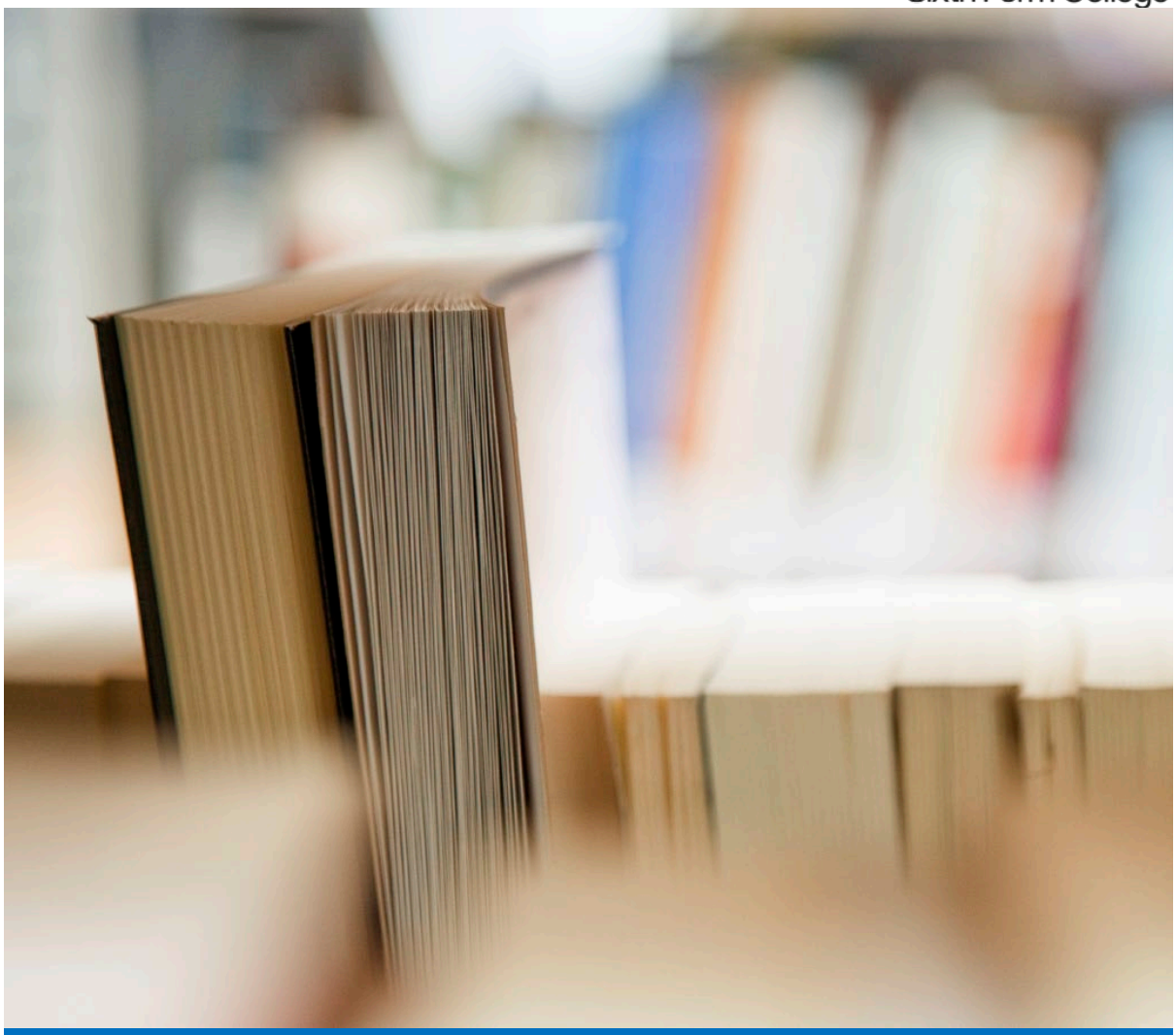
Scarborough Sixth Form College

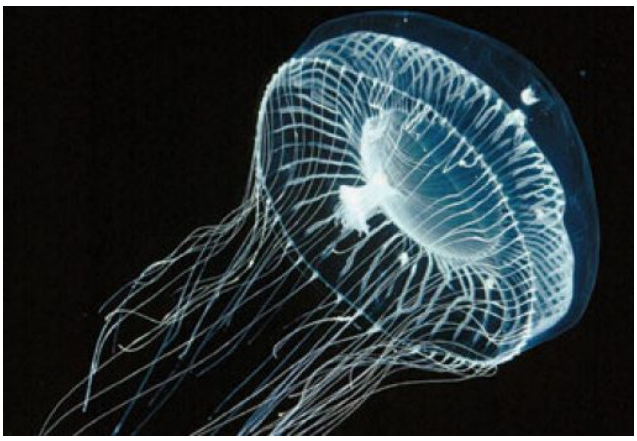


# Biology Summer Transition Pack

# Amazing Animals

All organisms are adapted to the environment they live in. Adaptations are what help them to survive. There are many animals with amazing adaptations, here are some of our favourites:

Tardigrades, also known as water bears, these animals are almost completely indestructible, like miniature superheroes.



The crystal jellyfish (*Aequorea Victoria*). Well, they are jellyfish and they can glow in the dark. 'Nuff said.

Pink fairy armadillo (*Chlamyphorus truncates*) have small eyes, silky yellowish fur, and a pink flexible shell. They are pretty much nocturnal animals that burrow in the sand in Argentina. How cute is that?

| **Activity 1 What, though, are your favourite animals? What are their special adaptations? Fill in the tables on the next 3 pages to show us!** | |
|---|---|
| Animal common name | |
| Scientific name | |
| Picture | |
| Habitat (where it lives) | |
| Niche (what it does) | |
| Special adaptations | |

| | |
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| Special adaptations | |

# Cells

The cell is a unifying concept in biology, you will come across it many times during your two years of A level study.

Prokaryotic and eukaryotic cells can be distinguished on the basis of their structure and ultrastructure. In complex multicellular organisms cells are organised into tissues, tissues into organs and organs into systems. During the cell cycle genetic information is copied and passed to daughter cells. Daughter cells formed during mitosis have identical copies of genes while cells formed during meiosis are not genetically identical

Read the information on these websites:

http://www.s-cool.co.uk/a-level/biology/cells-and-organelles

http://www.bbc.co.uk/education/guides/zvjycdm/revision

And take a look at these videos:

https://www.youtube.com/watch?v=gcTuQpuJyD8

https://www.youtube.com/watch?v=L0k-enzoeOM

https://www.youtube.com/watch?v=qCLmR9-YY7o

**Activity 1:** **Produce a one-page revision guide to share with your class in September summarising one of the following topics:**

**Cells and Cell Ultrastructure**
**Prokaryotes and Eukaryotes, or**
**Mitosis and Meiosis.**

**Whichever topic you choose, your revision guide should include: Key words and definitions, clearly labelled diagrams, short explanations of key ideas or processes.**

# DNA and the Genetic Code

In living organisms, nucleic acids (DNA and RNA) have important roles and functions related to their properties. The sequence of bases in the DNA molecule determines the structure of proteins, including enzymes. The double helix and its four bases store the information that is passed from generation to generation. The sequence of the base-pairs adenine, thymine, cytosine and guanine tell ribosomes in the cytoplasm how to construct amino acids into polypeptides and produce every characteristic we see. DNA can mutate leading to diseases including cancer and sometimes anomalies in the genetic code are passed from parents to babies in disease such as cystic fibrosis or can be developed in unborn foetuses such as Downs Syndrome.

Read the information on these websites:

http://www.bbc.co.uk/education/guides/z36mmp3/revision

http://www.s-cool.co.uk/a-level/biology/dna-and-genetic-code

And take a look at these videos:

http://ed.ted.com/lessons/the-twisting-tale-of-dna-judith-hauck

http://ed.ted.com/lessons/where-do-genes-come-from-carl-zimmer

**Activity 3** **Produce a wall display to put up in your classroom in September.**

**You might make a poster or do this using PowerPoint or similar.**

**Your display should use images, keywords and simple explanations to: define gene, chromosome, DNA and base pair; describe the structure and function of DNA and RNA; explain how DNA is copied in the body; outline some of the problems that occur with DNA replication and what the consequences of this might be.**

# Genetic Engineering

Genetic engineering also known as genetic modification or GM involves modifying the genome of an organism by introducing a gene from another organism to result in a desired characteristic.

Genetic engineering has the potential to produce higher yield crops and crops that are resistant to pests.

You might have learned about some genetically engineered food crops such as GoldenRice (https://en.wikipedia.org/wiki/Golden_rice) or the FlavrSavr tomato (https://en.wikipedia.org/wiki/Flavr_Savr).

Here are some examples of genetic engineered animals you might not have heard about:

**Giant Monkey Frog (*Phyllomedusa bicolor*)**

These frogs produce an antimicrobial peptide called dermaseptin. The gene for the peptide, *DRS B1* has been shown to be effective in preventing blight and other bacterial diseases in potato crops.

**Sheep (*Ovis aries*)**

Female sheep produce plenty of milk. Sheep have been used to make human factor IX to treat sufferers of haemophilia B.

**Zebrafish (*Rerio danio*)**

Genetically modified zebrafish expressing genes for fluorescent proteins are on sale in the USA marketed as Glo-Fish™.

**Goat (*Aegagrus hircus*)**

Female goats produce plenty of milk. So-called 'spider-goats' produce silk in their milk for medical and military applications.
Other GM goats produce a drug, human anti-thrombin III, used as an anticoagulant in surgery.

**Activity 4** **Cut out the speech bubbles and label them (or colour them in) as arguments <u>for</u> or <u>against</u> GM organisms.**
**Group the statements as <u>economic</u>, <u>environmental</u> or <u>ethical</u> arguments.**

| | | |
|---|---|---|
| We could make a crop that kills insects that try to eat it! | People might be allergic to the new genes | Even if the new crops are better, making them sterile forces farmers to keep buying them |
| We can make new crops that can grow in hot, dry conditions. This will help us feed the world's growing population | GM mice will help us do more medical research, e.g. into cancer | We can sell genetically modified animals – like glow-in-the dark fish – for a lot of money! |
| We can make sheep and goats make milk that contains useful proteins for medical treatments | Experimenting on animals – even if they have been genetically modified is wrong | We can't be sure that insect-resistant crops won't kill beneficial insects as well as harmful ones |
| If genes "escaped", we could end up with fast growing insects and 'superweeds' | We can't be sure that these genes won't get transferred to unwanted species | Third world farmers won't be able to afford expensive 'designer' crops |
| GM mice will help us do more medical research, e.g. into cancer | These "super" crops will out-compete normal crops, reducing biodiversity | We can make crops with higher yields |
| Creating herbicide-resistant crop species will encourage more use of herbicides | These "Frankenfoods" are just not safe to eat | Selective breeding has been altering animal and plant genes for thousands of years, this is just more efficient and predictable |

# Health and Disease

OK, its pretty topical we know, and a little bit scary, but there is good news: some of the most amazing advances in science have been in biology and in particular in the field of disease prevention.

For most of humankind's existence viruses have caused the deaths of millions of people. But your chances of not being one of them has never been better.

One of the most feared diseases in history is smallpox. The earliest evidence of smallpox is on the mummy of Pharaoh Rameses V, who died in 1145 BCE, but DNA analysis suggests the disease emerged as a new disease to humans about 120,000 years ago.

Smallpox was officially declared eradicated worldwide in 1980.

Read about the eradication of smallpox here: https://tinyurl.com/tdeg2yj, here: https://tinyurl.com/yyk7n6ww and here: https://tinyurl.com/s7rqtre
Or watch here: https://www.youtube.com/watch?v=yqUFy-t4MlQ and here https://www.youtube.com/watch?v=sJRJeOxX6no

| **Activity 5** | **In the space below make a well-illustrated sketch showing the structure of the smallpox virus.** |
|---|---|

# Trivia

Time to test your biology trivia (or your ability to google)

| **Activity 6 Answer the following questions:** | |
|---|---|
| World's tallest plant species | |
| Most endangered species | |
| Animal with the biggest brain | |
| Longest bone in the human body | |
| Smallest bone in the human body | |
| Animal with the widest nerves | |
| Longest living animal | |
| Largest bacterium | |
| Largest single-celled organism | |
| Fastest fish | |
| Scientific name of Aleksandr Orlov | |
| Animal with largest brain | |
| Animal with the longest tongue | |
| Number of pencils you can make from the carbon in the human body | |
| Correct term for plants, like algae, that have no roots, stems or leaves | |
| Number of cells contained in the human body | |
| Percentage of these that are bacterial cells | |
| Most abundant enzyme in the world | |
| Largest (longest) human gene | |
| Species with the fewest chromosomes | |

# Practical Biology

Biology is a very practical subject. The skills you will learn will build on the skills from GCSE and will include: microscopy, dissection, setting up equipment, taking measurements and readings, making drawing.

| **Activity 7** | **Here are some terms from practical work you will have done at GCSE. Match the term with the correct definition.** |
|---|---|
| Accurate | A statement suggesting what may happen in the future |
| Control variable | Measurements where repeated measurements show very little spread |
| Data | An experiment that gives the same results when a different person carries it out, or a different set of equipment or technique is used |
| Dependent variable | Information, in any form, that has been collected |
| Precise | A measurement that is close to the true value |
| Prediction | An experiment that gives the same results when the same experimenter uses the same method and equipment |
| Range | Physical, chemical or biological quantities or characteristics |
| Repeatable | A variable that is kept constant during an experiment |
| Reproducible | A variable that is measured as the outcome of an experiment |
| Resolution | The spread of data, showing the maximum and minimum values of the data |
| Uncertainty | This is the smallest change in the quantity being measured (input) of a measuring instrument that gives a perceptible change in the reading |
| Variable | The interval within the true value can be expected to lie |

# SI Units

Every measurement must have a size (e.g. 2.7) and a unit (e.g. metres or ºC).

Sometimes, there are different units available for the same type of measurement. For example, ounces, pounds, kilograms and tonnes are all used as units for mass.

To reduce confusion, and to help with conversion between different units, there is a standard system of units called the SI units which are used for most scientific purposes.

These units have all been defined by experiment so that the size of, say, a metre in the UK is the same as a metre in China.

The seven SI base units are:

| **Physical quantity** | **Usual quantity symbol** | **Unit** | **Abbreviation** |
|---|---|---|---|
| Mass | m | kilogram | kg |
| Length | l | metre | m |
| Time | t | second | s |
| Electric Current | I | Ampere | A |
| Temperature | T | Kelvin | K |
| Amount of substance | N | mole | mol |

All other units can be derived from the SI base units. For example, area is measured in square metres (written as $m^2$) and speed is measured in metres per second (written as $ms^{-1}$).

It is not always appropriate to use a full unit. For example, measuring the width of a hair or the distance from Manchester to London in metres would cause the numbers to be difficult to work with.

Prefixes are used to multiply each of the units. You will be familiar with centi (meaning 1/100), kilo (1000) and milli (1/1000) from centimetres, kilometres and millimetres.

There is a wide range of prefixes. The majority of quantities in scientific contexts will be quoted using the prefixes that are multiples of 1000. For example, a distance of 33,000 m would be quoted as 33 km.

The most common prefixes you will encounter are:

| Prefix | Symbol | Multiplication factor | | |
|---|---|---|---|---|
| Tera | T | $10^{12}$ | 1 000 000 000 000 | |
| Giga | G | $10^{9}$ | 1 000 000 000 | |
| Mega | M | $10^{6}$ | 1 000 000 | |
| kilo | k | $10^{3}$ | 1000 | |
| deci | d | $10^{-1}$ | 0.1 | 1/10 |
| centi | c | $10^{-2}$ | 0.01 | 1/100 |
| milli | m | $10^{-3}$ | 0.001 | 1/1000 |
| micro | μ | $10^{-6}$ | 0.000 001 | 1/1 000 000 |
| nano | n | $10^{-9}$ | 0.000 000 001 | 1/1 000 000 000 |
| pico | p | $10^{-12}$ | 0.000 000 000 001 | 1/1 000 000 000 000 |
| femto | f | $10^{-15}$ | 0.000 000 000 000 001 | 1/1 000 000 000 000 000 |

**Activity 8 Which SI unit and prefix would you use for the following quantities**

1. The time between heart beats

2. The length of a leaf

3. The distance that a migratory bird travelled each year

4. The width of a cheek cell

5. The mass of a rabbit

6. The mass of iron in the body

7. The volume of the trunk of a large tree

Sometimes, there are units that are used that are not combinations of SI units and prefixes. These are often multiples of units that are helpful to use. For example, one litre is 0.001 $m^3$, or one day is 86,400 seconds.

| **Activity 9** | **Choose the most appropriate unit, and estimate the size of each of the following** |
|---|---|

1. The mass of an elephant

2. The mass of an earthworm

3. The volume of water in a teardrop

4. The volume of water in a pond

5. The time taken for a sunflower to grow

6. The temperature difference between the blood in the heart and in the ear on a cold day

7. The width of a hair

8. The length that your fingernails grow each day

9. The total length of each of the hairs on your head