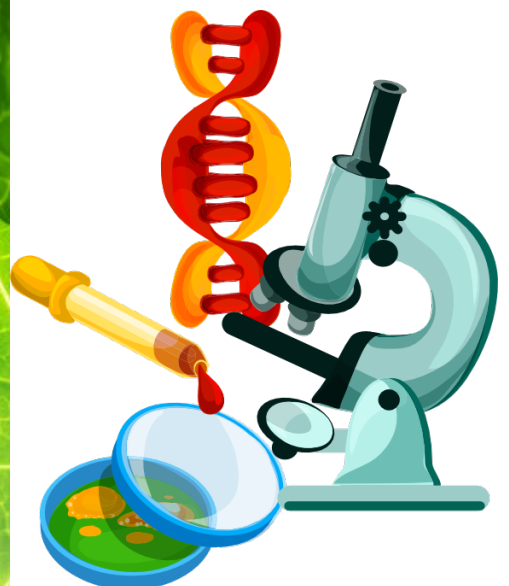


The Friary Sixth Form



Biology Summer Project Pack 2023



Summer Tasks



Complete the examination questions on the following pages which will help you consolidate the work covered in Year 12.

There are keywords that **must** be included in the responses in order for marks to be awarded. These are given to you in the space for your responses.

Q1.

- (a) Messenger RNA (mRNA) is used during translation to form polypeptides.
Describe how mRNA is produced in the nucleus of a cell.

Helicase
Template
RNA polymerase
Splicing

(6)

- (b) Describe the structure of proteins.

Polymer
Amino Acid
Peptide bond
Primary ->

(5)

(c) Describe how proteins are digested in the human gut.

Hydrolysis

Peptidases

(4)

(Total 15 marks)

Q2.

(a) In humans, the enzyme maltase breaks down maltose to glucose. This takes place at normal body temperature.

Explain why maltase:

- only breaks down maltose
- allows this reaction to take place at normal body temperature.

Tertiary structure

Complementary

Catalyst

E-S complex

(5)

- (b) Scientists have investigated the effects of competitive and non-competitive inhibitors of the enzyme maltase.

Describe competitive and non-competitive inhibition of an enzyme.

Prevent E-S
Shape
Allosteric site
[substrate]

(5)
(Total 10 marks)

Q3.

- (a) Describe how the structures of starch and cellulose molecules are related to their functions.

Shape
Osmosis
Size
Isomers

(5)

(b) Describe the processes involved in the transport of sugars in plant stems.

Source	_____
Active transport	_____
Phloem	_____
Water potential	_____
Osmosis	_____

(5)
(Total 10 marks)

Q4.

Some substances can cross the cell-surface membrane of a cell by simple diffusion through the phospholipid bilayer. Describe other ways by which substances cross this membrane.

Osmosis	_____
Facilitated diffusion	_____
Active transport	_____
Phagocytosis	_____

(Total 5 marks)

Q5.

- (a) Describe the processes involved in the absorption and transport of digested lipid molecules from the ileum into lymph vessels.

Micelles	_____
Bile salts	_____
Fatty acids	_____
Diffusion	_____

(5)

- (b) Describe how the structure of a protein depends on the amino acids it contains.

Primary	_____
Sequence	_____
Secondary	_____
Bonding	_____
Tertiary	_____

(5)

(Total 10 marks)

Q6.

(a) Explain **five** properties that make water important for organisms.

Metabolite	_____
Solvent	_____
Heat capacity	_____
Latent heat of vaporisation	_____

(5)

(b) Describe the biochemical tests you would use to confirm the presence of lipid, non-reducing sugar and amylase in a sample.

Ethanol	_____
Benedict's	_____
Acid	_____
Heat	_____

(5)

- (c) Describe the chemical reactions involved in the conversion of polymers to monomers and monomers to polymers.

Give **two** named examples of polymers and their associated monomers to illustrate your answer.

Condensation	_____
Hydrolysis	_____
Bonds	_____

(5)
(Total 15 marks)

Q7.

- (a) Describe and explain how cell fractionation and ultracentrifugation can be used to isolate mitochondria from a suspension of animal cells.

Homogenisation	_____
Filter	_____
Isotonic	_____
Cold	_____
Centrifuge	_____

(5)

(b) Describe the principles and the limitations of using a transmission electron microscope to investigate cell structure.

- Electrons
- Wavelength
- Resolution
- vacuum

(5)
(Total 10 marks)

Q8.

(a) Describe how mRNA is formed by transcription in eukaryotes.

- Hydrogen bonds
- Template
- Nucleotides
- Polymerase
- Phosphodiester
- Splicing

(5)

(b) Describe how a polypeptide is formed by translation of mRNA.

Ribosome	_____
Codon	_____
Anticodon	_____
tRNA	_____
amino acid	_____

(6)

(c) Define 'gene mutation' and explain how a gene mutation can have:

- no effect on an individual
- a positive effect on an individual.

Degenerate	_____
Tertiary structure	_____
Increased survival	_____

(4)

(Total 15 marks)

Q9.

- (a) Contrast how an optical microscope and a transmission electron microscope work **and** contrast the limitations of their use when studying cells.

Electrons/ light	_____
Resolution	_____
Dead / alive	_____
Colour	_____

(6)

- (b) The diagram shows an image from an optical microscope of meiosis occurring in a flower bud of a flowering plant. **W** and **Z** are undergoing meiosis.



Explain the appearance of **W** and **Z**.

Meiosis
Haploid / diploid

(4)

(c) An environmental scientist investigated a possible relationship between air pollution and the size of seeds produced by one species of tree.

He was provided with a very large number of seeds collected from a population of trees in the centre of a city and also a very large number of seeds collected from a population of trees in the countryside.

Describe how he should collect and process data from these seeds to investigate whether there is a difference in seed size between these two populations of trees.

Random
Large sample
Mass
Statistics

(5)

(Total 15 marks)

Q10.

(a) Describe the appearance and behaviour of chromosomes during mitosis.

Prophase	_____
Metaphase	_____
Anaphase	_____
Telophase	_____

(5)

(b) Describe and explain the processes that occur during meiosis that increase genetic variation.

Independent segregation	_____
Crossing over	_____

(5)

(Total 10 marks)

Q11.

(a) Describe and explain how the structure of DNA results in accurate replication.

Semi-conservative

Base pairing

Template

(4)

(b) Describe the behaviour of chromosomes during mitosis and explain how this results in the production of two genetically identical cells.

Identical

Chromatids

Middle

Spindle fibres

Centromere

(7)

- (c) A cancerous tumour is formed by uncontrolled mitotic division. This results in a mass of cells with an inadequate blood supply. Drugs are being developed which only kill cells in a low oxygen environment. Suggest how these drugs could be useful in the treatment of cancer.

(2)
(Total 13 marks)

Q12.

Different cells in the body have different functions.

- (a) Some white blood cells are phagocytic. Describe how these phagocytic white blood cells destroy bacteria.

Antigens	_____
Engulf	_____
Vesicle	_____
Lysosome	_____
hydrolysis	_____

(4)

- (b) The epithelial cells that line the small intestine are adapted for the absorption of glucose. Explain how.

Microvilli	_____
Mitochondria	_____
Carrier proteins	_____
Channel proteins	_____

(6)
(Total 10 marks)

Q13.

Bacterial meningitis is a potentially fatal disease affecting the membranes around the brain. *Neisseria meningitidis* (Nm) is a leading cause of bacterial meningitis.

- (a) In the UK, children are vaccinated against this disease. Describe how vaccination can lead to protection against bacterial meningitis.

Antigen binds T cell	
Cytokine	
B cells	
Antibodies	
Memory cell	

(6)

- (b) Penicillin has been the antibiotic of choice for the treatment of bacterial meningitis. Since the year 2000, strains of *Neisseria meningitidis* that are resistant to penicillin, sulfonamides and rifampin have been discovered in the UK.

Describe how a population of *Neisseria meningitidis* (Nm) can become resistant to these antibiotics.

Mutation	
Allele	

(4)

(c) Contrast the structure of a bacterial cell and the structure of a human cell.

Size	_____
Genetic material	_____
Ribosomes	_____
mitochondria	_____

(5)
(Total 15 marks)

Q14.

(a) When a vaccine is given to a person, it leads to the production of antibodies against a disease-causing organism. Describe how.

T cell	_____
Cytokine	_____
B cell	_____
antibody	_____

(5)

(b) Describe the difference between active and passive immunity.

Memory cells	_____
Plasma cells	_____
Time interval	_____
longevity	_____

(5)
(Total 10 marks)

Q15.

(a) Glucose is absorbed from the lumen of the small intestine into epithelial cells. Explain how the transport of sodium ions is involved in the absorption of glucose by epithelial cells.

Active transport	_____
Na+	_____
Lower [Na+]	_____
Facilitated	_____
diffusion	_____
Glucose	_____

(5)

- (b) Oxygen and chloride ions can diffuse across cell-surface membranes. The diffusion of chloride ions involves a membrane protein. The diffusion of oxygen does not involve a membrane protein.

Explain why the diffusion of chloride ions involves a membrane protein and the diffusion of oxygen does not.

Solubility	_____
Polarity	_____
Size	_____

(5)
(Total 10 marks)

Q16.

- (a) Many different substances enter and leave a cell by crossing its cell surface membrane. Describe how substances can cross a cell surface membrane.

Diffusion	_____
Lipid-soluble	_____
Osmosis	_____
Active transport	_____

(5)

- (b) Describe and explain how the lungs are adapted to allow rapid exchange of oxygen between air in the alveoli and blood in the capillaries around them.

Alveoli	_____
Capillaries	_____
Diffusion	_____
Ventilation	_____

(5)
(Total 10 marks)

Q17.

- (a) Describe the gross structure of the human gas exchange system and how we breathe in and out.

Trachea	_____
Bronchi	_____
Bronchioles	_____
Alveoli	_____
Intercostal muscles	_____
Diaphragm	_____
Volume / pressure	_____

(6)

- (b) Mucus produced by epithelial cells in the human gas exchange system contains triglycerides and phospholipids.

Compare and contrast the structure **and** properties of triglycerides and phospholipids.

Bond type?	_____
Saturation	_____
Solubility	_____
Fatty acids	_____

(5)

- (c) Mucus also contains glycoproteins. One of these glycoproteins is a polypeptide with the sugar, lactose, attached.

Describe how lactose is formed and where in the cell it would be attached to a polypeptide to form a glycoprotein.

Condensation	_____
Bond type?	_____
Golgi	_____

(4)

(Total 15 marks)

Q18.

- (a) Describe and explain **four** ways in which the structure of a capillary adapts it for the exchange of substances between blood and the surrounding tissue.

Lumen	_____
Thickness	_____
Permeability	_____
Diffusion	_____

(4)

- (b) Explain how tissue fluid is formed and how it may be returned to the circulatory system.

Arterial end	_____
Pressure	_____
Water potential	_____
Osmosis	_____
Lymph system	_____

(6)

(Total 10 marks)

Q19.

(a) Explain two ways in which the structure of fish gills is adapted for efficient gas exchange:

1. _____

2. _____

(b) Explain how the counter-current mechanism in fish gills ensures the maximum amount of oxygen passes into the blood flowing through the gills.

Lamellae	_____
Filaments	_____
Diffusion	_____
opposite	_____

Q20.

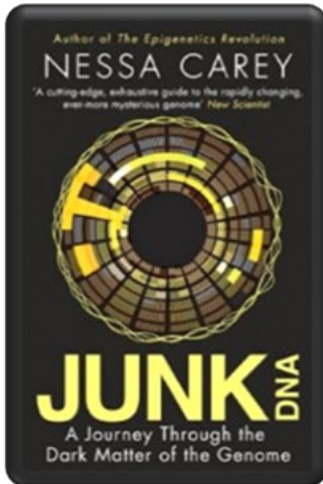
The cardiac cycle is controlled by the sinoatrial node (SAN) and the atrioventricular node (AVN).

Describe how.

SAN	_____
AVN	_____
Bundle of His	_____
Purkyne fibres	_____

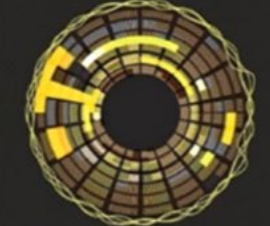
(Total 5 marks)

Additional Reading/ Supporting Resources



Author of *The Epigenetics Revolution*
NESSA CAREY

'A cutting-edge, exhaustive guide to the rapidly changing, ever more mysterious genome' *New Scientist*



JUNK DNA

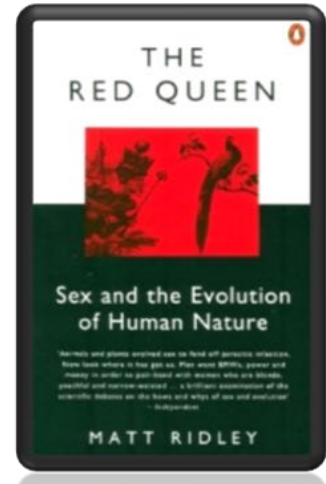
A Journey Through the Dark Matter of the Genome

Junk DNA

Our DNA is so much more complex than you probably realize, this book will really deepen your understanding of all the work you will do on Genetics. Available at amazon.co.uk

The Red Queen

Its all about sex. Or sexual selection at least. This book will really help your understanding of evolution and particularly the fascinating role of sex in evolution. Available at amazon.co.uk



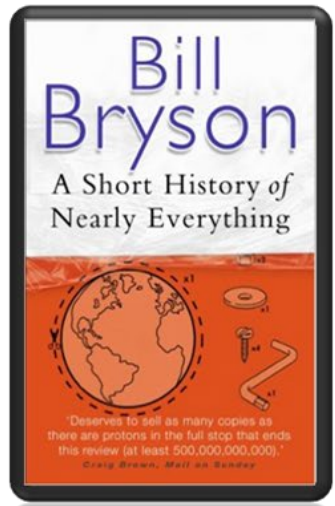
THE RED QUEEN



Sex and the Evolution of Human Nature

'Humans and plants evolved sex to fend off genetic infection. How does it work? It's not simple. But it's not simple either. It's a brilliant combination of the scientific debate on the forces and ways of sex and evolution'

MATT RIDLEY



Bill Bryson

A Short History of Nearly Everything

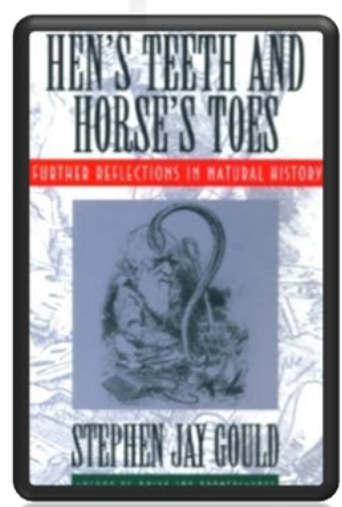


'Deserves to sell as many copies as there are protons in the full stop that ends this review (at least 500,000,000,000).'

Bill Bryson

A Short History of Nearly Everything

A whistle-stop tour through many aspects of history from the Big Bang to now. This is a really accessible read that will re-familiarise you with common concepts and introduce you to some of the more colourful characters from the history of science! Available at amazon.co.uk



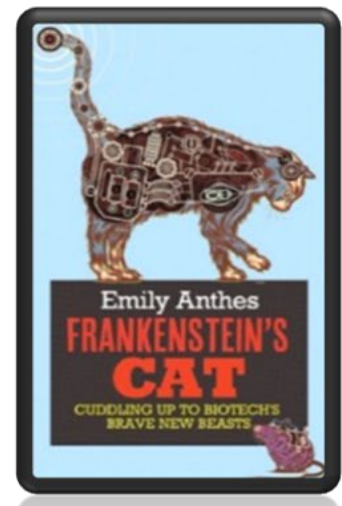
HEN'S TEETH AND HORSE'S TOES

FURTHER REFLECTIONS IN NATURAL HISTORY



STEPHEN JAY GOULD

Studying Geography as well? **Hen's teeth and horses toes** Stephen Jay Gould is a great Evolution writer and this book discusses lots of fascinating stories about Geology and evolution. Available at amazon.co.uk



Emily Anthes
FRANKENSTEIN'S CAT

CUDDLING UP TO BIOTECH'S BRAVE NEW BEASTS

An easy read..

Frankenstein's cat

Discover how glow in the dark fish are made and more great Biotechnology breakthroughs. Available at amazon.co.uk

