BOOK 4

HEALTH FITNESS AND SPORT

SECTION 1

FACTORS AFFECTING HUMAN HEALTH

DNA, GENES AND CHROMOSOMES

DNA

DNA (deoxyribonucleic acid) molecules are large and complex. DNA is the genetic code that determines the characteristics of all living things. Each person's DNA is unique, apart for identical twins. DNA can be cut up and separated, forming a sort of 'bar code' that is different from one person to the next. The shape of the DNA molecule is known as the 'double-helix'.

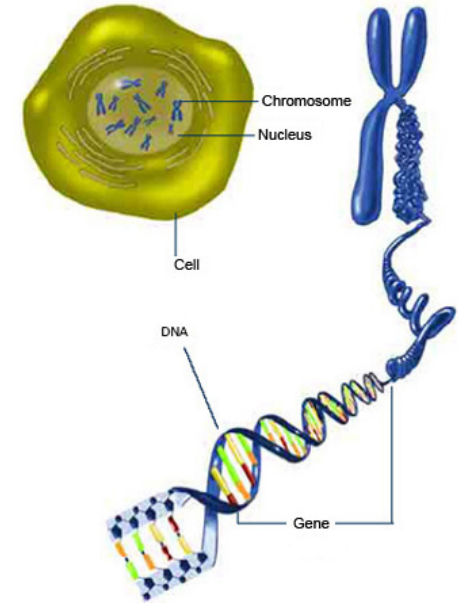
Double Helix
incamerastock /
Alamy Stock Photo

GENES

A gene is a short section of DNA. Each gene codes for a specific characteristic.

CHROMOSOMES

Chromosomes are found in the nucleus. They are made from long, twisted DNA molecules and are found in pairs. This is because the genetic information that makes up each individual comes from both parents. Half from the mother and half form the father. Therefore genes also come in pairs.



Chromosomes
National Institute of General Medical Sciences, http://bit.ly/2eAWUTI

There are dominant genes and recessive genes. The dominant gene always 'overrides' the recessive one.
For example:

Dominant gene – B (this could be the gene for brown hair).

Recesive gene - b (this could be the gene for blonde hair).

The parents both have one dominant gene and one recessive gene.

	B	b
B	BB	bB
b	Bb	bb

Offspring have a dominant gene and will have brown hair.

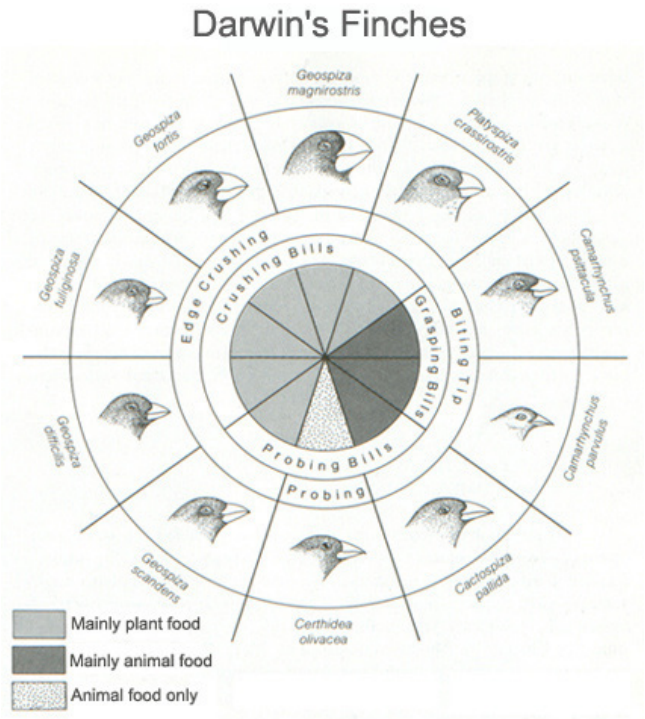
Offspring has only recessive genes and will have blonde hair.

Anyone with the genes Bb would display brown hair. Anyone with the genes BB would have brown hair. However, the offspring with bb would have blonde hair.

MUTATIONS

A mutation is a change in a gene. Some mutations are harmless and have no effect on the organism. Some mutations can be fatal. These mutations affect the organism in such a way that it cannot survive. These mutations don't get passed on and die out. However, some mutations provide organisms with an advantage.

All organisms compete with each other for space, food, water, resources and mates. Any mutation which makes the competition for these resources easier makes the organism more likely to survive and reproduce. The mutated genes then get passed on to the offspring, leading to either the eventual evolution of the species, or the creation of a new subspecies.



Darwin's finches
Flickr Creative Commons, http://bit.ly/2gcN76u

INHERITED DISEASES

Some diseases are inherited and are caused by mutations. These faulty genes are passed on through reproduction and there is very little that can be done about it. There are foetal screening programs, that allow the developing foetus to genetically tested for certain disorders/diseases. Parents are then given the option to terminate the pregnancy if they wish. Some genetic disorders are however completely harmless and only pose a slight inconvenience. An example of this is red-green colour blindness.

ALCOHOL

Drinking too much alcohol at any one time or even over long periods of time can have a very serious impact on the mind, body and health.

BRAIN:
Excessive alcohol consumption affects the way the brain sends signals along pathways. Alcohol interferes with these communication pathways in the brain. Changes in these pathways affect the mood and behaviour of an individual.

LIVER:
Heavy drinking impacts greatly on the liver and can lead to a variety of problems. The liver is responsible for removing toxins, like alcohol from the body. Damage to the liver by long-term alcohol consumption will lead to severe health problems, including liver failure and possible death.

PANCREAS:
Alcohol causes the pancreas to produce toxic substances that can eventually lead to pancreatitis. This is a dangerous inflammation and swelling of the blood vessels in the pancreas that prevents proper digestion.

A HEALTHY DIET

Food provides the necessary energy needed by living things.

Carbohydrates and fats are high energy sources. Proteins are needed for growth and repair.

Nutrient	Food source	Image	Role in the body
Carbohydrate	Breads, potatoes, pasta.	 **Carbohydrates** robynmac / Getty Images	Main energy source.
Protein	Animal products like meat, fish, cheese, milk and eggs.	 **Protein** a_namenko / Getty Images	Growth and repair.
Fats	Oils, milk and butter.	 **Fats** Multiart / Getty Images	Insulation and secondary energy source.
Fibre	Fruit, vegetables and cereals.	 **Fibre** Multiart / Getty Images	Aid with digestion.

Vitamins	Fruits and vegetables.	 **Vitamins** Serg_Velusceac / Getty Images	Various roles. Maintain health and body functions.
Minerals	Assorted food (depends on mineral).	 **Minerals** Serg_Velusceac / Getty Images	Various roles. Maintain health and body functions.

All food types have a GDA (guideline daily amount), and a RDA (recommended daily allowance). This information is provided to the consumer to help them make correct and informed decisions to consume a balanced diet.

A balanced diet is dependent upon the age of an individual, and the amount of activity that individual carries out.

ACTIVITY

In pairs produce a weekly balanced diet for the following:

1. A highly active teenager.
2. A middle-aged builder.
3. A middle-aged teacher.
4. An elderly person who likes gardening.

YOU WILL NEED:

- Pen
- Menu template

OBESITY

The consumption of an unbalanced diet can lead to obesity. This is because excess energy is consumed by eating too much food or too much of the wrong type of food. Large amounts of body fat results in obesity. The effects of obesity are wide reaching. There are health impacts, but also societal impacts.

HEALTH

People who are overweight have an increased risk of:

- Coronary heart disease
- High blood pressure
- Strokes
- Type 2 diabetes
- Some cancers.

In addition to the above, obesity can reduce life expectancy by up to 9 years.

Being overweight can also put extra pressure on joints and limbs, making activity quite difficult and sometimes any movement at all can be painful.

SOCIETY

There are many societal impacts of obesity. Obesity is associated with the development of long-term health conditions, placing demands on social care services.

Being overweight or obese and their associated health problems have a significant economic impact on the NHS and local authorities. Apart from these direct health care costs, obesity has financial implications for the wider economy through loss of productivity, incapacity and increased benefit payments.

"Take obesity: it already costs our NHS a staggering £4 billion a year. But within four years, that figure's expected to rise to £6.3 billion."

David Cameron, 16 May 2011.

SMOKING

Smoking is the most common cause of death and disease which is entirely preventable. In the UK, more than 86 000 people die each year from smoking-related diseases. Smoking is by far the greatest avoidable risk for developing many types of cancer. These include cancer of the throat and mouth, and cancers of organs such as the lungs, stomach and kidneys. Smoking damages blood vessels and increases the risk of heart disease and stroke. Smoking can also affect blood flow around the body. Regularly breathing in smoke damages airways. This can result in chronic obstructive pulmonary disease (COPD).

Insulin

Diabetes is a medical condition which has become much more common over recent years. Insulin is a hormone produced by the body which regulates the sugar level within the blood (the blood glucose level). Diabetics either do not produce insulin or do not produce enough insulin. A test for diabetes is to see if glucose is present in the urine (as glucose in the urine is a symptom of the condition).

The most common methods of treatment of diabetes are a combination of injections of insulin and a low sugar diet. Also, depending on the cause of the diabetes, sometimes a transplant of the pancreas is possible. However, if the cause is the result of an autoimmune response then this is not an option.

Diabetic monitoring and treatment
MihaPater / Getty Images

Injection
Tom Merton / Getty Images

A more recent development has been an insulin pump. A small device the size of a small mobile phone fits in the pocket of the patient. The device is then connected to the individual by a small tube. Insulin is continuously supplied to the diabetic (just like a normal pancreas). As a result of the insulin pump, many diabetics are now able to eat an unrestricted diet.

Insulin pump
Click_and_Photo / Getty Images

ACTIVITY

Benedict's reagent is used to test for glucose. In the presence of glucose, the blue solution changes colour to green, amber, and brick-red, depending on the concentration of glucose.

METHOD

1. To a test tube, add 10cm^3 of a prepared urine sample.
2. If testing more than one sample, label each test tube.
3. Add 10 drops of Benedict's reagent to each test tube.
4. Carefully heat the test tubes in a hot water bath at about 80°C for 5 minutes.
5. Note any colour change. If glucose is present the solution will turn green, amber or brick-red, depending on concentration.

RESOURCES - YOU WILL NEED

- Prepared artificial urine samples.
- Test tubes
- Benedict's reagent
- Water bath
- Pipette
- timer