Bio101 Lecture 20 Part 1

0:00:00.469,0:00:05.520
welcome back again welcome to lecture 20
this material on the peripheral nervous

0:00:05.520,0:00:11.700
system and reflex activity is covered in
chapter 13 of Marieb's textbook what we

0:00:11.700,0:00:15.540
want to do today is talk about the
cranial nerves and give you a little

0:00:15.540,0:00:18.480
mnemonic to help you remember them a
little bit better this is the tale of

0:00:18.480,0:00:23.220
old Opie we're also going to talk about
the structure of nerves and functional

0:00:23.220,0:00:27.060
classification and then what we want to
talk about the spinal nerve

0:00:27.060,0:00:32.040
plexuses and reflexes in this graphic
you can see we're discussing the

0:00:32.040,0:00:37.290
peripheral nervous system or PNS
remember from our discussion the

0:00:37.290,0:00:40.920
introduction of the nervous system that
the PNS includes two divisions that is

0:00:40.920,0:00:45.570
the sensory division and also the motor
division so in essence the peripheral

0:00:45.570,0:00:49.200
nervous system includes everything that
is not a central nervous system that is

0:00:49.200,0:00:56.010
is not the brain or the spinal cord so
what do we mean by cranial nerves and

0:00:56.010,0:00:59.489
spinal nerves
very simply cranial nerves are those

0:00:59.489,0:01:04.170
nerves that arise from the brain spinal
nerves are the ones that come from the

0:01:04.170,0:01:08.549
spinal cord if you look at this slide
you can also see that both cranial and

0:01:08.549,0:01:12.720
spinal nerves include two different
types of fibers namely somatic fibers

0:01:12.720,0:01:17.040
which as you see connect to the skin and
skeletal muscles as well as autonomic

0:01:17.040,0:01:21.240
fibers which connect to the viscera
later in the presentation I'll describe

0:01:21.240,0:01:25.950
exactly what the term somatic and
autonomic mean let's begin by talking

0:01:25.950,0:01:30.180
about the cranial nerves those nerves
coming directly into or going directly

0:01:30.180,0:01:35.369
out of the brain this slide is a view of
the inferior surface of the brain and

0:01:35.369,0:01:39.659
shown in yellow are the cranial nerves
first thing to note is that the cranial

0:01:39.659,0:01:44.880
nerves are paired that is we have one
set on each side of the brain when we

0:01:44.880,0:01:48.540
want to designate a nerve as being a
cranial nerve we use the prefix either

0:01:48.540,0:01:54.960
in capital N or CN to designate that
these are cranial nerves and we also use

0:01:54.960,0:01:59.369
the Roman numerals I through XII as you
see on the right side on the left side

0:01:59.369,0:02:03.960
of the figure here so cranial nerves are

numbered roughly from lower to higher

0:02:03.960,0:02:08.220
numbers beginning at the front of the
brain here the anterior and progressing

0:02:08.220,0:02:13.200
toward the back or the posterior you can
see that cranial nerve number one is

0:02:13.200,0:02:16.320
more toward
the front and cranial nerve number XII is

0:02:16.320,0:02:20.580
toward the back but you can see that
this scheme doesn't go exactly all the

0:02:20.580,0:02:24.360
time since the nerves are not exactly in
numerical order but generally proceed

0:02:24.360,0:02:28.920
from lower numbers to the front to the
higher numbers in the back you can also

0:02:28.920,0:02:33.270
see from this illustration that each of
the 12 cranial nerves has a name in

0:02:33.270,0:02:37.050
addition to its number for example
cranial nerve number one is called the

0:02:37.050,0:02:43.290
olfactory nerve okay so now that you
know what the cranial nerves are the big

0:02:43.290,0:02:46.860
question is how are you going to
remember the number name function of all

0:02:46.860,0:02:51.630
12 cranial nerves as well as
whether they have sensory motor or both

0:02:51.630,0:02:56.070
sensory and motor fibres glad you asked
that question that leads us to the next

0:02:56.070,0:03:00.900
slide the table shown in this slide
should make it a bit easier for you to

0:03:00.900,0:03:05.040
remember what you need to know about the
cranial nerves at the top you can see

0:03:05.040,0:03:10.110
that the table lists the number of the
nerve its name its function and whether

0:03:10.110,0:03:16.110
the nerve is sensory motor or both we
generally refer to nerves that contain

0:03:16.110,0:03:20.370
both sensory and motor fibres as mixed
nerves as you can see on the top of the

0:03:20.370,0:03:24.150
table but for the purposes of keeping
everything straight in the table and

0:03:24.150,0:03:27.720
using our mnemonic we're going to use
the term both you'll also notice that

0:03:27.720,0:03:33.420
beside the name of each cranial nerve is
a word shown in blue inside parentheses

0:03:33.420,0:03:37.200
the words when taken together make a
silly mnemonic to help you remember the

0:03:37.200,0:03:41.250
order of the cranial nerves as you can
see the mnemonic that we have here is

0:03:41.250,0:03:46.980
old Opie occasionally tries trigonometry
and feels very gloomy vague and

0:03:46.980,0:03:52.260
hypoactive although there are many
mnemonics floating around some of which

0:03:52.260,0:03:56.190
are x-rated or more suggestive than
this one this mnemonic has the advantage

0:03:56.190,0:03:59.250
of providing a clue to the names of the
cranial nerves by giving you the first

0:03:59.250,0:04:04.170
couple of letters in most cases for

example the old in the first word

0:04:04.170,0:04:07.650
implies the first two letters of the
word olfactory which is the name of

0:04:07.650,0:04:11.580
cranial nerve number one that he used
this mnemonic you'd first write the

0:04:11.580,0:04:15.330
Roman numerals one through twelve along
the left side of the page as you see

0:04:15.330,0:04:19.859
here and then beginning at number one
start reciting the mnemonic which should

0:04:19.859,0:04:23.610
remind you of the cranial nerve name and
then you'd write that name beside the

0:04:23.610,0:04:27.150
number of the nerve might take a couple
of tries to get this down pet

0:04:27.150,0:04:32.820
it's really not as difficult as it seems
the third column in the table gives you

0:04:32.820,0:04:36.539
a very abbreviated function of each
cranial nerve which you'll need to

0:04:36.539,0:04:41.820
remember for the exam you see those here
although each cranial nerve typically

0:04:41.820,0:04:45.630
does somewhat more than the function
that's indicated in the table the ones

0:04:45.630,0:04:48.389
that are shown here will be enough for
you to remember their main function

0:04:48.389,0:04:51.960
we're going to take a brief tour through
the cranial nerves in a minute or two

0:04:51.960,0:04:55.800
and we're also going to explore a few of
the functions and more detail as we go

0:04:55.800,0:04:59.460
through the remainder of the lectures on
the nervous system so hopefully you'll

0:04:59.460,0:05:03.720
become a little bit more familiar with
them the last column of the table

0:05:03.720,0:05:09.600
indicates whether each cranial nerve is
sensory using the letter S motor using

0:05:09.600,0:05:16.440
the letter M or mixed using a letter B
and as I said before we refer to nerves

0:05:16.440,0:05:20.460
that have both sensory and motor fibres
as mixed nerves but for the purposes of

0:05:20.460,0:05:25.470
our mnemonic we can't use em again so
we'll use the letter B to indicate both

0:05:25.470,0:05:30.330
or mixed nerves and you can look at this
mnemonic and the mnemonic is some say

0:05:30.330,0:05:36.000
marry money but my brother says big boobs
matter most once again kind of silly

0:05:36.000,0:05:41.070
mnemonic but it should help you remember
whether a nerve is sensory motor or

0:05:41.070,0:05:44.669
both okay so now that we've gone through
the structure of the table let me say

0:05:44.669,0:05:49.020
something about using the information on
your exam what I recommend is that you

0:05:49.020,0:05:53.610
review the table immediately before the
exam and then once you have the final

0:05:53.610,0:05:58.740
exam in front of you find a blank spot
on the exam and write the table out that

0:05:58.740,0:06:02.159
way you'll have the information in front

of you when you need it and you won't

0:06:02.159,0:06:05.610
have to worry about forgetting the
information during the heat of the exam

0:06:05.610,0:06:09.060
as you're reviewing other questions
might take you a few times you're

0:06:09.060,0:06:12.000
writing the table out before you master
it but it's really not as tough as it

0:06:12.000,0:06:15.810
seems at first glance what I want to do
now is take you on a brief tour of the

0:06:15.810,0:06:19.909
cranial nerves so you can see where they
are how they travel and what they do

0:06:19.909,0:06:23.370
hopefully this will acquaint you just a
little bit better with the cranial

0:06:23.370,0:06:28.110
nerves and make them a little less
intimidating for you let's start with

0:06:28.110,0:06:32.130
the most anterior cranial nerve which is
cranial nerve number one the name of

0:06:32.130,0:06:36.479
this is the olfactory nerve it's easier
to remember if you keep in mind the

0:06:36.479,0:06:40.500
phrase old factories smell give you a
reminder about the name

0:06:40.500,0:06:45.480
you can see that this nerve is purely
sensory you'll also notice that these

0:06:45.480,0:06:50.010
nerves have their origin in the roof of
the nasal cavity and travel up through

0:06:50.010,0:06:54.750
the perforations in the cribriform plate
of the ethmoid bone to connect with the

0:06:54.750,0:06:58.500
olfactory bulbs before being relayed
back to the brain through the olfactory

0:06:58.500,0:07:03.060
tracts the next cranial nerve is cranial
nerve number two which is the optic

0:07:03.060,0:07:07.020
nerve you can see that this nerve is
also a purely sensory and it's

0:07:07.020,0:07:12.110
associated with vision this nerve relays
these the impulses from the retina

0:07:12.110,0:07:18.150
through the optic nerve and back to the
brain where they're processed what

0:07:18.150,0:07:22.380
opening in the skull do these nerves
pass through if you said optic canal

0:07:22.380,0:07:25.590
good for you
this slide shows the cranial nerves that

0:07:25.590,0:07:30.780
are associated with the muscles that
move the eyes these are the oculomotor

0:07:30.780,0:07:35.010
nerve which is here the trochlear nerve
cranial nerve number four which is here

0:07:35.010,0:07:39.450
and the abducens nerve which is cranial
nerve number six let's take a closer

0:07:39.450,0:07:42.540
look at each of them you can probably
tell that since all three of these

0:07:42.540,0:07:46.500
nerves send the impulses the muscles
that move the eye that these are purely

0:07:46.500,0:07:50.130
motor nerves let's first look at cranial
nerve number three which is the

0:07:50.130,0:07:54.300
oculomotor nerve this cranial nerve as

you can see from its functions is a busy

0:07:54.300,0:08:00.510
little nerve it has functions here of
raising the eyelids moving the eyes four

0:08:00.510,0:08:04.890
of the six muscles that move the eyes
are powered by the oculomotor nerve it

0:08:04.890,0:08:09.870
also serves to focus the lens and it
also helps to adjust the pupil and that

0:08:09.870,0:08:16.410
is the pupil size whether it's dilated
or constricted the trochlear nerve or

0:08:16.410,0:08:20.700
cranial nerve number four is associated
with only one muscle that moves the eye

0:08:20.700,0:08:25.050
called the superior oblique muscle and
you can see that muscle right here you

0:08:25.050,0:08:28.440
can see that the superior oblique muscle
passes through a connective tissue loop

0:08:28.440,0:08:33.330
called the trochlea that changes the
direction in which the muscle inserts on

0:08:33.330,0:08:37.890
the eye this is actually where the nerve
that controls this muscle gets his name

0:08:37.890,0:08:42.599
so thus the trochlear nerve the last
thing I'd like to talk about is the

0:08:42.599,0:08:47.790
abducens nerve or cranial nerve number
six and this muscle gets its name

0:08:47.790,0:08:51.720
primarily from the fact that it abducts
the eyes by stimulating the lateral

0:08:51.720,0:08:57.000
rectus muscle the lateral rectus
is here and here has been cut away so we

0:08:57.000,0:09:01.440
can see the inside of the orbit and the
lateral rectus muscles are located on

0:09:01.440,0:09:05.640
the lateral aspect of each eye and as
you can guess move each eye laterally or

0:09:05.640,0:09:10.200
abduct the gaze away from the midline of
the body one more item I want to mention

0:09:10.200,0:09:15.029
is indicated in the blue rectangle at
the bottom of the slide as we mentioned

0:09:15.029,0:09:19.709
before a ganglion is a collection of
cell bodies located outside the central

0:09:19.709,0:09:23.070
nervous system and you can certainly see
that that's the case here this is the

0:09:23.070,0:09:26.910
ganglion and this is part of the central
nervous system this is the brainstem of

0:09:26.910,0:09:31.709
the central nervous system so you can
see that this ciliary ganglion which is

0:09:31.709,0:09:35.850
a swelling containing cell bodies
actually controls the size of the pupil

0:09:35.850,0:09:41.100
and helps control the shape of the lens
in the eye we're going to talk about the

0:09:41.100,0:09:45.600
pupillary size control as well as
control the lens in the eye when we come

0:09:45.600,0:09:49.649
to the special senses lecture the next
cranial nerve we'll look at is the

0:09:49.649,0:09:53.970
trigeminal nerve which is cranial nerve
number five from its name you might

0:09:53.970,0:09:57.899
guess that it has three branches and the

three branches are the ophthalmic

0:09:57.899,0:10:02.089
division or branch which collects
sensory information from around the eye

0:10:02.089,0:10:06.990
the maxillary division or maxillary
branch which collects information from

0:10:06.990,0:10:11.370
the upper jaw as you see here and the
mandibular branch which collects

0:10:11.370,0:10:15.990
information from the lower jaw and also
provides some motor function to the

0:10:15.990,0:10:21.750
lower jaw muscles since this nerve has
both sensory and motor functions we

0:10:21.750,0:10:26.730
would consider this a mixed nerve
however in spite of the fact that this

0:10:26.730,0:10:31.560
is a mixed nerve it's convenient for us
to remember that this is the major

0:10:31.560,0:10:36.450
sensory nerve of the face since much of
its function is associated with sensory

0:10:36.450,0:10:39.930
information that'll make it a little bit
easier to remember the general function

0:10:39.930,0:10:45.660
of a nerve the next cranial nerve we'll
look at can be remembered as being the

0:10:45.660,0:10:50.520
major motor nerve of the face
this is cranial nerve number seven which

0:10:50.520,0:10:54.720
is also called the facial nerve
as you can see cranial nerve number

0:10:54.720,0:10:59.579
seven controls many muscles around the
face that give us them many different

0:10:59.579,0:11:03.600
facial expressions that we have it also
controls the function of some important

0:11:03.600,0:11:07.740
glands like the lacrimal or tear glands
and also a couple

0:11:07.740,0:11:12.240
of salivary glands namely the
submandibular and sublingual salivary

0:11:12.240,0:11:17.610
glands cranial nerve number eight is
also known as the vestibulocochlear

0:11:17.610,0:11:23.760
nerve this is a sensory cranial nerve
that collects information about hearing

0:11:23.760,0:11:27.840
via the cochlear nerve which is
illustrated here and about equilibrium

0:11:27.840,0:11:32.430
and balance via the vestibular nerve
which is shown here after the cochlear

0:11:32.430,0:11:35.220
and the vestibular nerves combined this
becomes the vestibulocochlear nerve

0:11:35.220,0:11:40.590
which is cranial nerve number eight the
glossopharyngeal nerve cranial nerve

0:11:40.590,0:11:45.570
number nine you can see here and the
root word glosso- refers to the tongue

0:11:45.570,0:11:50.490
and the word here pharyngeal refers to the
area of the pharynx which is the back of

0:11:50.490,0:11:54.000
the oral cavity now from the
illustration you can see that this nerve

0:11:54.000,0:11:58.230
innervates glands and muscles in and
around the oral cavity in addition it

0:11:58.230,0:12:02.310
has important sensory functions as well

from the pharynx which is around here

0:12:02.310,0:12:06.600
the tongue and also from the carotid
arteries in the area of what we call the

0:12:06.600,0:12:11.990
carotid sinus which has important
receptors for control of blood pressure

0:12:11.990,0:12:15.720
next we'll take a look at the longest
cranial nerve which is called the vagus

0:12:15.720,0:12:19.890
nerve or cranial nerve number X on this
slide you can see that the vagus nerve

0:12:19.890,0:12:24.360
travels from the brain all the way down
to the lower digestive tract and

0:12:24.360,0:12:29.460
innervate several important structures
along the way including the heart the

0:12:29.460,0:12:34.830
lungs digestive organs and some of the
other abdominal organs as well the

0:12:34.830,0:12:38.280
cranial nerve provides the main
parasympathetic input to these

0:12:38.280,0:12:42.480
structures and also carries sensory
information from the viscera back to the

0:12:42.480,0:12:46.890
central nervous system the vagus nerve
is also important in controlling some of

0:12:46.890,0:12:51.750
the muscles of speech and swallowing as
well as playing a role in regulation of

0:12:51.750,0:12:55.890
cardiovascular system and respiratory
system reflexes through its connection

0:12:55.890,0:13:02.250
in the carotid sinus the last two
cranial nerves we'll explore are cranial

0:13:02.250,0:13:06.990
nerves number XI the accessory nerve and
cranial nerve number XII which is the

0:13:06.990,0:13:13.290
hypoglossal nerve both of these nerves
are primarily motor and function one of

0:13:13.290,0:13:18.270
the major functions of the accessory
nerve is to send impulses to muscles in

0:13:18.270,0:13:21.010
the neck
including the sternocleidomastoid

0:13:21.010,0:13:24.880
and the trapezius muscle that are shown
here these muscles of course move the

0:13:24.880,0:13:29.440
head the last cranial nerve is the
hypoglossal nerve cranial nerve number

0:13:29.440,0:13:33.519
XII and remember from our previous
discussion that glosso- refers to the

0:13:33.519,0:13:37.870
tongue this nerve is important in
controlling the muscles that move the

0:13:37.870,0:13:41.920
tongue and it's also important in speech
mastication which is chewing and

0:13:41.920,0:13:46.810
deglutition which is swallowing that
concludes our brief tour of the 12

0:13:46.810,0:13:50.529
cranial nerves hopefully this gave you a
little bit more familiarity with them

0:13:50.529,0:13:54.040
and made the job of remembering them
seem a little less daunting next session

0:13:54.040,0:13:59.430
we will pick up with the structure of
peripheral nerves see you then