Key Stage 5 Worksheet

Earth LIVE Lessons: Venoms – Awe-inspiring or awful?

What is it about?

In this video, conservationist, venomologist, and snakebite specialist Harry Fonseca Williams, discusses the venomous species of the world.

What is the difference between venom and poison? Find out here. Venoms are injected (e.g. through a bite), poisons are ingested (e.g. eaten).

Watch the video here:
youtu.be/N9b_UFVsrUU

Open file in your web browser to click on the links.

Key facts

- Venomous animals have high **biodiversity**. There are around 600 species of venomous snakes, 2,400 species of scorpions, 4,000 species of pseudo-scorpions, 8,000 species of centipedes, 50,000 species of spiders, and an untold number of venomous insects.
- Other creatures can also inject venom, such as the Iberian ribbed newt (Pleurodeles waltl), which uses its skin and ribs, and the Greening's frog (Corythomantis greening) through its skin and the spines on its head.
- Although the exact number of snake bites occurring each year is unknown (WHO), globally, snake bites kill around 100,000 people a year and even more people are seriously injured.
- Snakebite injury is a major health problem in the developing world. The UN has called snakebite injuries the greatest public health crisis no one has ever heard of. Watch a video about this **here**.
- Venoms are made of proteins (more complex) and peptides (simpler). Peptides bind or break into our cells and stop the cell from functioning. Proteins destroy the cell completely. If we eat venom though, it just gets broken down (unless you have a cut in your mouth!).

About the speaker

Harry's passion for venom started at a young age when he got his pet snake, Sleavey. He studied zoology at Cardiff University and then did postgraduate degrees as well. In 2013, Harry spent a year in Peru with a mentor who would catch snakes, without pinning them by the head. He was regularly bitten and so saw the effects of mild snake venom on a daily basis. A couple of years later he started working on a film called the Elephant Queen. In the filming camp they were inundated with snakes every day – but he was told to stop catching snakes because of the lack of medical resources in the area. In his research, he investigated snake bites and ways of improving the treatment and diagnosis of snake bites.

Venoms

Many species produce venoms, in many cases for predation, but also for defence, and parasitism. Snake venoms are highly complex. They can be categorised into vipers and elapids:

- **Vipers** *(Viperidae)*: hinged fangs, venoms mainly affect internal organs and blood.
- **Elapids** *(Elapidae)*: include cobras, neurotoxic, paralyse the animal, prevent them from breathing. Uses forked tongue to hunt down (smell) prey once venom has had its effect.

Other venomous creatures include:

Arachnids

- Spiders, such as tarantulas, have chelicerae (like jaws).
- Scorpions use the telson (like a tail).
- A pseudo-scorpion injects venom using a fang-like extrusion on claws.

Centipedes

- Modified legs evolved to take down prey, there is a slightly defensive aspect to venom.
- Cone snail
- Mollusc found in all tropical waters, it has a small harpoon to fish prey, and eats fish whole.

Venoms continued...

There are also creatures that only use venom for defence rather than predation, including:

Wasps & Bees

- Where the ovipositor (egg-laying body part) delivers the venom.

Slow loris

- The brachial gland, on the inner arm, produces toxic substances.

Platypus

- Have a venomous hind claw/spur in the males, it is used to defend females against other males.

It has also been argued that some hedgehogs use venomous toads by using their venom to cover their spines.

In venomous fish, all the spines are connected to venom glands, and predators learn not to eat them, including:

- Pufferfish
- Venomous sharks
- Weaver fish
- Scorpionfish
- Lionfish

Parasitic venom

Hematophagous parasites bite animals and use a venom that stops blood coagulating so they can drink free-flowing blood. This group includes:

- Mosquitos
- Ticks
- Lice
- Sandfly
- Vampire bats
- Leeches

Some animals also use venom to store their pray.

- Some animals, including shrews and moles, earthworms and other invertebrates will bite their prey with a venom, which paralyses the prey. They will then store the prey, in a hole, and return to eat it later.

Why are humans using venoms?

Venoms can be useful for medicine. There are some that are being used to treat pain. Research is ongoing on venoms that can treat infections from bacteria and viruses.

We are also researching ways to treat people who have been bitten by a venomous animal. Anti-venoms can be problematic because they are made from proteins that can degrade

(break down) if they are stored for a long time, in a hot place. They are not always the most reliable way to deliver treatment to a bite victim. Researchers hope to develop a drug, from studying venoms, which is the first line of defence and can be administered quickly to give enough time to get to a hospital.

Find out more about this research topic.

Harry Fonseca Williams is available to respond to questions on social media (@hazfw) or on email **harryfonsecawilliams@gmail.com**.

Questions

Interactive: Click on box to start typing

What sort of habitat is a good place to see snakes in the UK?

What is the name of the index used to test how dangerous a snake's venom is, and what is the most venomous snake in the world?

Longer answer activities

Practice your essay planning skills!

A great way to sketch out an essay is to use a 'pyramid'. Here's an example of an essay pyramid:

Essay example 1: Using the **concepts** of adaptation and natural selection, **discuss** how the predation relationship between a venomous newt and a snake could be described as a biological 'arms race'.

Essay example 2: Venoms are made up of either peptides or proteins which are produced by an organism and injected into another organism. **Compare** and **contrast** the structure of peptides and proteins.

Essay example 3: A snake bite could lead to negative effects on the human body, including kidney failure and paralysis.

- **Describe** how kidneys help regulate the body and **describe** what would happen if a bitten victim's kidneys stopped working.
- **Describe** how the nervous system transmits impulses. **Discuss** how venom prevents the transmission of nerve signals.

If you go out in the woods today, please be careful of snake bites! Adders can be found in some parts of the country. Less often, snakes and other creatures can escape from their enclosures. Always be careful around snakes and defer handling to a more experienced adult.

For teachers and home schoolers

Links to Science in the National curriculum for Wales (KS5)

AS Unit 1: Basic Biochemistry and Cell Organisation

"Learners should be able to use given structural formulae (proteins, triglycerides and carbohydrates) to show how bonds are formed and broken by condensation and hydrolysis, including peptide, glycosidic and ester bonds."

"(Learners should be able to recognise and understand but not reproduce the structural formulae of the above molecules.)"

1. Chemical elements are joined together to form biological compounds.
    - (i) the primary, secondary, tertiary and quaternary structure of proteins
    - (j) the relationship of the fibrous and globular structure of proteins to their function
2. Cell structure and organisation
3. Cell membranes and transport
4. Biological reactions are regulated by enzymes

A2 Unit 2: Biodiversity and Physiology of Body Systems

- Adaptations for nutrition
- (j) parasites; highly specialised organisms that obtain their nutrition at the expense of a host organism e.g. Taenia and Pediculus, including examination of specimens and slides of tapeworm e.g. Taenia

AS Unit 3: Energy, Homeostasis and the Environment

- Homeostasis and the kidney
    - the effects of kidney failure and its potential treatments
    - The nervous system
    - the effect of chemicals e.g. organophosphates and psychoactive drugs on the transmission of impulses

Swansea University Science for Schools Scheme
Swansea University Prifysgol Abertawe
EARTH LIVE LESSONS
UNDEB EWROPEAIDD EUROPEAN UNION
Llywodraeth Cymru Welsh Government
Cronfa Gymdeithasol Ewrop European Social Fund
(S4) Funded by the European Social Fund and the Welsh Government.