# Connection: B7.8 – Evidence of natural selection

## Connection – questions (Triple only)

**Q1. W**hat is the definition of a new species?

**Q2.** What is a hybrid?

**Q3.** How did the different shaped beak allow so many different species of finch to evolve on the Galapagos islands?

# Connection: B7.8 – Evidence of natural selection

## Connection – answers Triple only

**A1** organisms that can breed and produce fertile offspring

**A2** closely related species that can breed but the offspring produced are infertile

**A3** allowed them to exploit different ecological niches in terms of their food supply eg seeds, nuts, insects cacti

# Lesson 8: B7.8 – Evidence of natural selection

## Connection

Q1. Where are the oldest fossils found?

Q2. 3 bullet points to explain how fossils are formed

Q3. Why is archaeopteryx so important to the fossil record?

## Activation

**LI: Explain how the evolution of the pepper moth is a modern example of natural selection**

https://www.youtube.com/watch?v=Pop-xetGaBM
https://www.youtube.com/watch?v=sVVldxxbWig

1. Make a note of the title and the LI
2. Read pages 288-289
3. Make a list of keywords – define any you don't know
4. Produce a poster/ cartoon to show how pepper moths evolved

## Demonstration

Attempt questions 1-6
In 10 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

## Consolidation

Complete and self assess the relevant past paper question for this topic - From the B7 DIP file

## Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

# Answers: B7.8 – Evidence of natural selection

## Connection

**1** in the layers of rock furthest under ground
**2** organism dies/ sinks to the bottom of the ocean & is covered by sediment/ repeated layers of sediment form which compress to form sedimentary rock
**3** missing link between reptiles and birds

## Demonstration

**1** mutation.

**2** pollution was blackening bark and killing lichens on trees. The pale moths were easily spotted by birds and eaten; the dark/melanic form was camouflaged. The dark form therefore had a selective advantage. *Note that Tutt would not have known about genes at this time.*

**3** released identical numbers of pale and melanic moths. Carrying out the experiment in additional areas.

**4** collecting/breeding sufficient numbers of moths for the investigation; recapturing the moths. *In fact, Kettlewell had used a combination of moth trap caught and laboratory-bred moths. Their behaviours could have been different from wild moths. It would have been better to have obtained them from a single source. Recent studies by Professor Mike Majerus sourced all the moths from within 5 km of the test site and analysed the data from moths sourced in different ways separately. With small proportions being recaptured, it is difficult to know the extent to which the recapture technique and the numbers of moths being eaten have each contributed.*

**5** anti-pollution measures (including the Clean Air Act, 1956).

**6** melanism was found in other animals, such as ladybirds.
*Many other studies confirmed Kettlewell's findings. These included, in 1972, a series of investigations at seven sites along a transect from urban Liverpool to rural North Wales. As anti-pollution measures of the 1950s and 1960s took effect, the dark form also decreased in abundance in the USA and in The Netherlands. Experiments by Mike Majerus over a 7 year period in the early 2000s supported Kettlewell's findings.*

# Lesson 9: B7.9 – Key Concept: Evolution - fitting the jigsaw together (Triple)

## Connection

Q1. What variation is seen in pepper moths?

Q2. What was the environmental challenge that caused evolution in the pepper moth?

Q3. What was responsible for the colour variation?

## Activation

**LI: Explain how the work of Mendel, Darwin & Wallace fits together and how other scientists have contributed to the development of the gene theory**

1. https://www.youtube.com/watch?v=U5e2hg2uLco
2. Make a note of the title and the LI
3. Read pages 290-291
4. List the key words and define any you don't know

## Demonstration

Attempt questions 1-6
In 10 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

## Consolidation

Complete and self assess the relevant past paper question for this topic - From the B7 DIP file

## Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

# Answers: B7.9 - Key Concept: Evolution - fitting the jigsaw together (Triple)

## Connection

**1** wing colour – varied from light silver to dark grey
**2** The industrial revolution caused the trees that they rested on to be coated in a layer of soot so the moths became dark grey in colour. Post the industrial revolution when the air quality improved the trees became lighter and so the moths reverted to the light silver phenotype.
**3** A single gene was responsible for the variation and coded for the protein melanin.

**Demonstration**

**1** Mendel's paper was not widely read. It was published in a local journal and in German.

**2** no one yet knew. *It was thought to be some kind of 'blending' of characteristics from parents.*

**3** geneticists had only worked with characteristics that showed either/or traits and could not explain the variation in populations that led to natural selection.

**4** scientists (J.B.S. Haldane, R.A. Fisher and S. Wright) who produced mathematical models of natural selection and mutations.

**5** Thomas Hunter Morgan found that it was genes, located on chromosomes that controlled inheritance. His work confirmed the chromosomal theory of inheritance that we use today.

**6** It has taken years to develop the technology to be able to investigate the genetic code in detail. The fact that only a very small percentage of genes code for proteins (the rest code for switching on and off of genes) has made the job of deciphering
the genetic code more complex and time consuming than first thought

# Connection: B7.10 – Antimicrobial resistance

## Connection – questions (Triple only)

**Q1.** What about Mendelian inheritance did not seem to fit with Darwin's Theory of Evolution?

**Q2.** What theory was developed in the 21st century that linked Mendel's work with the idea of evolution?

**Q3.** Name 3 other groups of scientists that contributed to our understanding of inheritance?

# Connection: B7.10 – Antimicrobial resistance

## Connection – answers Triple only

**A1** Mendel's eitheror inheritance of genetic characteristics didn't seem to fit with the subtle variation seen to be responsible for natural selection and evolution

**A2** Gene Theory linked to Mendel's idea regarding units of inheritance

**A3**
Thomas Hunter Morgan – genes on chromosomes
George Beadle & Edwards L Tatum – genes made enzymes
Crick & Watson – structure of DNA

# Lesson 10: B7.10 – Antimicrobial resistance

## Connection

Q1. What variation is seen in pepper moths?

Q2. What was the environmental challenge that caused evolution in the pepper moth?

Q3. What was responsible for the colour variation?

## Activation

**LI: Explain how bacteria are becoming resistant to antibiotics**

1. https://www.youtube.com/watch?v=znnp-Ivj2ek
2. Make a note of the title and the LI
3. Read pages 292-293
4. List key words – define those you don't know
5. Draw and label figure 7.29

## Demonstration

Attempt questions 1-6
In 10 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

## Consolidation

Complete and self assess the relevant past paper question for this topic - From the B7 DIP file

## Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

# Answers: B7.10 - Antimicrobial resistance

## Connection

**1** wing colour – varied from light silver to dark grey
**2** The industrial revolution caused the trees that they rested on to be coated in a layer of soot so the moths became dark grey in colour. Post the industrial revolution when the air quality improved the trees became lighter and so the moths reverted to the light silver phenotype.
**3** A single gene was responsible for the variation and coded for the protein melanin.

## Demonstration

**1** in a population of bacteria exposed to the antibiotic, some are resistant because of mutations; bacteria with the resistant genes survive and pass these on to offspring as they divide; the whole population becomes resistant to the antibiotic.

**2** owing to genetic variation, some bacteria are better able to survive in this (changed) environment; characteristic/antibiotic resistance spreads throughout the population. *Note that new species of bacteria are not produced, simply resistant strains.*

**3** 'last-resort' antibiotics.

**4** we won't be able to treat common infectious diseases with common antibiotics, and some of these may be fatal. Organ transplants would not be possible because of the risk of infection (which normally would be controlled by antibiotics) and certain cancer treatments that weaken or destroy the immune system would not be possible as they are likely to lead to the death of the patient owing to infection.

**5** over-prescription of antibiotics.

**6** resistance is proportional to the use of penicillin; it is highest in countries where prescription is highest, e.g. France, and lowest where penicillin use is lowest; there are some anomalies, e.g. Spain and Hungary, where resistance is perhaps higher than expected from the trend.

# Lesson 11: B7.11 – Combatting antimicrobial resistance

## Connection

Q1. Give the 3x steps that lead to anti microbial resistance(AMR)?

Q2. Why is AMR such a problem?

Q3. How is AMR occurring?

## Activation

**LO: Explain how to reduce the development of AMR and why the development of new antibiotics is so important**

1. https://www.youtube.com/watch?v=xZbcwi7SfZE
2. Make a note of the title and the LI
3. Read pages 294-295
4. List key words – define those you don't know
5. Make a heath poster or booklet to explain how to prevent the further development of AMR.

## Consolidation

Complete and self assess the relevant past paper question for this topic - From the B7 DIP file

## Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

## Demonstration

Attempt questions 1-7
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

# Answers: B1.11 - Combatting antimicrobial resistance

## Connection

**1**

- Within a population of bacteria a single cell is resistant to an antibiotic.
- Treatment with the antibiotic kills all the other bacteria but the single bacteria survives and reproduces
- The whole population of bacteria now have the gene from the surviving bacteria that makes them all resistant to the antibiotic

**2** AMR could return us healthwise to the nineteenth century when a tiny cut could become infected and kill us. This would make surgical procedures impossible

**3** Inappropriate use of antibiotics, used in humans for minor viral infections against which they are not effective, over use in veterinary medicine, not taking the full course of antibiotics

## Demonstration

**1** any bacteria left may have a slightly higher resistance that those killed first.

**2** limit the prescription of antibiotics; not prescribe antibiotics inappropriately, i.e. when not absolutely necessary, or for diseases caused by viruses.

**3** currently lower than cancer, diabetes, diarrhoeal disease and road traffic accidents/higher than measles, cholera, tetanus. By 2050, will be the biggest killer (assuming other death rates do not increase markedly).

**4** deaths continue at the same rate; rate of developing resistance continues at the same rate; no way of making antimicrobials more effective discovered; no new antimicrobials/other method of treatment discovered that reduce the rate. Note that this is just *one* mathematical model/other mathematical models may suggest a (slightly) different trend. *It's also appropriate to say that some other catastrophic event may occur which could affect the world's population.*

**5** cost of treatment/more medical staff required; research and development/search for new antimicrobials/treatments; health effects on the workforce.

**6** research, development and trialling of new antibiotics is costly and takes a long time; drugs companies may be reluctant to invest money as an antibiotic developed is likely to be used only as a last resort and therefore not generate a profit.

**7** Sponsorship by government or entrepreneurs would provide an incentive for pharmaceutical companies and offset potential losses. It's a global problem that needs a global solution which perhaps should not be down to individual governments/pharmaceutical companies/research institutes.

# Lesson 12: B7.12 – Selective breeding

## Connection

Q1. Give 4x ways AMR can be slowed down.

Q2. How serious is AMR compared to cancer?

Q3. Why are drug companies not keen to invest a lot money in developing new antibiotics?

## Activation

**LI: Describe the process of selective breeding and why humans are interested in doing it.**

1. https://www.youtube.com/watch?v=fHS-OY9XDZc
2. Make a note of the title and the LI
3. Read pages 296-297
4. List key words – define those you don't know
5. Copy and annotate fig 7.33

## Demonstration

Attempt questions 1-7
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

## Consolidation

Complete and self assess the relevant past paper question for this topic - From the B7 DIP file

## Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

# Answers: B7.12 – Selective breeding

## Connection

**1**

- Take the whole course
- Only take them if you need them
- Don't share or skip doses
- Done overuse them in agriculture

**2** By 2050 AMR is predicted to kill more people than cancer

**3** Because the new antibiotics will not be used by many people only in an emergency and so they will not make much money by selling them

## Demonstration

**1** amount of muscle/meat; amount/length/quality of wool; amount and quality of milk.

**2** animals/plants with a desirable characteristic(s) bred; others prevented from breeding; the offspring with the best of the characteristic selected and bred; the process is repeated over many generations.

**3** hunting; temperament; named features relating to appearance.

**4**. capable of interbreeding and producing fertile offspring.

**5** the dogs become inbred; have limited gene pool/the incidence of rare disease alleles will increase with no outbreeding.

**6** hip dysplasia; heart valve problems; deafness; puppies may need to be born by Caesarean section.

**7** Benefits:
Desirable traits can be bred, distinctive features may be aesthetically pleasing for owners, more predicable temperament and behaviour of dogs Health risks:
Conditions such as hip dysplasia, deafness, hips to narrow for birth can occur from inbreeding to maintain pedigree lines.

# Lesson 13: B7.13 – Producing new plant varieties

## Connection

Q1. What is the selective breeding?

Q2. Why is selective breeding useful?

Q3. What are the 5x steps involved in selective breeding?

## Activation

**LI: Describe the process for selective breeding in plants**

https://www.youtube.com/watch?v=G2xDahfeGIE

1. Make a note of the title and the LI
2. Read pages 298-299
3. List key words – define those you don't know
4. Use the green section to produce 6x reasons why farmers might selectively breed plants
5. Copy the figure 7.38

## Demonstration

Attempt questions 1-6
In 10 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

## Consolidation

Complete and self assess the relevant past paper question for this topic - From the B7 DIP file

## Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

# Answers: B7.13 – Producing new plant varieties

## Connection

**1** breeding together organisms with desired characteristics – also know as artificial selection

**2** It enables us to produce organisms that are best suited to fulfilling their role eg milk or meat production in cows

**3**

- Selects best male and female for the desired characteristic
- Breed them to produce offspring
- Some of the offspring are better than others
- Pick the best from the offspring to breed
- Over time the desired characteristic becomes more prevalent and better developed in the offspring

## Demonstration

**1** grow and mature quickly; taste, aroma, colour; long shelf-life, store well or can be frozen.

**2** if susceptible/unable to tolerate the change, they may all die.

**3** physically transfer pollen to flower to be fertilised; place a bag over the fertilised flower to prevent further pollen reaching the flower.
*Note that some plants, e.g. hops, have male or female flowers. For plants having flowers with male and female parts, the male parts of the flower to be fertilised would have to be removed to prevent self-pollination.*

**4** because they may have genes/alleles, bred out of recent varieties/cultivars, that will be an advantage for new varieties to have, e.g. for disease resistance.

**5** many plants are grown and trialled over many generations; the offspring each go through a selection process, e.g. exposure to fungal diseases, testing for desirable properties/qualities.

**6** bitterness; yield; resistance/tolerance to fungal disease.