

# AQA - Biology 1a - *Human Biology*

## 11.1 How do human bodies respond to changes inside them and to their environment?

The nervous system and hormones enable us to respond to external changes. They also help us to control conditions inside our bodies. The menstrual cycle is controlled by hormones.

You should be able to:

- evaluate the benefits of, and the problems that may arise from, the use of hormones to control fertility, including IVF
- evaluate the claims of manufacturers about sports drinks.

Know that:

- The nervous system enables humans to react to their surroundings and coordinate their behaviour.
- Receptors detect stimuli which include light, sound, changes in position, chemicals, touch, pressure, pain and temperature. (The structure and functions of sense organs such as the eye and the ear are not required.)
- Information from receptors passes along cells (neurons) in nerves to the brain. The brain coordinates the response.
- Reflex actions are automatic and rapid. They often involve sensory, relay and motor neurones.
- The role of receptors, sensory neurones, motor neurones, relay neurones, synapses and effectors in simple reflex actions.
- Internal conditions which are controlled include:
  - the water content of the body – water leaves the body via the lungs when we breathe out and via the skin when we sweat, and excess water is lost via the kidneys in the urine
  - the ion content of the body – ions are lost via the skin when we sweat and excess ions are lost via the kidneys in the urine
  - temperature – to maintain the temperature at which enzymes work best
  - blood sugar levels – to provide the cells with a constant supply of energy.
- Many processes within the body are coordinated by chemical substances called hormones. Hormones are secreted by glands and are transported to their target organs by the bloodstream.
- Hormones regulate the functions of many organs and cells. For example, the monthly release of an egg from a woman's ovaries and the changes in the thickness of the lining of her womb are controlled by hormones secreted by the pituitary gland and by the ovaries
- Several hormones are involved in the menstrual cycle of a woman. Those hormones involved in promoting the release of an egg include:
  - FSH which is secreted by the pituitary gland and causes eggs to mature in the ovaries, and also stimulates the ovaries to produce hormones including oestrogen
  - Oestrogen which is secreted by the ovaries and inhibits the further production of FSH as well as stimulating the pituitary gland to produce a hormone called LH.
- The uses of hormones in controlling fertility include:
  - giving oral contraceptives which contain hormones to inhibit FSH production so that no eggs mature
  - giving FSH as a 'fertility drug' to a woman whose own level of FSH is too low to stimulate eggs to mature.

## 11.2 What can we do to keep our bodies healthy?

A combination of a balanced diet and regular exercise are needed to keep the body healthy.

You should be able to:

- evaluate information about the effect of food on health
- evaluate claims made by slimming programmes.

Know that:

- A healthy diet contains the right balance of the different foods you need and the right amount of energy. A person is malnourished if their diet is not balanced. This may lead to a person being too fat or too thin. It may also lead to deficiency diseases.
- The rate at which all the chemical reactions in the cells of the body are carried out (the metabolic rate) varies with the amount of activity you do and the proportion of muscle to fat in your body.
- It may be affected by inherited factors.
- The less exercise you take and the warmer it is, the less food you need. People who exercise regularly are usually fitter than people who take little exercise. If you exercise your metabolic rate stays high for some time after you have finished.
- In the developed world too much food and too little exercise are leading to high levels of obesity and the diseases linked to excess weight:
  - arthritis (worn joints)
  - diabetes (high blood sugar)
  - high blood pressure/heart disease.
- Some people in the developing world suffer from health problems linked to lack of food. These include:
  - reduced resistance to infection
  - irregular periods in women.
- Cholesterol is a substance made by the liver and found in the blood. The amount of cholesterol produced by the liver depends on a combination of diet and inherited factors. High levels of cholesterol in the blood increase the risk of disease of the heart and blood vessels.
- Cholesterol is carried around the body by two types of lipoproteins. Low-density lipoproteins (LDLs) are 'bad' cholesterol and can cause heart disease. High-density lipoproteins (HDLs) are 'good' cholesterol. The balance of these is very important to good heart health.
- Saturated fats increase blood cholesterol levels. Monounsaturated and polyunsaturated fats may help both to reduce blood cholesterol levels and to improve the balance between LDLs and HDLs.
- Too much salt in the diet can lead to increased blood pressure for about 30% of the population.
- Processed food often contains a high proportion of fat and/or salt.

### 11.3 How do we use/abuse medical and recreational drugs?

Drugs affect our body chemistry. Medical drugs are developed to relieve illness or disease. Drugs may also be used recreationally as people like the effect on the body eg alcohol and tobacco. People cannot make sensible decisions about drugs unless they know their full effects.

You should be able to:

- to evaluate the effect of statins on cardio-vascular disease
- to evaluate the different types of drugs and why some people use illegal drugs for recreation
- to evaluate claims made about the effect of cannabis on health and the link between cannabis and addiction to hard drugs
- to explain how the link between smoking tobacco and lung cancer gradually became accepted
- to evaluate the different ways of trying to stop smoking.

Know that:

- Drugs can be beneficial but may harm the body.
- Many drugs derived from natural substances have been known to indigenous peoples for many years.
- Scientists are developing new drugs. These need to be thoroughly tested.
- When new medical drugs are devised, they have to be extensively tested and trialled before being used. Drugs are tested in the laboratory to find if they are toxic. They are then trialled on human volunteers to discover any side effects.

- Thalidomide is a drug that was developed as a sleeping pill. It was also found to be effective in relieving morning sickness in pregnant women. However, it had not been tested for this use. Unfortunately, many babies born to mothers who took the drug were born with severe limb abnormalities. The drug was then banned, but more recently is being used successfully to treat leprosy.
- Some people use drugs recreationally. Some of these recreational drugs are more harmful than others. Some of these drugs are legal, some illegal.
- The overall impact of legal drugs on health is much greater than the impact of illegal drugs, because far more people use them.
- Drugs change the chemical processes in people's bodies so that they may become dependent or addicted to them and suffer withdrawal symptoms without them. Heroin and cocaine are very addictive.
- Nicotine is the addictive substance in tobacco smoke. Tobacco smoke contains carcinogens.
- Tobacco smoke also contains carbon monoxide which reduces the oxygen-carrying capacity of the blood. In pregnant women this can deprive a fetus of oxygen and lead to a low birth mass.
- Alcohol affects the nervous system by slowing down reactions and helps people relax, but too much may lead to lack of self-control, unconsciousness or even coma, eventually damaging the liver and brain.

#### 11.4 What causes infectious diseases and how can our bodies defend themselves against them?

Our bodies provide an excellent environment for many microbes which can make us ill once they are inside. Our bodies need to stop most microbes getting in and deal with any microbes which do get in.

You should be able to:

- relate the contribution of Semmelweis in controlling infection to solving modern problems with the spread of infection in hospitals
- evaluate the advantages and disadvantages of being vaccinated against a particular disease
- explain how the treatment of disease has changed as a result of increased understanding of the action of antibiotics and immunity
- evaluate the consequences of mutations of bacteria and viruses in relation to epidemics and pandemics eg bird influenza.

Know that:

- Microorganisms that cause infectious disease are called pathogens.
- Bacteria and viruses may reproduce rapidly inside the body and may produce poisons (toxins) which make us feel ill. Viruses damage cells in which they reproduce.
- The body has different ways of protecting itself against pathogens. White blood cells help to defend against pathogens:
  - by ingesting pathogens
  - by producing antibodies which destroy particular bacteria or viruses
  - by producing antitoxins which counteract the toxins (poisons) released by pathogens.
- Some medicines, including painkillers, help to relieve the symptoms of infectious disease, but do not kill the pathogens.
- Antibiotics, including penicillin, are medicines that help to cure bacterial disease by killing infective bacteria inside the body. Antibiotics cannot be used to kill viral pathogens, which live and reproduce inside cells. It is difficult to develop drugs which kill viruses without also damaging the body's tissues.
- Many strains of bacteria, including MRSA, have developed resistance to antibiotics as a result of natural selection. To prevent further resistance arising it is important to avoid over-use of antibiotics.
- People can be immunised against a disease by introducing small quantities of dead or inactive forms of the pathogen into the body (vaccination). Vaccines stimulate the white blood cells to produce

antibodies that destroy the pathogens. This makes the person immune to future infections by the microorganism, because the body can respond by rapidly making the correct antibody, in the same way as if the person had previously had the disease. An example is the MMR vaccine used to protect children against measles, mumps and rubella.