CIE Biology GCSE

15: Drugs

Notes

(Content in **bold** is for Extended students only)

A drug is a substance that, when taken into the body, has an **effect on the chemical reactions** that take place. There are a variety of different drugs which treat different diseases.

Antibiotics:
Antibiotic drugs are used to treat **bacterial infections**. **Some antibiotics kill bacteria by destroying their cell wall, leading to the cell bursting, whilst others inhibit the growth of the bacteria. Viruses** cannot be killed by antibiotics **as they do not grow and reproduce in the same way as bacteria, and do not have the same structure.**

Some bacterial strains become **resistant** to antibiotics as a result of **natural selection**:
1. A **mutation** occurs in a bacterial cell which makes it resistant to an antibiotic.
2. When that antibiotic is administered, this **cell is not killed,** whereas cells which have not become resistant are killed.
3. The resistant cell can therefore survive and **reproduce**, producing more resistant bacteria.

Resistance to antibiotics results in antibiotic resistant bacterial infections in hospitals such as MRSA (methicillin-resistant Staphylococcus aureus). **It is therefore important to try and slow the development of resistant bacterial strains. This can be done by only using antibiotics for serious infections, and always completing the full course of antibiotics to make sure that all the bacteria is killed.**

Misused drugs

Alcohol and heroin:
Alcohol and heroin are both **depressants**, meaning that they lower the rate of nervous impulses by **blocking synapses**. This means that **reactions are slower**. They also **lower self-control**, which can lead to increased crime rate and antisocial behaviour.

These drugs also cause the release of neurotransmitters such as dopamine into synapses in the reward pathway which causes a 'high'. This can be addictive and thus lead to withdrawal symptoms if the person stops taking the drug, such as anxiety, insomnia, headaches and nausea.

They can also lead to other medical problems:
- Heroin is usually injected, thus **infections such as HIV are common** from sharing dirty needles.
- Excessive alcohol consumption leads to **liver damage**. The liver usually breaks down alcohol and other toxins.

Performance-enhancing drugs:
Some drugs are used to enhance sporting performance. In competitive sports, these drugs are seen as unfair and are usually banned, with those using them being disqualified.

- **Anabolic steroids - anabolic steroids trigger the release of hormones which promote muscle mass and strength. Different types of steroids target different muscle groups. In 2018, the Russian Winter Olympic team was disqualified from competing for taking anabolic steroids to enhance their performance.**

- **Testosterone - testosterone is a hormone which enhances athletic performance by improving muscle strength and size, as well as increasing energy levels and hand-eye coordination.**

Smoking

Smoking and diseases:
Smoking is addictive due to a chemical called **nicotine** which is inhaled with the cigarette smoke and causes the release of dopamine. This leads to long-term smoking habits, which have been linked to many diseases:

- **Chronic obstructive pulmonary disease (COPD)** - a group of diseases that decrease the efficiency of gas exchange in the lungs by damaging the alveoli, hence decreasing the surface area for diffusion, and causing inflammation in the airways. COPD causes breathlessness, a persistent cough and frequent chest infections. The condition cannot be cured, although the progression can be slowed, and symptoms treated.

- **Lung cancer** - one of the more serious forms of cancer, for which smoking accounts for over 85% of cases. This is because cigarette smoke contains a variety of toxic chemicals, many of them carcinogens.

- **Coronary heart disease** - smoking puts a strain on the heart due to the nicotine and carbon monoxide breathed in. Carbon monoxide is dangerous as it displaces the oxygen bound to haemoglobin and binds to it instead. This means that there is less oxygen present in the blood so the heart must work harder to supply it to the tissues. There is also an increased risk of blood clots, and other chemicals can damage arteries. Coronary heart disease can lead to heart attacks and heart failure.

Although smoking is a major **risk factor** for all of these diseases, it does not mean that every smoker will develop these diseases. There are a **variety of other factors** that alter the **probability** of having one, such as **age, fitness and amount/length of time smoking**.

Components of cigarettes:

There is a toxic mix of over 7000 chemicals in every cigarette, many of which are poisons and carcinogens:

- **Nicotine** - addictive, causes high heart rate and blood pressure, and also triggers the release of adrenaline.
- **Tar** - tar, when inhaled, sticks to the cilia of cells in the lungs which usually transport mucus away from the lungs to protect them from infections. Tar prevents them from doing this, which is why smokers are more susceptible to chest infections. In addition, a build-up of tar can narrow airways.
- **Carbon monoxide** - Carbon monoxide decreases the amount of oxygen in the blood, thus putting a strain on the heart to supply more.

Other chemicals include arsenic (used in rat poison), formaldehyde (poisonous) and hydrogen cyanide (chemical used to kill ants).