The use of drugs for nontherapeutic effect biology essay

Science, Biology

Therapeutic agent: Barbiturates, Benzodiazepines, opiates analgesics and analogues, hypnotics and sedatives etc. Non-therapeutic agents: cannabis, opiates, alcohol, nicotine, caffeine, hallucinogens etc. Drug dependence is when the drug taking becomes uncontrollable that its use takes superiority over other needs and often leads to adverse outcome. It usually occurs due to the individual trying to avoid the withdrawal symptoms which are the effects of stopping the use of a drug, they are physical and psychological effects that lasts for days or weeks. Drug abuse is a more general term that covers the repeated use of illegal or harmful substance and can lead to dependence on the drug based on some factors which include: The route of administration: Delivery systems that are rapid (e. g. IV injections, smoking cocaine etc.) have a high dependence potential. The type of drug being abused: Schedule 2 drugs (e. g. opioids), central nervous system depressant (e. g. ethanol, barbiturates), central nervous system stimulant (e. g. cocaine, nicotine) all have a strong dependence potential. The individual taking the drug: Having easy access to the drugs, suffering from depression, anxiety disorder, schizophrenia or living in a society where the use of drug is socially acceptable can cause dependence on the drug. Dependence is usually associated with: Tolerance: This is the decrease in the pharmacological effect of a drug if its administration has been on a repetitive basis. This leads to an increase in the dose of the drug to produce the original pharmacological effect. Tolerance can be as a result of the increased metabolism of the drug (metabolic tolerance) but it is usually due to the neuroadaptive changes that occur in the brain (cellular tolerance). Physical abstinence syndrome: This is when a drug has been administered repeatedly

and stopping the drug leads to unpleasant effect such that the individual taking the drug tries to stop this effect by self-administration of the drug. The presence of this unpleasant effect (abstinence syndrome) shows a physical dependence on the drug. The severity of this physical abstinence syndrome varies from different classes of drugs and is more severe in opioids. Psychological dependence: This is seeking the continuous administration of a drug without any physical need for the drug (i. e. craving for the drug). The drug is needed due to the mental and psychological effect it produces. Dependence-producing drugs activate the same pathway as natural rewards and are thus " rewarding". This reward pathway is the mesolimbic dopaminergic pathway. Evidence from animal experiment has shown that the stimulation of the ventral tegmental area leads to the activation of dopaminergic neurons and increases the release of dopamine. Drugs such as opioids, alcohol and nicotine increases dopamine release from the presynaptic terminal while drugs other drugs like cocaine increase dopamine level by inhibiting presynaptic uptake of dopamine. The dopamine level is usually returned to normal by homeostatic regulation but continuous use of these drugs may lead to loss of this regulation and causes an increase dopamine level. The increase in dopamine level over a long period of time causes changes in the reward system (depletion of the dopamine pathway) which leads to lesser response to the drugs (Tolerance). A variety of problems are associated with drug abuse and these include: The short term effect of the drug withdrawal i. e. the physical and psychological symptoms of drug dependenceThe long term medical problems as a result of the drug e. g. AIDS from sharing drug use equipment (Injection) and worsening of HIV

symptoms, hepatitis etc. The effect on social behaviour. The individual might go to any extent to get money to purchase the drug (increase in criminal activity). The effect of moods, lack of a sense of responsibility and consciousness. Adverse effect on the body e. g. respiratory depression related to use of opiates, liver diseases associated with alcohol. METHADONE IN THE TREATMENT OF OPIOID DEPENDENCEOpioids are synthetic or natural drugs that are used in the management of pain. Examples includes: Naturally occurring: morphine, codeine, papaverine etc. Semi-synthetic: oxycodone, diacetylmorphine (heroin), buprenorphine etc. Synthetic: methadone, fentanyl, tramadol etc. Opioids main effects are analgesic and euphoric effect (except methadone), the analgesic effect is due to the activation of opioid receptors found in the brain, gastrointestinal tract and spinal cord. They activate opioid receptors by mimicking the effects of endogenous opioid peptides (e. g. endorphins, enkephalins etc.). There are 3 types of opioid receptors; mu (μ), delta (δ) and kappa (κ) and they are all G-protein-coupled receptors. Majority of known opioids act on μ receptors; physical dependence, euphoria, respiratory depression and analgesia are effects associated with the activation of these μ receptors. The pain inhibitory neuron is indirectly activated by the opioids; they bind to the opioid receptor and cause the inhibition of adenylyl cyclase which reduces the intracellular cAMP. They also cause the opening of K+ and closing of ca2+. This leads to hyperpolarization of the membrane and decrease in release of neurotransmitter. The overall effect is the inhibition of nociceptive processing into the dorsal horn of the spinal cord. Opioids (e. g. Heroin) are prone to abuse and dependence because of their euphoric effect. Opioids

produces euphoria by activating the mesolimbic dopaminergic pathway mentioned earlier. In the ventral tegmental area, μ receptors are expressed on GABAergic neurons and opioids inhibit this neuron once activated by the presence of an opioid on the receptor. GABA release is inhibited and this leads to an increase in dopamine release. (This could be the basis for the psychological dependence i. e. craving the drug)http://www. cnsforum. com/content/pictures/imagebank/hirespng/moa_heroin_mu. pngTolerance to opioids develops almost quickly when large doses are administered over a short intervals and this usually occurs when it is being abused and not used for analgesic purposes. Withdrawal symptoms associated with opioids incudes: irritability, anorexia, nausea, abnormal behaviours etc. opioids are used repeatedly to avoid these symptoms and hence lead to physical dependence. The mechanism for opioid dependence and tolerance is not known but it could be as a result of changes in the second messenger. The activation of μ receptors inhibits adenylyl cyclase but the continuous administration of the drug increases the activity of the enzyme. Withdrawal of the drug then causes an increase in cAMP production which increases the neuronal excitability. Methadone is used in the treatment of opioid dependence (substitution treatment) because it does not produce withdrawal symptoms and euphoric effect of opioids. Methadone is a synthetic opioid and a μ receptor agonist. It is referred to as a weak agonist because its maximum effect is less than those of some agonist (e. g. diamorphine) and therefore do not lead to dependence. Properties of methadone that makes it suitable for the treatment of opioid dependence are: It is a long acting agonist as its plasma half-life is 24hrs and this enables it to be administered

as a daily dose therefore it can be supervised. It produces stabilizing not euphoric effect like other opioids (morphine, diamorphine) therefore it cannot be over-used due to craving. It can be administered orally and parentally. It is commonly administered orally which reduces the dangers associated with using injections (e. g. HIV). There is little need to increase dose for a long time once the dose has been titrated to get an optimal dose. Methadone is initially prescribed on a low dose and gradually increased to increase tolerance to the dose and then it is slowly reduced till it is stopped. Some drug abusers would be on kept on this reduced dose for a long period of time (methadone maintenance therapy) to prevent them from abusing other opioids (e. g. Heroin). High dose of methadone produces side effects similar to other opioids including drowsiness, nausea, vomiting, etc. these effects are rare due to the supervised administration. DISULFIRAM IN THE TREATMENT OF ALCOHOL DEPENDENCEAlcohol (Ethanol) is a central nervous system depressant but has excitatory effect and its effect is similar to those of anaesthetics. It excitatory effect is due to the GABA mediated inhibition due to the inhibition of ca2+ entry in the presynaptic neuron. This leads to decrease in the release of GABA in the VTA which increases the release of dopamine in the nucleus accumbens leading to the " rewarding" effect. Alcohol abuse is when its consumption cannot be limited by the individual. Alcohol inhibits the receptor function of N-methyl-D-aspartate (NMDA) by preventing the ability of glutamate to open the cation channel associated with this receptor. The NMDA is responsible for cognitive functions such as learning and memory. Period of memory loss when a high amount of alcohol has been consumed is as a result of this inhibition. Human and animal

experiment has demonstrated that the rapid elimination of ethanol accounts for a little bit of tolerance to ethanol and tissue tolerance is a major cause of this tolerance but the mechanism is not known. Acute effect of alcohol is the inhibition of ca2+ entry which results in reduction in transmitter release, ca2+ entry recovers during chronic use of alcohol. This leads to a high transmitter release when alcohol is withdrawn and this contributes to the physical withdrawal symptomsAlcohol metabolism occurs mainly in the liver, it occurs by successive oxidation. Ethanol (alcohol) is firstly oxidised to acetaldehyde by the enzyme alcohol dehydrogenase (it also reduces NAD+ to NADH), the acetaldehyde is then oxidised to acetic acid by aldehyde dehydrogenase. Only little amount of acetaldehyde gets into the blood stream and this causes little effect in the body. Disulfiram is used to treat alcohol abuse by using it with the alcohol itself (used as an adjunct). It causes unpleasant effects such as distress, vomiting, flushing, hyperventilation etc. Disulfiram does this by inhibiting aldehyde dehydrogenase, this leads to an accumulation of acetaldehyde in the blood stream which causes the unpleasant effects. The main aim of disulfiram is to make the consumption of alcohol very unpleasant, therefore making the individual stay away from its consumption. ETHANOLOccurs in the liverAcetic acid is not formed and this leads to accumulation of acetaldehyde. Inhibition of aldehyde dehydrogenaseDISULFIRAMAldehyde dehydrogenaseNADHNAD+ACETALDEHYDENADHNAD+Alcohol dehydrogenaseACETIC ACID