

A LEVEL
Transition Guide

BIOLOGY A

H420
For first teaching in 2015

KS4 to KS5 Cell Division

Version 3



A LEVEL **BIOLOGY A**

Key Stage 4 to 5 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 4 which will help prepare students for progression to Key Stage 5;
- 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 4 and 5 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 4 and assess their 'readiness for progression' to Key Stage 5 content on this topic. This checkpoint task can be used as a summative assessment at the end of Key Stage 4 teaching of the topic or by Key Stage 5 teachers to establish their students' conceptual starting point.

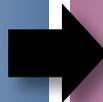
Key Stage 4 to 5 Transition Guides are written by experts with experience of teaching at both key stages.

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Key Stage 4 Content

GCSE content

- Most body cells contain chromosomes in matching pairs.
- New cells for growth, replacement, repair and asexual reproduction are produced by mitosis and are genetically identical.
- In mammals, body cells are diploid.
- Chromosomes need to be copied by DNA replication which must take place before cells divide:
 - Gametes are produced by meiosis and are haploid.
 - In meiosis, the chromosome number is halved and each cell is genetically different.



Key Stage 5 Content

A Level Content

- The cell cycle; the processes taking place during interphase (G1, S and G2), mitosis and cytokinesis, leading to genetically identical cells.
- How the cell cycle is regulated; the use of checkpoints to control the cycle.
- The main stages of mitosis; the behaviour of the nuclear envelope, chromosomes, chromatids, centromere, centrioles, spindle fibres and cell membrane.
- Microscopic sections of plant tissue showing the cell cycle and stages of mitosis; the examination of stained sections and squashes of plant tissue and the production of labelled diagrams to show the stages observed.
- The significance of mitosis in life cycles; growth, tissue repair and asexual reproduction in plants, animals and fungi
- The significance of meiosis in life cycles; producing genetic variation and haploid cells and crossing over.
- The main stages of meiosis; interphase, prophase 1, metaphase 1, anaphase 1, telophase 1, prophase 2, metaphase 2, anaphase 2, telophase 2.

Comment

Difference between the level of demand and KS3 and KS4

The move from KS4 to KS5 requires the learners to progress from regarding cell division as a separate process to an appreciation that it is part of a cycle that has checks. Learners also need to understand the significance of the different divisions in terms of the life cycle of an organism particularly with regard to genetic variability. New structures present in the cell during division are introduced such as centrioles, centromeres and spindle fibres. There is a substantial increase in the level of detail required of the stages of both mitosis and meiosis which, in turn, necessitates the learners to develop and use a greater range of technical vocabulary.

The KS5 content also requires learners to develop their practical skills by using a microscope to observe plant tissue undergoing cell division and to use these to identify, draw and label the stages. This will be challenging for some learners and the separate skills may need to be explicitly taught where learners have not had the opportunity to develop these at KS4.

Essential knowledge from KS4

From their work at KS4 students should be familiar with the structure of a chromosome and be able to use the terms haploid and diploid with confidence. It is useful at KS4 to emphasise that chromosomes are copied by DNA replication so that the genetically identical nature of them is embedded. This then helps with why daughter cells from mitosis are identical to each other and the parent cell.

They will need to be familiar with the sequence of events in mitosis and meiosis and appreciate the differences between them both in terms of the process of division, the daughter cells produced and their role in the life cycle of an organism.

Sequencing pictures of mitosis and meiosis can help reinforce the process especially where this is combined with matching the pictures to descriptions of the stage. Where possible it is helpful to compare diagrams with micrographs or videos of cells dividing.

Delivering the KS5 content

KS5 learners, in addition to acquiring additional factual knowledge, are required to apply their knowledge. Therefore, a mixture of content and concept based approaches to teaching the material will support learners with both recall and application (Braund et al, 2013). It is important that learners are able to use the new technical vocabulary accurately which can be developed using a combination of class discussion and written descriptions. Some learners struggle to grasp the movement of chromosomes and will need reinforcement of the KS4 content. The use of coloured modelling clay or pipe cleaners to model chromosomes will help to make the concept more concrete. This can be used as the basis for discussion using the vocabulary.

Learners should be able to use their knowledge of cell division in other contexts such as when discussing DNA replication. Explicit reference to other areas during teaching will help to embed the material and support learners to see the links between topics.

Learners' practical skills will vary considerably at the end of KS4 and the production of a root tip squash provides a good opportunity for learners to develop their ability to work precisely. It is unlikely that many learners will have experience of drawing from slides. Therefore, this will need to be demonstrated during teaching. However, learners will have had the opportunity to use a microscope whilst studying cell structure and this section provides an opportunity to reinforce the use of the light microscope, magnification and staining.

Braund, M., Bennett, J., Hampden-Thompson, G., & Main, G. (2013). Teaching approach and success in A-level Biology: Comparing student attainment in context-based, concept-based and mixed approaches to teaching A-level Biology. Report to the Nuffield Foundation. York: Department of Education, University of York.

Activities

Mitosis animation: Association of the British Pharmaceutical Industry

Resources: <https://www.abpischools.org.uk/topic/celldiv-cancer/4>

This is a simple animation of mitosis with annotation. It is particularly nice that learners can see the link to tumour formation in cancer giving some context to the learning.

Video and explanation of mitosis: YouTube

Resources: <https://www.youtube.com/watch?v=eV6nbisahek>

A video of mitosis which is 3 minutes long with good commentary. It could be consolidated using the cut and stick in the next resource.

Mitosis cut and stick: TES website

Resources: <https://www.tes.co.uk/teaching-resource/Mitosis-Cut-and-Stick-6035918/>

Part of the Times Education Supplement (TES) Secondary Biology Collection. This is a review activity with a good set of diagrams for sequencing mitosis. There is also an extension task which is beyond the requirements of the GCSE specification and could be used as a transition activity from KS4 to KS5. To access this resource you are required to register with the TES. However, registration is free.

Mitosis and Meiosis Animation: BBC

Resources: <https://www.bbc.co.uk/programmes/p031198n>

This animation/video on the BBC learning zone website gives a clear description of both types of cell division.

Mitosis and Meiosis Quiz: BBC

Resources: <https://www.bbc.co.uk/bitesize/guides/zvb7hyc/test>

A quick multiple choice quiz about both types of cell division that could be used as a plenary.

Mitosis and Meiosis Card Sort: TES website

Resources: <https://www.tes.com/teaching-resource/Mitosis-and-amp-Meiosis-6113203/>

Part of the Times Education Supplement (TES) Secondary Biology Collection. This is a card sort activity that checks whether learners can differentiate between mitosis and meiosis. Could be used as a plenary activity or a starter for a checkpoint activity task.

This activity provides a check to see if the concepts of mitosis and meiosis taught at KS4 have been fully understood by learners. It gives them the opportunity to show their understanding of the processes and use of terms. There is an opportunity for peer assessment by sharing the task evaluation sheet. The task evaluation sheet includes ideas not required at KS4 but which may be taught to learners showing the level of detail to which they have appreciated the content.

Teacher Guidance:

Modelling cell division – two scenarios:

- Why does my cut heal?
- How do sex cells form?

Working in pairs, half of the learners in the class could be given one of the two scenarios and the other half the other scenario. Each pair should be provided with modelling clay (plasticine) so that they can make a model cell. They should then use it to produce a short video with voice over explaining what is happening to the cell.

If the resources are not available to produce a video then learners could produce a series of photos, diagrams or models and write a short commentary or swap with another group and explain to the other learners what each model/diagram shows. There is an opportunity for peer assessment by sharing the task evaluation sheet

Teacher Instructions:

<https://www.ocr.org.uk/Images/170194-cell-division-checkpoint-task-instructions.pdf>

Learner Activity:

<https://www.ocr.org.uk/Images/170196-cell-division-checkpoint-task.docx>

Activities

Mitosis animation and video: PBS Learning Media WGBH Educational Foundation

<https://www.pbslearningmedia.org/resource/tdc02.sci.life.stru.dnadi/divide/mitosis/>

This is an excellent video/animation of mitosis with a commentary which highlights the differences between the process in plant and animal cells. There is an additional commentary if the teacher audio presentation is clicked. Could be used as an introduction to the use of microscopic examination of plant tissues. A demonstration of how to do microscopic drawing could be made by pausing the video at relevant sections and making a drawing of what is shown.

Instructions for a root tip squash; Nuffield Foundation

<https://www.nuffieldfoundation.org/practical-biology/investigating-mitosis-allium-root-tip-squash>

Detailed instructions for technicians, teachers and learners about how to prepare a slide showing the stages of mitosis. The activity at the end to calculate the percentage of time spent in each stage of mitosis could be used as an extension or enhancement activity.

Cell cycle, mitosis and meiosis; CK12

<https://www.cusd80.com/cms/lib/AZ01001175/Centricity/Domain/4939/Chapter%205%20%20CK-12%20Biology%20Chapter%205%20Worksheets.pdf>

Set of worksheets about all aspects of cell division. There are 24 pages of definitions, descriptions and a variety of styles of checking knowledge including multiple choice, close and longer style writing opportunities. The different sheets could be used as plenary activities or as checking exercises at the end of the topic.

Cell Division Knowledge Quiz: CK12

<https://www.ck12.org/biology/Cell-Division/asmtpractice/Cell-Division-Practice/>

Interactive quizzes that learners can use to check their knowledge of all aspects of cell division.

Stages of Meiosis – Cells Alive

<https://www.cellsalive.com/worksheets/MeiosisPhases.pdf>

A standard worksheet about the stages of meiosis that learners can use to recall their knowledge.

Summarising Cell division (OCR lesson element)

This activity is designed to be used after the content relating to cell division has been taught. Each task could be completed as a written exercise or a discussion in small groups. The activity could be split up and used as each section of content is completed. The checklist of items that should have been covered could also be used for peer assessment.

Activities

Cell cycle: Khan Academy

<https://www.khanacademy.org/science/ap-biology/cell-communication-and-cell-cycle/cell-cycle/v/interphase>

This is a series of videos and notes going through the cell cycle. At the end there is a practice test to check understanding. It is followed up by 'Cell cycle control' lesson, which goes through the various checkpoints for the control of the cell cycle. Some of the content goes beyond the A Level specification.

Observing Meiosis: Nuffield Foundation

<http://www.nuffieldfoundation.org/practical-biology/preparing-anther-squash>

This web page contains practical instructions for learners, teachers' notes, guidance for technicians and health and safety details for preparing an anther squash to look at the stages of meiosis.

Resources, links and support

Science Spotlight – Our termly update Science Spotlight provides useful information and helps to support our Science teaching community. Science Spotlight is designed to keep you up-to-date with Science here at OCR, as well as to share information, news and resources. Each issue is packed full with a series of exciting articles across the whole range of our Science qualifications: www.ocr.org.uk/qualifications/by-subject/science/science-spotlight/

Find resources and qualification information through our science page: <https://www.ocr.org.uk/subjects/science/>

Contact the team: science@ocr.org.uk

Continue the discussion on the science community forum: <https://social.ocr.org.uk/>

and follow us on Twitter, [@ocr_science](https://twitter.com/ocr_science)

To find out more about GCSE and A Level reform please visit: <http://www.ocr.org.uk/qualifications/gcse-and-a-level-reform>

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