

>> Today's March 27th, 2017. Lecture 14. This is the first lecture of part two of the nervous system. We finished the CNS. What's that?

>> Central nervous system.

>> So it's time to walk out into the so-called PNS, peripheral nervous system. This is a system of incoming and outgoing nerves. Those affiliated with the spinal cord and those affiliated with the brain itself. Essentially divisible then into two sub-parts, the afferent or sensory division, which provides feedback that is sensation from muscle, so-called somatic sense. Something also called proprioception, the ability to know where your muscles are at any given time. It also gives information about the status of internal organs. Do you have a tummy ache? Does your chest hurt? Is your bladder full? Those are sensations that are visceral in nature. So that's the afferent. The afferent division is synonymous with the sensory side of the PNS. Then there's the efferent side. Efferent meaning leaving the central nervous system. And this is otherwise known as the motor division. And it serves two very distinct populations of muscle. The somatic nervous system basically serves and stimulates skeletal muscle bringing about movement, voluntary motion, whether it's taking notes or even breathing. But are there other kinds of muscle other than skeletal muscle? Of course. There's cardiac and there's smooth muscle. And those components of the efferent or motor division that serve and control that kind of muscle, they belong to the ANS which stands for autonomic nervous system. And of course we'll have a whole lecture devoted to the ANS. So this is just a rough outline of the basic kinds of services accomplished by the PNS. In other words, it's both sensory and motor, the motor serving skeletal muscle and cardiac muscle. So let's do as we said we would do. Let's consider first spinal nerves and then we'll look at the 12 pairs of cranial nerves. As you recall, the spinal cord is organized by regions. We have cervical, then thoracic, finally lumbar and sacral. And by definition, a spinal nerve is a mixed bundle which is either entering or exiting at a particular point. These then are sensory and motor, afferent and efferent. And there are 31 pairs. You know that they exit between the vertebrae and they are unencumbered because they pass through a space known as the intervertebral foramen. So what about these 31 pairs? Let's list them in terms of their number and how we arrive at this total of 31. There are eight cervical, 12 thoracic, five lumbar, five sacral, and one or maybe two coccygeal. Now what's odd about that list? What caught your attention right off the bat?

>> Eight cervical.

>> How could there be eight cervical? As you know there's only seven cervical vertebrae. It turns out that C1 exits between the occipital and the atlas and C8 actually exits below C7. So I hope that answers the question. How many cervical vertebrae are there? Seven. How many spinal nerves are there? Eight, because C1 actually exits between the occipital and the atlas. And the rest of the names follow suit. C1, C2, C3 and so on. So there are indeed eight cervical, 12 thoracic, five lumbar, five sacral, and one coccygeal. A fact that we mentioned I think last time is that your spinal cord actually stops growing at

about the age of four. And so below L2 the solid cord doesn't actually exist. The space below L2 is occupied by nerves which will exit in the sacral and coccygeal area but they more or less are roots, that is spinal nerves which are dangling and essentially surrounded by the fluid that fills the space, i.e. cerebral spinal fluid. So that was useful as a fact because we mentioned if you're going to extract spinal fluid, where would be the best, the safest place to do that?

>> Below L2.

>> Below L2. So is the space below L2 empty? No. It basically contains nerve roots which will exit in and be part of the sacral and coccygeal group but they're dangling. They're more or less floating free in this fluid, cerebrospinal fluid. And the name of this location, the name of this structure at this location is here. It's called the Cauda Equina. Cauda means tail and Equina probably familiar, the word equestrian refers to what? Horses. So literally in Latin Cauda Equina means horse's tail. The spinal cord itself stops at about L2 and those nerve fibers which exit at levels below that are part of the so-called Cauda Equina. Therefore a needle, a spinal needle can be put in this location and not disturb the spinal cord because the spinal cord itself actually ends where? Above or at L2. Good. What we're going to do now then is revisit these spinal nerves, specifically the plexi which are formed by many of these 31 pairs. And as you recall, how many plexi did we describe? There were four; cervical, brachial, lumbar, and sacral. So let's enumerate those, give meaning, and especially highlight some of the big or major members of each of these plexi. So to begin with, the cervical plexus apparently exits from the cervical region and therefore includes C1, C2, C3, and even C4. Its distribution— that means the structures which are served by members of this plexus— include structures of the neck, structures of the jaw, and surprisingly what? Why is that surprising? Is the diaphragm in your neck? It's way down here. So you're surprised to learn that at least one member of the cervical plexus— in fact you could argue the most important member of the cervical plexus, the so-called phrenic nerve— innervates and stimulates the diaphragm. You might wonder how that came to be but at least in embryonic life the diaphragm is actually formed up high near the neck and then it moves down in development. So that carries with it and helps to elongate the phrenic nerve. So in terms of this plexus, it includes what? C1, C2, C3, and C4. Each of these nerves, let's recall, is not exclusively sensory. Not exclusively motor. But what? Mixed. This one, the phrenic nerve, is most important for its motor function because as we mentioned it innervates what muscle? And so injury to the phrenic nerve, indeed injury to the cervical plexus, could jeopardize what important function? Breathing. This story is perhaps too dated because many of you were toddlers or not even born in 1995, but a very notorious, a very famous celebrity, his name was Christopher Reeve, he was star of the early Superman movies. All right, blank stares by many. But he was an equestrian which means he was an accomplished horseperson and he was coaxing his horse into a jump, horse refused, he went over the front of the horse and he broke his neck, C1 and C2. He would've been dead on the spot if it weren't for first responders, and he survived another 10 years, not as a paraplegic but as a

quadriplegic. And he was only able to breathe because of ventilators, because he was lacking the function of, for instance the phrenic nerve. His claim to fame quite outshaded his movie career. He established the Reeve Institute at Irvine which is specializing in research associated with spinal cord. Further tragedy to that story, his wife Diane Reeve actually nursed him for 10 years until he finally died, and he died of an infection which is not uncommon in a quadriplegic. So he survived how long after this injury? Nine years. And within two years she died of lung cancer of all things even though she had never smoked. So what's that adage, life is not fair? Definitely not fair in that tragic story. So is the cervical plexus precious? Can injury to the neck be fatal or at least catastrophic? Yes. Next let's move down to the brachial plexus. You would assume correctly that this serves the shoulder and indeed all of the arm- upper, lower, hand, fingers. So it actually includes C5, C6, C7, C8 and actually only T1 of the thoracic level. It innervates the shoulder, the axillary area and the entire arm right on down to the wrist and through the fingers. There are many important members of this group. These are the ones you need to know by name and function. First one, musculocutaneous. There's two words put together there right? Musculo-muscle, cutaneous- skin. This nerve basically innervates this muscle which is of course famous, the biceps brachii and its synergist alongside of it called the brachialis. Those two muscles accomplish this which is what? F word, flexion. Now this is not just a motor nerve, it also receives sensory input from the skin in this area. So the questioning that you should be preparing for is what happens if someone injures the musculocutaneous nerve? They're not going to be able to do this. What's that?

>> Flexion.

>> Flexion. And they're going to have numbness of the skin on the anterior aspect of their upper arm. The next member of this group is the radial nerve. Why do you suppose? Which side of the arm does it travel along? Well, lateral side. This one innervates muscles that extend the forearm and wrist and fingers. And so its motor activity is almost entirely devoted to, E word, extension. Extension of the arm. Extension of the forearm. Extension of the wrist. Extension of the fingers. Remember though, all of these nerves are mixed meaning what? Not just motor but sensory. So someone has numbness on the back of their hand or numbness on the posterior aspect of their arm or forearm. That would be the result of radial nerve injury. Next let's go to ulnar. Ulnar goes along the medial side. And basically innervates structures mainly below the elbow. Responsible for flexion of digits four and five. And sensation on the anterior aspect of the palm, especially the medial side of the palm which is of course the ulnar side as well. So to repeat, this is responsible for flexion of digits four and five. Also some flexion of the wrist. And therefore responsible for movement of the hand and wrist. Is it sensory as well? Are all of these nerves mixed? Yes. So numbness in these areas would also be attributed to the ulnar nerve. So we have the radial running along the lateral side. We have the ulnar running along the medial side. So what's this third one? It's not the medial nerve, it's the median, which means it runs pretty much down the

middle. It also continues into the hand and is responsible for flexion of digits one, two, and three. Also flexion of the wrist in part. Remember though, these are not just motor nerves, they're also, S word, sensory. So numbness in this area could also be the result of damage to the median nerve. And incidentally of the three, the median is most clinically problematic because it travels into the hand through a very tight passageway which is called the carpal tunnel. And so if you've heard of carpal tunnel syndrome you know it's basically the result of compression of the median nerve which leads to weakness of digits one, two, and three. And is very common in what sort of activity or careers? People that are keyboarding a lot, whether it's a piano or a computer keyboard. So you may know someone who's had carpal tunnel syndrome and perhaps had surgery for that kind of compression. So as we leave this plexus, let's remember what you need to know for any spinal nerve. You need to know its name. You need to know its number. And you need to know the plexus it's a member of, its distribution, that means where it goes and where it returns from. And its function or functions. Remember when it comes to spinal nerves, we're dealing with what's the M word here? Mixed. And so will there be sensory functions? Will there be motor functions for pretty much all of these? Yes?

[Inaudible audience question]

>> Yup. Yup. But I will say this, some of them are not 50/50. What does that mean? Half sensory half motor. In fact, what would you say about the phrenic? Is it sensory? Yes but what it's, what's its most important function is its motor function. So we will highlight those disparities. But at least these that we've just mentioned- one, two, three, four- all of these are M word, what's that? Mixed. Meaning they have sensory and motor value or function. So what's next? How many plexi are there? Four. So here's number three. It's called the lumbar plexus. It consists of T12, but then L1, L2, L3, and L4. Now usually a question pops here. Let's go back. The so-called brachial plexus included C5 through C8 and then only what? T1. The next plexus starts at T what? T12. So the question that emerges is okay well what happened to T2, 3, 4, 5, 6, 7, 8, 9, 10, and 11? They're there but they don't form a plexus. They basically travel between the ribs and as such are not that important. Remember a plexus is a converging network of nerves and simply put, there is no plexus between the brachial and the lumbar plexus. So the lumbar plexus begins at and includes T12 and then L1, 2, and 3. What's it innervate? Innervates the abdominal wall. That means especially the anterior abdominal wall and the thigh. And especially the anterior aspect then of the thigh. Members of this group are as follows- the femoral nerve, then the lateral femoral cutaneous, then the genitofemoral. And finally the iliohypogastric. There are many more members of this group. These are the ones we want you to know because they're the most important. The femoral nerve, so-called because it runs down what? The femur. And it innervates these muscles on the anterior thigh which you may know already are called the quadriceps. These muscles are responsible for this and this. What's this motion? Flexion. What's this motion? Extension. So flexion of the thigh, extension of the lower leg, the femoral nerve. Remember

though it's a mixed nerve, so is it just motor? No. So if somebody has numbness on the anterior thigh, they can't feel anything here, what nerve's at fault? Femoral nerve. What about the lateral femoral cutaneous? What's cutaneous mean? Skin. This one is mostly sensory so its motor function is unimportant. And so here if someone has numbness on the side of their leg, that would be the fault of the lateral femoral cutaneous. The genitofemoral you could guess—two words put together—genitalia and femoral. This innervates the skin in the groin or the inguinal area and is associated then with sensations in that area. And so it's mostly a sensory nerve. Iliohypogastric. Ilio referring to the bone up here. What's that bone? Ilium. Hypogastric, below the stomach. Essentially this is a mixed nerve which innervates, among others, the abdominal muscles responsible for movement, especially flexion of the trunk, lateral flexion for instance, anterior flexion. So mostly motor and therefore weakness in this action which is anterior flexion could be the result of hypogastric injury. Also, remember it is sensory so numbness in these areas could also be attributed to that nerve. Next and last plexus, sacral plexus. Sacral plexus includes L5 and then S1 through S4. It innervates the gluteal region, better known to you as the buttocks. And pretty much the backside of your leg. That means posterior thigh and everything, everything below the knee including not just the lower leg but also the foot and toes and so on. So essentially everything on the backside of the leg through the foot. The most important member of this group is the largest of the spinal nerves, one which has its own dedicated route. You recall the sciatic notch, remember that? The sciatic notch accommodates this nerve which is the sciatic nerve. That nerve is huge. It's about the diameter of your thumb. And once again, a mixed nerve. This one bifurcates at the knee. That means it splits and becomes below the knee the tibial, and the common fibular. The fibular runs lateral as the name fibular implies. The tibial runs medial. These are all, again, mixed nerves. So they control movement, especially this action. What's this? Flexion of the leg. Also extension of the thigh. And sensation from everything pretty much behind the leg. Perhaps the most important syndrome or clinical impact in this example is sciatica. Ever heard of sciatica? It's pain which radiates down the back of the leg. It's due to injury or compression of the sciatic nerve. Then we have a rather small member of the group but important nonetheless. It's called bu- what is that? Pudendal. And there's no T in there so it has nothing to do with teeth. It's not dental, it's dental. And actually the word pudendal means to be ashamed. Strange name. But this is the name which innervates the penis and the vagina. And what's that up there for? What is that device, what does that look like? A bicycle seat which is a pretty horrible excuse for a seat if you ask me. But why do I mention it? People who ride bicycles with that kind of seat are going to compress over time what nerve? The pudendal nerve. And if you're a male rider would this be somewhat perhaps unfortunate? Um hum. Because you might have mentioned, you might've noticed [inaudible] that this nerve innervates the penis and therefore important in establishing an erection. So these ought to be banned in my opinion because, well— at least they ought to have warning stickers on them if you know what I mean. But they don't. The pudendal nerve. Incidentally this is useful— that is this

nerve and its clinical references are important in obstetrics because what is the counterpart of the penis but obviously the vagina. So is there something in obstetrics called a pudendal block? A pudendal block would be useful during labor and delivery as it reduces sensation which might be painful during delivery of a child. Then we have the gluteal nerve which innervates pretty obviously the gluteal muscles. That means the gluteus maximus and its smaller synergist. And therefore responsible for hyperextension of the thigh and sensation in and around the gluteal area. So to restate your objectives, you need to know the name and number of every what? Spinal nerve that we listed. What plexus is it a part of? What is its distribution? That means where does it go? Where does it return from? And what are some of its sensory and motor functions? If you missed any of this information it's in your textbook. You can also re-listen to the podcast but these are the members of each plexus then that you should concentrate on. Let's move now to the cranial nerves. Why are they called cranial nerves? Guess what, they go into or they leave the cranium. And so these do not connect with the spinal cord but rather the brain. These are 12 in number and unlike spinal nerves they may be M- they may be what- they may be mixed. But they can also be exclusively sensory or almost entirely motor. So we'll emphasize their composition as we list these off, and we'll do so essentially from anterior to posterior as we move from front to back. There are no bony references here so we can't refer to them by vertebrae. Instead they're given arbitrary designations, roman numerals in fact. So this is roman numeral number one and the first of the 12 pairs of cranial nerves olfactory. There's no d in the word, it's not oldfactory. It's what? Olfactory. Which is your sense of smell. This emerges- that is, this nerve rests in the cribriform plate as you may already know. It receives sensory information from receptors in your nose and naturally gives rise to the pleasant sensations, the unpleasant sensations of smell that fills our immediate environment. Although the name implies that it's entirely devoted to smell, it also has a lot to do with our sense of taste believe it or not. If you've ever had a- an infection of your nose and you notice that you have difficulty moving air through your nose and you suffer what sensory loss? Sense of smell. But you may also know that food doesn't taste as well in that setting. And so much of what we call taste is contributed by our sense of smell. Indeed, what are those folks that taste for a living? They're called wine tasters and they just don't, you know, knock it back. What do they do? They smell and they always clean their palate and they make sure they don't have a cold on the day that they're, you know, working. So clearly our sense of taste is not just a function of our tongue, but a function of the olfactory nerve as well. Now the second nerve is the optic nerve, the largest of the purely sensory nerves. The olfactory is purely sensory and so is the optic. Its entire function is devoted to what? Vision. It emanates- that means it starts or originates in the retina. It passes through the optic canal as you know. And the left optic nerve crosses over the right optic nerve just above the pituitary and forms a cross or crossover point there called the optic chiasma. This is just above the pituitary gland which is significant because if the pituitary is enlarged- if a tumor forms in the pituitary gland- that mass can only go up and therefore will pinch or

compress what nerve? And so very often the first indication of a pituitary tumor is what? Vision— vision loss. And so that's just an anatomical fact related to the position of the optic nerve to the pituitary gland. Now of course it goes past, that is to say, it goes through the thalamus and eventually terminates where? Where in your brain do you actually see? Occipital lobes. So we've made it quite clear that we don't see with our eyes, we see with our occipital lobes. Injury to the occipital lobe will cause blindness just as surely as losing an eyeball itself. So what do we have so far? One and two, both of these are purely 100% what? Sensory. They have no motor components at all. Third, the oculomotor, two words put together. Oculo refers to eye. Motor refers to movement. So it's primarily motor as the name suggests. It is involved in contraction of most but not all muscles that move the eye. And those that are involved here are those that move the eye up and down. That means cause vertical movement of the eyeball. Branches of the oculomotor nerve also innervate the eyelids and some members of the oculomotor nerve actually go inside the eye and control that colored portion of the eye. What's that colored portion of your eye known as? Iris. And the size of the iris dictates the size of that opening that many of you know is called the pupil. So could there be many symptoms associated with injury of the oculomotor nerve? Yes. First symptom, patient would be unable to gaze what? Vertically. Second of all they'd have droopy eyelids. Something called ptosis. I see that a lot in class. And then they have dilated pupils. There are other reasons for that as well, but the oculomotor nerve is after all primarily motor. So as you think of these functions and notice what you need to know about each and every cranial nerve is its name, its number, its distribution and its functions. But of course when you know the function you can also project the dysfunction. So if someone had injury to the oculomotor nerve, they would have trouble with vertical gaze. They would have droopy eyelids. And their pupils would be dilated. Next on the list, there are 12 and this is number four, roman numeral four, the trochlear nerve. The nerve— well, the name trochlea reminds you of that portion of the humerus but the word trochlea really means pulley, P-U-L-L-E-Y. And it refers to the fact that the muscle that moves your eyes outward and downward is passing through a little pulley which carries the contraction of the superior oblique muscle of the eye. I know that's a lot of information. But look at it in your textbook, it'll make more sense. As far as we're concerned though, this nerve controls contraction of the superior oblique eye muscles and it causes your eyeball to turn out and down. That is, diagonally outward. This could easily be tested in an office setting. How would a physician test your trochlear nerve? He or she would ask you to follow a flashlight or some image and be able to follow it laterally and downward. If you can't, you'd blame what? Trochlear nerve. Next nerve, number five, roman numeral five, is called the trigeminal. What's tri mean? Gemini meaning twin because of course there are two of these, left and right. It's a mixed nerve and as the name implies there are three branches. Essentially these go to and from the jaw. That means the mandible and some of the facial muscles. And so this is a map of the distribution of the three components of the trigeminal. The three branches of the trigeminal are first the ophthalmic. The

word ophthalmic refers to eye but this has nothing to do with the eye. At least nothing to do with vision or even the movement of the eye. Notice that the ophthalmic is marked as S. What's that mean? Sensory. And its distribution is shown here in red. Notice that it covers this real estate from the tip of your nose including your eyelids, your forehead, and much of your anterior scalp. S stands for what? So how would a physician test for the integrity of this nerve? They would ask you to close your eyes and they would take a Q tip or something and touch this area. If you say I can't feel that, then blame what? The ophthalmic. Is it motor? No, it's exclusively sensory. Easy to test for. Next, the maxillary, which has the distribution seen here in yellow. Notice that it also is S. S stands for? So how would you test for that? Well it's easy enough. You just poke around here, and if you don't feel that then you would blame or suspect the maxillary nerve. Notice it also includes the upper lip and not surprisingly the upper teeth. So some of you may have had dental work, extractions, on the upper teeth. Does the dentist take care to numb up this nerve? And therefore you leave the office not feeling what? Anything over there. Because you have temporary anesthesia of what? The maxillary division of the trigeminal. So many of you have experienced that if you've had any extractions or drilling of the upper teeth. What about the lower teeth? Well, those are innervated by the mandibular nerve which actually goes through the foramen ovale and into the mandibular foramen which you recall from lab. It's S & M. What does that mean in this context? Sensory and motor. So how would you test for the sensory aspect? Notice that in purple it includes the lower lip, the chin, the side of the face, even way up here to the forehead. So a Q tip which is more or less moved across your jaw and face would register some sensation and that nerve is the mandibular nerve. But M stands for what? So how would you test for the motor aspect? What movement do you suppose the mandibular nerve is responsible for? Yeah, chewing. And chewing involves two things: elevation and depression. So this might seem dangerous but the practitioner would just put his or her finger in your mouth and ask you to do what? Bite down. And if it's weak you would suggest injury to what? The mandibular nerve. Is this one also of concern to dentists? Would they want to anesthetize this nerve for what sort of extractions? Lower teeth. And notice if you've ever had any dental work down there you come out with numbness you know all the way here. You can't feel your lower lip and that sort of thing. Some of you are looking at me strangely because you've never had any dental work, and that's great because you have perfect teeth. But if you've ever visited a dentist you know that these are important nerves in that regard. All right, more to come. Number six is the abducens. The word abducens reminds you of what motion? What's the verb? Abduction, exactly. And this doesn't have to do with the arms but rather the eye. Moving the eyes horizontally as you scan or watch let's say a tennis match or ping pong match, that's a function of this nerve. It's primarily motor and it brings about contraction of the lateral rectus muscle which in fact moves the eye horizontally. So in summary, any dysfunction of eye movement could be one of how many possibilities? Any dysfunction of eye movement might involve this one. Might involve the oculomotor. Might involve the trochlear. And these

are very important, not in vision, but in moving the eye appropriately so that vision is clear and singular. What am I saying? If your left and right abducens or trochlear nerves are not in synchrony, your left eye's going to be looking at something that your right eye is not and that creates something called diplopia which is commonly called double vision. And sometimes also known as lazy eye, and therefore treatable either with surgery or with patching of one eye. You can read more— maybe you know more about that. But here's the final thing. Do any of these have anything to do with vision per se? Vision per se is exclusively the domain of what nerve? Optic. So these do not make vision possible, they simply move the eye and therefore allow us to see stereoscopically. That is, have depth perception and proper movement of the eyes. Next, this must be what? V-I-I stands for seven. This is the facial nerve known to you already because what's that bump ca- well it's the mastoid process. The one next to it is the styloid process. What's the hole between those? And what nerve does it accommodate? You knew this, the facial nerve. This is mixed. That means it serves structures in and around the face and mouth. The sensory side of it covers the front part, the anterior two thirds of the tongue. And by sensation we mean not just taste but also touch. So how would a clinician evaluate the sensory side of this nerve? Stick out your tongue and they would place some sugar or something bitter on the tongue and you would report the presence of that or not. Then the motor side of this controls many of the important facial muscles of expression. That is, being able to wince or smile or have any facial muscle tone. It goes beyond that, also innervates what important glands? Lacrimal glands and salivary glands. This cranial nerve is pretty problematic because it's very often trapped in the tunnel that it passes through. What is that foramen which this nerve exits? The stylomastoid foramen. And if this nerve is inflamed, it gets fat and therefore it pinches itself and leads to what problems? Well obviously you're not going to have much in the way of what? Facial expression. So these people will come in with a totally flat affect on one side. They'll be smiling on one side but nothing going on on the opposite side. Some of you know the name of this syndrome. You may have actually seen it or suffered from it. What's it called? Bell's Palsy. I'm sure there's a picture in your book and I had one ready for you. Imagine it right there. But Bells Palsy is easy to detect because it's due to compression of the motor part of this facial nerve. Usually it's transitory meaning it goes away of its own accord. But apart from the impact that it has on facial expression, what is the most dangerous aspect of this kind of Palsy or injury to this nerve? It's not the facial expression. it's not the taste. It's what? Of all the things that this nerve does, what is the most important to day to day activity? It's not the salivary glands. You can get by without those. It's the what? Lacrimal glands. Lacrimal glands provide tears which keep your eyes wet and failure to lacrimate leaves you with chronic dry eye which means possibility of infection, irritation to the cornea, even blindness. So people who have this disease obviously have to put in what?

>> Eye drops.

>> Eye drops all the time. Interesting factoid of totally useless information.

George Clooney suffered from Bells Palsy as a child. I know you're weepy eyed over that. But the reason it's interesting is that— the reason I even know that is that he was being interviewed and he was talking about bullying. And do you think this would cause people to bully you in elementary school? Yeah. So anyway he seemed to overcome that. Seems to do pretty well. [laughter] All right, moving on. Acoustic nerve. Also known as vestibulocochlear. Also known as auditory. This comes out of the middle ear, specifically through the internal auditory meatus. It's not a mixed nerve, it's entirely what? Entirely sensory. But not just what you think. It's not just hearing. It's also our ability to maintain balance which is important in locomotion. What's locomotion? The ability to walk. So if you had injury to the acoustic nerve, you might not be hearing very well. Or you might have disturbances of equilibrium. Perhaps you know the term vertigo. Perhaps you know the idea of motion sickness. Many of these things are associated with impairments of the acoustic nerve. And indeed if this nerve were blocked you would be profoundly deaf, but you may also have disturbances of balance and equilibrium. We mention hearing loss but is there something worse than hearing loss? Actually you could say there is because there are people who hear noises all the time. That's called tinnitus. Ever hear of tinnitus? Ringing in the ear. I don't know which I'd rather have. You know being totally deaf or having ringing in the ears all the time. It's a hard choice, not that you know you would make that choice. But equally severe in impact. Number nine is the glossopharyngeal. Two words put together. Glosso means tongue. Pharyngeal, throat. This is a mixed nerve so it brings about some sensation on the tongue but what part of the tongue? Posterior one third. And the throat. Every stuck a finger down your throat and you have that reflex? What's it called? The gag reflex. You can thank what nerve? The glossopharyngeal nerve. Also it's motor. It brings about swallowing and some salivation. But hold on, did we mention salivation earlier? Um hum. So notice an interesting fact, some of these cranial nerves— that is some of the functions of these cranial nerves— are shared. So if someone had dry mouth, what would be the suspect? What are the suspicious nerves if you had dry mouth? It could be the glossopharyngeal. Could be the facial. Next as we move down, number 10, the vagus. Has nothing to do with the city in Las Vegas. Nevada. The word vagus means to wander as many do in that town. But anyway, this goes to the chest and even to the abdomen. This is the longest cranial nerve by far. It goes down the neck, into the chest, even into the abdomen. It's mix so it has sensory components. Sensory associated with the heart. So chest pain, abdominal pain sometimes vagus in nature. Also it controls the heart and GI contraction. So this nerve is not just somatic, it's also motor. I mean it's not— it's autonomic as well as somatic. And we're almost there. Number 11 is accessory, primarily motor. It serves the sternocleidomastoid as well as the clavotrapezius muscles. What do those muscles do? Sternocleidomastoid turns the head. Clavotrapezius elevates the shoulders. How would you test for this nerve in an office or clinical setting? Basically the practitioner would put his or her hand on the side of your face and ask you to what? To turn. If you can't turn or if it's weak, then you would suspect the accessory nerve. Some

people come into an office with their head like this and automatically– unless you missed this day in anatomy class– you would say well you’ve got a problem with your what? Your accessory nerve. The condition’s called torticollis. You can Google it or read it in your textbook. George Clooney suffered from this too! I don’t know, a double whammy for George. He’s gotten over it. But would that be something that people would bully you about? Hey George! All right finally the hypoglossal. You know this nerve because it goes through what canal? What a coincidence. And it obviously is concerned with muscles that move the tongue, especially protraction of the tongue. We’ve all visited doctors and they ask you to open your mouth and stick out your what? They’re not interested in looking at your tongue necessarily. They are interested to notice that you can stick it out. What if it goes left? What if it goes right? Obviously a problem with the hypoglossal. Now when I was taking this class there was a traditional mnemonic which has been replaced because it’s just not politically correct anymore. But here it is. On Old Olympus Towering Top, a what? A Fat Eared German. Oh no we can’t say that– Viewed a what? Now you think well that’s nonsense. Well of course it’s nonsense, it is a mnemonic therefore gives you clues to what your task is. Your task is to memorize the cranial nerves. How does that work? On, olfactory. Optic, oculomotor. All right you get the rest. Fat? Ooh, facial. Eared, acoustic. German, you can fill in the rest. Today we have a cleaned up one. This is the new mnemonic. Oh, once one takes the anatomy final, very good vacations are had. Right? So let’s say it again. Oh stands for–

>> Olfactory.

>> olfactory, optic–

>> ocular.

>> Oculomotor, trochlear, trigeminal, abducens, facial.

[Inaudible]

No actually that’s vestibulocochlear. Yup. Vestibulocochlear. Good, glossopharyngeal. Vacations?

>> Vagus.

>> Vagus. Accessory and finally what? Hypoglossal. So fun enough. Sorry to keep you a little bit longer. Hope you have a great day.