

Conditioning models of addiction: Part 1

In his next Background Briefings, Professor David Clark describes the processes of operant and classical conditioning, as well as positive and negative reinforcement. He looks at how these processes are involved in problematic substance use and addiction.

There is a substantial body of research that shows that the ingestion of psychoactive substances and the development of problematic substance use or addiction involve psychological processes similar to those involved in normal appetitive behaviours such as eating, drinking and sex.

Research in laboratory animals has provided many insights into the role of reinforcement, learning and conditioning in normal appetitive behaviours, as well as in the misuse of psychoactive substances. In this regard, it is important to note that when given the opportunity, laboratory animals, such as the rat, learn to self-administer psychoactive drugs (except LSD).

Over millions of years, the brains of animals have evolved a motivational system that helps animals survive and reproduce. Behavioural responses that lead to positive consequences, such as the reduction of hunger, are likely to be repeated. Moreover, animals learn to escape from or avoid painful or noxious stimuli.

Operant conditioning, or instrumental learning, refers to the way in which the consequences of behaviour influence the likelihood of that behaviour being repeated. One class of consequence which can affect behaviour, positive reinforcement, is illustrated by a laboratory rat learning to press a lever to obtain food, or a dog sitting up to beg for a biscuit.

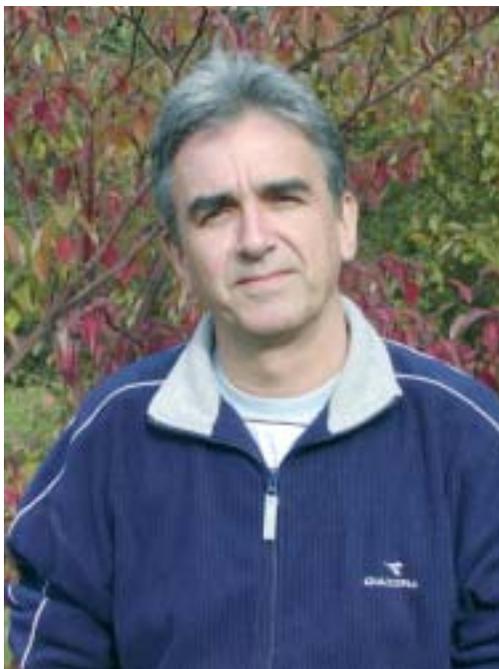
Drugs of dependence tap into the motivational system underlying this behavioural change. The drug acts as a reward, or positive reinforcer, and with repetition the association between cue, response and reward becomes stronger and stronger.

Another important principle here for understanding problematic substance use is the immediacy of reinforcement. It is well-established that the sooner a reinforcer follows a behaviour, the more powerful its effect will be on that behaviour and the more likely the behaviour is to be repeated.

A second class of consequence that can affect behaviour (negative reinforcement) can be demonstrated in the laboratory by training a rat to press a lever to avoid being punished by, for example, a small electric shock to the feet. Each time the animal receives the cue (eg a light predicting impending shock), it will perform an operant response to avoid the shock being delivered.

Similarly, the dependent heroin user may take the drug (perform an operant response) to avoid impending withdrawal symptoms and the associated physical and psychological discomfort.

It is important to emphasise that these



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instrumental learning mechanisms can operate outside conscious awareness and not involve a decision-making process.

Robert West (2006) points out that in this model, addiction can be viewed as involving the 'development of a habitual behaviour pattern that is independent of any conscious evaluation that might be taking place about the costs and benefits of the behaviour. The impulses to engage in addictive behaviour that are generated by this mechanism can be so strong that they overwhelm the desire of the addicts to restrain themselves'.

Classical (or Pavlovian) conditioning is a process that involves a neutral stimulus (such as a red light)

becoming rewarding and influencing behaviour because it has reliably preceded a reward such as food.

In Ivan Pavlov's seminal experiments at the turn of the 20th century, salivation was demonstrated in dogs presented with food. After a neutral stimulus (bell) was presented in combination with the food on a number of occasions, the bell became capable of eliciting salivation in the absence of the food. Thus, the bell had become a conditioned stimulus capable of influencing behaviour, ie producing a conditioned response.

Conditioned stimuli play an important part in our daily life, and they have played a significant role in evolutionary terms, in respect of the survival of the species. They allow us to react to threatening situations and alert us to such necessities as food and sexual partners; they shape behaviour.

As discussed earlier for operant conditioning, classical conditioning processes can become automatic. Behaviour can be influenced without conscious, decision-making processes.

I know this well from lighting the gas ring above an oven that had been left on for many hours: I was blown across the room, fortunately with only hairs singed. But I was left with a strong conditioned response, such that every time I heard a sound near a gas stove, I literally jumped out of my skin. The response took years to extinguish.

These stimuli, such as Pavlov's bell, are known as secondary reinforcers because they derive their ability to influence behaviour by association. Secondary reinforcers can generalise in the sense that stimuli with similar characteristics (eg similar colour light) will produce a similar, but not necessarily identical, impact on behaviour.

The impact of the conditioned response can also extinguish, in that if presentation of the bell is not followed by food on a number of occasions, salivation in the dog will disappear.

In the next Briefing, we will look at the role of classical conditioning in substance use and addiction, considering conditioned withdrawal, conditioned drug-opposite responses and conditioned tolerance, and conditioned drug-like responses.



Recommended reading:
Robert West (2006) *Theory of Addiction*. Blackwell Publishing. (Available at discounted rate from the DDN bookshop at www.drinkanddrugs.net.)

Nick Heather and Ian Robertson (2001) *Problem Drinking*. Oxford Medical Publications.