Abstract

THE EFFECTS OF ENVIRONMENTAL ENRICHMENT ON ABSTINENCE AND RELAPSE USING AN ANIMAL CONFLICT MODEL

by

Joshua A. Peck

Advisor: Professor Robert Ranaldi

Heroin addiction is a significant health and societal problem for which there is no effective and well-accepted long-term behavioral or pharmacological treatment. Therefore, strategies that prolong heroin abstinence should be the primary focus of heroin treatment research. There is promising evidence that environmental enrichment may indeed support drug abstinence in animals using the reinstatement model of abstinence and relapse. The current studies used an animal conflict model that captures the aversive consequences of drug seeking (as are typical in humans, e.g., arrest, incarceration, job loss, and strained social relationships) to test the effects of environmental enrichment on heroin abstinence, prolonged abstinence, and relapse. In Experiment 1, the procedure consists of three phases: drug self-administration (phase 1), electric barrier application (phase 2) that resulted in abstinence, and the continued assessment of prolong abstinence (phase 3). For phase 1, male rats were trained to self-administer intravenous heroin under a fixed-ratio schedule of reinforcement. After self-administration was acquired, environmentally enriched animals (EE) were housed in environmental enrichment boxes, while control rats with no enrichment (NEE) were transferred to standard cages, drug-free in both cases. Each rat continued to reside in their respective EE or NEE housing conditions until the end of the abstinence and prolonged abstinence phases. During abstinence in phase 2, all rats were introduced to an electric barrier by electrifying the floor area near the levers in order to model the aversive consequences of continued drug seeking. Shock intensities increased over
sessions until no active lever responses occurred for three consecutive sessions (abstinence achieved). After the abstinence criterion was met, in phase 3 all rats continued daily abstinence sessions until they resumed responding on the active lever as a measure of prolonged abstinence or until the maximum number of sessions (30) allotted without resumption of responding had been reached. It was found that EE rats achieved abstinence in significantly fewer sessions than NEE rats. Further, EE rats remained abstinent for significantly more sessions than NEE rats. In Experiment 2, the same self-administration (phase 1) and abstinence procedure (phase 2) as in Experiment 1 was employed except that EE rats were housed in their respective enrichment boxes after abstinence was achieved. Further, in phase 3 the ability of non-contingent drug cue presentations to induce relapse was assessed. Each rat was placed in its respective housing conditions for three days of either EE or NEE before being returned to the operant chambers for the relapse test. During the relapse test, the electric barrier was turned on at the shock intensity that previously led to 3 consecutive sessions with no active lever presses for each rat. Further, each rat was exposed to non-contingent presentations of the drug cue previously paired with drug infusions during self-administration training. The cue was presented for 20 s every 5 min during the entire 30-min relapse test session. It was found that EE rats displayed significantly less individual relapse than NEE rats. The current studies’ use of the abstinence-conflict model to investigate environmental enrichment as a behavioral strategy to induce drug abstinence will help in the development of effective treatment outcomes for human addicts by bringing together both the positive consequences of abstinent behavior in an enriched environment with the aversive consequences of drug seeking (e.g., electric barrier). Collectively, these results support the use of environmental enrichment to induce and prolong abstinence, and to protect against relapse in heroin seeking rats.