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Welcome to the Museum

ADMIT ALL

Anatomicum

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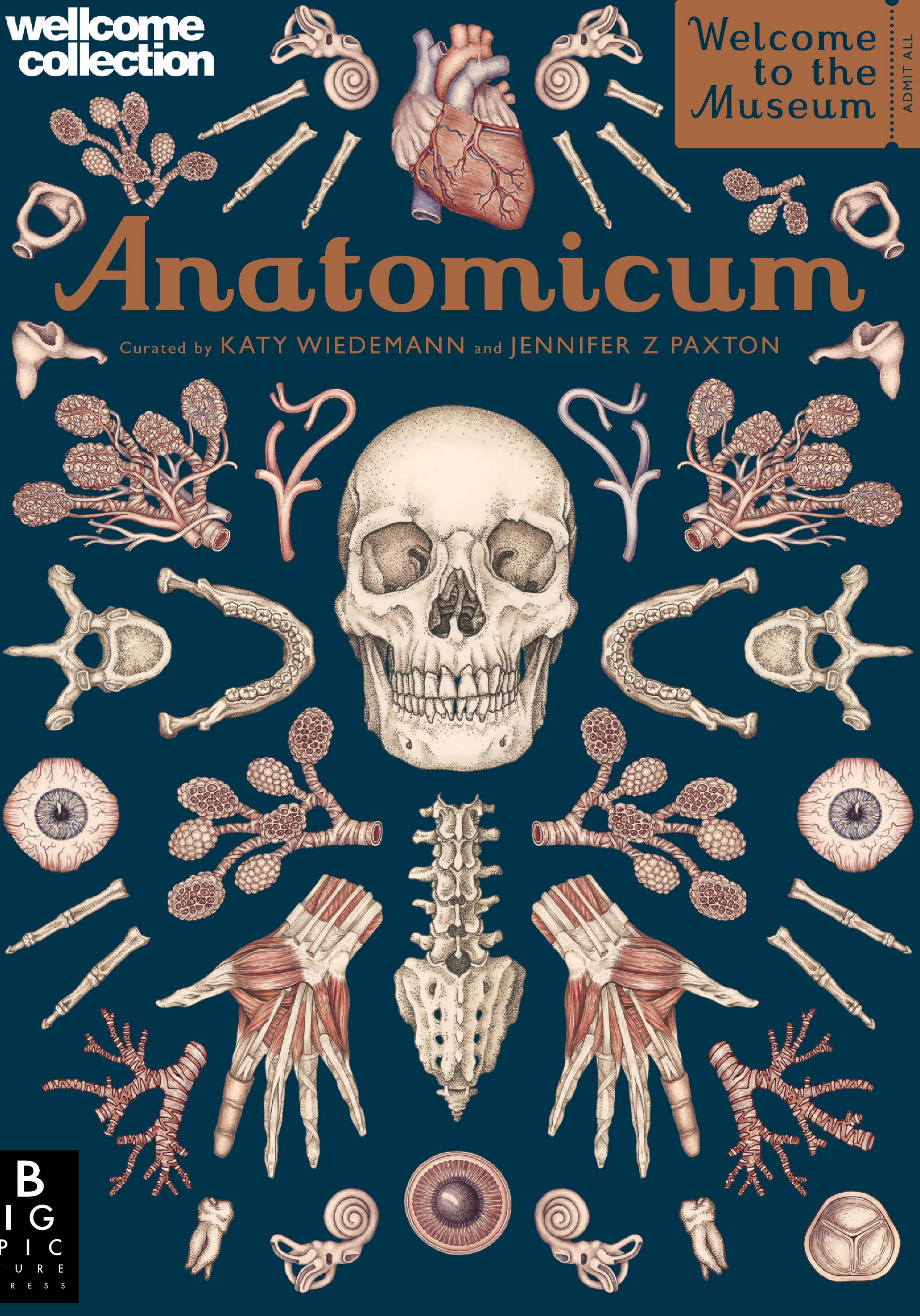

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The *Muscular* System

From the cautious first steps of a baby finding its way in the world, to the speed of an Olympic athlete or the grace of a ballet dancer, the muscular system is responsible for producing every possible kind of movement.

Found throughout the body in three types – skeletal, cardiac and smooth – all muscle tissue shares one important feature: the ability to contract, or shorten, making part of the body move. In skeletal muscle, contractions pull on the bones they attach to, moving them into a new position. Because these muscles can only pull in one direction, they usually work in pairs. So after one muscle contracts to bend a joint, a corresponding muscle contracts to straighten it out again. For example, when the *biceps* muscle in your upper arm contracts, it pulls on tendons connecting to your forearm, raising your hand and wrist upwards. To lower your forearm again, the *biceps* relaxes and the *triceps* muscle on the underside of your arm contracts instead. Skeletal muscle gives the body its shape, and is thought to account for around 40 per cent of an adult's total body weight.

As well as moving the skeleton, the muscular system has other key roles, from pumping blood around the body (cardiac muscle), to moving food through the digestive tract (smooth muscle), to communicating via facial expressions (skeletal muscle). Muscles even have a role to play in keeping us warm – in fact, muscle contractions produce around 70 per cent of our total body heat.

Key to plate

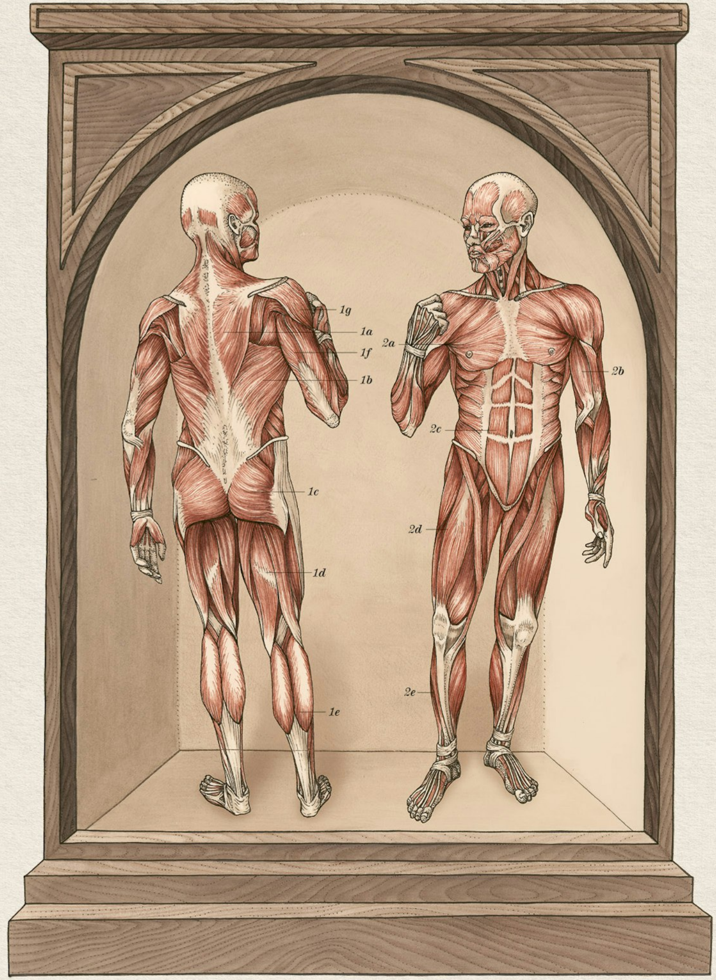
1: **Skeletal muscles, seen from the back (posterior view)**
There are over 600 named skeletal muscles in the body. Their names follow simple rules based on the action, shape, size or location of the muscle. *Flexor* and *extensor* are commonly used prefixes, which identify their function as *flexors* (for bending) or *extensors* (for straightening) at joints.

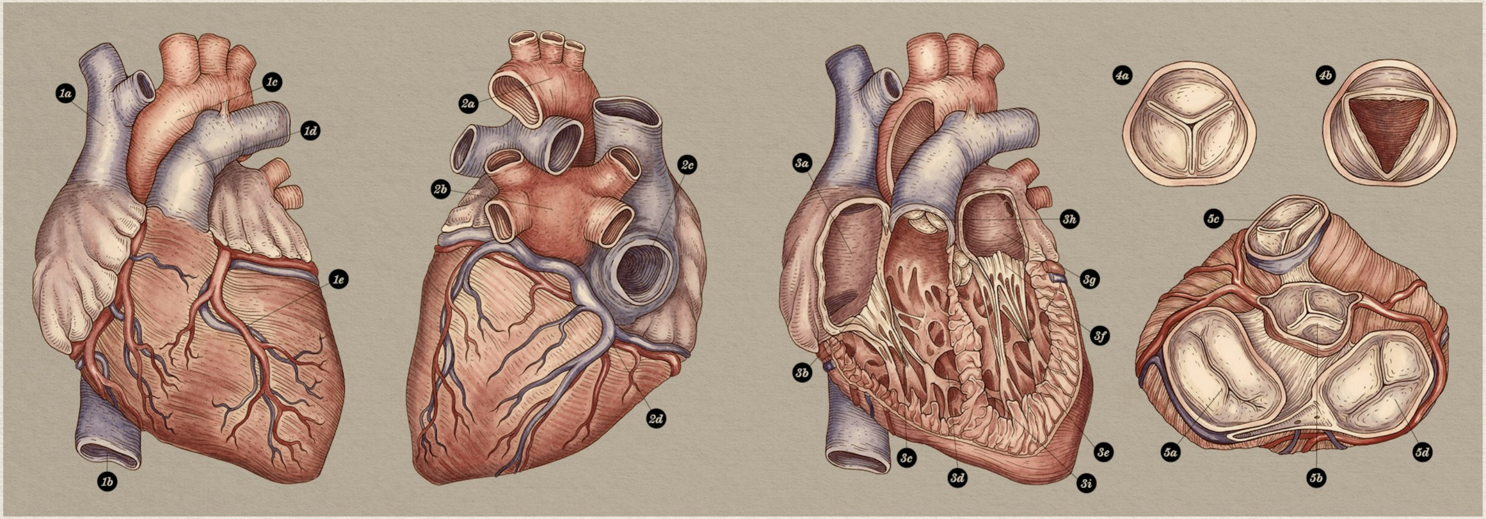
Scientific terms also relate to the comparative size of muscles such as *maximus* (large), *minimus* (small), *longus* (long) and *brevis* (short).

The word 'muscle' itself comes from the Latin for 'little mouse', suggested to be because the muscle belly (the central part that bulges) and tendon (that attaches it to the bone) resemble a mouse and its tail.

a) *Trapezius*
b) *Latissimus dorsi*
c) *Gluteus maximus*
d) Hamstrings (*semitendinosus, semimembranosus* and *biceps femoris*)
e) *Gastrocnemius*
f) *Triceps brachii*
g) *Deltoid*

2: **Skeletal muscles, seen from the front (anterior view)**
a) *Pectoralis major*
b) *Biceps brachii*
c) *Rectus abdominus*
d) Quadriceps (*rectus femoris, vastus lateralis, vastus medialis, vastus intermedius*)
e) *Tibialis anterior*





The Heart

The hardest working muscle in the body is the heart, beating over 100,000 times every day of our lives to transport blood all the way around the body. Located under the ribcage and between the lungs, this organ is only about the size of a fist. It acts as a specialised pump – in fact, two pumps in one, each with a vital job to do. The right side of the heart pumps blood towards the lungs where it picks up oxygen. Oxygen-filled blood returns to the heart, where the left side pumps it on to the rest of the body. A thick wall called the septum divides the right and left sides, and keeps the blood in each 'pump' separate. Although both sides are similar in appearance, the left side is thicker and stronger as it has to push blood further around the body against high pressure.

The pumping action of the heart is produced by cardiac muscle in its walls, which contracts (squeezes) to push blood between one part of the organ and another. The four areas, or chambers, within the heart are split into two ventricles at the bottom and two atria at the top. With each heartbeat, the two atria contract first, pushing the blood inside them down into the ventricles. Then the ventricles contract, pushing the blood out of the heart and on to other parts of the body. After contracting, the heart muscle relaxes, allowing the chambers to refill with blood before the next contraction. One complete cycle of this pattern, or heartbeat, takes less than a second to occur.

It is crucial that blood only flows in one direction in the heart. To control this, special valves exist between the ventricles and atria and the blood vessels entering and exiting the heart. These act like trapdoors, letting blood flow through one way, but closing tightly to stop it from flowing backwards. These valves slamming shut make the rhythmic 'lub-dub' sounds of the heart beating.

Key to plate

1: **Heart, seen from the front (anterior view)**
a) Superior vena cava
b) Inferior vena cava
c) Ascending aorta (to body)
d) Pulmonary trunk (to lungs)
e) Cardiac blood vessels supplying the wall of the heart

2: **Heart, seen from behind (posterior view)**
a) Arch of aorta
b) Left atrium
c) Entrance to right atrium via inferior vena cava
d) Cardiac vessels draining the wall of the heart

3: **Heart, internal structure, from the front (anterior view)**
a) Right atrium
b) Tricuspid valve
c) Chordae tendineae (heart strings)
d) Right ventricle
e) Left ventricle
f) Mitral (bicuspid) valve
g) Left atrium
h) Pulmonary valve
i) Interventricular septum

4: **Heart valves**
Valves between the atria and ventricles, and ventricles and blood vessels, stop blood flowing backwards.
a) Closed
b) Open

5: **Heart, with view of the valves, from above (superior view)**
a) Mitral (bicuspid) valve
b) Aortic valve
c) Pulmonary valve
d) Tricuspid valve

The Mouth & Throat

The oral cavity, known as the mouth, is the gateway to the body: this is where all food and drink starts its journey through the digestive system. Even before you take your first bite of food, your body begins to prepare itself for digestion. The smell of food cooking (or sometimes just the thought of a tasty meal) is enough to kick-start the salivary glands into action. They pump out a watery liquid called saliva – on average over 2 litres each day – literally making your mouth water. As well as making the food you eat wetter and easier to swallow, saliva contains chemicals called enzymes, which start to break down complex molecules within food. Teeth also grind food down mechanically, and, together with the tongue, help shape food into a slimy ball called a bolus, which is easy to swallow.

At the moment of swallowing, an important safety mechanism kicks in at the top of the pharynx (throat). A small trapdoor called the epiglottis swings into place, covering the entrance to the trachea (windpipe) as food and drink slips into the oesophagus (food pipe). This ensures no food or drink accidentally enters the respiratory system. Sometimes the epiglottis fails and things 'go down the wrong way' – but a cough is usually enough to clear the airway again, and no harm is done.

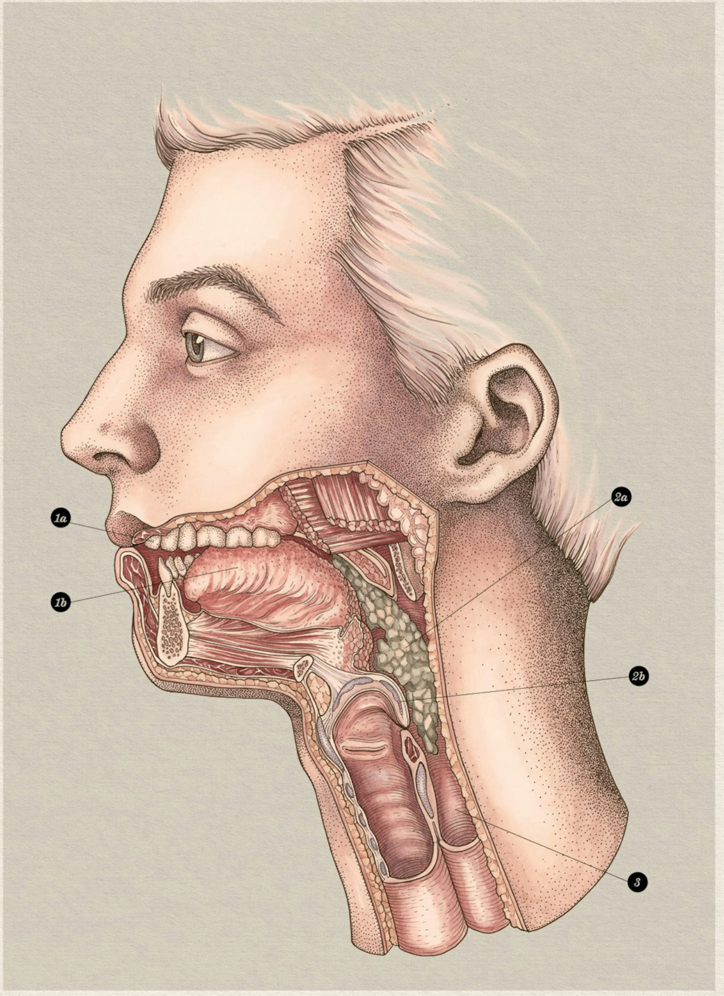
Once a food bolus has passed the epiglottis, it travels down the oesophagus, a long, muscular tube. Rather than acting as an open chute that food simply falls down, the muscles of the oesophagus squeeze the bolus down towards the stomach. Incredibly this means food would still reach the stomach even if you were standing on your head!

Key to plate

1: **The mouth (oral cavity)**
a) Teeth: The 32 teeth are used to rip, tear and grind food into smaller pieces that can be swallowed.
b) Tongue: This muscular organ is made up of several muscles, the largest of which is the *genioglossus*. During swallowing, the tongue shapes the food and pushes it towards the back of the mouth.

2: **The pharynx (throat)**
a) Food bolus
b) Epiglottis: Although it is usually classed as part of the respiratory system, the epiglottis has an important role in the digestive system. During swallowing, it folds over the larynx, stopping food from entering the airways.

3: **The oesophagus (food pipe)**
This muscular tube, approximately 25cm long, runs from the pharynx to the stomach, transporting the food bolus on into the rest of the digestive system.



The Nose & Tongue

Our senses of smell and taste can detect and recognise a staggering number of substances. For modern humans, these senses are most likely to whet our appetites or to bring back distant memories, but they can also alert us to a potential danger, for example toxic chemicals or rotten food. Even so, they are not usually considered essential. Yet many years ago, our senses were far more important for our survival. The repulsion created by disgusting smells or tastes helped to keep the body safe from life-threatening infections that could be found in faeces (poo), dirty water or bacteria-ridden food, which would once have been daily encounters.

It is thought that the average human can detect several billion different odours. The sense of smell is most sensitive at birth to help newborns recognise their mother. Smell works by detecting odour molecules which float in the air around us. When we breathe, they enter the nostrils and pass into the nasal cavity – a large space behind the external nose. The roof of the nasal cavity contains millions of receptor cells that detect odours and transfer the 'smell' into an electrical impulse. This signal travels to the brain via a connection called the olfactory nerve.

Although our sense of smell is said to be 10,000 times more powerful than our sense of taste, the two are closely linked, and food tastes different if our ability to smell is impaired. This is something you might have encountered before, especially if you've eaten while you have a heavy cold or have pinched your nose while chewing food.

Thousands of taste sensors are found on the top surface of the tongue, on little bumps called papillae. More commonly known as taste buds, these special sensors detect chemicals in the food we eat and send messages to the brain. For many years, there were known to be four basic flavours of food that we can detect: sweet, sour, salty and bitter. More recently, a fifth taste category has been proposed, called *umami*, meaning 'savoury' in the Japanese language.

Key to plate

1: **Nose**
a) External nose: Mostly made of cartilage, the external nose is where odour molecules will enter the nasal cavity through the nostrils *(i)*.
b) Nasal cavity: This space inside the skull is home to the olfactory nerves *(i)* – the nerves that detect odour molecules and transmit the sensory impulse towards the brain.

2: **Tongue**
The tongue sits in the oral cavity and is made up of several muscles. Many thousands of taste buds (or papillae) cover the top surface and are responsible for detecting one of the five different categories of taste sensation: sweet, salty, sour, bitter and umami.