Evolution

Ideas for Teachers

Explore life on earth with your students, with a focus on species from the Museum of Zoology collections and the Department of Zoology's research.

Our resource packs link museum collections with National Curriculum topics. While activity suggestions help you to get the most out of the specimens featured here, we encourage teachers to use the specimen images in ways that work for you and your students.

Note: Accession numbers found in this pack can be used to access further information and images on our database at : http://bit.ly/zoocollections

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Peppered Moth

Scientific Name: *Biston betularia*

Location: Northern Hemisphere

This night-flying moth has excellent camouflage properties. The caterpillar is a twig mimic, and the moth takes on a white and black speckled colouration in its usual (*typical*) form, hence the common name 'peppered'. An alternative, black-coloured (*melanic*) form is also seen in Britain. This variation, combined with their 1 year life-cycle, makes the Peppered Moth an excellent species to study evolution and genetics.

Accession number: due to the small size and quantity of our insect specimens, they are not yet catalogued. To keep track of our mini-beasts we arrange them systematically by species.

Explore further…Michael Majerus conducted predation studies with this moth to explore Darwin's theory of natural selection. Finding that the increase in the number of melanic moths during the industrial revolution was probably due to the increase in blackened tree trunks and branches from pollution.

RED LIST Not Assessed

Other resources:

http://www.arkive.org/peppered-moth/biston-betularia/

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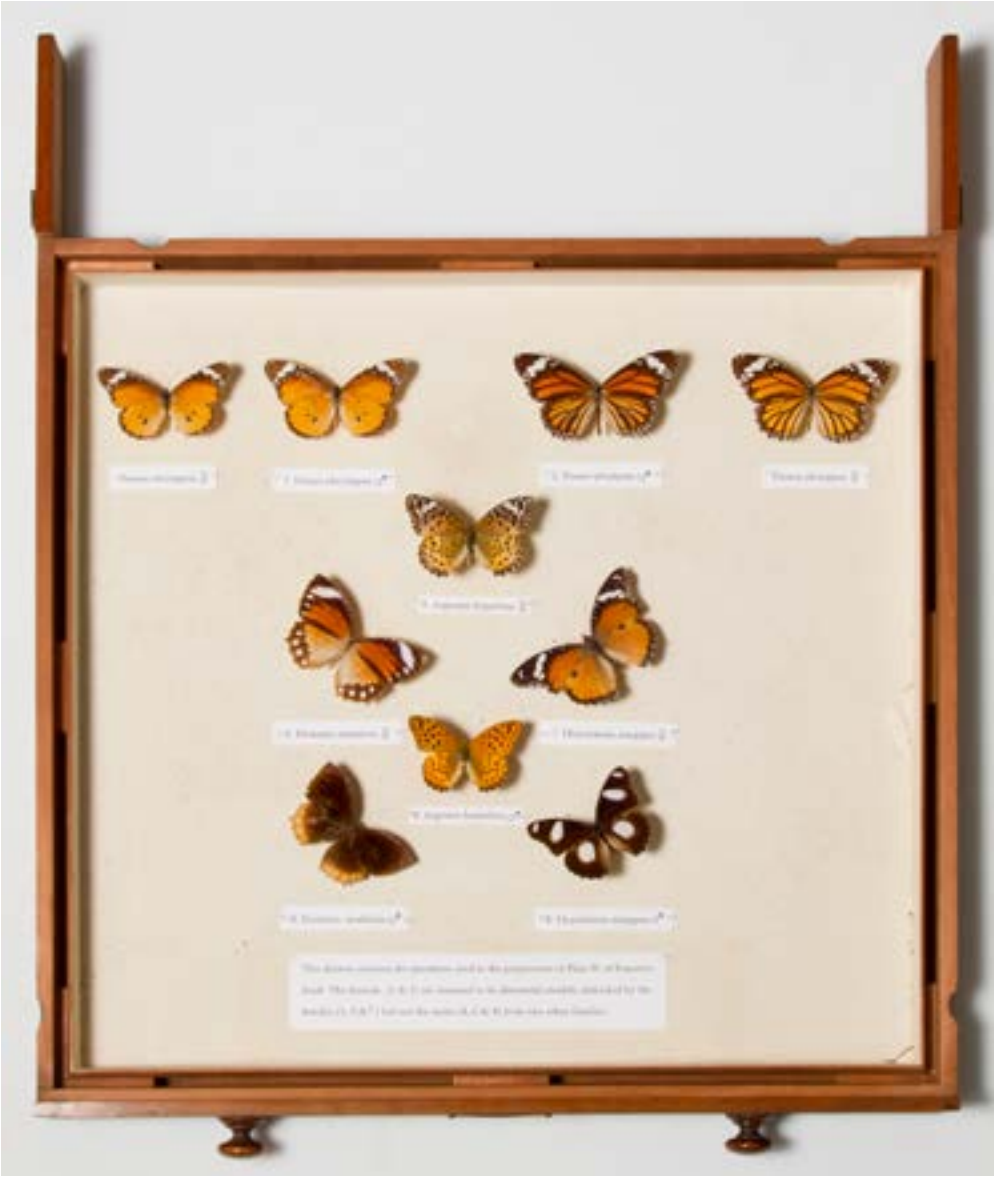

Butterflies and Mimicry

Scientific Name: *Danaus(1&2), Argynnis(3&4), Elymnias(5&6), Hypolimnas(7&8) sp.*

Location: 1Asia/Africa, 2 Americas, 3&4 Himalayas, 5&6 South Asia, 7&8 Africa/Asia/Australia

The butterflies labelled 1 & 2 in this image have developed their bright colours to warn predators that they contain bad tasting, poisonous chemicals. The other female butterflies (3, 5&7) are mimics; and have developed their colours in order to look like the toxic species (1&2), and avoid being eaten. The males (4, 6 & 8) have not mimicked the distasteful species, and have instead invested their energies into being attractive to females.

Accession number: due to the small size and quantity of our insect specimens, they are not yet catalogued. To keep track of our mini-beasts we arrange them systematically by species.

Did you know...Monarch Butterflies acquire their distasteful properties by eating poisonous plants, such as milkweed, during their larval (caterpillar) stage. These plants contain cardiac glycosides; heart-arresting steroids.

RED LIST Not Assessed

Other resources:

http://www.learnaboutbutterflies.com/Survival%20Strategies%204.htm

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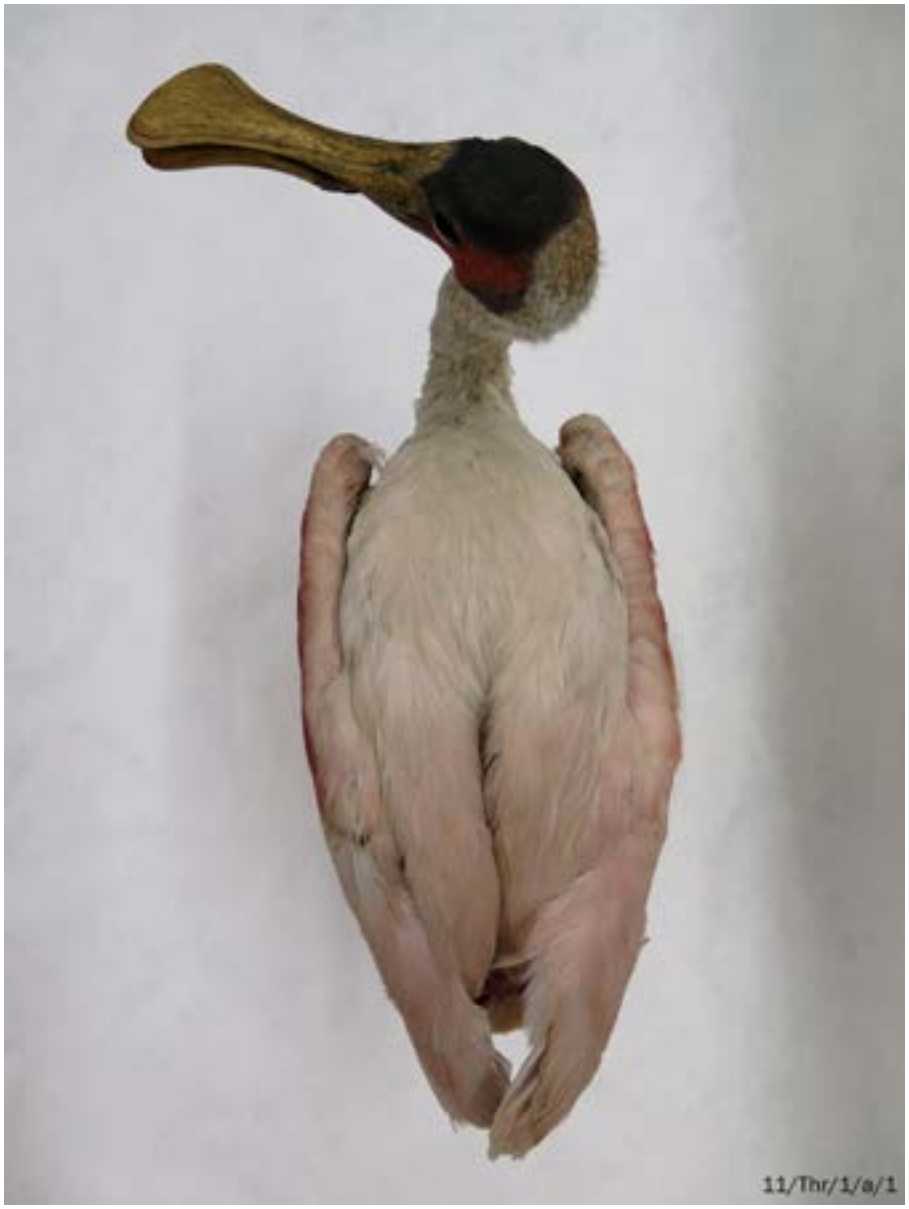

Roseate Spoonbill

Scientific Name: *Ajaja ajaja*

Location: South America & Caribbean coastal regions

This large bird's spoon shaped beak is perfectly adapted to catching small animals in the water. It sweeps its bill from side to side, catching small fish and crustaceans. Like flamingos, the Roseate Spoonbill's pinkish colour is believed to come from pigments in the crustaceans it eats.
The nostrils are located at the top of the beak, close to the head, allowing the spoonbill to breathe and feed at the same time.
Long legs also allow it to remain over the water without getting its belly wet.

Accession number: 11/Thr/1/a/1

Did you know...Britain has its own species of spoonbill, *Platalea leucorodia*. Athough white in colour, they possess the same spoon shaped beak.

RED LIST Least Concern

Other resources:

https://www.rspb.org.uk/birds-and-wildlife/bird-and-wildlife-guides/bird-a-z/s/spoonbill/

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Argus Pheasant

Scientific Name: *Argusianus argus*

Location: Southeast Asia

The male Argus Pheasant has uniquely long and decorated wing and tail feathers. He will move and dance, showing off his colourful feathers, in order to attract a female. These lengthy secondary flight feathers actually inhibit flight. This and their complex pattern, only seen when displaying, led Charles Darwin to believe that they are a perfect example of evolution through sexual selection.

Accession number: 400.F

Take a closer look...Argus is the name of a one hundred-eyed giant in Greek mythology. Why do you think Carl Linnaeus named this bird after the mythical giant?

RED LIST Near Threatened

Other resources:

http://www.iucnredlist.org/details/22725006/0

http://www.arkive.org/great-argus/argusianus-argus/#text=Facts

https://animalbytescambridge.wordpress.com/2014/02/11/argus-pheasant-feathers/

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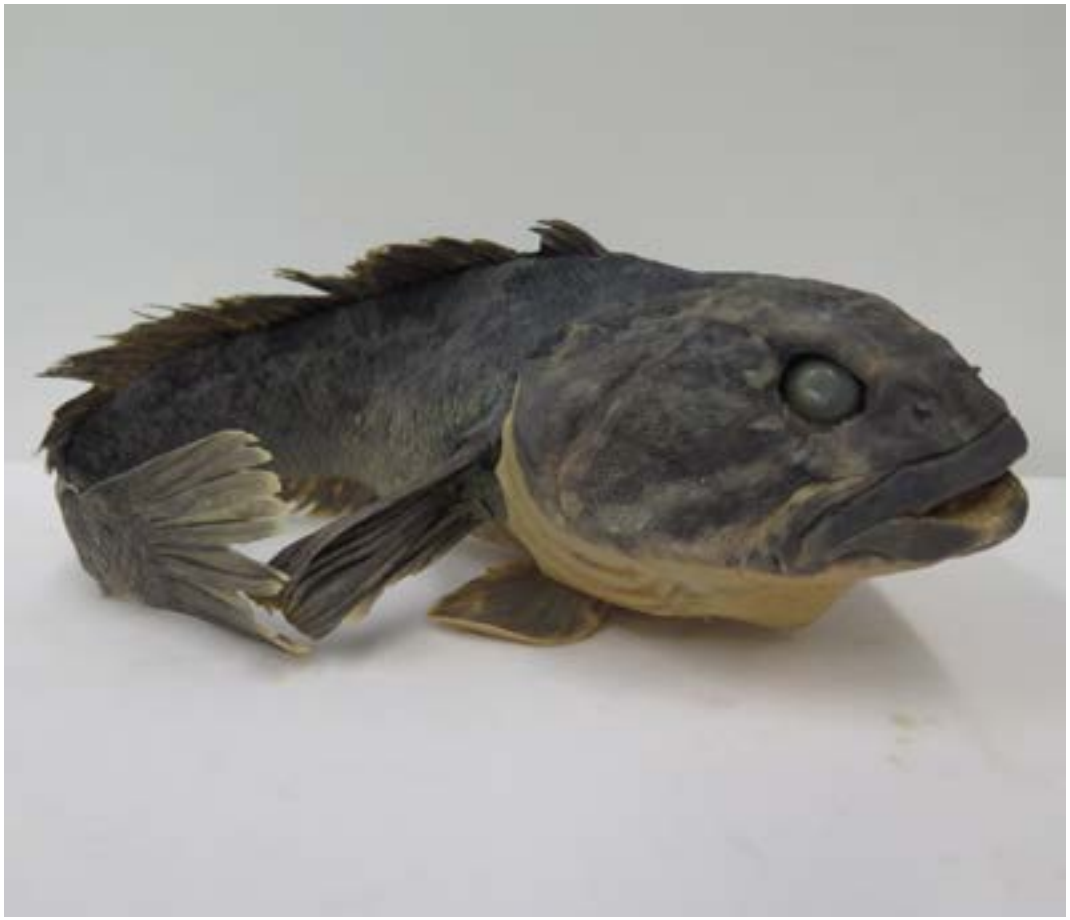
Antarctic Cod



Scientific Name: *Notothenia neglecta*

Location: Southern Ocean

This fish is perfectly adapted to life in the minus 1.8°c waters surrounding Antarctica. They produce organic antifreezes, composed of molecules called glycoproteins. These lower the freezing point of their blood and other fluids so that they stay liquid in sub-zero temperatures. Most fish freeze below 0.7c!

This specimen is preserved in spirit; a liquid with a high alcohol content in order to preserve the skin and soft tissues.

Accession number: F.5615

Fun Fact…Antarctic Cod do not have a swim bladder. A swim bladder helps many fish control buoyancy. However bottom-dwellers, such as the Antarctic Cod, live on the ocean floor. A buoyancy aid would make life very difficult for them.

RED LIST Not assessed

Other resources:

http://www.arkive.org/antarctic-cod/notothenia-nudifrons/

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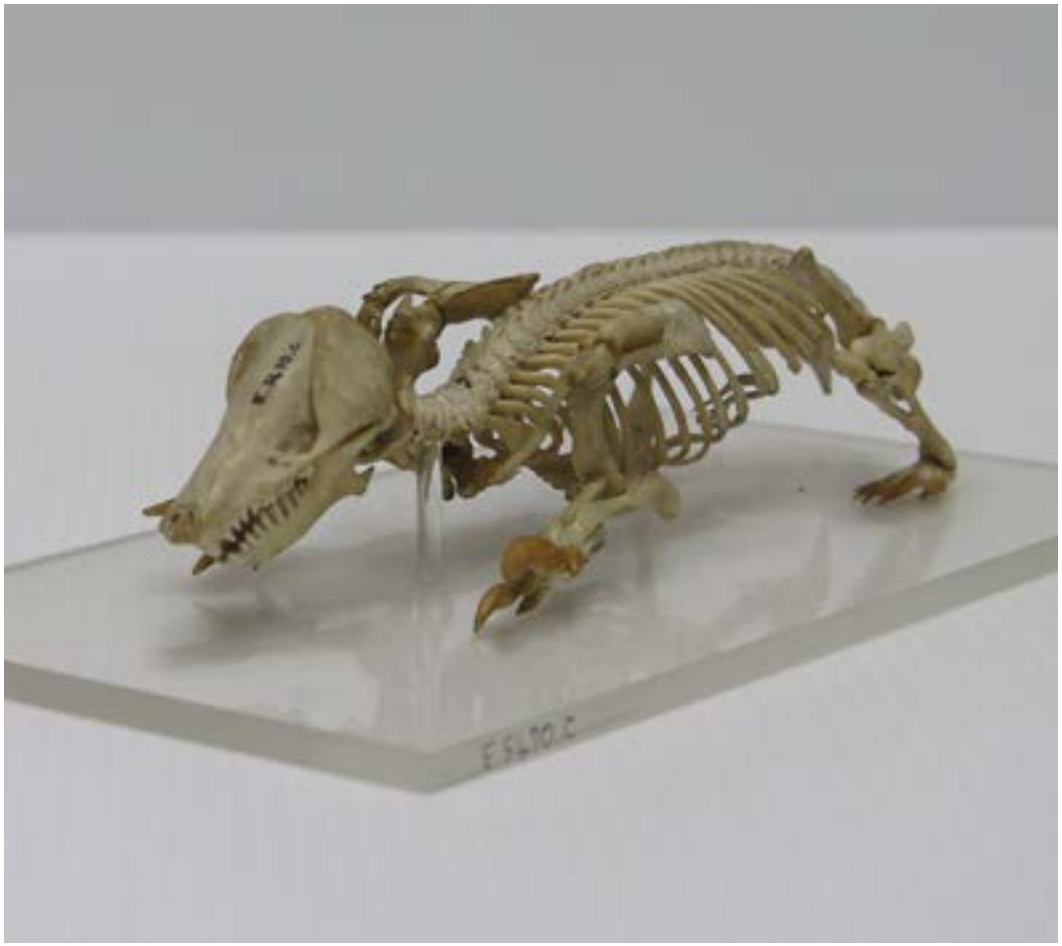
Giant Golden Mole



Scientific Name: *Chrysospalax trevelyani*

Location: South Africa

This animal feeds on insects, and grows to the relatively large size of around 25cm, for a Golden Mole. While the Golden Mole is blind, it has very sensitive hearing which it uses to locate its prey.

Moles are a good example of convergent evolution. Recent genetic evidence suggests that Golden Moles and 'true' moles, like the European Mole, are not of the same lineage; with Golden Moles belonging to a group of African mammals called Afrotheria.

Accession number: E.5470.C

Take a closer look...Notice the shortened toes and flat palms on the forelimbs, perfect for digging, the hind limbs have webbed toes, perfect for shovelling soil backwards and the head is wedge-shaped; making it a perfect burrower.

Endangered

Other resources:

http://www.iucnredlist.org/details/4828/0

https://animalbytescambridge.wordpress.com/2013/04/26/giant-golden-mole-chrysospalax-trevelyani/

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Tasmanian Tiger

Scientific Name: *Thylacinus cynocephalus*

Location: Extinct (previously found in Tasmania)

The Tasmanian Tiger, or Thylacine, was once the largest marsupial carnivore. It is now considered to be extinct, a consequence of being targeted as a pest by farmers.

This animal was probably given the name 'tiger' for its stripes, and has also been called a 'wolf' due to its canid like appearance. It is a perfect example of convergent evolution; the independent evolution of similar features in species of different lineages. While it looks very much like a wolf, the Thylacine is a marsupial and so more closely related to kangaroos and koalas than to dogs and wolves. Female Thylacines had a backwards-opening pouch in which their young developed.

Accession number: A.6 7/6

Did you know...A Thylacine could open its mouth remarkably wide, with a gape beaten only by that of a snake!

RED LIST Extinct

Other resources:

Video of last living thylacine: http://www.arkive.org/thylacine/thylacinus-cynocephalus/video-00.html

https://animalbytescambridge.wordpress.com/2013/03/19/tasmanian-tiger-or-thylacine/

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Activity Ideas for the Classroom

BACKGROUND	ACTIVITY IDEAS	RESOURCES	KEYSTAGE	CURRICULUM LINKS
Adaptation, Habitats & Camouflage Predators and prey have developed a variety of different camouflage techniques. Colours, like the Peppered Moth, or even appendages, like the Leafy Seadragon, can help to hide animals in plain sight, and enhance survival.	Print images of different habitats as well as separate images of animals from this pack, and in the 'resources' column. Have students match the animals to the habitats in which they would be best camouflaged. For example, the Thylacine's stripes help it to blend into a forest habitat and stalk prey. Extension activity: allow students to choose their own animal, and then design a habitat/background for their animal to hide in.	Leafy Seadragon: https://animalbytes-cambridge.wordpress.com/2014/09/ Time: 20 minutes; extention 20-30 minutes	KS1 KS2 SEND	Biology: Habitats, Adaptation, Evolution Art and Design: Drawing, Colour, Patterns, Texture, Shapes
Feeding Adaptations Feeding adaptations come in many different forms.	Explore the different feeding adaptations developed throughout the animal kingdom by asking students to match animals to their food. The Spoonbill beak is a perfect example, other specimens have also been suggested in the 'resources' column. You can use these sources as a way to explore types of teeth, as well as non-dental adaptations (e.g. beak shapes or insect mouthparts).	Parrot Fish Jaw: F.6545 Snakes Jaw: R3.25/3 Cave Bear Skull: K.1083 Time: 20 minutes	KS1 KS2 SEND	Biology: Adaptations, Teeth, Food Chains, Nutrition/Diet, Grouping, Predators, Movement, Skeletons
Mimicry as Defence Like the butterflies in this pack, some animals have evolved to use mimicry as defence against predation. They have developed colours and patterns in order to convince predators that they are harmful if eaten.	The Butterfly Game has been created by the Butterfly Genetics Group in the University Department of Zoology. Have your students play the game to see how predation and learnt feeding behaviours of predators can affect the evolution of colour patterns in butterflies. Extension activity: what algorithms would a game like this need to use in order to produce the next generation of butterflies.	Butterfly Game: http://heliconius.org/evolving_butterflies/ Time: 10 minutes; extention 20 minutes	Upper KS2 KS3	Biology: Natural Selection, Evidence for Evolution, Adaptation, Food Chains, Working Scientifically Information Technology: Algorithms, Sequencing and Repetition Maths: Predicting Outcomes

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Convergent Evolution Nature often finds similar solutions to the same hurdles. There are many good examples seen between marsupial and placental mammals. Marsupials have evolved in an isolated part of the world, but some species have similar adaptations to other mammals found elsewhere.	Draw and compare the features and functions of the Tasmanian Tiger with a canid, such as a wolf or fox. What are the similarities and differences in form and behaviour? Why might both animals evolved pointing ears or strong jaws? Extension activity: Compare the Giant Golden Mole with a European Mole in the same way as above. Explore why it took so long for scientists to find out their true origins. For further information see: https://animalbytescambridge.wordpress.com/2013/04/26/giant-golden-mole-chrysospalax-trevelyani/	Tasmanian Tiger Giant Golden Mole European Mole: E.53345.S https://www.ucl.ac.uk/culture/grant-museum-zoology/thylacines Time: 30 minutes	KS2 KS3	Biology: Convergent Evolution, Comparative Anatomy, Adaptation, Developing Conclusions, Behaviour, Scientific Ideas Changing over Time Art and Design: Observational Drawing
Human Impact & Extinction As seen in the Peppered Moth example, our actions can have a big impact on the lives and development of animal species. Many organisations and charities today work together to protect species and their habitats from threat and extinction.	Choose a specimen that is extinct, or endangered on the Red List: http://www.iucnredlist.org/ Explore the different reasons for the species' extinction or extinction threat. If we could go back in time, how could this animal's extinction be prevented? What are the ethical considerations with these solutions?	Kakapo: 18/psi/76/a/1 https://animalbytescambridge.wordpress.com/2013/09/19/kakapo-strigops-habroptilus/ Time: 30 minutes	KS3 High ability KS4	Biology: Environmental Changes & Invasive Species, Human Impact & Ethical Issues
Feather Colours Practical The colours seen in feathers such as the Argus Pheasant can be created in two ways. By pigmentation, or as a structural colour; using microscopic structures and air gaps to scatter light and produce colours.	Grind a yellow or red feather into a powder, then grind a blue feather into a powder. The blue feather will immediately become dark as the structure used to create the colour is destroyed. The pigmented colours of yellow or red remain visible when ground as the pigments are not damaged even though the feather structure is destroyed. Futher information sources: http://www.cam.ac.uk/research/features/why-does-the-kingfisher-have-blue-feathers https://www.theguardian.com/science/punctuated-equilibrium/2007/oct/16/birds-physics	Yellow or red feathers Naturally blue feathers (e.g. peacock feathers) Bowl Grinding tools (e.g. pestle or spoon) Time: 20 minutes	KS3 High ability KS4	Biology: Colours in Nature, Evolution of Colours, Sexual Selection Physics: Working Scientifically, Particle Structures, Light Transmission and Reflection, Differential Colour effects

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