



Biology
**The Search for
Better Health**

Revised Edition

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Science Press

Contents

Use the table of contents to record your progress through this book. As you complete each topic, write the date completed, then tick one of the three remaining columns to guide your revision for later. The column headers use the following codes:

?? = Don't understand this very well at all.

RR = Need to revise this.

OK = Know this.

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Introduction

Each book in the 'Surfing' series contains a summary, with occasional more detailed sections, of all the mandatory sections of the syllabus, along with questions and answers.

It is envisaged this book will be useful in class for both initial understanding and revision, while the more traditional textbook can remain at home for more detailed analysis.

All types of questions – multiple choice, short response, structured response and free response – are provided. Questions are written in exam style and use the verbs specified by the Board of Studies so that you will become familiar with the concepts of the topic and answering questions in the required way.

Answers to all questions are included.

A topic test at the end of the book contains an extensive set of summary questions, including multiple choice and free response questions. These cover every aspect of the topic, and are useful for revision and exam practice. Marking guidelines are supplied where appropriate.

Verbs To Watch

When you are answering questions in this book, your textbook or any examinations, make sure you answer what the question is asking. To do this you will have to know what each of the terms below means – they dictate what sort of an answer is required. It is essential that you learn their meanings as required by the Board of Studies. Your exam answers will be marked according to what these terms indicate your answer should be saying.

account for	State reasons for, report on, give an account of, narrate a series of events or transactions.
analyse	Identify components and the relationships among them, draw out and relate implications.
apply	Use, utilise, employ in a particular situation.
appreciate	Make a judgement about the value of something.
assess	Make a judgement of value, quality, outcomes, results or size.

calculate	Determine from given facts, figures or information.
clarify	Make clear or plain.
classify	Arrange into classes, groups or categories.
compare	Show how things are similar or different.
construct	Make, build, put together items or arguments.
contrast	Show how things are different or opposite.
critically (analyse/evaluate)	Add a degree of level of accuracy, depth, knowledge and understanding, logic, questioning, reflection and quality to an analysis or evaluation.
deduce	Draw conclusions.
define	State the meaning of and identify essential qualities.
demonstrate	Show by example.
describe	Provide characteristics and features.
discuss	Identify issues and provide points for and against.
distinguish	Recognise or note/indicate as being distinct or different from, note difference between things.
evaluate	Make a judgement based on criteria.
examine	Inquire into.
explain	Relate cause and effect, make the relationship between things evident, provide why and/or how.
extract	Choose relevant and/or appropriate details.
extrapolate	Infer from what is known.
identify	Recognise and name.
interpret	Draw meaning from.
investigate	Plan, inquire into and draw conclusions about.
justify	Support an argument or conclusion.
outline	Sketch in general terms; indicate the main features.
predict	Suggest what may happen based on available information.
propose	Put forward (a point of view, idea, argument, suggestion etc) for consideration or action.
recall	Present remembered ideas, facts or experiences.
recommend	Provide reasons in favour.
recount	Retell a series of events.
summarise	Express concisely the relevant details.
synthesise	Put together various elements to make a whole.

1 Assumed Knowledge

1. Define mitosis.
2. Explain why mitosis is important.
3. Figure 1.1 shows the cell cycle. What is the cell cycle?

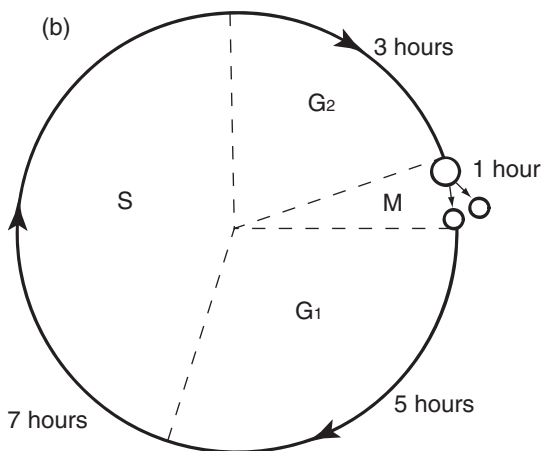
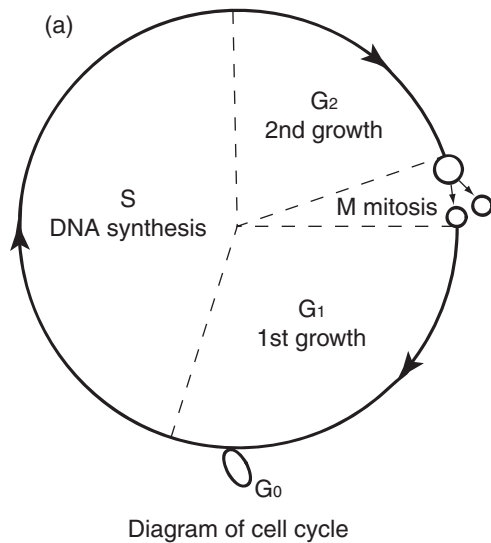


Figure 1.1 Cell cycle

4. Define cancer and explain how it can occur.
5. What is cell differentiation?
6. Explain why multicellular organisms require specialised tissue and give some examples of specialised cells.
7. Define parasite.
8. In an experiment, what is a control?
9. What is fermentation?
10. Distinguish between procaryote and eucaryote.
11. Describe the structure and function of a codon.
12. Outline the function of proteins and the role of amino acids.

13. Describe mitosis. Use diagrams to aid your description.
14. Briefly describe the lymph system.
15. Briefly describe bacteria.
16. Briefly describe viruses.

Examples of RNA viruses	Examples of DNA viruses
<i>Lyssavirus</i> (rabies virus)	<i>Orthopoxvirus</i> (vaccinia and smallpox viruses)
<i>Influenzavirus</i> (influenza viruses A and B)	<i>Simplexvirus</i> (herpes simplex virus 1 and 2)
<i>Arenavirus</i>	<i>Mastadenovirus</i> (adenovirus)
<i>Reovirus</i> (Colorado tick fever virus)	<i>Rubivirus</i> (rubella virus)
<i>Lentivirus</i> (HIV)	<i>Hepadnavirus</i> (hepatitis B virus)
	T-even bacteriophage

Figure 1.2 Viruses

17. Describe the structure of proteins.

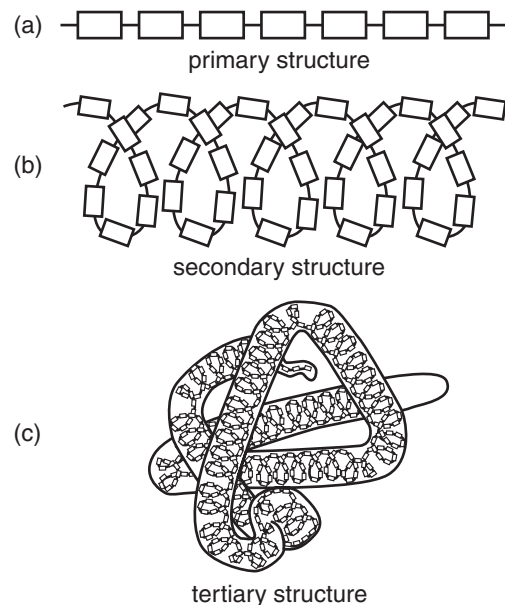


Figure 1.3 Three levels of protein structure

2 Health, Disease and Cleanliness

Health is often defined as a state of physical, mental and social wellbeing. There are difficulties in applying this definition, however, as different people have different standards about what is a 'healthy' level of physical activity, application of mental ability or socialising with friends, co-workers, or neighbours. Health involves the effective functioning of the body and is not just the absence of disease or infirmity.

Disease is any condition that impairs or interferes with the normal functioning of the body.

Infectious disease is caused by pathogens which invade the body. Infectious diseases are contagious and can often be passed from one person to another.

Non-infectious disease is not caused by a pathogen. It can, for example, be caused by heredity, nutrition, physiological malfunction, environment and chemicals. Non-infectious diseases cannot be easily passed from one person to another (except by heredity).

Pathogens are disease-causing parasites that live on or in a host. They can be microscopic or macroscopic and are found in air, water, soil and any contaminated articles. Transfer from one person to another can be by direct or indirect contact.

History of cleanliness: Many ancient civilisations recognised the importance of cleanliness in maintaining health. The Romans built public baths, sewers and aqueducts. Over 3000 years ago, the Chinese and Hebrews supported cleanliness in food, water and personal hygiene.

Maintaining Health

1. Function of genes

Genes consist of DNA with the bases forming **codons** that relate to the production of specific amino acids. Since amino acids are the functional unit of proteins such as enzymes, the gene message often translates into a particular enzyme that controls a specific reaction.

2. Mitosis

Mitosis is part of the cell cycle and is important in the maintenance and repair of body tissues. Two types of genes control the cell cycle – the **proto-oncogenes** stimulate cell growth and cell division while **tumour suppressor genes** slow down or stop cell growth and cell division. If either of these types of genes are damaged or mutated, cancers can form due to the uncontrolled cell replication.

3. Cell differentiation and specialisation

Multicellular organisms need specialised cells to carry out particular functions to allow the whole body to survive. Specialised cells include red blood cells, white blood cells, neurons, muscle cells, bone and epithelium.

Controlling Infectious Disease

As infectious diseases are caused by pathogens, control measures need to be able to maintain cleanliness to prevent pathogens from entering and then multiplying in food, water or on/in your body and to prevent the transmission of the pathogen from one person to another. Examples of control measures include washing hands before eating food, cooking food properly, effective sewage treatment, providing uncontaminated water, not coughing over food, and covering hair and open sores when preparing food.

For You To Do

1. Define health and disease.
2. Discuss one difficulty in defining health.
3. Outline how each of the following assists in the maintenance of health.
 - (a) gene expression
 - (b) mitosis
 - (c) cell differentiation
4. Use an example to show that the need for cleanliness in food, water and personal hygiene was recognised by ancient cultures.
5.
 - (a) Distinguish between infectious and non-infectious disease.
 - (b) Distinguish between direct and indirect contact.
6. Explain why cleanliness in food, water and personal hygiene practices assist in the control of disease. Use examples.
7. Define pathogen.
8. Describe where pathogens can be found and how they can transfer from one person to another.
9. Using the example of a mutation in the allele in the b-haemoglobin gene, show how health is determined by gene expression.
10. Explain how a mutation or damage to genes can lead to the growth of a cancer.
11. Use an example to show why multicellular organisms need differentiation.
12. Leukaemias are a group of conditions involving the increase in numbers of leucocytes in bone marrow, bloodstream and other organs. Discuss how leukaemia is related to health and mitosis.

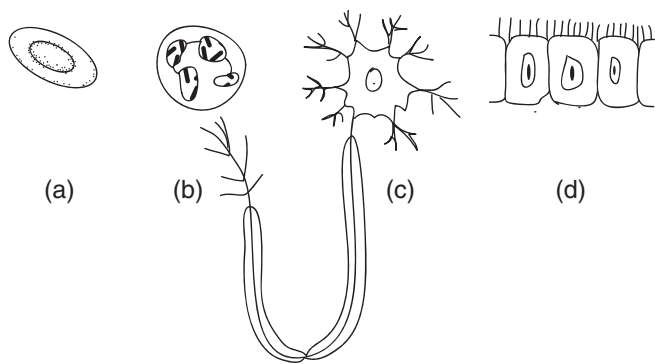


Figure 2.1 Different types of human cells

13. Figure 2.1 shows four different types of cells. Identify each type of cell and describe a disease which involves that particular cell type.
14. Classify each of these diseases as either infectious or non-infectious:
 - (a) cholera
 - (b) chicken pox
 - (c) Down syndrome
 - (d) scurvy
 - (e) scoliosis
 - (f) rheumatic fever
 - (g) measles
 - (h) meningitis
 - (i) glaucoma
 - (j) anorexia nervosa
15. The bacteria which causes cholera has a direct life cycle and infects people when ingested with contaminated food or water. Suggest how sewage treatment helps prevent a cholera epidemic.
16. If there is a change in the sequence of bases, gene expression is affected and the health of the organism can be impaired. For example, if the allele in the β -haemoglobin gene has a mutation with thymine instead of guanine at one particular location, the person suffers from the disease thalassemia major which results in abnormalities such as severe anaemia and growth retardation. Use this example to evaluate how major advances in scientific understanding and/or technology have influenced scientific thinking.
17.
 - (a) Identify the cause of some cancers.
 - (b) Each body cell with a nucleus contains the full number of chromosomes. Outline the degree of activity of each gene in any one cell.
18. Using the understanding of the causes of disease, assess the impact of implications of biology on society and the environment since the beginnings of recorded history.
19. Which is the best definition of health?
 - (A) physical, mental and social wellbeing
 - (B) correct gene expression to maintain and repair body tissues
 - (C) not suffering from a disease
 - (D) absence of infirmity with mental alertness
20. Which of the following describes how gene expression affects the health of the organism?
 - (A) directly monitors homeostasis
 - (B) prevents entry of pathogens into the body
 - (C) controls the manufacture of antibiotics
 - (D) controls protein synthesis
21. Uncontrollable mitosis leads to:
 - (A) a large healthy body
 - (B) repair of body tissues
 - (C) cancer
 - (D) formation of differentiated tissues
22. Which of the following describes an infectious disease?
 - (A) regulated by a strict diet
 - (B) transmitted from one host to another
 - (C) the result of a genetic abnormality
 - (D) caused by a micro-organism
23. What is a common sign of disease in mammals?
 - (A) gain in body weight
 - (B) decrease in body hair
 - (C) increase in antagonistic behaviour
 - (D) increase in body temperature
24. Which of the following relates to a non-infectious disease?
 - (A) cured using antibiotics
 - (B) transmitted from one host to another
 - (C) the result of a genetic abnormality
 - (D) caused by a micro-organism
25. Scientists are now looking at historical literature to give a modern diagnosis for diseases that were observed in ancient times but not understood. For example, a hieroglyph from Memphis in ancient Egypt dated 3700 BC shows a temple priest with the typical clinical signs of paralytic poliomyelitis. Which successful procedure was used by the Chinese and Hebrews over 3000 years ago to reduce the incidence of disease?
 - (A) addition of the mineral chlorite to their water wells
 - (B) practice of cleanliness in food, water and personal hygiene
 - (C) wearing of leather suits sewn together once on the body
 - (D) vaccination against diseases by using animal extracts