LEES BROOK COMMUNITY SCHOOL

Science autumn term – Combined Biology: Natural Selection and Genetic Modification (CB4)

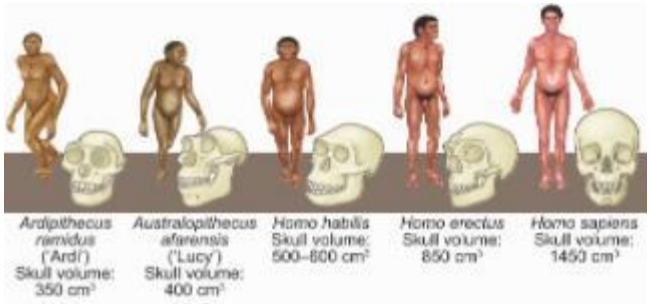
Section A: Vocabulary

Tier 3 Vocabulary

binomial system	System of naming organisms using two Latin words.
evolution	A change in one or more characteristics of a population over a long period of time.
species	A group of organisms that can reproduce with each other to produce offspring that will also be able to reproduce. Organism names have two Latin words – the first is its genus and the second is its species.
competition	There is competition between organisms that need the same things as each other (such as food). We say that they 'compete' for those things.
natural selection	A process in which certain organisms are more likely to survive and reproduce than other members of the same species, because they possess certain genetic variations.
resistant	Unaffected or less affected by something.
classification	Sorting things into groups.
domain	The three main groups that organisms are now sorted into: Archaea, Bacteria and Eukarya.
genus	A group of similar organisms. The genus name is the first word in the scientific name for a species (the second word is the 'species name'). Different closely related species belong to the same genus.

Section B: Evolution

Evidence

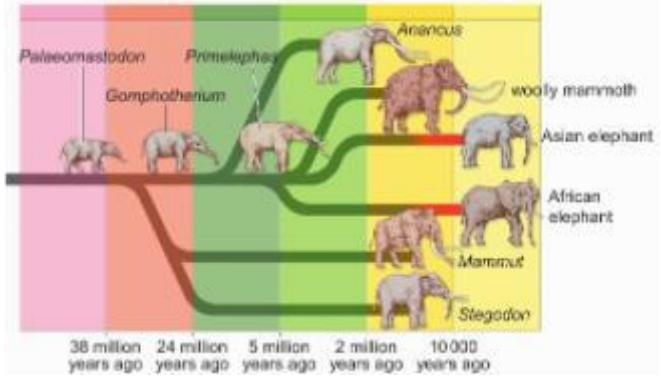


Stone tools

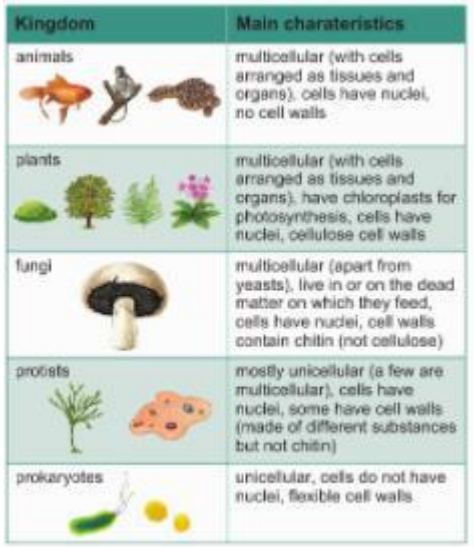
The earliest evidence of human-like animals using stone tools dates to about 3.3 million years ago. Scientists can work out the ages of different layers of rock. They then assume that a stone tool is about the same age as that layer of rock.

The oldest stone tools are very simple, but would have helped with skinning an animal or cutting up meat. Tools found in more recent rocks are more sophisticated.

Darwin's Theory



Section C: Classification & Genetic Modification

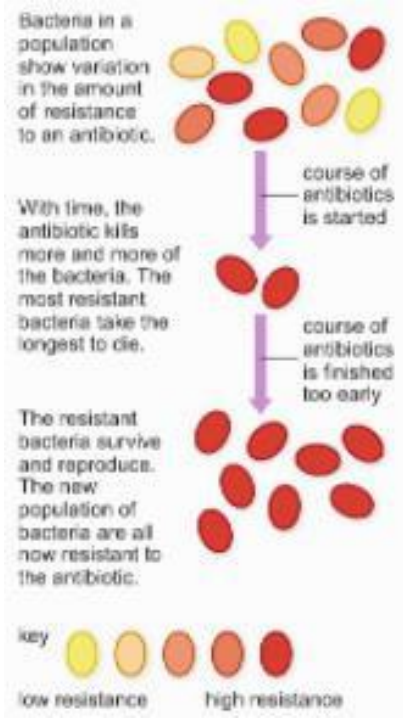


Kingdom	Main charateristics
animals	multicellular (with cells arranged as tissues and organs), cells have nuclei, no cell walls
plants	multicellular (with cells arranged as tissues and organs), have chloroplasts for photosynthesis, cells have nuclei, cellulose cell walls
fungi	multicellular (apart from yeasts), live in or on the dead matter on which they feed, cells have nuclei, cell walls contain chitin (not cellulose)
protists	mostly unicellular (a few are multicellular), cells have nuclei, some have cell walls (made of different substances but not chitin)
prokaryotes	unicellular, cells do not have nuclei, flexible cell walls

Breeds – Selective Breeding & Artificial Selection

kingdom	There are five kingdoms into which organisms are divided: plants, animals, fungi, protists and prokaryotes.
species	A group of organisms that can reproduce with each other to produce offspring that will also be able to reproduce. Organism names have two Latin words – the first is its genus and the second is its species.
artificial selection	When people choose organisms with certain characteristics and use only those ones for breeding.
genetically modified organism (GMO)	Organism that has been produced using genetic engineering.
selective breeding	When humans choose an organism that has a certain characteristic and then breed more of these organisms, making that chosen characteristic more and more obvious.
ligase	An enzyme that joins two DNA molecules together.
plasmid	A small loop of DNA found in the cytoplasm of bacteria.
recombinant DNA	DNA made by joining two sections of DNA together.
restriction enzyme	An enzyme that cuts DNA molecules into pieces.
sticky end	A short section of single-stranded DNA found at the end of a section of DNA that has been cut by a restriction enzyme.
vector	Anything that transfers material from one organism to another.

Faster Evolution



Developing the Theory – Natural Selection

A Santiago Island mockingbird

B Española Island mockingbird

Genetic Engineering

Genetic engineering involves changing the DNA of one organism (its **genome**), often by inserting **genes** from another. This creates **genetically modified organisms (GMOs)**. The process is much faster than artificial selection but much more expensive.

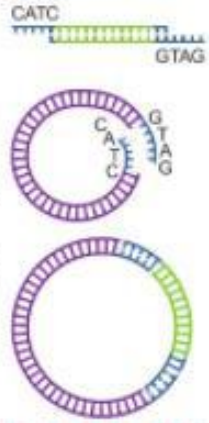
Higher

1 Restriction enzymes make staggered cuts in DNA molecules, producing sections with a few unpaired **bases** at each end – 'sticky ends'. A section of DNA containing the gene for making insulin is cut from a human chromosome in this way.

2 Restriction enzymes are also used to cut plasmids open. By using the same restriction enzyme as was used on the human chromosome DNA, the cut plasmids have the same sticky ends.

3 Sections of DNA containing the insulin gene are mixed with the cut plasmids. The complementary bases on the sticky ends pair up. An enzyme called ligase is used to join the ends together.

4 The plasmids are then inserted back into bacteria, which are then grown in huge tanks. The insulin they now make can easily be extracted.



GM crops have been produced to be resistant to some insects (so less insecticide is needed). Others are resistant to certain herbicides (weed killers) which then kill weeds but not the crop. These herbicides do not affect animals and are very effective against weeds, so less herbicide is used. However, the seeds for many GM plants are expensive. Some people think that GM crops will reproduce with wild plant varieties and pass on their resistance genes, and these genes may also have unknown consequences in wild plants. Others think that eating GM organisms may be bad for health (but there is not evidence to support this).

GM bacteria produce many useful substances, such as **insulin** (needed to treat **type 1 diabetes**). Insulin used to be extracted from dead pigs and cows, but insulin from GM bacteria is cheaper and suitable for vegans or people who do not eat pork or beef for religious reasons. However, it is slightly different to insulin from mammals and so not all diabetics can use it.