Special Senses: Taste & Smell

A nervous system lab activity using Visible Body’s Human Anatomy Atlas

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This lab activity is aligned with Visible Body's Human Anatomy Atlas app.

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1. What do you do when you smell?
   You draw air into your nasal cavity.

2. What do you think creates odors?
   Chemicals within the air

3. The goal of your senses of smell and taste is to take sensory information from the environment and convert that information into a neural signal. This involves the stimulation of receptors that encode that information. What do you think is stimulating the receptors in this case?
   Chemicals

4. Do your senses of smell and taste work together? Plug your nose. Does food taste the same when your nose is plugged as it did when it was not plugged?
   When your nose is plugged, you taste a lot less than when it is unplugged. This is because your sense of smell is intimately linked with your sense of taste. You actually smell much of what you perceive yourself as tasting.
IN-LAB EXERCISES

A. Olfaction

Go to the Views menu, select Regional Views, and choose 1. Head and Neck.

You are responsible for the identification of **all bold terms** and answers.
1. Hide the following structures:
   a. Muscles
   b. Vessels
   c. Lymphatic system
   d. Frontal bone
   e. Dura mater
   f. Frontal lobe of the brain
   g. Falx cerebri

2. As you zoom in, you will see two yellow nerves between the eyes. These are the olfactory nerves (CN I).

3. The end of the olfactory nerve is the olfactory bulb. Hide an olfactory bulb. What you see now is the cribriform plate of the ethmoid bone.
   a. Note that this plate has small yellow projections coming through it. These are projections from the olfactory bulb that project into the nasal cavity, capturing volatile compounds with receptors on their cilia and turning those compounds into neural signals.

   b. What kind of tissue is the olfactory bulb?
   Neural

   c. Examine the path that air must take to reach those receptors. It goes through the nasal cavity, flowing past the nasal conchae, which mix, moisten, and warm the air. The turbulence created by this movement makes it more likely that an odorant will reach the receptors on the olfactory epithelium.

   d. Note that you have two olfactory bulbs. What function do you think this serves?
   Since the nose is divided by a septum, having two olfactory bulbs allows each olfactory bulb to receive and process its own information. This allows you to orient toward a smell.

   e. What region of the brain does the olfactory bulb send its signal to?
   The olfactory area of the temporal lobe of the cerebral cortex
4. Hide the maxilla, the mandible, and the parotid salivary gland. Now, you will see a pinkish tube. This is the pharynx. Note that the **oropharynx** and the **nasopharynx** are physically connected. This means that odorants do not have to enter only from your nose; they can also flow from the oropharynx through the nasopharynx and to the olfactory receptors. In fact, if you plug your nose prior to taking a bite of food, you will be able to experience how much of your sense of taste is actually due to your sense of smell.
A. Go to the Views menu and select Cross Sections. Go to the coronal set of head cross sections and choose 1. Head (Orbit).

1. Note that there is a division or septum between the nostrils. Why do you think the septum is important?

   The septum allows for separation between the nostrils, keeps you okay if one nostril gets blocked, and allows you to triangulate sources of smell.

2. Note that the nasal cavity contains bony projections called the nasal conchae; these serve to make the air entering the nose swirl, so it is warmed and mixed. They also allow for the movement of odorants, making them more likely to contact a receptor.
PART 2: TASTE

A. To Start: Go to the Views menu, select Microanatomy, and choose 12. Tongue Regions.
You are responsible for the identification of all bold terms and answers.

1. Note that there are no bones or joints in the tongue. What do you think the muscle of the tongue moves against to create the movements needed for talking and eating?

   The tongue has some attachment points, but most of its movement involves it moving against itself in different planes.

2. Find the following regions.
   a. **Root**
      i. What is the root of the tongue connected to?
      **The hyoid bone**
   b. **Palatine tonsils**
      i. What function do the palatine tonsils serve? Discuss how their location influences their function.
      **They have an immune function (MALT associated tissues), which protects the digestive tract from pathogens that would enter via the mouth.**
      
      ii. Why would they be larger in children than in adults?
      **The child's immune system is still adapting and learning to function, which means a child's immune structures are often larger than those of adults.**
c. **Lingual tonsils**

d. **Median sulcus**

   i. This divides the tongue into two lateral halves.

e. **Apex**

f. **Frenulum**

   i. What is the function of this part of the tongue?
   
   **It restricts the movement of the tongue.**

   ii. What happens when the frenulum projects to the apex of a tongue (also known as being tongue tied)?
   
   **The tongue is not as free to move as it should be. The person may have problems with speech, as well as eating.**

g. **Circumvallate (vallate papillae)**

   i. Note that the circumvallate papillae form a somewhat V shape, when you are looking at the tongue. As there are many types of papillae, this is a good way to remember which ones are the vallate.

   ii. What is the function of these papillae?
   
   **These papillae are involved in taste.**
B. Go to the Views menu, select Regions, and choose 1. Head and Neck.

1. Hide the mandible and examine the tongue. Which nerves receive taste information from the tongue?
   **CN VII facial, CN X vagus, and CN IX glossopharyngeal**

2. Do they receive their sensory information from the same parts of the tongue?
   **No, the facial nerve receives its sensory information from the anterior tongue, the vagus nerve receives its sensory information from the back of the tongue/throat, and the glossopharyngeal nerve receives its sensory information from the back of the tongue.**

3. Draw a diagram of the taste pathway below.
   **Taste buds > glossopharyngeal/vagus/facial nerve > medulla oblongata > thalamus/cortex/insula**
1. Locate the **lingual tonsils**.

2. Locate the **circumvallate papillae**.

3. Having located these items, what part of the tongue is this section from? Justify your answer.
   
   *This is the back of the tongue. You can tell by the presence of the lingual tonsils and the circumvallate papillae.*

4. Select the **filiform papillae**. Note their jagged appearance. How does this appearance influence their function?
   
   *It allows them to move food and break it down more by increasing friction.*

5. Select a **fungiform papilla**. These are named because of their mushroom-like appearance.
   
   a. Where are they typically found?
      
      *They are found on the body of the tongue.*

   b. What is their primary function?
      
      *Taste*
6. Rotate the tongue section, so you have a side view of a circumvallate papilla. Select the papilla. Zoom in to examine the taste buds.

- Note that each taste bud is made of multiple cells
  - What are the two cell types present in a taste bud?
    **Support cells and receptor (gustatory) cells**

- How do these taste buds come into contact with tastants?
  **The gustatory cells have a taste hair that projects from a pore. This hair has receptors for specific tastants.**
PUTTING IT ALL TOGETHER

1. When an odorant enters the nose, what are all the structures it passes on its way to becoming a fully processed conscious neural signal (in the cortex). Fill in the blanks below.

The odorant enters the ____nasal____ cavity and passes along the ____septum____, which divides the nose into two nostrils, on its way past the ____conchae____, which make the air more turbulent. Then, it reaches the cilia on the receptors of the ____olfactory epithelium____, where it binds, creating a neural signal. That signal travels through the ____cribriform plate____ of the ethmoid, on its way to the ____olfactory bulb____. The signal is then transferred to the ____olfactory nerve____, which takes it to the olfactory area in the ____temporal lobe____ of the cerebral cortex.

2. When a tastant enters the mouth, what are all the structures it passes on its way to becoming a fully processed neural signal? Fill in the blanks below.

The food enters the mouth, passing the ____apex____ (tip) of the tongue. It is moved around by the motion of the tongue and teeth as the food is chewed. Its movement is facilitated by ____filiform papillae____ on the tongue, which are jagged, aiding them in their ability to move food. ____Fungiform papillae____, on the ____body____ of the tongue, and ____circumvallate papillae____, located ____toward the back of the tongue____, come in contact with the ____tastants____. Both types of papillae have ____taste buds____ that have receptors for the individual tastes—sweet, sour, salty, umami (savory), and bitter. Once a tastant is bound to the receptor, it creates a signal that travels through one of three cranial nerves, depending on the location of the taste bud. For a taste bud located on the front of the tongue, the signal travels through the ____facial nerve____. For a taste bud located on the back of the tongue, the signal travels through the ____vagus nerve____. For a taste bud located on the middle and back of the tongue, the signal travels through the ____glossopharyngeal nerve____. These signals travel to the ____medulla oblongata____ of the brainstem, where they are relayed to the ____thalamus____ for higher processing.
Student Practice

Label the structures in the following figures.
Source: Regional Views: View 1: Head and Neck
Source: Cross Sections: View 1: Head (Midsagittal)
Source: Cross Sections: View 1: Head (Orbit)
Source: Microanatomy Views: View 12: Tongue Regions
Source: Regional Views: View 1: Head and Neck
Source: Microanatomy Views: View 13: Tongue Section

- Circumvallate papille
- Lingual tonsils
- Filiform papillae
- Fungiform papillae
Source: Microanatomy Views: View 13: Tongue Section

Circumvallate papilla

Taste buds