

this is how →

There are specialized cells within the pituitary that release their specific type of hormone.

Within the hypothalamus, depending on the neighborhood that a cell lives in, the effects of the hormones will vary.

There is a lot of communication between the cells and the hormones.

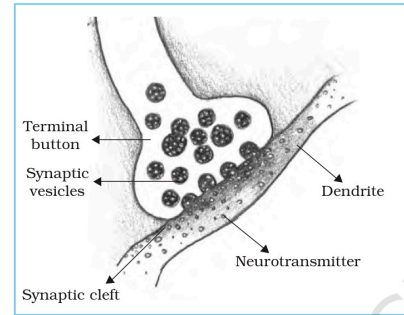


Fig.3.2 : Transmission of Nerve Impulse through Synapse

② How do you understand & identify any neuro-transmitters ?

⇒ first you gotta know where it's located. they're not located just anywhere in the brain. they're located in axon terminals.

② Now what triggers the action of a neurotransmitter ?

⇒

② what is the effect of a neurotransmitter?

⇒ /

most of the hormones we talked about are neurotransmitters.

we cannot do anything if our body isn't moving so how we do it by moving muscles & what's triggers the muscle contraction.

Now we gotta know neuropharmacology?

⇒ the external manipulation of synaptic events. to improve communication.

why people do it?

⇒ research, cure disease

• how to do this

⇒ LSD, N-N-dimethyl  
tryptamine

[https://  
youtu.be/  
eZundDVPIYw](https://youtu.be/eZundDVPIYw)

check this  
shit out



He returns to the massively complicated points that the cells in the pituitary are more responsive to their type of hormonal signal, from hypothalamus & the level of their sensitivity is based on the type of cells around them.

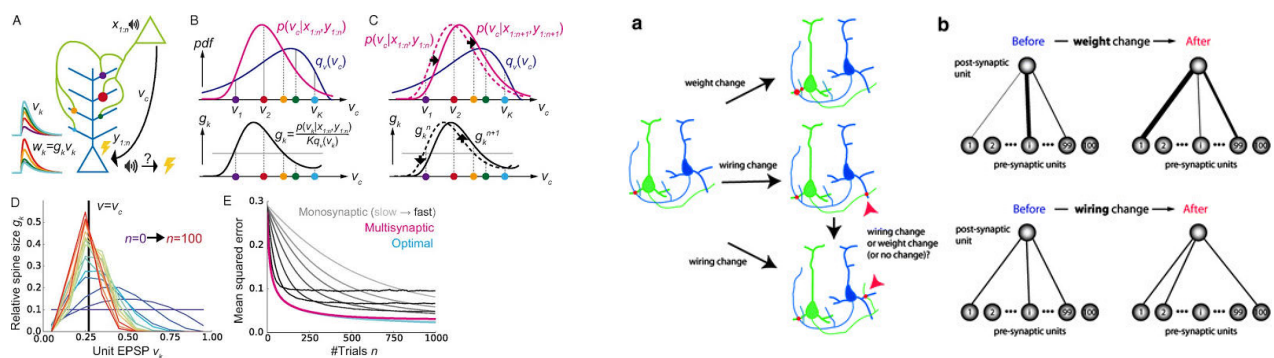
A better example is Type II diabetes, in which cells grow resistant to insulin after being overstuffing and overstimulated for too long. Too much insulin leads to fat cells rebelling and no longer "accepting" insulin's requests. Thus even more insulin has to float around in order to find a cell that will take on the blood's sugar. If it doesn't the person becomes hyperglycemic and is at risk for a diabetic sugar coma. Eventually the pancreas can burn its insulin producing cells out from their overproduction.

## LECTURE 11

① why we are not able to remember any story which had been told before bedtime?

② on the other side we <sup>will</sup> remember the same story if it <sup>had been told</sup> before any <sup>^</sup> car accident. & you never forgets it?

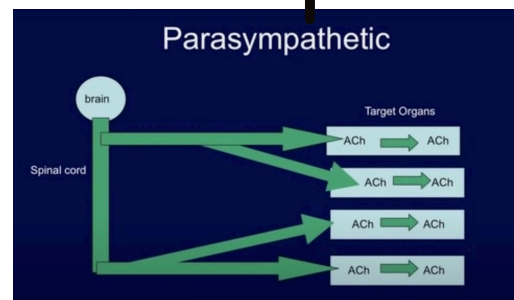
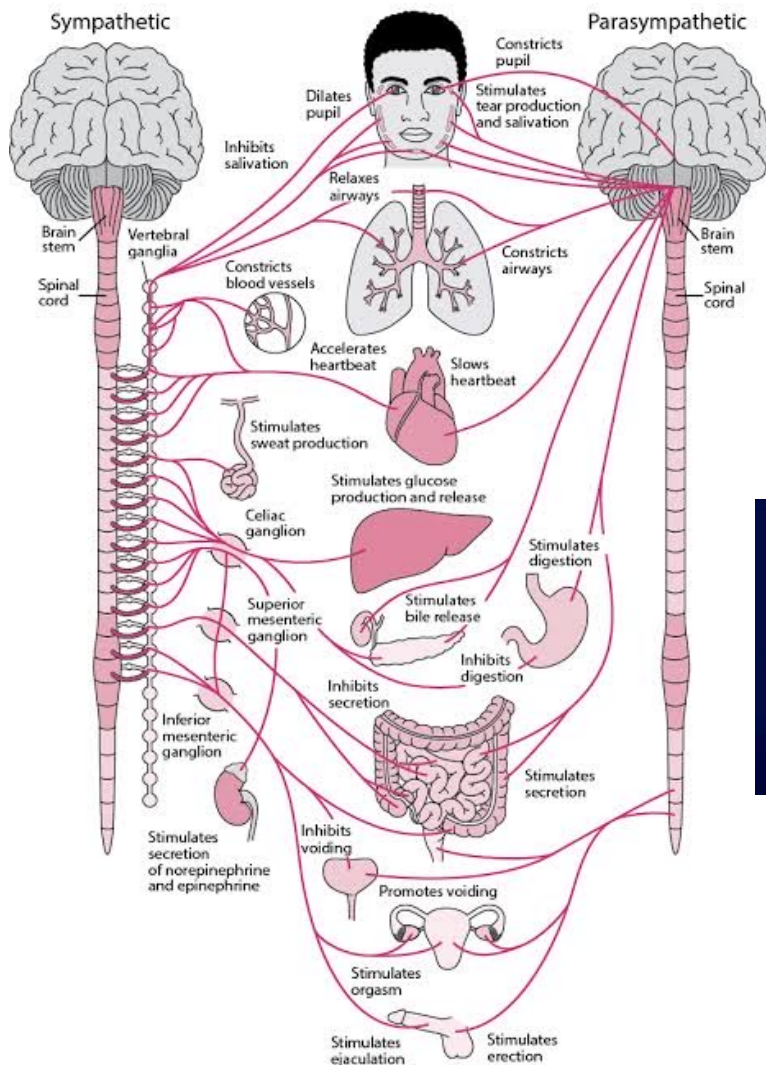
growing new memory means growing new neurons



GABA works by blocking the excitatory neuron, not the receiving end. It does so on the axon, not the dendrite.

like running from a hippo

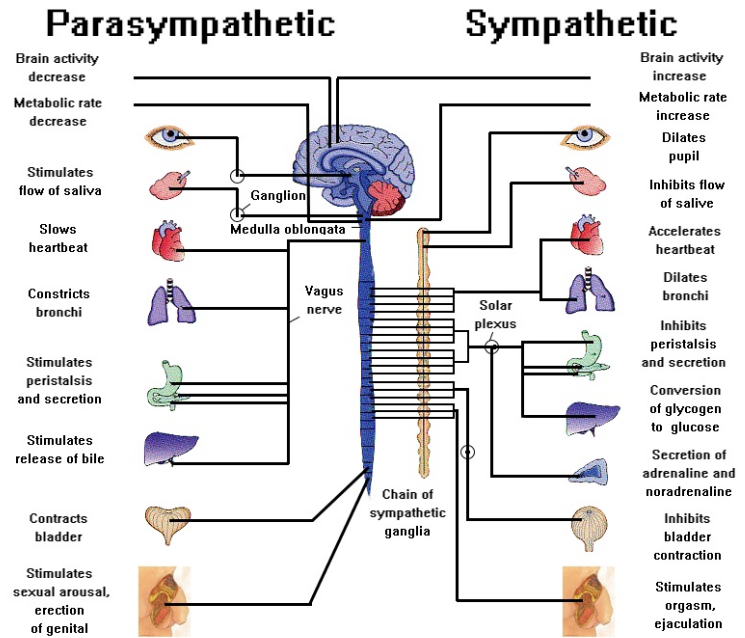
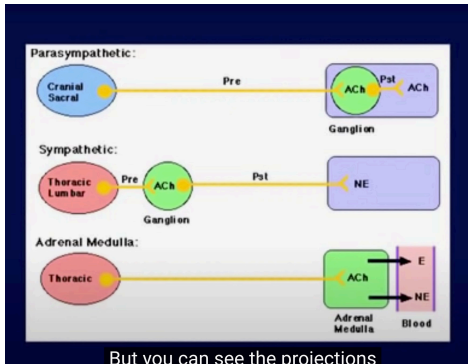
in fight or flight situation, you send signals to your blood vessels & it saves you.



autonomic nervous system

calm, vegetative function

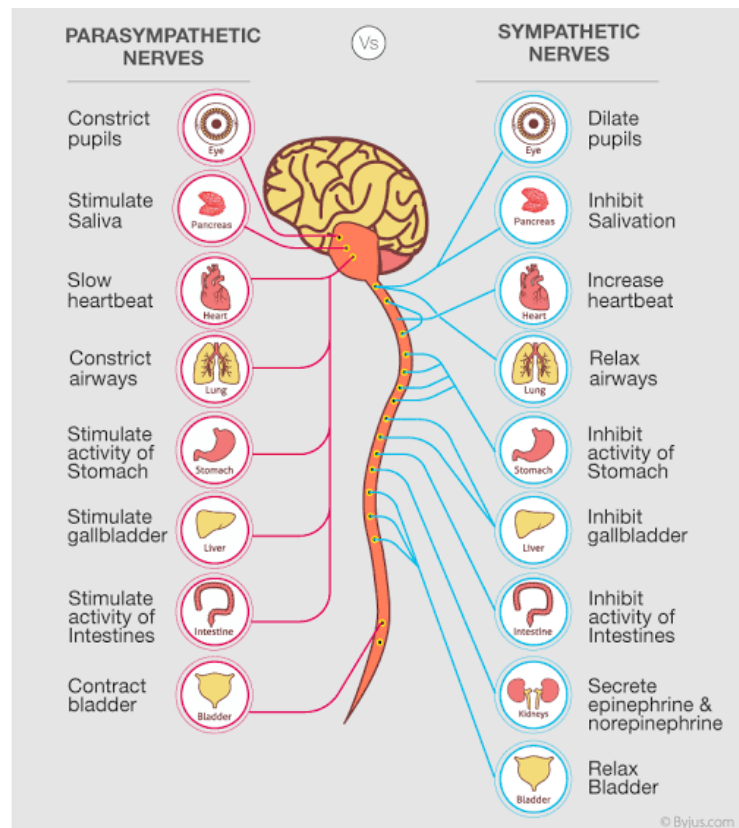
fight/flight

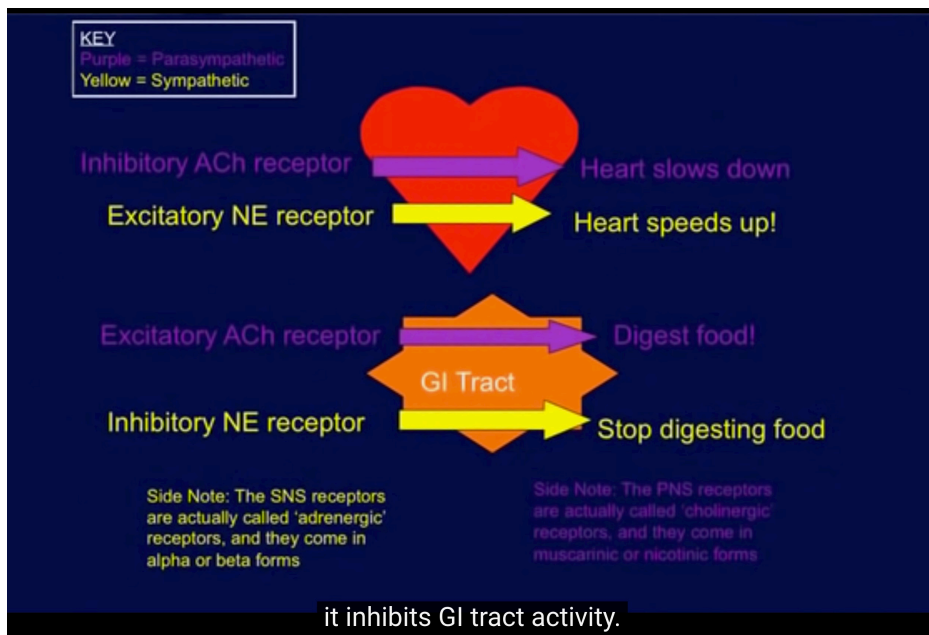


## Excitation vs. Inhibition of Organs

- SNS not always excitatory - ex. GI tract
- PNS not always inhibitory
- NEED TWO DIFFERENT RECEPTORS for each system!
- Sympathetic system can have **excitatory NE receptors** on some organs (ex. heart) and **inhibitory NE receptors** on some organs (ex. GI tract)
- Parasympathetic system can have **excitatory ACh receptors** on some organs (ex. GI tract) and **inhibitory ACh receptors** on some organs (ex. heart)

works of all nervous system.





function of transmitters to inhibit & exhibit your actions. *audio*

works of hypothalamus

### Regulation

- Center of regulation of the ANS is the *hypothalamus*.
- Contains cell bodies of ANS (that send projections) or it is just one synapse away from these cell bodies

And this is actually called the baroreflex.

### What about emotions?

- Need the *limbic system* (emotion, behavior, memory) too - the emotional area of brain surrounding the hypothalamus

So what about mammals?

the plasticity of autonomic nervous system



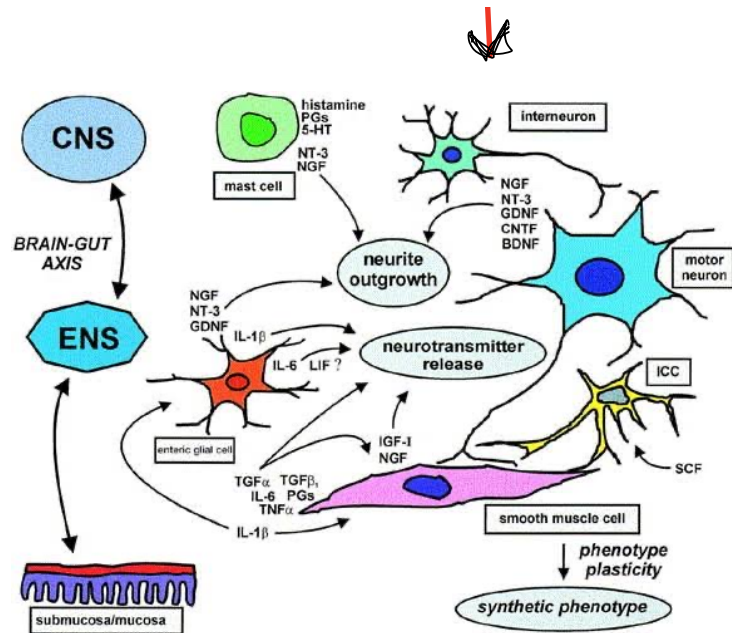


① there are hell lot of differences between autonomic & voluntary nervous system.

② Understand the neurotransmitters involved in ANS

& why PNS & SNS need 2 types of receptor (inhibition & excitatory)

audio



### Plasticity of ANS

- ANS function is highly plastic (can change over time)
- Molecular Ex: lots of stress sustained (lots of NE being used), increase synthesis of an enzyme used to make NE
- Cellular Ex: SNS has projections to skin, eyes, nose etc -- can change thresholds of sensory receptors
- Ex. biofeedback and blood pressure

So we just learned the plasticity in neurons,

The diagram shows the synthesis of catecholamines. Tyrosine is converted to L-DOPA by Tyrosine hydroxylase. L-DOPA is then converted to Dopamine by Aromatic L-amino acid decarboxylase. Dopamine can be converted to Norepinephrine by Dopamine β-hydroxylase, or to Epinephrine by Phenylethanolamine N-methyltransferase. Norepinephrine can be converted to Epinephrine by Phenylethanolamine N-methyltransferase. The diagram also shows the degradation of these catecholamines by MAO and COMT.

③ Know one or two example of what PNS & SNS do to an organ

④ Know broad overview of how brain regulates ANS.

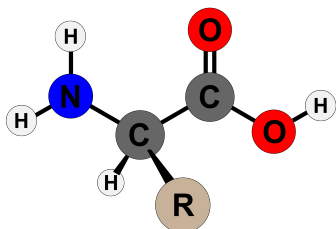
DON'T FORGET

## LECTURE 12

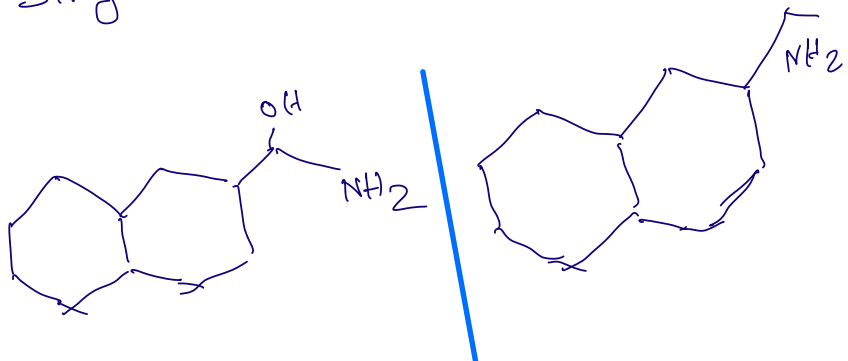
today's topic is endocrinology. So what is it exactly?  
 => It's a study of hormones. hormones are our everyday essential for survival. they control our temperature, sleep, mood, stress, growth, more.

### Multicellular life is all about COMMUNICATION

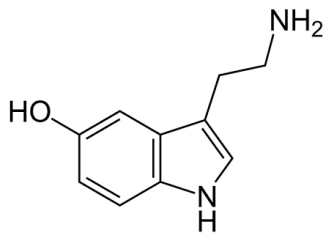
Type of Communication	Range/Speed/Specificity
Cell-Cell Contact	Short-range, 1:1 (Passing note to neighbor)
Paracrine	Short-range, Neighborhood (Whispering to several neighbors)
Neuronal	Long-range, Fast, Highly specific (Texting your friend during class)
<b>*Endocrine</b>	Long-range, Slower, Very Widespread! (Steven sending email to entire class)



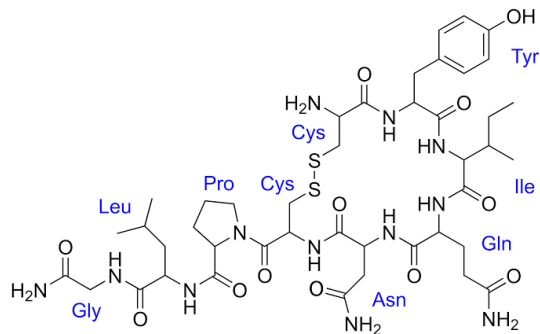
← single amino acids, peptide



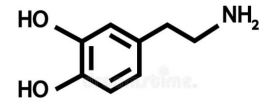
- **DEVELOPMENTAL:** Coordinated transformation of all cells in organism
- **ADULT ORGANISM:** Coordination of body's response to a given environmental trigger



## Serotonin




oxytocin



## Hormone vs Neurotransmitter

Characteristics	Hormone	Neurotransmitter
Organ System	Endocrine System	Nervous System
Mode of Transmission	Through blood stream	Across synaptic cleft
Transmission Speed	May take a few minutes or a few days	Usually within milliseconds
Transmission Distance	Act on a distant site from where it is produced	Reacts in direct proximity to their target cells
Function	They affect physiological processes such as growth and development, metabolism, mood, sexual function, reproduction, etc.	They facilitate transmission between neurons by passing action potential from the axon of one neuron to the dendrite of the next neuron
Types	Amino acid-based hormones and steroids	-According to Facilitation of Ion Flow: excitatory and inhibitory -According to structure: Small molecule and neuropeptides
Unique Capability	Regulation of the target organs and tissues	Only capable of stimulating postsynaptic neuron

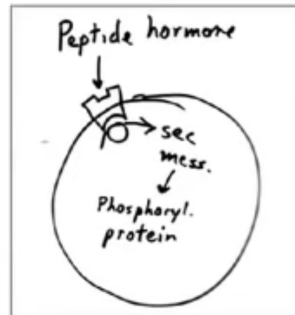

**Difference  
Between.net**



Images courtesy  
of R. Sapolsky

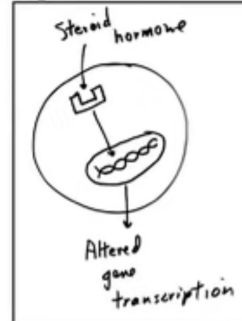
# Peptide vs. Steroid Hormones

## Interaction with Target Cell



Onset: Quick  
Duration: Short

Main Effect: So peptide hormones, because they can travel freely

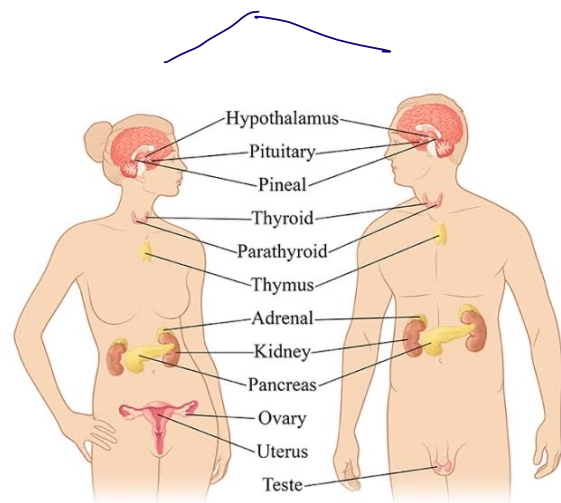


Onset: Slow  
Duration: Long

Main Effect: Transcription

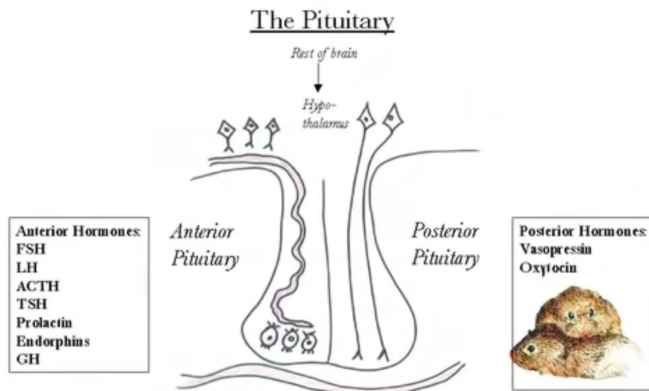
hypothalamus & the pituitary controls all the hormonal activity in the body.

## Hormonal glands



The pituitary excretes seven major hormones that can be organized under the acronym FLATPeG. Why this is the best word is not at all clear. The hormones are follicle-stimulating hormone (FSH), luteinizing hormone (LH, ICSH), adrenocorticotrophic hormone (ACTH), thyroid stimulating hormone (TSH), prolactin (PRL), beta-endorphin and growth hormone (GH, STH).

## Nervous System Control of Hormone Release



Within the hypothalamus, depending on the neighborhood that a cell lives in, the effects of the hormones will vary. There is a lot of communication between the cells and the hormones.

*read zebra book*

## Hormone Action on the Brain

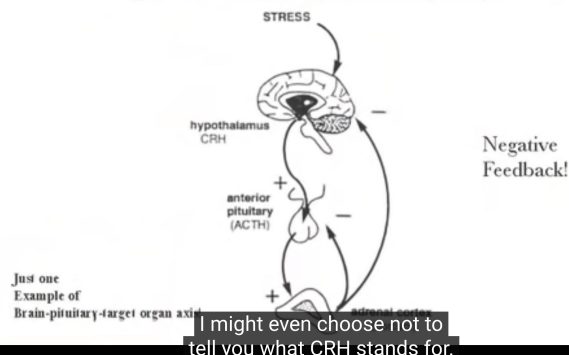
### Hormone to Neuron: An Epic Journey

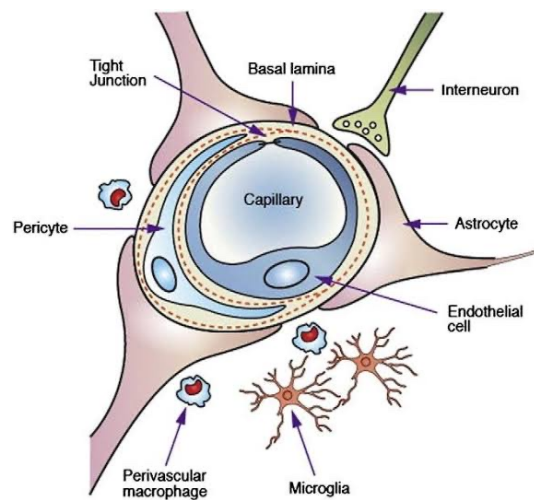
1. Can it get past the blood-brain barrier?
2. Does the neuron have the right receptor?
3. Once it binds, how can it influence activity?



## Nervous System Control of Hormone Release

### Hypothalamic-Pituitary-Adrenal (HPA) Axis:





Blood brain barrier

## TAKE HOME POINTS

- **Steroid vs. Peptide Hormones**
  - Structure, Transport, and Effect on Target Cell
- **Nervous System Control of Hormone Release**
  - Hypothalamus, Ant vs. Post Pituitary, HPA axis (and negative feedback)
- **Hormones on the Brain**
  - Blood Brain Barrier, the Importance and Diversity of Receptors, & Impact on Neuronal Activity

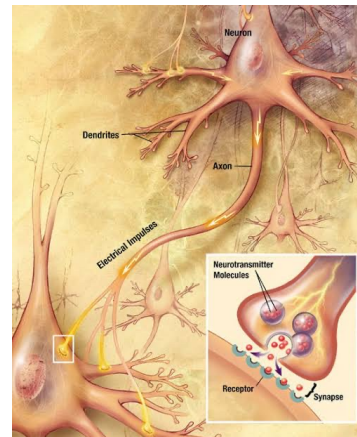
# LECTURE 13

the whole limbic system that we've studied in the past is involved in the production of emotions & personality & the core to who we are.

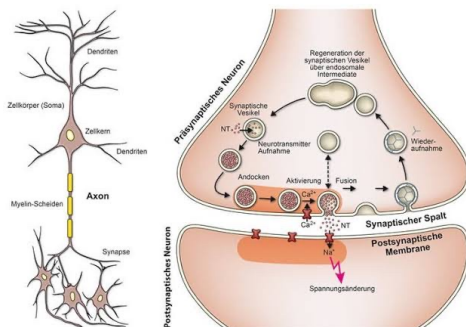
Scientist Dale proposed 2 laws of neurotransmitter —

- ② Each neuron with axon & axon terminal & states that each neuron has one characteristic neuron & releases only that type from its axon terminal.

this is not the same as stating it only has receptors for 1 type of neurotransmitter — it would still accept many



Research in the 1980's showed Dale's 2nd law was incorrect. Researchers discovered that not only would the neuron itself have more than one neurotransmitter, but the vesicles themselves would have two types. A few even have three types. Generally the types are structurally very different, perhaps a single amino acid and a complicated protein structure. This impacts speed of action. One of the neurotransmitters will have receptors for it on the neuron itself (bookkeeping).



He then sidesteps into his favorite topic - glucocorticoids. Why Zebras Don't Get Ulcers is mainly about these guys.

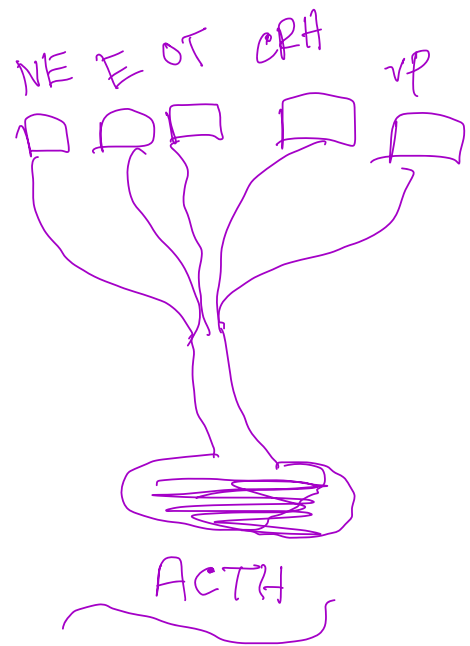
In short they are stress hormones (hydrocortisone is the human equivalent - it's a steroid that is used for its anti-inflammatory and immuno-suppressant effects).

These steroids are different than anabolic steroids that weightlifters use for increased strength).

He cites the example of the stimulation of ACTH by the pituitary stimulating release of epinephrine and epinephrine (adrenaline and noradrenaline).

**These are activating hormones that tell your body to get ready for action, whether it be running, fighting, killing a squirrel or fretting about the mortgage. In the short term they redirect energy to your muscles, enhance your focus (mostly) and put you in a stimulated state.**

In the long term they burn you out and leave you vulnerable to cell damage and death (heart disease, stroke, Alzheimer's). It's a fight or flight stimulus mechanism that ignites under stress and, as such, is great for handling real stress but can be disastrous if turned on too often.



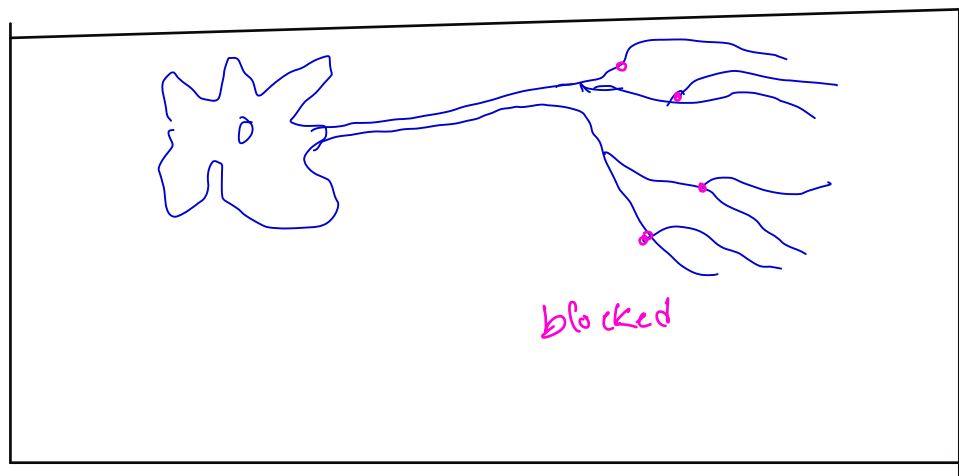
why  
audio

Corticotropin inhibit factors contribute by inhibiting the release of 'ACTH' by the Pituitary, instead releasing possibly, Delta 6 sleep inducing hormone.

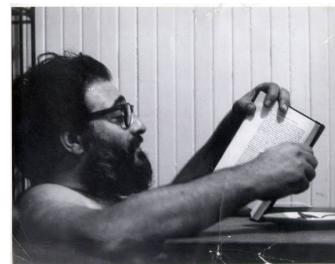
He points out that this makes sense because sleep time is a good time to turn off the stress response & do some repairs.

Dale's law #1 states that once the action potential is reached & the neuron is turned on, it will result in the release of the neurotransmitter from all the axon terminals.

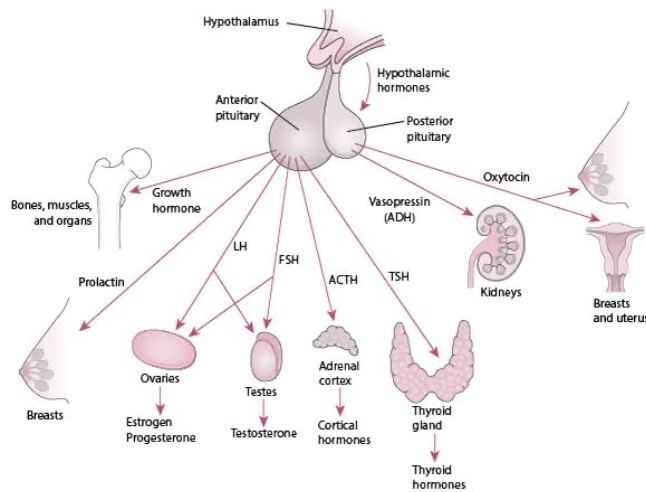
(Action potentials work as all or none deals, so once the threshold is reached, it's off to the races.)



In the 1970's (probably) Jerry Latvin published a paper that provided example of some exception to Dale's first law, with some of the action potentials being blocked at the axon terminal site.



the pituitary secretes 7 major hormones that can be stated under the acronym FLATPeG

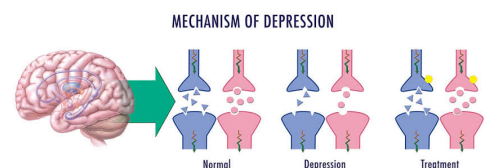


FSH  
LH, ICSH  
ACTH  
TSH  
PRL  
GH, STH

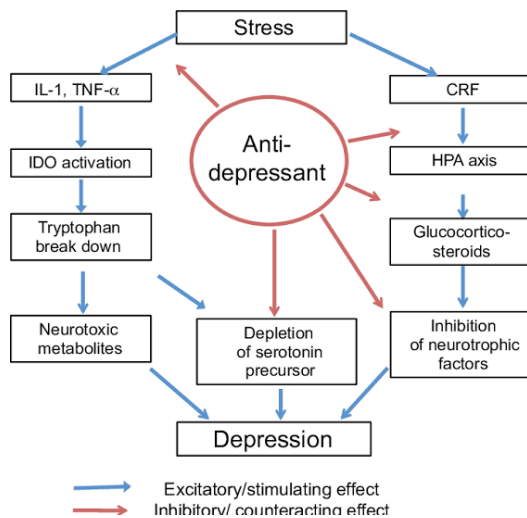
within the hypothalamus, depending on the neighborhood that a cell lives in the effects of the hormones will vary. There is a lot of communication between the cells & hormones

There are negative feedback systems that can sense amounts of the hormones in the bloodstream and turn off the activity when the appropriate level is reached. This is done in part by autoreceptors, which are on the neuron itself. So when the vesicle opens, one neurotransmitter floats across and others in the synapse will float back and hit that synapse.

There's some internal calculation that the cells do that regulate what the conversion rate is. Disruptions of the correct calculation can cause hormonal imbalances and behavioral problems, for example depression. Often one of the neurotransmitters will work exclusively on the autoreceptor while the other heads out of town.







The brain regulates levels of hormones in the body. If there are too few, it sends an excitatory stimulus to the hypothalamus. If too many, an inhibitory stimulus is sent.

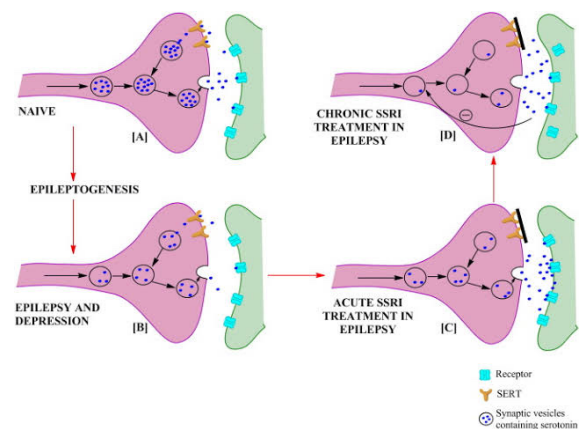
The brain also monitors and regulates the rate of change. This tends to happen more for the short term, while the amount of the hormone in the bloodstream is generally the longer term measurement. Exactly how the rate of change is counted by cells is not currently known.

read zebra book

there are also positive feedback system in which the presence of a hormone stimulates in which the presence of a hormone stimulates more. Estrogen during pregnancy is an example that's easy to predict & understand.

Auto Regulation can occur when an organism becomes used to large or small amounts of a stimulant and adjusts itself to it.

**If a lot of a hormone is present in the bloodstream, the body will begin to down regulate the amount of receptors for it (a sort of feedback control method in case the other system is producing too much).**





If there's too little, the body can increase the sensitivity of the receptors to the hormone. Problems come in when you don't compensate enough, or too much.

He mentions that this is probably an issue with depression as it relates to the neurotransmitters dopamine, serotonin and epinephrine. Patients experience a lag time from starting to take the pills to feeling better. The amount of the neurotransmitter changes within minutes to hours while the receptors change in days to weeks (which is typically how long it takes for the pills to help)

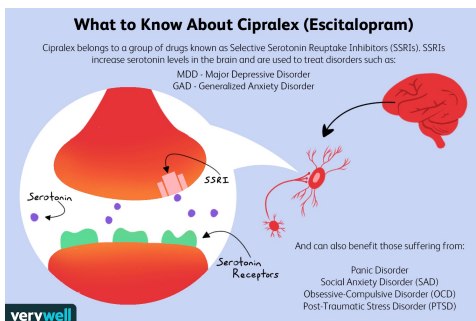
This example actually makes little sense because it implies that the massive dose would lead to down regulations, not increased effectiveness and does not explain why there wasn't an up-regulation.

However, this is mainly because the point he is making has more to do with the regulation on the releasing axon terminal, which is better explored in the lecture on depression. (This is likely what the girl asks him at the 45 minute mark.)

diabetes (audio)

read Zebrafish's depression chapter.

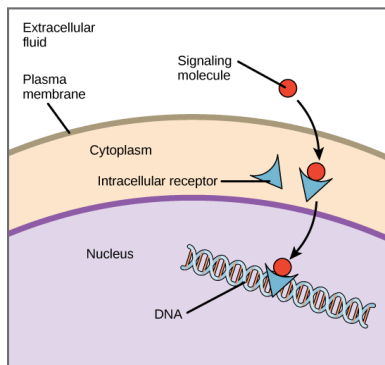
She asked this



The next point he makes scared me so much I couldn't drink a beer for weeks! He returns to the issue of glucocorticoids in the bloodstream and notes that the negative feedback will down-regulate the release of CRH once the appropriate level of glucocorticoids has been hit and that each hormone has its own process going on that the brain is constantly up and down regulating through those feedback systems. Incredibly complicated and delicate in appearance.

Start messing with any of that and the whole thing can be thrown out of whack. (In fact, this is what happens with some drug use, meth for example, in which the dopamine system gets so screwed up through the auto regulation process that normal amounts of dopamine have no effect and the person can't even feel good enough to feel crappy without meth because there's virtually no functional dopamine!)

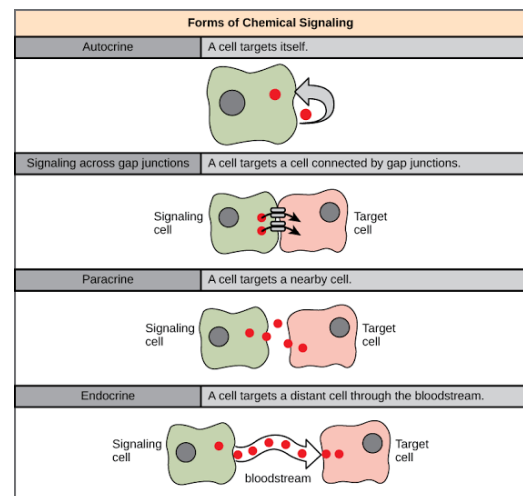
Sometimes neighbouring hormones also effects How the hormone will react in a perticular part/time.



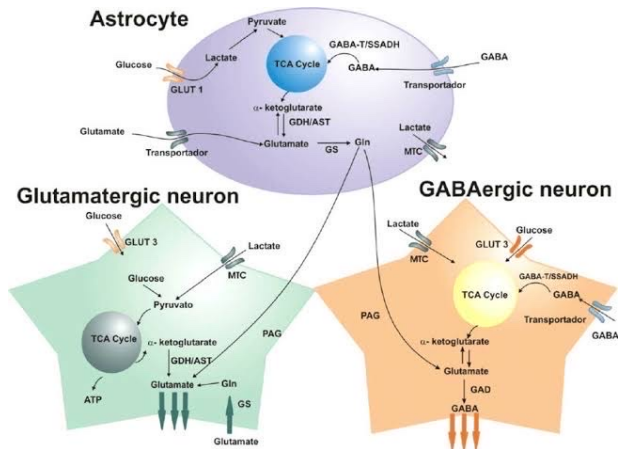
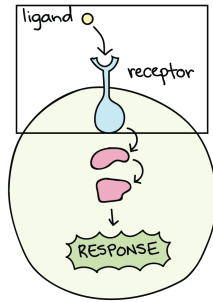
Ligand - a neurotransmitter is a ligand for a neurotransmitter receptor, a hormone is a ligand for a hormone receptor. The ligand is whatever the receptor normally binds (like a baseball to a baseball glove, the baseball is the ligand).

Receptors are often made up of many different proteins, a complex of proteins. They have a lock and key pattern to receive their ligands. The shape is made from the proteins, which are coded for by the genes in the DNA. So if there are three protein shapes, we're talking three pieces of DNA.

This introduces the potential for variation. And what follows is a range in working slower, faster or even not at depending on the gene expression in those proteins (harkens back to the earlier lectures



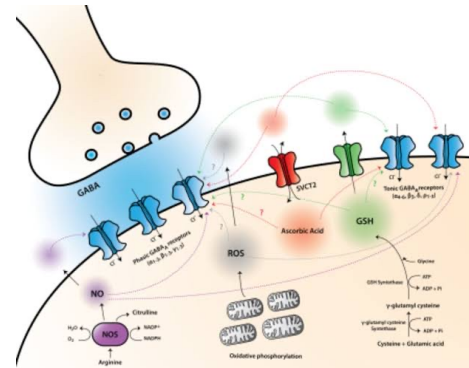
cell types specific coding



Cells can create changes by impacting their receptors and causing changes on the receptors. They can cause degrading of the proteins or replacement. This will in turn impact how well the receptor does its job.

Glutamate, for example, is involved in learning and part of how it works is by changing the shape and functioning of the glutamate receptor, making it more responsive.

Of course, this can also go wrong, for example by causing it to be way too receptive and easy to excite, such as is seen with epilepsy when a stimulus will provoke way too much of a response within a section of the brain.



Gabba

Gabba is  
insanely  
complicated  
& it binds  
some other  
things as  
well

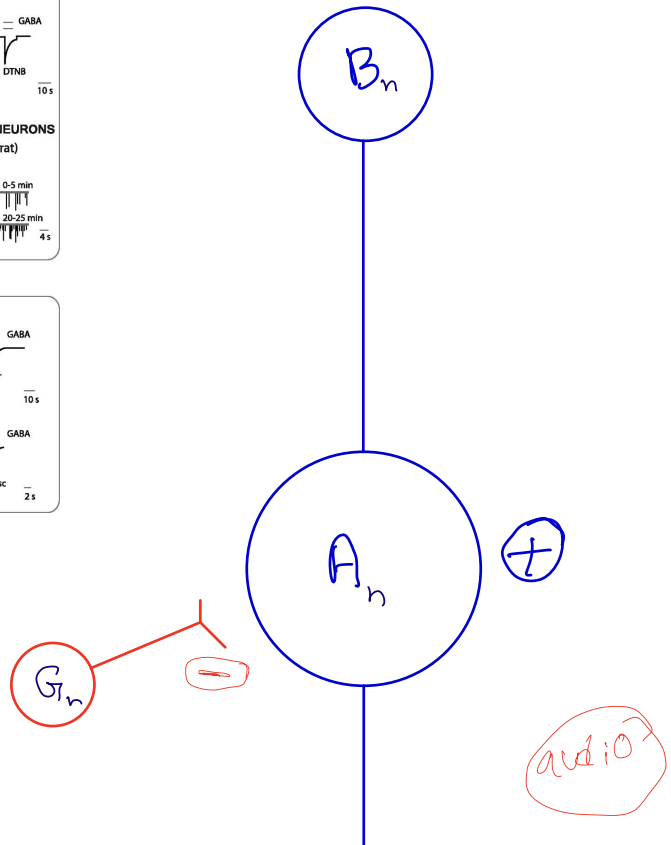
Another complication is that receptors can bind more than one ligand. Gabba, for example, is the primary inhibitory neurotransmitter in the brain. It works by binding to the gabba receptor on the transmitting neuron and thus making that excitable neuron unable to send its message (like closing a gate). It works if and only if the transmitting neuron is attempting to send a message. It prevents that from completing.

The gabba receptor also binds major tranquilizers (barbiturates), minor tranquilizers (benzodiazepines - valium, librium), and derivatives of the hormone progesterone. This hormone - a shortage of it - may be implicated in the effects of PMS.

**A**

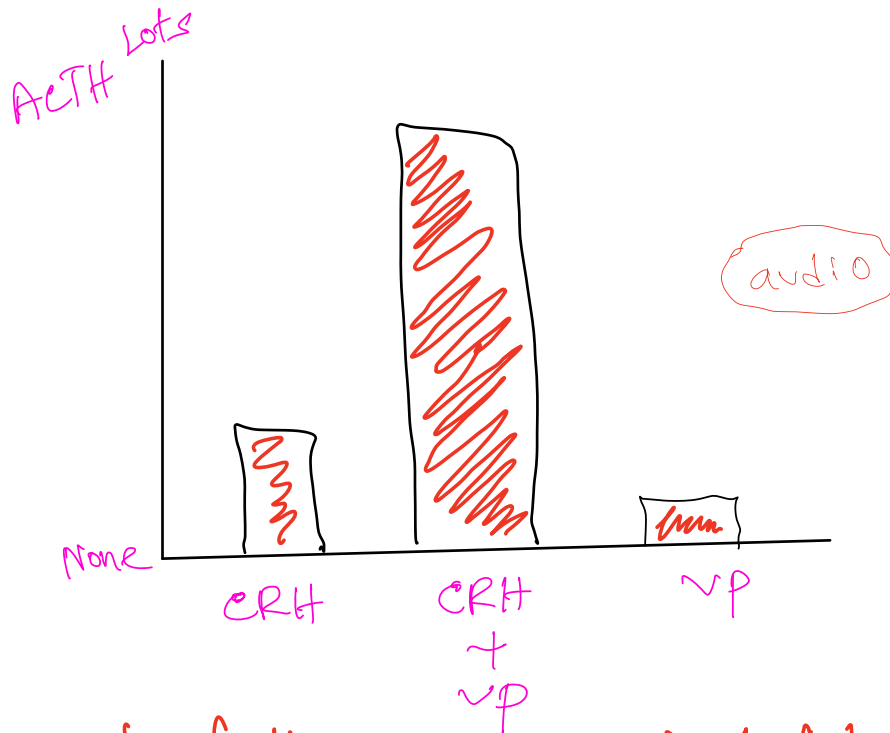
**B**

	M1	M3	M3-M4 linker
GABA <sub>A</sub>	GYFVIQTTLTLMYVLISQVS 244	ATAMQWFIATVAVFSALIE 303	
GABA <sub>B</sub>	GYFVIQTTLTLMYVLISQVS 243	ATAMQWFIATVAVFSALIE 302	
GABA <sub>C</sub>	GYFVIQTTLTLMYVLISQVS 268	ATAMQWFIATVAVFSALIE 327	
GABA <sub>D</sub>	GYFVIQTTLTLMYVLISQVS 242	ATAMQWFIATVAVFSALIE 301	GABA <sub>D</sub> PQRSDTGYTLEQDASFFTPEDATGSG 392
GABA <sub>E</sub>	GYFVIQTTLTLMYVLISQVS 247	ATAMQWFIATVAVFSALIE 306	GABA <sub>E</sub> EPRDRTGYTLEQDASFFTPEDRTGSG 390
GABA <sub>F</sub>	GYFVIQTTLTLMYVLISQVS 242	ATAMQWFIATVAVFSALIE 301	GABA <sub>F</sub> EPRDRTGYTLEQDASFFTPEDRTGSG 412
GABA <sub>G</sub>	GYFVLTQSPGILLTILSNVS 238	VALDITIMATVAVFSALIE 298	
GABA <sub>H</sub>	GYFVLTQSPGILLTILSNVS 238	VALDITIMATVAVFSALIE 298	
GABA <sub>I</sub>	GYFVLTQSPGILLTILSNVS 239	VALDITIMATVAVFSALIE 297	
GABA <sub>J</sub>	GYFVLTQSPGILLTILSNVS 256	VALDITIMATVAVFSALIE 311	
GABA <sub>K</sub>	GYFVLTQSPGILLTILSNVS 254	VFMQDIPSVTFVFFVAALIE 315	GABA <sub>K</sub> KSLTLEGLTPFFPMSGLDSDHSGKGLD 389
GABA <sub>L</sub>	GYFVLTQSPGILLTILSNVS 257	VFMQDIPSVTFVFFVAALIE 313	GABA <sub>L</sub> EKFTLEGLTSLMSKSGMDGDSSEANSLD 370
GABA <sub>M</sub>	GYFVLTQSPGILLTILSNVS 252	VFMQDIPSVTFVFFVAALIE 316	GABA <sub>M</sub> GKISRTNTHDVAQATDGLDSDSDMDQ 373
GABA <sub>N</sub>	GYFVAPGVPSSVTGMLSNVS 276	ITADLTDTATVFFVCALLIE 325	
GABA <sub>O</sub>	LYFTLELYTSPSTVLTLISNVS 247	ITADLTDTATVFFVCALLIE 307	
GABA <sub>P</sub>	NSFLVQVITVLTLTISNVS 265	ITADLTDTATVFFVCALLIE 324	



audio

if B neuron try to excite A then gabba will have it's own effect on system.



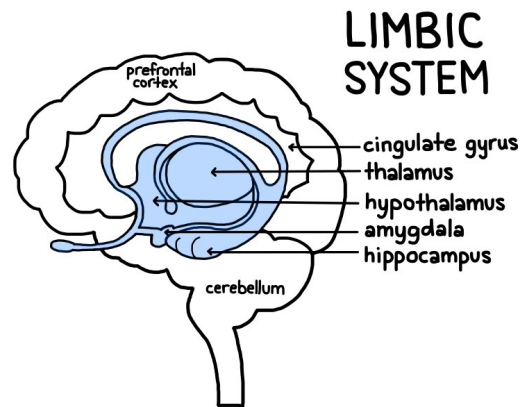
moral of the story — individual variability  
if/then class

## LECTURE

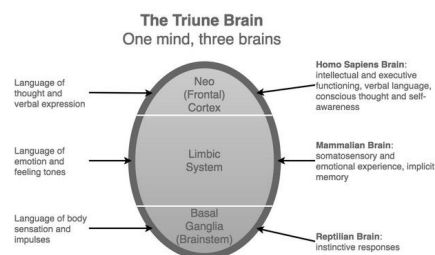
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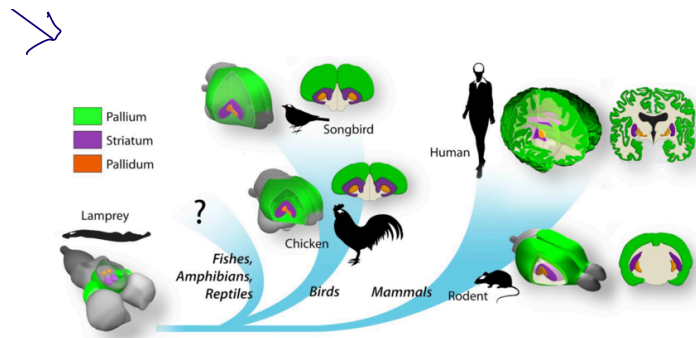
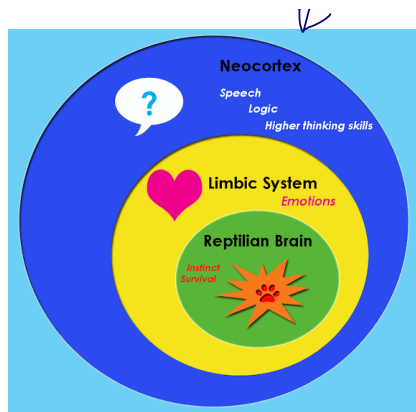
the limbic system is mostly involved in emotions. Originally it was studied in rats & known as the "Rhinencephalon",

or the nose brain, because activity was being coordinated & run through the rat's olfactory system because all rat emotions will be tied into smell. But for species that also take in, or primarily take in, info through the auditory or visual system so the wiring of the emotional stimuli will depend on the sources of sensory information.



In the 1950's neuroscientist Paul MacLean presented the triune brain model. The brain is divided up into three sections.





- ① Hypothalamus : pituitary, pathways down the spinal cord. this is the reptilian part of the brain. automatic regulatory things - temperature regulation, blood pressure, blood glucose.

He then mentions Ondine's Curse (Congenital Central Hypoventilation Syndrome) involves a disruption in this mid-brain area. Once the person stops actively controlling their breathing, they stop breathing. Ultimately you die of sleep deprivation due to constantly interrupted sleep.

- ② above that is the emotional center of the brain, the limbic system, which is primarily a mammalian invention & function.

- ③ Finally above that is the cortex, which handles the higher level processes. It is greatly intertwined with the limbic system.

As such it is far from being a completely rational abstract independent center.

the limbic system absolutely influence decisions made in the cortex, likewise the



cortex influences the limbic system.

Antonio D'Amasio's Descartes Error is recommended for more information on this topic.  
<https://youtu.be/3DHh8OOBoJ4>

James Papez is credited as advancing the research into the interconnections in the circuitry within the limbic system.

The wiring is complicated but the main thing is that every center wants to be king & to be king it really wants to be the one telling the hypothalamus what to do.

The hypothalamus is the central hub for all the neuro-endocrine stuff, thus it would influence emotions & behavior plus the hypothalamus plays a role in the autonomic activity.

Every center also wants to ensure that no other center is telling the hypothalamus what to do.

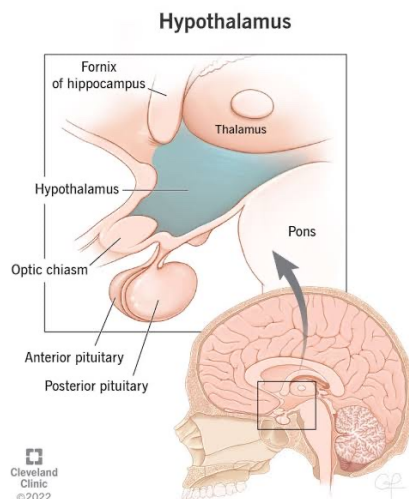
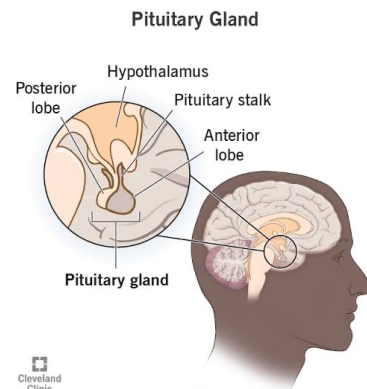
As a result the circuitry contains a lot of excitatory & inhibitory wiring & stimuli.



To calculate who has the pole position look at how far away the projecting center is from the hypothalamus - the fewer neurons & synapses in between, the better your odds of calling the shots.


As far as our senses go, every sensory modality has to go through 3-4 synapses to get a message to the limbic system, except for smell. The olfactory system is one synapse away.

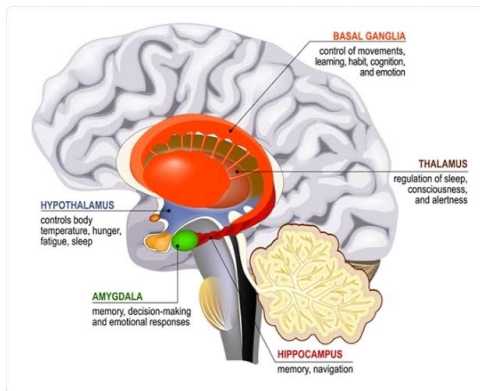
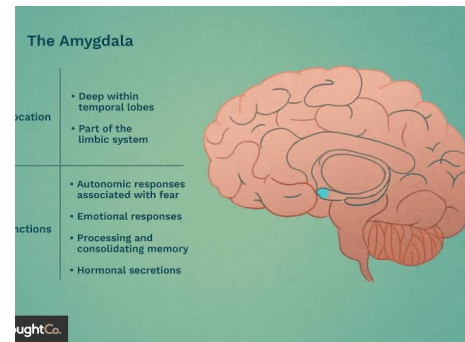
*Pituitary Gland - secretes hormones that help regulate growth, blood pressure, aspects of maternity, lactation, sexual activity, thyroid gland function, metabolism, water balance, water levels (osmosis), temperature regulation. Works along with hypothalamus.*





*Hypothalamus - links the nervous system to the endocrine system. Connects with the pituitary gland. Involved in the same major processes.*



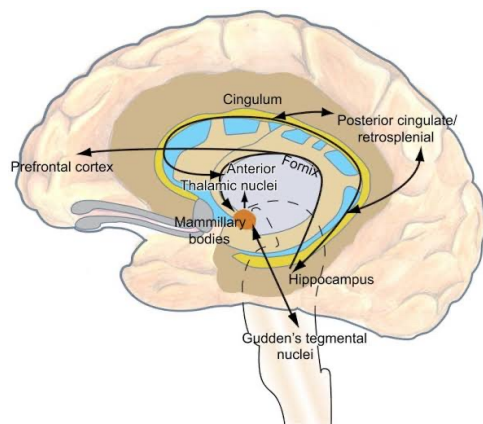
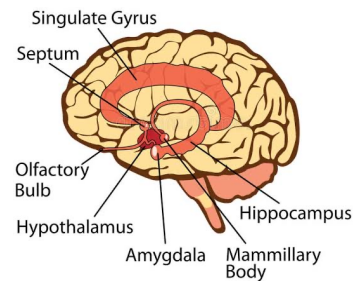
Amygdala - involved with fear, anxiety, aggression and sexual motivation. It is centrally involved in the formation and recollection of emotional memories. 




 **Hippocampus** - majorly involved in spatial tasks and hugely involved in the conversion of short term to long terms memories. A central location of neurogenesis.

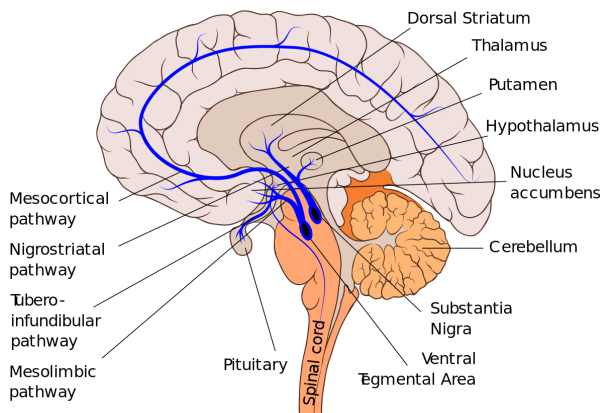
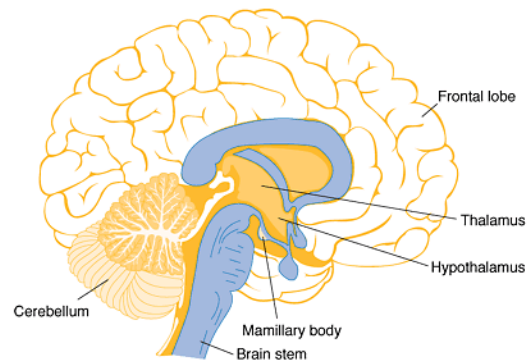
**Septum** - a dividing section within the limbic system. 

#### LIMBIC SYSTEM STRUCTURES



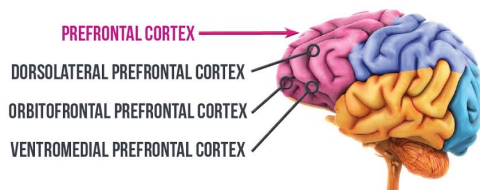
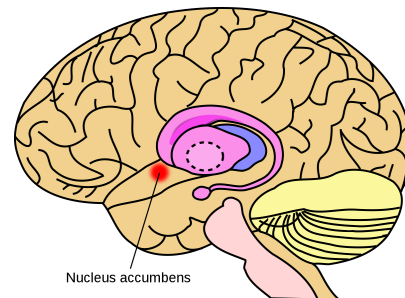
 **Mammillary bodies** - They, along with the anterior and dorsomedial nuclei in the thalamus, are involved with the processing of recognition memory. They are believed to add the element of smell to memories.

Thalamus - Its function includes relaying sensory and motor signals to the cerebral cortex, along with the regulation of consciousness, sleep, and alertness.



Ventral Tegmental Area - this is important in the function of dopamine within the limbic system and is, thus, involved with the natural reward centers of the brain. It has a role in addiction, motivation, depression, intense emotions, several psychiatric

Nucleus Accumbens - this is thought to play an important role in reward, pleasure, laughter, addiction, fear, aggression and the placebo effect.



And the last piece the prefrontal cortex (or frontal cortex), including the anterior cingulate. It is arguably the cortical component of the limbic system. The prefrontal cortex is involved in emotional items like impulse control, long term planning, delayed gratification. It isn't fully myelinated until the mid 20's, thus accounting for the changes people go through from the teenage years to their early 20's and on to adulthood.

(audio)

Research by Dr. Ian Dunbar demonstrated that the size of the prefrontal that the size of the prefrontal cortex in primate species of their social group. This suggests that it evolved into a tool for correct social behavior.

All the limbic parts are connected to each other. Key connections include -

① Amygdala to hippocampus. Amygdala is involved in fear, aggression & anxiety.

② The hippocampus handles the formation of new memories is emotionally laden territory.

audio

③ Hippocampus to septum. Septum then sending a huge projection to the hypothalamus & mammillary bodies.

This is known as the medial forebrain bundle.

Imaging studies (CAT, PET, fMRI) enables researchers to track activity & see things like metabolic increases in areas depending on the cortex.

For example, in patients with PTSD the amygdala is enlarged and more metabolically reactive than normal. People with long term major depression will sometimes have a smaller hippocampus due to atrophy.

In general the areas that are fed grow larger & those that are starved grow smaller. The more active, the more dendritic connections that are formed & the stronger those connections become.

Now Let's understand How this limbic system function :- audio  
& How you do it?  
⇒ endless warfare.



*However, he notes issues with pathways vs. nuclei and the overall complexity which make it overly simplistic to boil something down to a simple rule along the lines of this is the center that does fear for you.*

**There are simply too many connections running back and forth everywhere to define the brain that way. Additionally one has to be an ethologist to place the behavior in context (aggression versus predatory behavior).**

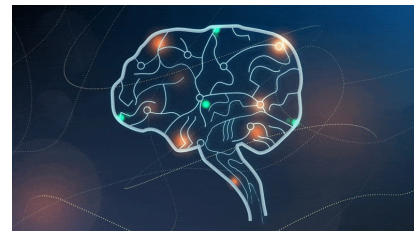
*Social structures also impact the expression of behaviors. A dominant animal will show a threat gesture while a subordinate will inhibit the behavior.*

**The takeaway is that even though that's the part of the brain that "does" a certain behavior, it will not be expressed. This points to the importance of knowing the individual as well as the species and also demonstrated the complexity of the brain.**

The amygdala is centrally involved in fear, anxiety & aggression & this tells us that we cannot understand the neurobiology of being violent without also understanding the neurobiology of being afraid. It also plays a role in male sexual behaviour.

The septum inhibits aggression these two will try to inhibit the other in order to help their message to win out.

The hippocampus is a central figure in memory & learning. It also measures the levels of glucocorticoids in the blood stream. Thus memory and stress are intertwined which makes sense. For example, if you encounter a stressful, scary situation, it's important to remember how you survived it if you do.



Mammillary bodies - aspects relative to maternal behavior.

---

Prefrontal cortex - maturation, correct sexual behaviours, correct context for aggressive behavior.

---



Anterior cingulate - it's tied in with empathy & concern for others (the pain of others).

it lights up when people are in compassionate states. But it is also implicated in depression, an overactivation in which the pain of the world make it a bleak hopeless place to be.



VTA and nucleus accumbens - this is the part of the brain that has all the neurons involved with the release of dopamine (a neurotransmitter deeply involved in pleasure).

It's the part of the brain that cocaine works on, that all drugs work on indirectly (including key elements of addiction).

This part of the brain activates when you are anticipating getting the reward. More so, it's about powering the behavior you need to do in order to get the reward.

For instance, when a rat has to pull a lever to get a food reward, dopamine is the agent that will make him look forward to doing this & get him motivated to take actions.

Dopamine is like a homuncular version of Tony Robbins running around in your head urging you to take action. If you block the rise in dopamine, the behavior won't happen, the rat or monkey will just sit there. Thus it is about stimulating the pursuit of pleasure rather than simply rewarding pleasure itself.

---

Dopamine activates when you anticipating feeling pleasure. (monkey experiment)



audio  
7.20.28

Now James Lange theory of emotions which in essence posits that your body reacts & then you figure out that reaction as emotions

<https://www.verywellmind.com/what-is-the-james-lange-theory-of-emotion-2795305>

check  
this

Example

while many think it's a mambo jumbo but recent studies has shown it's true.

In fact your emotions can come from your brain trying to figure out what your body is doing.

Suppose you are walking in the woods, and you see a grizzly bear. You begin to tremble, and your heart begins to race.

The James-Lange theory proposes that you will interpret your physical reactions and conclude that you are frightened ("I am trembling. Therefore I am afraid.")

He mentions a famous epinephrine study in which subjects were given long acting epinephrine and then exposed to either an angry fellow participant or a happy, excited one. People responded to their increased epinephrine based on the environment.

the takeaway is that the stimulus prompts you to decide what it means & when you do so, you'll create the meaning for you.

then he mentions a classic example of state depending learning in which a couple argues, their bodies get stressed & after they resolved issue number one.

one of them remember another wrong from the past that induced a similar feeling & off you go. the feelings themselves are tied in with the emotional state.

ON THE POSITIVE SIDE, YOU CAN INDUCE POSITIVE EMOTIONS BY DOING THE THINGS YOU WOULD DO IF YOU WERE HAPPY.

AS AN EXAMPLE HE MENTIONS THAT SMILING CAN HELP CREATE MORE POSITIVE EMOTIONS, EVEN IN SOMEONE THAT IS DEPRESSED. (THE DIFFICULTY IS OUR OLD PAL DOPAMINE WHO IS OFTEN LACKING IN A DEPRESSED PERSON AND WHO IS NEEDED TO GET SOMEONE TO TAKE THE ACTIONS NEEDED TO PRODUCE PLEASURE).

watch "life"  
with BBC by  
david attenborough

Moral of the story  
physiology can be  
used to influence  
emotions.



## LECTURE 15

alien  
^ martians comes to earth & be friends  
with everybody. & people ask them how  
do you guys reproduce? *funny story*

then martians ask the same question to humans?  
*funny story*

*but one question*

*why they were such a rush at the end?*

⇒ coz it feels good! & it driven by sensory stimulus  
& immediate sensation.

⊗ so how do we study sexual behaviour of that sort.  
⇒ ⊗ you gotta have them in natural setting otherwise  
you won't be able to cause in labs most of the  
species act differently

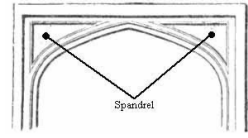
⇒ another freudian term is — *Libido / horniness or*

- ① attractivity
- ② ,proceptivity
- ③ & receptivity

⊗ next question, how do people find out info about  
sexual behaviour?

A:

Orgasm is simply a spandrel in woman & nipples are spandrel in men.



⇒ what are some of the traits in sex in humans which are unique to humans?

A: - ① we have non-reproductive sex (but recent study has shown it's not the case, bonobo chimps do it)

② foreplay but sorry bro bonobos are above us

③ homo sexuality but it's also not the case

④ egalitarian sex. →

ATTITUDES TOWARD GENDER EQUALITY, AND DEFINE GENDER EQUALITARIANISM AS A BELIEF THAT MEN AND WOMEN SHOULD ATTAIN A CERTAIN DEGREE OF EQUALITY WITHIN BOTH PUBLIC AND PRIVATE REALMS OF SOCIETY, AND THAT WOMEN'S STATUS SHOULD NOT DEPEND ON THEIR REPRODUCTIVE BEHAVIOR.

⑤ cheating no (single cell do it)

⑥ Romance new innovation (audio) N. 23.40

⑦ Series of monogamy

Most of the sexual behaviour has been controlled by the limbic system & it depends upon gender that which part is gonna be most active.

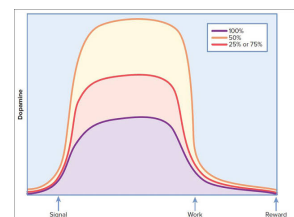
like, midbrain involves a lot in female sexual behaviour & amygdala in male

vascular erection

the dopamine system activates if the person (male) make eye contact (audio)

here 2 dopamine receptors work  $D_1$  &  $D_2$

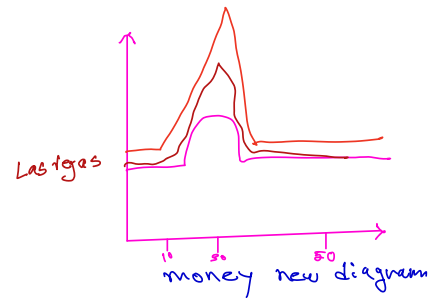
(audio) they all respond to dopamine but in a different way.



⇒ So what's the  $D_1$ ,  $D_2$  ratio go about in humans?

Ans. & one study of  $D_1$  &  $D_2$  in higher ratio predicts stable human relationship.

⇒  $D_2$  is formation of attachment &  $D_1$  is about the maintenance.



frontal cortex :

① makes you appropriate in sexual behaviour

② getting you to do sexual behaviour

Sexual motivation in female :

⇒ Oxytocin (audio) from <sup>sexual</sup> attachment, <sup>sexual</sup> pair bonds, <sup>mother</sup> offspring

⇒ if you can introduce in human, they become believable / cooperative

Vasopressine :

⇒ this pair bonds in males & monkey helps to become monogamous

visual stimuli : (audio)

tactile receptors will change depends on your hormone level

⇒ pheromone

① males do not generate sexual pheromone if they lack testosterone level

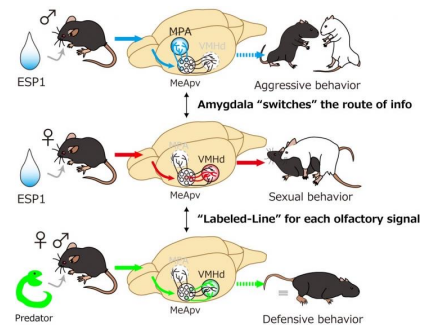
② ovariectomized females, women, rats, monkeys etc don't produce pheromones if their ovary has been removed

- (111) pheromones are breakdown product of sex hormones -  
 estrogen in female, testosterone in male. (audio)  
 interesting thing about perfume

## LECTURE 16

Some physiological effects of sexual pheromones  
 the wellesley effect

THE WELLESLEY EFFECT IS CHARACTERIZED BY THE PHYSICAL CHANGES WELLESLEY STUDENTS UNDERGO, THE MOST NOTABLE OF WHICH IS AN INCREASE IN APPETITE AND IN THE CAPACITY OF THEIR DESSERT STOMACH. THIS INCREASED HUNGER HAS LED TO AN INCREASED FIXATION WITH THE WELLESLEY FRESH WEBSITE FOR SOME, AND HAS EVEN BREED COMMUNITY AMONGST STUDENTS, WITH STUDENTS POSTING ON YIKYAK TO NOTIFY THE WELLESLEY



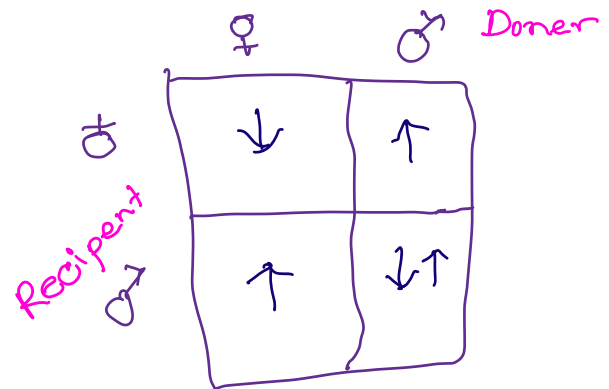
A PHEROMONE IS A CHEMICAL THAT AN ANIMAL PRODUCES WHICH CHANGES THE BEHAVIOR OF ANOTHER ANIMAL OF THE SAME SPECIES.

⇒ Sometimes pheromones delay the onset of puberty of younger females. & it a gene competition strategy there.

⇒ In some species males are able to differentiate between smells of very high ranking males.

⇒ In some cases it drives down their testosterone level.

In ovulation time females voice goes higher.

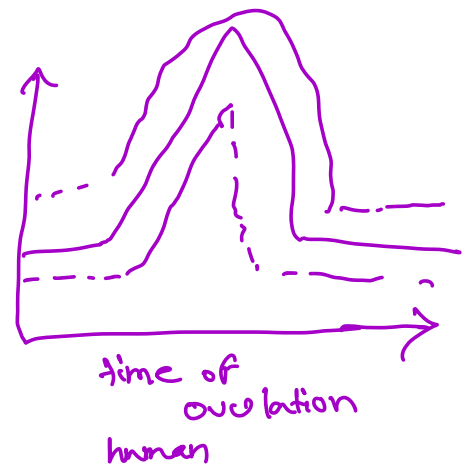
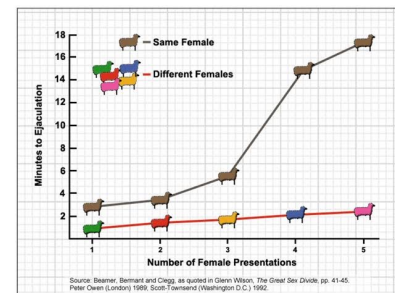
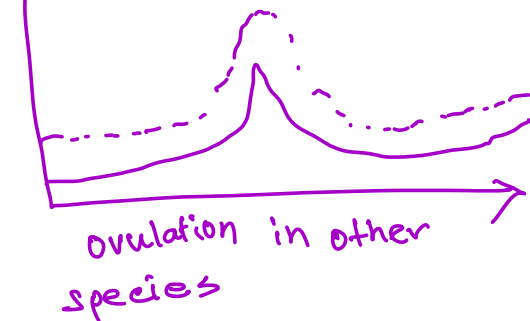


Ovulation = release eggs from ovary

The Coolidge effect is a biological phenomenon seen in animals, whereby males exhibit renewed sexual interest whenever a new female is introduced, even after sex with prior but still available sexual partners. To a lesser extent, the effect is also seen among females with regard to their mates.

now the question is where does human fit into this?

A: — female :



- ① oestrogen increase the receptor of progesteron.
- ② In ovulation time females feel more pair bonding after sex.

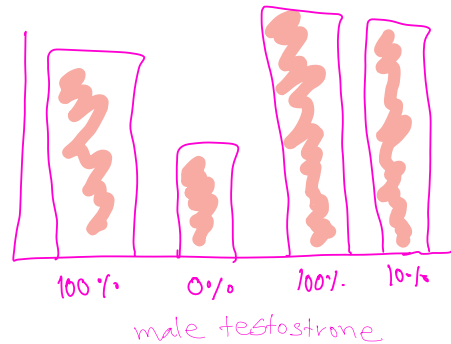
How what males does?

- ① high testosterone more sexual behaviour & vice versa.
- ② & vasopressine



- Zero testosterone doesn't exist. it won't work.  
castration doesn't make it zero.

⇒ However when idiots in gym try to make it high in order to gain muscles they take steroids & push it way higher than normal. & it does more harm than good.



- Evidence shows there is no correlation between learning how to go about sex early or any influence that sort of matter

- More in zebra book.

- Siblings matter (by spending time)

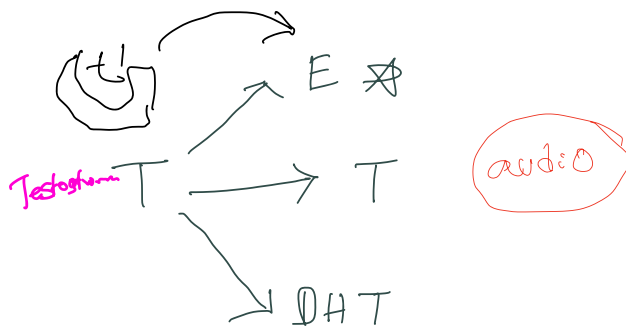
⇒ How boy become gay model!

⇒ fatherhood model, crazy mother model it's nonsense.

⇒ Prenatal androgen & lesbian!

cause ~~if~~ if you born with prenatal androgen then you will have different sorts of genitals

⇒ your gender can be dictated by chromosomes



⇒ genes effect with sexual orientation / determination

⇒ Bonobo chimps have female dominance rather than male.

they have very different sex picture

low aggression, highly sexual, polygamous  
females pick the nice guy



⇒ this encounter darwin theory of sexual selection. not only chimp or Bonobo as well as human cause they not only indulge in sex for reproduce<sup>but</sup> also for fun.

⇒ female pickiness regarding mate selection

⇒ mate guarding in male.

⇒ Sperm competition

⇒ chemical releases for reduce attractiveness

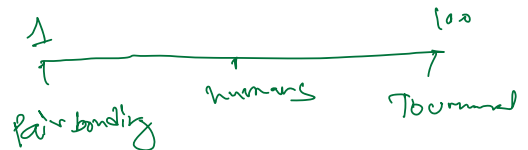
female counter strategy % (audio)

⇒ hidden ovulation

⇒ phrudo astress

so where are we ?

Ans: In between

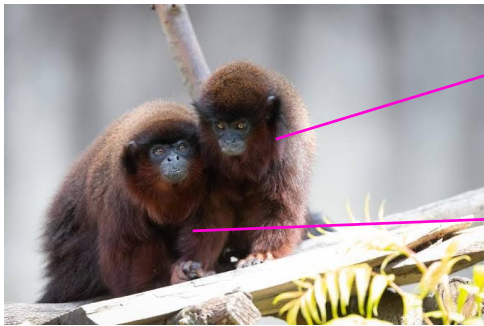


Promiscuity  
= polygamy

female female competition  
in sexual reproduction

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In some species females tend to be more aggressive than males - like, new world monkey & lot of bird species, they tend to have larger body part & they compete against other female to reproduce



female

male

Now what about homosexuality evolution? there

---

are basically 3 theories floating around —  
there has been genetic component in this

① heterozygote-vigor argument —

---

whatever gene, genes are relevant maybe the homozygotic form is that one produces behavioral phenotype which decreases reproductive success. but heterozygotic form one-fourth of the relative with homozygotic version.

### (ii) gender dependent genetic argument :

It is a genetically reproductive trait that one gender is maladaptive & decreases reproductive success. & in other gender it's highly adaptive & increase reproductive success.

for instance, the gay man has a higher reproductive rate in female sister & it's there in literature.

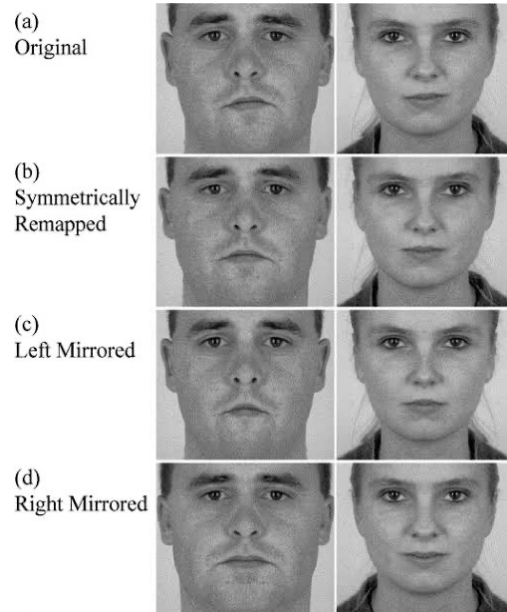
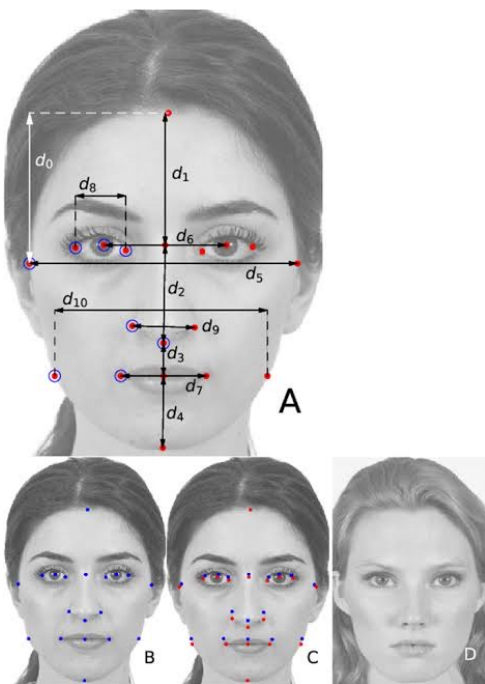
### (iii) helper at the nest : Individual who traditionally is

not passing on copies of their genes directly instead what they are doing is expending resources on helping their siblings.

for instance here they says both  
sister & brothers should have 'increased reproductive  
rates'. kin selection kind of argument.

## Symmetrical & attractiveness :

[https://en.m.wikipedia.org/wiki/Facial\\_symmetry](https://en.m.wikipedia.org/wiki/Facial_symmetry)



the more average & symmetrical the face,  
the more attractive the person is  
perceived to be.

babies at 2 months  
of age are already  
took a picture  
of a symmetrical  
faces.

people who have symmetrical  
faces are better  
dancer!

Bazinga

Secondary sexual characteristics as  
indications of health, high energy and a  
powerful immune system. Their sperm may  
be more fertile. Another study showed that  
although women generally show a  
preference for males with defined  
secondary sexual characteristics (strong jaw,  
high forehead, muscles, tall and dark and  
handsome), the longer the life expectancy  
of people within the culture and the better  
the SES, the less this preference was shown.

In theory a lot of this might be about  
avoiding infectious diseases. The  
counterpoint is found among cultures who  
can show off their secondary sexual  
characteristics despite infection - look how  
good my DNA must be.

## Zahavi's handicap principle

The handicap principle is a hypothesis proposed by Amotz Zahavi to explain how evolution may lead to "honest" or reliable signalling between animals which have an obvious motivation to bluff or deceive each other.

It suggests that costly signals must be reliable signals, costing the signaller something that could not be afforded by an individual with less of a particular trait.

For example, in sexual selection, the theory suggests that animals of greater biological fitness signal this status through handicapping behaviour, or morphology that effectively lowers this quality.

The central idea is that sexually selected traits function like conspicuous consumption, signalling the ability to afford to squander a resource. Receivers then know that the signal indicates quality, because inferior quality signallers are unable to produce such wastefully extravagant signals.

[https://  
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the  
man on  
1.05



In humans male prefer women with higher hip to waist ratio as a sign of health & fecundity.



But before one gets too excited about how shallow men are, studies of appearance & traits show that when given a set of photos of men with more or less defined secondary sexual characteristics women tend to view males with rounder faces as more likeable, more trustworthy, more honest & less attractive.

Not surprisingly, a confound running through the field is that females expend more energy on offspring of attractive males, thus producing better results

Bandwagon jumping - if others appear to like a particular being or a being with certain traits, the odds are that the female will suddenly be interested in the guy.

in addition to that —  
audio 2.1.20

In pair bonding species sexual selection happen on parenting skill - 2.2.20



Homogamy : mating with someone who is similar to you. This is

where people match. (opposite do not attract)

the odds are good that your eventual mate will share political views, religious views, comes from a similar background, be of a similar race, have a similar height etc. In addition to that there's a stronger skew for worldview issues (SES, religion, politics) than for physical features (hair colour, height, eye colour, lung capacity, weight)

with respect to all the traits there's been a lot of study which shows — audio 2.4.4 who is nicer to them.



Aggression is innate; learning is about the context within which it's acceptable. The same behaviors can be award winning or felony record producing.

We love violence in the right context.

Competitive infanticide & other species  
kill in premeditated

ways too. chimps definitely kill this way & they enjoy it, use weapons & will engage in genocide.

Broder patrol In chimps tribe, the females leave in the teenage years, resulting in bands of related males that can be very externally aggressive.

Empathy : chimps & troublestarters is innocent bystanders. Way more grooming for the victim (comfort).

<https://m.youtube.com/watch?v=ecTUhfHj8k>

Humans take empathy to a whole new level, being able to moved be suffering halfway across the planet affecting people we don't know, art work, literature & even commercials about lamps.

Top down or bottom up hierarchies. In top down a single dominant individual (usually male) sets the rules and enforces them with aggression. He takes the best for himself and will fight and kill anyone that tries to interfere.

This is chimps, baboons, Republicans. The bottom up version, as seen in vervet monkeys, is rule by consensus. The guy in charge is in charge because others want him to be and he rules fairly. This is democratic rule, this is the noble chief.



Patas monkey have virtually no male vs male fights in their natural habitat. Put them in a cage & they will fight to the death.

they have no signals for stopping aggression. thus they can be viewed as being so aggressive, once they start that they avoid fighting at all cost.

Is this aggression?

No, you never see them fight.

Yes, the entire structure of their society focuses on keeping males away from each other.

*This also points to another distinction about aggression. We are generally comfortable with someone getting what they deserved, but if the violence goes beyond that point, we are very uncomfortable with it.*

*Even within the hyper violent world of a UFC fight there are carefully coordinated codes of honor - tap out and it's over, too much dominance and the referee ends it, get a guy in a dangerous hold and instead of immediately injuring him and the opponent will wait for him to quit rather than actually completing the move.*

Sometimes  
aggression is  
aggression,  
sometimes it's  
getting  
dinner.

Human aggression comes in multiple forms. Sure, you can bash a guy over the head with a club, but there's also the aggression, pulling a trigger, dropping a bomb from 30,000ft away. Damning with faint praise, passive aggressive actions & symbolic aggression. Black eggs, drones, colligops.

The amygdala is centrally involved in fear, anxiety, aggression. ~~✱~~ the lolipop story

Charles Whitman, mass murderer, went up until the belltower on UT's Austin campus and shot a whole bunch of people. This was one of those cases where all the people who knew him said he was such a nice guy and where did this come from.

On postmortem he was found to have a tumor in his amygdala.

In this case what's happening with the tumor is it's stimulating the activity within the amygdala.

Person's amygdala is destroyed they don't look at others eyes.

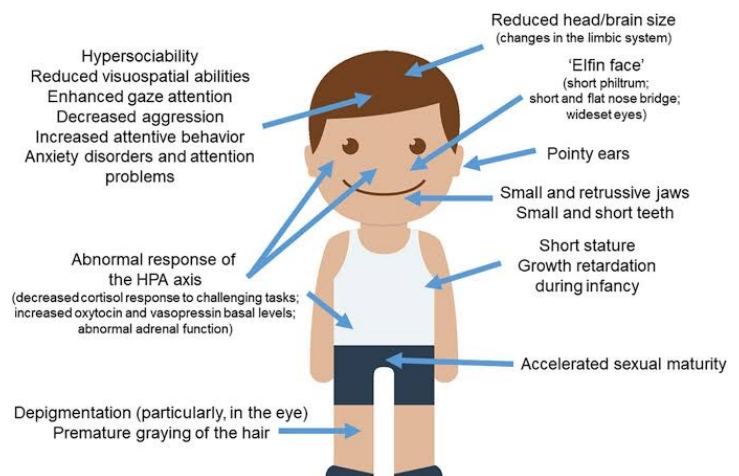
## LECTURE 18

People with damage to the amygdala do not respond to fear evoking stimuli the way a normal person would.

the brain also has direct pathways to the amygdala that generate quicker responses, but less accuracy. Individuals with PTSD tend to have stronger pathways here accounting for out of context.

### william syndrome :

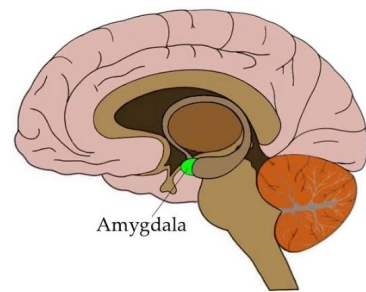
Williams syndrome is a developmental disorder that affects many parts of the body. This condition is characterized by mild to moderate intellectual disability or learning problems, unique personality characteristics, distinctive facial features, and heart and blood vessel (cardiovascular) problems



facility with language & emotion despite being mentally retarded, very trustful & gregarious. Susceptible to being taken advantage of. Their amygdala basically doesn't respond to aggressive faces. So we have high functioning with low amygdala activity.

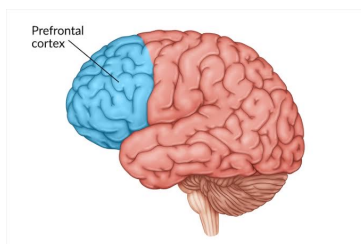
Social phobias. Any face invokes activity in the amygdala. For depressives the amygdala becomes more active when they are shown something sad. Perhaps what the amygdala is truly tuned into is whatever is scariest to you.

**Us and them. Another role for the amygdala.**

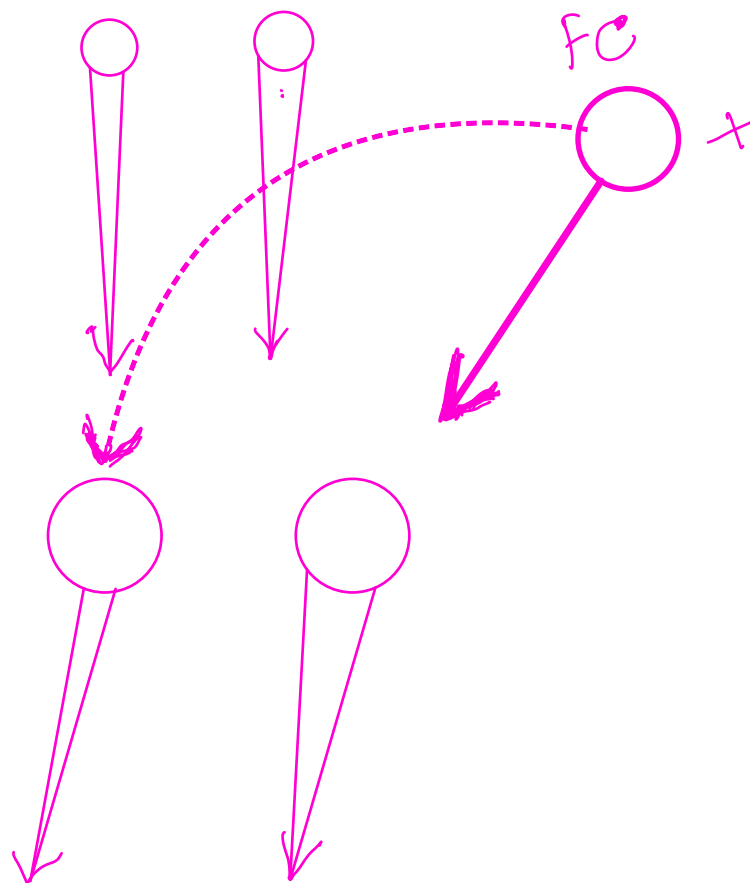


frontal cortex ☺ The frontal cortex is responsible for getting you to do the harder thing when there's a choice between doing something easy & doing something hard, when the harder thing is better.

& it has to do this through a series of weak & diffuse signals. so it's more or slow, consistent urging & dopamine is the fuel that helps with those urges.







most of the time it uses  
in cognition audio

Dopamine drives goal directed behavior. Dopamine isn't so much the reward in the pleasure pathway; it's what drives you to do the action in order to get the reward.

Executive function - grouping, ordering and remembering. Strategy. This is a big role for the frontal cortex. People with damage to the frontal cortex don't use cognitive strategies.

remember the  
monkey  
experience



## frontal temporal dementia %

clock face \$

11.10 example.

Another example is reciting months backwards - can only go backwards for a short period.

the next test will be counting back from 20 & you get 20-19-18-17 September. Previous tasks include on the current task.

the frontal cortex is responsible for remembering rules. having said that,



In modern world this kind of damage is seen more with individuals



They have a high metabolic rate, which in turn means they are more vulnerable than other neurons. The good news is rules can eventually become implicit.

PHINEAS GAGE, FOREMAN ON RAILROAD CONSTRUCTION LINE IN VERMONT. A DYNAMITE EXPLOSION PROPELLED A METAL ROD STRAIGHT THROUGH HIS HEAD AND FRONTAL CORTEX. PHINEAS WENT FROM RESPONSIBLE TO WILD. THE SIMPLE CONCLUSION WAS THAT THE FRONTAL CORTEX REINS IN "ANIMAL" BEHAVIOR.

← first identified individual with frontal damage.

who has been exposed to damage to frontal cortex. About 25% of inmate on death row have a history of concussive head trauma to the front of the head. this can create frontal damage.

hits to the front or back of the head can cause this type of damage as concussions occur when the brain gets slammed around inside the skull. The damage is often seen on the opposite side of the originating blow as that's where the brain was shoved.)

## the crucifixion test.

McNaughton Rule - can the individual tell the difference between right and wrong? McNaughton was a paranoid schizophrenic who attempted to kill the British Prime Minister back in 1849. The man was so over the top psychotic that the jury basically ruled that he was too far gone to be expected to be responsible for his actions as he clearly was thoroughly disconnected from reality. The giveaway is any attempt to cover one's tracks. After Hinckley was found criminally insane there was massive backlash across the US.

the catch is that there's a difference between knowing the rules & being able to follow them. for most of us

this is about struggling to maintain a diet or exercise as much as we should.

For others it can be the difference between following social rules & ending up committing crimes.

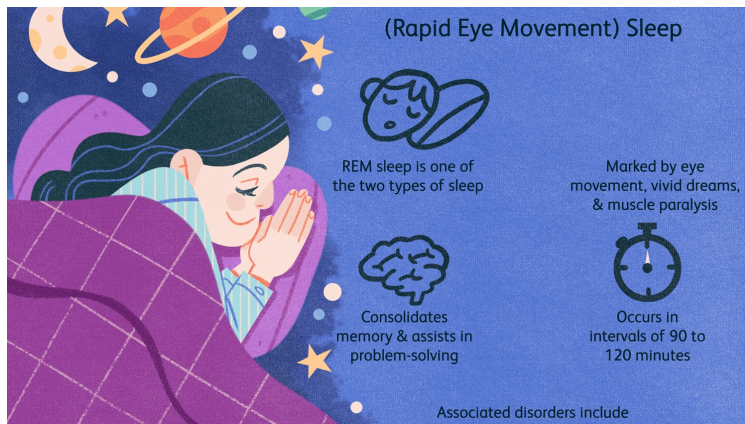
the timing of frontal damage impacts whether the person knows the rules. Get frontal damage before you're 5-6 years old & you don't even grasp the rules.

Get damage later on & you become one of those that says "this is wrong & against the rules" & then goes & does it anyway.

the frontal cortex is least active during REM sleep, accounting for bizarre dreams & odd thought flows.

However, environment impacts what type of behavior emerges. In the end the result isn't always violent.

Where the challenge comes in is what do you do with someone who has 100% of the cortex messed up? 99%? 95%? Where's the line? Is there one?



It doesn't fully develop until the early to mid 20's. Thus it is least constrained by genes & most influenced by humans.

Dopamine fluctuations for unexpectedly good rewards and not getting an earned reward are much greater in teens than adults. Thus unexpected joys are more pleasant and unfair deprivations are more depressing.

sadly it's vulnerable during normal aging.

the substantia nigra, the hippocampus & then the frontal cortex. So we get weakness & trembling (& maybe Parkinson's) trouble with memory (& learning maybe Alzheimer's) & endless constant complain (& old ladies with their dentures knocked out?)

with chimps  
they simply  
cannot go for  
the 1 M&M's

but they can  
go for 1 chip  
of wood to get

5 M&M's. Thus they understand  
the task but the food drive is too great.  
remove the food & they can do it correctly.

audio

Highly regimented people have high metabolic rates in the frontal cortex. Sociopaths not so much. When tested for non emotive tasks, it takes much more effort metabolically for a sociopath to activate the frontal cortex pathways (say for the months backward task).

Studies suggest that by age 5 there are already measurable differences in the thickness and resting metabolic rates of the frontal cortex in different socioeconomic groups. Different levels of glucocorticoid action are also evident (glucocorticoids are stress hormones that, over time, degrade neurons).

generally speaking  
the frontal cortex  
seems to have  
more role in regulating  
the amygdala also

tries to regulate the frontal cortex

Lateral hypothalamus – Food acquisition not  
Aggression



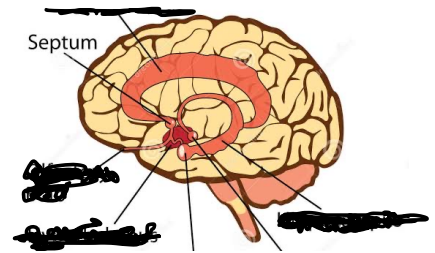
## Spleum

ANTERIOR CINGULATE. PAIN, COMPASSION  
PATHWAY. FEELING THE PAIN OF THE WORLD.

JOSH GREEN OF HARVARD CONDUCTED  
EXPERIMENTS IN WHICH PEOPLE WERE  
ENCOURAGED TO IMAGINE THE FOLLOWING  
SCENARIO - YOU'RE A JEW IN HIDING IN NAZI  
GERMANY. A CHILD IN YOUR GROUP IS CRYING  
LOUDLY AND IS GOING TO GIVE YOU AWAY.

IS IT OK TO SMOTHER THE CHILD?

PEOPLE WHO ACTIVATE THE ANTERIOR CINGULATE  
LESS WHEN MAKING THEIR DECISION ARE MORE  
LIKELY TO DECIDE THAT IT'S OK TO SMOTHER THE  
CHILD.



Descartes Error ! the notion that emotion  
& thought aren't  
separate domains at all. The trolley  
test - if it's about pulling the lever the  
context is primarily activated. if it's  
about pushing the guy, it's the limbic  
system. (audio) 2016.00

The human brain, the literal, and metaphors. The basic off the rack brain isn't really designed for all  
this fancy abstract stuff and it essentially has to use the old wiring. So we get this whole world of gut  
responses and moral views expressed through physiological metaphors, including the insular cortex  
(warm personalities, that makes me sick, it's nauseating, how disgusting). Moral transgressions and the  
part of the brain designed to watch out for rotten food.

Thus the moral decisions are really affective decisions that we then rationally the way we want to. But what else could they be when that's the brain's design?  
audio (2.18.20)

Elie Wiesel:

the opposite of love is not hate, it's indifference. Physiologically true - a lot about excitation. helps explain how human - "Get these Confused"

Testosterone is associated with aggression but is not the cause.  
Behavior drives testosterone release.  
It amplifies but does not initiate.



Bizarre: spotted hyenas. Dominant females with male like genitalia. Among primates males can get erections to show dominance. In spotted hyena world, males will get erections to show submission.

their food eating style is also different than lions.  
cub > female > male

cubs  
^  
females  
^  
male  
^



## LECTURE 19

Mirror neurons :  
these are connected with  
notion of feeling someone  
else's pain.



Mirror neurons are a class of neuron that modulate their activity both when an individual executes a specific motor act and when they observe the same or similar act performed by another individual.

Dopamine into the cortex :

long term rewards , Serotonin also stimulates  
the frontal cortex (except violent sociopaths)  
The literature suggests that low levels of serotonin

are associated with aggression.

Of course low levels of serotonin cannot cause aggression (the absence of something else - through serotonin can be inhibitory by encouraging a restraint = reward mentality)

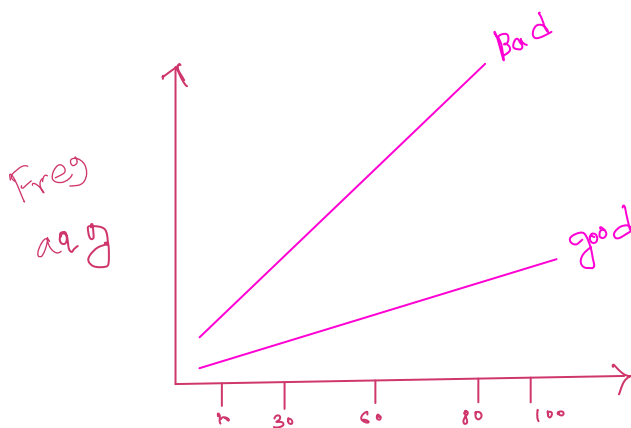
Same as testosterone & aggression graph

Alcohol doesn't make people aggressive; it heightens the existing tendency. Pain & frustration encourage aggression.

Alcohol has many effects in the brain. The main neurotransmitter effect is to increase gamma signalling. Gamma doesn't act directly at the action potential level. Instead what it does is bind to neurons at the dendritic level and block other neurotransmitters from binding to the neuron.

Thus it has a depressing effect because those neurons cannot get their excitatory signal going. This is where the disinhibition comes from.

but the modulation thing again - those who are predisposed toward aggression will go in that direction.



Tryptophan

TH

enzyme

5-HTP

TSH

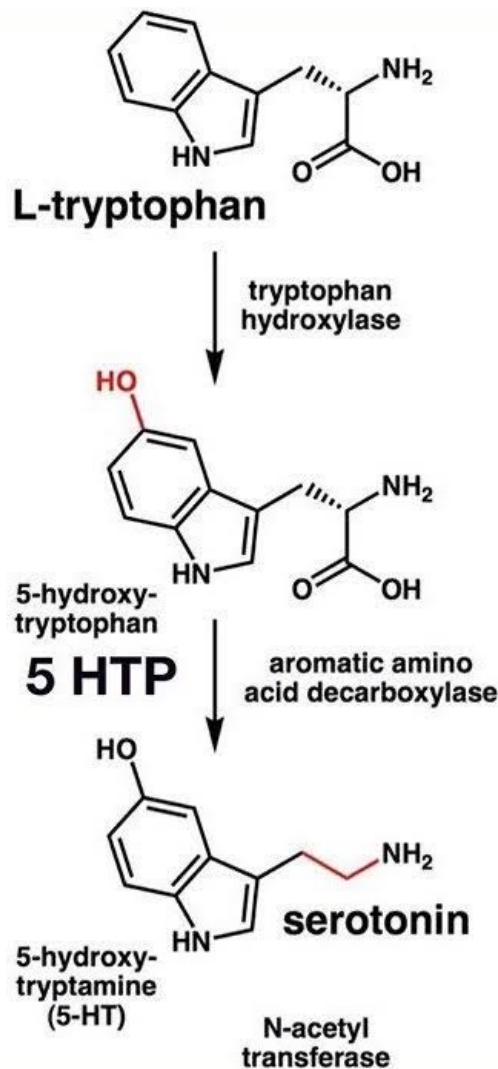
Serotonin

MAO, COMT

waste

building block of  
Serotonin

there are also  
cultural context  
to alcohol.  
it depends upon  
what culture you've  
been born to &  
who taught you  
to have it.



Crowding is the same - when there's a crowd more aggressive individuals become more aggressive. More submissive individuals become more submissive.

PMS (perimenstrual)  
& heightened irritability  
& aggression in women  
& baboons.

Curiously, the spike in aggression occurs in high ranking baboons while spike in depressive moods spikes in low ranking baboons.

Progesterone can be mildly seductive - it can bind at gamma sites. It drops around the menstrual period. Natural opioids also drop.

Konrad Lorenz. "On Aggression." Role of environment in aggression. **Probably good that Sapolsky calls him unrepentant Nazi swine.**

Are we really going to accept instruction from a Nazi on the environment not impacting aggression?  
*Oh, it's just biology. "There is no love without hate." What a swell guy. He used a pressure builds up until release model, arguing that the longer it's been since the individual was aggressive, the less of an environmental trigger that will be required to provoke aggression.*

This is of course utter nonsense. Aggression thus decreases the likelihood of aggression soon afterward.

on the other hand, there's the Soviet advocated notion that aggression is about frustration, fear, pain. Environment is thus having a huge impact for instance —

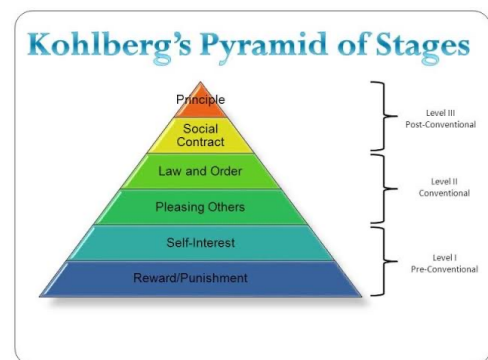
unemployment goes up & so do rates of spousal abuse & associated aggression. Displacement aggression.

"The poorer you are, the more likely you are to be violent"

- Realistically aggression is a possibility & early learning is about learning when to be aggressive.

**Lawrence Kohlberg and the stages of moral development in children. A disciple of the Swiss psychologist Piaget who pioneered the notion of stages of development. Kohlberg looked at sequential development of morality.**

- ① Preconventional Moral Reasoning
- ② Conventional moral Reasoning
- ③ Postconventional moral Reasoning





These can be understood through the lens of the reason why you act morally. at the Preconventional level your motivation is that you might get caught if you do the wrong thing. if you act morally you might get a reward.

At the conventional stage shared group values, rules, norms, law and order predominate. Here following the moral rules makes you "good."

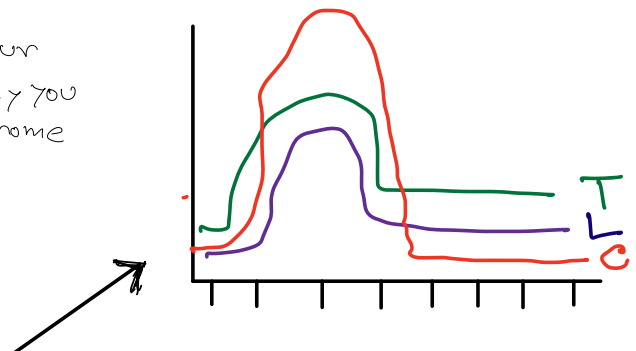
### Postconventional morality

transcending those base laws for the more important ultimate right & wrong. Here bad laws are broken, People's opinions are disregarded, the good & the true is pursued. This is the Socratic realm.

Not everyone reaches the same level of development.

watching violent tv, games makes you more violent if that's your tendency, same with music, video, game, etc.

Not Surprisingly the more violent your childhood neighborhood, the more likely you are to be violent. And if it's in the home the likelihood increases.





Age and likelihood of being violent (age as proxy for testosterone).

Likelihood of committing murder in late teens to early 20's - similar rate in Chicago, Toronto and London. Super-imposable curves.

**However, in the year studied the murder totals in London and Toronto were way lower than Chicago.**

## Side note & Socialization

low ranking baby female baboon attempts to go see a high rank baby female baboon & gets pulled back by her mother.

The lesson is that if you're low ranking you don't approach

the high rank baboon - you just sit quietly & hope you aren't noticed.

### **Judith Rich Harris - "The Nurture Assumption" -**

peer groups are often more important than the field recognizes in establishing social values. Kids vastly prefer the language and accent of peer group. At the end of the day parents are mostly good for determining what peer groups kids have access to. On the bad side, this is the whole world of conformity and us-them mentalities.

here -  
you are the average  
of 5 people metaphor  
comes into play.





An important study which had been done by Levett & Donahue studied crime rate noted that there has been a significant drop off in the US since the late 1980's, or around the time that a whole batch of would have been kids didn't hit their late teens in the wake of Roe v. Wade.

Again, suggesting the importance of environment especially to kids that no one wanted.

They argued Roe v. Wade accounted from 50% of the drop.



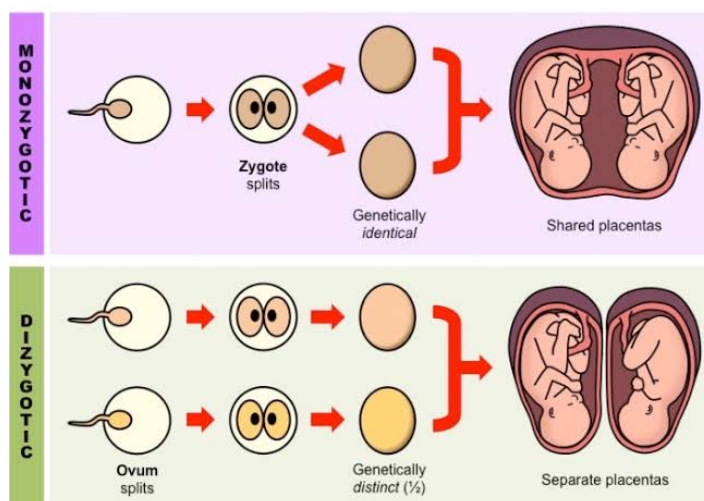
Revise it  
3 times

## LECTURE 20

Simon Baron-Cohen (The essential difference)

autism, hypermale syndrome, Notion that autism is related to hypermale being more analytical, female more empathetic.

Spatial skills, Physical features, Drive the analytical organization, hierarchical male personality high enough & you get behaviour similar to autism (decreased social empathy & connection)



Curiously, this accounts for the prevalence of autism among higher SES parents - get yourself a brain that's better at dealing with hierarchies and organization within a Western economy and you're likely to do better financially (until you pass a social tipping point).

genes & aggression, formally a taboo topic  
there are contributions, tough to track  
maybe the gene modulates, maybe it's  
about impulsivity, pain, levels of arousal.  
It goes right back to different versions  
of the genes being expressed differently  
depending on the environment.

genes are relevant to  
aggressive behaviour in the same way they  
are relevant to other behaviour - it  
only makes sense to state what they  
do in the context of particular environment.

*Richard Speck. Horrifying sociopath. Student nurse  
killer. Odd gene make-up? A lab tech discovered that his  
genotype was XYY. This extra male Y chromosome was  
then "responsible" for his juiced up aggressive behavior.  
Big foofaraw. Turned out to be a lab error.*

Nomadic pastoralist,  
warfare, single god  
warrior classes.  
Success in war as  
gateway to honor &

glory & groups that stay home to protect  
against having the animals stolen.

The American South was disproportionately settled by sheep people from the northern ends of the British Isles. Pastoralists.

cultures of honor, killing over symbolic slights  
Vendettas, Samurai, clear rules about  
politeness & hospitality.

Richard Nesbit of U of M did some studies on culture and aggression. He sets up the study by having volunteers come to his lab to do some random task or whatnot. But the study itself occurs in the hallway. A trained participant gets in the way of the subject, bumps into him and then makes a derogatory comment, telling the participant to "watch it asshole." People from the North were generally annoyed but got over it quickly.

People from the South were seeing red. Measures of the stress response (such as blood pressure, heart rate, testosterone levels), showed that the Southerners were off the scale with rage. Culture of honor. In the South you don't disrespect people. Politeness and good manners are demanded. There is the suggestion here that these behaviors may be genetically influenced (remember the settlers) and powerfully shaped by environment.

It is also highlights a theme subtly suggested by Michel Foucault - the extent to which a society emphasizes that people are a certain way suggests the extent to which they aren't that way & the amount of effort required to inculcate the behaviour.