



The Axial Skeleton

A skeletal system lab activity using Visible Body's Human Anatomy Atlas

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EXERCISE 10 - THE SKELETON

When studying the skeletal system, the bones are often sorted into two broad categories: the axial skeleton and the appendicular skeleton. This lab focuses on the axial skeleton, which consists of the bones that form the axis of the body. The axial skeleton includes bones in the skull, vertebrae, and thoracic cage, as well as the auditory ossicles and hyoid bone.

In addition to learning about all the bones of the axial skeleton, it is also important to identify some significant bone markings. Bone markings can have many shapes, including holes, round or sharp projections, and shallow or deep valleys, among others. These markings on the bones serve many purposes, including forming attachments to other bones or muscles and allowing passage of a blood vessel or nerve. It is helpful to understand the meanings of some of the more common bone marking terms.

Before we get started, look up the definitions of these common bone marking terms:

Condyle:

Facet:

Fissure:

Foramen: (see Module 10.18 Foramina of Skull)

Fossa:

Process:

Throughout this exercise, you will notice bold terms. This is meant to focus your attention on these important words. Make sure you pay attention to any bold words and know how to explain their definitions and/or where they are located.

Use the following modules to guide your exploration of the axial skeleton. As you explore these bones in Visible Body's app, also locate the bones and bone markings on any available charts, models, or specimens. You may also find it helpful to palpate bones on yourself or make drawings of the bones with the bone markings labeled. The drawings don't have to be perfect; just make sure the different bone markings are in the correct locations, relative to each other.

If you have trouble finding a bone or bone marking, don't forget you can always type its name into the search bar to get a list of 3D anatomical views where that bone or bone marking is highlighted for you.

To access disarticulated bones with color-coded bone markings, select a bone and then, in the content box, choose the landmark icon, which shows a bone with pink, yellow, and blue ends.

Use Part I to become familiar with the bones and structures you need to know, as well as understand their functions by answering the questions.
Use Part II to practice identifying and labeling the structures/bones you need to know by filling in the blanks on the diagrams.

Open the Human Anatomy Atlas app. From the Views menu, go to System Views to view the Skeletal System Views at the top of the screen.

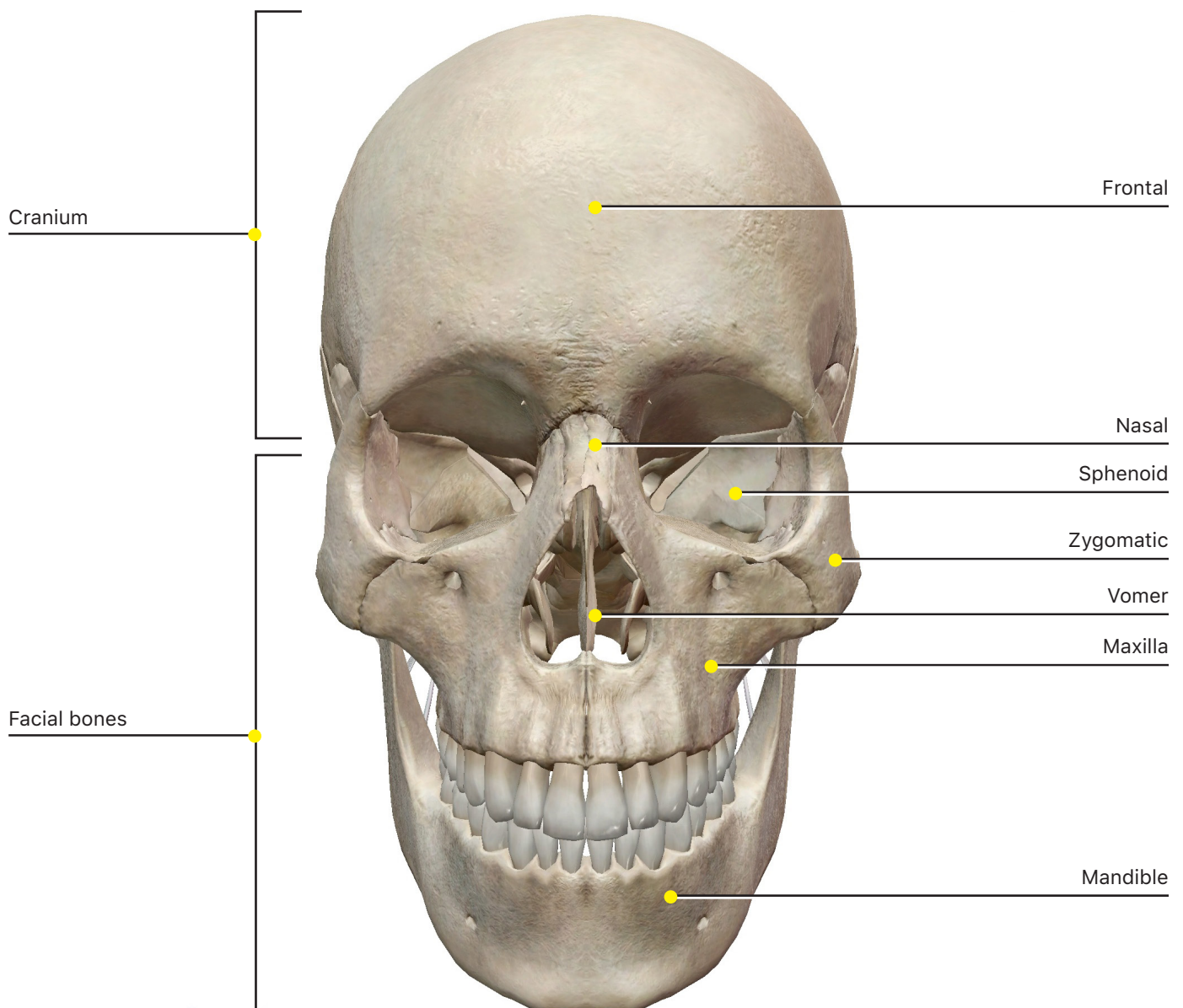
You are responsible for the identification of **all bold terms**.

I. Axial Skeleton - Identifying Structures

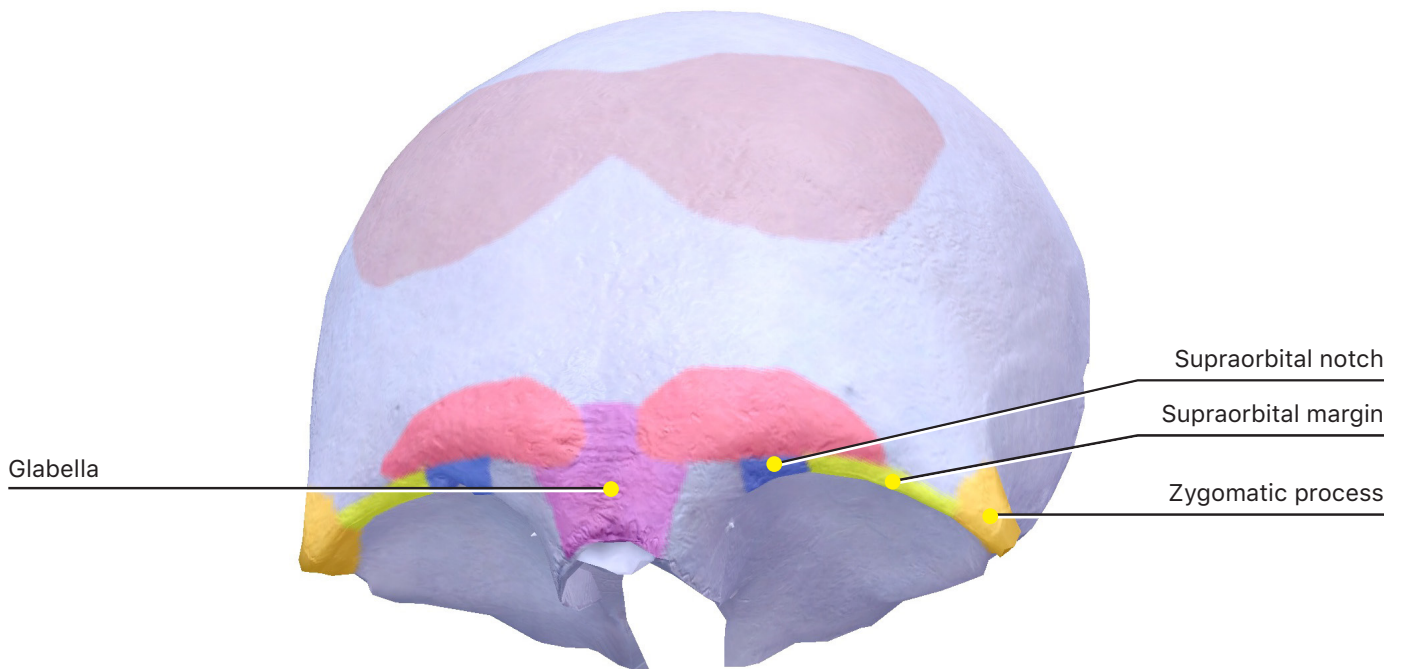
A. The Skull

The skull is composed of two parts: the cranium and the facial bones. The cranium is responsible for protecting the brain, while the facial bones form the framework of the face and support for the special senses (sight, smell, and taste).

In the Skeletal System Views, select View 2. Skull and locate the following skull bones and bone markings.



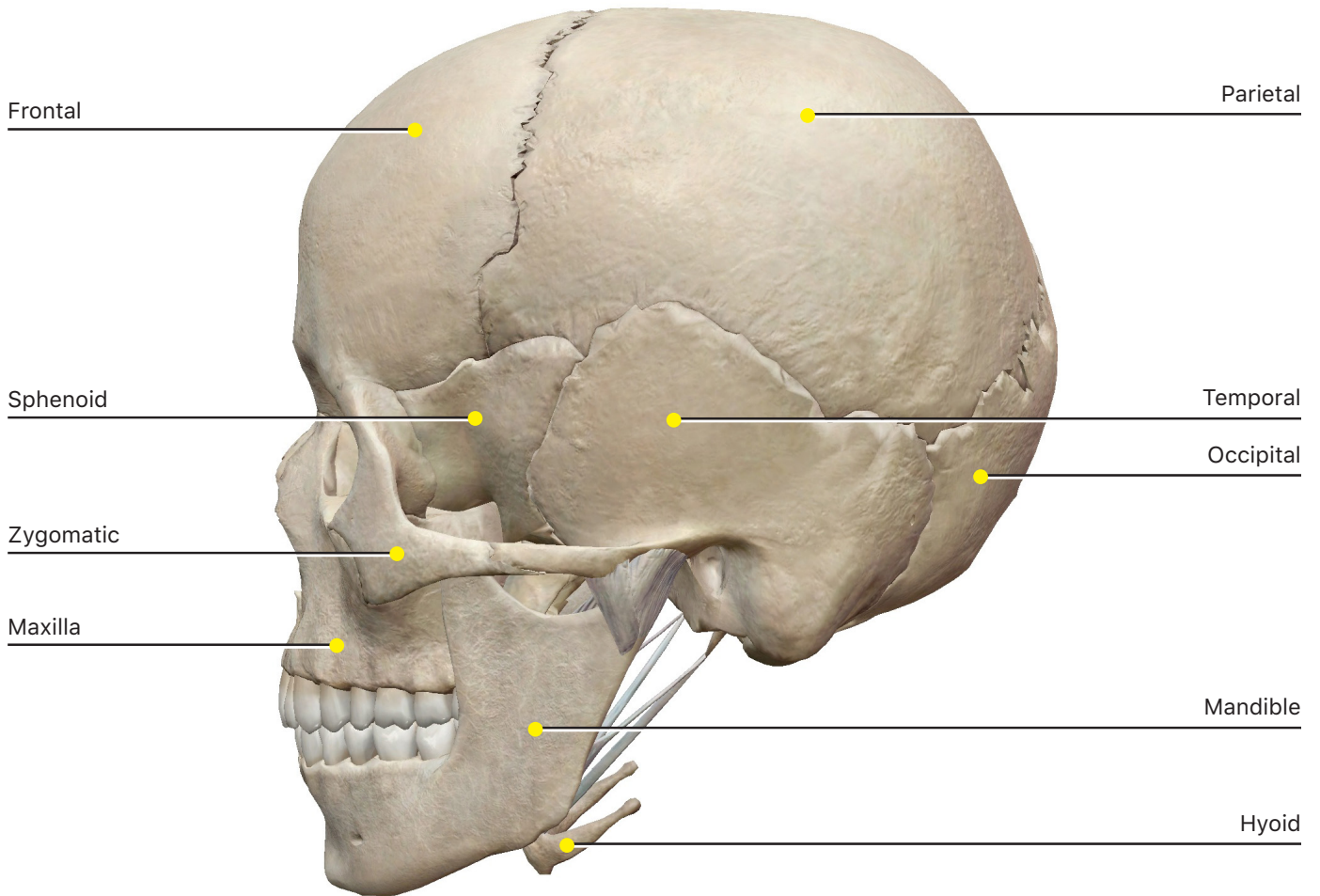
1. Cranial bones



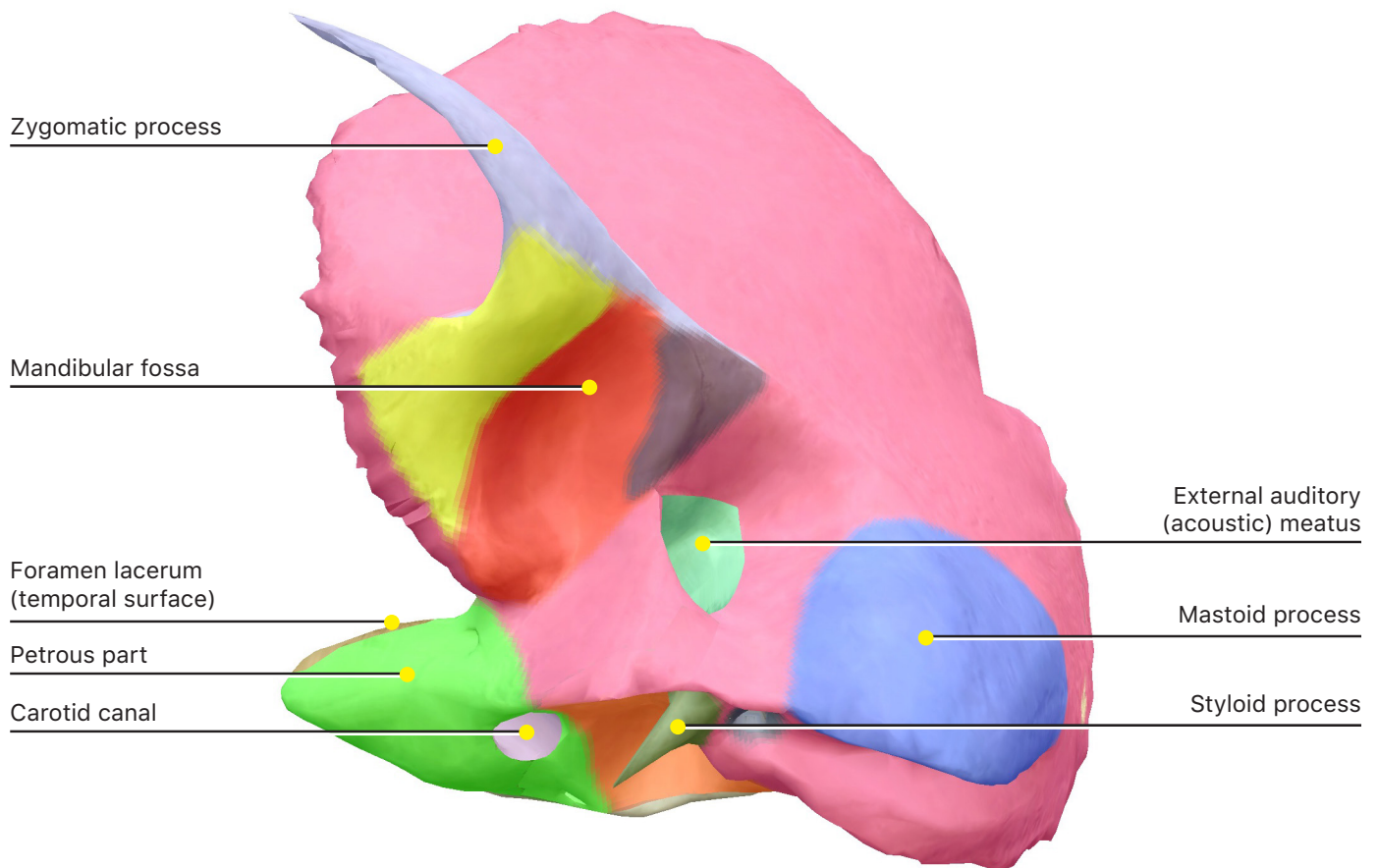
a. Select the **frontal bone**, which is located in the forehead region on the anterior and superior part of the skull. Use the landmark icon in the content box to locate the following bone markings:

- i. **Supraorbital notch**
- ii. **Glabella**
- iii. **Zygomatic process**

b. Rotate the skull to see the lateral side and select the right or left **parietal bone**, located on the lateral and superior part of the skull.



c. Select the right or left **temporal bone**, which is located immediately inferior to the parietal bone.



i. Use the landmark icon in the content box to locate the following bone markings:

a. **Zygomatic process** (note how the zygomatic process of the temporal bone is different from the zygomatic process of the frontal bone)

b. **Mandibular fossa**

c. **External auditory (acoustic) meatus**

d. **Internal auditory (acoustic) meatus** (turn the model around to the medial side of the bone to find this)

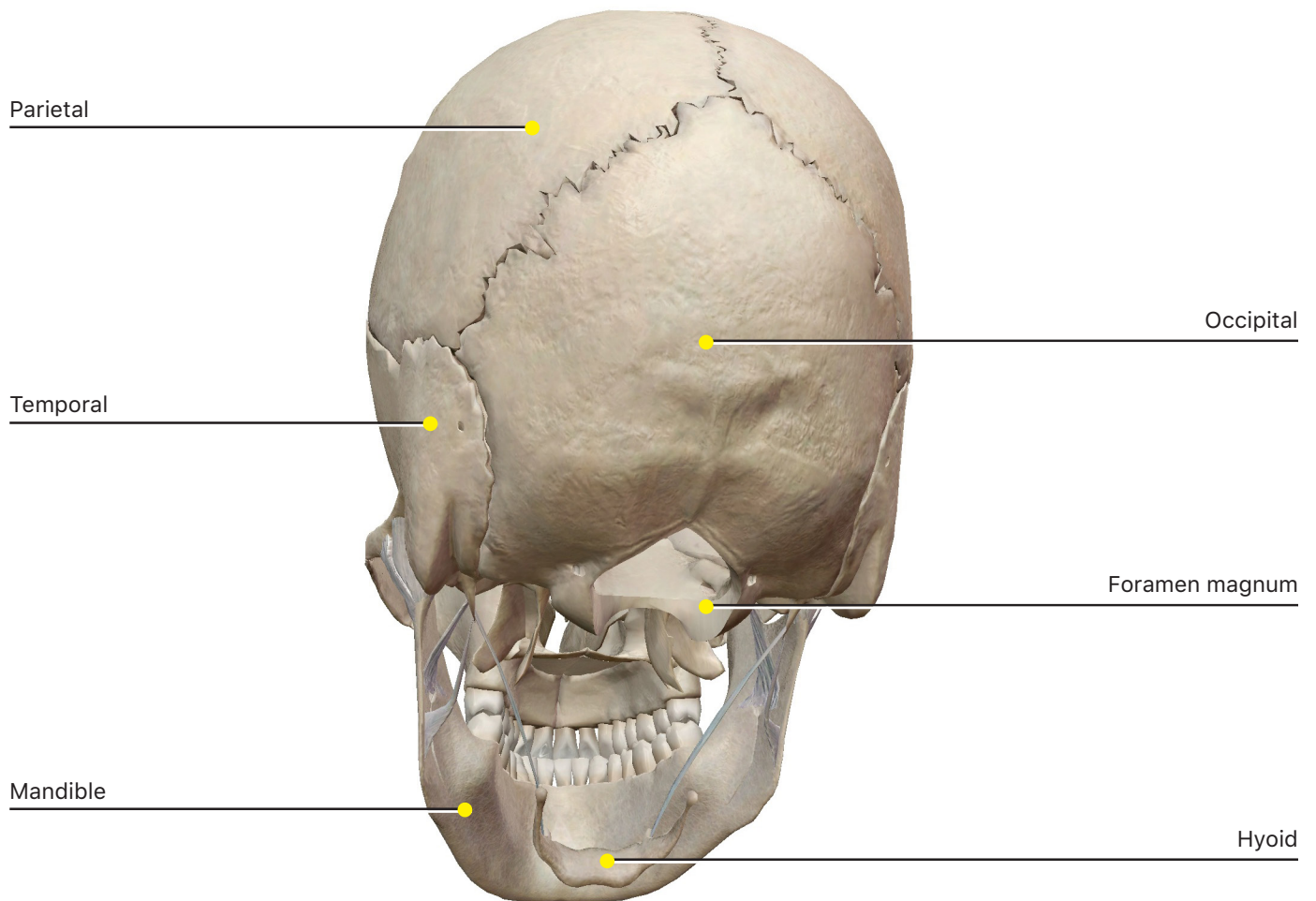
e. **Styloid process**

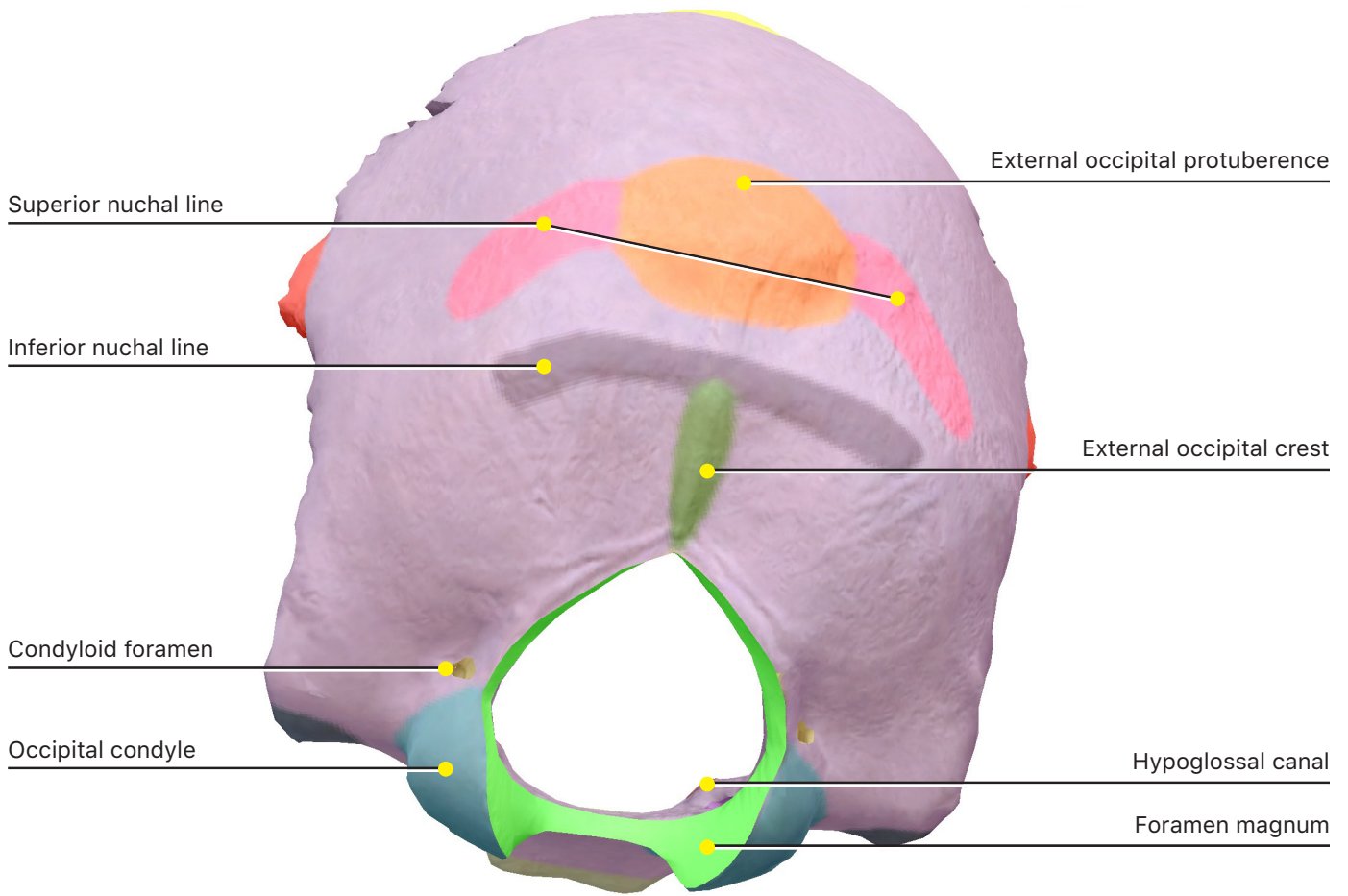
f. **Mastoid process**

ii. Where does the lower jaw attach to the skull?

iii. Where do sound waves enter the ear?

d. Continue to rotate the skull and select the occipital bone, located on the posterior side of the skull.





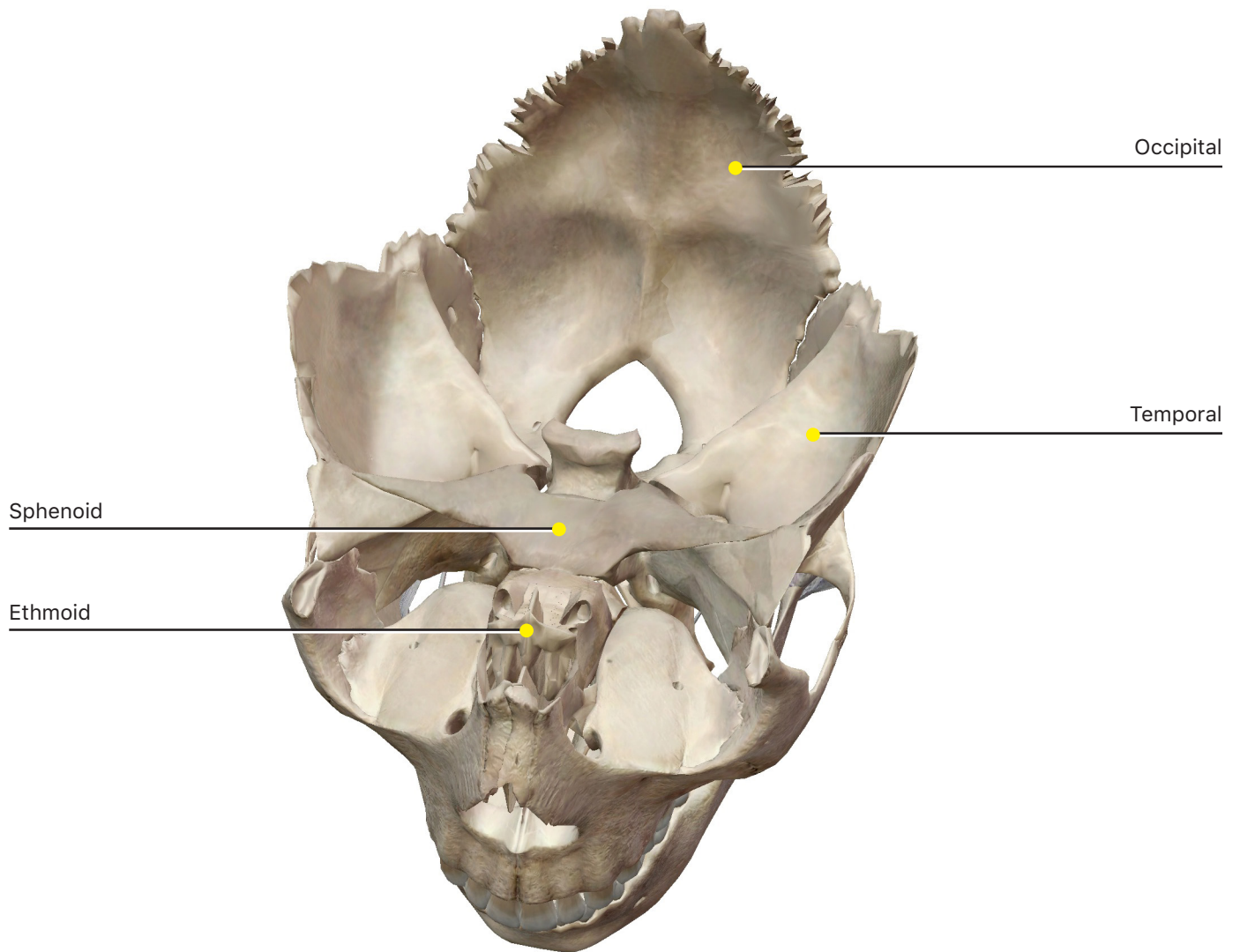
i. Use the landmark icon in the content box to locate the following bone markings:

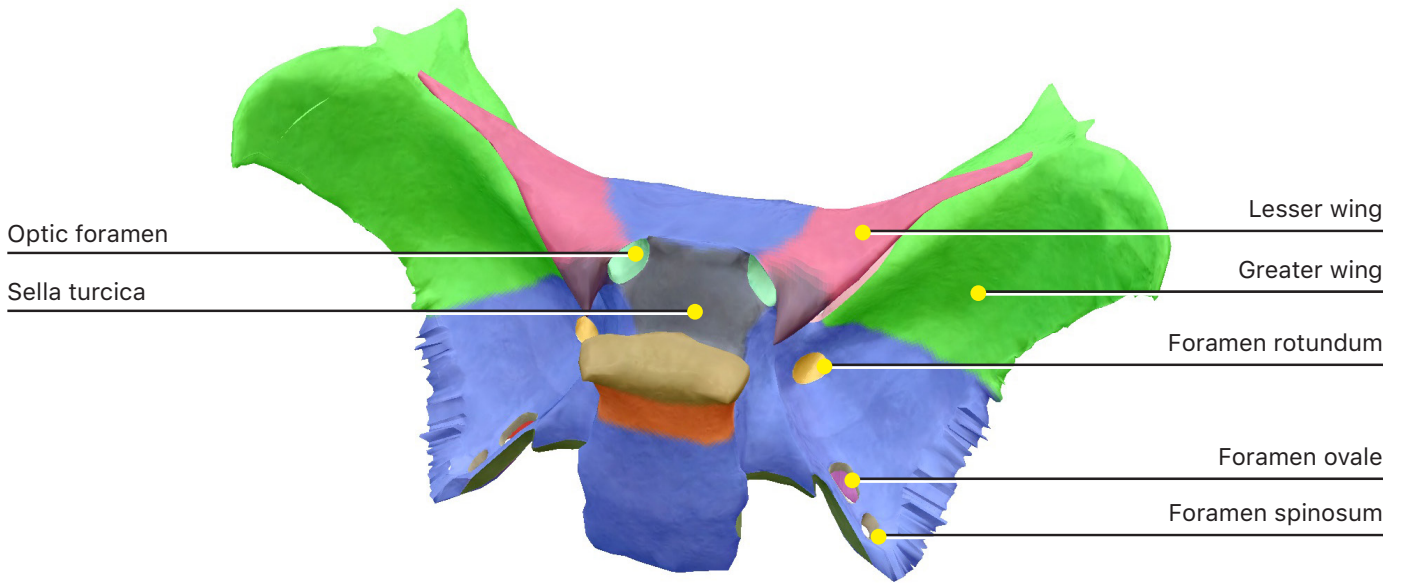
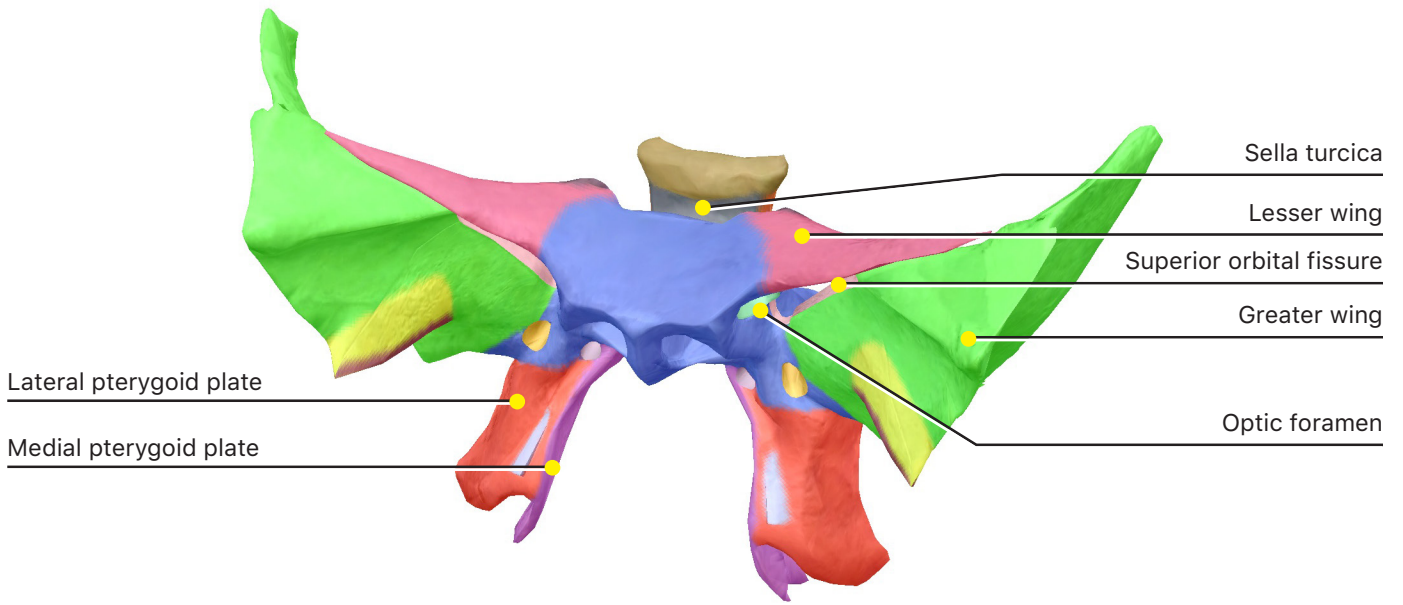
- a. **Foramen magnum**
- b. **Hypoglossal canal**
- c. **Occipital condyle**
- d. **External occipital protuberance/crest**
- e. **Inferior nuchal line**

ii. What structure passes through the foramen magnum?

iii. What structure is responsible for articulating with the vertebral column? (articulate means to join with; so the question is asking what structure joins with the vertebral column?)

e. Rotate the skull to look at the superior (top) surface. Select and hide the frontal bone and the two parietal bones and choose the sphenoid bone, which is shaped like a butterfly.



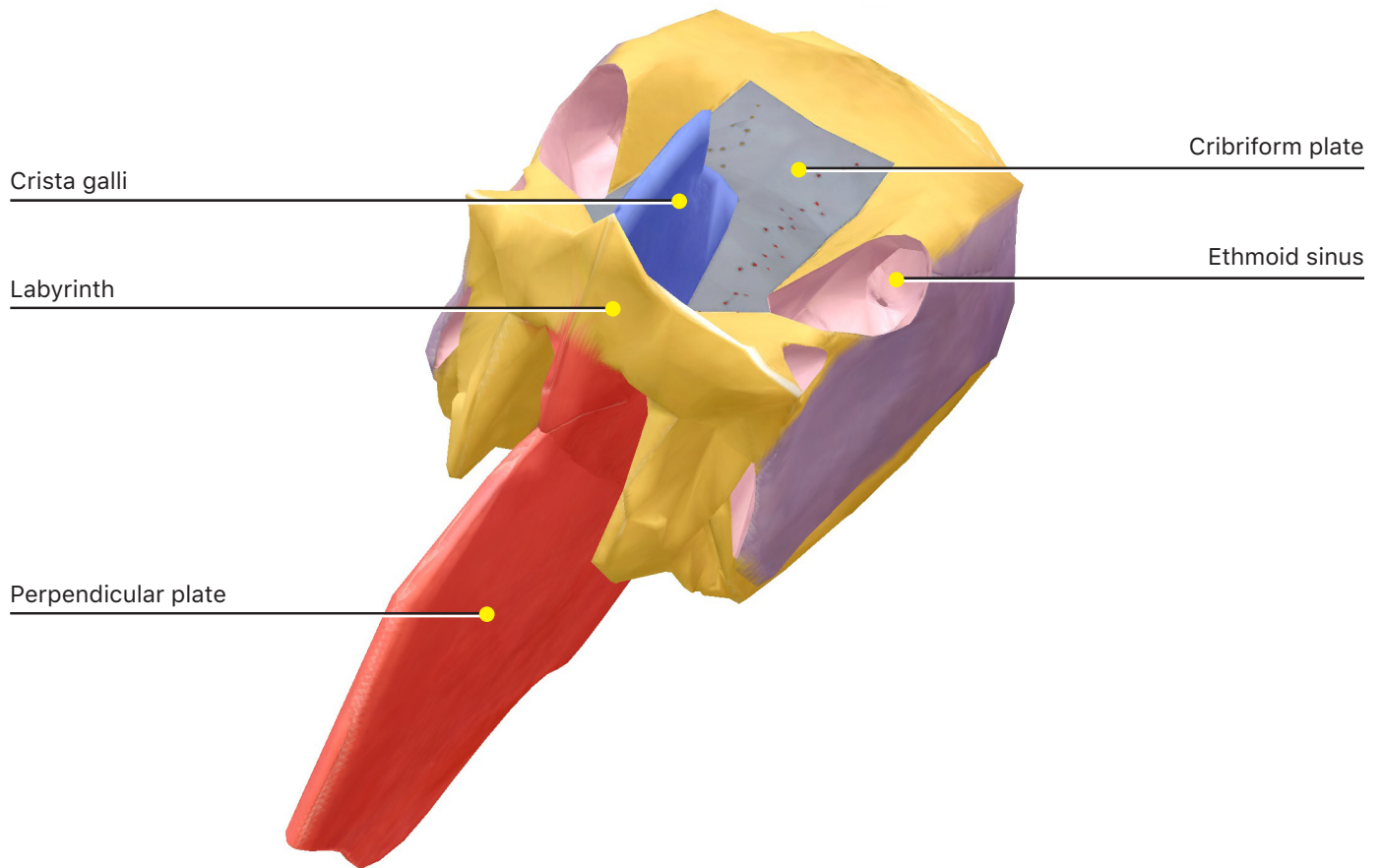


i. Use the landmark icon in the content box to locate the following bone markings:

- a. **Greater wing**
- b. **Lesser wing**
- c. **Sella turcica**
- d. **Optic foramen**
- e. **Foramen ovale**
- f. **Lateral pterygoid plate**

ii. The pituitary gland is nicknamed the “master gland” of the body because it secretes many hormones that have widespread effects in the body. Which part of the sphenoid bone houses it?

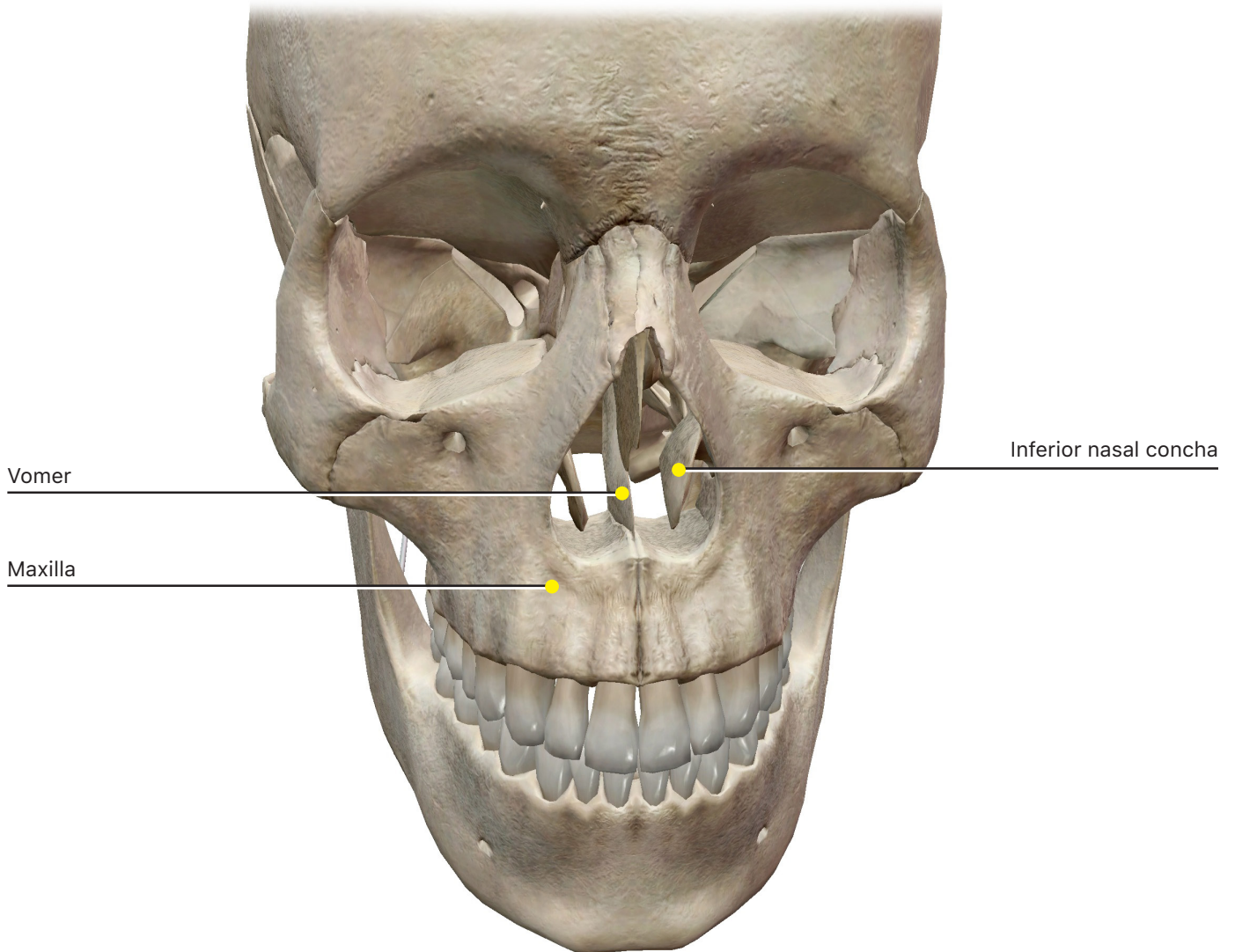
f. Select the **ethmoid bone**, which is located anterior to the sphenoid bone between the orbits of the eyes.



i. Use the landmark icon in the content box to locate the following bone markings:

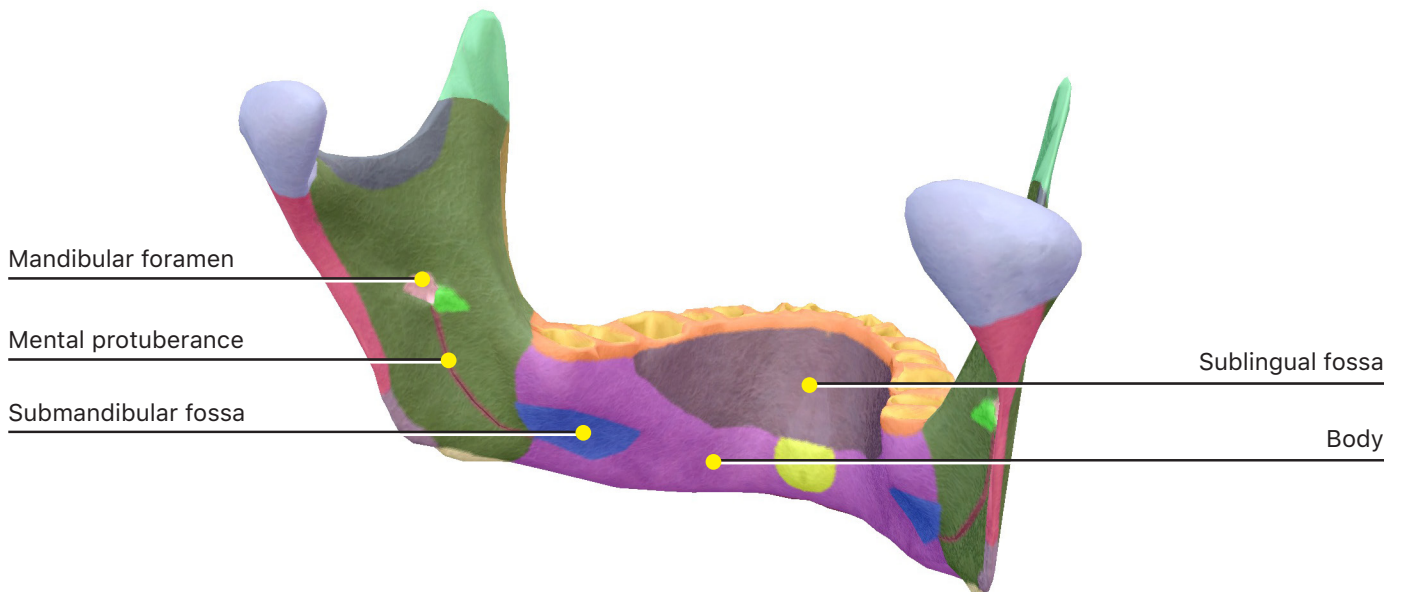
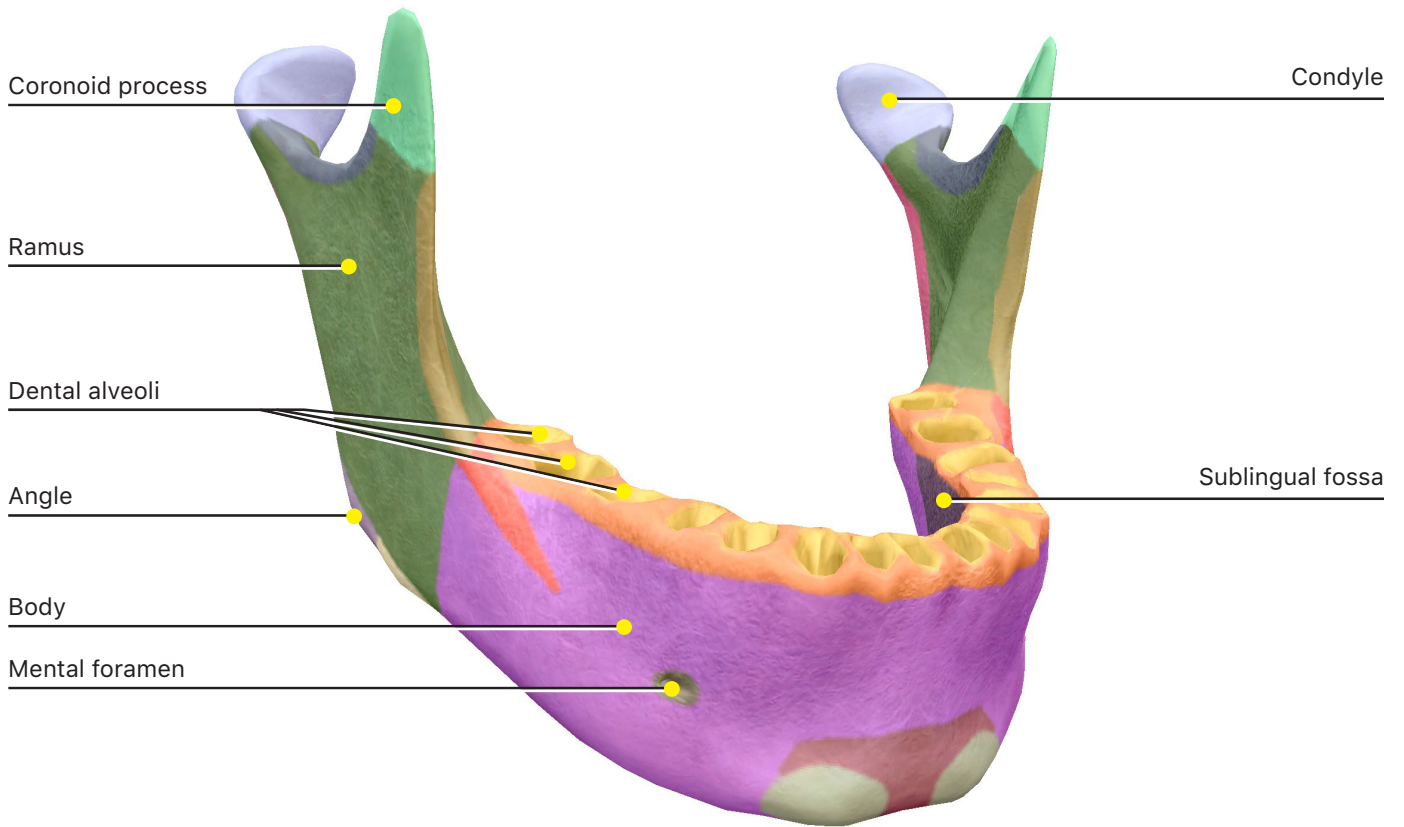
- a. **Crista galli**
- b. **Cribriform plate**
- c. **Middle nasal concha**
- d. **Perpendicular plate**

2. Facial bones



- Rotate the skull, so you're looking at the anterior (face) side again. Zoom into the nose area and select one of the **inferior nasal conchae bones**, which stick out toward the inside of the nose.
- Select the **vomer**, which is located medial to the two inferior nasal conchae in the nose.
- Select one of the **maxillae** bones, which form the upper jaw.

d. Select the **mandible**, which forms the lower jaw

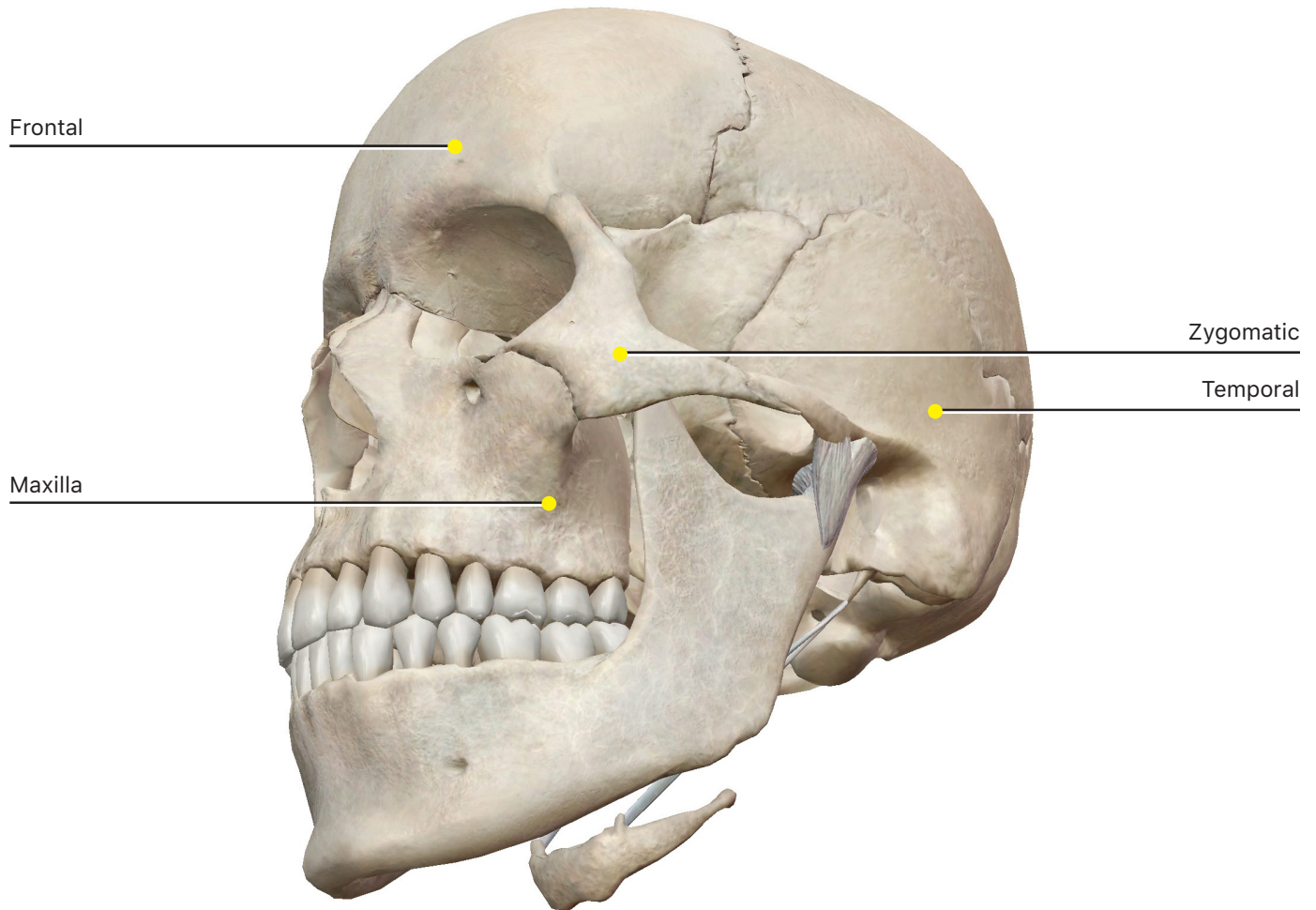


i. Use the landmark icon in the content box to locate the following bone markings:

- a. **Body**
- b. **Ramus**
- c. **Angle**
- d. **Coronoid process**
- e. **Condyle**
- f. **Mental foramen**

ii. Which part of the mandible attaches to the cranium? Where does it articulate?

e. Select one of the **zygomatic bones**, which form part of the cheekbones of the face. The zygomatic bones are shaped roughly like triangles, with each vertex pointing toward a different bone: the temporal bone, maxilla, or frontal bone. Use the landmark icon in the content box to locate the following bone markings:



- i. **Temporal process**
- ii. **Maxillary border**
- iii. **Frontal process**

f. Locate the small **nasal bones** on the bridge of the nose.

g. Locate the **palatine bones**, which are posterior to the hard palate of the maxillae.

3. Rotate the skull, so you are looking at the inferior side and find the **hyoid** bone, which is attached by only ligaments. For a better view of the hyoid in relation to its function, go back to the Systems menu, scroll down to the Respiratory System Views, and select view 4. Pharynx and Larynx. Although the hyoid does not articulate with any other bones, notice how many muscles and ligaments attach to the hyoid.



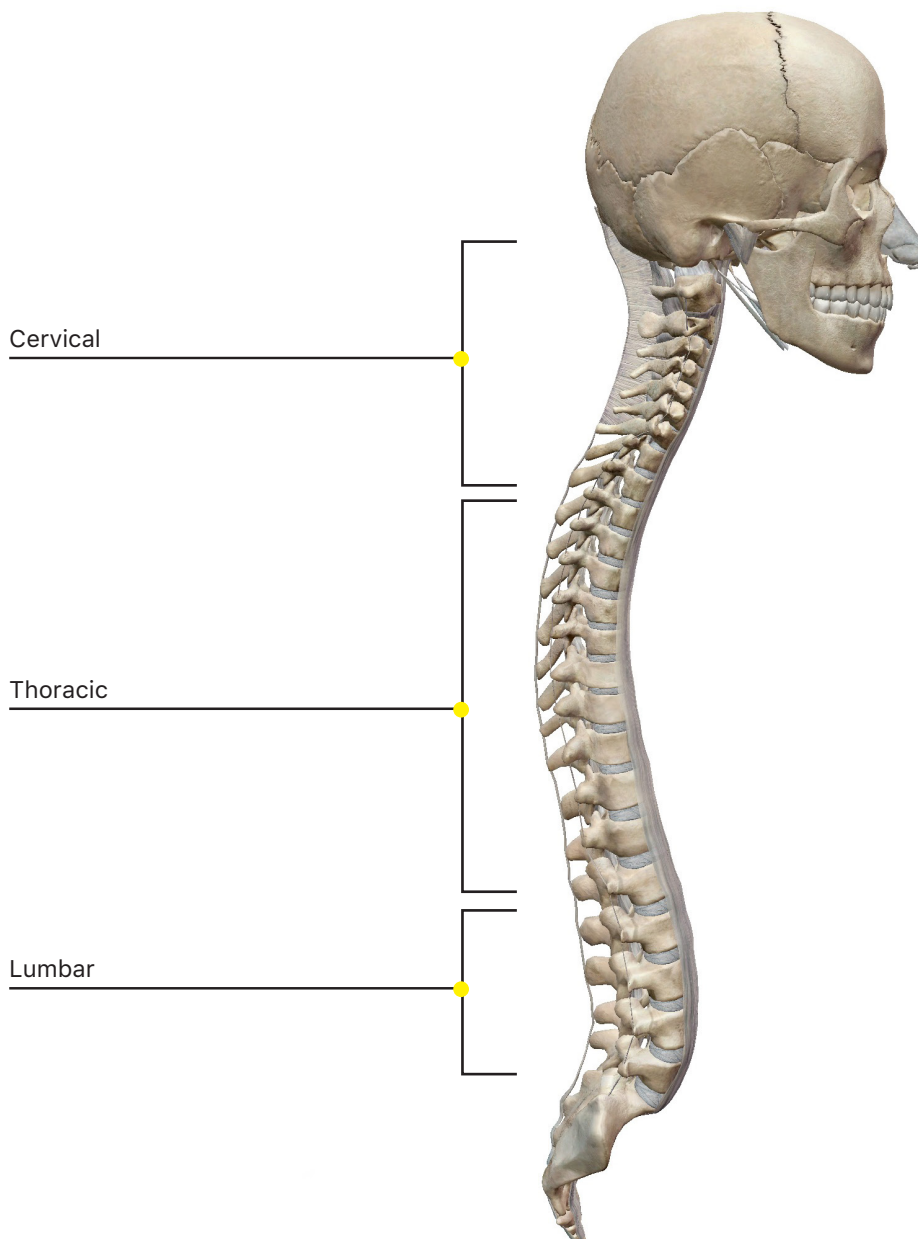
B. Vertebral Column (Spine)

The **vertebral column** consists of 24 vertebrae of different sizes and shapes. The primary function of the **vertebrae** is to protect the spinal cord. They are classified in groups based on their location. As you look at the different vertebrae, compare and contrast vertebrae from different regions in the body. Take note of the bone markings that are found in each type of vertebrae.

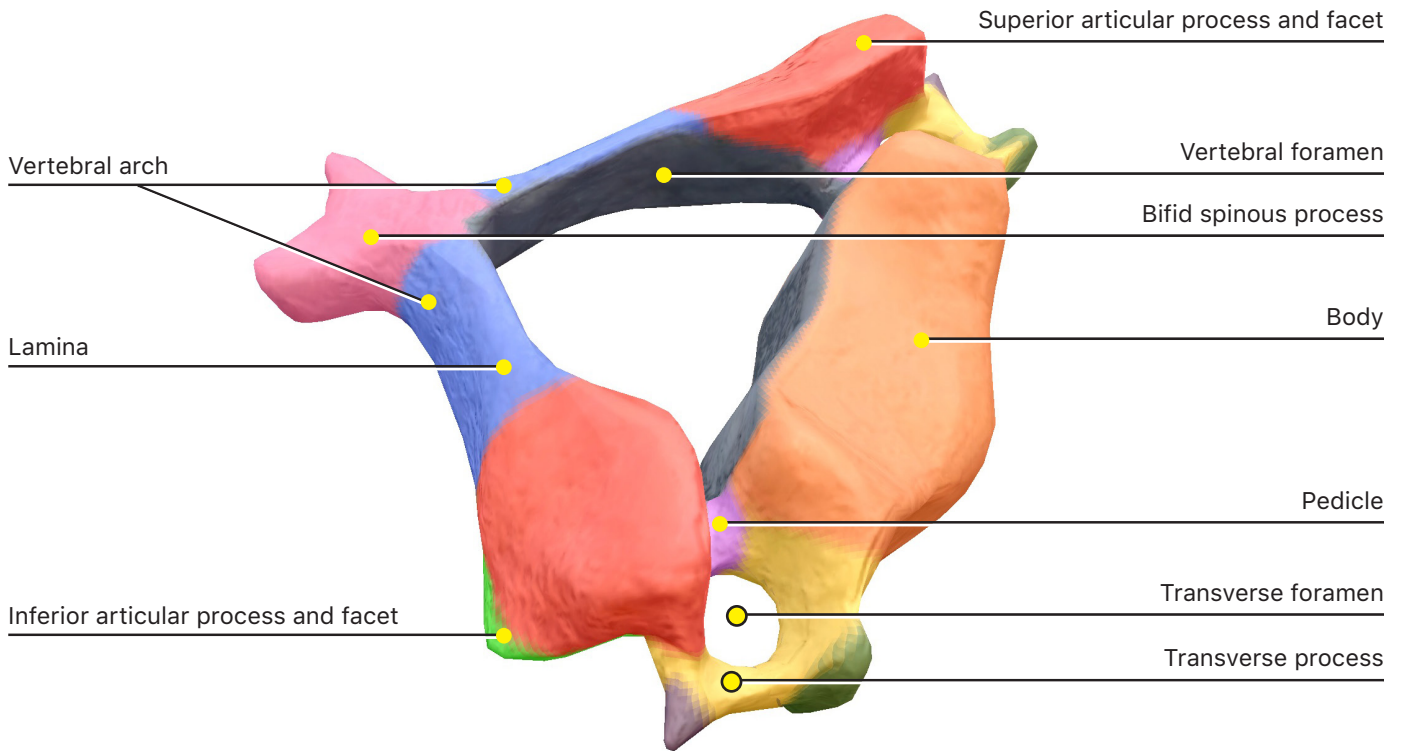
Students often confuse processes and facets that have the same name. Remember the definitions for these terms: processes are bony projections, while facets are flat surfaces.

Helpful Hint: To help remember how many vertebrae are in each region, think of 'standard meal times'. For instance, one usually eats breakfast at 7am, lunch at 12p, dinner at 5p - 7,12,5. These are the number of bones in each region. Cervical has 7 vertebrae, Thoracic has 12, and Lumbar has 5.

Go back to the Skeletal System Views and select View 13. Spine, Lateral. Identify the following bone markings and answer the questions.



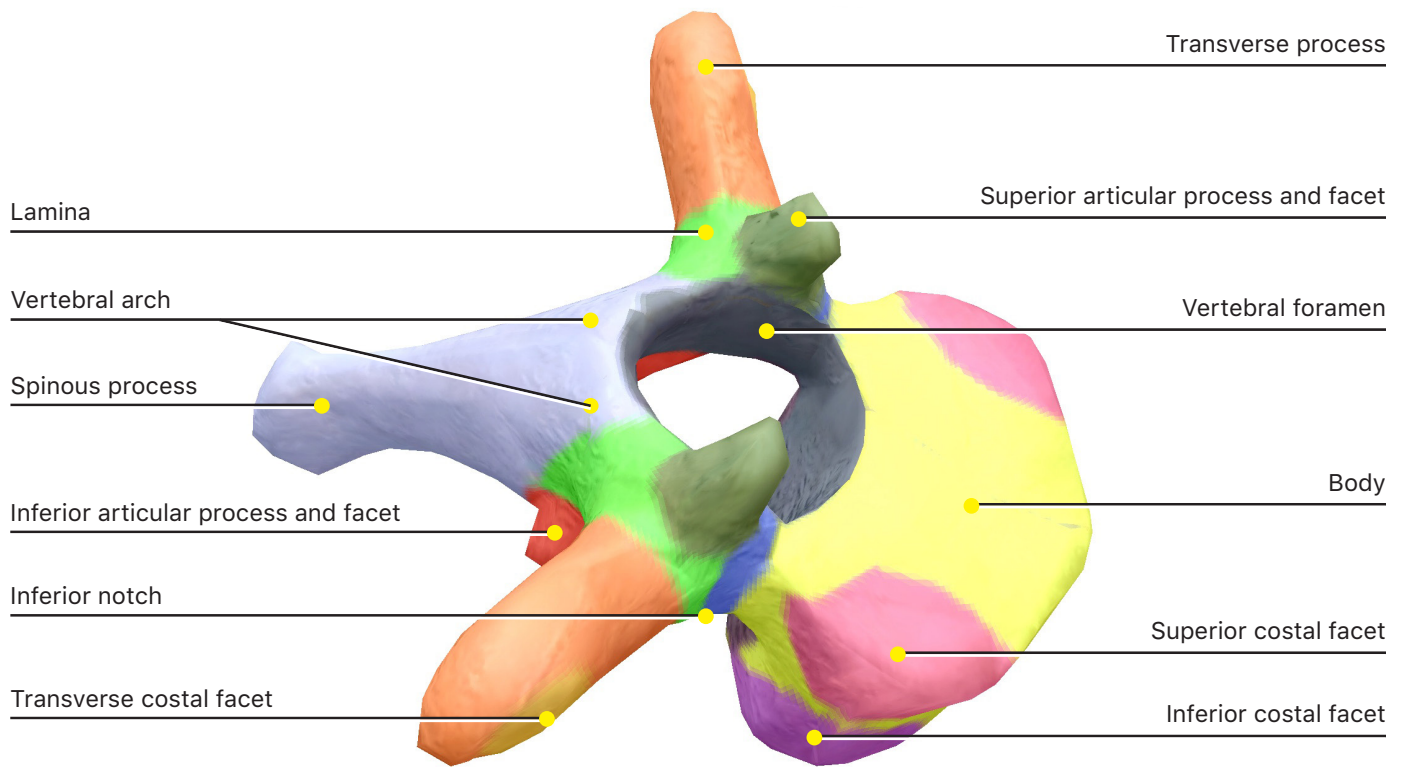
1. **Cervical vertebrae** are in the neck area, **thoracic vertebrae** are in the chest area on the back of the ribs, and **lumbar vertebrae** are in the small of the back. Identify the bone markings found in these different types of vertebrae. While all vertebrae share common characteristics, there are also markings that distinguish them from each other. Pay attention to these distinguishing characteristics so you can tell the difference between cervical, thoracic, and lumbar vertebrae just by looking at them.



a. Identify the **atlas (C1)** and **axis (C2)**, as well as the following bone markings of the cervical vertebrae:

- i. **Body**
- ii. **Lamina**
- iii. **Superior articular process and facet**
- iv. **Bifid spinous process**
- v. **Transverse process and foramen**
- vi. **Vertebral foramen**

b. Identify the following bone markings of the thoracic vertebrae:



i. **Body**

ii. **Vertebral arch**

iii. **Lamina**

iv. **Vertebral foramen**

v. **Spinous process**

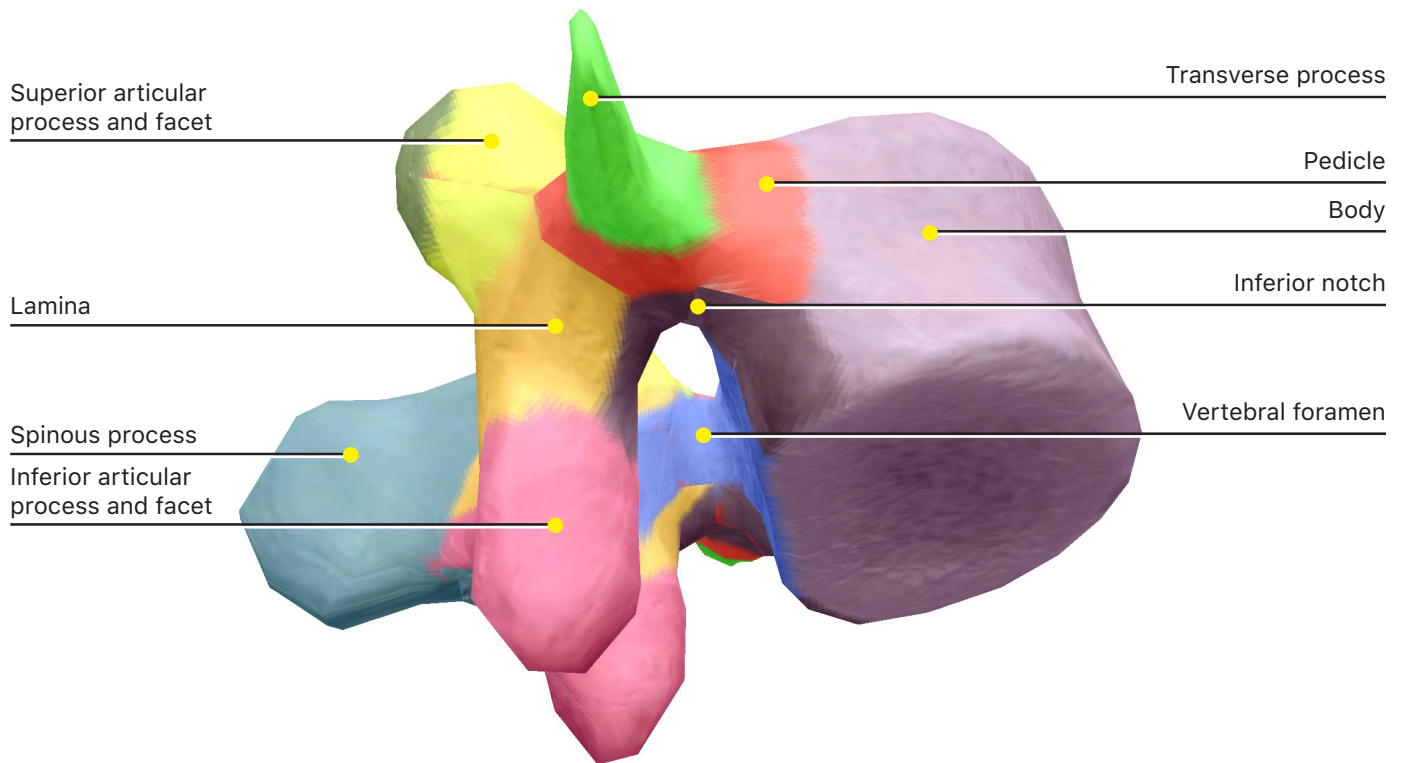
vi. **Transverse process**

vii. **Transverse costal facet**

viii. **Superior articular process and facet**

ix. **Inferior articular process and facet**

c. Identify the following bone markings of the lumbar vertebrae:



- i. **Body**
- ii. **Vertebral arch**
- iii. **Lamina**
- iv. **Vertebral foramen**
- v. **Spinous process**
- vi. **Transverse process**
- vii. **Superior articular process and facet**
- viii. **Inferior articular process and facet**

d. How many cervical, thoracic, and lumbar vertebrae are there?

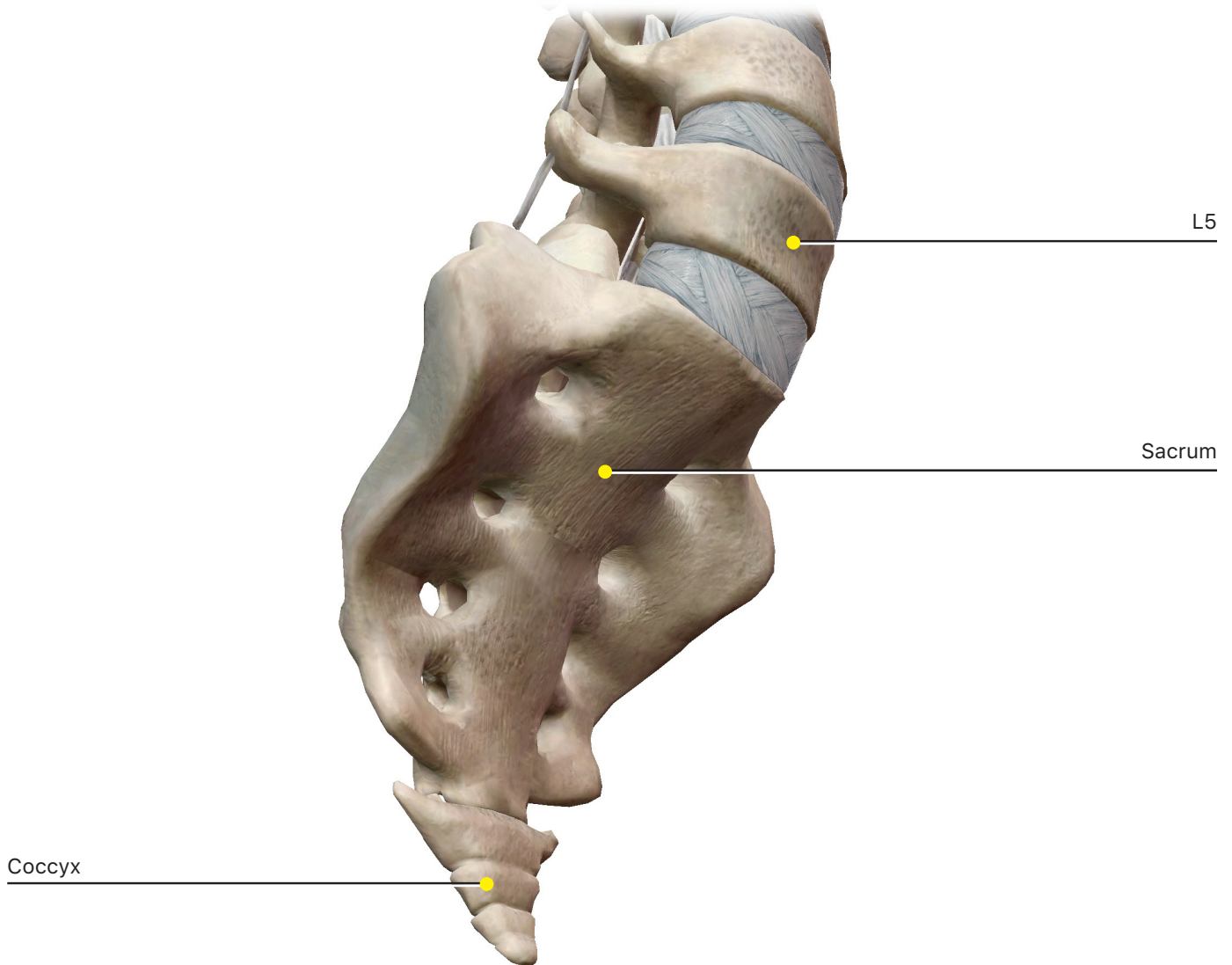
e. Which bone markings enclose the spinal cord?

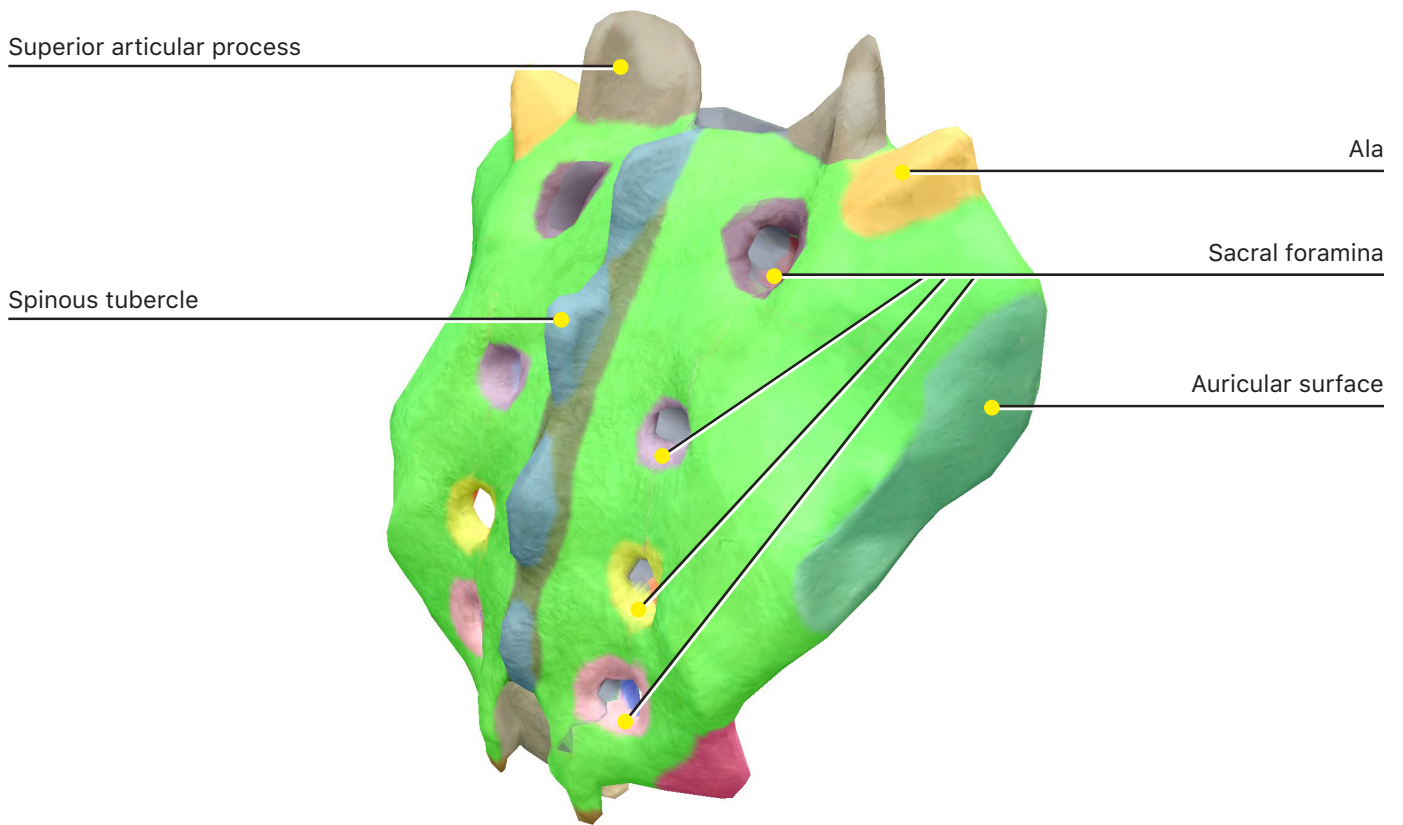
f. What is the function of the costal facets of the thoracic vertebrae?

g. What is the significance of the size of the body in lumbar vertebrae?

h. What are the distinguishing characteristics of cervical vertebrae?

2. The **sacrum** and **coccyx** are found in the pelvis in the inferior part of the vertebral column.





a. Identify the following bone markings of the sacrum:

i. **Sacral foramina**

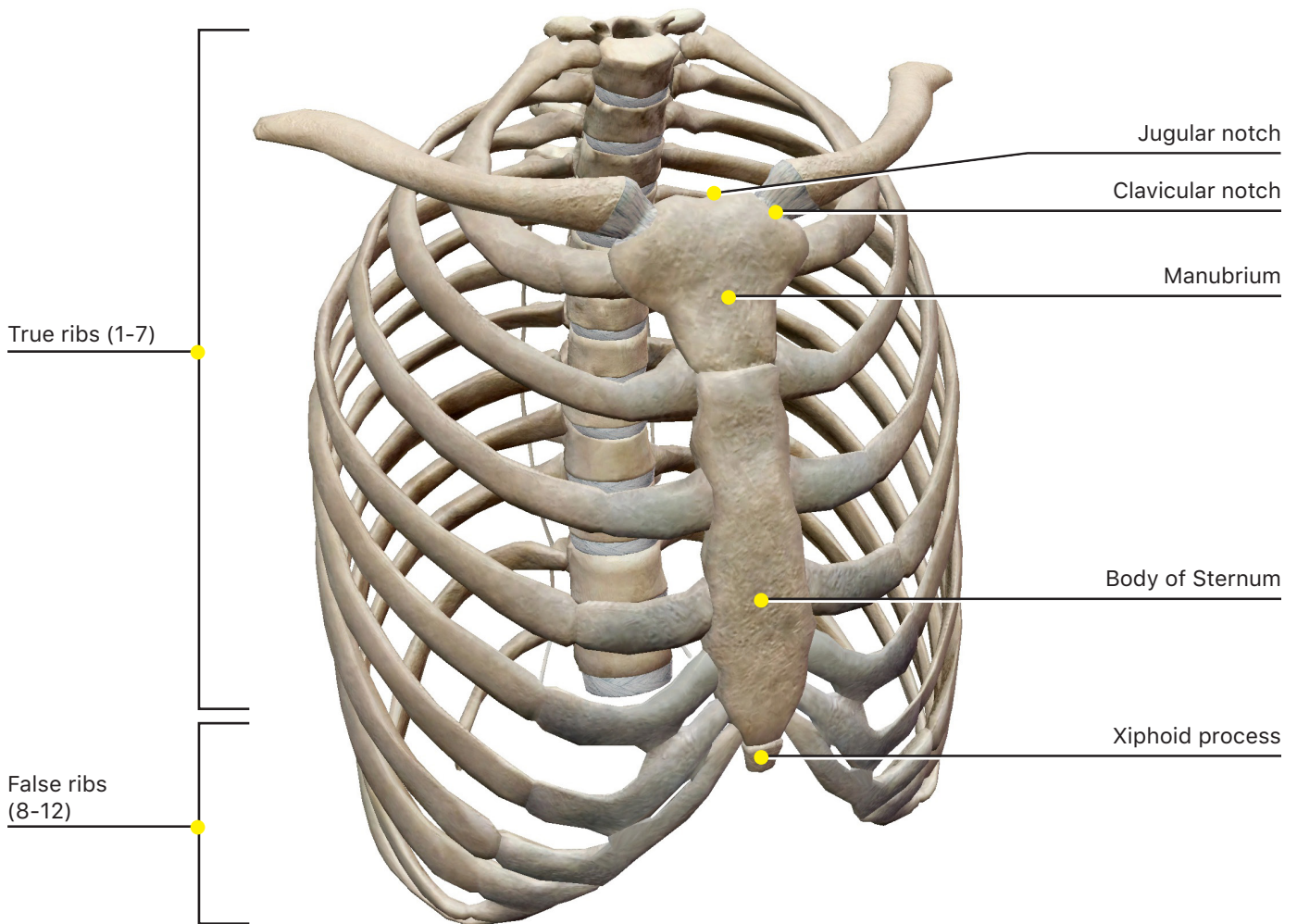
ii. **Superior articular process**

b. Identify the coccyx.

C. Thoracic Cage

The thoracic cage protects important underlying organs, such as the heart and lungs. The bones also serve as attachment points for respiratory muscles.

Go back to the Skeletal System Views and select View 9. Thoracic Cage. Identify the following bones and bone markings:



1. Sternum

a. Manubrium

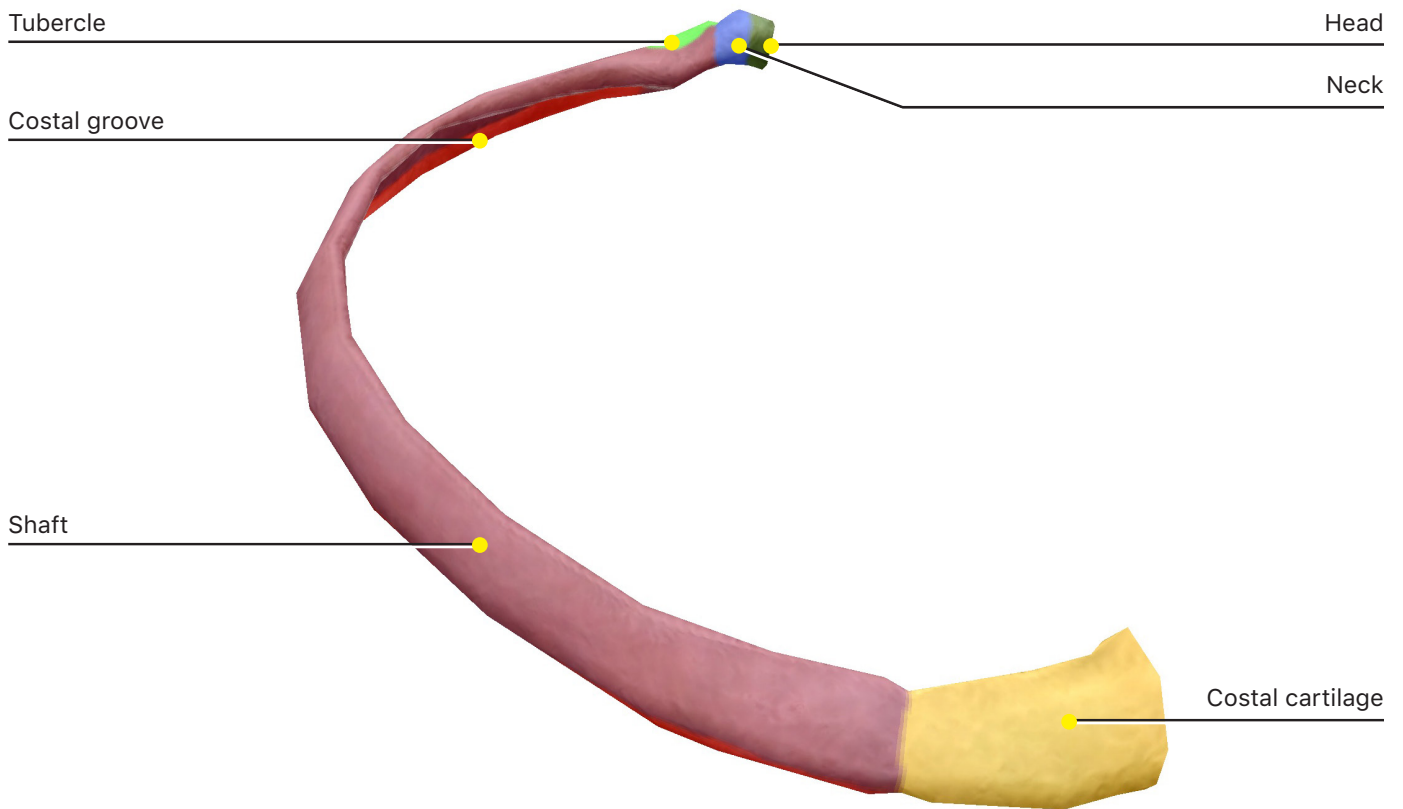
i. Jugular notch

ii. Clavicular notch

b. Body of the sternum

c. Xiphoid process

2. The **ribs** are classified based on how they attach to the sternum. Be sure to select the book icon for several different ribs to read about how they are classified.



a. Identify the following bone markings:

i. **Head**

ii. **Neck**

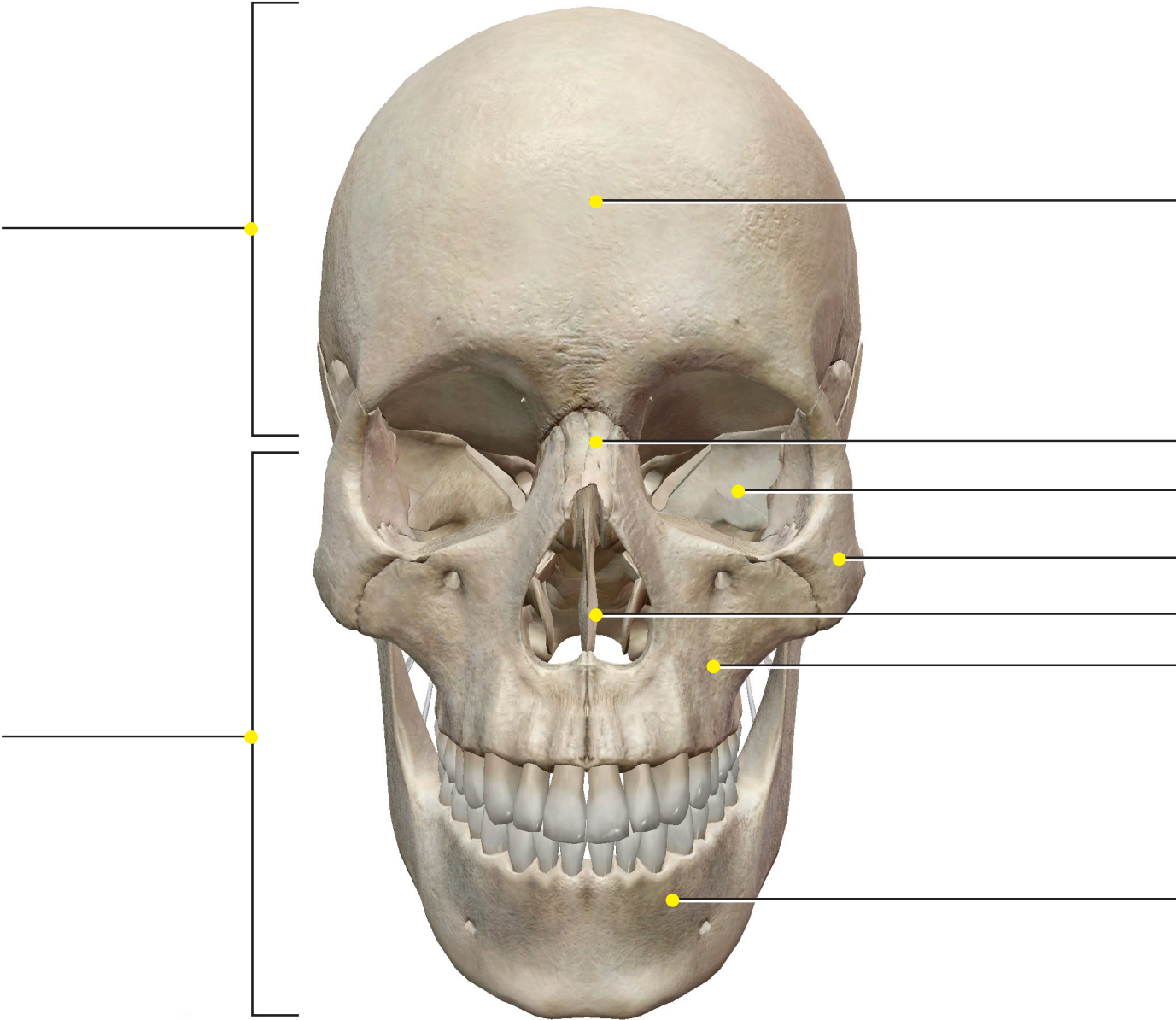
iii. **Tubercle**

b. Which ribs are **true ribs**? Why are they classified as true ribs?

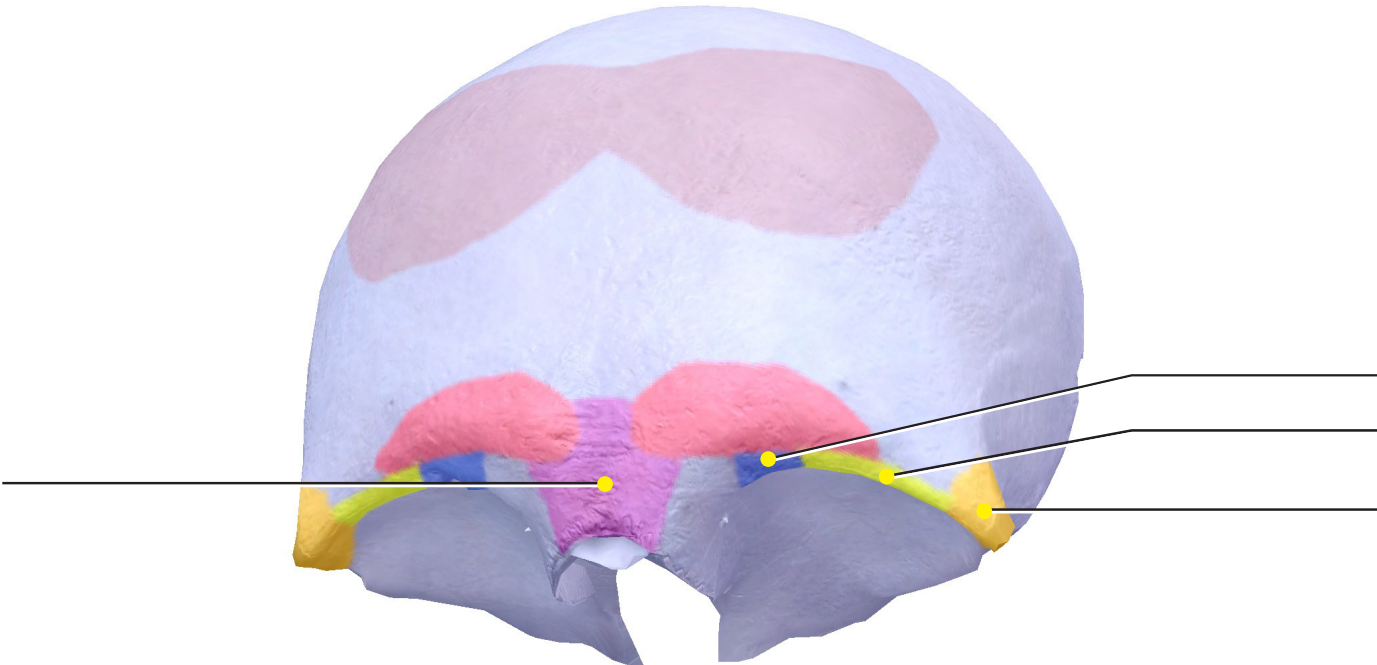
c. Which ribs are **false ribs**? Why are these classified as false ribs?

PART II. Labeling Practice

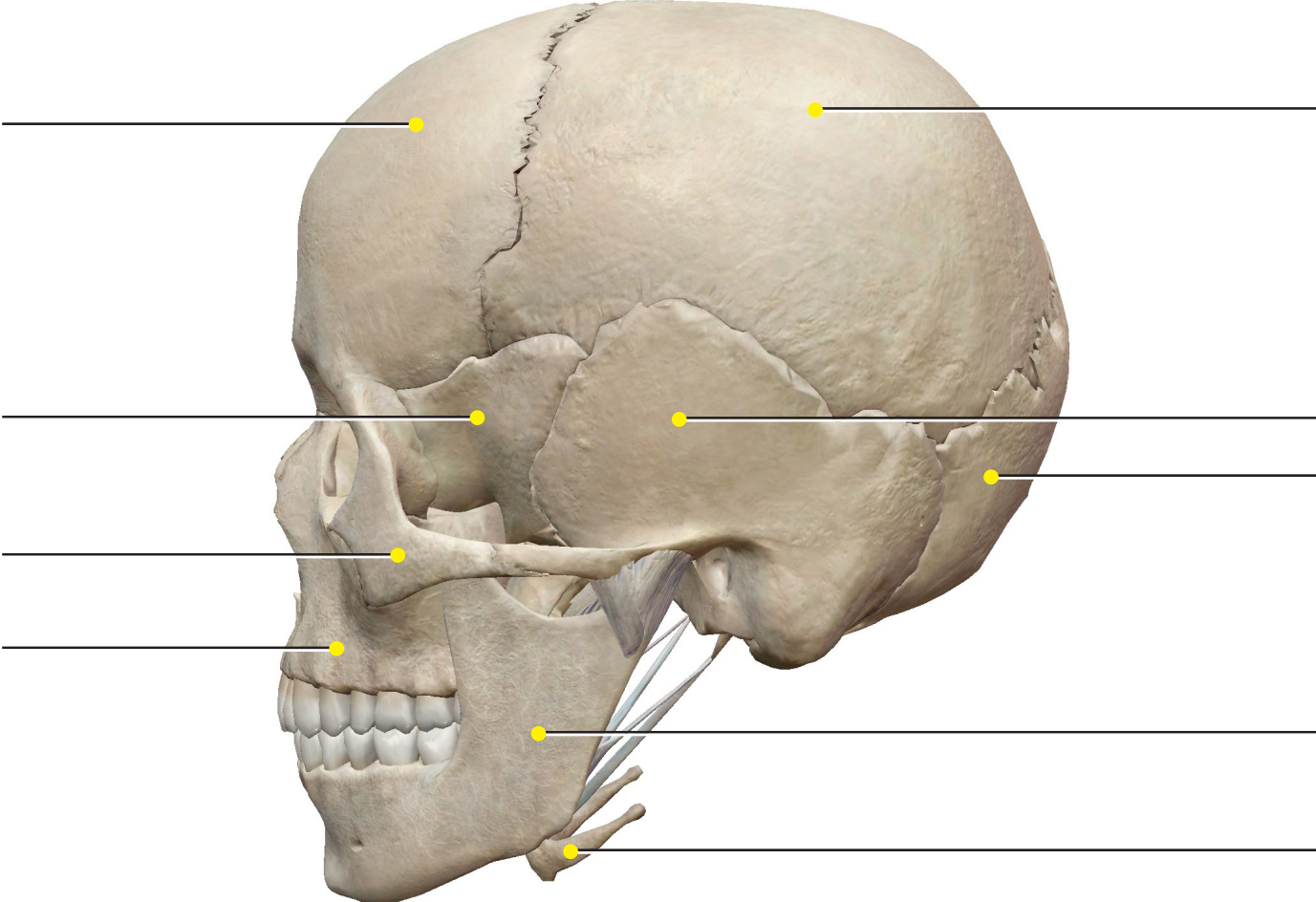
Source: Skeletal System Views: View 2. Skull



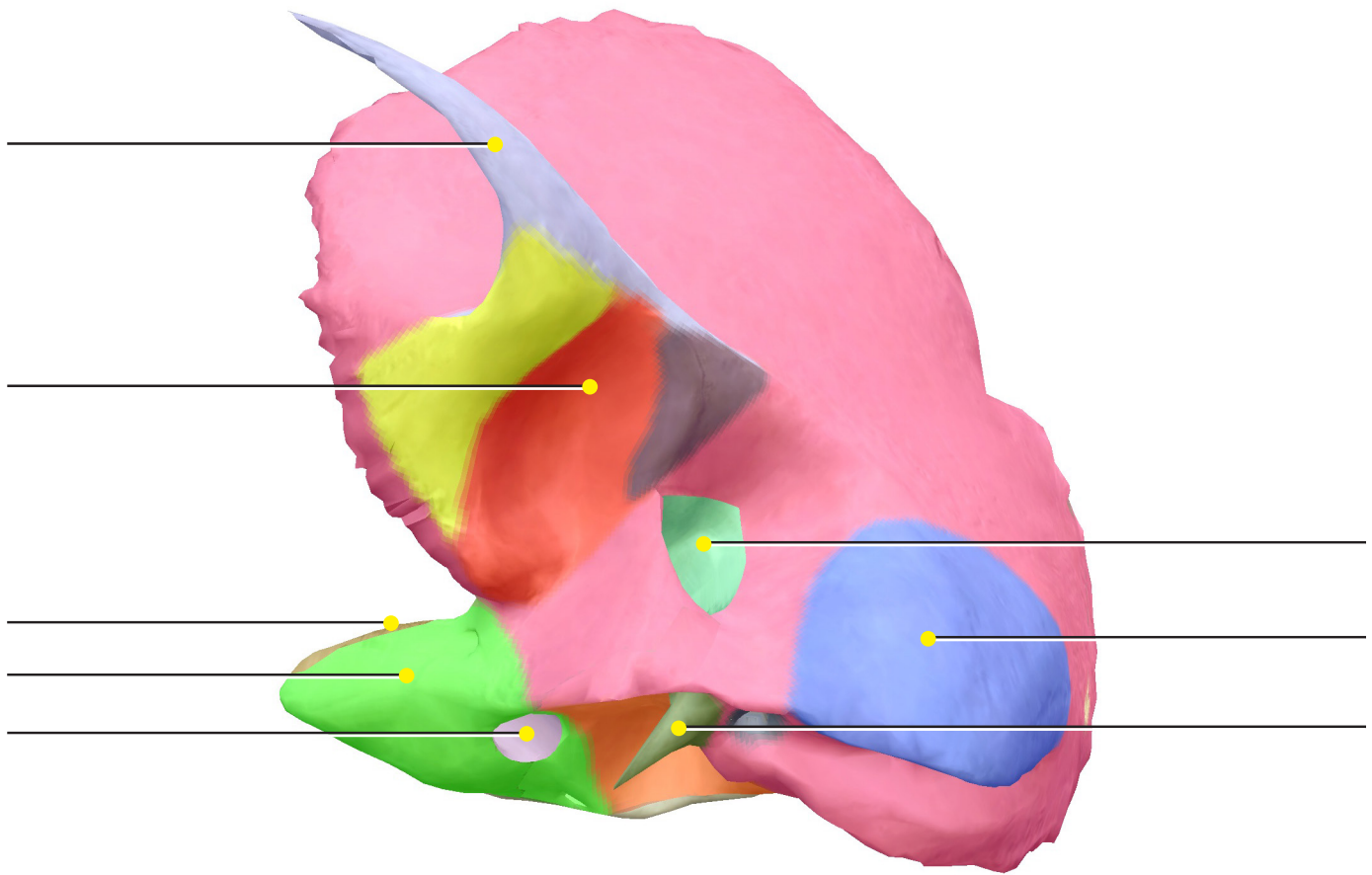
Source: Skeletal System Views: View 2. Skull



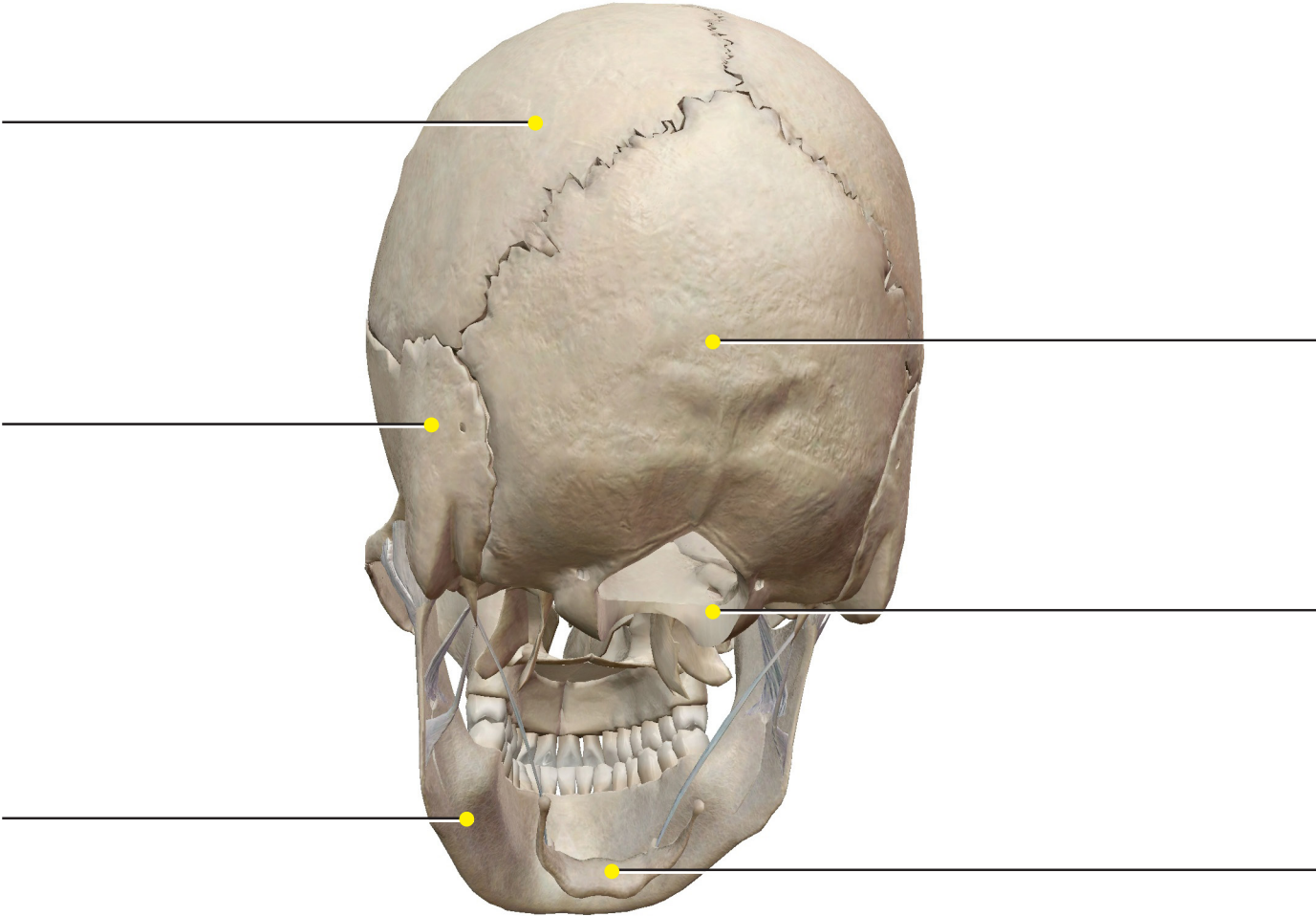
Source: Skeletal System Views: View 2. Skull



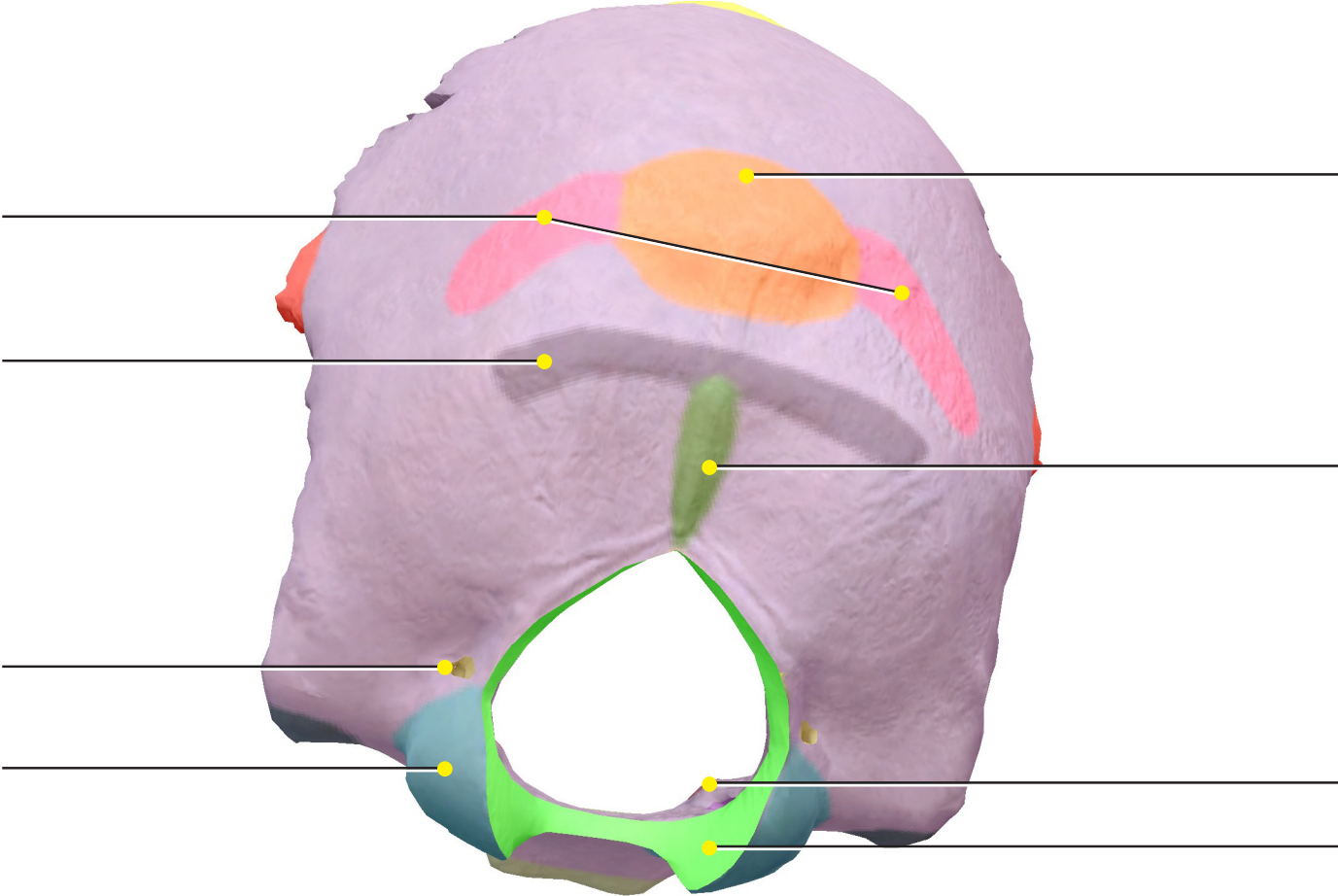
Source: Skeletal System Views: View 2. Skull



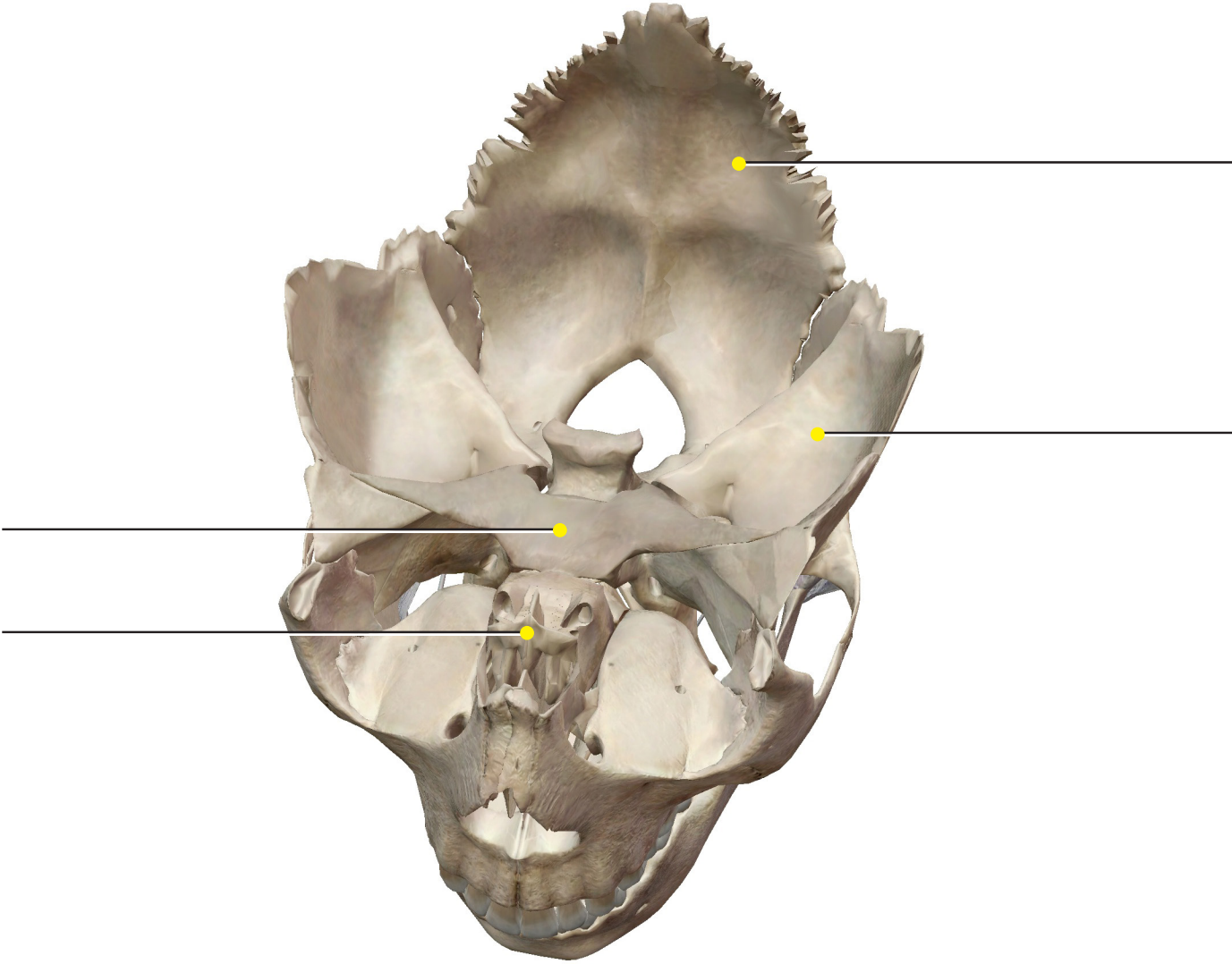
Source: Skeletal System Views: View 2. Skull



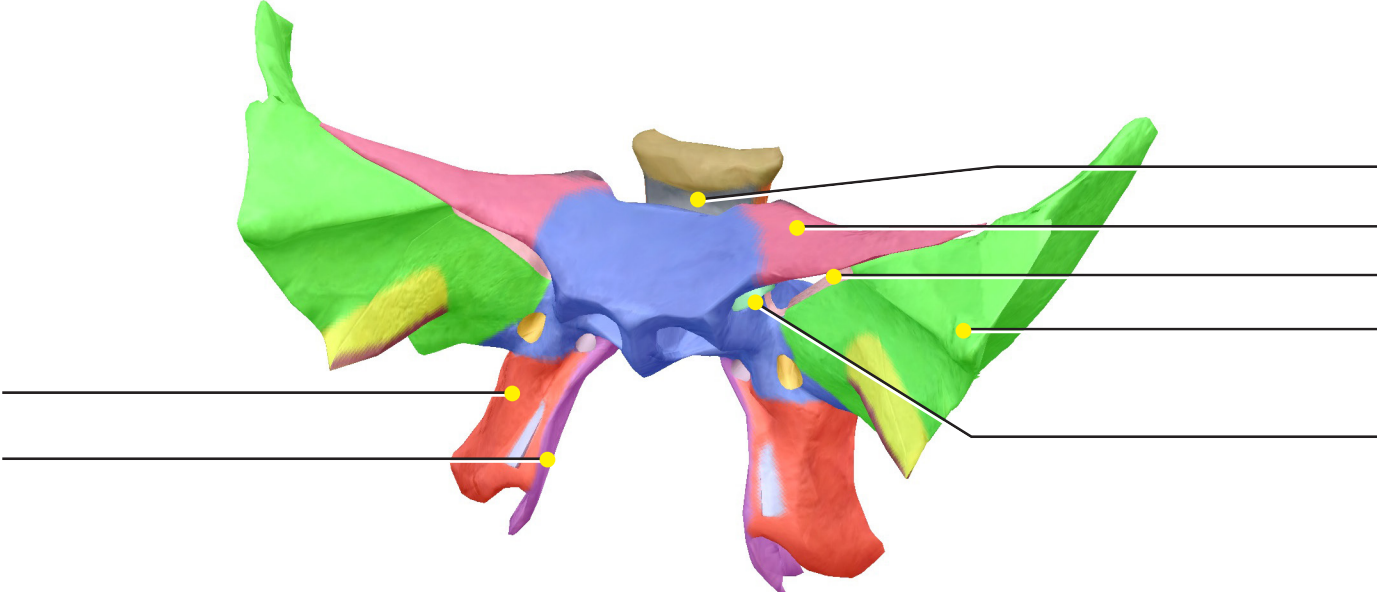
Source: Skeletal System Views: View 2. Skull



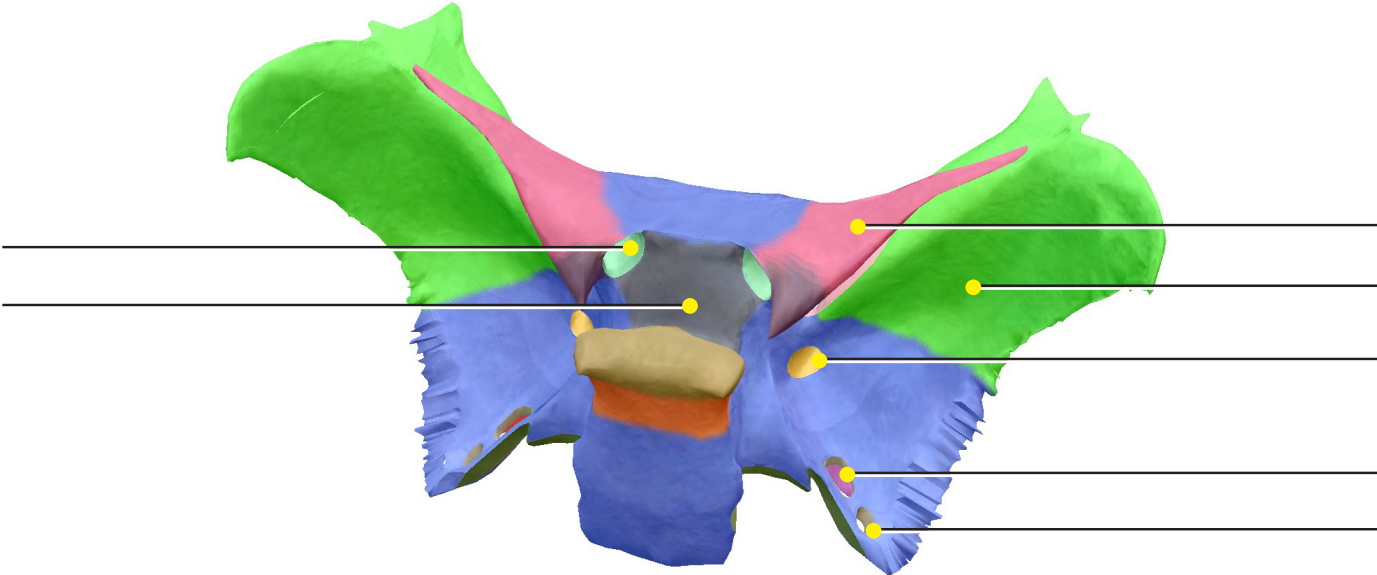
Source: Skeletal System Views: View 2. Skull



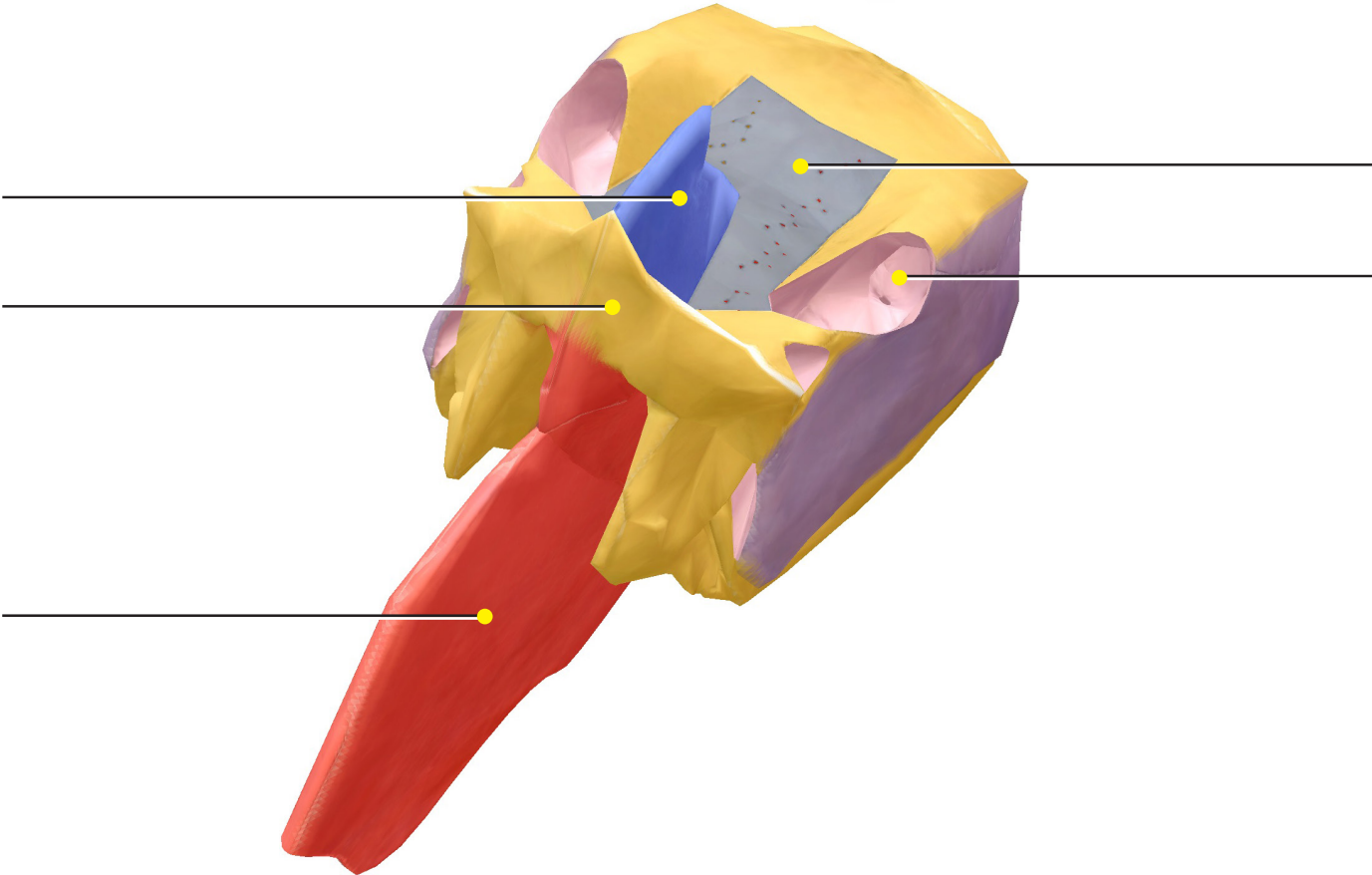
Source: Skeletal System Views: View 2. Skull



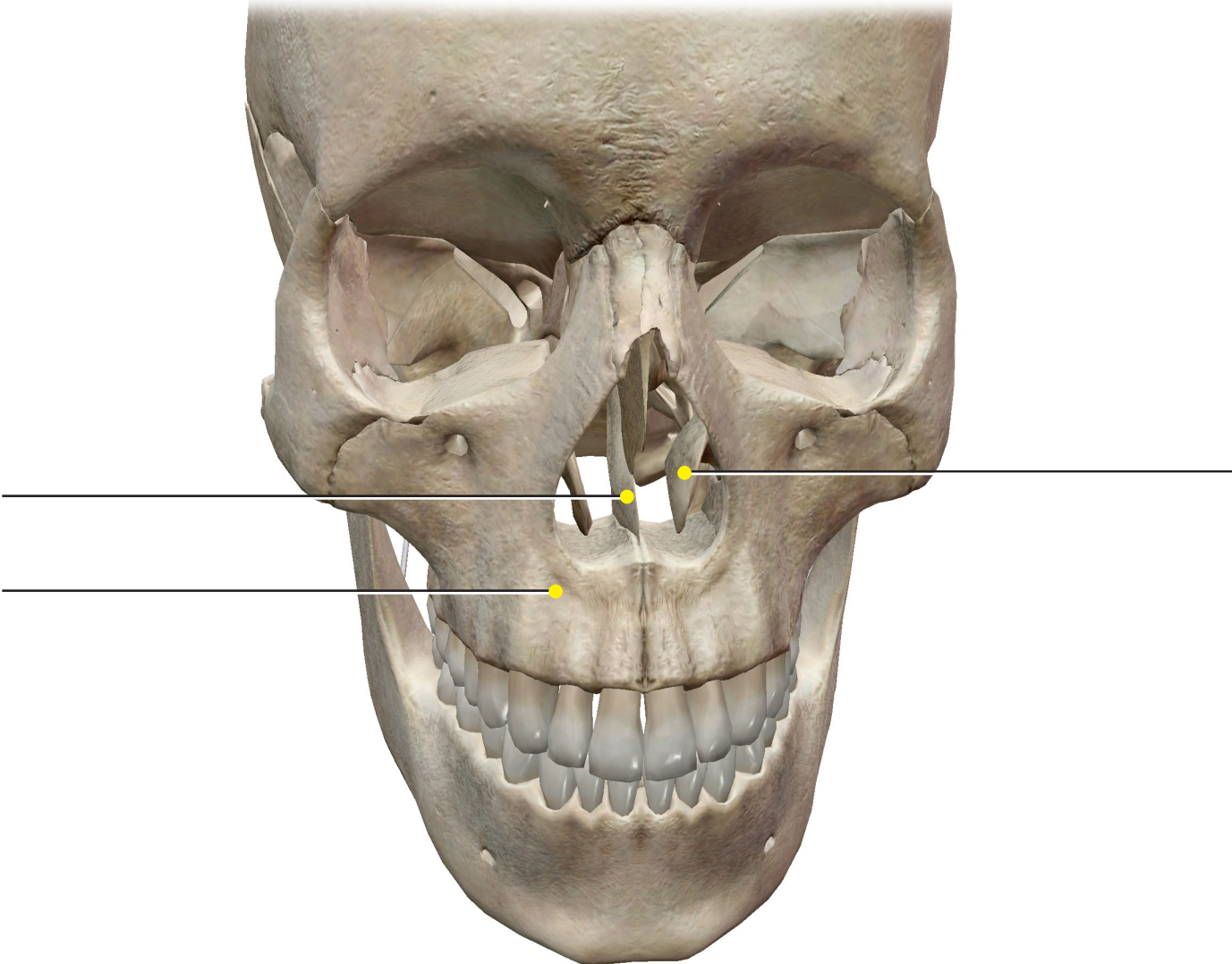
Source: Skeletal System Views: View 2. Skull



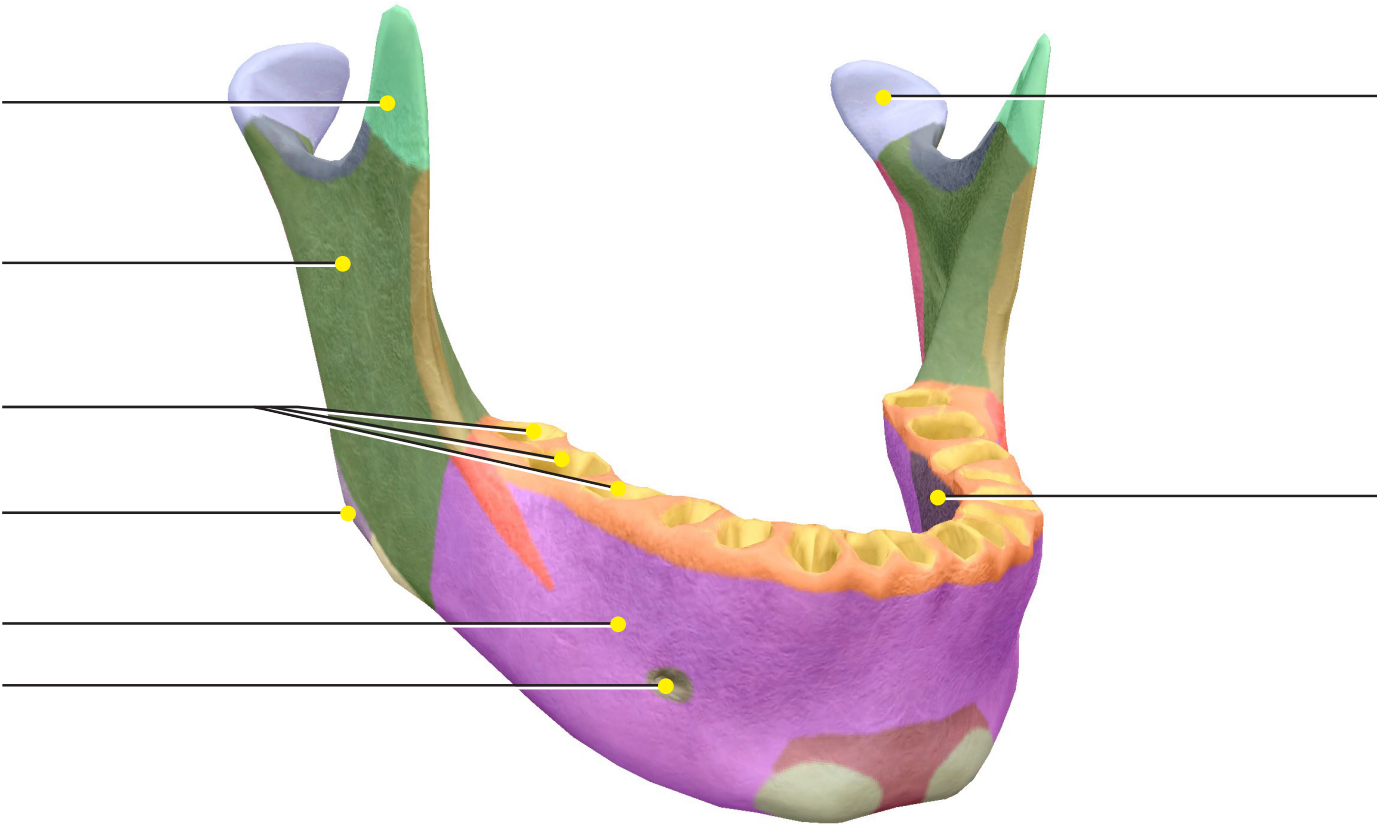
Source: Skeletal System Views: View 2. Skull



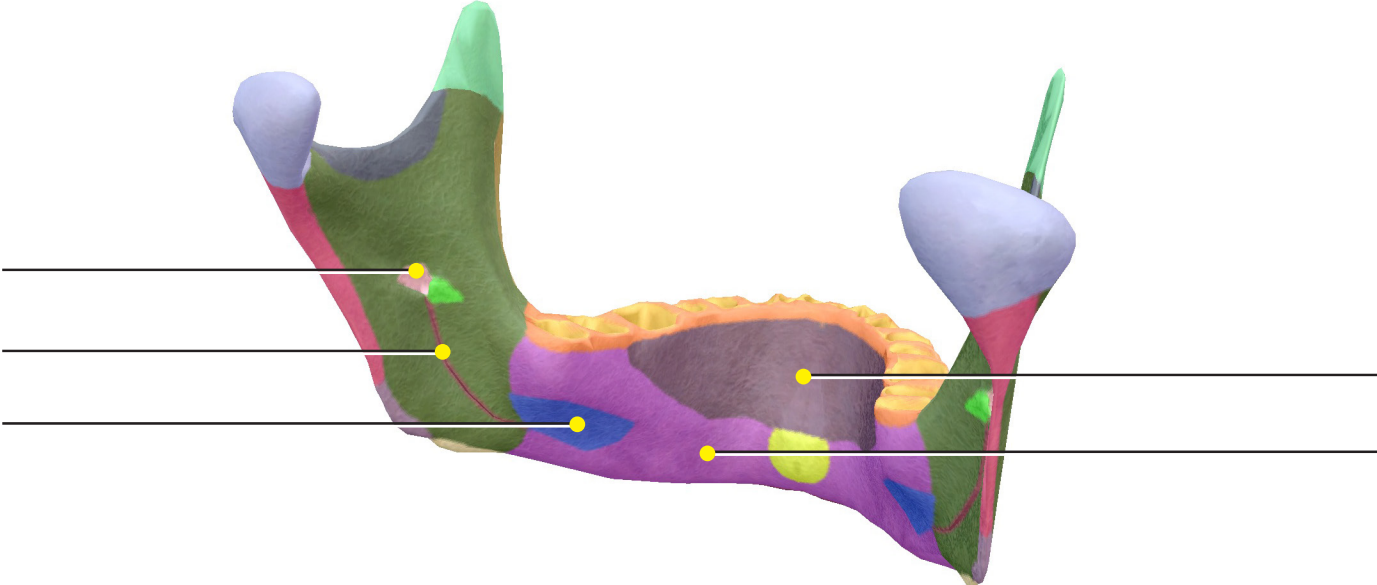
Source: Skeletal System Views: View 2. Skull



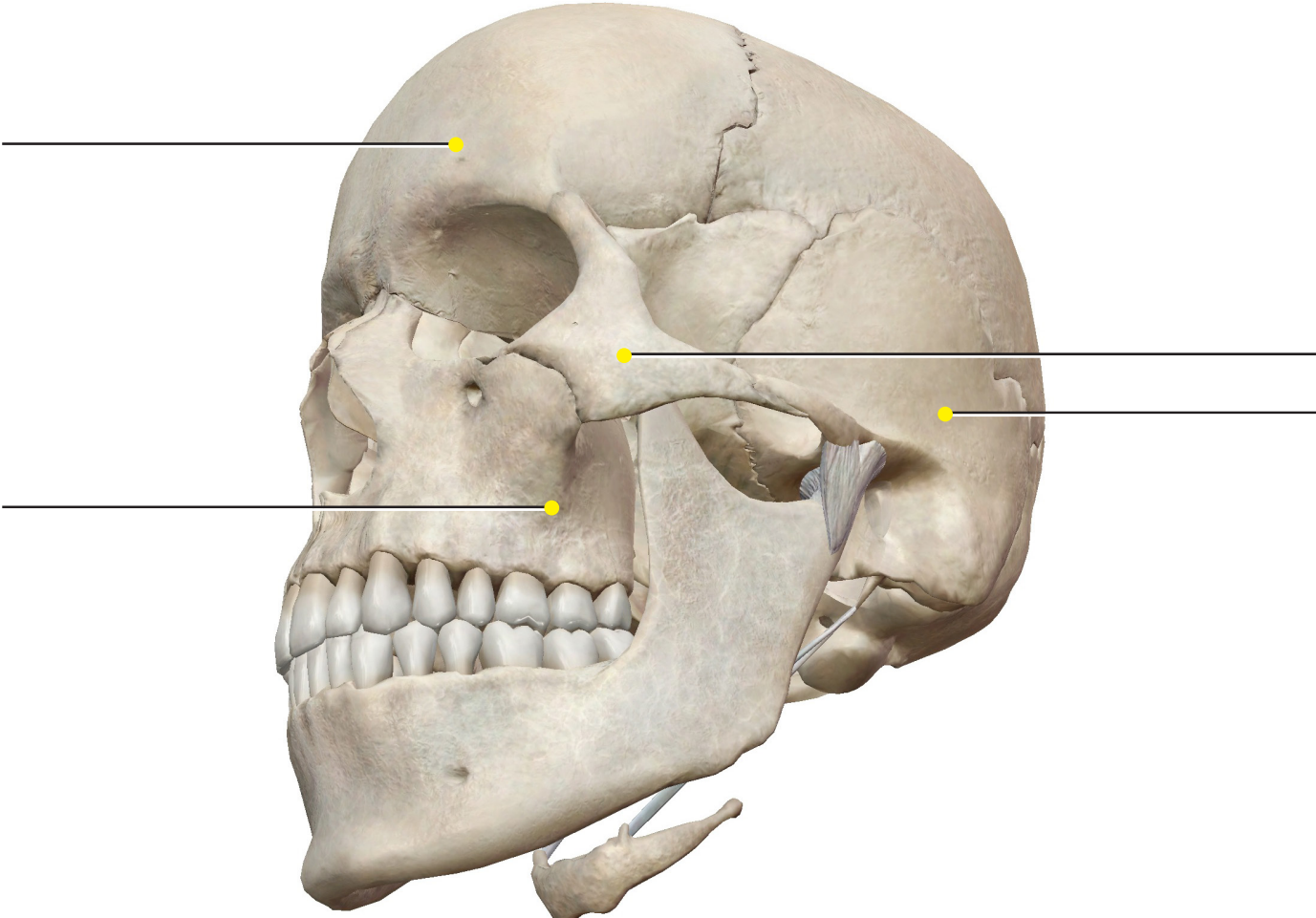
Source: Skeletal System Views: View 2. Skull



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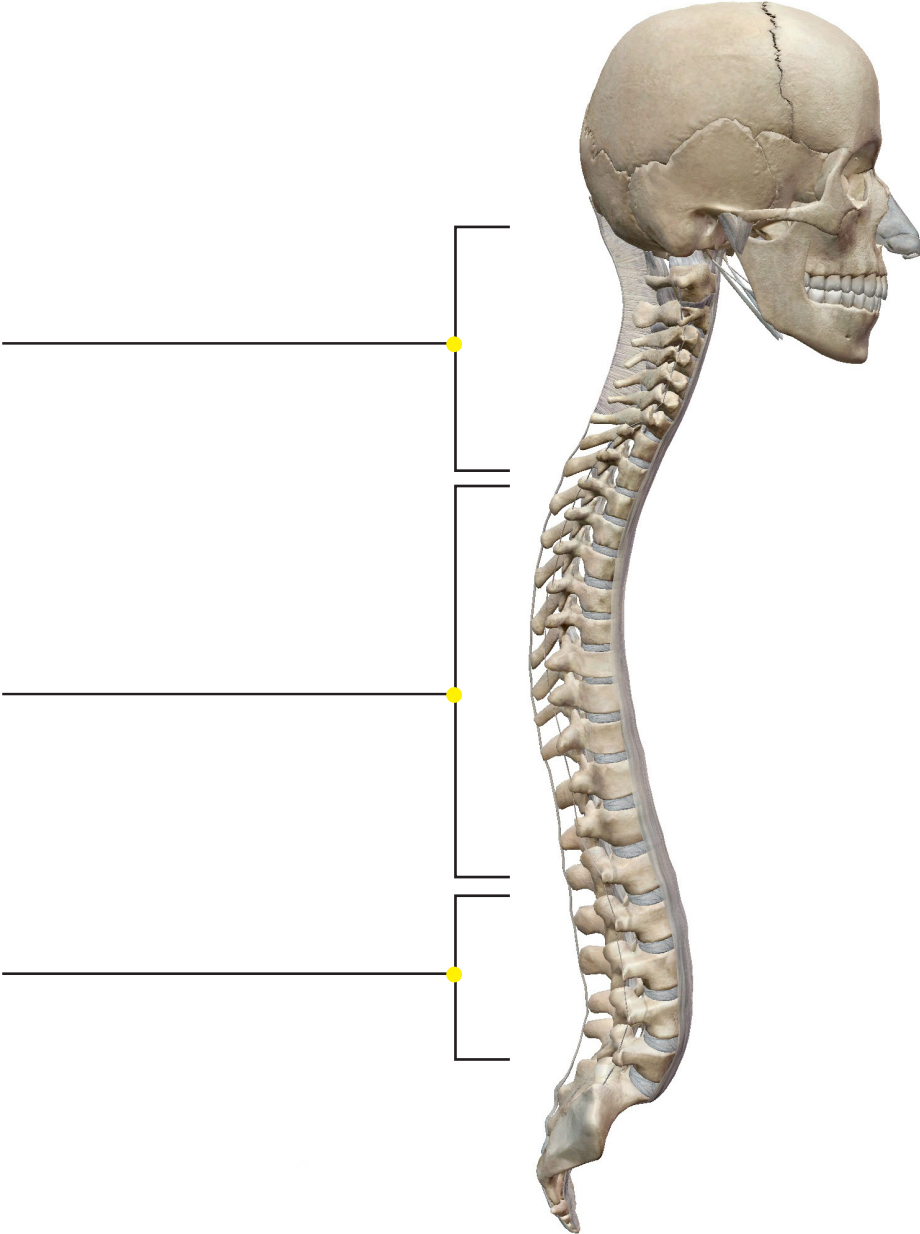
Source: Skeletal System Views: View 2. Skull



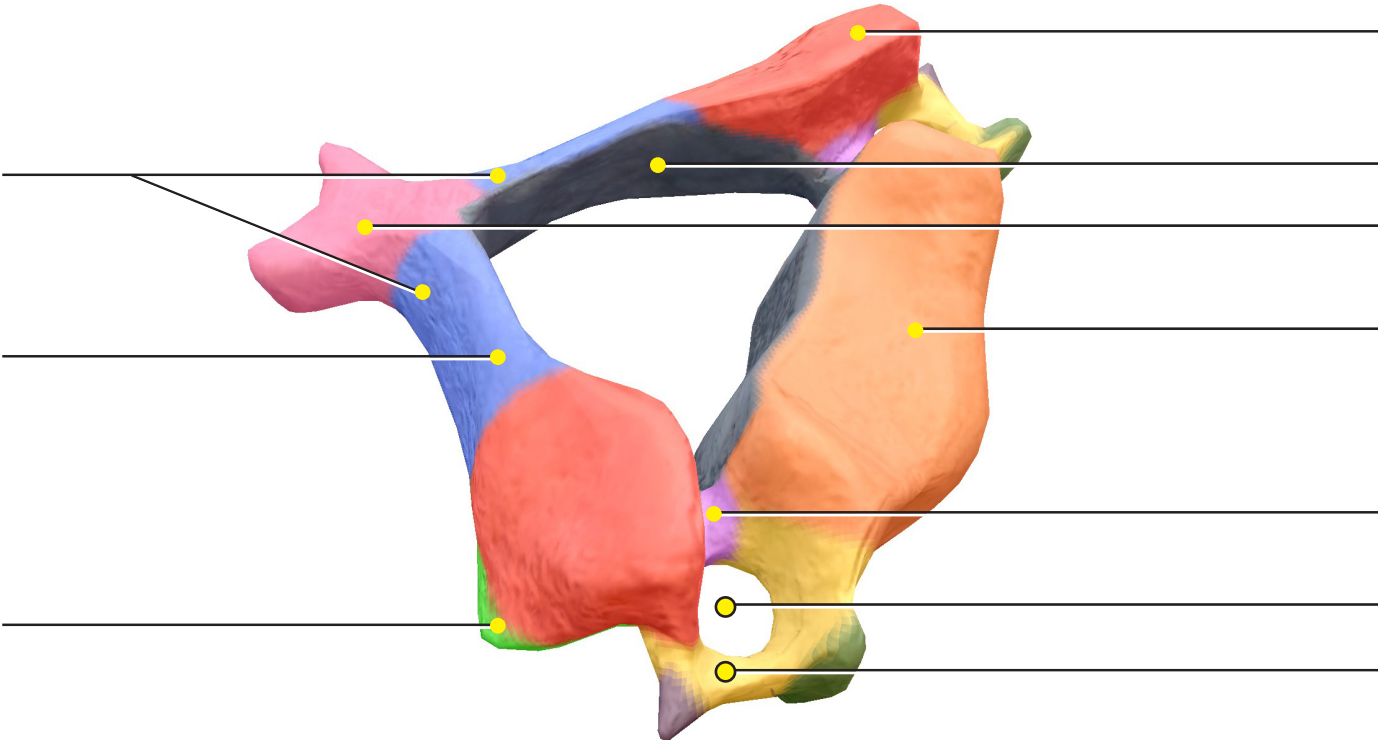
Source: Skeletal System Views: View 2. Skull



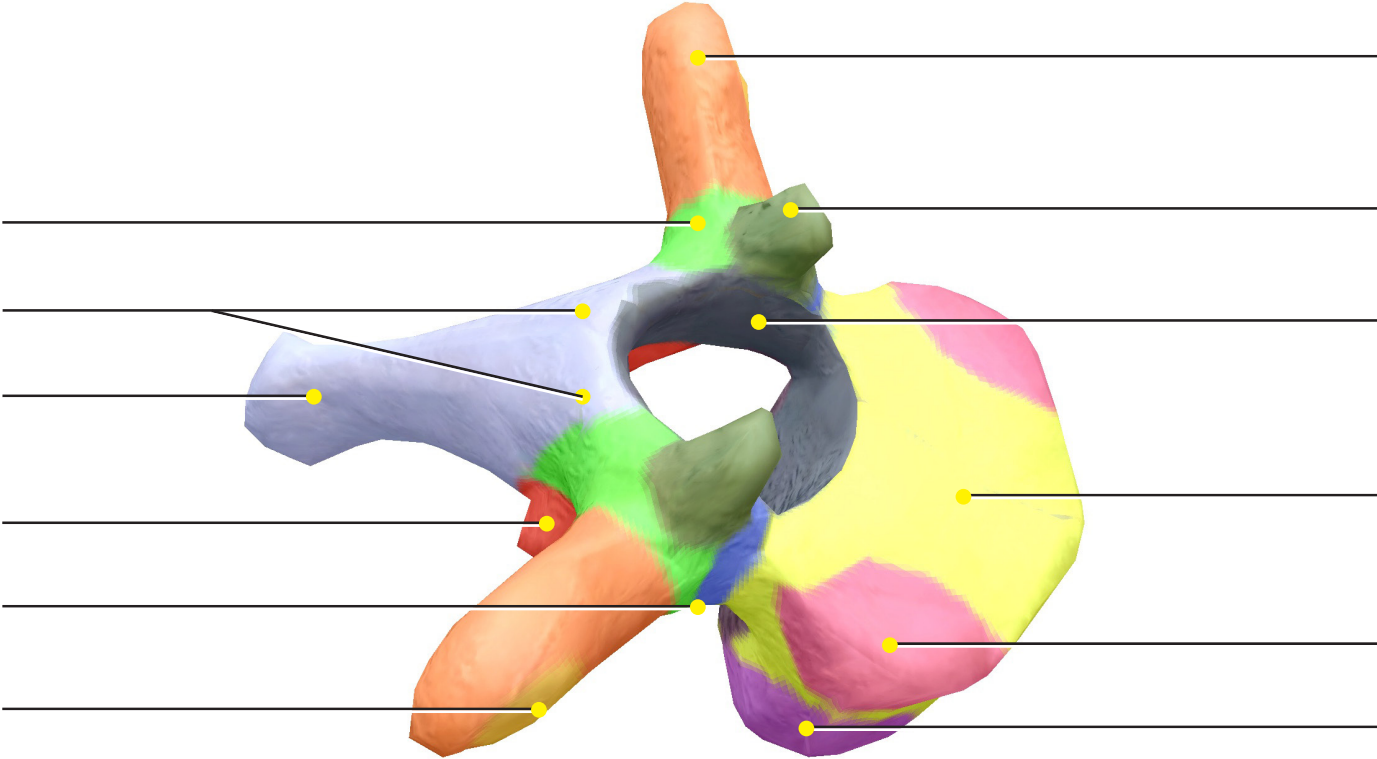
Source: Skeletal System Views: View 13. Spine, Lateral



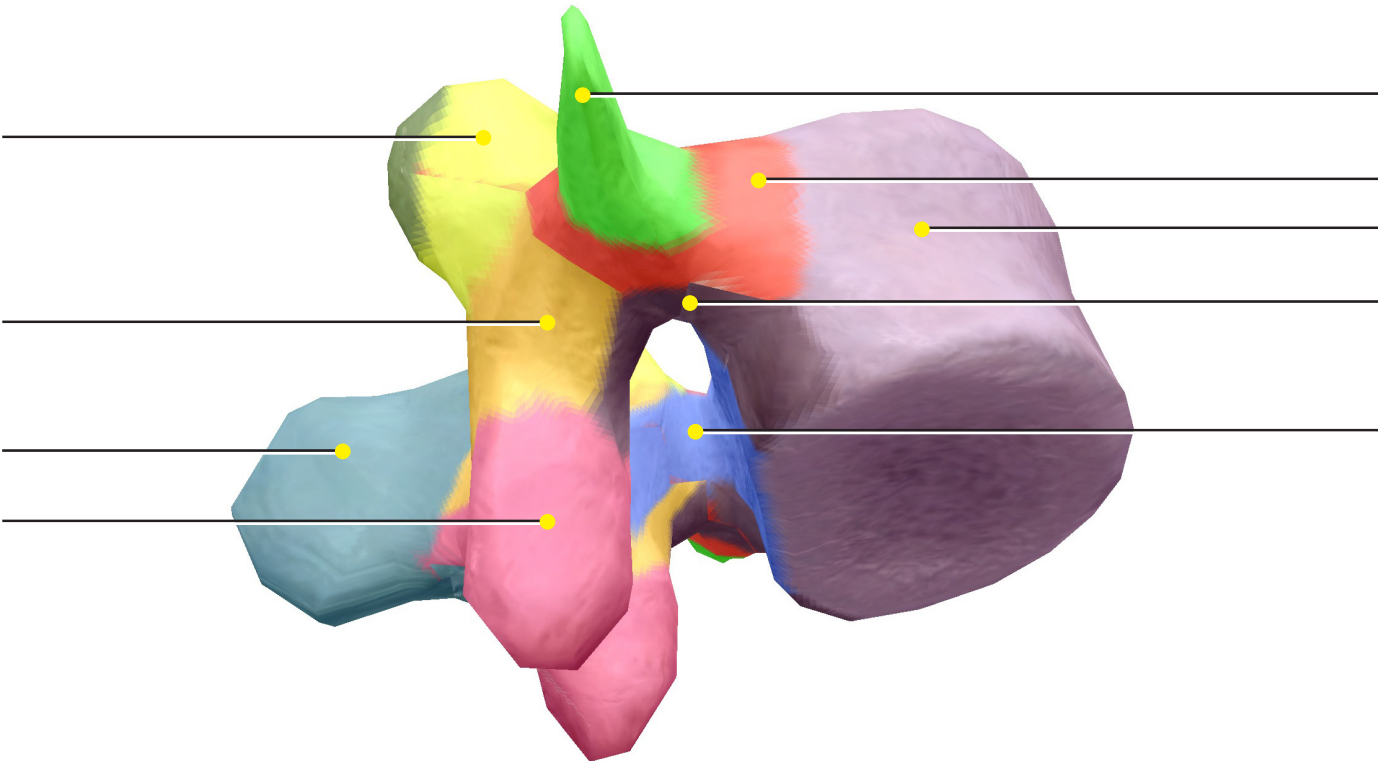
Source: Skeletal System Views: View 13. Spine, Lateral



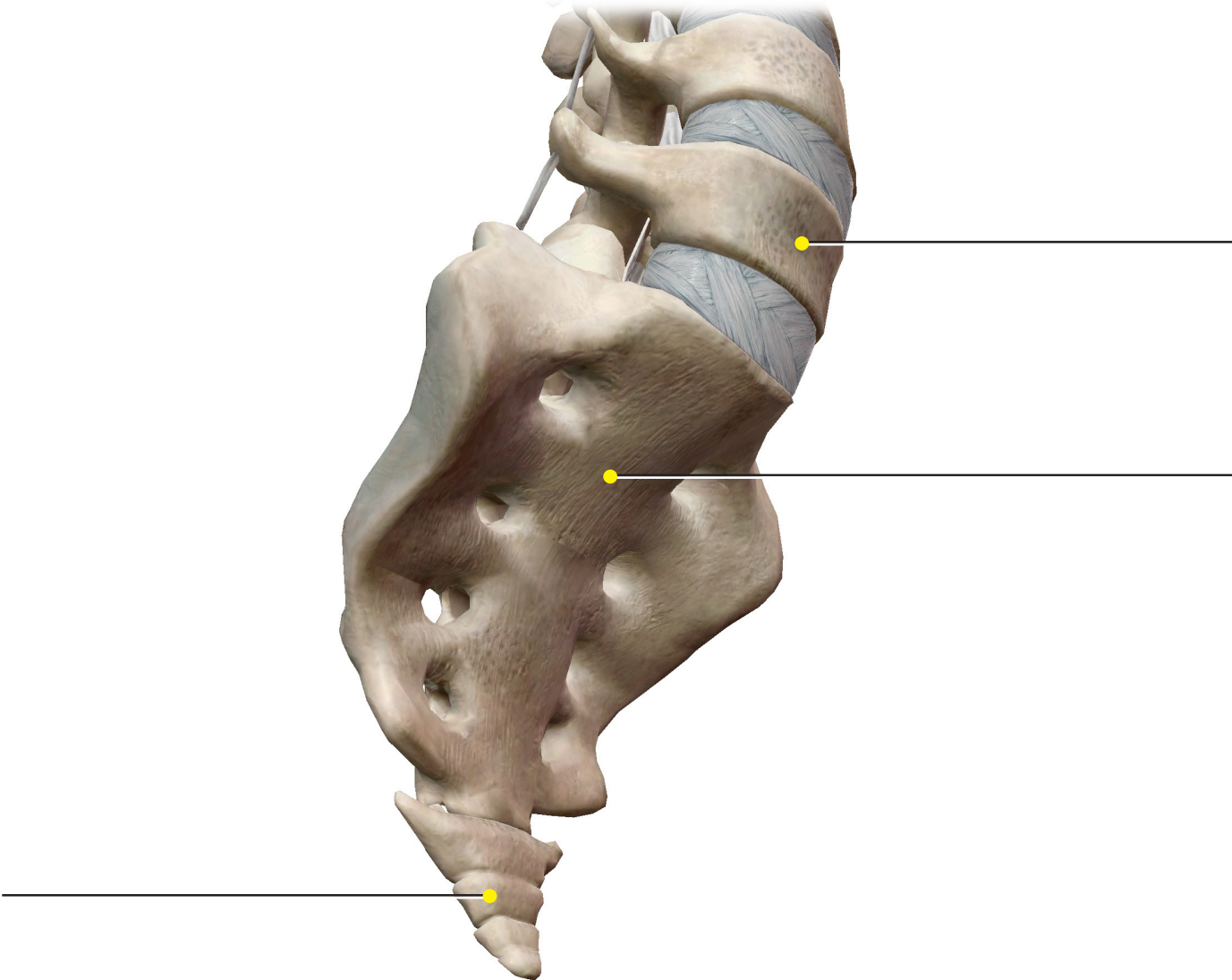
Source: Skeletal System Views: View 13. Spine, Lateral



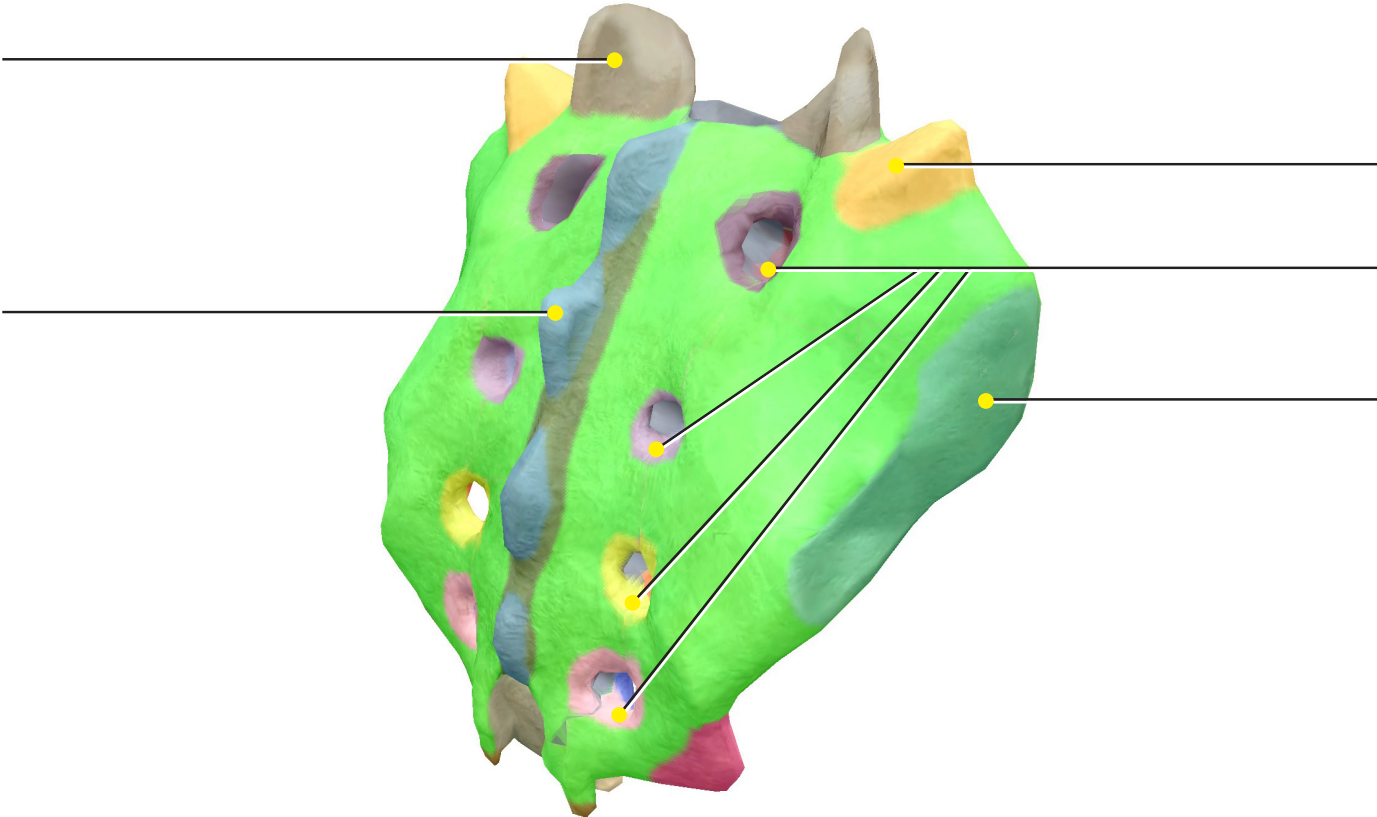
Source: Skeletal System Views: View 13. Spine, Lateral



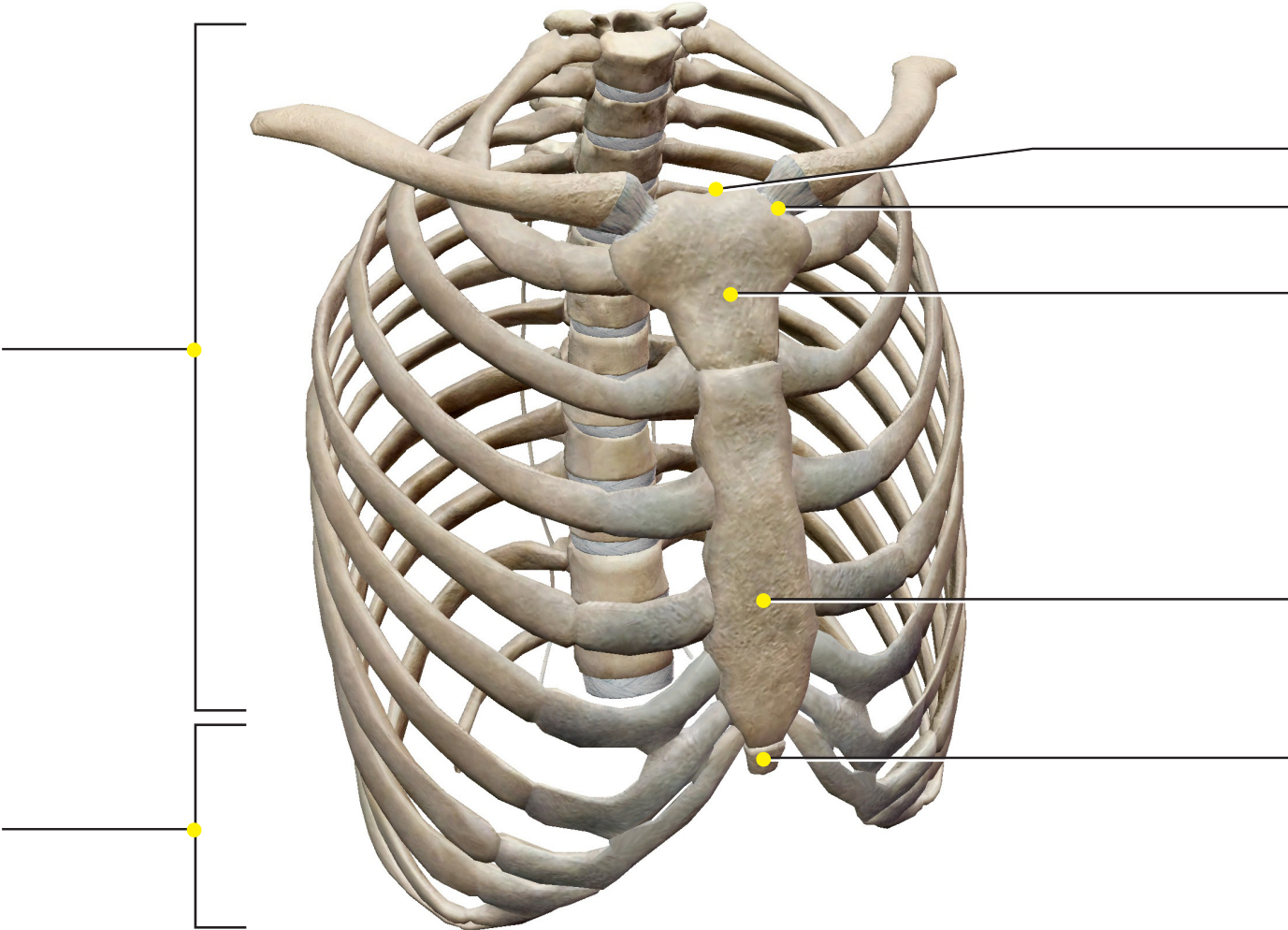
Source: Skeletal System Views: View 13. Spine, Lateral



Source: Skeletal System Views: View 13. Spine, Lateral



Source: Skeletal System Views: View 9. Thoracic Cage



Source: Skeletal System Views: View 13. Thoracic Cage

