to abstain from cigarettes prior to the experimental days and so attended the laboratories at their preferred nicotine level. All subjects were required to chew the gum slowly and steadily for 20 minutes to allow for buccal absorption of the nicotine. Hindmarch et al. (1990) recorded average increases in plasma nicotine of 4.6 ng/ml (smokers) and 3.7 ng/ml (non-smokers) over baseline evels 30 minutes after the administration of 2mg nicotine gum using a similar methodology.

The task was an adaptation of Sternberg's original test of high speed scanning and retrieval from short term memory (Sternberg 1966). Subjects memorised a set of 1, 3 or 5 digits (stimuli) presented sequentially in the centre of a screen for 1.2 seconds each, followed after a 1 second pause by a series of probe digits. The task was to judge as quickly and as accurately