E C S T A S Y: RECENT SCIENCE

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Recent media coverage of Ecstasy has again raised the question of what evidence there is on the acute and longer-term health effects of taking this drug. This question is also relevant to recent parliamentary consideration of the Public Entertainment (Drug Misuse) Bill.

This note outlines recent scientific results subsequent to POST's detailed 1996 review of the health effects of ecstasy and other illegal drugs.

BACKGROUND

POST's 1996 report ("Common Illegal Drugs and Their Effects - cannabis, ecstasy, amphetamines and LSD" [1]) reviewed the mode of action and evidence on adverse health effects of ecstasy. It pointed out that ecstasy (chemically known as MDMA) was first synthesised and patenting in Germany in 1914, and was first used as a 'recreational' drug in the USA as part of the 1960s psychedelic drug culture in California. It remained a legal drug for some time there (until 1985), and was only one of a number of drugs taken to enhance mood during the 1980s.

Ecstasy's big breakthrough was the emergence of the dance scene in the late 1980s, where a synergy developed between the effects of the drug and the increasingly popular all-night raves. Ecstasy meshes well with this environment. Firstly, it has some of the amphetamines' stimulant qualities, making the individual feel alert, confident, energetic and providing staying power. Secondly, ecstasy is particularly effective at enhancing mood, where it induces a mild euphoria, feelings of serenity and empathy with others (and is sometimes referred to as having mildly hallucinogenic properties). Such properties mesh well with the sound and light displays in the rave, with ecstasy supplying the energy to dance all night, and reducing inhibitions and promoting empathy with fellow dancers. Indeed, for many, the drug has become an integral part of the rave scene.

The previous POST review pointed out that, in contrast to cannabis, where there is research literature stretching back 25 years or more, the relatively recent emergence of ecstasy means that there has been much less research on its potential psychological and health effects. There thus has to be a greater emphasis on extrapolating insights gained from experiments on animals, and thus even limited research findings on humans become quite important.

1. "Common Illegal Drugs and Their Effects - Cannabis, Ecstasy, Amphetamines and LSD" (110pp), free to Parliamentarians (POST, 7 Millbank, E: 2840), otherwise £15 (Parliamentary Bookshop: 0171-219-3890).

UPDATING THE SCIENCE

Media focus continues to be almost exclusively concerned with the dangers of dropping dead soon after taking ecstasy. But, as summarised in the POST report, there is good evidence from animal experiments that ecstasy is neurotoxic (it has displayed this property in all species investigated to date), and that there may thus be a danger of significant and irreversible damage to the human brain.

Ecstasy-related Deaths

As outlined in the earlier report, obtaining a precise figure for the number of 'ecstasy deaths' is difficult. Data from the Department of Health suggest that there are currently around 10 deaths a year in England and Wales where ecstasy was **the only drug involved** (the actual figures are 1, 6, 5, 12 and 10 for the years 1990 to 1994 respectively, giving a total of 34 deaths over this period). However, this may well be an under-estimate; despite the intense media interest, some cases may be 'missed' (e.g. if death occurs away from a rave setting); such figures may also exclude cases where ecstasy was used in combination with other drugs. As discussed in the full POST report, the 'real' number of deaths could thus be higher. Recent harm prevention initiatives (e.g. warning of the dangers of over-heating in a dance setting, or drinking too much water in other circumstances) raise hopes of a decline in the number of such deaths in future years.

As pointed out in the POST report, if we assume some 10 to 20 ecstasy-related deaths each year as indicating the scale of the **immediate risk** involved, very different interpretations can be placed on this figure. Those seeking to down-play the risk compare it with the risk of being killed in a traffic accident, where the odds are similar. Others would compare tolerating 10-20 deaths a year from taking one particular chemical with society's reluctance to accept much lower risks in other fields (whether from contraceptive pills or nuclear power).

Longer Term Effects on the Brain

As discussed in the earlier report, ecstasy causes (*inter alia*) a massive release of the neuro-transmitter serotonin - it does this by causing the pre-existing stores of neuro-transmitter in the brain nerve cells (neurons) to be released. Ecstasy also inhibits the neurons' ability to re-absorb the serotonin released, so that its effect is both increased and prolonged. This gives a boost well outside the range of that experienced by normal emotions, accounting for the intense empathy and mood change while under the influence of the drug. Most studies on the detailed effects of the drug are in animals such as rats and monkeys which reveal that in addition to 'serotonin behavioural syndrome'[2], MDMA proves neuro-toxic at relatively modest levels. The drug causes degeneration of the nerve endings from which the serotonin is released, leading to a reduction in the ability of the cells to make serotonin. This damage is only slowly reversed on cessation of drug taking, and the damaged nerve cells reconnect to different parts of the brain than before, with consequences which are difficult to predict.

Since human recreational doses are comparable to those used in animal experiments, there are justifiable concern that similar effects might be happening in chronic ecstasy users. However, because of the impossibility of carrying out analogous experiments on humans, actual information on effects on humans is very limited. At the time of the POST, report little scientific evidence was available concerning the effects on chronic ecstasy users, although one study did suggest that serotonin levels of regular ecstasy users were lower than those in non-users. The possibility that MDMA has damaging longer-term effects on the human brain should thus be taken seriously but remained unproven.

Since the POST report was published, two pieces of research strengthen such concerns. In a study conducted by Dr Michael Morgan at the University of Swansea, three groups of people - ecstasy users (who had used the drug at least 20 times and also used other drugs such as cannabis and amphetamines), other 'dance' drug users (who had never taken ecstasy) and a group who had never used any illegal drug - were given a range of psychometric tests designed to assess their 'neuropsychological' performance, personality and mood. **Researchers found that the ecstasy users performed significantly less well in some of the neuropsychological tests than the other two groups.** One of the tests measured problem-solving skills (such as the ability to plan ahead or think through a solution), while the other was a figure-matching exercise (involving visual recognition and working memory), so the results point to chronic ecstasy use reducing the ability to carry out cognitively demanding tasks. This study points the finger squarely at ecstasy, since the effects were not seen in the non-ecstasy drug user group. Dr Morgan sees the effects as being long-term, and likens them to the gradual erosion of dopamine-producing cells that leads to the onset of Parkinson's disease.

The second study (By Dr Val Curran at University College London) provides evidence of short-term psychological problems related to ecstasy use. She gave ecstasy users tests designed to assess their mood at various points during the week following use of the drug on a Saturday night. This study found that users were significantly more depressed mid-week than they were at the weekends (both while under the influence and the day after taking ecstasy), to the extent that some of the users qualified for a psychiatric diagnosis of depression at the mid-week assessment. Similar tests given to alcohol users found no such mood swings mid-week compared to the weekends. Such effects are consistent with the neurochemistry (see POST report) where the drug provides a short-term boost to serotonin levels, followed by a depletion some time later.

IN CONCLUSION

The two studies outlined above strengthen concerns that ecstasy use can affect the brain some time after the immediate effects of the drug have worn off. The real fear is that ecstasy may cause long-term permanent effects on the human brain in much the same way as observed in animal experiments. This remains unproven, but many experts see such long-term effects as a bigger potential threat to public health than the much more widely publicised short-term risks.

References

H. V. Curran and R. A. Travill, 1997. "Mood and Cognitive Effects of MDMA: Week-end 'High' Followed by Mid-Week 'Low'", 'Addiction', in press.

M. J. Morgan, *et al*, 1997. "Lasting Neuropsychological Sequelae of Recreational Use of MDMA: A Controlled Study in Humans", submitted to 'Neuropsychopharmacology'.

2. A form of hyperactivity which involves a series of complex repetitive movements not unlike some of the more repetitive human behaviour on the dance floor.