Appendix A: Structures of the skull

The upper ('superior') and underside ('inferior') aspects of the skull have different holes ('foramina') which allow the passage of **nerves, arteries and veins** (along with a few muscles). The skull (fig 1) is made of 22 bones, some of which are paired (including frontal bone, parietal, temporal, zygomer, sphenoid, etc.) – identifying the bones are not the primary concern of the following task.

When we study the skull, we cut the skull cap off ('calvarium') to reveal the structures beneath where the brain would normally sit (fig 2). This allows us to see the superior foramina of the skull. The structures we need to be able to identify (in a properly created 3D model) are:

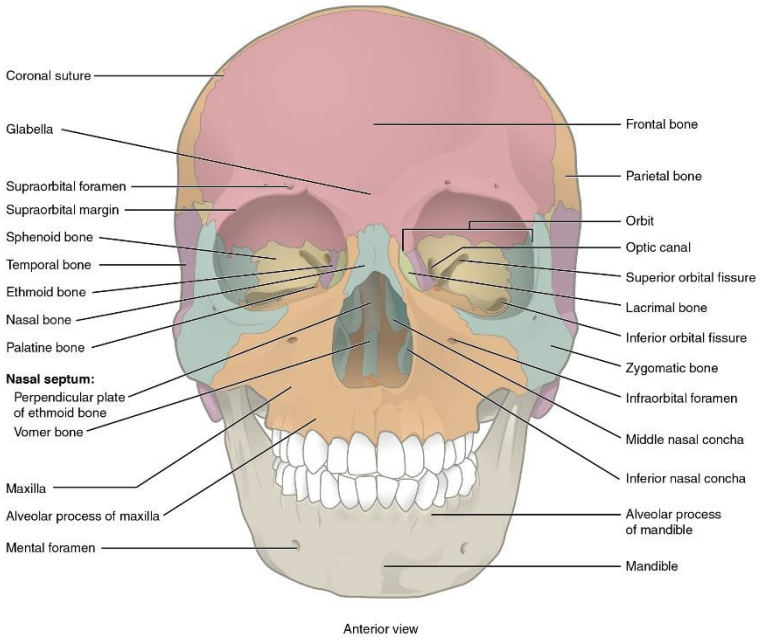

Figure 1

1. Crista galli
2. Optic canal
3. Superior orbital fissure
4. Foramen rotundum (the 'round' foramen)
5. Foramen ovale (the 'oval' foramen)
6. Foramen spinosum
7. Foramen lacerum
8. Carotid canal (for the carotid artery)
9. Internal acoustic meatus
10. Jugular foramen
11. Foramen magnum
12. Hypoglossal canal

Whilst many more bony structures exist, these are the most important few as these contain the major cranial nerves which we will be dealing with.

From the underside (inferior aspect) of the skull, we will need:

1. Foramen lacerum (note foramen lacerum is ALSO present on the superior surface!)
2. Forman spinosum
3. Foramen ovale (note there is no foramen rotundum – this is because it opens into the pterygopalantine fossa, a beautiful structure we will hate, but then eventually love; fig 3)
4. Carotid canal
5. Jugular foramen
6. Hypoglossal canal

From the orbit (where the eyes would otherwise sit), we need to be able to see the:

1. Optic canal
2. Superior orbital fissure
3. Inferior orbital fissure (which gives us view of the pterygopalatine fossa)

For the meantime, we won't worry about the nose, ear and the mandible too much

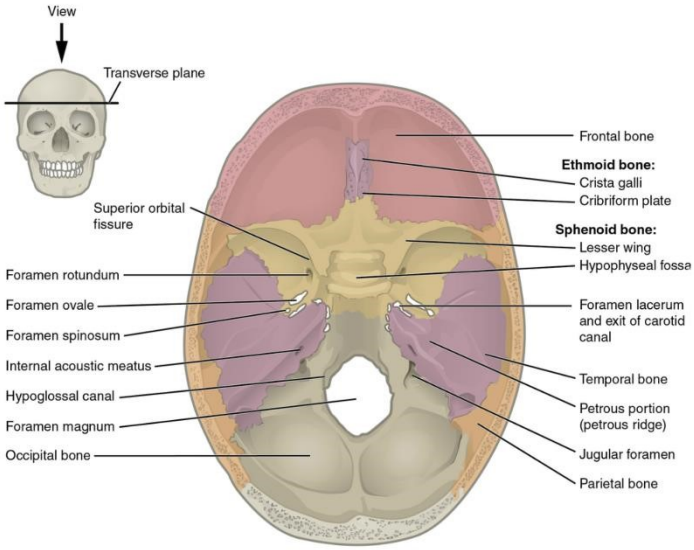

Figure 2

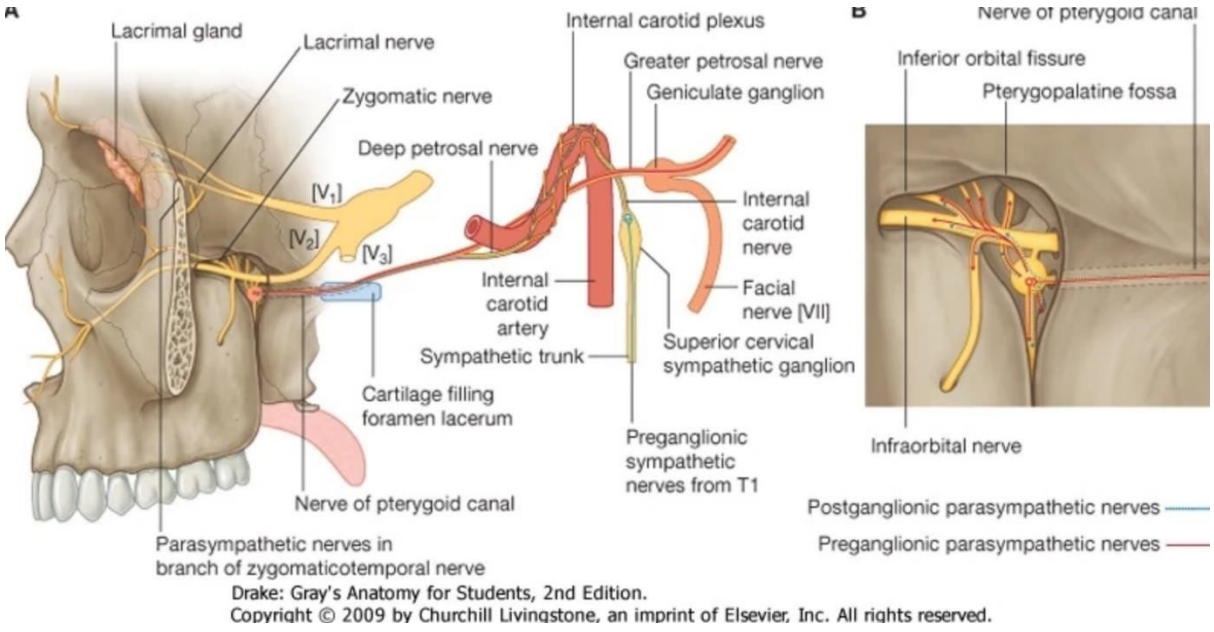

Figure 3

Appendix B: The order of structures to be carved out

1. Create a space between the pterygoid and palatine bones as in Figure 4
2. Ensure patency between this space and:
    a. Inferior orbital fissure
    b. Foramen rotundum
    c. Pterygomaxillary fissure
3. Create the direct (simple) foramen – the foramen which can simply be made by 'punching a hole' in the skull/bone
    a. Foramen spinosum
    b. Foramen lacerum
    c. Foramen rotundum
    d. Foramen ovale
    e. Hypoglossal canal
    f. Optic canal
    g. Superior orbital fissure
4. Create complex foramen – foramen which need to have structures generated using a spline
    a. Optic canal
    b. Internal acoustic meatus/facial canal (within the bone)

In steps 3 and 4, where holes are made by 'punching out' – use a BOOLEAN subtraction in blender3D between the shape of the canal and the skull model you will be provided. Exercises will be provided for this.

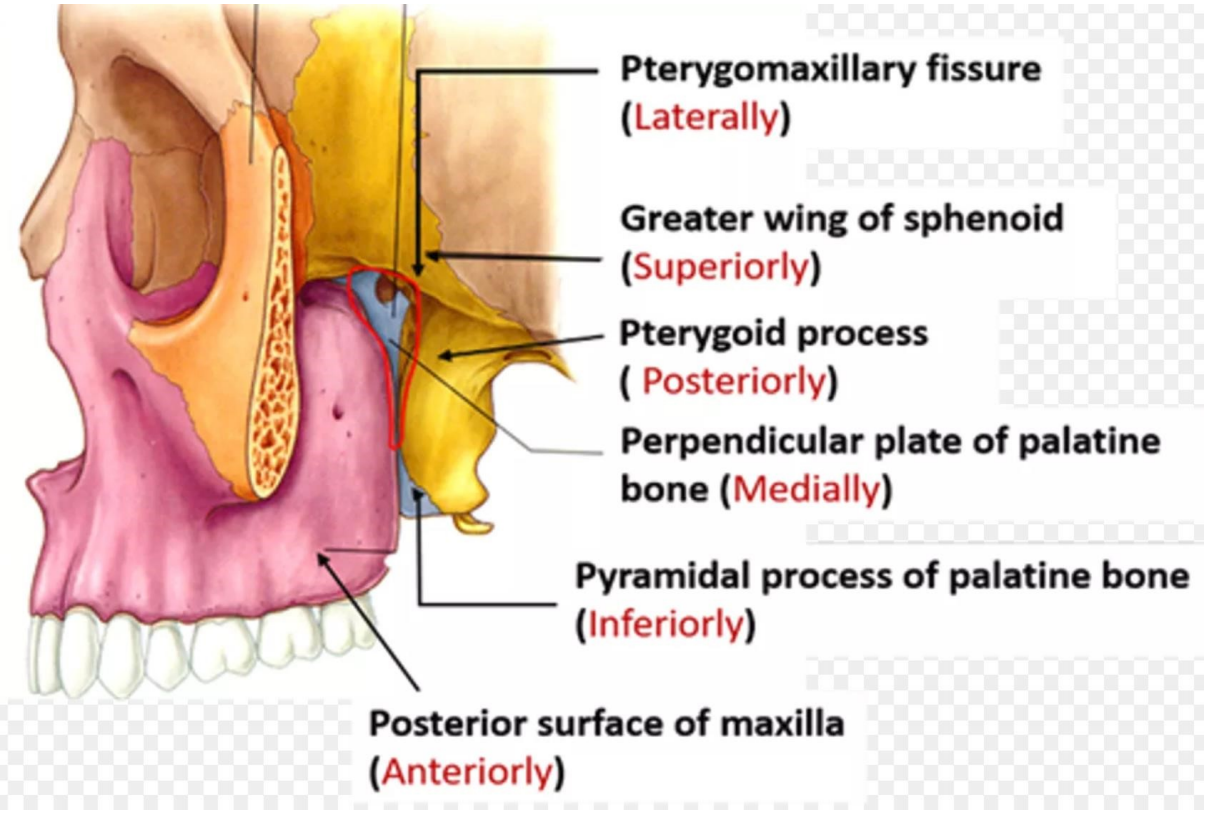

Figure 4

Appendix C: The cranial nerves

There are a few cranial nerves in charge of the function of your whole face (as well as some function of your body)

1. Olfactory nerve – carries olfactory sensation "smell"
2. Optic nerve – carries vision
3. Oculomotor nerve – lets you move your eyes and open your upper eyelid
4. Trochlear nerve – 'down and out' of your eyeball (cannot individually activate this nerve)
5. Trigeminal nerve – controls your jaw, and all sensation (pain, temperature, proprioception, etc.) from your face
6. Abducents nerve – controls a specific function of your eye - lets you deviate your right eye to the right and left eye to left
7. Facial nerve – controls facial muscles for expression (single sided damage = bell's palsy) and taste of anterior 2/3 of tongue
8. Vestibulocochlear nerve – controls hearing ('cochlear' component) and balance ('vestibular' component)
9. Glossopharyngeal nerve – controls taste of posterior 1/3rd of tongue and pharyngeal movement/swallowing
10. Vagus nerve – the traveller – provides parasympathetic innervation of the whole body (i.e. lets you poop and pee) and slows down heart rate (think of 'rest and digest')
11. Accessory nerve – lets you shrug … I can't remember anything else about this off the top of my head
12. Hypoglossal nerve – lots of tongue movement controlled by this nerve

These nerves come off the brainstem (The lower part of the brain before the spinal cord) and have a very strange course. I'll choose a few of the easier nerves for us to talk about as an exercise.

The most important vessel we will need to look at is the **internal carotid artery**. If time permits we may look at the vertebral artery and the circle of Willis.