General Senses

0:00:00.030,0:00:04.440
welcome to the introduction to sensory
reception and senses this is lecture 22

0:00:04.440,0:00:08.790
this is going to be part one of lecture
22 we'll finish the remainder of this in

0:00:08.790,0:00:14.130
class and the material for this lecture
actually comes from chapter 13 which is

0:00:14.130,0:00:19.430
on the general sensory receptors and so
you can find this in your textbook so

0:00:19.430,0:00:24.359
let's begin and we're going to talk
about introduction to the senses and

0:00:24.359,0:00:29.670
sensation what they are how they come
about why we need them classification of

0:00:29.670,0:00:34.680
sensory receptors and then we'll talk
about some of the general senses that we

0:00:34.680,0:00:40.260
want to cover in this lecture so first
let's ask a few questions and kind of

0:00:40.260,0:00:44.100
discover why we need the senses in the
first place and when we talk about

0:00:44.100,0:00:48.510
receptors and senses we have to first
understand what kind of messages the

0:00:48.510,0:00:52.230
brain understands and remember we talked
about this pretty extensively when we

0:00:52.230,0:00:57.449
covered neurophysiology and class the
brain understands electrical type of

0:00:57.449,0:01:01.050
signals and when we talk about this of
course we're talking about nerve

0:01:01.050,0:01:04.500
impulses those were the action
potentials that we discussed when we

0:01:04.500,0:01:10.159
talked about neural physiology so the
brain understands electrical impulses so

0:01:10.159,0:01:16.860
as an example let's imagine that we open
the skull and we have a somebody's brain

0:01:16.860,0:01:22.080
and they're awake with the brain do
anything if for example we shown a light

0:01:22.080,0:01:25.200
on it and no it wouldn't it wouldn't
know that we were shining a light on it

0:01:25.200,0:01:29.759
if we yelled at it would it respond nope
if we rub the pizza on it could the

0:01:29.759,0:01:34.380
brain taste it somehow nope the only
thing that the brain can understand is

0:01:34.380,0:01:38.400
those electrical messages which are
nerve impulses or action potentials so

0:01:38.400,0:01:41.930
the next question that we want to ask is
what type of things in the environment

0:01:41.930,0:01:46.229
do we have to respond to well some of
the things we just mentioned like for

0:01:46.229,0:01:54.030
example light sound taste smell touch
temperature all these different sorts of

0:01:54.030,0:01:57.030
things are things in the environment
that we have to react to things that we

0:01:57.030,0:02:01.590
call stimuli so the question then
becomes if the brain only understands

0:02:01.590,0:02:05.520
electrical impulses or nerve impulses

and none of the things in the

0:02:05.520,0:02:10.050
environment that we have to respond to
are in fact electrical impulses how does

0:02:10.050,0:02:13.440
it work
well what we have to do then is we would

0:02:13.440,0:02:17.069
have to
convert the stimuli to something else and

0:02:17.069,0:02:21.569
what does this in the body
well receptors this is the reason we

0:02:21.569,0:02:24.780
need receptors what they will do is
we'll see in a couple of minutes is they

0:02:24.780,0:02:30.799
change the energy of light sound heat
and these other impulses or stimuli into

0:02:30.799,0:02:34.700
electrical signals that the nervous
system can understand and in fact

0:02:34.700,0:02:39.829
eventually two signals that the brain
can interpret okay so let's take a look

0:02:39.829,0:02:45.060
at some general information about
receptors we can classify receptors in a

0:02:45.060,0:02:49.470
couple of different ways one of the ways
we can classify them is by location and

0:02:49.470,0:02:54.629
as you see when we classify by location
we can classify them in two major ways

0:02:54.629,0:02:59.670
we can classify them as exteroreceptors receptors
and what this actually means is that

0:02:59.670,0:03:04.260
we're responding to signals that come
from outside the body and some of the

0:03:04.260,0:03:09.180
most common things would be for example
touch pressure pain temperature those

0:03:09.180,0:03:12.629
sort of things where the stimuli
originate from someplace outside of

0:03:12.629,0:03:17.459
ourselves and most of the special sense
organs that we're going to talk about a

0:03:17.459,0:03:21.780
little bit later are exteroreceptors in
that they're responding to things that

0:03:21.780,0:03:27.090
are outside the body now the other major
classification that we have of locations

0:03:27.090,0:03:31.680
of receptors are the interoreceptors
and as the name implies these are

0:03:31.680,0:03:35.900
internal or inside our body sometimes
these are also known as visceral

0:03:35.900,0:03:41.340
receptors and these respond to stimuli
arising in the internal viscera and the

0:03:41.340,0:03:45.870
blood vessels normally we're not even
aware of them but these are sensitive to

0:03:45.870,0:03:49.889
for example chemical changes to
stretching of tissues in the body to

0:03:49.889,0:03:53.849
changes in the temperature in the body
and so when we talked about homeostasis

0:03:53.849,0:03:57.959
and we talked about some of those
receptors that respond to internal

0:03:57.959,0:04:01.079
conditions these were some of the types
of things that we were talking about

0:04:01.079,0:04:04.980
about the interorceptors now that's

certainly not the only way we can

0:04:04.980,0:04:10.319
classify receptors we can also classify
them by the structure and what we're

0:04:10.319,0:04:14.730
going to talk about here in this video
is the receptors for general senses and

0:04:14.730,0:04:19.650
these include as you see here touch
pressure stretch vibration temperature

0:04:19.650,0:04:25.740
pain muscle sense these sorts of things
and in large part these simple receptors

0:04:25.740,0:04:30.030
that we classify as
general senses are really nothing more

0:04:30.030,0:04:35.550
than just modified dendritic endings of
sensory neurons so these are really

0:04:35.550,0:04:40.020
nothing fancy typically it may be just
one cell that's responding to a certain

0:04:40.020,0:04:44.820
stimulus on the other hand when we talk
about the special senses and we're going

0:04:44.820,0:04:48.180
to talk about the special senses a
little bit more when of course we talk

0:04:48.180,0:04:52.590
about the eye in the year the special
senses are things that include receptors

0:04:52.590,0:04:58.470
for vision hearing equilibrium smell
taste now we're gonna focus mainly in

0:04:58.470,0:05:02.430
our lecture on the special senses on
these three we're not going to really

0:05:02.430,0:05:06.750
cover smell and taste although there are
some slides in that presentation that

0:05:06.750,0:05:11.040
will be at the end and this is largely
covered in chapter 15 now

0:05:11.040,0:05:16.350
one more way we can classify sensory
receptors is by the type of stimulus and

0:05:16.350,0:05:19.260
that's really what we're gonna focus on
here when we categorize these and go

0:05:19.260,0:05:23.100
through some of these special sensory
receptors so the sensory receptors that

0:05:23.100,0:05:26.160
we're talking about here sometimes are
specialized cells as we said especially

0:05:26.160,0:05:30.870
in the case of general type sensory
receptors or in the case of special

0:05:30.870,0:05:35.130
receptors like those for the eye and the
ear we're talking about multicellular

0:05:35.130,0:05:39.630
structures so these all have something
in common what they do is they respond

0:05:39.630,0:05:43.919
to stimuli and they collect information
and I mentioned before that what we have

0:05:43.919,0:05:48.630
to do is we have to take stimuli and
change that energy into an electrical

0:05:48.630,0:05:53.490
impulse and the word we use for that is
transduce so we say that receptors

0:05:53.490,0:05:59.340
basically transduce one form of energy
into another and the form that they

0:05:59.340,0:06:04.229
eventually transfer these into or
transduce these into is the electrical

0:06:04.229,0:06:07.290
energy that the nervous system

understands and then of course the

0:06:07.290,0:06:12.090
sensory receptors will stimulate neurons
to send impulses along the sensory

0:06:12.090,0:06:15.210
fibers that eventually make it up to the
brain or whatever structures we're

0:06:15.210,0:06:18.330
dealing with now the next thing we want
to do is we want to talk about some

0:06:18.330,0:06:22.680
receptors that are classified by the
type of stimulus so we're going to talk

0:06:22.680,0:06:26.310
about a list of receptors these are
important for you to know of course the

0:06:26.310,0:06:29.700
first type of sensory receptor that we
want to talk about and you see that this

0:06:29.700,0:06:34.710
is classified as a general sensory
receptor is a chemoreceptor as the name

0:06:34.710,0:06:39.930
implies chemo it means that something is
responding to chemical changes or

0:06:39.930,0:06:43.740
chemical concentrations in the
body or body fluids so these are things

0:06:43.740,0:06:47.939
that detect for example levels of acid
in the body different levels of

0:06:47.939,0:06:53.189
chemicals like co2 these are all chemoreceptors they detect levels of
chemical

0:06:53.189,0:06:57.270
concentrations of things another
category of a sensory receptor

0:06:57.270,0:07:03.360
classified by its type of stimulus are
pain receptors or nociceptors so these

0:07:03.360,0:07:06.870
two names are important for you to know
these are equivalent names this is a

0:07:06.870,0:07:12.300
once again a general class of sensory
receptor these respond to stimuli likely

0:07:12.300,0:07:15.870
to cause tissue damage so here we're
talking about something that's too hot

0:07:15.870,0:07:20.610
something that's too cold something
that's pressing on the skin too hard and

0:07:20.610,0:07:24.360
extreme heat those sort of things
anything likely to cause tissue damage

0:07:24.360,0:07:29.460
will activate pain receptors or
nociceptors and this as we'll see in a

0:07:29.460,0:07:32.909
little while
is to alert us that we need to withdraw

0:07:32.909,0:07:37.050
or get away from that stimulus as
quickly as possible when we talked about

0:07:37.050,0:07:40.770
reflexes that was one of the primary
reasons why we had reflexes these were

0:07:40.770,0:07:46.889
very quick responses enabled us to avoid
any kind of tissue damage another class

0:07:46.889,0:07:50.969
of sensory receptors are thermoreceptors and as the name implies you

0:07:50.969,0:07:55.620
can guess that these respond to some
form of change in temperature and these

0:07:55.620,0:08:01.319
are once again general class of sensory
receptors another class of receptor is

0:08:01.319,0:08:05.039
called
a mechanoreceptor so these respond to

0:08:05.039,0:08:09.270
mechanical type forces and we're going
to talk about a few examples of

0:08:09.270,0:08:13.169
mechanoreceptors when we talk about
positions of joints and how we detect

0:08:13.169,0:08:17.159
changes in the position of joints
receptors that detect stretching of

0:08:17.159,0:08:21.449
different things and you'll notice that
we have mechanoreceptors that fall into

0:08:21.449,0:08:26.669
both the general and special categories
of receptors and finally we have photo

0:08:26.669,0:08:30.990
receptors and you'll notice that these
are classified as special receptors

0:08:30.990,0:08:35.459
these are what we find in the retina of
the eye and in particular we're going to

0:08:35.459,0:08:39.510
talk about rods and cones when we
discuss the eye in class and these are

0:08:39.510,0:08:43.500
designed to respond to light more
specifically what they respond to are

0:08:43.500,0:08:48.029
photons of light and these all have
their own special way of responding and

0:08:48.029,0:08:51.779
the signals that they send to the brain
are specialised depending on what

0:08:51.779,0:08:55.620
they're designed to respond to what type
of stimuli so these are the sensory

0:08:55.620,0:08:59.190
receptors classified by stimulus these
are important for you to know you're

0:08:59.190,0:09:03.240

going to be talking about many of these
in anatomy and physiology II when we go

0:09:03.240,0:09:07.290
over different body systems so many of
these are very very important for you to

0:09:07.290,0:09:10.790
understand now let's just go into a
little bit more detail about

0:09:10.790,0:09:15.300
mechanoreceptors this is once again a
general class of receptor and we're

0:09:15.300,0:09:19.230
talking about things that detect
mechanical forces like changes in

0:09:19.230,0:09:24.089
pressure movement of fluid in the body
that might stretch a tissue and when we

0:09:24.089,0:09:28.500
look at these we really have two main
groups of mechanoreceptors very

0:09:28.500,0:09:33.510
importantly we have the baroreceptors
and you may know from the prefix Baro

0:09:33.510,0:09:38.730
here refers to pressure for example the
weather person on the TV or on the radio

0:09:38.730,0:09:44.069
says the barometric pressure is and so
Baro actually refers to pressure and

0:09:44.069,0:09:48.300
these type of receptors respond to
changes in pressure someplace in the

0:09:48.300,0:09:53.760
body for example in arteries in the
aorta in the lungs to stretch in the

0:09:53.760,0:09:57.120
digestive and urinary systems -
stretching of different tissues there

0:09:57.120,0:10:01.769
and these are classified as
baroreceptors the other type of general

0:10:01.769,0:10:05.250
receptor that we have that responds to
mechanical forces are called

0:10:05.250,0:10:11.940
proprioceptors and these sense changes
in muscles and in tendons so this is one

0:10:11.940,0:10:16.079
of the ways that we know how our joints
are in three-dimensional space how are

0:10:16.079,0:10:19.350
we holding our joints how are we holding
our arms legs that sort of thing so

0:10:19.350,0:10:24.390
these are the two main groups that we
have of mechanoreceptors now I want to

0:10:24.390,0:10:28.500
go into a little bit more detail about
proprioceptors and what these do

0:10:28.500,0:10:31.769
specifically is they send information to
the central nervous system

0:10:31.769,0:10:37.019
concerning the length and the tension of
muscles so when we stretch our muscles

0:10:37.019,0:10:41.399
for example proprioceptors would detect
that when we generate tension with our

0:10:41.399,0:10:46.319
muscles proprioceptors will detect that
and when you think about what these type

0:10:46.319,0:10:51.899
of receptors have to do you realize that
they're really designed to avoid any

0:10:51.899,0:10:57.269
kind of damage to the body one type as
we'll see prevents over a contraction of

0:10:57.269,0:11:00.750
muscle that is a contraction that might
be too strong and might tear tissues to

0:11:00.750,0:11:05.850

which it's attached and another kind of reflex or another kind of receptor I

0:11:05.850,0:11:09.450
should say initiates the reflex one of the reflexes that we talked about

0:11:09.450,0:11:12.720
before so let's look at these a little bit more carefully the first

0:11:12.720,0:11:17.910
classification of a proprioceptor is called a muscle spindle and I'll show

0:11:17.910,0:11:21.150
you a photograph or an illustration of these in a second these are within the

0:11:21.150,0:11:26.010
skeletal muscles themselves I'm not sure you know how they're actually wired what

0:11:26.010,0:11:30.630
these do is they initiate contraction as it says here and this mediates what we

0:11:30.630,0:11:34.470
call the stretch reflex now you may remember the stretch reflex but by a

0:11:34.470,0:11:38.850
different name that was called the knee jerk reflex and if you remember the knee

0:11:38.850,0:11:43.410
jerk reflex occurred when something stretched the patellar tendon and so

0:11:43.410,0:11:47.880
stretched the muscle and the muscle responded by contracting and bringing

0:11:47.880,0:11:51.900
the lower leg up in other words extending to me that was an example of a

0:11:51.900,0:11:56.040
stretch reflex and that type reflex is handled by the muscle spindle now the

0:11:56.040,0:12:00.690
second type of proprioceptor is called a Golgi tendon organ and these are of

0:12:00.690,0:12:04.410
course as the name implies in tendons
and what these are designed to do is

0:12:04.410,0:12:09.600
inhibit contraction in the event that we
try to over stress or over-contract the

0:12:09.600,0:12:13.320
muscle so that it might tear the tissues
to which it's attached like the tendons

0:12:13.320,0:12:18.060
like the bone the periosteum of the bone
into which the tendons attach those sort

0:12:18.060,0:12:20.730
of things let me show you a couple of
illustrations of these it'll make it a

0:12:20.730,0:12:24.420
little bit clearer the first one is the
muscle spindle which is on the left and

0:12:24.420,0:12:28.440
in the muscle spindle you can see that
we have these items which are called

0:12:28.440,0:12:33.480
intrafusal fibers these are special
fibers within the muscle and what they

0:12:33.480,0:12:38.040
have or nerve endings wrapped around the
fibers and these continually send

0:12:38.040,0:12:43.890
signals into the central nervous system
via the sensory nerve fiber and when the

0:12:43.890,0:12:48.900
muscle is stretched the amount of signal
that these nerves send changes and the

0:12:48.900,0:12:52.890
nervous system detects that as stretch
in the muscle and when the muscle

0:12:52.890,0:12:57.780
detects the stretch what it does is
cause contraction of the muscle in which

0:12:57.780,0:13:02.160

the intrafusal fibers are so this is
basically that same reflex as I

0:13:02.160,0:13:06.150
mentioned before like the knee jerk
reflex and this is called the stretch

0:13:06.150,0:13:10.200
reflex now the other type of
proprioception that we just talked about

0:13:10.200,0:13:14.340
a couple of minutes ago is the Golgi
tendon organ and as I said this inhibits

0:13:14.340,0:13:17.670
contraction so these basically have
opposite ends these two different types

0:13:17.670,0:13:21.510
of proprioceptors the Golgi tendon organ
is shown here

0:13:21.510,0:13:25.380
as you see this is embedded in the
tendon and what it's designed to do is

0:13:25.380,0:13:30.330
to sense stretch in the tendon and from
what we've talked about with tissues you

0:13:30.330,0:13:34.470
know that tendons are basically a dense
kind of connective tissue that really

0:13:34.470,0:13:39.000
isn't designed to stretch it's designed
to provide strength so anytime that

0:13:39.000,0:13:42.420
tissue stretches a little bit it means
that something is pulling on it a little

0:13:42.420,0:13:46.740
too strongly and may result in tearing
of either the tendon or it's attachment

0:13:46.740,0:13:51.480
into the bone so consequently this will
inhibit contraction and try to prevent

0:13:51.480,0:13:56.130
any damage to those tissues to which the
tendon is attached whether it be the

0:13:56.130,0:14:00.270
muscle or the bone the next thing we
want to talk about is about a phenomenon

0:14:00.270,0:14:04.740
called sensory adaptation I'm sure we've
all encountered this I don't

0:14:04.740,0:14:08.460
particularly like fish and if I walk
into some place where somebody's cooking

0:14:08.460,0:14:12.440
fish that really hits me in the face and
I can smell that very very strongly

0:14:12.440,0:14:17.850
however if I stay in there for a while
the smell seems to diminish and I'm

0:14:17.850,0:14:22.800
not really bothered by it so much and that is
an example of sensory adaptation but

0:14:22.800,0:14:26.040
think about what happens if somebody
throws a new piece of fish on the grill

0:14:26.040,0:14:29.940
or whatever they're cooking it on and
you have that smell wafting again

0:14:29.940,0:14:34.230
through the area well you'd smell it
again okay so that really brings up a

0:14:34.230,0:14:38.160
couple of points that we're going to
talk about here in in connection with

0:14:38.160,0:14:43.560
sensory adaptation first of all what
this is is a reduction in sensitivity of

0:14:43.560,0:14:48.690
sensory receptors and due to and this is
important some continuous stimulation

0:14:48.690,0:14:53.700
that is both painless and constant one
of the important things here is that it

0:14:53.700,0:14:57.990

has to be painless if it's not painless
that is if it's painful that means we're

0:14:57.990,0:15:02.940
likely to cause some tissue damages the
smell of a fish is maybe painful to me

0:15:02.940,0:15:06.360
but it's not gonna cause any tissue
damage in my body so that would be

0:15:06.360,0:15:11.160
considered a painless stimulus and if
somebody keeps cooking the same fish

0:15:11.160,0:15:16.020
that's a kind of constant stimulus that
eventually my receptors my smell

0:15:16.020,0:15:21.030
receptors can adapt to and diminish the
intensity of the signals that it sends

0:15:21.030,0:15:24.870
to my nervous system so these are two
important points when you think about

0:15:24.870,0:15:30.060
sensory adaptation is that the stimulus
has to be both painless and constant in

0:15:30.060,0:15:34.020
order for this adaptation to occur now
as I mentioned if somebody were to throw

0:15:34.020,0:15:37.950
a new piece of fish on
well that would be a stronger stimulus

0:15:37.950,0:15:41.490
than what I was just getting used to and
what that would do is it would

0:15:41.490,0:15:45.870
reactivate the receptors so once again I
would smell that now primarily we have

0:15:45.870,0:15:49.560
smell and touch receptors that undergo
sensory adaptation especially since

0:15:49.560,0:15:54.030
we're talking here about these general
type of sensory receptors a smell we

0:15:54.030,0:15:57.150
already talked about touch a good
example of this and I think we may have

0:15:57.150,0:16:01.740
discussed this already in class is when
you put on your shirt in the morning you

0:16:01.740,0:16:06.900
can feel it against your skin but very
very quickly your receptors your sensory

0:16:06.900,0:16:11.490
receptors in your skin adapt and you no
longer feel that and so this is an

0:16:11.490,0:16:15.060
example of sensory adaptation as well we
have many many other examples that I'm

0:16:15.060,0:16:19.680
sure you can even come up with
yourselves now pain receptors usually do

0:16:19.680,0:16:24.240
not undergo any kind of sensory
adaptation and this is a very useful and

0:16:24.240,0:16:28.260
a very valuable thing for the body we do
not want pain receptors to undergo

0:16:28.260,0:16:32.310
sensory adaptation at least not at the
level of the receptor that's detecting

0:16:32.310,0:16:37.470
the pain and the reason for this of
course is remember what pain is pain is

0:16:37.470,0:16:42.450
a response to a stimulus that may cause
damage to tissues and so if that we were

0:16:42.450,0:16:46.170
to adapt to that at the level of the
receptor that would mean we would be

0:16:46.170,0:16:50.160
able to ignore that stimulus that is
likely to cause tissue damage and we

0:16:50.160,0:16:53.700

certainly don't want that so typically
we find that pain receptors do not

0:16:53.700,0:16:58.650
undergo sensory adaptation and as we
said before the impulses after

0:16:58.650,0:17:02.880
adaptation can be retried if the
intensity of the stimulus changes and

0:17:02.880,0:17:07.380
especially if it gets stronger so this
is the phenomenon of sensory adaptation

0:17:07.380,0:17:12.959
at the level of the receptor now the
last thing we want to talk about in

0:17:12.959,0:17:17.520
terms of general receptors are the
thermal receptors and these are of

0:17:17.520,0:17:22.170
course temperature receptors the first
class are warm receptors and you'll

0:17:22.170,0:17:25.410
notice that the warm receptors have a
range of temperature to which they

0:17:25.410,0:17:28.260
respond
so these respond to temperatures above

0:17:28.260,0:17:32.220
about 25 degrees centigrade depends on
what book you read and these are

0:17:32.220,0:17:38.610
unresponsive to temperature above 45
degrees the next class of receptor is a

0:17:38.610,0:17:41.610
cold receptor and these are more
numerous and they're actually placed

0:17:41.610,0:17:45.600
more superficially in the skin and these
are sensitive as you see the temperature

0:17:45.600,0:17:49.230
between about 10 degrees centigrade and
20 or so degrees

0:17:49.230,0:17:55.500
and these are unresponsive below 10
degrees so take note of these two points

0:17:55.500,0:17:59.159
right here where the temperature
receptors begin to become unresponsive

0:17:59.159,0:18:03.990
what happens
well when the receptors for warm and

0:18:03.990,0:18:10.019
cold are outside their normal range
what's activated are pain receptors now

0:18:10.019,0:18:14.159
you think about this in terms of a
stimulus being too warm or too cold

0:18:14.159,0:18:19.440
what is it likely to do it's likely to
cause tissue damage so what we want to

0:18:19.440,0:18:22.799
happen is we'd rather have pain
receptors activated when we get outside

0:18:22.799,0:18:26.850
the normal range of these warm and cold
receptors to detect any kind of

0:18:26.850,0:18:31.710
possibility of tissue damage so pain
receptors are activated when the range

0:18:31.710,0:18:37.110
of the warm and cold receptors is
exceeded and this is a valuable response

0:18:37.110,0:18:41.880
that we have when we have something
that's too warm and too cold now since

0:18:41.880,0:18:45.149
we're talking about pain receptors let's
talk in some more detail about pain

0:18:45.149,0:18:49.409
itself in the sense of pain pain
receptors as we said before are also

0:18:49.409,0:18:53.700

called nociceptors and nociceptor is
an important word for you to know as

0:18:53.700,0:18:59.789
well in general pain receptors usually
consist of free nerve endings in other

0:18:59.789,0:19:03.539
words these are nerves basically just
naked nerve endings without any kind of

0:19:03.539,0:19:08.190
substantial structure to them and these
use as a neurotransmitter something

0:19:08.190,0:19:12.330
called substance P and the P stands for
pain or something called glutamate which

0:19:12.330,0:19:16.440
is an excitatory neurotransmitter to
remember that table that we showed you

0:19:16.440,0:19:21.779
in in lecture of all the different
neurotransmitters these were two types

0:19:21.779,0:19:24.860
of neurotransmitters you'll also
remember that when we talked about

0:19:24.860,0:19:28.980
neurotransmitters we also talked about
substances that we classified as neural

0:19:28.980,0:19:33.809
modulators and those substances would
include things like endorphins and enkaphalins

0:19:33.809,0:19:37.769
we use the example of a runner
reaching a certain point in the run

0:19:37.769,0:19:41.850
where they feel really good the runner's
high and this was mediated by the

0:19:41.850,0:19:46.110
endorphins and enkephalins well what
these do is they can actually dampen the

0:19:46.110,0:19:52.289
stimuli generated by the nociceptors
by substance P or glutamate so these can

0:19:52.289,0:19:56.460
actually dampen the sense of pain which
is that phenomenon of the runner's high

0:19:56.460,0:20:00.929
that we talked about in class now one of
the things about the brain is remember

0:20:00.929,0:20:02.909
we said before that it really doesn't
respond

0:20:02.909,0:20:08.909
to outside stimuli like light if we
touch it if we rub something on it it

0:20:08.909,0:20:14.849
won't taste it the brain also lacks pain
receptors so if you were to cut into the

0:20:14.849,0:20:19.979
brain you wouldn't actually feel that as
pain in fact the brain wouldn't really

0:20:19.979,0:20:24.599
feel anything however you got to
remember that the meninges which

0:20:24.599,0:20:28.769
surround the brain in the spinal cord
have an abundance of nociceptors so

0:20:28.769,0:20:33.809
anytime the meninges are subject to
irritation by chemicals inflammation any

0:20:33.809,0:20:38.999
kind of stretching these respond very
vigorously and send pain signals so

0:20:38.999,0:20:42.599
these have an abundance of nociceptors
in the meninges but not the brain itself

0:20:42.599,0:20:46.769
and in general we can say that pain is
stimulated by anything that will cause

0:20:46.769,0:20:52.349
tissue damage like chemicals mechanical
forces extremes in temperature as we

0:20:52.349,0:20:56.519

talked about a little while ago and very
importantly as we mentioned with sensory

0:20:56.519,0:21:01.019
adaptation nociceptors do not adapt at
least not at the level of the receptor

0:21:01.019,0:21:05.340
we do have some adaptation to for
example chronic pain and if you remember

0:21:05.340,0:21:09.479
one of the structures that we talked
about associated with the brain stem was

0:21:09.479,0:21:13.999
called the reticular activating system
or the reticular formation and that

0:21:13.999,0:21:20.609
system had an ascending pathway that
actually deadens pain slightly and this

0:21:20.609,0:21:23.970
of course doesn't happen at the level of
the receptor but happens in the central

0:21:23.970,0:21:27.840
nervous system so this is a different
kind of dampening or adaptation of pain

0:21:27.840,0:21:33.809
but typically nociceptors themselves
don't usually adapt now the last thing

0:21:33.809,0:21:37.200
we want to talk about is about this
phenomenon a visceral pain this is

0:21:37.200,0:21:41.129
something that you've heard about if
you've never experienced it and this is

0:21:41.129,0:21:45.960
the pain that comes from the organs in
the body for example your intestines

0:21:45.960,0:21:49.559
your stomach different internal
structures like the heart for example

0:21:49.559,0:21:56.789
like the lungs and usually these this
type of visceral receptor exhibits this

0:21:56.789,0:22:01.799
kind of sensation or this pain due to
some kind of stretch chemical irritation

0:22:01.799,0:22:07.379
ischemia which is decrease in blood flow
so the deprivation of oxygen but they

0:22:07.379,0:22:11.070
don't usually for example the intestines
don't usually respond to any kind of

0:22:11.070,0:22:15.839
cutting so you could be awake and if
somebody cut your intestines you

0:22:15.839,0:22:19.440
actually wouldn't feel
but if they stretch them or irritating

0:22:19.440,0:22:23.250
them with a chemical or somehow cut the
blood flow off to them you would

0:22:23.250,0:22:26.190
definitely feel that
so these respond to a different kind of

0:22:26.190,0:22:31.860
pain and one of the things this can lead
to this visceral pain sensation is lead

0:22:31.860,0:22:36.270
to something that we referred to as
referred pain and referred pain is kind

0:22:36.270,0:22:38.880
of something that everybody's familiar
with especially with something like a

0:22:38.880,0:22:43.740
heart attack and it's basically the
painful stimuli arising in one part of

0:22:43.740,0:22:48.570
the body are perceived or interpreted as
coming from another body part what this

0:22:48.570,0:22:52.650
really arises from is the fact that the
visceral pain afferent fibers travel

0:22:52.650,0:22:57.720

along the same pathways as somatic pain fibers and this time that they join

0:22:57.720,0:23:01.800
together and the brain interprets that is coming from something somatic when in

0:23:01.800,0:23:06.510
fact it's coming from something visceral like an organ an example as we said is a

0:23:06.510,0:23:10.410
person experiencing a heart attack they may feel the pain that radiates along

0:23:10.410,0:23:14.429
the left arm for example the medial aspect of the left arm primarily because

0:23:14.429,0:23:19.470
the same spinal segments in the thoracic nerves innervate both the heart and the

0:23:19.470,0:23:23.670
arm and the brain interprets those impulses is coming from the somatic

0:23:23.670,0:23:28.140
pathways which are really more commonly activated so this can lead to the

0:23:28.140,0:23:33.150
sensation of referred pain and the other thing about visceral pain is it usually

0:23:33.150,0:23:37.679
not well localized at all so you know you can feel pain in your stomach and

0:23:37.679,0:23:41.400
your intestines in some of the internal organs and it's very tough to pinpoint

0:23:41.400,0:23:45.330
the pain and that's what we mean by not well localized it's not like for example

0:23:45.330,0:23:49.110
if you had a bruise or a muscle pain where you could specifically point to

0:23:49.110,0:23:53.580
one location visceral pain is not usually well localized at all okay so

0:23:53.580,0:23:57.600
that basically concludes our
introduction to the general senses as I

0:23:57.600,0:24:01.350
said we're going to pick up with the
special senses notably the eye and the

0:24:01.350,0:24:06.540
ear in lecture and don't forget to do
the quiz I'd like you to do the quiz so that

0:24:06.540,0:24:09.960
you see if you have a good handle on the
material that we talked about in the

0:24:09.960,0:24:14.450
video I will see you next time bye-bye