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MD122 Respiratory System

hi and welcome back after your break i hope you had a good one that everybody stayed safe and healthy and that you're all relaxed and ready to go for a new semester so this module is md122 at the respiratory system and it's delivered 100 by anatomy and physiology and split 50 between anatomy and physiology in terms of marks and hours of delivery i'm brendan wilkins you've met me before and i'm the module coordinator and along with me will be elish heinz



who will be covering the physiology component of the module now for reasons that are historical and relate to the delivery of practical material the anatomy component of this module is delivered to the lecture component is delivered entirely within the first three weeks of the module and because this coincides with the period of time when we appear to be



hitting the peak of the omicron variant of covet 19 i've made the decision that
i will remain online and deliver lectures by
recordings in order to ensure consistency of delivery and consistency
of what every student receives in terms of the anatomy component of this module
so there will be no in-person anatomy



lectures in this module there will however be

in-person physiology lectures or other activities which we'll cover

in a future slide the module title is respiratory system

and the module code is



MD122 Respiratory System


md122 the staff as i've just mentioned are

elish heinz in physiology and myself in anatomy

the anatomy lectures will be delivered as pre-recorded videos

and these videos will be released at the scheduled lecture slots on your

timetable so that's monday at 12 tuesday at 12 thursday at 11 and friday at 9.



Lectures and Labs

Staff

Dr. Ailish Hynes, Physiology component
Dr. Brendan Wilkins, Module Coordinator & Anatomy component

Lectures

Anatomy delivered as pre-recorded videos [anatomy] on Mon 12:00, Tue 12:00, Thu 11:00, Fri 09:00 weeks 1-3

Physiology delivered in person, Thu 12:00, Fri 11:00 weeks 1-6

Labs

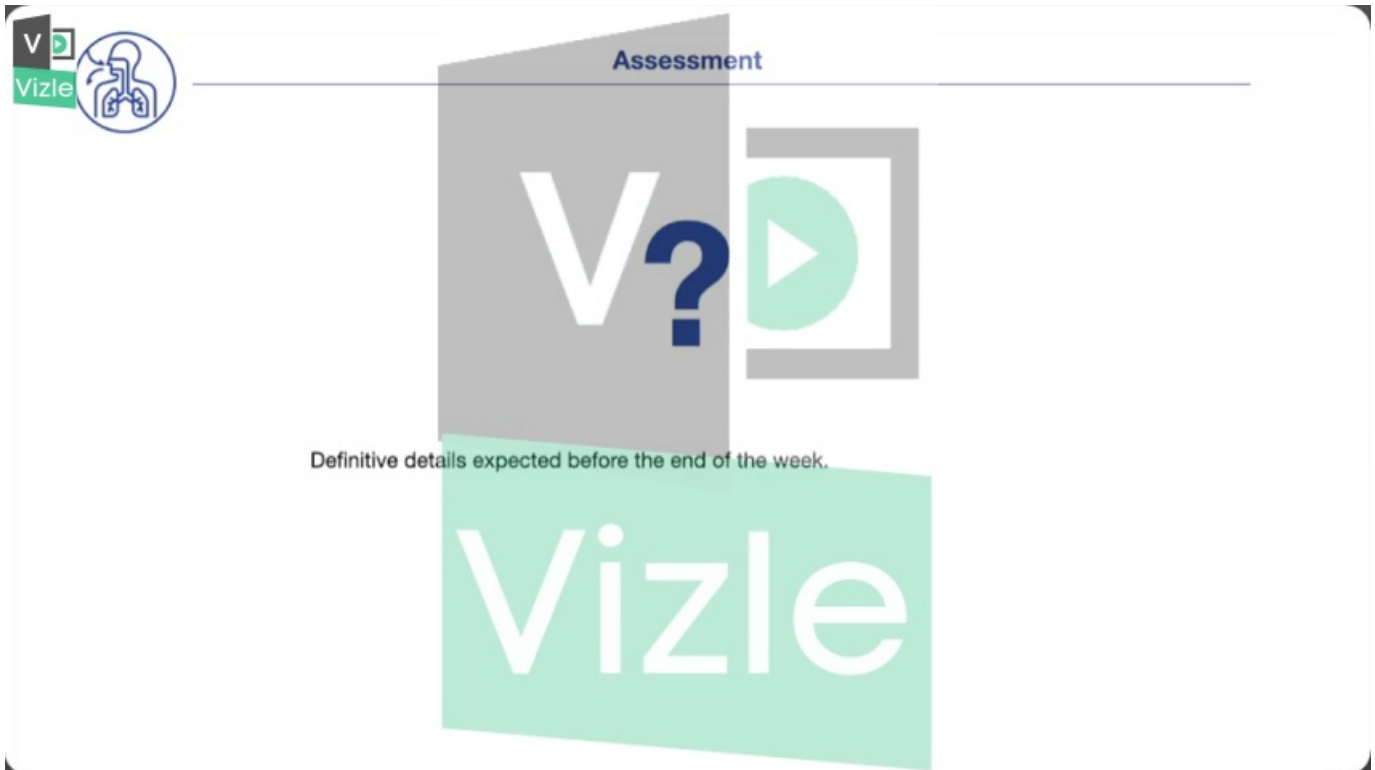
Anatomy
Mon, Tue, Wed, Thu at 14:00
Weeks 2-4

Physiology
Mon 14:00, 16:00
Tue 14:00, 16:00
Weeks 2-6

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some of these videos will be videos that were used last year some of the videos will be entirely new for this year and some of the videos will be repurposed videos from other sources in most cases the videos are significantly shorter than the full one hour so there may be multiple videos released on any given lecture slot during these first three weeks and there will be no md122 respiratory anatomy lectures after the end of week three the physiology lectures are delivered at least in part in person and the lecture times are thursday at 12 and friday at 11 delivered in the large lecture theater in the hbb and you've already received a timetable indicating which groups should attend which sessions labs in anatomy occur between weeks two and four only for the module md-122 the lab times are monday tuesday wednesday and thursday at two o'clock although the monday lab has been amended slightly to 2 15 because of an academic commitment some of you have that keep you busy up until 10 minutes before at 2 o'clock the

groups and the times you attend are the same as they were in semester 1 for the md 1101 module physiology labs are held on Mondays at two and at four and Tuesdays at two and at four and these labs for md121 and md122 take place between weeks at two and week six and physiology will inform you as to which labs are taking place when and who should attend in their own way



everybody wants to know how the module is going to be assessed well it'll be assessed by a combination of multiple choice examination covering largely the lecture material anatomy spot exam covering the anatomy lab material and physiology assignments covering the physiology lab material which has been covered at the moment we still have to work out the details of the mcq component of the assessment there are some timetabling issues around this that we need to resolve and we expect we'll be able to do this before the end of this week but for now you should be aware that the physiology lab assignments are continuous and are completed as you go along and do the labs so that's that component of the module and the anatomy spot exam will be held as we informed you before christmas as part of a comprehensive spot exam in week 12 of the semester that comprehensive spot exam will cover the anatomy lab component of all four modules that you are doing in this

semester that is respiratory system cardiovascular system renal system and gastrointestinal system and i think we had already told you that there will be 17 questions on that comprehensive spot exam covering respiratory anatomy and we'll give you more details of that as the module proceeds i've already posted some required readings some required videos and there'll be additional notes will also be posted covering some aspects that aren't covered in the recommended or required text grey's anatomy for students fourth edition principally this is some reading material on the embryology of the respiratory system on the histology of the respiratory system and one or two little interesting clinical bits and pieces that you might find interesting so all the detailed elements of the reading have already been posted to the module blackboard site in terms of the organization and scope of the module the anatomical

Organisation and Scope


The diagram illustrates the respiratory pathway. It shows the nasal cavity leading to the nasopharynx, then the oral cavity leading to the oropharynx, and the laryngopharynx leading to the larynx and trachea. The trachea branches into the mainstem bronchi and lobar bronchi, which further divide into segmental bronchi and bronchioles, ending at the alveoli. A circular arrow indicates the cycle of inspiration (inward arrow) and expiration (outward arrow).

- Follow the pathway of airflow
 - Enters nose (and mouth)
 - ▶ Nose
 - Passes through nasopharynx
 - Passes through oropharynx
 - ▶ Mouth
 - Passes through laryngopharynx
 - ▶ Larynx
 - Enters trachea
 - ▶ Enters mainstem, lobar bronchi
 - Enters lungs
 - ▶ segmental bronchi, bronchioles
 - Alveoli
 - ▶ Gas exchange

component is such that we will follow the pathway of airflow as it enters the respiratory system and then follow it as it extends down through the respiratory system looking at the anatomy of the various structures that air would encounter on the way so the general pathway of airflow is that it enters the nose and to a lesser degree of the mouth it passes through a space called the nasopharynx the opening into which is the nose and then it passes from there to the oropharynx the opening into which is the mouth and then it passes through the laryngo pharynx the bulk of the laryngo pharynx is made up of and opens into the larynx air or voice box air passes through the larynx and enters the trachea the main windpipe then from there air then enters the main stem bronchi and the lobar bronchi supplying the lungs and from there it enters the lungs proper in the lungs the airways further divide into segmental bronchi and bronchioles and

eventually end up as a series of dilated air filled sacs called the alveoli and it's across the walls of the alveoli that gas exchange occurs oxygen from environmental errors exchange for carbon dioxide in the blood and then exhalation occurs and the cycle repeats

the general functions of the respiratory system aren't simply limited to a gas exchange although the system is principally concerned with gas exchange gas exchange and the actions the functions of the lungs also contribute to blood ph and blood pressure various



General Functions

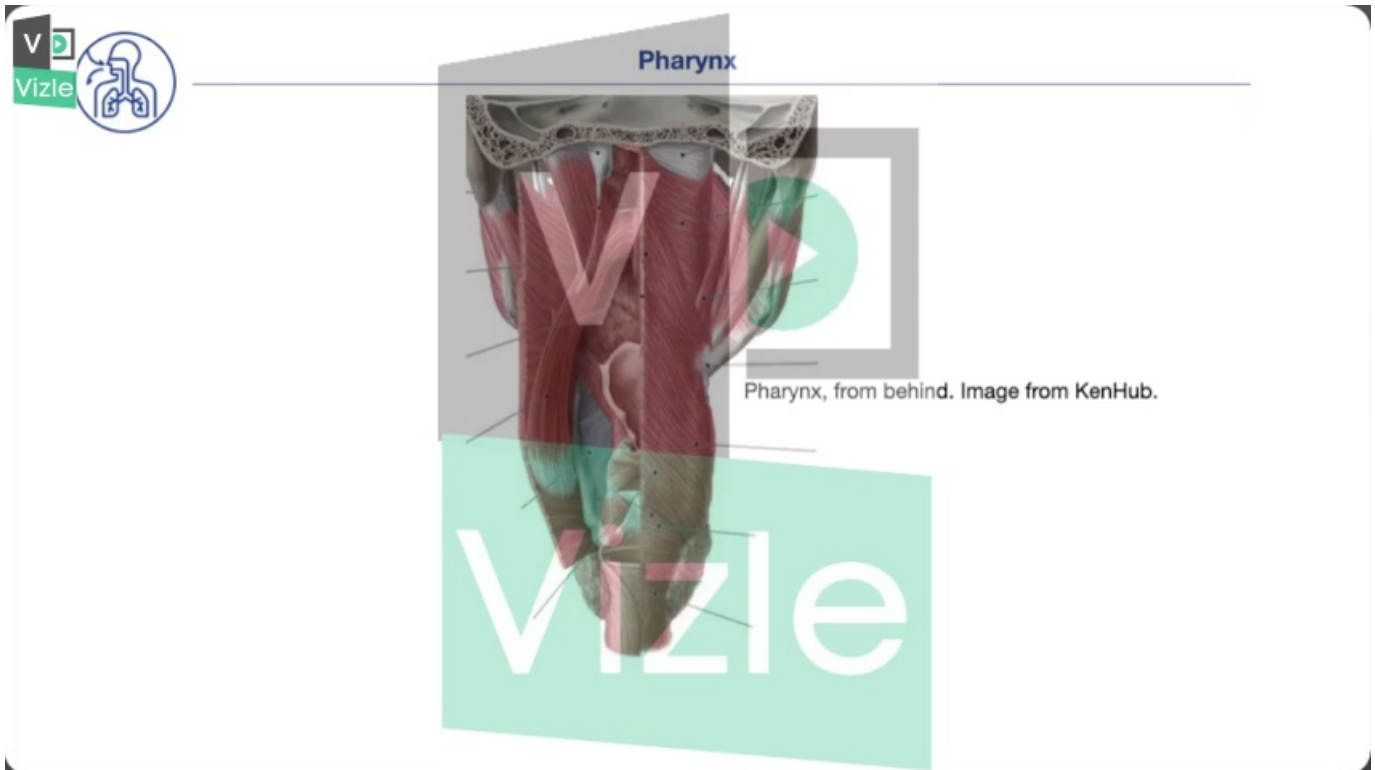
- Respiratory system principally concerned with gas exchange which takes place in the lungs
 - Also contributes to blood pH, blood pressure etc.
- Air (gas) entering the system also has to be sampled and analysed
 - Chemically
 - Immunologically
- Air entering the system has to be conditioned
 - Temperature
 - Humidity
- Equalisation of middle ear pressure
- Vocalisation
- Increasing thoracic and/or abdominopelvic pressure
 - Coughing
 - Straining (childbirth, defecation)

other components of blood chemistry air or gas entering the system also has to be sampled and analyzed and this occurs both chemically and immunologically and we'll see how this happens when we look in detail at the nose the nasopharynx and a little bit of the oral pharynx the air entering the system has to be conditioned that is the physical characteristics of the air have to be altered somewhat to maximize the efficiency of respiration and maximize the efficiency of water retention and temperature and maintenance and this means that both the temperature and the humidity of the incoming air have to be both monitored and altered and this occurs principally in the nose it's also important that for reasons we'll get to a little bit later that pressure in the middle ear where the organs of a hearing sensation are located pressure in the middle ear has to be equalized

with the external environmental pressure and this occurs by an opening from the middle ear into the nasopharynx called the nasopharyngotomic tube or eustachian tube

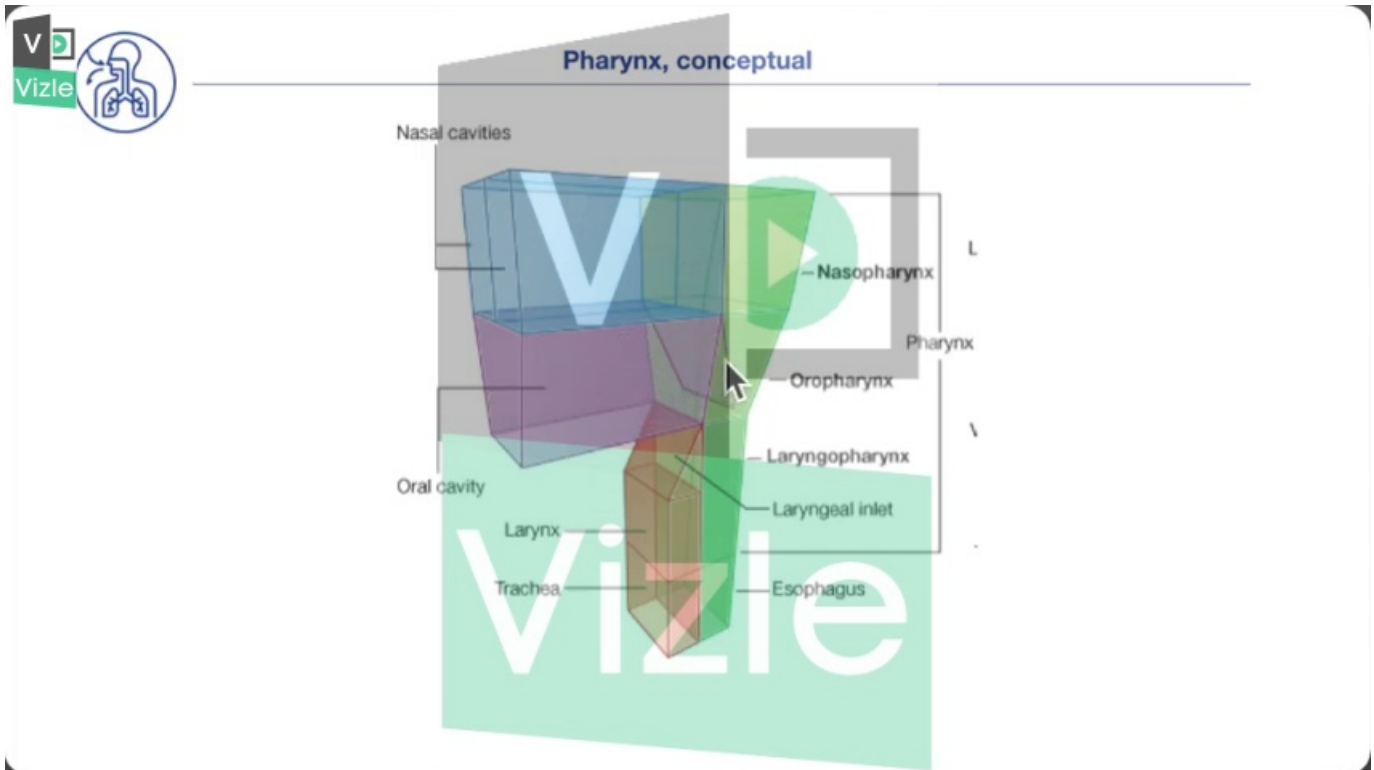
the respiratory system also by controlling airflow is involved in the process of vocalization this is the process by which we use controlled airflow to generate sound such as for example when a dog barks but with humans this is particularly important because not uniquely but most almost uniquely among animals we have a very subtle series of vocalizations and we're capable of generating meaningful speech we also generate vocalization for pleasure in the case for example of singing and these all require very very fine control of the flow of air into and out of the lungs and control of the muscles that regulate the airflow into and out of the lungs and we'll look at this in particular we'll look at the muscles that operate on the vocal folds in some detail a little later in the module a very important feature of the respiratory system is that by regulating the rate of airflow into and out of the respiratory system specifically by filling the lungs with air and then attempting to exhale against a closed glottis it's possible to increase intra-abdominal pressure and this is important in situations such as in childbirth and in defecation where elevation of intra-abdominal pressure is used to drive something out of the abdomen changes in intrathoracic pressure ones that occur rapidly include coughing and coughing is a mechanism used to eject small particulate matter from the lungs and from the airways

because the only thing that really should end up in your respiratory system
at least in the lungs is gas not solid material and again we'll look at
this in a bit more detail later an important conceptual structure in
understanding at least the early phases




of the respiratory system is a structure called the pharynx which properly is part of the gastrointestinal system the pharynx is a muscular tube that hangs down from the base of the skull and in the illustration here we're looking at the muscular tube here it is on this side you can see what the pointer is and here the muscular tube we're looking at it from behind and here the muscular tube has been opened and one half of it has been reflected away so that we can see into the pharynx looking from behind here's the opening into the larynx here guarded in part by the epiglottis here's the posterior one third of the tongue and here's the oral cavity and up here is the opening of the posterior aspect of the nose into the nasal pharynx so this muscular tube hangs down from the base of the skull and into the muscular tube are the openings of the nose the mouth and then from the muscular tube opening into the rest of the airway is the larynx now we'll be looking

at some aspects of the pharynx in a bit more detail later but for today that's as much as we need you to know that the pharynx is a muscular tube that hangs down from the base of the skull and the nose and the mouth open into it and the larynx and later on the esophagus open from it here's a conceptual view of the pharynx from your textbook and here what's illustrated is that the nasal cavities the posterior aspect of the nasal cavities open into the pharynx the oral cavity the posterior aspect of



the oral cavity opens into the pharynx and so we subdivide the pharynx into the nasopharynx that part of it related to the nasal posterior nasal apertures the oropharynx that part of it related to the posterior aspect of the oral cavity and then we have two openings from the pharynx that exit the pharynx one gut passes into the larynx and subsequently on through the airway to the trachea and the second is the esophagus which is the onward continuation of the pharynx as the tube continues on down to the stomach forming part of the gut and this part of the pharynx is referred to as the laryngopharynx because this is the where the opening to the larynx is found functionally the larynx is a very important space it's a dynamic space because the shape of the pharynx changes depending on the activities which are taking place and the activities which take place that affect the shape of the



Pharynx functions

- Dynamic space - shape adapts for specific activities
 - Breathing
 - Swallowing
 - Phonation/vocalisation
- 2 functional valves
 - Soft palate
 - Epiglottis
 - Position of valves and shape of pharynx altered by specific coordinated muscular contractions
- Anything that affects the anatomy or function of the valves and related muscles can affect pharyngeal function
 - Breathing
 - ▶ Apnoea
 - Swallowing

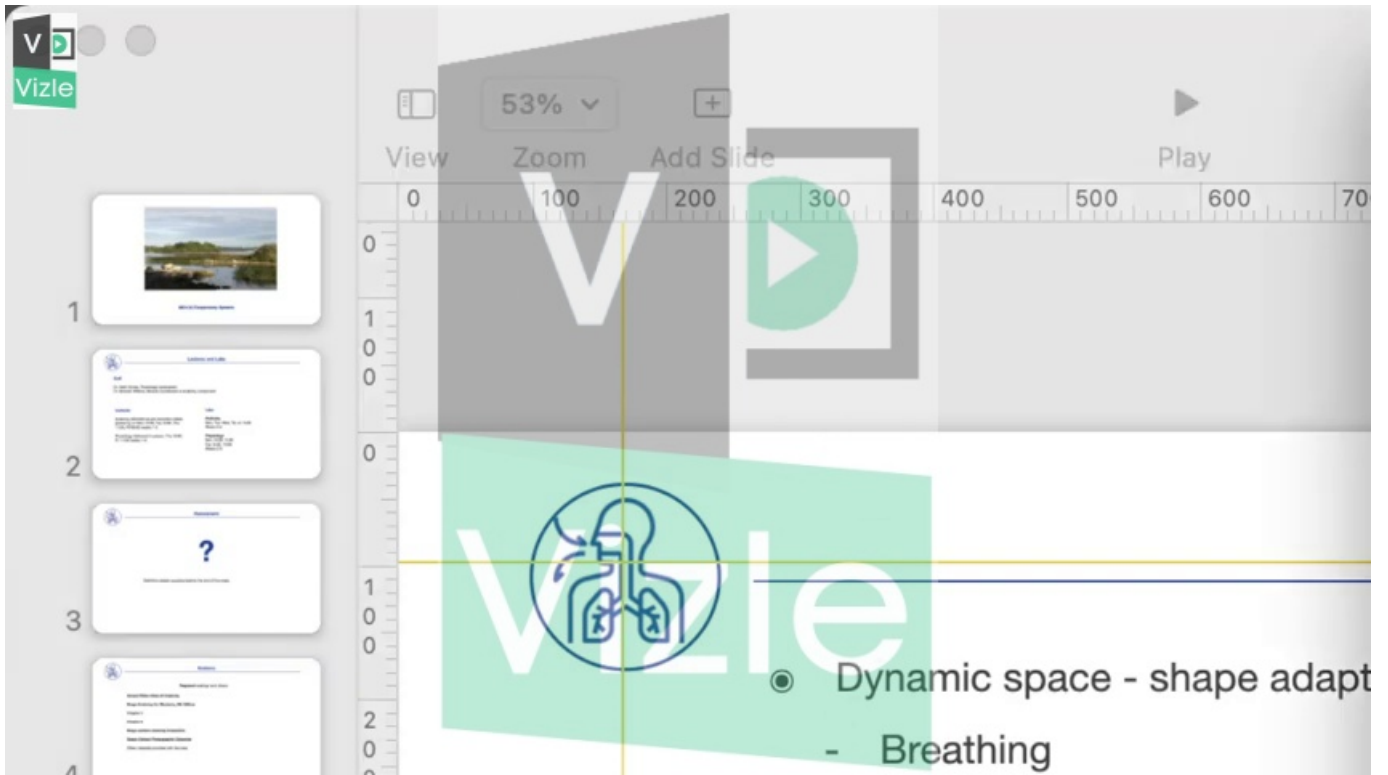
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pharynx principally are breathing swallowing in which there are specific anatomical shifts which facilitate the movement of food into the esophagus and prevent the movement of food into the airway equally when we're breathing the anatomical structure of the pharynx is such that air is drawn principally into the trachea and armor to the lungs and isn't swallowed or doesn't enter the esophagus and enter the gastrointestinal system another time when the shape of the pharynx changes somewhat is during phonation or vocalization so if you picture for example if you were looking at the neck of an individual who's singing you would see quite a bit of movement as the larynx moves up and down and some movement at their mouth as their lips open and close and these movements are accompanied by movements of the pharyngeal muscles which change the shape of the pharynx

which in turn shapes and affects the tone of the sound that's been generated

there are two functional vowels in the pharynx the first of these lies between the nasopharynx and the oropharynx and it's a fibromuscular sheet called the soft palate we look at this in more detail and the second of these is called the epiglottis it's a elastic fibromuscular structure whose position can be shifted relative to the opening of the larynx so as to divert food and liquid away from the laryngeal opening when swallowing is occurring and then permits air flow into the laryngeal opening when one is just breathing anything that affects the anatomy or the function of these valves and their related muscles can impact pharyngeal function so for example there's a condition called apnea often sleep apnea in which a person effectively stops breathing during the course of often in times it occurs with people sleeping when they snore and apnea is a result of negative anatomical changes in components of the pharynx that results in if you like blockage of breathing and this can be quite a serious problem for some individuals equally in persons who are very elderly or persons who have suffered a stroke swallowing may become very difficult and where swallowing becomes difficult and isn't accomplished effectively then it's possible that the individual will aspirate either solid matter or liquid into the airway and by gravity it'll just fall down into the lungs and there it can cause a condition called aspiration pneumonia which is quite a common cause of death in debilitated individuals and in individuals who are very elderly

so that completes the
short introduction that we're looking at



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