Acland's DVD Atlas of Human Anatomy

Transcript for Volume 4

INTRODUCTION TO VOLUMES 4 AND 5

00.00

In this tape, the first of two on the anatomy of the head and neck, we'll look first at the structures involved in support and movement of the head; then at the facial skeleton and base of the skull, then at the structures involved in breathing, eating, swallowing and speaking.

00.19

In the second tape we'll look at the blood vessels of the head and neck, then at the brain, the cranial nerves, the ear, and the eye.

00.29

As in other parts of the body, understanding the bones provides the foundation for everything else we need to learn. The skull is such a complicated piece of bony anatomy that we won't try to understand all of it at once. Instead, we'll build up our picture of it a little at a time in the course of this tape. In each section we'll add the parts of the skull that are new, to the parts that we've seen already. In that way we'll end up with a complete picture.

01.00

VOL 4 : THE HEAD AND NECK PART 1

PART 1 OF VOL 4

SUPPORT AND MOVEMENT OF THE HEAD

In this first section we'll look at the way the head is attached to the body, and how it moves. We'll start by looking at the bones that are involved, then we'll look at the joints and ligaments that connect them. After that we'll look at the muscles that maintain the position of the head and cause it to move.

01.19

BONES

The bones that are involved in support and movement of the head are the thoracic and cervical vertebrae, the upper ribs, the clavicles, and this part of the underside of the skull, that's called the occiput.

01.44

The skull consists of the cranium and the facial skeleton. The cranium is the bony container for the brain, and the foundation for the facial skeleton. The cranium is made up of a number of originally separate bones. These lines of fusion, known as sutures, show where the bones are joined.

02.15

The principal bones that form the cranium are the occipital bone behind and below, the parietal bone, and temporal bone on each side, the sphenoid bone, and the frontal bone.

02.40

The two bones of the cranium that we're concerned with at present are the occipital bone, and the lower part of the adjoining temporal bone.

02.54

To see the full extent of the occipital bone, we'll take the mandible out of the picture. The occipital bone extends all the way from here at the back, to here underneath. The most striking feature of the occipital bone is this large opening, the foramen magnum, through which the spinal cord and its accompanying structures pass.

03.20

The part of the occipital bone in front of the foramen magnum is called the basilar part, often referred to as the base of the occiput. The two temporal bones converge on it from each side. We'll look at them in a minute.

03.34

Let's look at the occipital bone on the inside, in a skull that's been divided in the mid-line. Here's the foramen magnum, here's the basilar part of the occipital bone. It slopes forwards and upwards, more steeply on the inside than on the underside, since it's triangular in sagittal section.

03.59

Let's look at some more details in a skull that hasn't been colored.
On each side of the anterior half of the foramen magnum are the two occipital condyles. The occipital condyles are the joint surfaces which articulate with the atlas vertebra to form the atlanto-occipital joints. We'll look at these joints in a minute.

04.25

The outline of the front and the top of the cranium is well known
to us from our everyday observation of surface anatomy. It's perhaps surprising to see how far round the back of the cranium curves, and what an extensive overhang there is behind. The overhang is formed by the part of the occipital bone that's behind the foramen magnum, the squamous part.

04.51

The overhang is obscured by the neck muscles that are attached to this broad area on the occipital bone. The bone bears the marks of their attachment.

05.02

This lump in the middle is the external occipital protuberance. This faint ridge, leading out toward the mastoid process, is the superior nuchal line, below it is the inferior nuchal line. We'll meet the structures that are attached here, later in this section.

05.23

Now that we've looked at the occipital bone, let's take a look at the temporal bone. It's quite a complicated bone. To see its full extent, we'll again remove the mandible. The temporal bone goes from here on the outside, to here underneath. This is the petrous part of the temporal bone, this is the squamous part.

05.55

The feature of the temporal bone is this large projection, the mastoid process. As we'll see, it's the origin of some of the muscles that move the head, including the sternocleidomastoid. It's easy to feel the mastoid process here, behind and below the ear.

06.18

While we're getting introduced to the temporal bone, we'll take a first look at some of its other important features, which we'll appreciate in later sections of these two tapes. We'll also meet some of the small openings through which important blood vessels, nerves and other structures enter and leave the cranium. There are many of these openings! Here, we'll just look at the openings on the outside of temporal and occipital bones.

06.46

This is the zygomatic arch, formed largely by the temporal bone, and partly by the adjoining zygomatic bone. Here on the underside of the root of the zygomatic arch, this complex curved surface articulates with the condyle of the mandible to form the temporomandibularjoint.

07.13

This is the external auditory meatus, leading to the middle ear. This long, sharp projection is the styloid process. Just at the base of the styloid is the little stylo-mastoid foramen, for the facial nerve.

07.31

Medial to the styloid process are two major openings for blood vessels - the carotid canal, passing forwards, for the internal carotid artery, and the jugular foramen, passing backwards, for the internal jugular vein. Just above the occipital condyle is the hypoglossal canal for the hypoglossal nerve.

07.54

Let's also take a brief look the the occipital and temporal bones from the inside. Here's the squamous part of the occipital bone, here's the basilar part, here's the foramen magnum. Here's the squamous part of the temporal bone, here's the petrous part, which contains the structures of the inner and middle ear.

08.28

Here's the jugular foramen on the inside. This big groove behind it is for the sigmoid sinus , the main venous drainage channel for the brain. Below and medial to the jugular foramen is the hypoglossal canal. Above the jugular foramen is the internal auditory meatus for the vestibulocochlear, and facial nerves. The carotid canal ends here at the foramen lacerum, as we'll see in the next section.

09.00

Now we've looked at the part of the skull that we're concerned with in this section. We'll move on now to look at the bones below it. First we'll look at the special features of the first two cervical vertebrae - the atlas and the axis. Then we'll look at the continuity of the cervical spine with the bones of the upper part of the trunk.

09.25

Here's the atlas, here's the axis. These two vertebrae are adapted to allow movement of the head. Forward flexion and extension of the head take place up here at the atlanto-occipital joints, Lateral flexion of the head takes place at these joints too. Rotation of the head, together with the atlas, happens here, at the joints between the atlas and the axis, the atlanto-axial joints

09.59

Because of their special functions, the atlas and the axis differ in several ways from typical cervical vertebrae. As we've seen in Volume 3, a typical cervical vertebra has a body in front and a neural arch behind, enclosing the vertebral foramen.

10.23

It has a spinous process behind with two tuberosities, and a transverse process on each side, also with two tuberosities. On each side there are two articular surfaces one above, and one below, which form the intervertebral joints. The articular surfaces slope upward and forward. They're connected by this mass of bone, the articular pillar.

10.58

Each vertebra is joined to its neighbors by an interbertebral disk in front, and by two intervertebral joints behind, one on each side. Now let's look at the ways in which the atlas and the axis are different.

11.16

The atlas vertebra doesn't have a body. In front it just has this narrow anterior arch which matches the posterior arch. The two arches of the atlas, together with these two lateral masses, enclose an unusually large vertebral foramen. This part is occupied by the spinal cord, this part by the odontoid process of the axis, which we'll meet in a moment.

11.14

The upper articular surfaces of the atlas are shaped like parts of the inside of a cup, to match the shape of the occiptal condyles. The lower articular surfaces are shaped like parts of the inside of a cone.

11.58

Now let's look at the axis vertebra. The body of the axis is prolonged by this important projection, the odontoid process. In terms of development the odontoid process represents the missing body of the atlas. In terms of function it's the pivot around which the head, together with the atlas, rotates.

12.23

The upper articular surfaces of the axis are placed well in front of the lower ones. The upper surfaces are in a straight line with the odontoid process. As rotation occurs between these surfaces and those of the atlas, the odontoid process stays in the middle.

12.44

The odontoid process is surrounded in front and on each side by bone. It's held in place behind by a strong ligament, the transverse ligament of the atlas. The odontoid process is also held in place from above by two strong ligaments, the alar ligaments, which are attached here and here. We'll see these ligaments shortly.

13.08

The odontoid process has two small articular surfaces, one behind for the transverse ligament, and one in front for the anterior arch of the atlas.

13.20

To see how these structures relate to the base of the skull, we'll take an inside look from behind at a specimen in which the neural arches, and (the back of the occipital bone have been removed.

13.37

Here's the foramen magnum, here's the inside of the basal part of the occipital bone. Here's the atlas, here's the axis, here's the odontoid process. Here are the atlanto-occipital joints, and the atlanto-axial joints.

13.59

Now that we've looked at the atlas and the axis, we'll look at the bones below them that are involved in support and movement of the head. The lowest cervical vertebra, the seventh, articulates with the highest of the twelve thoracic vertebrae.

14.17

The two first ribs slope downward and forward from the first thoracic vertebra. The costal cartilages of the first two ribs articulate here with the upper part of the sternum, the manubrium.

14.28

The manubrium, the first ribs, and the body of the first thoracic vertebra form the margins of this opening, the superior thoracic aperture through which many important structures pass.

14.42

To complete our picture of the bones in this section, we'll add the clavicles and the scapulae. On each side the clavicle articulates with the highest part of the manubrium, to form the sterno-clavicular joint. The sternocleidomastoid muscle is inserted here.

15.04

The scapula is attached to the clavicle here, at the acromio-clavicular joint. In addition the scapula is held in place by powerful muscles, the highest of which, the trapezius, arises here on the skull, and is inserted here.

15.23

JOINTS AND LIGAMENTS

Now let's move on to look at the ligaments that connect the skull and the cervical vertebrae. Like ligaments elsewhere in the body, these structures hold the bones

together, permit the bones to move in relation to one another, and set limits to their movements.

15.41

We'll look first at the structures that permit movement between individual vertebrae, the intervertebral disks and the intervertebral joints. Then we'll look at three ligaments that run the length of the cervical spine - the nuchal ligament, and the anterior and posterior longitudinal ligaments. Lastly we'll look at the special ligaments around the odontoid process.

16.07

Here's what the cervical spine looks like in the living body. Here are the spinous processes, the articular pillars, the transverse processes, and the vertebral bodies. The intervertebral joints are here. They're synovial joints. To get a better look at them we'll make a cut through the articular pillars along this line

16.34

As with all synovial joints, each bony surface is covered by a layer of smooth articular cartilage. The space between the cartilages is filled with lubricating synovial fluid. The fluid is contained within a fibrous joint capsule, which permits movement.

16.54

Between each vertebral body and its neighbor there's an intervertebral disk. To see the disks we'll make a cut in the mid-line. The disks are made of fibrocartilage that's attached firmly to the vertebra above and below. The fibrous joints formed by the disks permit only a little movement between the regular cervical vertebrae.

17.21

The movements that can occur between these vertebrae are forward flexion, extension, and a twisting movement that's a combination of rotation and lateral flexion. In the intervals between the occiput, the atlas, and the axis, where so much movement occurs there are no disks, only synovial joints.

17.48

Now we'll look at the three ligaments that run the length of the cervical spine, starting with the nuchal ligament.

17.55

Here's the nuchal ligament, also called the ligamentum nuchae. It's a sheet of strong fibrous tissue that extends from the spinous process of the first thoracic vertebra, to the external occipital protuberance. The nuchal ligament limits forward flexion of the head and the cervical spine. It also serves as the attachment for some major muscles.

18.23

Next we'll go round to the front to see the anterior longitudinal ligament. This broad band is the anterior longitudinal ligament. It runs the whole length of the vertebral column, connecting the fronts of the vertebral bodies. It ends up here, at this tubercle on the arch of the atlas.

18.44

The anterior longitudinal ligament is not as impressive in the neck as it is lower down. In the neck, the ligament that's impressive is the posterior longitudinal ligament, which runs down the backs of the vertebral bodies, inside the vertebral canal.

19.00

To see the posterior longitudinal ligament we'll remove the arches of the vertebrae, and also the back of the skull along this line. The spinal cord and the brain have been removed, together with their covering layer of dura. Here's the base of the occiput, here's the foramen magnum, here are the divided vertebral arches.

19.28

This is the posterior longitudinal ligament. It's much broader and thicker here in the neck, than it is lower down the spine. The highest part of this ligament goes by a different name - it's called the tectorial membrane.

19.43

To get a different view of it we'll look at a specimen that's been divided in the mid-line. Here's the foramen magnum, here's the anterior arch of the atlas, here's the odontoid process.

20.01

Here's the tectorial membrane. It's attached to the base of the occiput, and to the body of the axis. Continuing as the posterior longitudinal ligament, it's attached to the backs of the vertebral bodies, all the way down the spine.

20.19

Now we'll look at the ligaments which hold the odontoid process in place, making it the stable pivot round which rotation of the head occurs. We'll see the transverse ligament of the atlas, the cruciform ligament (which the transverse ligament is part of), and the alar ligaments. To see them, we'll go back to the previous rear view, and remove the tectorial membrane.

20.44

Directlly beneath the tectorial membrane is this strong and important ligament, the transverse ligament of the atlas. The transverse ligament is attached on each side to these two tubercles on the atlas. The transverse ligament prevents the odontoid process from being displaced backwards.

21.08

A slender ligament, the superior band, runs upward from the transverse ligament to the base of the occiput, another one, the inferior band runs downward to the body of the axis. These, along with the transverse ligament of the atlas, are referred to collectively as the cruciform ligament.

21.29

We'll remove all of the cruciform ligament to see the odontoid process and the alar ligaments. Here's the odontoid process. Here are the massive alar ligaments. They pass from here on the odontoid process, to here on the inside of the occipital condyles. The alar ligaments limit rotation of the head, specially in lateral flexion.

21.54

Here's the side view again. Here's the tectorial membrane, here in front of it is the divided transverse ligament of the atlas. It's quite an impressive structure.

22.11

Lastly, we'll look at the ligaments that connect the vertebral arches. The arches of the regular cervical vertebrae are held together by strips of yellow fibrocartilage, known collectively as the ligamentum flavum.

22.27

The arches of the axis and the atlas, and the edges of the foramen magnum are held together by these loose and flexible sleeves of fibrous tissue, the atlanto-occipital and atlanto-axial ligaments.

22.42

We've looked at a lot of anatomy already! Before we move on to look at the muscles, let's review what we've seen of the bones, joints and ligaments of this very fundamental part of the head and neck.

22.56

REVIEW OF BONES, JOINTS AND LIGAMENTS

Here's the occipital bone, and the temporal bone. Here are the basal part, and the squamous part of the occipital bone; the foramen magnum, the occipital condyles, the external occipital protuberance, the superior, and inferior nuchal lines.

23.29

On the temporal bone here's the petrous part, and the squamous part. Here are the mastoid process, the zygomatic arch, the surface for the temporomandibular joint,

23.48

Here's the external auditory meatus, and the styloid process; the stylo-mastoid foramen, the carotid canal, the jugular foramen, and the hypoglossal canal.

24.11

On a typical cervical vertebra, here's the body, the neural arch, the vertebral foramen, the spinous process, the transverse processes, the articular surfaces, and the articular pillar.

24.37

On the atlas vertebra, here's the anterior arch, the posterior arch, and the lateral bodies. On the axis vertebra here's the odontoid process. Here are the intervertebral joints, and the intervertebral disks.

25.02

Here are the atlanto-occipital, and atlanto-axial joints. Here's the nuchal ligament, the anterior longitudinal ligament, the posterior longitudinal ligament, and the tectorial membrane.

25.24

Here's the cruciform ligament consisting of the transverse ligament of the atlas, the superior band, and the inferior band, and here are the two alar ligaments.

25.40

MUSCLES

Now we'll look at the principal muscles of the neck. We'll build up our picture from the inside, to the outside. We'll start with four short muscles on the underside of the occiput, the two oblique muscles, and the two rectus muscles. Collectively these are called the suboccipital muscles.

26.06

Here are the rectus capitis muscles, minor, and major. Rectus capitis minor goes from the middle of the posterior arch of the atlas, to this area on the occiput. Rectus capitis major goes from the spinous process of the axis, to here on the occiput.

26.31

Here are the two oblique, or obliquus capitis muscles, the inferior, and the much smaller superior. The inferior oblique goes from the spine of the axis vertebra, to the transverse process of the atlas. The superior oblique goes from the transverse process of the ~~atlas~~ [axis], to here on the occiput. The action of the suboccipital muscles is to extend the head, and to rotate it toward the same side.

27.06

Next we'll go round to the front to see the longus muscles, and the scalene muscles. Here are the longus muscles: longus cervicis here, merging with longus capitis higher up.

27.22

Longus capitis arises from the base of the occiput, and inserts on the transverse processes of C3,4, and 5. Longus cervicis arises from the bodies of C1 to 4, and inserts on the bodies of the vertebrae from C5, all the way down to T4. Longus capitis and cervicis are weak flexors of the head and cervical spine.

27.48

Next we'll add the three scalene muscles to the picture, the anterior scalene, middle scalene, and posterior scalene. They arise from the transverse processes of the lower five cervical vertebrae, the anterior scalene from the anterior tubercles, the middle and posterior scalene from the posterior tubercles. The anterior, and middle scalene muscles insert on the first rib, the posterior scalene inserts on the first and second ribs.

28.22

The scalene muscles are involved not in movements of the neck, but in elevating the upper ribs in deep inspiration. The scalene muscles have important relationships to the subclavian artery and the brachial plexus, shown in Volume 1 of this atlas.

28.39

Now we'll add the clavicles and the scapulae to the picture, and go round to the back again to look at three large muscles that shape the back of the neck: semispinalis, splenius, and trapezius. We'll add semispinalis to the picture first. Here's semispinalis. It arises by many tendons of origin from the articular processes of C4 to C7, and from the transverse processes of T1 to T6.

29.14

Semispinalis runs almost vertically, to insert here on the occiput, just behind the two rectus muscles. The action of semispinalis is to extend the head. In addition, when we're upright, or leaning forward the tonic action of semispinalis prevents gravity from flexing of the head.

29.37

Next we'll add splenius to the picture. Here's splenius. It's a broad strap of muscle, which arises from the spinous processes to T3 to C7, and from the lower half of the nuchal ligament. Splenius passes upward and laterally, to insert on the lateral half of the superior nuchal line, and on the back of the mastoid process. Splenius assists in rotating the head, toward the same side. This muscle beside splenius is levator scapulae, which is shown in Volume 1 of this atlas.

30.20

Lastly we'll add trapezius to the picture. Here's trapezius. Trapezius is a large and complex muscle. As shown in Volume one, its lower part extends all the way down to T12. Here we're concerned only with its upper part.

30.42

The upper part of trapezius arises from the medial part of the superior nuchal line, and from the ligamentum nuchae. Its fibers fan out downward and laterally, to insert on the spine of the scapula, the acromion, and the lateral third of the clavicle.

30.58

The trapezius muscles largely define the shape and outline of the neck, both from behind (here are the two trapezius muscles) and from in front. This is trapezius again.

31.14

Trapezius is thought of mainly as a shoulder muscle. Its upper part raises the scapula. In addition, when the scapula is held steady by the action of other muscles, trapezius acts in the same way as semispinalis, in extending the head, and in keeping the head upright when we lean forward.

31.35

The last muscle to add to our picture is the sternocleidomastoid. Here it is. It arises from here on the mastoid process and just behind it. Ther sternocleidomastoid muscle runs downwards, forwards and medially to insert partly on the medial end of the clavicle, and partly on the manubrium.

32.09

Contraction of one sternocleidomastoid muscle produces rotation of the head toward the opposite side. Contraction of both sternocleidomastoids together produces flexion of the head and cervical spine. When we're leaning backwards, their tonic action prevents gravity from extending the head and neck.

32.32

The tendons of insertion of the two sternocleidomastoid muscles, together with the medial ends of the clavicles, which are back here, define this hollow in the lower part of the neck.

32.42

Now, we've seen the muscles that produce movements of the head and neck. Let's review the muscles that we've seen.

32.52

REVIEW OF MUSCLES

Here's rectus capitis minor, and major, and obliquus capitis inferior, and superior. Here's longus capitis, and longus cervicis.

33.14

Here are the scalene muscles: anterior, middle, and posterior. Here's semispinalis, splenius, and trapezius. And here's the sternocleidomastoid.

33.32

That brings us to the end of this section on support and movement of the head.

33.44

END OF PART 1

PART 2

THE FACAL SKELETON AND THE BASE OF THE CRANIUM

00.00

In this section we'll look at the bones of the facial skeleton, and at the part of the skull the facial skeleton is attached to, the base of the cranium. Understanding the bony anatomy of this region will give us a good foundation for understanding some large and important parts of the head and neck. We'll begin by taking an all around look at the main bony features of the region. Then, we'll look at the individual named bones that make up the facial skeleton and the base of the cranium. Lastly, we'll look at the openings in the base of the cranium, which some important nerves and blood vessels pass through.

00.45

MAIN BONY FEATURES

The facial skeleton consists of a number of named bones. We'll look at them individually later in this section, but we'll start by looking at the main overall features of the facial skeleton. To simplify the picture, we'll remove the mandible.

01.02

The cavity for the eye is called the orbital cavity. It's protected on the outside by the thickened orbital margin. The opening for the nose leads to the right and left nasal cavities, which are separated by the nasal septum.

01.22

The upper jaw, or maxilla bears the upper teeth. The prominence of the cheek bone leads back to this bony arch, the zygomatic arch.

01.33

The deepening hollow here is the temporal fossa. It's enclosed by this ridge, the temporal line; by the lateral orbital margin, and by the zygomatic arch. The temporal fossa contains the large temporalis muscle.

01.53

The temporal fossa is continuous with this deeper hollow, the infratemporal fossa. The walls of the infratemporal fossa are formed by this part of the base of the skull, and by the posterior part of the maxilla. The infratemporal fossa contains the pterygoid muscles, and also this part of the mandible, the coronoid process.

2.18

On the underside of the skull we come to structures that we've seen already. Here's the foramen magnum, the basilar part of the occipital bone, and the petrous part of the temporal bone.

02.33

Two thin sheets of bone project down from the base of the skull behind the maxilla. They're the pterygoid plates, lateral, and medial. Between the two medial pterygiod plates are the posterior openings of the nasal cavities, the posterior nares, or choanae.

03.00

The hard palate forms the roof of the mouth, and the floor of the nasal cavities. Here inside the nasal cavities are the conchae, or turbinate bones. We'll look inside the nasal cavity in the next section.

03.14

The posterior nares open into the nasopharynx, which lies in the space between the medial pterygoid plates, the base of the occiput, and the anterior arch of the atlas vertebra.

03.25

In a minute we'll look at the individual named bones that form the facial skeleton. Before we do that, we need to take a look at some of the features of the inside of the skull.

03.40
This special skull has been cut away at a series of levels that are just above the floor of the cranium. The way it's been cut reflects the fact that there are two big steps in the floor of the cranium, formed by the sphenoid ridges, and the petrous temporal bones. These divide the floor of the cranial cavity into three parts, the anterior cranial fossa, the middle cranial fossa, and the posterior cranial fossa.

04.16
We saw the posterior cranial fossa in the previous section. In this section we'll look at the main features of the anterior and middle cranial fossae. The bone that forms this upward bulge in the floor of the anterior fossa is the same bone that forms the roof of the orbit

04.40
This midline crest is called the crista galli. On either side of it is a depression, the base of which is formed by these small areas of thin, perforated bone, the cribriform plates. The cribriform plate forms the very narrow roof of the nasal cavity. Here we can see it from below. The filaments of the olfactory nerve, which transmits the sense of smell, pass through the openings in the cribriform plate.

05.13
This flat area behind the cribriform plates is the roof of a cavity that we'll see later, the sphenoid sinus. Now we'll move back to the middle cranial fossa.

05.27
The bone that forms the side wall and floor of the middle cranial fossa also forms, on the outside of the skull, the wall of the temporal fossa, and of the infratemporal fossa.

05.43
We've seen that this is the roof of the orbit. The bone that forms the anterior wall of the middle temporal fossa also forms part of the orbit: it forms this posterior part of the lateral orbital wall.

06.03
This complicated raised area in the middle is called the sella turcica. The main features of the sella turcica are this deep depression, the pituitary fossa for the pituitary gland, this shallow groove for the two optic nerves, and these four projections, the anterior, and posterior clinoid processes. This sloping surface behind the posterior clinoid processes, the dorsum sellae, is continuous with the base of the occiput.

06.39
The floor of the middle cranial fossa is marked by numerous openings for nerves and blood vessels, which we'll come back to later in this section.

06.51

INDIVIDUAL NAMED BONES

Now that we've looked at the shape of the facial skeleton, and the parts of the cranium that it's attached to, let's look at the individual facial bones, and see how each of them contributes to the features that we've seen. We'll look at the five largest facial bones first. They're the frontal and zygomatic bones, the maxilla, the sphenoid bone, and the ethmoid bone.

07.22
The frontal bone is a very large bone. The lower part of the frontal bone forms the beginning of the root of the nose, the upper part of the orbital margin, a small part of the temporal fossa, and a large part of the roof of the orbit.

07.41
The frontal bone also forms most of the floor of the anterior cranial fossa. The part of the frontal bone near the midline is hollow. The hollow space is the frontal sinus, one of the paranasal sinuses, which we'll look at shortly. Next we'll look at the zygomatic bone.

08.10

The zygomatic bone forms the bony prominence of the cheek. It also forms the lower lateral part of the orbital margin, and this part of the lateral orbital wall. The zygomatic bone extends backward to meet the zygomatic process of the temporal bone, forming the zygomatic arch. Now we'll move forward and look at the maxilla.

08.36

Here's the maxilla. The right and left maxillae are joined together in the midline. On each side the maxilla forms the lower medial part of the orbital margin, and almost all of the floor of the orbit. The maxilla bears the upper teeth. On the underside it forms much of the hard palate.

09.01

The maxilla is hollow. It contains the largest of the paranasal sinuses, the maxillary sinus. To see the posterior part of the maxilla, we'll remove the zygomatic arch. Here's the back of the hollow part of the maxilla. Down here the maxilla is joined to the bone behind it, the sphenoid bone.

09.25

Apart from this attachment the maxilla is separated from the sphenoid by this impressive cleft, which has a vertical part and a horizontal part. The vertical part of the cleft is called the pterygo-maxillary fissure. The horizontal part of the cleft is called the inferior orbital fissure.

09.45

The inferior orbital fissure - here it is from in front - separates the floor of the orbit, formed by the maxilla, from the lateral wall that's formed by the sphenoid.

09.58

Now we'll move on to look at the sphenoid bone. The sphenoid bone is extremely complex! It extends all the way from one side of the skull to the other. The sphenoid bone forms important parts of the underside, and outside of the skull; and it forms part of the orbit. The sphenoid bone also forms this large and complicated part of the floor of the cranium.

10.38

Here's a sphenoid bone all by itself. The sphenoid bone has a central part, and three major projections on each side - the lesser wing, the greater wing, and the pterygoid process. The central part part of the sphenoid includes the clinoid processes, and the pituitary fossa. The central part of the sphenoid bone is hollow, as we'll see.

11.12

The lesser wing, which is the highest part of the sphenoid bone, forms the sphenoid ridge, which separates the anterior and middle cranial fossae.

11.25

The underside of the lesser wing forms this small but important part of the back of the orbit. The greater wing of the sphenoid forms the front wall and part of the floor of the middle cranial fossa.

11.44

On the outside the greater wing forms this part of the temporal, and infratemporal fossae, and it also forms this large part of the lateral wall of the orbit .

11.59

The greater wing and the lesser wing are joined here, but more medially they're separated by this triangular gap, the superior orbital fissure, which forms an large opening between the orbit, and the inside of the cranium.

12.16

Here's the superior orbital fissure from the inside. We'll get a better look at it in a minute. The pterygoid process of the sphenoid bone projects downward behind the maxilla.

12.35

The pterygoid process includes the lateral, and medial pterygoid plates, which are the attachments for some important muscles that we'll see later. This hollow between the

pterygoid plates is the pterygoid fossa. This little hook is the pterygoid hamulus. It's a pulley, as we'll see later.

13.02

The last bone on our list of large facial bones is another quite complicated bone, the ethmoid. The ethmoid bone is a little hard to understand at first, because in the intact skull most of it is hidden from view.

13.16

The only parts of the ethmoid bone that we can readily see are this small part of the floor of the anterior cranial fossa, the two cribriform plates with the crista galli in between, and this part in the medial wall of each orbit .

13.35

It'll be easier to understand the ethmoid bone when we look at the nasal cavity in the next section. Till then we'll leave the ethmoid bone alone. There are three smaller facial bones that we'll look at briefly: the nasal, lacrimal, and palatine bones.

13.54

This is the nasal bone, this is the lacrimal bone. The two thin nasal bones form just the upper part of the bridge of the nose. The structural supports for the projecting parts of the nose are made of cartilage, as we'll see later.

14.12

The little lacrimal bone forms the most medial part of the inferior orbital margin. This opening between the lacrimal bone and the ethmoid bone is for the nasolacimal duct, which takes tears from the corner of the eye to the nasal cavity.

14.28

Last of all we'll look at the palatine bone. Here's the lower part of it. On each side the palatine bone forms the posterior part of the hard palate, and part of the side wall of the nasal cavity. We'll get a better look at the palatine bone when we look at the nasal cavity.

14.53

OPENINGS IN THE BASE OF THE CRANIUM

Now we'll move on, to take a look at the openings in the floor of the anterior and middle cranial fossa that we saw earlier. We'll look at three openings that pass forwards, two openings that pass downwards, and one that, in spite of appearances, passes obliquely backwards. We'll start with the ones that pass forwards.

15.25

This round opening just in front of the anterior clinoid process is the optic canal, for the optic nerve. Lateral to it, this large triangular opening is the superior orbital fissure, which we've seen already. Numerous nerves and blood vessels pass through it into the orbit.

15.45

Below and behind the medial end of the superior orbital fissure, this smaller round opening, the foramen rotundum, is for the maxillary branch of the trigeminal nerve. We'll put this pointer in the foramen rotundum, and go round to the outside. Here's the superior orbital fissure again. Here, medial to it, is the optic canal. The foramen rotundum emerges not into the orbit, but into the ptreygo-maxillary fissure.

16.19

The two openings that pass downward are the foramen ovale, for the mandibular branch of the trigeminal nerve, and just behind and lateral to it, the foramen spinosum, for the middle meningeal artery.

16.38

To see where those two come out we'll go round to the underside. Here's the foramen ovale, just behind the lateral pterygoid plate. Here's the foramen spinosum, just behind and lateral to the foramen ovale.

17.00

The last opening to look at is this untidy looking opening, the foramen lacerum, for the internal carotid artery. In a dry skull the appearance of the foramen lacerum is quite misleading: it appears to pass straight down through the base of the skull emerging here, at the tip of the petrous temporal bone.

17.22

In the living body the apparent opening on the underside is filled in with dense fibrous tissue, represented by this material. Fibrous tissue also fills in this ragged part of the internal bony opening.

17.40

What's left of the foramen lacerum is a clean cut opening, through which the internal carotid artery emerges from its obliquely runnning bony tunnel, the carotid canal. The other end of the carotid canal, as we saw in the previous section, is back here, just medial to the styloid process.

18.03

In front of the opening for the carotid canal there's one further opening that we haven't seen yet, the opening for the auditory tube, also called the eustachian tube. The auditory tube passes backwards and laterally, to emerge here in the middle ear.

18.23

The auditory tube is longer than this: medially it's prolonged by a tube of cartilage, represented by this colored material. The auditory tube opens into the nasopharynx, as we'll see.

18.43

We'll look at these openings again, in the sections of these two tapes that deal with the blood vessels and cranial nerves. We've seen a lot of bony anatomy in this section! Let's review what we've seen of the anatomy of the facial bones and the base of the cranium.

19.00

REVIEW OF BONES

Here's the frontal bone, the zygomatic bone, the maxilla, the sphenoid bone, and the ethmoid bone. Here's the nasal bone, the lacrimal bone, and the palatine bone.

19.25

Here's the orbital cavity, the orbital margin. and the opening for the nasolacrimal duct

19.34

Here's the zygomatic arch, the temporal line, the temporal fossa, and the infratemporal fossa. Here's the pterygo-maxillary fissure, and the inferior orbital fissure.

19.52

On the sphenoid bone, here's the lesser wing, the greater wing, and the pterygoid plates, medial, and lateral. Here's the pterygoid fossa, here's the hamulus.

20.07

On the inside, here's the anterior cranial fossa, the middle cranial fossa, and the posterior cranial fossa. Here's the sphenoid ridge, the crista galli, and the cribriform plates. Here's the sella turcica, consisting of the anterior, and posterior clinoid processes, the pituitary fossa, and the dorsum sellae.

20.36

Here's the optic foramen, the superior orbital fissure, and the foramen rotundum. Here's the foramen ovale, and the foramen spinosum, and the foramen lacerum. Here's the true opening of the carotid canal. Here's the opening for the auditory tube, here's the cartilage of the auditory tube,

21.03

That brings us to the end of this section on the bony anatomy of the facial skeleton, and the base of the skull. In the next section we'll move on to look at the upper part of the air passage. You'll recall that there's one important bone that we haven't yet understood - the ethmoid bone. We'll take a good look at it in the next section.

21.30

END OF PART 2

INTRODUCTION TO PARTS 3, 4 AND 5

00.00

In the next three sections we'll look at the parts of the head and neck that are involved in two vital functions: breathing, and eating and drinking. To get a preview of these major topics, we'll look at a specimen that's been divided in the mid-line.

00.21

The passage for air, and the passage for food and liquid, begin separately at the nose and the mouth. Air passes backward through the nasal cavity, and the nasopharynx. Food and liquid pass backward through the oral cavity. The two passages unite here.

00.44

Air, food and liquid all pass through this common passage, the oropharynx. The two passages separate again here, in the hypopharynx. Food and liquid pass backward into the esophagus on their way to the stomach. Air passes forward through the larynx and into the trachea, on its way to the lungs.

01.06

So the lines of travel for air, and for food and liquid, cross over in the oropharynx. It's important that air on the one hand, and food and liquid on the other hand, don't pass upward or downward into the wrong passageway.

01.21

To take care of this, there are important mobile structures above and below the oropharynx that act as separators. These are the soft palate above, and the epiglottis, and vocal cords below.

1.36

As we'll see in later sectrions of this tape, the structures that form the passages for air, and for food and liquid, are also involved in a further important function: the production of voice sounds.

PART 3

THE NASAL CAVITY AND ITS SURROUNDINGS

BONY FEATURES

01.52

In this section we'll look at the upper part of the air passage. We'll look at the external nose, the nasal cavities, the paranasal sinuses, and the nasopharynx. We'll start by looking at the bony structures that surround these spaces.

02.21

The bony opening for the nose is called the piriform aperture. Inside it there are two nasal cavities, a right and a left, separated in the midline by the nasal septum. To get a better look inside we'll divide the skull in the frontal plane along this line.

02.30

There's a lot to see here. Let's get ourselves oriented. Here's the hard palate. Here's the floor of the anterior cranial fossa. Here are the medial walls of the orbits. Here are the two nasal cavities. The septum dividing them is a little off center, which is not unusual. The roof of each cavity, formed by the cribriform plate, is very narrow.

03.04

The medial wall of each nasal cavity, formed by the septum, is smooth and featureless, so is the floor. By contrast the lateral wall is marked by a number of features, most notably by these three delicate bony projections, the conchae, also known as the turbinate bones. This is the inferior concha, this is the middle concha, this is the much smaller superior concha.

03.30

The three conchae partially divide the air passage into three parts, the inferior meatus, the middle meatus, and the superior meatus. Here's the back of the orbital cavity. Below it is the hollow space in the maxilla, the maxillary antrum, which we'll look at later.

03.53

At about the level of the floor of the orbit, the nasal cavity becomes much narrower. The narrowing is caused by the presence of this collection of small hollow spaces, the ethmoid air cells. We'll see more of these in a minute.

04.08

To see more of the septum and the nasal cavity we'll look at it in a skull that's been divided just to the left of the mid-line. Here's the bony part of the nasal septum. It's formed by this part of the ethmoid bone, the perpendicular plate, and by this small bone that we haven't encountered up till now, the vomer. The lowest part of the septum is formed by the maxilla and by the palatine bone.

04.37

Here's the divided left cribriform plate. This projection above it is something we've seen before: it's the crista galli. The frontal section we were looking at was divided here, just behind the crista galli.

04.53

Now we'll remove the septum to get a good look at the lateral wall of the nasal cavity. The roof of the nasal cavity runs along this line, rising to its highest point along the length of the cribriform plate. Here are the conchae again, superior, middle, and inferior.

05.17

There are several openings in the lateral walll of the nasal cavity. They're partly hidden by the conchae. We'll see these in a minute. The lateral wall of the nasal cavity is formed partly by the maxilla, partly by the ethmoid bone, and partly by the perpendicular part of the palatine bone. Further back, where the nasal cavity becomes the nasopharynx, the lateral wall is formed by the medial pterygoid plate.

05.50

The large facial bones that surround the nasal cavity - the frontal bone, the maxilla, the sphenoid and ethmoid bones - are hollow to a greater or lesser extent. The hollow spaces in these bones contain the paranasal sinuses, which in the healthy living body are filled with air. The paranasal sinuses all communicate with the nasal cavity.

06.15

To see the sinus cavities we'll look at a skull in which part of the bone overlying the various sinuses has been removed. Here's the cavity for the right frontal sinus. There's a left one too, on the other side of this partition.

06.31

The frontal sinus extends upward, behind the lower part of the forehead, and also to a variable extent backwards, between the roof of the orbit and the floor of the anterior cranial fossa. Here's the cavity for the right maxillary sinus, also known as the maxillary antrum.

06.57

It extends backwards to the part of the maxilla that borders the pterygo-maxillary fissure. It extends downwards almost to the root of the upper molar and premolar teeth. The medial wall of the maxillary sinus is also the lateral wall of the nasal cavity. Its roof forms a large part of the floor of the orbit.

07.32

The sphenoid sinuses occupy the central part of the sphenoid bone. This opening has been made to show the right sphenoid sinus. To see it better we'll look at the skull divided in the midline. Here's the right sphenoid sinus again.

07.52

Above the sphenoid sinus is the floor of the anterior cranial fossa, and the sella turcica. Behind it is the basilar part of the occipital bone. In front of it is the high part of the nasal cavity. Below it is the roof of the nasopharynx.

08.12

Lastly we'll come round to the front, to look at the collection of small cavities that contain the ethmoid air cells, collectively referred to as the ethmoid sinus. These extend from just behind the naso-lacrimal duct, all the way back along the medial wall of the orbit. As we've seen already, the ethmoid air cells lie between the medial wall of the orbit, and the lateral wall of the upper part of the nasal cavity.

08.42

Before we go further, we need to catch up on something that we left unfinished in the previous section: understanding the ethmoid bone. We've encountered the various parts of the ethmoid bone, but till now we've put off seeing the whole of it.

08.59

We'll do that now, then we'll come back and look at the openings of the paranasal sinuses. The ethmoid bone is a fragile coalition of parts. The best way to see all of them is to go back to go back to the skull that was divided in the frontal plane.

09.17

All of this is the ethmoid bone. This part, the perpendicular plate of the ethmoid, forms a large part of the bony nasal septum. This upward projection is the beginning of the crista galli, which rises up in the floor of the anterior cranial fossa.

09.36

On each side of the crista galli are the cribriform plates. We've seen the cribriform plates from above, and from below. The most lateral part of the ethmoid bone is this paper-thin layer, the lamina papyracea, which forms this part of the medial wall of the orbit.

09.56

Between the lamina papyracea and the upper part of the nasal cavity are the ethmoid air cells, as we've seen. The superior and middle conchae are also parts of the ethmoid bone. The ethmoid bone is joined to the frontal bone above, the maxillae below, and the central part of the sphenoid bone behind.

10.22

Now that we've seen the ethmoid bone, we'll return to the cavities for the paranasal sinuses, and see how they connect with the nasal cavity. We'll look at the openings for the frontal and maxillary sinuses first.

10.35

Here's the frontal sinus cavity, here's the maxillary sinus cavity, seen through an artificial opening. The frontal and maxillary sinuses both open in this complex area beneath the middle concha, which we need to look at in more detail. In a dry skull there are two large irregular openings from the nasal cavity into the maxillary sinus, separated by this flake of bone, the uncinate process.

11.05

In the living body all of this opening, and much of this one, are closed off by soft tissue. The real opening of the maxillary sinus is back here. If we look in from in front, we can see that the opening is quite high on the medial wall of the maxillary antrum.

11.25

The frontal sinus opens into the nasal cavity by way of a narrow passage, the fronto-nasal duct. The fronto-nasal duct starts above the uncinate process, and runs upward and forward to reach the frontal sinus.

11.43

The frontal and maxillary sinuses open into the nasal cavity not directly, but into a narrow side chamber located here, called the infundibulum. The infundibulum isn't apparent in a bony specimen. We'll see it when we look at the soft tissues.

12.04

Now we'll look at the openings for the other sinuses. The sphenoid sinus opens into the nasal cavity here, above and behind the superior concha. The ethmoid air cells, which are up in this region, have several small openings into the nasal cavity. Some of these are behind the middle concha some of them are below it.

12.26

There are two more openings to see in the lateral wall of the nasal cavity: the opening for the nasolacrimal duct, or tear duct, and an opening for nerves and blood vessels, the spheno-palatine foramen.

12.42

As we've seen, the bony passage for the naso-lacrimal duct starts here.
The naso-lacrimal duct, which is quite short, passes downwards and backwards to open beneath the inferior concha: here's its opening.

13.00

The last opening to look at, the sphenopalatine foramen, is the inner end of a short tunnel for blood vessels and nerves to the nose and palate. On the inside it opens near the back of the superior meatus. We'll go all the way round to the outside to see the other end of the sphenopalatine foramen which is here, in the depths of the pterygo-maxillary fissure.

13.30

Now that we've seen the bony features of the nasal cavity, we'll move back and look at the bones that surround the nasopharynx. Here's the posterior opening of the nasal cavity, the choana, or posterior naris. Its lateral wall is formed by the medial pterygoid plate.

13.51

The medial pterygoid plate ends in the hamulus. This piece of colored material, represents the cartilage of the auditory tube. The cartilage forms an incomplete tube, open on the underside.

14.12

Close to the medial end of the cartilage are a group of openings in the base of the cranium that we've seen before from a different angle: the foramen ovale, foramen spinosum, the opening of the carotid canal, and the jugular foramen.

12.28

The roof of the nasopharynx, formed by the underside of the sphenoid, and the basal part of the occipital bone, slopes downward toward the foramen magnum.

14.41

To complete our picture of the bones around the nasopharynx, we'll add the cervical vertebrae. Here's the anterior arch of the atlas, and here's the odontoid process of the axis .

14.57

Now let's review what we've seen of the bony structures that surround the upper part of the air passage.

15.06

REVIEW

Here's the piriform aperture and the nasal septum. Here are the posterior nares, or choanae. Here's the inferior concha, the middle concha, and the superior concha. Here are the superior meatus, middle meatus, and inferior meatus.

15.36

Here's the cavity for the frontal sinus, the maxillary sinus, the sphenoid sinus; and here are the ethmoid air cells. Here are the cribriform plates, the uncinate process, and the vomer.

15.55

Here are the fronto-nasal duct, the openings for the maxillary sinus, the sphenoid sinus, and the ethmoid air cells, posterior, and anterior. Here are the openings for the nasolacimal duct, and the sphenopalatine foramen.

16.15

NASAL CAVITY AND ITS SURROUNDINGS: MUCOSAL FEATURES

Now that we've seen the bony features of the nasal cavity, the paransal sinuses, and the nasopharynx let's see what this region looks like in the living body. We'll start with the entry to the air passage that forms such a distinctive feature of the face, the external nose.

16.38

The skin over the upper, bony part of the nasal framework is thin and mobile. The skin over the lower, cartilaginous part is thicker, and fixed to the underlying structures.

16.53

The openings which form the beginning of the air passage are the nostrils, also called the anterior nares. We'll remove the skin from one half of the nose so that we can see the underlying structures. The edge of the bony opening for the nose, the piriform aperture, is here.

17.14

Here's the nasal bone. The two nasal bones, united in the midline, form the bridge of the nose down to here. From here almost to the tip, the bridge of the nose is formed by the front edge of the septal cartilage, which we'll see more fully in a minute. On each side the framework of the nose is formed by two slender pieces of cartilage, the lateral cartilage, and the alar cartilage.

17.42

The lateral cartilage is thin and flat. In front it's continuous with the septal cartilage. The alar carilage has two parts, the lateral crus, and the medial crus.

17.58

The lateral crus forms the curved outer framework of the nostril. The medial crus turns sharply backwards, ending here. Together the two medial crura form the framework of the lowest, most anterior part of the nasal septum, which is called the columella.

18.18

To get a good look at the nasal septum, we'll divide the bone and soft tissues along this line, and remove the left side of the face. Here's the nasal septum. Before we look at it let's get oriented. Here's the anterior cranial fossa. Here's the bony palate, or hard palate, with the soft palate extending behind it. Here's the oral cavity. Here's the opening of the right nasal cavity. Behind it is the nasopharynx, which we'll look at in a minute.

18.55

The nasal septum extends from here behind, to here in front. This small part of the septum is covered with skin. The rest of it is covered with this layer of mucous membrane. We'll remove a small piece of the mucous membrane so that we can appreciate its thickness.

19.19

The highest part of the septum is the specialized olfactory area. It contains some of the fibers and nerve endings of the olfactory nerve, which are the sensory receptors for our sense of smell. The cribrifom plate, which the olfactory nerve fibers go through, is at this level.

19.38

Now we'll remove all the mucous membrane from the septum so that we can see the underlying cartilage and bone.

19.46

This part of the septum is bone, as we've already seen. This part is formed by the septal cartilage. In this specimen there's an unusual defect in the cartilage, here. In front, the septal cartilage forms the bridge of the nose down to here, then runs downwards and backwards to attatch to this bony prominence on the maxilla, the anterior nasal spine.

20.12

Now we'll remove the whole of the nasal septum nasal septum so that we can see the lateral wall and floor of the nasal cavity. The inside of the nostril, up to the lower border of the lateral cartilage which is here, is called the nasal vestibule. It's lined with skin. The rest of the nasal cavity is lined with mucous membrane.

20.35

Here are the conchae, superior, middle, and inferior. The mucous membrane that covers them is richly supplied with mucus glands, and with blood vessels. The complex surfaces of the conchae have imporatant functions in humidifying the inspired air, and warming it. This olfactory area, like the corresponding area on the septum, contains olfactory nerve fibers and nerve endings.

21.02

All the paranasal sinuses, and the nasolacrimal duct for the tears, open into the nasal cavity. To see their openings into openings into the nasal cavity, we'll remove the conchae. The inferior concha was here. Here beneath it is the opening for the nasolacrimal duct. Beneath the middle concha, which was here, is a deep groove called the semilunar hiatus.

21.32

To see where this leads, we'll retract its lower border with this thread. The semilunar hiatus leads into a narrow, irregular shaped side chamber called the infundibulum. The infundibulum receives the openings of the frontal sinus, and the maxillary sinus.

21.54

Sometimes the more anterior ethmoid air cells open into the infundibulum too. Sometimes, as in this case, they open separately, below the middle concha. Here's where the superior concha was . The more posterior ethmoid air cells open below the superior concha. The sphenoid sinus, which is this cavity, opens forwards into the highest part of the nasal cavity, the spheno-ethmoidal recess.

22.25

Here's the frontal sinus cavity, in a different specimen. The opening to the fronto-nasal duct is behind here. To see the other sinus cavities we'll take a look from the outside, at a dissection in which all the facial soft tissues have been removed.

22.46

Here's the maxillary sinus cavity, opened from in front. The opening from the sinus into the infundibulum is all the way up here on the medial wall. Here are the ethmoid air cells, with the lamina papyracea removed. This bony opening in the medial wall of the orbit also exposes the infundibulum.

23.12

Now we'll move back, and look at the nasopharynx. To do that, we'll put the nasal septum back in place. Here's the right half of the nasopharynx. The openings from the two nasal cavities into the nasopharynx, (here's the right one) are called the choanae, or posterior nares.

23.34

The roof of the nasophaynx lies underneath the basilar part of the occipital bone. The back of the nasopharynx lies in front of the atlas vertebra: here's the anterior arch of the atlas.

23.47

In the mucosa of the lateral wall of the nasopharynx there's a pronounced inward fold called the torus tubarius. It's produced by the inward projection of the cartilage of the auditory tube. The mucosal opening of the tube is here. Behind the torus tubarius is a deep recess, the pharyngeal recess.

24.07

The floor of the nasopharynx is formed by the soft palate, which forms a highly mobile partition between the nasopharynx and the back of the oral cavity. The nasopharynx opens downward, into the oropharynx.

24.22

The soft palate can move upwards, backwards and downwards. Its movements, which are important in swallowing and in speech, are produced by several small muscles. These converge on the soft palate from above and from below on. Most of them insert on a sheet of aponeurosis or tendon like material that occcupies this part of the palate.

24.47

In this section we'll see only the palatal mucles that come from above. We'll see the ones that come from below in the next section. The two that we'll see now are the levator palati and the tensor palati.

25.03

To see these muscles, we'll remove the mucosa of the nasopharynx. Here's the end of the cartilage of the auditory tube. Here below it is the levator palati muscle: its full name is the levator veli palatini.

25.21

Levator palati arises here on the petrous temporal bone. It passes along the underside of the auditory tube, runs downwards and medially, and joins in the midline with its fellow from the other side, forming a sling. Levator palati moves the soft palate upwards and backwards.

25.48

To see the tensor palati muscle we'll remove the remove the levator. Here's tensor palati. Tensor palati arises from this area just above the root of the medial pterygoid plate. Here's the edge of the medial pterygoid plate. The fibers of tensor palati pass downward and fdrward towards the pterygoid hamulus, which is here.

26.18

The tendon of tensor palati makes a complete 90º turn round the pterygoid hamulus. Here's the tendon emerging. It passes medially to insert on the palatal aponeurosis.

26.39

The action of tensor palati is to tighten the palate when the tongue presses up against it in the act of swallowing. It also may help to open the auditory tube. We'll end this section with a look at the auditory tube.

26.58

Here's the end of the cartilage of the auditory tube. The cartilage doesn't form a complete tube: it's open on the underside. Here's the cut edge of the mucous membrane which forms the real auditory tube. It passes backwards and laterally to reach the cavity of the middle ear. The function of the auditory tube is to keep the pressure inside the middle ear the same as the pressure outside it.

27.30

Now let's review what we've seen of the upper part of the air passage.

27.36

REVIEW

Here are the nostrils or anterior nares, the columella, the lateral cartilage, the alar cartilage, the septal cartilage, the nasal vestibule, and the olfactory area.

28.00

Here are the conchae again, superior, middle, and inferior. Here's the nasopharynx, with the torus tubarius, the pharyngeal recess, and the soft palate.

28.16

Here’s the semilunar hiatus, and the infundibulum, Here’s the levator palati, the tensor palati, and the cartilage of the auditory tube.

28.32

That brings us to the end of this section on the upper part of the air passage. In the next section we’ll look at the upper and lower jaws, and the oral cavity.

28.48

END OF PART 3

PART 4

THE ORAL CAVITY AND ITS SURROUNDINGS

00.00

In this section we'll look at all the structures, other than nerves and blood vessels, that are connected with the oral cavity and oropharynx. We'll look at the upper and lower jaw and the muscles of mastication; then we'll look at the the hyoid bone and the tongue and their muscles; then we'll see the muscles of the cheek and lips, then the teeth and the salivary glands, and lastly we'll look at the pharynx. It's going to be a long section! Don't aim to watch it all at once.

00.38

UPPER AND LOWER JAWS: BONY FEATURES

In looking at the jaws we'll start, as always, with the bones. The word jaw is used in two ways. When we speak of "jaws " in the plural, we're referring to both the upper jaw, the maxilla, and the lower jaw, the mandible. When we say "jaw" in the singular, as in jaw movement or jaw bone, we're referring to the mandible.

01.03

We'll take a good look at the mandible in a minute. Before doing that, let's take a fresh look at the parts of the facial skeleton that we'll be seeing in this section. Here's the zygomatic arch enclosing the temporal fossa, and the infratemporal fossa.

01.22

Here's the joint surface of the temporomandibular joint, with the external auditory meatus and the styloid process just behind it. Here's the styloid process. Here are the pterygoid plates, with the pterygoid fossa between them. This sharp projection just medial to the temporomandibular joint is the spine of the sphenoid bone.

01.44

The part of the maxilla that bears the teeth is called the alveolar process. We'll look at the teeth later in this section. The alveolar process ends behind at the tuber.

02.01

Now we'll bring the mandible into the picture. The mandible develops from two originally separate bones, one on each side, which fuse together here at the symphysis. The mandible is described as consisting of the body, and the right and left ramus.

02.27

The corner between the ramus and the body is the angle of the mandible. The rounded projection that articulates with the temporal bone is the condyle, or condylar process. The narrowing below the condyle is the neck.

27.46

The sharp, slender projection in front of the condyle is the coronoid process, a major muscle attachment, as we'll see. The dip between the coronoid process and the condyle is the mandibular notch.

03.01

The angle of the mandible is roughened on the outside, and on the inside, by the insertions of a matching pair of muscles, the medial pterygoid on the inside and the masseter on the outside, which we'll see shortly.

03.16

The body of the mandible is described as consisting of the base and the alveolar process. The side of the body slopes upward and inward, slightly on the outer aspect, markedly on the inner aspect. The posterior part of the alveolar process bulges medially above this hollow, the submandibular fossa.

03.42

This projection in the mid-line is the mental protuberance. On the inside, this roughened area is the mental spine; two pairs of muscles are attached to it, the genio-hyoid and genioglossus muscles.

04.01

On the inner aspect of the mandible this thickening below the coronoid process is the buttress. In the middle of the ramus, level with the tops of the teeth, is the mandibular foramen. Just in front of it is a small upward projection, the lingula.

04.19

The mandibular foramen is the start of a tunnel for the inferior alveolar nerve and blood vessels. A major branch of the nerve emerges on the outside, at the mental foramen.

04.30

TEMPOROMANDIBULAR JOINT, JAW MOVEMENT

Now that we've seen the mandible, let's take a look at the joint that enables it to move: the temporomandibular joint. It's a synovial joint, with articular cartilage on the bone surfaces, and a joint capsule that encloses synovial fluid. It's a double joint: there are two separate synovial cavities, one above the other. These are separated by an articular disk that's flexible and highly movable. This arrangement permits two kinds of movement, as we'll see.

05.04

Here's what the two joint surfaces look like in the living body: they're shaped quite differently. The articular surface of the condyle is curved sharply from front to back. It's almost pointed on the top. The articular surface of the temporal bone has a double curve: this concave part is the mandibular fossa; this convex part is formed by the downward bulge of the articular tubercle.

05.36

Here's the temporomandibular joint with its joint capsule intact. Most of the capsule is thin and loose, to allow the variouus movements that we'll see. On the lateral aspect the capsule is thickened by this lateral ligament.

05.58

The articular disk is inside the joint here. To see it, we'll remove part of the capsule above and above and below it. Here's the upper joint cavity, here's the lower one. Here between them is the articular disk. It's made of dense fibrous tissue. It's attached to the joint capsule all the way round its edge. Here's the articular disk by itself: it's thin in front, and thick behind. It's quite flexible.

06.32

The two kinds of movement that can occur at the temporo-mandibular joint are a hinging movement and a forward and backward gliding movement. The hinging movement takes place between the condyle and the disk, the backward and forward movement takes place mainly between the disk and the temporal surface.

07.00

The normal opening and closing of the jaw is a combination of the two movements. If you put your finger here, you can feel the condyle moving forwards as the jaw opens.

07.14

MUSCLES OF MASTICATION

Forward movement of the body of the mandible is held in check by two ligaments that lie outside the temporomandibular joint. We'll add these to the picture after we've looked at the four principal muscles that move the jaw. We'll move on now, to look at those four muscles. They're known collectively as the muscles of mastication.

07.33

The muscles that close the jaw are much more powerful than the ones that open it. Closing is produced by three large muscles on each side, the medial pterygoid, the temporalis, and the masseter. Opening is produced by the lateral pterygoid muscle, which we'll see in a moment, and by some smaller muscles below the mandible that we'll add to the picture later in this section.

07.59

Of the four muscles that we'll look at now, we'll start with the one that's hardest to see, the lateral pterygoid. To get a look a look at it, we need to remove the coronoid process, and the zygomatic arch. This lets us see the infratemporal fossa, and behind it, the lateral pterygoid plate.

08.23

Here's the lateral pterygoid muscle. It's quite small. The lateral pterygoid muscle arises partly from the underside of the greater wing of the sphenoid, and partly from the lateral aspect of the lateral pterygoid plate.

08.41

The fibers of the lateral pterygoid run backward and a little laterally. We'll go round to a medial view to see where they go. The main insertion of the lateral pterygoid is into this hollow on the front of the condylar process.

09.01

The lateral pterygoid also inserts onto the capsule of the temporomandibular joint, and into the front edge of the articular disk. These windows in the capsule were made artificially, as in the shot that we saw previously.

09.23

Now that we've seen the lateral pterygoid, we'll add the medial pterygoid muscle to the picture. The medial pterygoid muscle is larger than the lateral pterygoid, and runs in a quite different direction. The medial pterygoid muscle arises from both the pterygoid plates: the medial aspect of the lateral one, and the lateral aspect of the medial one, also from this corner of the maxilla, the tuber.

09.53

The fibers of the medial pterygoid muscle run downards, backwards and laterally. They insert here along the inner aspect of the angle of the mandible.

10.07

Before adding the next muscle, the temporalis, to the picture we'll put the coronoid process back in place, since that's where the temporalis inserts.

10.21

Here's the temporalis, the largest of the muscles of mastication. It's shaped like a fan. The temporalis arises from the wide area on the side of the skull that lies within the temporal line.

10.38

The fibers of temporalis converge from above, and from behind, on the coronoid process. They insert insert on the outer aspect, and the inner aspect of the coronoid process, and also here on the anterior part of the ramus of the mandible.

10.59

Now we'll put the zygomatic arch back into back into the picture. The temporalis muscle lies inside the zygomatic arch. Near its insertion the temporalis is a thick muscle. It occupies the whole of the infratemporal fossa.

11.22

The temporalis muscle is covered over by this dense layer of deep temporal fascia. The fascia is attached to bone along the zygomatic arch, and all the way round the temporal line .

11.37

Lastly we'll add the masseter muscle to the picture. Here's the masseter. It's a thick, powerful muscle. The masseter arises from the anterior two thirds of lower border of the zygomatic arch on its outer aspect and from the whole length of the arch on its inner aspect.

12.04

The fibers of the masseter muscle that arise on the outside run downwards and backwards, those on the inside run straight downwards. The masseter inserts into this wide area on the angle and ramus of the mandible. The masseter muscle on the outside, and the medial pterygoid muscle on the inside, converge on the angle of the mandible in very similar ways.

12.38

Now let's take a look at the actions of the muscles that we've just seen. The action of closing the jaw is performed by the upward pull of the temporalis, the masseter, and and the medial pterygoid muscles.

12.59

Opening of the jaw is brought about partly by the force of gravity, partly by the forward pull of the lateral pterygoid muscles, and partly by the backward and downward pull of muscles we'll see in a minuite, that act by way of the hyoid bone.

13.14

We've not yet seen the two accessory ligaments that restrain forward movement of the mandible. These are the stylomandibular ligament and the sphenomandibular ligament. The stylomandibular ligament goes from the styloid process, to the angle of the mandible. The sphenomandibular ligament goes from this small projection, the spine of the sphenoid, to the lingula.

13.41

HYOID BONE AND ITS ASSOCIATED MUSCLES

Now that we've looked at the mandible and the principal muscles that move it, we'll move on to look at a small but important bone that we haven't seen yet, the hyoid bone.

13.55

The hyoid bone is a slender, U-shaped bone. It's suspended just beneath the mandible. It isn't directly attached to any other bone. You can feel your own hyoid bone here, and you can move it from side to side.

14.17

Together with its attached muscles, the hyoid bone has two important functions: it holds up the tongue, which sits above it, and it holds up the larynx, which hangs below it. It also transmits the force of muscles which help to open the jaw. Let's take a closer look at the hyoid bone.

14.38

This broad central part is the body. Its forward facing upper surface is convex, with facets for the attachment of numerous muscles that we'll see shortly. The backward facing lower surface of the body is deeply concave.

14.54

On each side this long slender part of the hyoid bone is the greater horn or greater cornu. The greater horn is attached to the body by a small synovial joint, which gives it a little mobility. This small projection is the lesser horn, or lesser cornu.

15.11

When the structures above and below it are at rest, the hyoid bone lies slightly below the lower border of the mandible. In the frontal plane the body of the hyoid is about in line with the last molar tooth.

15.26

From its resting position the hyoid bone can be moved upwards and downwards, and forwards and backwards, by the muscles that are attached to it.

15.38

Now we'll look at the muscles that hold the hyoid bone in place, and cause it to move. There are seven pairs of them: two that pull the hyoid bone upwards and forwards, one

that pulls it upwards and backwards, one that pulls it upwards by means of a pulley, and three that pull it downwards.

15.59

We'll start with the two that pull upwards and forwards: the mylohyoid, and geniohyoid muscles. Here are the two mylohyoid muscles. Between them they form a continuous sling of muscle that forms the mobile floor of the oral cavity.

16.16

The mylohyoid muscle arises from the mylohyoid line on the mandible. Most of its fibers pass downwards and medially, joining in the midline with the fibers from the opposite side, all the way from the symphysis of the mandible, to the body of the hyoid bone.

16.34

The more posterior fibers of the mylohyoid insert here on the body of the hyoid bone. The mylohyoid muscle has a free posterior border which runs straight downwards when seen from the side, also a little inward when seen from behind.

16.53

Now we'll add the two geniohyoid muscles to the picture: here they are: They lie above the mylohyoid: On each side the geniohyoid arises from the lower part of the mental spine. It inserts here, on the body of the hyoid bone.

17.12

Now we'll add the base of the skull to the picture, and add the muscle that pulls upwards and backwards, the stylohyoid. Here's the stylohyoid. It's a long, slender muscle. Just above its insertion there's an opening in the stylohyoid. The digastric muscle passes through this opening as we'll see.

17.34

The stylohyoid arises from the lateral aspect of the styloid process. It's inserted on the base of the greater horn of the hyoid bone.

17.44

Next we'll add the digastric muscle to the picture. Here it is. The digastric muscle is unusual in that it has two bellies, an anterior and a posterior, that are connected in the middle by a tendon.

17.58

The posterior belly of the digastric arises from the digastric notch on the underside of the temporal bone, and from the medial aspect of the mastoid process. The origins of the sternocleidomastoid and splenius muscles, which have been removed in this dissection, lie lateral to it.

18.18

The posterior belly narrows to a tendon which passes between the two slips of the stylohyoid. The digastric tendon then passes through a sling of fibrous connective tissue, by which it's tethered to the hyoid bone, here.

18.32

The tendon then broadens out into the anterior belly of the digastric, which runs almost straight forward beneath the mylohyoid. It's attached low down on the inner aspect of the body of the mandible, just lateral to the midline.

18.49

Lastly we'll take a brief look at the attachments of the three muscles that pull the hyoid bone downwards. They're the omohyoid, sterno-hyoid, and thyrohyoid muscles, known collectively as the infrahyoid muscles.

19.05

Here's the body of the hyoid bone. Here's the upper end of the omohyoid muscle, which goes all the way down to the scapula. Medial to it is the sternohyoid muscle, which goes to the sternum.

19.20

Behind these two is the short thyro-hyoid muscle, which goes down to a structure we haven't seen yet, the thyroid cartilage. These muscles insert on the edge of the body of

the hyoid bone, the thyrohyoid here, the omohyoid here, and the sternohyoid here. We'll see these three muscles more fully, later in this tape.

19.45

The infrahyoid muscles pull the hyoid bone downwards. Acting together with the digasric muscle, the infrahyoid muscles assist in opening the jaw. The actions of the other hyoid muscles that we've seen are evident from the direction of their fibers.

20.03

TONGUE

Now that we've seen the hyoid bone and the muscles that hold it in place and move it, we'll move on to look at the tongue.

20.12

The shape of the of the mobile anterior part of the tongue is familiar to us from everyday encounters. What's perhaps surprising is how much of the tongue we don't see from in front. The tongue goes a long way back, and a long way down.

20.29

To understand the overall shape of the tongue, let's look at a specimen that's been divided in the mid-line. All this is the tongue, right back to here. The tongue consists almost entirely of muscle, covered by specialized mucous membrane. The freely mobile anterior part of the tongue almost fills the oral cavity. The massive posterior part of the tongue, which is much less mobile, faces backwards into the oropharynx.

21.03

This structure below and behind the back of the tongue is the epiglottis. We'll see it in the next section.

21.10

To get a look at the whole tongue, we'll look at a specimen consisting of just the tongue, the mandible, and the hyoid bone. Here's the mylohyoid muscle. The body of the hyoid bone is here; here's the greater horn.

21.28

We'll look at the outside of the tongue first. The tongue is covered with mucous membrane, on top, on the sides, and also here in front, on the underside. The mucous membrane of the tongue is continuous with the mucous membrane that covers the floor of the mouth, and the alveolar process.

21.50

There's a deep valley between the alveolar process and the side of the tongue. This projecting fold in the mid-line is the frenum. On either side of it the submandibular ducts open, as we'll see later.

22.07

The mucous membrane over the root of the tongue is thin and mobile. Over the sides and the upper surface the mucous membrane is thick, firmly attached to the underlying muscle, and covered by projections called papillae. The largest of these, the valleculate papillae, are in a row back here. This shallow pit in the mid-line is the foramen cecum.

22.38

The muscles that form the bulk of the tongue are intrinsic muscles, which run from one part of the tongue to another, and extrinsic muscles, which are attached to bone. There are three extrinsic muscles on each side. Of these the two largest, which we'll see now, are hyoglossus, and genioglossus. The other one, stylo-glossus we'll see later.

23.05

To get a view of the major extrinsic muscles we'll divide the mandible along this line and remove the ramus, and the alveolar process. We'll also remove all of the mucous membrane, from this line downwards.

23.22

Here are the hyoglossus, and genioglossus muscles, which together form the root of the tongue. To see the full extent of genioglossus, we'll remove hyoglossus for a moment. All this is genioglossus. Genioglossus arises just above the genio-hyoid, from the upper part of the mental spine.

23.51

Its fibers fan out, the highest ones arching forward almost to the tip of the tongue, the lowest ones running straight backward to the most posterior part of the tongue. Genioglossus compacts the tongue, and pulls it forwards.

24.08

Now we'll put hyoglossus back back in the picture. Hyoglossus is a thin, flat sheet of muscle. Its fibers run upwards and forwards. Hyoglossus arises from the whole length of the greater horn of the hyoid bone, (here's the greater horn) and ends here, along the side of the tongue. Hyoglossus flattens the tongue, and pulls it backwards and downwards.

24.36

Here alongside hyoglossus is the third extrinsic tongue muscle, styloglossus, coming in from behind. We'll see it later. Here's the mylohyoid muscle, seen from behind.

24.50

The space between the mylohyoid and hyoglossus muscles is the pathway for the nerves to the tongue, and the submandibular duct, as we'll see in the next tape.

25.00

The intrinsic muscles of the tongue, which we won't look at in detail, run both longitudinally and transversely, above and between the extrinsic muscles. They're responsible for many of the fine movements that are involved in handling food, and in speech.

25.17

We've looked at a lot of muscles in this section: the muscles of mastication, the muscles of the hyoid bone, and the extrinsic tongue muscles. Later in this section, when we look at the salivary glands, and at the pharynx, we'll have a chance to see how all the muscles fit together, that we've seen up to now. Before we move on, let's review the structures that we've seen so far in this section.

25.42

REVIEW

Here's the ramus of the mandible, here's the body, formed by the alveolar process, and the base.

25.57

Here's the angle, the condyle, the neck, the coronoid process, and the mandibular notch. Here are the symphysis, the mental protuberance, the buttress, the mandibular foramen, the lingula, the mylohyoid line, the submandibular fossa, and the mental spine.

26.23

Here's the temporomandibular joint, the articular disk, the stylomandiblar ligament, and the spheno-mandibular ligament.

26.35

Here are the lateral pterygoid muscle, the medial pterygoid muscle, the temporalis, and the masseter. On the hyoid bone, here's the body, the greater horn, and the lesser horn.

26.53

Here are the mylohyoid muscles, the geniohyoid, the stylohyoid, the digastric, the omohyoid, sternohyoid, and the thyrohyoid. Here's the genioglossus muscle, and here's the hyoglossus.

27.13

ORAL CAVITY

Now we'll move on to take an overall look at the oral cavity, and at some important, closely related structures. We'll look first at the shape and extent of the oral cavity, then we'll look at the muscles of the cheek and lips, then at the teeth, then at the salivary glands.

27.37

To understand the shape of the oral cavity, and its extent, we'll look at it in a living model. Here's the tongue, here's the palate, here's the inner aspect of the alveolar process of the maxilla, and of the mandible.

27.54

The alveolar processes of the maxilla, and mandible, together with the upper and lower teeth, project into the oral cavity from above and below. They divide the oral cavity into an inner part, and an outer part.

28.12

The upper and lower gums, or gingivae, are formed by mucous membrane that covers the alveolar processes on the outside, and on the inside.

28.23

The outer part of the oral cavity, the vestibule, lies between the teeth and gums on the inside, and the cheek and lips on the outside. The mucous membrane of the lips and the cheek is continuous above and below with the mucous membrane of the gums.

28.42

The inner part of the cavity is closed off above by the hard palate, and further back by the soft palate, which ends back here at the uvula. It's closed off below largely by the tongue, and partly by the mucous membrane of the floor of the mouth.

28.58

To see the features of the posterior part of the oral cavity, we'll look at a dissected specimen that's been divided in the mid-line. This specimen is missing a number of teeth.

29.10

The mucous membrane that lines the cheek passes medially behind the last molar teeth and becomes continuous with the mucous membrane of the inner part of the oral cavity. The front of the ramus of the mandible is here. To look at the wall of the oral cavity further back, we'll move the soft palate backward.

29.32

This fold in the mucous membrane running from the soft palate to the side of the tongue is the palato-glossal arch. It acts as a dam, preventing liquid from spilling backward past the side of the tongue. This less noticable fold is the palatopharyngeal arch.

29.50

This triangle between the two arches is occupied in early life by a prominent mass of lymphoid tissue, the tonsil. In later life, as in this specimen, the tonsil atrophies. Here's the palatoglossal arch in a young person. Here behind it is the tonsil.

30.09

MUSCLES OF CHEEK AND LIPS

We'll look at the soft palate along with the oropharynx, at the end of this section. Now that we've looked at the overall shape of the oral cavity, we'll move on to look at the muscles of the cheek and lips. The muscles we'll look at are the buccinator, which forms the muscular lining of the cheek, and the complex of muscles that surround the mouth, collectively called the orbicularis oris.

30.34

Before looking at these muscles, we need to get acquainted with a ligamentous structure that the posterior fibers of the buccinator are attached to, the pterygo-mandibular band also called the pterygo-mandibular raphé. The pterygo-mandibular band, represented by this piece of material, passes from the pterygoid hamulus, to the posterior end of the mylo-hyoid line.

31.02

Two muscles arise from it: the buccinator in front, and the superior constrictor of the pharynx behind. The pterygomandibular band can stretch to accomodate jaw movement.

31.13

Now, to see the muscles of the cheek and lips, we'll look at a dissection in which the skin and subcutaneous fat have been removed from the lower part of the face. The muscles of facial expression have also been removed. Here's the orbicularis oris, here's the buccinator. The two are closely associated.

31.35

We'll look at the buccinator first. Here it's partly hidden by the masseter muscle, which we'll remove. The buccinator is a thin pouch of muscle that closely follows the contours of the mucous membrane of the vestibule. It has a long line of origin.

31.55

The buccinator arises from the maxilla and from the mandible along these lines. Above, the line of attachment curls round behind the tuber of the maxilla. Below, it curls round onto the buttress of the mandible. Between these two points, the most posterior fibers of the buccinator arise from the pterygo-mandibular band.

32.20

The buccinator muscle passes forward, and divides at the corner of the mouth. Its fibers continue forwards to become the deepest part of the orbicularis oris.

32.33

The orbicularis oris muscle complex surrounds the opening of the mouth. It consists partly of intrinsic fibers, but it's formed mainly by the fibers of other muscles: on the deep aspect by the continuing fibers of the buccinator, and on a more superficial level by these by these muscles of facial expression. We'll take a good look at them in the last section of this tape. The action of the orbicularis muscle is to press the lips together, closing the mouth.

33.07

The action of the buccinator is to prevent the cheek from distending when we raise our intra-oral pressure. When we let the buccinators relax, this happens.

33.19

TEETH

Now that we've looked at the muscles of the cheek and lips, we'll move on to look at the teeth.

33.24

These are the lower teeth of a young adult. In the full dentition there are sixteen teeth above and sixteen below, thirty two in all. In each quadrant there are two incisors, one canine, two premolars, and three molars. (This individual's third molars have been removed.)

33.49

The incisor teeth are flat and chisel shaped. The canine teeth have a crown that's cone shaped, and a massive root which forms a prominence in the gum. The premolar teeth are broad, and short from front to back. They have two projecting cusps.

34.10

The molars are longer from front to back than the premolars, and have from three to five cusps.

34.19

Each tooth consists of a crown, which projects above the gingiva, and a root or roots which are embedded in bone. The tip of the root is called the apex. The crown and the root meet at this slight narrowing, the neck. The crown is covered on the outside with enamel, which is extremely hard. The inner part of the crown, and the root, are made of dentin.

34.48

The tooth is fixed to the surrounding bone by a layer of specialized periosteum, the periodontal membrane or ligament. The space within the tooth is the pulp cavity. The pulp of the tooth contains blood vessels and nerves, which enter through the apical canal.

35.04

The incisors and canines have one root, the premolars have a single root that's forked at the end. The molar teeth have multiple roots: the upper ones have three, the lower ones usually have two.

35.21

SALIVARY GLANDS, MUSCLE OVERVIEW

Now that we've looked at the teeth we'll move on to look at the glands that produce saliva, the salivary glands. There are three salivary glands, the parotid gland on the side of the face, the submandibular gland beneath the body of the mandible, and the sublingual gland in the floor of the mouth. We'll look at the parotid gland first.

35.40

Part of the parotid gland lies superficially in the posterior part of the cheek, part of it lies deep in the space between the ramus of the mandible and the sternocleidomastoid muscle. We'll look at the deep part first.

35.58

To look at the deep part of the parotid gland we'll start with a dissection in which the whole of the gland has been removed. This is a good opportunity to see all in one place a number of structures that we've learned about separately. Let's take a good look round.

36.16

Here's the posterior border of the ramus of the mandible, here's the zygomatic arch, here's the external auditory meatus, here's the mastoid process. Here's the sternocleidomastoid muscle, here's the masseter muscle. Here's the space that's occupied by the deep part of the parotid gland.

36.40

Here's the posterior belly of the digastric muscle, lying deep to the sternocleidomastoid. Here's the styloid process, and the stylohyoid muscle. Here, emerging behind the styloid process, is the trunk of an important nerve, the facial nerve.

36.59

The facial nerve, which provides the motor innervation to all the muscles of facial expression, has an important relationship to the parotid gland: it runs right through it, dividing into several branches as it does so.

37.13

Now that we've seen the space that's occupied by the deep part of the parotid gland, we'll add the deep part of the gland to the picture. Here's the cut surface of the parotid gland. Again, here are the sternocleidomastoid muscle, the masseter, and the ramus of the mandible. Before we add the superficial part of the parotid gland, we'll add the facial nerve to the picture.

37.37

Here's the trunk of the facial nerve, entering the parotid gland from behind. The branches of the facial nerve fan out upwards, forwards and downwards. We'll take a

more complete look at the facial nerve in the next tape in the series. Here, we're concerned only with its relationship to the parotid gland.

38.04

Now we'll add the superficial part of the gland to the picture. Here it is. The superficial part of the parotid gland covers the posterior part of the masseter muscle. Its extent varies. It usually extends up as far as the zygomatic arch, and down to the angle of the mandible. It can also overlap the anterior border of the sternocleidomastoid muscle.

38.31

The saliva that's secreted by the parotid gland passes into the parotid duct, which emerges from the anterior border of the gland, and passes forward around the anterior border of the masseter. The parotid duct enters the oral cavity by passing through the buccinator muscle and through the underlying mucous membrane, at about the level of the second upper molar tooth.

38.55

Next we'll look at the submandibular gland. The submandibular gland lies under the posterior part of the body of the mandible.

39.06

We'll start by looking at a dissection in which the gland has been removed. Again, we'll take the opportunity to review the bony and muscular anatomy.

39.16

Here's the body of the mandible, here's the body of the hyoid bone. Here's the anterior belly of the digastric, here's the digastric tendon, passing through the stylohyoid muscle. Here's the mylohyoid muscle, here's the styoglossus. Here, deep to the digastric, is the the hyoglossus muscle.

39.42

Now we'll add the submandibular gland to the picture. Here it is. The submandibular gland curls around behind the free border of the mylohyoid muscle, so that it has a superficial part, which we can see here, and a deep part. To see the deep part we'll remove the superficial part.

40.05

Here's the cut edge of the deep part of the submandibular gland, between the mylohyoid and styloglossus muscles. It extends forward to about here.

40.17

The saliva that's produced by the submandibular gland passes into the submandibular duct, which runs forwards in the floor of the mouth. To see the duct, and also to see the third salivary gland, the sublingal gland, we'll look at a specimen consisting of the mandible, the tongue, and the floor of the mouth. We'll remove the alveolar process, and we'll remove the mucous membrane.

40.46

Here, just beneath the mucous membrane, is the sublingual gland which we'll see in a moment. For now, we'll remove it too, to see the submandibular duct. The submandibular duct runs forward in the floor of the mouth alongside the base of the tongue. It ends here, just beside the frenum. To see where it starts we'll go round to the back.

41.12

Here's the submandibular duct, here's the submandibular gland. The duct passes forward in the interval between the mylohyoid muscle, and the muscles of the side of the tongue, the hyo- and styloglossus muscles.

41.26

Now we'll go round to the front again, and put the sublingual gland back in the picture. The sublingual gland is thin, flat, and somewhat diffuse. It lies alongside the base of the tongue, just lateral to the genioglossus muscle.

41.45

The saliva formed by the sublingual gland enters the oral cavity by way of several very small openings in the mucous membrane of the floor of the mouth. The openings are too small to see.

41.59

THYROID AND CRICOID CARTILAGES

Now that we've looked at the salivary glands, we'll move on to complete our picture of the structures around the oral cavity, by looking at the pharynx. To understand the lower part of the pharynx we need to look at two important structures that we haven't seen yet, the thyroid cartilage, and the cricoid cartilage.

42.18

The thyroid cartilage is here, below the hyoid bone. The cricoid cartilage is here, just below the thyroid cartilage.

42.29

Here are the thyroid cartilage and the cricoid cartilage together. The cricoid cartilage is partly enclosed by the larger thyroid cartilage. We'll look at the thyroid cartilage first.

42.48

The thyroid cartilage consists of two slightly curved plates, the laminae. The laminae are joined together in front. They're widely separated behind. The laminae meet at an angle of 120º in the female, 90º in the male. This is a female specimen. In the male, the thyroid cartilage projects forwards, giving rise to the laryngeal prominence, also known as the "adam's apple".

43.19

Above, the two laminae meet in a V-shaped notch, the superior thyroid notch that's easy to feel just above the laryngeal prominence. On the sides of the lamina are two projections, the superior and inferior tubercles. They're joined by this slight ridge, the oblique line, which is a major muscle attachment, as we'll see.

43.43

The posterior border of each lamina is prolonged upward and downward to form two projections, the superior horn, and the inferior horn. The superior horn points upwards and backwards, the inferior horn points downwards.

44.02

The thyroid cartilage hangs directly below the hyoid bone. The upper border of the thyroid cartilage has the same curvature as the arch of the hyoid bone. The thyroid cartilage is suspended from the hyoid bone by this membrane, the thyro-hyoid membrane. On each side the posterior part of the membrane is thickened forming the lateral thyrohyoid ligament.

44.29

The inferior horn of the thyroid cartilage articulates with the cricoid cartilage at the cricothyroid joint. Unlike the thyroid cartilage, which is open at the back, the cricoid cartilage forms a complete ring. Let's look at the cricoid cartilage by itself. It's much taller behind, than in front.

44.59

The narrow part in front is the arch, the tall part behind is the lamina. The inferior horn of the thyroid cartilage articulates here. Below, the cricoid cartilage is continuous with the upper end of the trachea.

45.18

The cricoid and thyroid cartilages form the framework for the larynx. We'll see them in that context in the next section of this tape. We're concerned with them in this section because they also give attachment to some important muscles of the lower part of the pharynx. Now that we've seen them, let's look at the pharynx.

35.37

PHARYNX

To get a view of the pharynx from the side, we'll start with a dissection in which all the neck muscles are present. The only parts of the pharynx we can see are here, and here.

45.54

To get a better view we'll remove the sternocleidomastoid muscle. We'll also remove all the underlying nerves and blood vessels. Here, just in front of the vertebral column, are the longus capitis and longus cervicis muscles.

46.13

Here, below them, are the scalene muscles. Here's the lower half of the pharynx. The pharynx lies just in front of the longus muscles. To see the whole of the pharynx, from behind, we'll remove the vertebral column and all the neck muscles.

46.32

Here's the pharynx. The pharynx extends from the base of the occiput, to the level of the top of the clavicle. The upper part of the pharynx is partly hidden by the digastric muscle, which we'll remove.

46.49

The upper part of the pharynx is hidden also by the styloid process, and the three muscles that descend from it, stylohyoid which we'll remove, and two other slender muscles, which we'll meet shortly, styloglossus, and stylopharyngeus. For now, we'll remove them too, along with the styloid process.

47.15

Now we can finally get a clear view of the whole of the pharynx. Here above the pharynx is the base of the occiput. These are the occipital condyles. Here's the medial pterygoid muscle, sloping downwards from the medial pterygoid plate, which is here.

47.37

The wall of the pharynx is formed by an almost continuous layer of muscle, lined by mucous membrane. The muscular layer consists of three sheets of muscle, the constrictor muscles, superior, middle, and inferior. These overlap behind, the one above inside the one below. Here's the inferior constrictor, here's the middle constrictor, here's the superior constrictor.

48.09

The superior constrictor is very thin. Its fibers arise from the lower part of the medial pterygoid plate, the hamulus, and the pterygo-mandibular band, and also from the side of the tongue.

48.28

The superior constrictor has a free upper border. Above this the wall of the pharynx is formed by this layer of fascia, the pharyngo-basilar fascia. The highest fibers of the superior constrictor insert on the base of the occipital bone. The remaining fibers meet in the midline with the fibers from the opposite side, extending down inside the middle constrictor.

48.52

Here's the middle constrictor. It's a thicker muscle. The middle constrictor arises from the lesser horn, and the greater horn of the hyoid bone. Here's the tip of the greater horn of the hyoid bone, heres the edge of the lateral thyrohyoid ligament. The fibers of the middle constrictor fan out, meeting with those of the opposite side, from here, down to here inside the inferior constrictor.

49.21

Here's the upper border of the inferior constrictor. It's thicker again than the middle constrictor. The inferior constrictor arises from just behind the oblique line on the thyroid cartilage, and also from the side of the cricoid cartilage. Its fibers fan out, meeting with the fibers from the other side all the way from here, down to here.

49.51

The lower end of the inferior constrictor muscle is continuous with the muscular coat of the esophaus. The lowest part of the inferior constrictor, which is functionally separate from the rest of the muscle, is referred to as the cricopharyngeus muscle. It forms a sphincter round the upper end of the esophagus,

50.10

To complete our picture of the upper part of the pharynx, we'll put the styloid process back, along with two of its three muscles. The longer one is styloglossus, the shorter one is stylopharyngeus.

50.27

Stylopharyngeus runs down outside the superior constrictor, and passes into the wall of the pharynx between the superior and middle constrictors. Styloglossus passes downwards and forwards alongside the superior constrictor, and enters the posterior part of the tongue, joining with hyoglossus.

50.49

To complete our picture of the pharynx we'll look at a specimen that's been divided in the midline. Looking at the pharynx from the inside will also let us see the muscles of the palate that we left out of the picture in the previous section.

51.08

Here's the pharynx. Throughout its length, the back wall of the pharynx lies just in front of the vertebral bodies and the longus muscles, with a layer of loose fascia in between that permits movement. The pharynx opens forwards into the nasal cavity, the oral cavity, and the larynx.

51.36

Up here, it opens laterally into the auditory tube as we've seen. Down here it opens downward into the esophagus. The pharynx is often described in three parts, the nasopharynx, which we've looked at already, the oropharynx, and the hypopharynx, also sometimes called the laryngopharynx.

51.57

The muscles of the palate that we haven't seen yet lie directly beneath the mucosa, which we'll remove.

52.08

Here's palatoglossus. It arises here from the palatal aponeurosis, and passes downwards and forwards to insert on the side of the tongue. Palatoglossus pulls the soft palate downward and forward.

52.24

Here's palatopharyngeus. It arises partly from the edge of the hard palate, partly from the palatal aponeurosis. Palatopharyngeus passes downwards and backwards to blend with an almost continuous layer of longitudinal muscle that lines the lower part of the pharynx. The lowest fibers of palatopharyngeus insert here, on the posterior border of the thyroid cartilage.

52.50

The palatoglossus muscle lies inside the constrictor muscles, hiding them almost completely in this medial view. From here we only see the upper part of the superior constrictor.

53.01

We'll take a closer look at it. Here's the upper free border of the superior constrictor muscle. Coming in towards us from above are structures we met earlier in this tape, the levator palati muscle, the tensor palati muscle, and the cartilage of the auditory tube.

53.23

Now, let's review what we've seen of the oral cavity, the muscles of the cheek and lips, the teeth, the salivary glands, and the pharynx.

53.36

REVIEW

Here are the gingivae, the hard palate, the soft palate, and the uvula.

53.50

Here are the palatoglossal arch, and the palatopharyngeal arch. Here's the tonsil. Here's the pterygo-mandibular band, the buccinator muscle, and the orbicularis oris muscle.

54.06

Here are the teeth: the incisors, the canine, the premolars, and the molars. Here's the crown of the tooth, the root, and the apex. Here's the neck, here's the pulp cavity, here's the apical canal, and the periodontal membrane.

54.28

Here's the parotid gland, and the parotid duct. Here's the submandibular gland, and its duct. Here's the sublingual gland.

54.39

Here's the thyroid cartilage, here's the cricoid cartilage. Here are the superior constrictor, the middle constrictor, and the inferior constrictor.

54.51

Here's styloglossus, and stylophyaryngeus. Here's palatoglossus, and palatopharyngeus.

55.02

That brings us to the end of this long section on the oral cavity and the structures that surround it. In the next section we'll look at the larynx and its surrounding structures.

55.19

END OF PART 4

PART 5

THE LARYNX AND ITS SURROUNDINGS

00.00

The larynx controls the passage of air into and out of the trachea. The muscles of the larynx can both open and close the airway. In addition the muscles of the larynx adjust the length and tension of the vocal folds, leading to the production of voice sounds.

00.24

INTRODUCTION, LARYNGEAL OPENING

We'll start by seeing where the larynx is, and what it looks like from behind and from above. Next we'll look at the cartilages of the larynx and the vocal ligaments. Then we'll look at the muscles, and the movements they produce. At the end of this section we'll also see the infrahyoid muscles that are in front of the larynx, and the thyroid gland that's just below it.

00.48

We'll start by looking at the front front of the neck with just the skin and subcutanous tissue removed. We'll remove the sternocleidomastoid muscles, and the clavicles, and we'll also remove these slender muscles, the infrahyoid muscles. We'll see them later. This is the thyroid gland. We'll see it later too. For now, we'll remove it.

01.15

Here's the thyroid cartilage, here below it is the cricoid cartilage, hidden by the cricothyroid muscle. These two cartilages form the framework of the larynx. The thyroid cartilage is suspended from the hyoid bone, which is here, by the thyrohyoid membrane. Below, the cricoid cartilage is continuous with the upper end of the trachea.

01.40

Here on each side this sleeve of connective tissue, the carotid sheath, contains the major blood vessels of the head and neck. We'll remove the carotid sheaths.

01.52

We'll also remove the musculo-skeletal structures behind and below the larynx. Here's the trachea, here's the esophagus, here's the lower part of the pharynx. To see the larynx from behind, we'll remove the posterior wall of the pharynx.

02.10

Here's the opening to the larynx, the superior laryngeal aperture. It faces almost directly backwards. The opening is formed in front by the epiglottic cartilage, on each side by this fold of soft tissue, the ary-epiglottic fold, and behind by two important structures that we'll meet in a minute, the arytenoid cartilages. The space that's lateral to the ary-epiglottic fold is the piriform recess. Here in front of the epiglottis is the back of the tongue. The space between the tongue and the epiglottis is the vallecula.

02.50

To see the larynx from inside we'll look at a specimen that's been divided in the mid-line. Here's the epiglottis, here's the ary-epiglottic fold. Here's the divided thyroid cartilage, and the divided arch and lamina of the cricoid cartilage.

03.16

The important features of the wall of the larynx are this small side cavity, the vestibule, and these two folds in the mucous membrane, the vestibular fold above, and the vocal fold below. Just beneath the mucosa of the vocal fold is an important structure, the vocal ligament, which we'll see shortly.

03.37

Here’s the larynx in the living body, seen from above with an endoscopic camera. Here’s the epiglottis, here's the left ary-epiglottic fold. Here are the vestibular folds, here are the vocal folds, here between them, we’re looking down through the vocal opening into the trachea.

04.01

To get a preview of the muscles of the larynx, we’ll remove the mucous membrane from here, down to here. Some of the muscles of the larynx are visible here, others are hidden by the thyroid cartilage. We’ll see these muscles later in this section.

04.19

LARYNGEAL CARTILAGES

Before we look at the muscles, we need to take a further look at the cartilages of the larynx, then we need to understand the vocal ligaments, and the vocal opening.

04.30

In looking at the cartilages, we’ll first revisit the thyroid and cricoid cartilages, which we saw in the last section, then we’ll add to our picture the epiglottic cartilage, and the small but important arytenoid cartilages.

04.45

We took a good look at the thyroid cartilage, and the cricoid cartilage in the last section. As we saw, the two cartilages articulate here. When the arch of the cricoid moves up and down, the top of the lamina moves backward and forward. The two cartilages are held together at the front by the strong crico-thyroid membrane, which is part of a larger structure, as we’ll see later.

05.16

Now we’ll add the epiglottic cartilage to the picture. The epiglottic cartilage is shaped like a leaf, with a slender stem that’s attached here to the thyroid cartilage.

05.30

The epiglottic cartilage is also attached to the body of the hyoid bone by fibrous tissue that runs through this pad of fat. The epiglottic cartilage is covered by mucous membrane here on the back, and on the front down to here. The epiglottic cartilage is highly flexible.

05.50

Next we’ll add the arytenoid cartilages to the picture. Here they are. The arytenoid cartilages, which are highly mobile, sit on top of the lamina of the cricoid cartilage, just to each side of the mid-line. They articulate with the cricoid cartilage at these two surfaces.

06.11

Here’s the right arytenoid cartilage seen from behind. This tall upward projection is the colliculus. This pointed forward projection is the vocal process. The vocal ligament is attached here.

06.29

On the underside, this inward facing surface articulates with the cricoid cartilage. Next to the articular surface, this projection on the lateral aspect is the muscular process.

06.43

Muscles are attached to the muscular process, and also to the lateral border, and to this broad convex surface, which faces forwards. The top of the colliculus is prolonged by this tiny corniculate cartilage, which faces backwards.

06.59

In the intact larynx the arytenoid cartilages are here. When seen from the side, the arytenoid cartilage is here, with the vocal process just in line with the vocal fold. The arytenoid cartilages can move laterally, and medially, and they can rotate about

a vertical axis. When the muscular process moves backward and forward, the vocal process is abducted, and adducted.

07.37

VOCAL LIGAMENTS, VOCAL OPENING

Now that we've looked at the skeleton of the larynx, it's time to get acquainted with the vocal ligament and the vocal opening. To see the vocal ligament, we'll look at a specimen in which the lamina of the thyroid cartilage, has been removed on the right side.

07.53

Here are the vocal processes of the arytenoid cartilages. We'll add the vocal ligaments to the picture. Here they are. The vocal ligaments run from the thyroid cartilage in the mid-line, to the tips of the vocal processes of the arytenoid cartilages. They're fixed in front, and highly mobile behind. Their tension is affected by the tilt of the cricoid cartilage.

08.19

The gap between the vocal ligaments is affected by rotation of the arytenoid cartilage. The vocal ligament isn't an isolated structure. It's the free upper border of this cone-shaped sheet of membrane, the conus elasticus.

08.40

The conus elasticus is attached below, all the way along the upper border of the cricoid cartilage. Its upper border, which is free from here to here, forming the vocal ligament is attached further back to the arytenoid cartilage. The anterior part of the conus elasticus is firmly attached to the thyroid cartilage, forming the crico-thyroid ligament, which we saw earlier.

09.07

Here's the right half of the larynx with the mucous membrane intact.
The conus elasticus is just beneath the mucous membrane, here. The mucous membrane is closely attached to the vocal ligament, and also to the inner aspect of the arytenoid cartilage.

09.28

At the level of the vocal folds, there's a narrowing betwen the walls of the larynx. Its anatomical name is the rima glottidis, but in this tape we'll refer to it as the vocal opening. Its shape is extremely variable, depending on the movements of the arytenoid cartilages.

09.46

Here's the vocal opening in a living person, seen from above. In quiet breathing the opening is diamond shaped. When we breathe deeply it widens to a triangle. When we speak or sing it narrows to a slit. When we hold our breath, it closes completely.

10.06

MUSCLES

Now we'll look at the muscles that produce movement betwen the cartilages of the larynx. First we'll see the cricothyroid muscle, then the two crico-arytenoid muscles, then the thyro-arytenoid, transverse arytenoid and ary-epiglottic muscles. Here are the thyroid and cricoid cartilages with all the muscles removed.

10.31

We'll add the crico-thyroid muscle to the picture. Here it is. The cricothyroid muscle arises from here on the cricoid cartilage. It inserts on the thyroid cartilage partly here on the lower border, and partly here, on the inner aspect of the lamina..

10.52

The cricothyroid muscle pulls the arch of the cricoid cartilage upwards. In doing so, it pulls the arytenoid cartilages backwards, making the vocal folds longer and tighter.

11.06

To see the remaining muscles, we'll remove this half of the thyroid cartilage, together with the cricothyroid muscle. Here are the internal laryngeal muscles. To begin understanding them, we'll take them all out of the picture for a moment.

11.25

Here's the cricoid cartilage, here's the arytenoid cartilage. Here's the conus elasticus. The vocal ligament is up here. This is the mucosa of the vestibule. The first muscles to add are the two crico-arytenoid muscles. Here's the posterior one, here's the lateral one.

11.54

They both converge on the muscular process of the arytenoid cartilage. The posterior crico-arytenoid muscle arises from here on the back of the lamina of the cricoid cartilage.

12.05

The lateral crico-arytenoid muscle arises from the upper border of the cricoid cartilage. The posterior crico-arytenoid pulls the muscular process backwards. This rotates the arytenoid cartilage, thus widening the vocal opening.

12.25

The lateral crico-arytenoid muscles pulls the arytenoid cartilage forwards and laterally, producing a maximal widening of the back of the vocal opening.

12.37

The crico-arytenoid muscles act to widen the vocal aperture in two different ways. The next two muscles that we'll see, the thryro-arytenoid and transverse arytenoid muscles, act to shorten and narrow the vocal opening.

12.53

We'll add the thyro-arytenoid muscle to the picture first. Here it is. The thyro-arytenoid muscle arises from here on the inner aspect of the thyroid cartilage. It inserts here in front of the lateral border of the arytenoid cartilage.

13.13

Next we'll add the transverse arytenoid muscle. Here it is. The transverse arytenoid muscle, also called the arytenoideus, is a sheet of muscle that bridges the gap between the posterior surfaces of the two arytenoid cartilages.

13.30

Let's see how these two muscles work. Contraction of the thyro-arytenoid muscle rotates the arytenoid cartilage inward and pulls it forward, along with the cricoid cartilage. This action slackens the vocal ligaments, and shortens the vocal opening from font to back.

13.48

Contraction of the transverse arytenoid muscle brings the two arytenoid cartilages closer together, thus closing the posterior part of the vocal opening.

14.00

The sphincter action of the last two muscles is augmented by a pair of slender muscles that pass upward toward the epiglottis, the ary-epiglottic muscles. These begin behind the transverse arytenoid muscle, cross the mid-line, and extend upward and forward a little below the ary-epiglottic fold.

14.22

Acting together, the thyro-arytenoid, transverse arytenoid and ary-epiglottic muscles act as a sphincter that can completely close the larynx. We close our larynx every time we swallow, cough, and hold our breath.

14.40

The most medial part of the thyro-arytenoid muscle, which is attached to the vocal ligament, has a special function. It's known as the vocalis muscle. It makes fine adjustments to the tension of the vocal ligament.

14.53

INFRAHYOID MUSCLES, THYROID GLAND

We'll end this section on the larynx by looking at the structures that are close to it in front and below: the infrahyoid muscles and the thyroid gland. In addition, we'll see the parathyroid glands.

15.09

Here again are the thyroid cartilage, the cricoid cartilage, and the trachea. These are the rings of cartilage which reinforce the wall of the trachea. We'll add the carotid sheaths to the picture

15.24

Here, just on each side of the trachea, are two of the four parathyroid glands. They're recognizable by their brownish color. The other two parathyroid glands are further down.

15.38

Next, we'll add the thyroid gland to the picture. Here it is. This is the left lobe of the thyroid gland, this is the right lobe. The two lobes are connected across the mid-line by the isthmus. The top of each lobe of the thyroid gland is level with the lower border of the thyroid cartilage. The top of the isthmus is about level with the third ring of the trachea.

16.07

Now we'll add the four infrahyoid muscles to the picture, starting with the two deepest ones, the thyrohyoid, and the sternothyroid muscles.

16.18

In effect they're one continuous muscle. The thyrohyoid arises from the back of the body of the hyoid bone, and inserts on the oblique line of the thyroid cartilage. The sternothyroid arises from the same oblique line, and passes down behind the upper end of the sternum. It inserts on the back of the sternum, down here.

16.39

Now we'll add the other two infrahyoid muscles to the picture, the omohyoid, and the sternohyoid. The omohyoid muscle arises here, the sternohyoid here on the body of the hyoid bone.

16.54

The sternohyoid runs straight downwards, close to the mid-line, and inserts on the back of the sternum, here. The omohyoid muscle runs downwards, laterally and backwards.

17.06

It lies in front of the carotid sheath, and the brachial plexus, which is under here. The omohyoid muscle passes beneath the trapezius muscle, to insert on the upper border of the scapula.

17.20

Finally, we'll return the clavicles, and the sternocleidomastoid muscles to the picture. In looking at the intact neck, it's useful to remember that when the neck isn't extended, the bottom of the cricoid cartilage imay be no higher than the top of the clavicle.

17.39

Now, let's review what we've seen of the larynx and its surroundings.

17.444

REVIEW

Here's the thyroid cartilage, heres the cricoid cartilage, here's the arytenoid cartilage, with its colliculus, vocal process, and muscular process.

18.05

Here's the trachea, here's the crico-thyroid ligament, here's the conus elasticus, here are the vocal ligaments. Here's the epiglottis, the ary-epiglottic fold, the vallecula, and the piriform recess. Here's the vestibule, the vestibular fold, and the vocal fold.

18.30

Here's the crico-thyroid muscle, the crico-arytenoids, posterior, and lateral, the thyro-arytenoid muscle, and the transverse arytenoid muscle. Here are the parathyroid glands, and the thyroid gland. Here are the thyrohyoid sternothyroid, omohyoid, and sternohyoid muscles.

18.59

That brings us to the end of this tape, "The Head and Neck Part 1". In the next tape we'll look at the face, the brain, the blood vessels and nerves of the head and neck, the eye, and the ear.

19.20

END OF VOLUME 4