

GCSE (9–1)
Transition Guide

GATEWAY SCIENCE

BIOLOGY A

J247
For first teaching in 2016

KS3–KS4 focus
Organism Level
Systems

Version 1



GCSE (9–1)

GATEWAY SCIENCE BIOLOGY A

Key Stage 3 to 4 Transition guides focus on how a particular topic is covered at the different key stages and provide information on:

- Differences in the demand and approach at the different levels;
- Useful ways to think about the content at Key Stage 3 which will help prepare students for progression to Key Stage 4;
- Common student misconceptions in this topic.

Transition guides also contain links to a range of teaching activities that can be used to deliver the content at Key Stage 3 and 4 and are designed to be of use to teachers of both key stages. Central to the transition guide is a Checkpoint task which is specifically designed to help teachers determine whether students have developed deep conceptual understanding of the topic at Key Stage 3 and assess their 'readiness for progression' to Key Stage 4 content on this topic. This checkpoint task can be used as a summative assessment at the end of Key Stage 3 teaching of the topic or by Key Stage 4 teachers to establish their students' conceptual starting point.

Key Stage 3 to 4 Transition Guides are written by experts with experience of teaching at both key stages.

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Key Stage 3 Content

- Reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta.



Key Stage 4 Content

GCSE Content

- B3.1a - describe the structure of the nervous system
- B3.1b - explain how the components of the nervous system can produce a coordinated response
- B3.1c - explain how the structure of a reflex arc is related to its function
- B3.1d - explain how the main structures of the eye are related to their functions
- B3.1e - describe common defects of the eye and explain how some of these problems may be overcome
- B3.1f - describe the structure and function of the brain
- B3.1g - explain some of the difficulties of investigating brain function
- B3.1h - explain some of the limitations in treating damage and disease in the brain and other parts of the nervous system
- B3.2a - describe the principles of hormonal coordination and control by the human endocrine system
- B3.2b - explain the roles of thyroxine and adrenaline in the body. With thyroxine as an example of a negative feedback system
- B3.2c - describe the role of hormones in human reproduction including the control of the menstrual cycle
- B3.2d - explain the interactions of FSH, LH, oestrogen and progesterone in the control of the menstrual cycle
- B3.2e - explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception
- B3.2f - explain the use of hormones in modern reproductive technologies to treat infertility
- B3.2g - explain how plant hormones are important in the control and coordination of plant growth and development, with reference to the role of auxins in phototropisms and gravitropisms

Key Stage 4 Content

- B3.2h - describe some of the variety of effects of plant hormones, relating to auxins, gibberellins and ethane
- B3.2i - describe some of the different ways in which people use plant hormones to control plant growth
- B3.3a - explain the importance of maintaining a constant internal environment in response to internal and external change
- B3.3b - describe the function of the skin in the control of body temperature
- B3.3c - explain how insulin controls blood sugar levels in the body
- B3.3d - explain how glucagon interacts with insulin to control blood sugar levels in the body
- B3.3e - compare type 1 and type 2 diabetes and explain how they can be treated
- B3.3f - explain the effect on cells of osmotic changes in body fluids
- B3.3g - describe the function of the kidneys in maintaining the water balance of the body
- B3.3h - describe the gross structure of the kidney and the structure of the kidney tubule
- B3.3i - describe the effect of ADH on the permeability of the kidney tubules
- B3.3j - explain the response of the body to different temperature and osmotic challenges

Comment

Differences between Key Stage 3 and Key Stage 4

At Key Stage 3 learners will have studied the male and female reproductive systems, the menstrual cycle, fertilisation, gestation and birth. This is an excellent basis to progress onto Key Stage 4 where they will build upon that knowledge. Learners will look at the menstrual cycle in more detail at Key Stage 4, the main addition being the effects of hormones on different stages of the cycle, their use in contraception and how they can be used to treat infertility.

Although learners will have studied examples of organ systems when learning the hierarchy of organisms, their knowledge of the nervous system and endocrine system will be very limited. Learners need to understand the structure and function of the nervous system, the brain and the eye and the difficulties we have investigating brain function and treating damage and disease of the brain. With regard to the endocrine system learners need to be able to explain the role of a variety of hormones such as thyroxine as part of negative feedback systems.

After learning about the effects of a number of hormones on the human body, students will further their knowledge of hormones at Key Stage 4 by looking at the effects of plant hormones such as auxins, gibberellins and ethane as well as how we can use plant hormones, e.g. their use in controlling plant growth (rooting powder and weed-killers).

Homeostasis is also another relatively new concept to learners starting Key Stage 4. They will need to be able to explain how the hormones insulin and glucagon interact to control blood sugar concentrations and what happens if the body does not produce or respond to insulin i.e. diabetes. More able learners may have covered diabetes when looking at the consequences of imbalances of the diet at Key Stage 3, but it is likely that most learners focussed on obesity and deficiency diseases rather than diabetes. Some learners may however have members of their family who are diabetic, so the level of knowledge of learners for this topic is likely to be very varied. For this reason teachers may want to do a short activity at the start of this area of study to find out what their learners know in order to inform future lesson planning.

Finally, learners should be able to recognise an image of a kidney and some may be able to state the function of the kidney, but their structure and role in controlling water balance using ADH will be a new concept to them.

Common learner misconceptions

The following list of misconceptions is not exhaustive but will give teachers an idea of concepts to stress/check understanding of whilst delivering activities:

Learners may:

- think the brain is separate from the nervous system and is a uniform mass of tissue.
- not realise that the brain is involved in the control of involuntary actions e.g. controlling heartbeat, breathing etc.
- think that the nervous and endocrine systems are completely separate, not realising that the two interact to maintain homeostasis and respond to stimuli.
- believe only women have hormones.
- think that the pupil is a black spot on the surface of the eye and that there is nothing in the eye.
- think that seeds must be planted facing up so the shoots can grow upwards and the roots down.
- think that fertilisation occurs in the vagina and are often unsure exactly when in the menstrual cycle fertilisation takes place.
- think that the foetus does not produce waste products and that it doesn't need oxygen in the womb as it only uses oxygen after birth.
- believe that only animals have hormones, they often will not realise that plants have hormones that control and coordinate plant growth and development.
- believe that if a person is overweight or obese they will eventually develop diabetes. They don't realise that although this is a risk factor, there are other risk factors involved therefore it is not a certainty.
- be under the impression that insulin injections are a cure for diabetes rather than just a management of diabetes.
- think that a diabetes diagnosis automatically means that a person would have to have insulin injections. They don't understand that it is just type 1 diabetes that need insulin as they don't produce insulin. Type 2 diabetes may be managed with pills and a change in diet for some individuals.

Activities

Structure and function of the male and female reproductive systems: C Palms

Resources: <http://www.cpalms.org/uploads/Resources/final/28126/Document/2874/Reproductive%20System%20Card%20Activity.docx>

A card activity whereby each group in the class receives a picture of part of a reproductive system and some questions. Using text books, the groups answer the questions and present their findings to the rest of the class to build a picture of the structure and function of the male and female reproductive systems.

Menstrual Cycle: TES

Resources: <https://www.tes.com/teaching-resource/menstrual-cycle-6383821>

A number of resources including a presentation of what happens during the menstrual cycle, a worksheet to add this information to, a crossword and a card sort to check learners knowledge.

Reproduction summary: BBC KS3 Bitesize

Resources: <http://www.bbc.co.uk/education/guides/z9fgr82/activity>

An animation summarising the reproductive systems, menstrual cycle, fertilisation, gestation and birth. At the end of the animation is a quick quiz to check learners' knowledge.

Reproduction summary activities

Resources: http://www.kscience.co.uk/revision/reproduction/reproduction_index.htm

This page links to a number of quick interactive activities for learners to test their understanding of reproduction. They include a crossword, true/false statements and interactive labelling of male and female reproductive systems.

Checkpoint task

This checkpoint task is designed to consolidate Key Stage 3 learning. It consists of four sections, the first three can be printed and given to learners to work through individually. The final section is a card sort.

Section one asks learners to label diagrams of the male and female reproductive systems and match the parts to their role. For lower ability learners you may want to hand out a separate sheet with the keywords written on, or put the keywords on the classroom whiteboard.

Section two requires learners to colour code a 28 day cycle to show what processes occur during the menstrual cycle.

Section three gives learners the answers to some questions and learners have to write the question. There is no one correct question for each answer, expect to receive a variety of questions from the class for each answer. To check learners' understanding of the processes and key terminology, teachers should encourage learners to use key words learnt throughout the topic when writing the questions.

Section four is a card sort grouping the changes that occur during puberty. Learners group each change under the headings 'girls', 'boys' or 'both'. This could also be done as a whole class mini whiteboard activity.

Checkpoint Task:

www.ocr.org.uk/Images/324531-organism-level-systems-checkpoint-task.docx

Activities

Reflex actions and reaction times: University of Washington

Resources: <https://faculty.washington.edu/chudler/chreflex.html>

<https://faculty.washington.edu/chudler/chgames.html>

The first web page gives a number of examples of reflex activities. Teachers may want to select two or three that learners can carry out in the classroom. This could then be followed by measuring the speed of learner's reactions using the links to some online response time experiments on the second web page. Although this is not a reflex action, it is a good way of measuring reaction times if IT is not available, and also for getting learners to think about the path of the nerve impulse. Teachers may then discuss with learners the route of the 'message' from the eye/ear to the CNS and to the finger. This can be measured on learners and used to calculate the speed of the 'message' by dividing the distance travelled by the time to react. Discussions about the structure of the reflex arc can follow and why it is important. Learners could then build labelled models of a neurone from pipe-cleaners, clay, straws etc.

The eye and how we see: Zerobio

Resources: <http://www.zerobio.com/central/Eye.pdf>

A good DARTS activity worksheet covering the structures of the eye and their functions and common defects of the eye. This could be used as the main activity to deliver the content or as a summary.

The menstrual cycle: TES

Resources: <https://www.tes.com/teaching-resource/the-menstrual-cycle-activities-6177658>

A lesson plan including images of the stages of the menstrual cycle to place around the classroom for learners to annotate onto the menstrual cycle worksheet. This is followed by a short quiz and then a card sort showing the roles of FSH, LH and oestrogen in the menstrual cycle.

The menstrual cycle: PBS

Resources: http://www-tc.pbs.org/wgbh/amex/pill/sfeature/sf_cycle.swf

This could be followed with an animation of the menstrual cycle with and without the 'pill'. Learners compare and contrast the two cycles and discuss the advantages and disadvantages of the pill and other methods of contraception.

Plant Hormones: Sumanas, Inc.

Resources: <http://www.sumanasinc.com/webcontent/animations/content/plantgrowth.html>

Excellent animation explaining the role of auxins in phototropism and gravitropism and what effects other hormones e.g. ethane and gibberellins have on a plant. Activities are included at stages through the animation to check knowledge.

Control of blood sugar: Harvard University Life Sciences – HHMI Outreach Program

Resources: <http://outreach.mcb.harvard.edu/teachers/Summer09/KarynCoulon/TeacherNotes.pdf>

Page three to five of this resource gives instructions for how to carry out a role play with learners to show the role of hormones in controlling blood glucose in the body. Cards/labels required for the activity can be found on pages six to sixteen.

Water balance and the kidneys: abpischools

Resources: http://www.abpischools.org.uk/page/modules/homeostasis_kidneys/.cfm?age=Age range 14-16&subject=Biology

An excellent resource with information and short interactive activities covering the structure of the kidney and kidney tubule, why maintaining water balance is important, osmotic challenges and the effect of ADH. Section ten has a series of interactive quizzes to check learners knowledge of the whole topic. Sections seven to nine can be used as an extension activity for learners to research kidney damage and how dialysis and transplants can treat this.

Activities

Vision: Museum of Vision

http://www.museumofvision.org/dynamic/files/uploaded_files_filename_3.pdf

A series of activities learners can carry out to further their knowledge about the eye and vision. Activities include finding your blind spot, making a thaumatrope (spinning disc) and flipbook and optical illusions. Teacher instructions and background information are included in the booklet.

The Brain: The Wellcome Trust

[http://bigpictureeducation.com/search/brain?ff0\]=field_age_group%3A5](http://bigpictureeducation.com/search/brain?ff0]=field_age_group%3A5)

Links to a number of articles about the brain suitable for 14 to 16 year olds. Learners could be given different articles to read and produce a two minute presentation on their findings. Some of the topics include: How we process sound, does brain gym make you smarter? does brains structure explain the differences between the sexes? the brain and evolutionary behaviour, brain disorders and left and right brain etc.

Resources, links and support

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