



# HIGH-LIGHT



ALCOHOL AND DRUG NEWS BRIEF FOR EMPLOYERS  
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## ECSTASY & THE BRAIN

### ECSTASY – a brief history

Although widely regarded as a novel member in the family of recreational drugs, Ecstasy ( Methylene-dioxymethamphetamine or MDMA ) is in fact an old timer in new rags. In 1912, the German pharmaceutical company, Merck, filed a patent application for MDMA but no specific medical application was mentioned in this application. During the fifties, the US army conducted some animal experiments with various chemicals including MDMA. It was in fact MDA, a distant cousin and metabolite of MDMA which first gained popularity as a recreational drug. In the Eighties, several psychotherapists started using this drug on their patients because of the drug's reported empathogenic effects and it's alleged ability to help patients overcome suppressed emotions. By the mid –eighties the MDMA's popularity as a recreational drug gathered so much momentum that the US government moved swiftly to have the drug declared an illicit substance. The rave dance explosion which first hit the UK during the late eighties soon spilled over to the United States and created a launchpad which saw the drug's popularity soaring by 1996. With the increased popularity of the drug it was inevitable that fatalities from overdoses and experimentation would soon follow – this in turn saw a further clampdown in the form of the Club Drug Anti – Proliferation Act, designed provide for harsher penalties for the distribution and use of Ecstasy and other club drugs such as ketamine, Rohypnol and GHB.

In South Africa, Ecstasy use do not appear to have reached alarming proportions compared to other drugs. The MRC's drug surveillance system SACENDU indicates that the number of admissions to treatment centers who indicated Ecstasy as primary substance between 1996 and 2002 , have remained very low ( <1 – 2 % ) and stable.

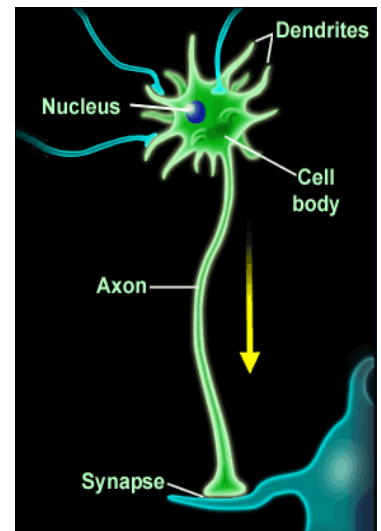
### Understanding nerve cells and neurotransmission

Normal brain functioning depends on the action of millions of nerve cells called **neurons** and every brain structure is made up of millions of these although they may vary considerably in function. Typically, the neuron consists of three parts :

a) a central cell body that directs the activities of the neuron

b) dendrites, which are short fibers that receive messages from other neurons and relay them to the cell body and the

c) axon, a long single fiber surrounded by a fatty sheath ( myelin ) that transmits messages from the cell body to the dendrites of other neurons or to body tissues.



The transfer of a message from the axon of one nerve cell to the dendrites of another is called **neurotransmission**. Although axons and dendrites are located close to each other, the transmission of a message from an axon to a dendrite does not occur through direct contact : When an electrical impulse travels along the axon, it arrives at a gap in the cell membrane of the adjacent neuron. This " gap " is known as the **synapse**. When it arrives at this gap the electrical impulse triggers the release of chemicals called **neurotransmitters** into this gap. These chemicals travels across the gap and binds to special sites , called **receptors**, located in the cell membrane of the receiving dendrite, almost like a key ( chemical ) fitting into a lock. This process in turn , may result in the original message being facilitated ( intensified ), inhibited or modulated. After the neuron has processed the incoming electrical impulse, the neurotransmitter in this gap is inactivated in one of two ways :

a) it can be broken down by an enzyme, eg the neurotransmitter dopamine is broken down by the enzyme Monoamine oxidase which forms part of the chemical mechanism involved in cocaine addiction.

b) it can be reabsorped back into vesicles of the nerve cell which released it making them available for use at a later time, a process often



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referred to as re-uptake. So-called transporter cells bind to the neurotransmitter and transport it back into the membrane of the pre-synaptic cell. In this manner, anti-depressant drugs ( known as SSRI's – selective serotonin re-uptake inhibitors) prevent the transporter cell to attach to the neurotransmitter serotonin, thus ensuring that more serotonin remains in the synapse to relieve the symptoms of depression.

Some drugs like the **narcotics and LSD** mimic the effects of the brains natural neurotransmitter eg endorphins. The endorphins are closely involved with respiration, nausea and pain modulation, hence the narcotic drugs effectiveness in the relief of severe pain Others like **cocaine**, block the reabsorption of the natural neurotransmitter ( dopamine ) back into the neuron whilst a **Dagga** activates cannabinoid receptors (which respond to the neurotransmitter anadamide) mainly in 3 regions of the brain , ie the frontal cortex ( loss of inhibitions, talkativeness, giggling ) the Hippocampus ( storage of incoming information = memory) and the cerebellum ( loss of balance, impaired motor function.)

### How does Ecstasy work in the brain ?

Ecstasy essentially works in 3 ways ,namely, by stimulating the release of the neurotransmitter serotonin in the synapse, by stimulating the release of dopamine and by preventing serotonin from being reabsorped in the pre – synaptic neuron. Both serotonin and dopamine are intimately involved in the brain's pleasure circuit .

What makes Ecstasy remarkable is the drug's ability to simultaneously induce both serotonin release and re-uptake blockade : By binding with serotonin's transporter cell, Ecstasy prevents the re-uptake of serotonin, keeping liberal amounts of this natural anti-depressant drug available in the synapse. Because Ecstasy molecules are similar in size to serotonin molecules it can hitch a ride on the transporter molecules back into the cell membrane where it is dropped off and stimulates the release of more serotonin in the synapse. Thus large amounts of serotonin flood the synapse causing the distinctive Ecstasy high. The process can be described in four steps.

1 Ecstasy piggy backs a ride on the transporter cell into the synapse. Once inside, Ecstasy drops off and the transporter cell changes shape

2 The transporter now has the correct shape to pick up serotonin and transport it out of the cell into the synapse.

3 Once the transporter is out in the synapse, it changes shape again and the serotonin is dropped off.

4 The transporter now has the correct shape to pick up Ecstasy in the synapse and transport it back into the cell to repeat the process.

If Ecstasy is taken in conjunction with a Mono-amine oxidase inhibitor ( that is, any drug which prevents this enzyme from destroying excess serotonin in the synapse ) this may cause some severe and potentially fatal hypertensive reactions

MDMA still has one other function in the brain : It inactivates the enzyme responsible for the making of new serotonin ( Tryptophan hydroxylase ) so that serotonin may fall below baseline levels. This may account for the mild dysphoria and depression following an Ecstasy high. However, with normal recreational use of Ecstasy, serotonin levels usually return to normal baseline levels after 24 hours.

To a lesser extent, Ecstasy also stimulates the release of dopamine. This release of inordinate amounts of dopamine appears to be dependent on serotonin release, thus the more serotonin, the more dopamine. Apart from playing a critical role in the regulation of emotions, dopamine also helps the brain stem and the cerebellum to control muscle movement. However, the mechanism of dopamine release and re-uptake blockade is not principally involved as in the case of cocaine addiction.

The debate rages on as to whether Ecstasy causes brain damage. However, most animal studies to date support the notion that high or repeated doses of Ecstasy does produce long term changes in serotonergic functioning which may be the result of damage. Studies comparing users with non users indicate that some heavy users experience some cognitive changes but these results are in no way conclusive. At this junction it would probably be wise to err on the side of caution by assuming that long term use of Ecstasy could possibly cause neuronal damage.

**For more information about Ecstasy and other club drugs, please contact :**  
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