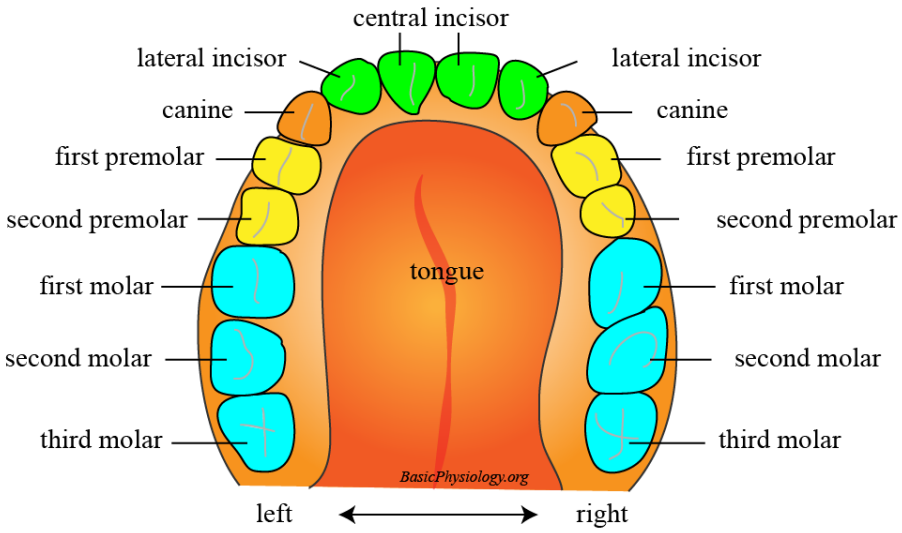
E.2. The Mouth and the Nose

A. Introduction

1. Yes, the food comes into the body through the mouth! This is the first stop where the food starts to be processed (in tis case chewed into bits).	2. I also include the nose here, as you will see later, because the smell plays an important factor in the choice and the delight in our eating.
3. The function of the mouth in the process of eating and chewing is performed by several structures:	4. The following structures will be discussed: a. the teeth b. the muscles c. the glands d. the (masticating) muscles

B. Teeth

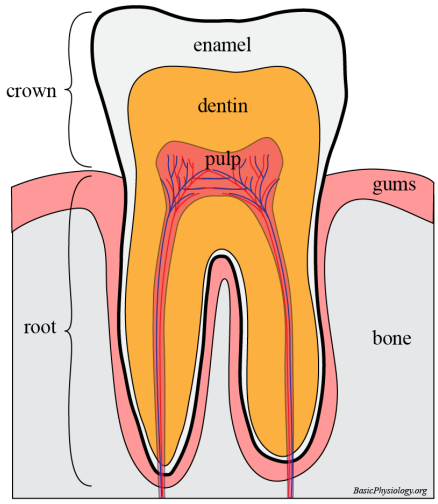
1. Obviously, we need our teeth to be able to bite and crunch our food into small bits.	2. The diagram shows the distribution and type of teeth in our mouth. This diagram depicts the teeth located in the lower jaw (= mandible) but the same distribution is also true for the upper jaw (= maxilla).



3. When we are adults, we have 32 teeth in our mouth, 16 in the upper jaw and 16 in the lower jaw. Children have less, mostly about 20 'milk' teeth.	4 The teeth at the front, the **incisors**, are good at cutting our food whereas the tooth at the back, the **molars**, is better at chewing and grinding food.

5. Btw, the last or third molar is also called the 'wisdom teeth' (because it is the last one to develop, in young adults.

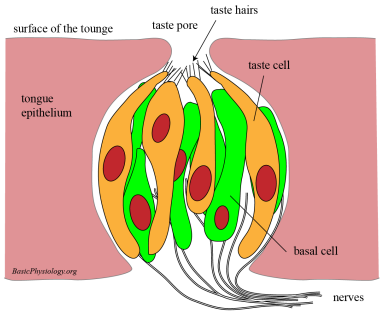
C. Anatomy of a tooth

1. This diagram shows the anatomy of one tooth, in this case a molar.	
2. The tooth consists of the following two parts: the **crown** (located outside the gums) and the **root** (located inside the gums and bone).	
3. Inside a tooth, there are three layers: a. the pulp b. the dentin c. the enamel	
4. The pulp consists of soft connective tissue with small arteries, veins and nerves supplying the tooth. This is the 'root' where the tooth grows from.	5. The dentin is a tough mineralized tissue but is also porous to allow nutrients from the pulp to diffuse into the tooth.
6. The enamel is the toughest material (in the whole body!), is very hard, non porous and is the substance with which we cut and grind our food.	7. In fact, the enamel is also called **ivory** when 'stolen' from the tusks of elephants for making delicate carvings such as Japanese netsukes. *(link: https://en.wikipedia.org/wiki/Netsuke)*

D. The tongue

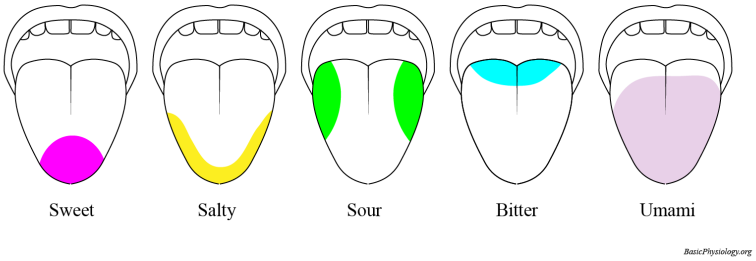
1. The tongue is a skeletal muscle, attached at one end to the bones of the skull.	2. Its major function is to move the food (= bolus) around the mouth, by the teeth and the inner membranes of the mouth cavity and to mix it with saliva to help the digestive process.

3.
The upper surface of the tongue also has several sensors to detect five types of tastes. They do this by having taste buds imbedded into the surface of the tongue.



4.
These taste buds have sensory cells that pick up a particular taste with their taste hairs and then deliver action potentials to the nerves that go to the brain.

5.
Because these taste cells don't live very long, 5-10 days max, they are constantly being replaced by the accompanying base cells.



6.
These are the five tastes that the tongue can detect. Please note that the tip of the tongue detects the nicest thing in our food: sweet!

7.
Also note that that the back of the tongue detects what could be most dangerous for us, before swallowing something that is very bitter!

8.
Although you may be familiar with the tastes sweet, salty, sour and bitter, you may not be familiar with the taste 'Umami" (I wasn't!).

9.
Umami as a taste was 'discovered' only last century by a Japanese scientist. Umami in Japanese means 'delicious'. It tastes essentially as yummy, nice flavor in many types of food, in sushi's, in tomato sauce etc.

10.
A recent article informed me of two new/important facts about these taste bugs:
a) the taste areas depicted in the above figure shows where a particular taste (sweet, or salty, etc) is most sensitive. But other areas in the tongue can also detect sweet, salty or other tastes, only less sensitive. In other words, the taste bugs are located all over the tongue.

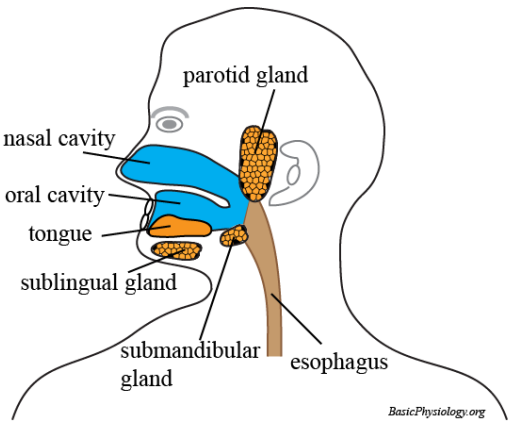
11.

b) we also have taste bugs elsewhere in the body! Apparently, taste bugs are also located in the gastrointestinal tract, muscles, brain etc. and ongoing research will discover more locations and what they are doing there!
(for more see: *The Textbooks Were Wrong About How Your Tongue Works*)

D.2. Artificial tasting?

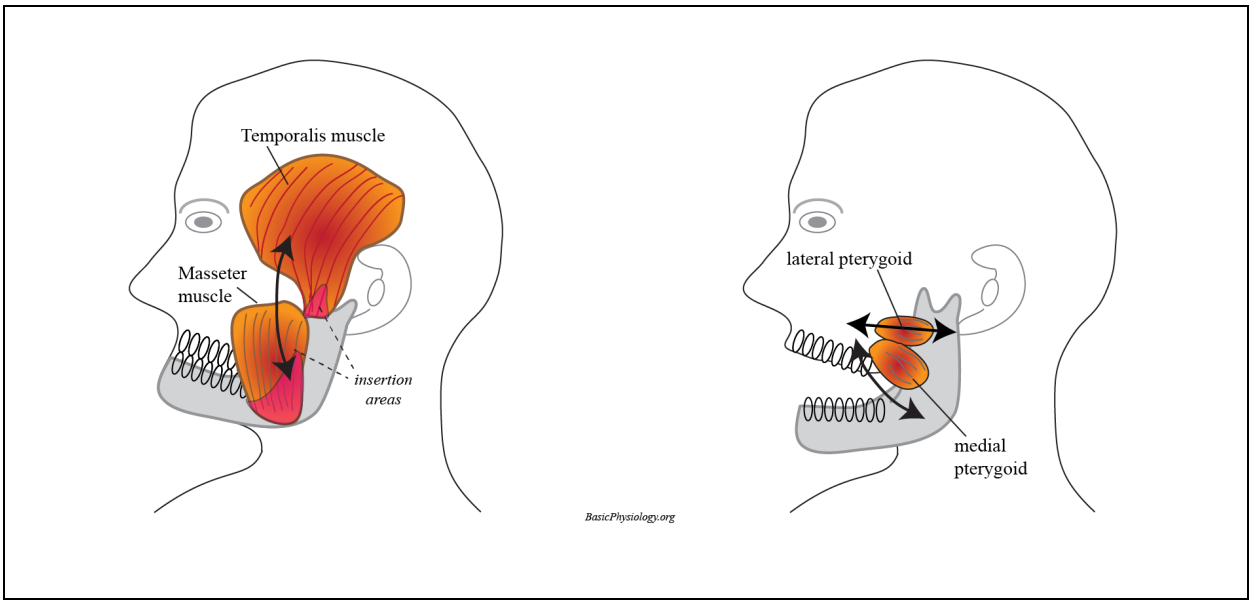
NYT just published an article containing a system whereby you can taste what someone else is eating (= tasting) far away! But they are also testing electrical stimulation of parts of the tongue! In this case, a very small pump will pump some fluid from a very small bag when stimulated by a signal from far away. Link: NYT	 Anterior (middle)

E. The salivary glands

1. When breaking down our food with our teeth and tongue, it helps a lot if this is all mixed up with a liquid; saliva.	2. Therefore, we have several glands that produce saliva in the neighborhood of our mouth: a) the parotid gland b) the submandibular gland c) the sublingual gland
3. Sub-lingual = below the tongue (=lingua)! Sub-mandibular = below the mandible; the lower jaw	4. Actually, we already start producing saliva when we even think about our food! We are getting hungry!
5. We actually produce a lot of saliva; about 0.5 - 1.5 liters per day! And this saliva is very helpful as it contains enzymes to start breaking down several compounds in our food such as starches.	
6. But, saliva also contains mucus, which keeps our mucous membrane wet and healthy.	
7. Finally, saliva secretion is regulated by our brain, mainly through the parasympathetic nervous system. That's why, when you think of nice food, you already start salivating!	

F. The masticating muscles

1. You also need muscles to chew your food. This is called 'mastication'.	2. You can chew by moving your lower jaw (=mandible) against the upper jaw (= maxilla).
3. This chewing will grind your food into smaller particles so that the digestive juices from the saliva can access the food particles.	4. Several muscles are involved in the process of mastication: a) the masseter muscles b) the temporalis muscles c) the medial pterygoid muscles d) the lateral pterygoid muscles
5. These 2 x 4 muscles (left and right = bilateral) determine the movements of the mandible against the maxilla using the joint that connects these two structures: the temporomandibular joint.	6. This joint is very special as it allows multiple types of movements of the mandibular such as chewing (left to right), moving the jaw forward or backward, and opening or closing the jaw.
7. The **masseter** muscle is the strongest muscle. It lies on top of the other muscles and is used mainly to open or close the mouth.	8. The **temporalis** muscle is the largest muscle of this set, originating from the side of the skull to taper down to a tendon that connects to the posterior part of the mandible. Upon contraction it will close the mouth and pull the mandible back (=retract) towards the skull.
9. The **medial pterygoid** muscle connects the bottom border of the skull to the back of the mandible. Contraction of the medial pterygoid will close the mouth.	10. The **lateral pterygoid** muscle also connects the border of the maxilla to the back of the mandible and is located above the medial pterygoid, running horizontally. When both left and right lateral pterygoid contract, this will protract the jaw (moving forward). When only one side contracts, this will produce a 'side to side' movement.


Temporalis muscle
Masseter muscle
insertion areas
BasicPhysiology.org
lateral pterygoid
medial pterygoid