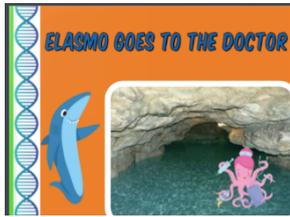


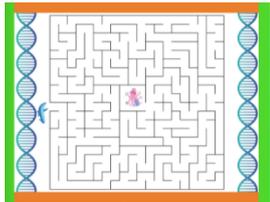
## Chapter 4 ELASMO Goes to the Doctor Teacher's Notes

These notes provide additional information for teachers to help guide you with answers to difficult questions – and much deeper information than the students need.



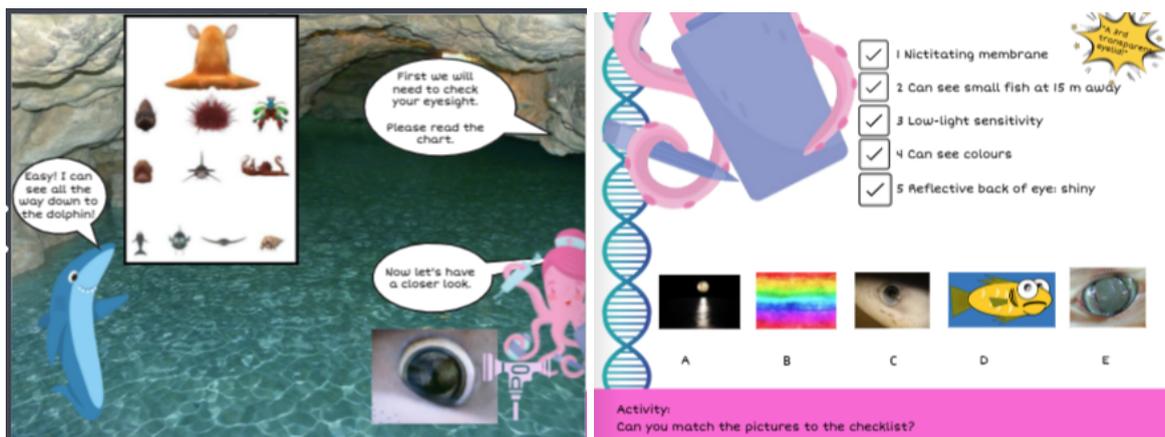
This e-book is to introduce the concept of exceptional senses that Sharks like ELASMO use to survive, hunt and live underwater. It also suggests that a trip to the doctor might be fun.

In this Quarter you would benefit from watching the video output before the ebook-.



A maze to find the Dr's surgery cave, this could be printed out or displayed on the smart board in the classroom with magnetic markers or sticky notes moved along the maze by students until they solve it.

### EYESIGHT



Testing eye sight. Introduces the SIGHT CHART regularly used at the doctors.

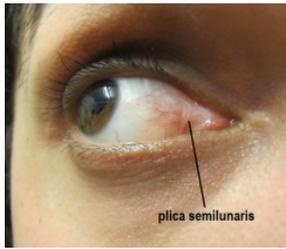
All the images are marine animals humans might never have seen most of them, but a shark would be aware of all different creatures living underwater.

On the bottom right corner, Dr.Octopus is using an **ophthalmoscope** to look into ELASMOS Eye.

She mentions the nictating membrane and the tapetum lucidum:

- **Nictating membrane** – a third eye lid is drawn across the eye for protection. Some sharks close this when biting their prey. Other sharks without this nictating membrane roll their eyeballs under the upper eyelid giving a white-eyed appearance.
- **Tapetum Lucidum** – acts as a mirror in the back of the eye to reflect light making sharks see better at night. “a layer of cells containing a silvery pigment. This works like a mirror to reflect any light that passes through the retina back into it for greater sensitivity” It also means that the shark’s eye appears to shine in the dark – like a cat’s.

### Activity:



This pink part in the human eye is actually the remainder/vestigial structure of a nictating membrane. But Vestigial means that it has no more use to us. So the answer is no – we do not have a nictating membrane And we don't have a Tapetum Lucidum – If we did – our eyes would shine the same way the eyes of a cat shines at night!

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### Extra information:

- **Shark eyes are typical of most vertebrates, including humans.** The jelly-filled eyeball is protected in a socket or orbit in the skull. At the front of the eyeball is a transparent “window” – the cornea. Light passes through this, through a hole called the pupil in a ring of muscle known as the iris, through a hard, ball shaped lens, through the clear jelly within the eyeball, and shines on the light sensitive layer on the rear eyeball lining: the retina. (Parker, 1999) (Parker, 1999) (Parker, 1999)
- **Most sharks have eyes on the sides of the head facing outward rather than to the front.** They can see backward and forward, even up and down, at the same time. They are unable to see the same image with both eyes – like our forward-facing eyes, this limits their ability to judge distances well by sight using binocular or stereoscopic vision. They can see around 15 m in good clear water. (Parker, 1999)
- **Sharks living in clear waters are able to see some colours,** but whether the shark sees them like we do is not yet known. Sharks living in gloomy mid-water have bigger eyes, to catch more light. Big eye Thresher sharks that live in deep water have eyes the size of a human's fist.

## HEARING



Shark's ears do not stick out like human ears. **Shark's ears are tiny holes behind the eyes.**

Sound and vibrations travel as ripples of water pressure. Sound travels faster in the water because the particles are closer together and can move a vibration further.

There are three sound files for the children to experiment with. This could lead to discussions about what the sound is.

Perhaps this could lead to an experiment in sound vibrations

<https://www.youtube.com/watch?v=ivSS0Q8J5LY> or making a string and can telephone

<https://www.youtube.com/watch?v=PmmGSF7TXBI>

### **Activity**

Big sound icon- Dog barking

Top Sound icon – Sea lion Barking

Bottom sound icon – Fish flapping

Human Hearing Range 180m

## SMELL

1 You have two nostrils. Let's test them!

2 Now we need to see if you know the difference between good and bad blood.

3 I'm going to put some blood into this Olympic-size swimming pool - Tell me when you can smell it!

LEFT RIGHT

Looking good! This means you have stereo-smell! So you know which direction the smell comes from.

This is the only one that smells good!

Great! That's the only type of blood here that you're attracted to!

NOW! I can already smell fish blood.

Amazing! You can already smell the blood after only ONE drop!

Elasmo, your nostrils are clear. All is well.

- Sense 1 drop of fish blood in Olympic-size swimming pool (2.5 million liters!!!!)
- 100 times better than a dog
- Stereo-smelling
- Attracted to fish blood

A B C D

Activity: Can you identify which smells will attract a shark?

**Two thirds of the shark's brain is devoted to olfaction** – showing how important the sense of smell is underwater.

Sharks have two nostrils, in front their eyes. As they point in opposite directions the shark can tell where the smell comes from LEFT or RIGHT. Called **Stereo smell**.

Sharks have a limited range of smells that they react to – mainly the ones that help it eg smell-carrying substances in water (odorants) produced by prey, predators or mates - for these the shark is super sensitive. **Fish blood is very high on the list and sharks can react to as little as one part in a million eg one pinhead size drop in a bathtub full of water or 1 teaspoon of fish blood in an average swimming pool.**

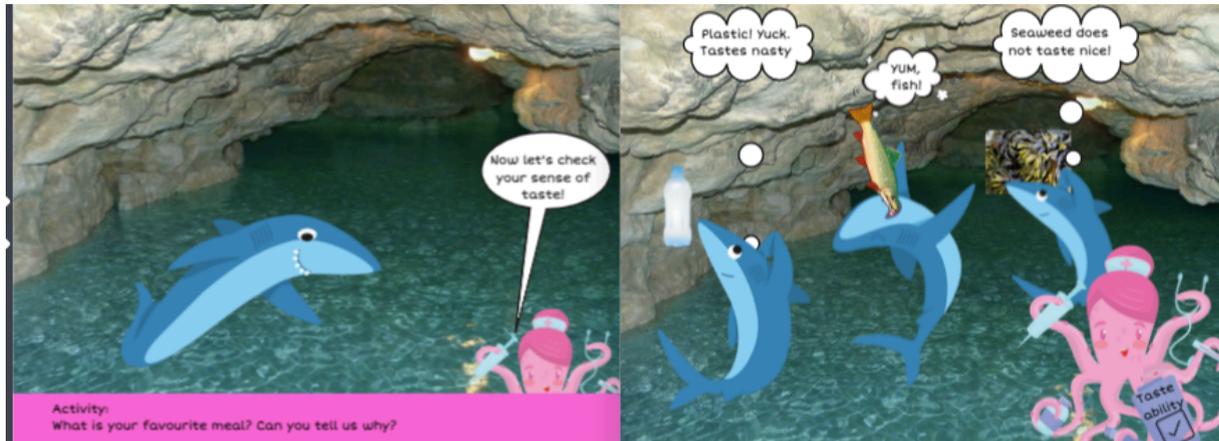
Experiments show sharks react most strongly to body fluids and secretions of injured or distress prey. A reasonably large, injured animal such as a seal could attract a shark from 1.6 km away. If the animal is healthy and uninjured the shark reacts less strongly and quickly loses interest. They are not attracted to human blood.

### Activity:

A

C

## TASTE



Sharks like humans can discriminate only a few basic flavours, such as bitter, sweet, salty, and sour.

Not much is known about shark taste but we do know **different shark species have different preferences**. Some are planktivorous, meaning they eat plankton, others are very generalist feeders, meaning they like many different food sources. Others have a more specific taste for either fish or crustaceans. There is even a shark that eats seaweed- but it is the only known species to do this -the **tibur hammerhead shark** (<https://www.youtube.com/watch?v=xVUUyf8itw&t=9s> )

The media would have us believe that sharks EAT HUMANS – this is mainly untrue. Sharks are carnivores **but human flesh does not taste good to them**. Sharks who are still learning what is good to eat and have not encountered humans before may take a small “test taste” bite which can have unfortunate consequences to a human – who may bleed to death because of this encounter. But it is only ONE bite. If they liked the human meat they would continue eating.

**BUT to put this into context an advertising campaign in 2010 called RETHINK THE SHARK stated that 652 people world-wide were killed by falling off chairs and 4 were killed by sharks!**

### **Activity**

The purpose of this activity is to stimulate discussion and talk about preferences.

## ELECTRIC AND PRESSURE SENSES

Time to check your electric and pressure sensors!

You need these to work well because this is how you feel what is around you! You use them for hunting and to protect yourself.

Your Ampullae of Lorenzini detect the electricity made by moving muscles and your lateral line senses changes in water pressure.

Close your eyes and tell me when you can feel ripples in the water!

Activity:  
Blow on your hand. Feel the air pressure change. This works like Elasma's lateral line feeling changes in water pressure.

ELECTRIC AND PRESSURE SENSES

- Lateral line detects pressure changes
- Ampullae of Lorenzini can detect electrical fields
- Can sense fish heartbeat when it hides under sand

AWESOME!

Elasma, well done! Your annual medical says you are 100%. Off you go and I'll see you next year!

Thank you so much Dr. Sue Octopus! Goodbye!

**The lateral line:** Could be considered the equivalent sense to a humans sense of touch (x1000). is a row of very sensitive cells running along both sides of the shark's body which are able to detect small changes in the water pressure.

- This enables the shark to know where anything and everything is in the water around its body. **As other creatures move through the water they create small ripples, and therefore changes in pressure which the shark's brain can react to – even in total darkness.**
- Many scientists believe that the lateral line helps the shark navigate the oceans by using the earth's weak magnetic fields – but this is still not understood. Scientists are still trying to understand many things about sharks. Sharks have been in the oceans for some 400 million years and they have evolved extremely well developed senses.

**The Ampullae Of Lorenzini:** These allow sharks to “see electricity” Called electroreception. are very sensitive jelly filled pores around the snout of the shark which are electroreceptive. They can sense the electricity generated by a heart beating in a creature hiding under the sand!

- **This is a special sense that humans don't have.** It is more common in aquatic species. We likely lost this ability as the air is a poor conductor of electricity and we had no more use to this.