**Secondary Schools/Sixth Form:
Discovering Epigenetics – Ageing in *C. Elegans***

Approximate timing: 20 minutes

Required resources: PowerPoint presentation, fact sheet, lesson plan, internet access for video

Summary: This lesson will introduce students to the idea of using *Caenorhabditis Elegans* *(C. Elegans*) nematode worms to understand aspects of human biology (ageing) by comparing the appearance and behaviour of young and old worms raised under different conditions.

**The lesson supports:**

*AQA GCSE Biology*

4.6.1.4 DNA and the genome

4.6.1.5 DNA structure (biology only)

4.6.2 Variation and evolution

4.6.2.4 Genetic engineering

*EDEXCEL GCSE Biology*

3.4 Describe DNA as a polymer

3.5 Describe the genome as the entire DNA of an organism and a gene as a section of a DNA molecule that codes for a specific protein

3.13 Explain the term: chromosome

*OCR GCSE Biology*

B1.1 What is the genome and what does it do?

B1.2 How is genetic information inherited?

B1.3 How can and should gene technology be used?

*AQA A Level Biology*

3.4.1 DNA, genes and chromosomes

3.4.2 DNA and protein synthesis

*EDEXCEL A Level Biology*

7.2iv Understand that gene expression can be changed by epigenetic modification, including non-coding RNA, histone modification and DNA methylation.

7.2v Know that epigenetic modification is important in ensuring cell differentiation.

*OCR A Level Biology*

5.1.1 Patterns of inheritance

5.1.3 Gene technologies

Links to Babraham Institute research themes:

<https://www.babraham.ac.uk/our-research/healthy-ageing>

<https://www.babraham.ac.uk/our-research/epigenetics>

Links to Babraham Institute scientific services

<https://www.babraham.ac.uk/science-services/bioinformatics>

<https://www.babraham.ac.uk/science-services/sequencing-facility>

Link to online video

<https://www.youtube.com/watch?v=QbdHIW8xNKA&feature=youtu.be>

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| **Learning outcomes** |
| All students will: | Be able to explain why worms could be a useful mode organism for understanding ageing. |
| Most students will: | Provide an example of how lifestyle factors can affect how we age. |
| Some students will: | Describe the process of addressing a scientific problem through weighing up the advantages and disadvantages of different model organisms.  |
| Key word/s | Worms, ageing, model organism, diet, healthspan, lifespan |

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| **Teaching notes** | **Student learning activities**  |
| **Starter or ice-breaker activity** (3 mins)Identify students’ existing knowledgeRead over fact sheet | Slide 3Student actionsDefine ageing in groups – what are some features of an old person / animal?* Wrinkled skin
* Spine curvature
* Weaker muscles/frailty – increased risk of falls
* Increased risk of infection
* Age associated disease (Alzheimer’s etc.)

Cataracts  |
| **Development** (5 mins) Go over slide content – refer to slide notes & fact sheet | Slide 4 & 5Student actionsDiscuss why it might be useful to use c.elegans in research:* What areas of research could they be useful? (Ageing, basic and simple biology – evolutionarily conserved)

What might some disadvantages be? (Not so closely related to humans) |
| **Principal Activity** (10 mins)Teacher notes: * Go over slide content & fact sheet
* Show the video of 4 representative worms, and ask the students to write down differences they see: old vs. young; dietary restricted vs. normal diet
* You can use the drawing sheet to help students visualize and remember these differences.
* Be sure to explain that any differences seen through diet restriction does not mean the same effects is seen in humans. No study has ever been successful in humans due to the affect that dietary restriction has on human quality of life. These results mean that we assess the effect in more complex models, and see what the underlying causes were.
 | Slides 6-8Student actionsWork individually or in small groups, studying the video and thinking about the differences between the groups* What do you notice?
* Are there differences between young & old worms? What are they?
* Are there differences between normal diet & restricted diet? What are they?

If they’d like they can use the drawing sheet to visualize any differences that they see.  |
| Plenary (2 mins)Plenary questions are linked to initial learning outcomes | Students answer question(s) on summary slide 9 to assess learning.What makes c.elegans a good model organism? What are the drawbacks? |
| **Homework** | Discovering Epigenetics* Stem cell quiz
* The Epigenetic Clock
* The ethics of animals in research

Ethics Workshop: Animals in Research - AlternativesMaking Your MarkEpigenetics model challenge |