How The Brain Creates Mind
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Lecture – 15
Consciousness

Continuing from the last lecture, I am talking about, more about amygdale, I am not fixated on amygdale, but still because it is seems to be the.

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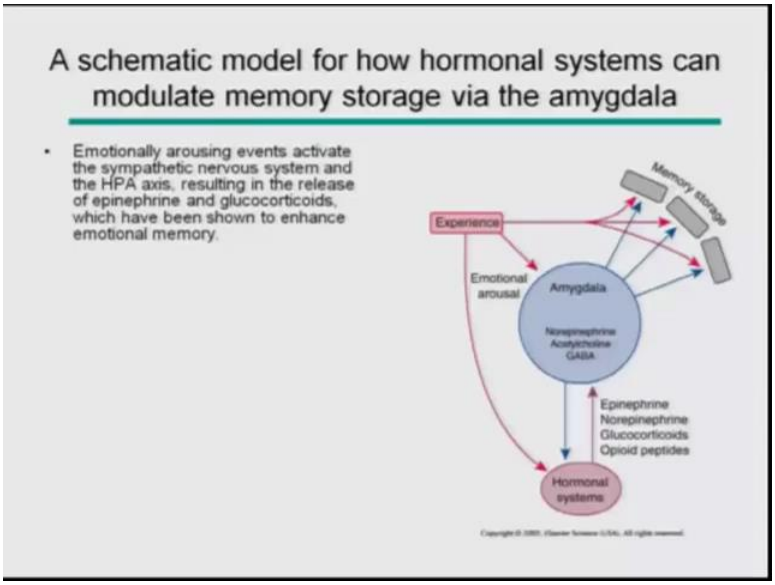

So, this is like schematic model of how hormonal systems can modulate memory. So it is all connected if you now, just take a step back and think from where we started with the body, and the mind, the structure, and network, and the sin apses, sympathetic, parasympathetic system, It is all connected, the body is under control of mind. So, just look at it amygdale which control nor epinephrine asetilkolina GABA, experience memory storage, hormonal systems, this is all connected. and we have enough proof now by modulating with chemicals, and with the, even people who had lesions, about the way this whole complex of amygdale manages, the emotional response on one hand, two (Refer Time: 01:19) stimuli by comparing it through emotional and verbal memory. This is one part of the emotional system.

The second part, why we do things which we do - now sociological it may become a problem, if we try to prove everything under chemical and electrical control, then nobody has the responsibility of any behavior, but that is the social problem in one hand, then all quotes and law and morality will go haywire, but on the other hand we also have proved that people who keep doing all those things. It all started from study of drug addiction, dependence, and antisocial behavior. If you look at it, just for a minute break away from yourself and observe it.

Do not we do things again and again which gives us a kick? We feel pleasure, even if it means, we want to do mathematics. So, why does not everybody do mathematics, because is giving pleasure to somebody, a painting may giving pleasure to somebody? Or for that surfer you just take a surfer board and wait for on the goal post just one way to come, or the footballer, you strive hours and hours for just one goal which you have to do. What is this? Is this will, why could Mahatma Gandhi walk 348 kilometer at the age of 61 12 hours a day.

See this is the transacalation problem in the world, where neurosciences have to unite with the world, with the behavior. What was his purpose? His purpose was to defy the law. He found it away which was very tough on his body, and it was not one go. If you want to kill assassinate you go and fire a bullet, you may lot of planning may go, but it still one of act. Walking twelve hour a day for 24 days is not one of act. You have to constantly keep your mind into that state. Why do the people who have one leg go on to Mount Everest?

On the other hand why somebody does not stop taking brown sugar, when somebody knows alcohol is damaging, drugs are damaging why. But if we talk on this, man thinking will disappear, then you are a slave of chemical actually. All emotional behavior, all behavior actually occurs and response to rewards, or punishment. Positive reinforcement, if you give a positive reinforcement to anybody or somebody takes some chemical and feels good. The chances are that your brain will ask it for again. If somebody take something and start feeling fearful and all chances are that that person will not take that again. So, it is always, even you train kids, if you give them some praise and all they will do it again and again. If you will give punishment, punishment

may not always work, but you take away from that, then they may choose. So, negative rewards are less effective than positive rewards, but nevertheless, how do they do it.

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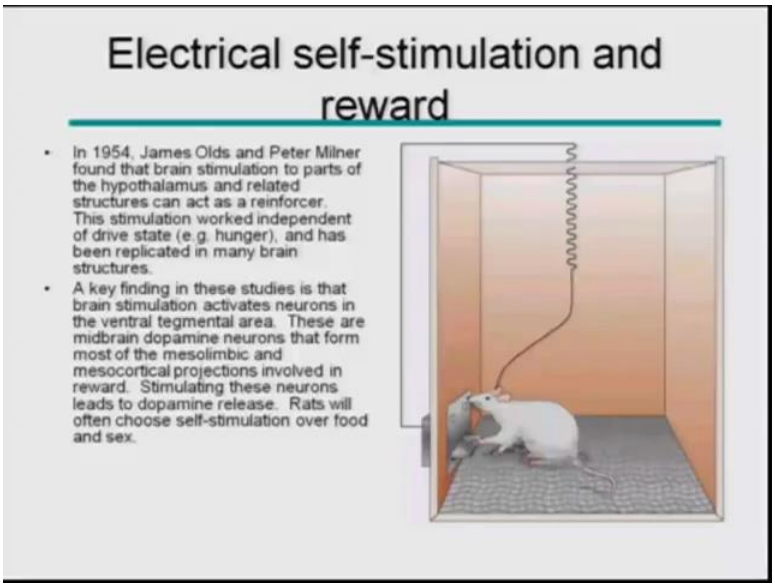

Just you go through these experiments. So, this are actually, the brain stimulation activates neurons in the ventral segmental area, this is called VTA. Again this is we have reached structure thing. These are midbrain dopamine neurons. If remember dopamine energy which have extension to that form, mesolimbic, stimulating these neurons leads to dopamine release. Rats will often choose self-stimulation over food and sex. This is the electrical self-stimulation, every time it press small electrical self-stimulation, is going, and there were food available, there were sex available, but rats would do electrical self-stimulation. You see lot of kids they will put the finger like this in fort of sun and do this, or they lot of kids will go round spine and spine, it just give kick to them. The whole kick is that because of this activity, dopamine is segregated in segmental area, and that give them the sense of kick, and that is what you are looking for, is the positive reward is the feeling reward.

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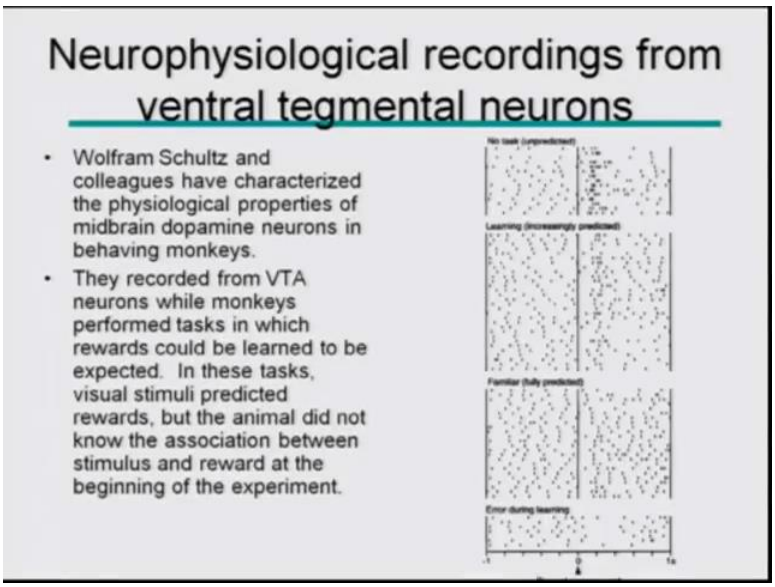

So, what they do. They record it from the neurons when monkeys performing tasks, visual stimuli predicated the rewards. So, this is the type of firing which happens, in the ventral segmental.

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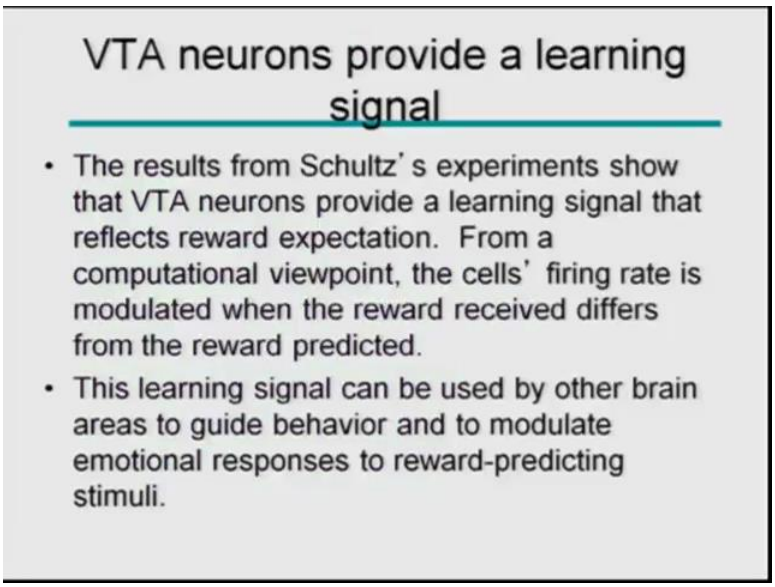

They provide a learning signal, that every time you do a certain act, you actually get a reward right and. So, the trick of the brain is, if you do act you get a reward. You anticipating the act, and accepting the same rewards, but that difference. Suppose you keep wearing the rewards, then the brain will judge it, the brain will judge. It is not brain will say fine I got two units next act should be get two units, but it will give 1.9 the brain will judge it; that is the source of addiction. Every time brain what that much, if you do not give, it will have to increase the dose of it.

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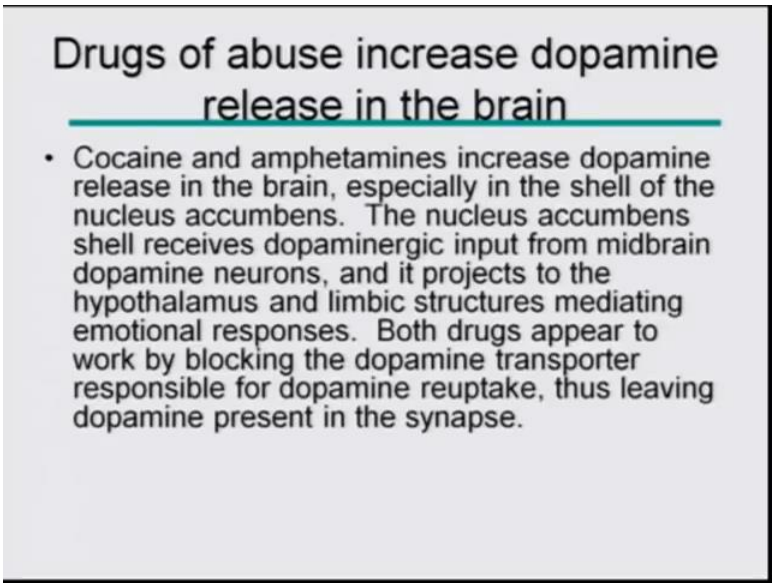

So, you see how tricky the whole computation business in it. So, this is why what the bases of addiction is. Lots of this drugs cocaine amphetamines they increase dopamine release, especially in the area called nucleus acumens. nucleus acumens, when it receive dopamine input from mid brain, and project to the hypothalamus, both drugs appear to work by blocking the dopamine transporter for this. So, reuptake means, is certain amount of dopamine is released pre synaptic neuron, like this is the pre synaptic neuron, and this is the postsynaptic neuron. Dopamine is release in the synapse; somehow it is taken by pre synaptic. So, what do cocaine and amphetamines do, they block this. So, lot of dopamine available here the dopamine here, lot of dopamine means lot of firing in that nucleus acumens, which give you a sense of kick.

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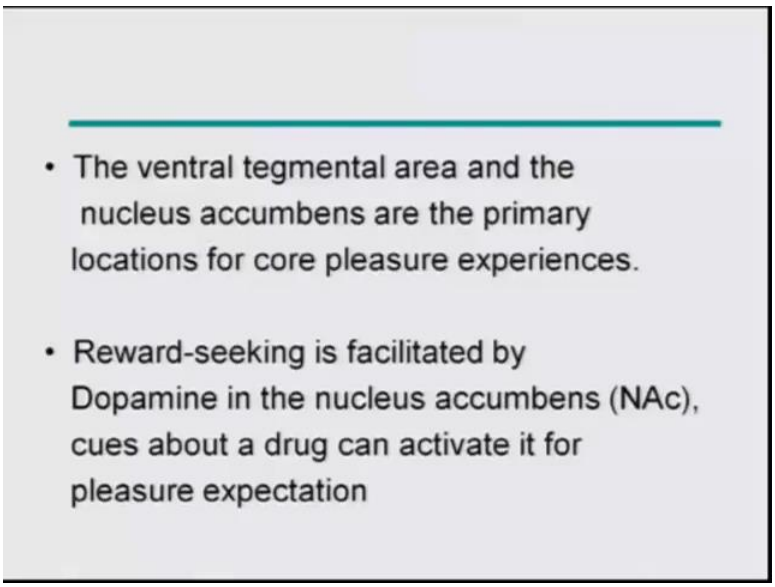

So, that is the primary location for core pleasure. So, if whatever act you do, if you actually having pleasure in that, the areas which actually get excited are this; reward seeking in nucleus acumens.

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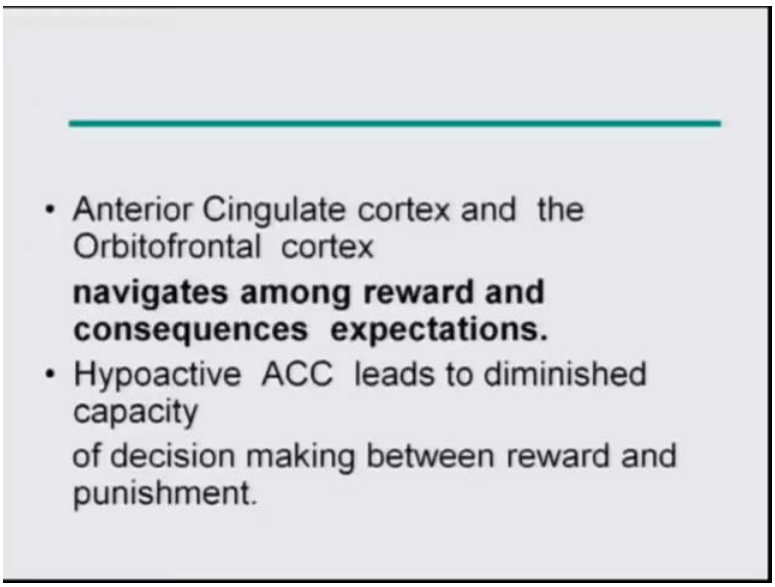

Now, I showed you the ring which was there that something called anterior cingulate cortex and orbit frontal cortex, the part of the cortex. This navigates between the rewards and consequences, like if you are doing the mind will tell you, you know this is wrong. So, even if you are getting a reward your higher center; that is the morality actually. suppose you get a brain damage, you do not have the part of the brain which is controlling everybody, will keep doing things in which gives them reward and lot of happiness and all that, but your higher centers will keep assessing your rewards, but the consequences of that also. You take a drug you know what is happening, but if anterior cingulate there is damage, the capacity to judge is diminished. Especially if you see that the people who have who do lot of the solvent abuse, solvent which you find on the petrol pump. They get into this brain damage, where the consequence of their behavior, the brain has not able to judge.

Hence, they may appear as totally facile and totally lose cannons, which you will say the person is not having the morality, but actually the anterior cingulate (Refer Time: 10:09) which is not there. So, what is it? It is the last sentence which is written here, between the reward of act and the punishment of the act. If he actually boiled down to this is everybody is doing, because of this this are the biological under paining of it, than I do not thing anyone is criminal, but we cannot do this. Obviously, either we have to prove that they are brain damaged, and that is why they have done. So, lot of this a investigative agency in the word have behavioral psychology section, because if it is the brain damage thing, than the legal course is different, but if it is not, if the person knows it is in full competence, and then acts upon it, then it is the different issue all together.

So, this tussle between biology and. So, the important thing is, even after you are doing things again and again your mind still can get habituated, because It is like neurotransmitter is added, you do certain thing, excess has to go off your brain will keep trying, but same amount of neurotransmitters will not produce same amount of response, because brain cannot keep going high and high, after every act it has to come down to what you call see I told you once word which is called survival. Brain network first act for survival .the second act of brain is homeostasis. Homeostasis brings the whole thing to statesco. So, even in if there perturbation in the brain even if you send the signal, the brain will always try to bring it back to the balance state, chemical disturbance bring it

back. When this homeostatic part the brain, actually gets destroyed; that is the point of time lot of illness and everything start jumping.

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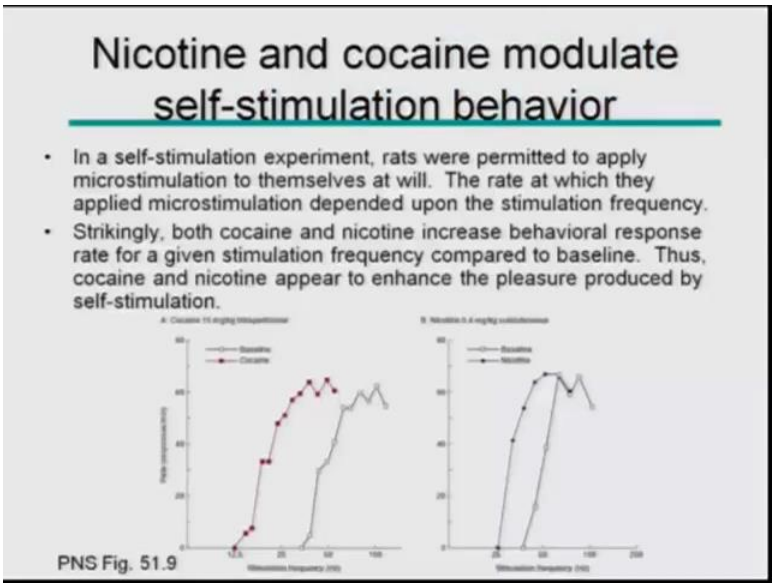

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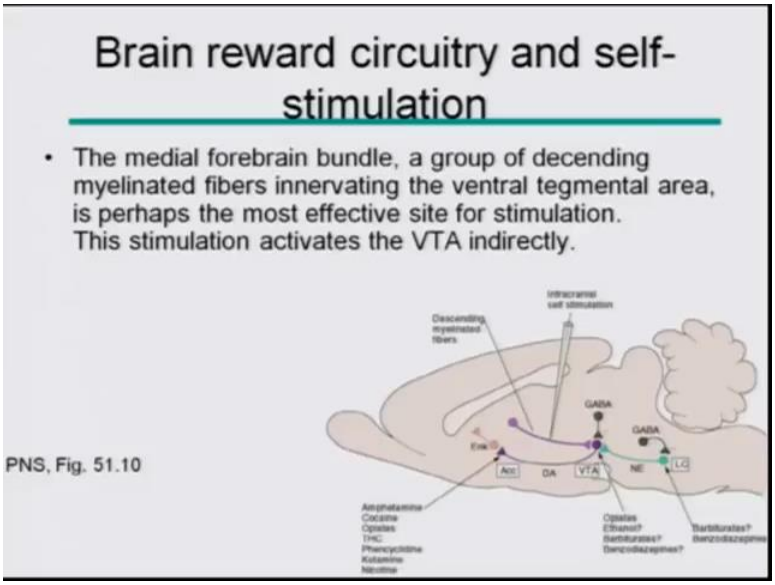

So, as I said nicotine and cocaine modulate self-stimulation behavior, this we can. This is the reward you are getting. Again as I told you this area, ventral segmental area, this is a

self-stimulation, and this are the drug phentermine, cocaine, opiates, trihedral (Refer Time: 12:44) which is the part of what you take ganja bhang and cannabis. Here you can see opiates, probably alcohol. Alcohol seems to be different mechanism in the brain and rest of the drugs, probably it works there, barbiturates, benzodiazepines is the common drugs of prescription abuse like alprazolam, clonazepam. They work through gaba, but they all actually. Why do people have headache, because they take it they feel pleasure, they take it more, after sometime the same dose stop working, you have to increase the dose, but different drugs can intervene in it.

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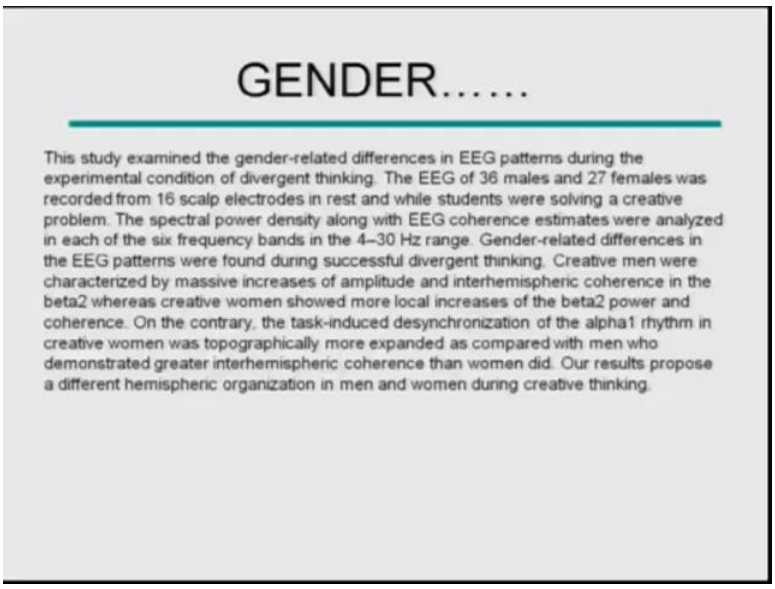

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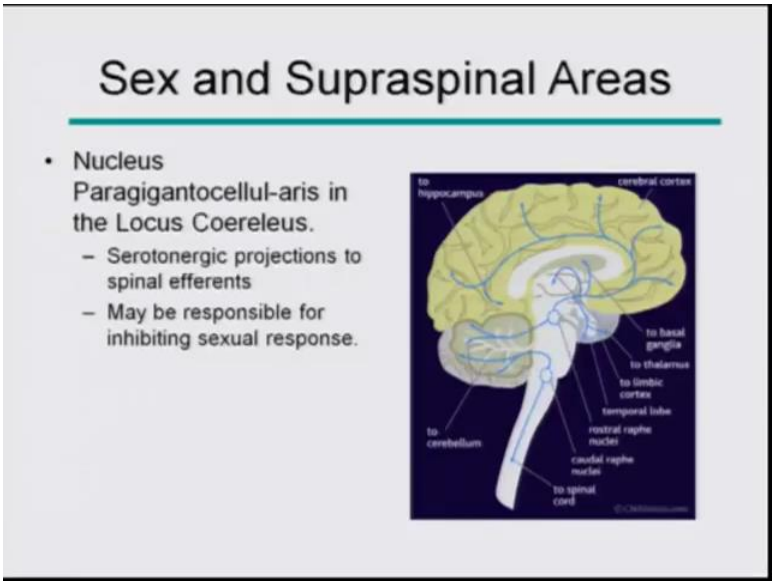

Now, briefly something about the basis of this is, gender and sexuality. It is lot of fight around right from the time, when the human mind was conceived; but what biological bases do? We have locus coereleus, like dopamine system, we have norphenamine and (Refer Time: 13:54). So, probably these are the centers. See again their projections here. So, and we know about the inhibitory neurons. This serotonergic system, they actually control your sexuality urge control under control.

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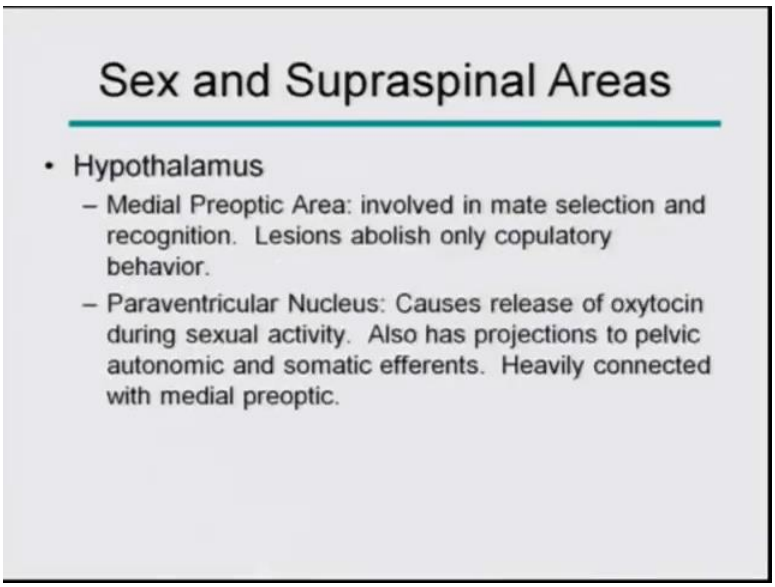

The hypothalamus again I told you, it involves inmate selection and recognition; oxytocin is the hormone which is released during sexual activity. Oxytocin incidentally is also the hormone which increases the warmth and the maternal bonding. So, in the fetus around in the noetic fluid, the level of oxytocin also acts towards in bonding. In fact, there is the nasal spray is formed that once you put it. Lot of empathy and warmth will follow in, I do not know whether it will work or not, but this type of experiment keep happening, because it happens, then lot of fight and race can be almost decimated.

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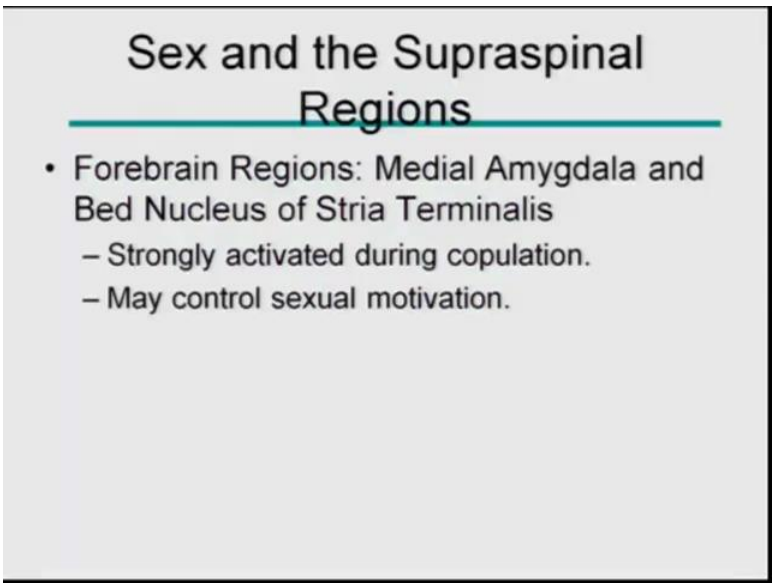

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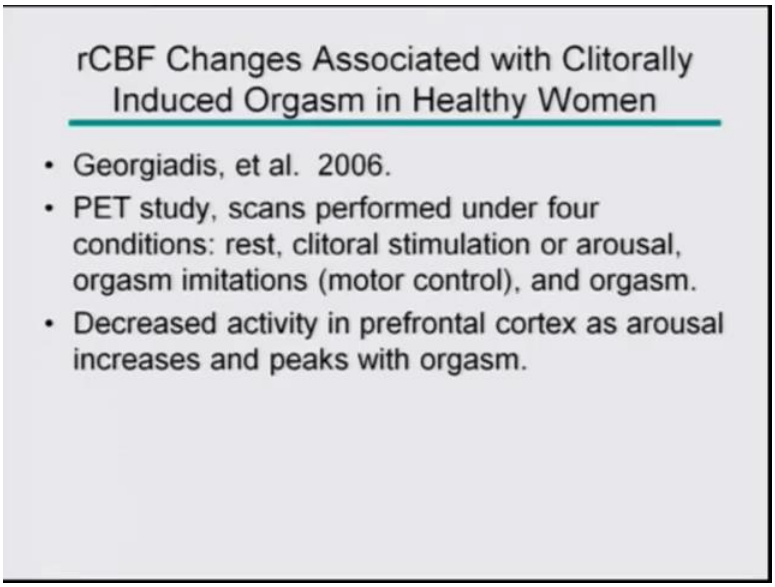

Forebrain region amygdale again, they strongly activated when during physical part of the sex. Now see this; prefrontal cortex is the one which decides which controls decision making, there blood flow decreases in prefrontal lobe when people are involved in sexual activity. So, lot of it, is actually is under your chemical control. Now whether will your morality, your decision making, your situation thing, can actually control it. Yes and no,

we do not know. The big question why I mentioning this. This is will highlight what is happening in the world your, go through the history of human race. the whole fight has been for all this things for food, for land, for sex, for women, for men, people have been acting, if you look at history, you normally do not read history when people will be leaving in peaceful times, when they were having harmony, when they are developing science or art and all, all history is record of violence, on a very broad basis, and violence is the refection of emotion.

So, big question is, do people act through emotional flow, or rationality is just time for time when things are peaceful. In the moment of crisis emotions, which actually right from the individual to nations, is the emotions which overflow. Although the surface it all appears that people are thinking and talk. Similarly with sexuality with lot sexual crime here and there, where people. Are the brain damaged. Now you do MRI for them you really not find the brain damage, but maybe later 10 year later 20 year later, when we are able to really describe brain in the sense of computational networking power, or really bring out some new physics to understand that. Are we going to tell them that they are (Refer Time: 17:17) network is transformed; like we are not able to tell them about autism right now, but we know there is the problem with the network, dyslexia we do not know; that is the transnational problem.

The transnational problem is, when we talk about behavior and try to do something to help these people. We have no connection except we are giving drugs; we have no connection what is happening in the brain, we do not know what is happening in the brain. Maybe someday we know that this is the network problem, and I am not saying it all network, because right now we are talking in terms of network, but maybe ten years later we will be talking something else, we talked about brain with quantum physics with non-linear dynamics, with graph theory, with network, with Hamiltonian state, with what not computers, but we still do not have the comprehensive theory, we still do not have the quotients of the brain, and this is the surprise because physiatrist what they do, they priscribe medication. Do you know about some grossly the gross balance of various neuro transmitters, and how they really effect? We have made synthetic chemicals, which go and alter that. We have some gross data about how they alter, we still fully do not understand that, whatever our claims maybe.

Grossly we know we will give (Refer Time: 18:58) it will block the serotonin reuptake which will increase the serotonin level, which will decrease the (Refer Time: 19:06) this is what happening inside. What happens in the behavior? We observe, we observe in states of illness we meets in. So, we have corroborative evidence; like MRI signals and pet signals are indirect evidence, we have corroborative evidence of behavior illness with medication and their effect. now having said this, whatever interventions we do with behavior, physiological or training wise, or maybe non clinical, say meditation, or we on one hand we do this, on second we cannot directly co-relate with it. We cannot say fine I am telling you this cognitive behavior therapy, it is going to alter middle prefrontal cortex, no, or maybe we going to give drugs which are going to pump dopamine. we know this much, but if we know this much why do not go and change the VTA nucleus acumens to stop drug addiction, we cannot, because we do not know the full import of it.

What we have seen that if you give this on MRI on functional MRI, or maybe some. This all co-relative corroborative evidence of the brain and that is the problem. So, the big question still remain, whether sex is the alter state of mind, it is the good chance, because you whole prefrontal low which is deciding and giving and guiding you a morality and decision making, along with the anterior cingulate gyres, is hypo activated, during all this activity. Then it is altered state, you are not deciding, what happen in illness. So, in illness also you cannot decide, you are on different world all together. If you really define whole brain functioning through these things, I am sure in next twenty years the whole definition of illness and normal, see everything will be changed.

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So, what is a happening behavioral correlation between, now see the congnalty. Love is the normal state or abnormal state; somebody said that love is the normal physiological state nearest to madness. Now, you see just see this is very interesting, because all unless your knowledge is placed in real context, is useless, when sex love drugs see what all is happening there, the attention focus shifts in love, you really lost in the different world no, you will not listen to anything, searching, wanting, always keeps hunting for this things, preoccupation. people who really in love if you ask them they whether they are working or studying there mind all the time with their partner, looking restless, excessive wakefulness, sleepiness, we know this all are Devdas symptoms, climatic arousal - ignoring negative effects.

You know what all has happen in love sons fight with their father, daughters run away, all sorts of drama goes on, and if you cannot get then you have depression, angst anxiety, fantasy, all this three four things, and you combine this another situation, when you put on your stake on one ambition that I want this, and suppose you do not get and you get into all this things. This is the problem, the firing of the brain, the electrical activity of the brain, the chemistry of the brain is, you have not been able to find specific things, that that this is for drugs, this is for sex. Similar behavior problems happen in hundreds of states. I have just written just these three things, but lot of these things can happen, if

you have a loss in your life, or if you put your stack I want admission in this college, I want to get so many marks, and you really do not get.

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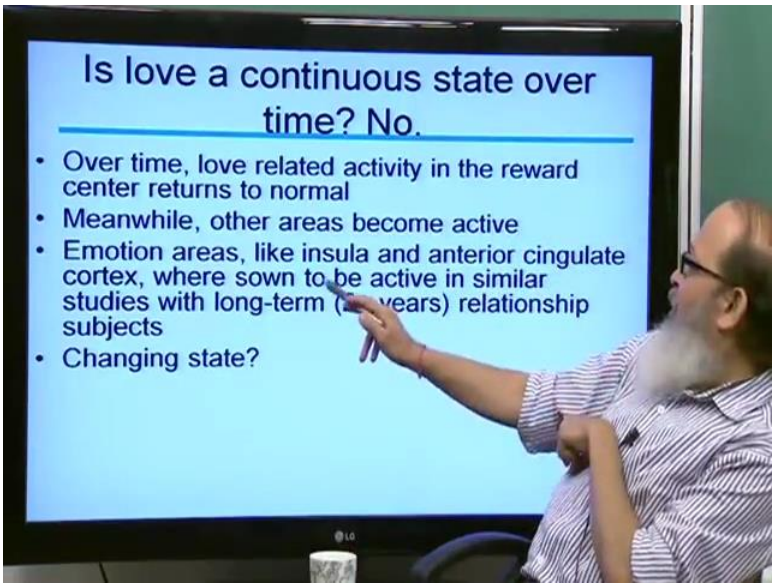

But what we know that in love what happen is certain chemical changes, and the rewards center keep firing, but over two or three years, this chemical come back to normalcy. So, love in the true energetic state, does not last or long, people get married at the time or separate at that time, that is the different issue all together. So, this is the type of state which we have seen, emotional area like insular and anterior cingulate cortex, where shown to be, sorry for the spelling mistake it has to be shown, to be active in similar studies.

So, is it a changing state of mind because again come back to translation thing, lot of people when they do love marriages, and they live together and some year say I am not like before, and you use to love me so much, it is the common thing in the marriage, and other person will say no I am like that, show, you cannot show; obviously, you do not love like you are loving in the initially years. The poor guy does not know biology, otherwise he would say boss at that time my dopamine was surging high, my rewards center was going, now dopamine is come down.

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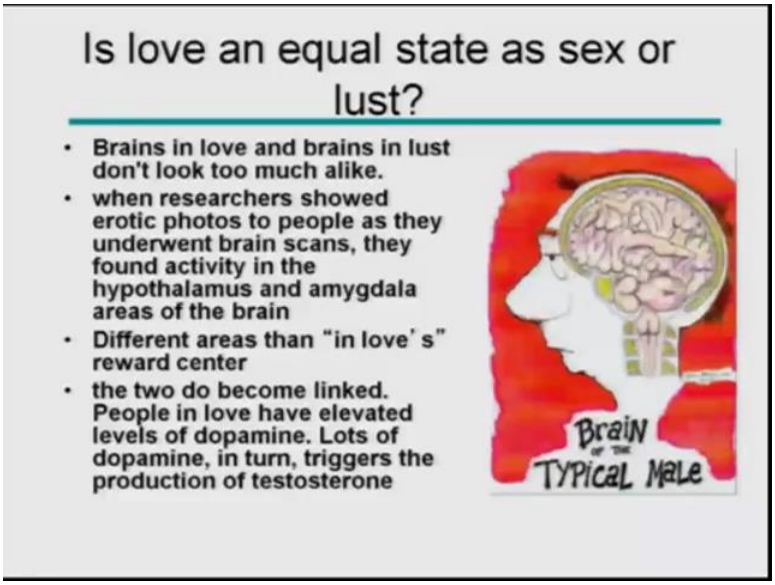

So, this is the type of star. So, this is interesting to end with. it is the brain of a typical male, brain in love and brain in lust do not look too much alike, when researchers showed erotic photos to people as they underwent brain scans, they found activity in the hypothalamus and amygdale areas of the brain in, but this area of lust is different from when you are in love, but eventually what happens hypothalamus and amygdale are firing, in love something, they both eventually match, because they both have elevated levels of dopamine, and lots of dopamine triggers testosterone again raises the lust level, these are the real problem we talk about brains. The problem is that; however, heart; however, differentiated. So, with all this at the end of three weeks, in the seven and half hours, I hope you have got some idea and you are already thinking you have questions in mind, which you should post to us and we will try to have a panel type of discussion towards the end, when we receive lots of question from you.

Before moving onto the fourth week, in the last two three minutes; I hope you understood, or maybe you feeling confident now that I know, where love is how networks fire and how synapses work and we know the whole area MRI know, plethora of data; this area does this, this area does that, this area, you find easy oscillation, your brain mouse does this, electrical stimulation, drug work through this, anger come from here, fear comes from there. Now try to put everything together, and everything put

together falls, because when we talk of certain task and area, at that point of time, we are not taking whole brain into the picture. The movement we do this we do not know what is happening where, that is one. Second, the brain also has this capacity of linking with each other, so if you take one behavior, you will find so desperate area getting activated together you will not know what is happening, or if you take certain activation of brain area. Suppose we just are able to linearly translate into behavior, I am sure you will not get one behavior; same area will have ten type of behavior.

So, if you go back to first thing when I started at. We are talking at so many levels right from micro tubules where penurious (Refer Time: 28:12) telling quantum physics, to synaptic 0.5 millisecond transmission, to assembly of neurons working from 10 milliseconds to 100 milliseconds, to hexon 2.5 to 120 per second. You go up there is assembly of neurons which goes into abianway of pre synaptic post synaptic firing to make memory. Certain ages of brain secreting more dopamine to get reward and punishment those assemblies unite together to go to mille column and micro columns, where large assembly are sending dipole, the voltage difference and voltage current, which you which create oscillation.

Thalamus on the other hand is integrating and taking all differentiation, and integration of information. Thalami Polticala is creating this isolation which keeps you awake and make you sleep and we have not talk about that, and then amygdale is there which is firing its own emotional things. Then there is a seribulam which has more number of cells find, tuning the movement basal ganglia, which is seating there to make decision making, all do we put it together, how do we put it together.

In last week lectures, we will try to put it together, and we will see global brain states, and see whether we can make some sense out of it.

Thank you.