

Faculty of Medicine 2012

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We are going to talk about the chemistry of the brain; we have already started with the dopamine.

We have at least a hundred and fifty chemical substances within the central nervous system that scientists believe they are either potential or actual neurotransmitters, however 50 of them are well-known neurotransmitters that we know what their function is and the diseases they cause.

Of course 50 neurotransmitters we will not be able to approach them all. It's going to take a while until you master them all but we'll approach at least 6 or 7 that are very important to you in your personal life and very important to you scientifically at this level of studying.

The brain stem, besides being very important for the vital function, this area contains 4 very important regions that release the major neurotransmitters that alter and affect the brain functions.

Dopamine:

It is secreted from substantia nigra, (and nigra from black, substantia means substance, so it means the black substance or the black area).

-The areas of the brain have been named according either to their color or to their shape. They didn't know their functions.

Dopamine is considered the neurotransmitter that really affects your mood, when you wake up early in the morning and you feel like the sun rising and life is smiling and you are happy, then your dopamine is high, but on the other day when you wake up in the morning and you cover your head with sheets and you don't like to go out of bed then this is the day when your dopamine goes down and feeling a bit depressed or unhappy, we call it a bad day.

Dopamine alters your mood it lets you feel the feeling of happiness or the feeling of unhappy. It is called the hormone or the neurotransmitter of love, it is when you are in love, when you are feeling that you are loved and love a person, here is where the dopamine is high in your brain and you feel all this well-being of happiness.

Dopamine usually affects motor activity in certain areas in the brain, we call it the basal ganglia, and there is a balance in basal ganglia between the Ach and the dopamine, usually the motor activity that we do is controlled by the brain, Ach tends to increase the motor activity, while dopamine works inhibitory. The balance between Ach and dopamine will lead to a smooth motor activity. So when dopamine is reduced in the brain, only Ach will work, so it makes the person rigid, and leads to a disease. The disease caused by reduction of dopamine in the brain is Parkinson disease, (الشلل الرعاشي) it is characterized by this pes pill rolling.

Usually Parkinson patient has very stiff arms and body, because dopamine is not much in it, and only Ach is working and causing this stiffness of the muscle, when dopamine is high in the brain it will lead to another disease which is Schizophrenia. High rates of dopamine improve your mood, when it is too much high it's going to increase the activity in the brain to the extent that will lead to hallucination.

**Hallucination is different from delusion and from illusion

Hallucination: it is the sensation that the patient feels without the presence of a stimuli. A patient sees things, sees a lion coming to attack when there is none, sees people choking him or hitting him but there is no people.

Types of hallucinations: hearing voices (auditory hallucinations), visual hallucination and tactile hallucinations.

How we diagnose schizophrenia:

1-Tactile hallucinations: could be pleasant or unpleasant:

- the pleasant in the form of hugging, or sexual sensation, and from it the patient usually doesn't want to get treated, usually the mother and the father of the patient comes to the clinic begging you to help their son:

a young male, he is staying in his room all the day and he is laughing and happy, he doesn't want to work or study, he's not doing anything but staying in his room, he doesn't like to take a bath, doesn't like to mingle with people or socialize because he's content.

Does he need treatment? Definitely, we came to life to be productive, to achieve things not to stay and laugh for hallucination. These patients really respond well to treatment, they start washing themselves, taking a bath and shaving and they go out and start working or continue their studies.

**Treated by: antischizophrenic drug like phenothiazine which depresses the dopamine down.

-Unpleasant tactile sensation: when the person feels like people are beating him or choking him, and these are the patients who come for your clinic asking for help, because they are in pain and afraid.

2- Visual hallucinations, when he sees animals or humans talking to him, telling him what to do.

** The most important diagnostic criteria where we diagnose schizophrenia when the patient is having auditory hallucinations. The tactile and visual are not diagnostic, they just support the diagnosis, but the only diagnostic type of hallucination are the auditory type.

Schizophrenia is one in thousand? And in medical school 1% will never make it to graduation because of psychiatric illness, on the day of graduation around 20% of the graduated medical students are on antipsychotic, antidepressant or anti anxiety drugs. Because we are choosing a very stressful life and career, that's why the doctor encouraged us to have fun, we have to study but on weekends we have to balance our lives , you will fall under so much stress to the extent that will drive deviated from normal, we may suffer of anxiety and depression.

-If a patient comes to my clinic and he suffers of tactile or visual hallucinations I have to investigate more thoroughly, he might be withdrawal from alcohol, maniac, in severe depression. All can lead to these types of hallucinations, so it is not diagnostic, but the only diagnostic type of hallucination is auditory.

3-Auditory hallucinations: Usually patient refers to himself as the 3rd person.

If a patient (let's assume his name is Duraid) comes to your clinic and tells you that he hears voices and you ask him explain to me what are you hearing? He will tell you: "there are two people talking to me but they are usually talking to each other about me", so he is referring to himself as the 3rd person, then you ask him what do they talk about you, he says: "they say that Duraid is useless, he cannot do anything successful in life, he is a loser, everybody is talking about him and he must go and kill himself, so I am thinking of committing suicide".

Or he says: "there are two ladies, talking in between them, one of them is blond, have long hair", he describes them because he sees them and hear them. He says that "they are saying that Duraid is stupid, his wife is cheating on him, everybody knows but he doesn't know. So I went home and I killed my wife".

**These are the auditory hallucinations that drive him to be aggressive. This is when they consult a doctor in the court room to see whether this person is sane, healthy and his brain is working okay or he is insane and his hallucination is telling him to commit a crime.

**Not all Schizophrenic are dangerous but there is good percentage of them that might be dangerous to themselves or to others.

When a young male or female start closing interest, stop taking care if his/her personal hygiene, you enter the room and you see her/him talking to her/himself, when she/he is telling you things that are unreal, (we will come now to delusion, patients with Schizophrenia is not only hallucinating but they are also delusional).

-Now why do we call it Schizophrenia (انفصام شخصية)? Because the thoughts that the person or the patient relays in has got no reality basis, there's dissociation between the thought and the reality.

If a patient comes to you and tells you: "there are people coming from other stars or planets to steal my mind", therefore he's covering all the windows with aluminum foil and he stays home, these are delusions, Or "there is a conspiracy, I've been hunted by people and they want to imprison me" and there is nothing about him, he's an ordinary person, this is what we call paranoid Schizophrenia.

**Kids (3-4 years-old) who refer to themselves as third person or have an imaginary friend are not diagnosed Schizophrenic, they are perfectly normal.

**Schizophrenia is usually diagnosed in teenagers and early 20's usually males.

**Schizophrenia usually can be treated and controlled.

**Psychiatric illness has been delayed the discovery of their treatment because people were thinking of psychiatric illness as a taboo, or shame to the family.

**Psychiatric illness is no more than chemical disturbance in the brain and it can be treated and controlled very easily.

**It's Very rare to have Schizophrenic patients non-functioning and their IQ really affected after long period.

What precipitate Schizophrenia?

Schizophrenia is a genetic predisposition, there is a chromosome 5 involved, there is a D2 receptors involved, that's why it's familial, and that's why even more families are not willing to talk about it. You can see more than one Schizophrenic in the family. Also a lot of stress in childhood, sexual abuse, physical abuse and severe infections can precipitate Schizophrenia in early youth.

**Stress in life can lead to Schizophrenia, insomnia, anxiety or depression so it must be overcome.

Norepinephrine:

There's an area within the brain stem we call it the locus ceruleus (ceruleus means blue, locus means location, so it means blue location) which releases norepinephrine.

*Norepinephrine is really important for your concentration and performance in exams.

*When you find it hard to concentrate (not following) while studying, that means that norepinephrine is really low in your brain, it is the neurotransmitter of concentration and understanding.

*Coffee usually stimulates the locus ceruleus to release norepinephrine to give you more alertness and concentration

The other important thing about norepinephrine that it helps in the rapid eye movement sleep, we call it the REM sleep.

When we sleep at night, we relax our body and souls, usually when you are really tired at night and you fall asleep; first 60-90 minutes you are relaxing your body (all muscles are relaxed and there is a slow wave in the brain) after that you start rapid eye movement where the eyes start blinking and some people even open their eyes while they are sleeping and they start dreaming, and this is the relaxation for the soul, you fulfill your dreams that you cannot achieve in life. (We mean by dreams the ones that relief you psychological stress). Therefore norepinephrine relieves you psychologically during sleep.

This cycle will continue 1-1 1/2 hour for your body and then 5-30 minutes for your soul, and then again a cycle: slow-wave sleep then rapid eye movement sleeping. Until you wake up in the morning on a rapid eye movement sleep (you remember the dream). That's not true for everybody but what's true is that everybody is dreaming.

*Norepinephrine has to be in a good amount so that you can dream and rest.

Sleeping pills that are prescribe to patients, the hypnotic substances and the tranquilizers they are usually preventing the rapid eye movement sleep or reduce it, therefore even if you put the patient to sleep when they wake up there won't be balance in their body between the healthy

body and the healthy soul, they feel sleepy and as if they haven't have slept for good period, but actually they have slept for long period but not good quality sleep.

**So norepinephrine is important for concentration and for quality sleep (this is in normal conditions).

What happens if norepinephrine gets disturbed in the brain?

There is a disease called bipolar disease or manic-depressive illness.

** Only in the United States there is 10 million person suffering from the maniac-depressive disorder, even much more than schizophrenic (8 million).

People have swinging of mood, we have a good day (good morning and a good mark... so you'll be in a good mood) and a bad one (the car won't move, got to school late.. so you'll be in a bad mood) and this is healthy, this is what we call a healthy swinging of mood.

Usually females have more swinging of mood because of their menstrual cycle, they suffer a little bit of down mood before period (3 or 4 days because estrogen and progesterone goes really down) and they feel really gloomy, they don't like to move or work (not all of them) but still varies within acceptable level.

When norepinephrine is disturbed the patient starts feeling good, euphoric, happy and then goes to mania (like taking off his cloth and walking naked in the street, or telling bad jokes, or telling people things that are not accepted) and he stays for this situation for weeks or months and then his mood goes down, he becomes severely depressed and suicidal (he maybe try to kill himself) and this swinging of mood is abnormal. The swinging of mood that can cause euphoria reach to mania and depression goes to suicide is dangerous and they have to be treated.

They have found that those patients have suffered abnormalities in chromosome 11, where the tyrosine hydroxylase enzyme is responsible for the metabolism of norepinephrine is disturbed.

**High rates of norepinephrine leads to mania and very low leads to depression.

**Depressed females usually try to kill themselves, depressed males usually kill others.

**maniac-depressive could be seen in more than one in the family, and usually the females.

Serotonin:

Dopamine, norepinephrine and serotonin are very much related to each other and the three of them are really giving you the good mood that you feel at a good day. (When they are really regulated in your brain).

Serotonin is an element elevates mood when it is high in the brain.

What elevates serotonin? When you eat a carbohydrate meal.

When you eat pizza or pasta or potato, any kind of carbohydrate, because there is tryptophan (or tryptan) which is amino acid which enters in the synthesis of serotonin, after a heavy meal of

carbohydrates you feel sleepy and relaxed and content>> here the serotonin is high in your brain. Serotonin gives you a very beautiful sleep, not REM sleep, but quite peaceful sleep and when you wake up healthy fresh and ready to work. While decrease in serotonin will lead to insomnia (Wakes up very tired).

So it's important for sleep physiology.

**Sleep disturbances or disorders like sleep walking, sleep talking and sleep eating. During sleep the brain puts the motor system into paralysis, so that we don't act our dreams. People who suffer of sleep walking or talking have incomplete paralysis of the muscles.

Norepinephrine, serotonin and dopamine are very important for your mood, emotion and even your cognitive function (your performance). When you come to the exam content and satisfied you will get the best answer, if you come anxious and worried (neurotransmitters are disturbed especially norepinephrine) and you'll get confused.

**Red meat improves and elevates the rates norepinephrine and dopamine, it gets you alert.

**Carbohydrate that elevates the serotonin makes you sleepy but also gets you in a good mood.

**We should balance between the 3 to reach the ideal performance.

**Chocolate releases the 3 of them and really gives us the well being, especially in females.

**Food changes the mood and makes you happier but it does not reach the abnormality, but drugs make you.

**crystal meth (also called Methamphetamine and ice) this is an addictive drug that makes you alert>> highly dangerous and addictive, it releases the 3 of them, it puts you in a good mood, you don't like to eat much, and it gives you very high concentration because norepinephrine is high. It makes you addictive from the first dose.

Best of luck :)