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NPTEL ONLINE CERTIFICATION COURSE

Course Name

Stress Management

By

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Lecture 08: Effect of Stress on Immune System

Hello everybody, welcome to the third module,

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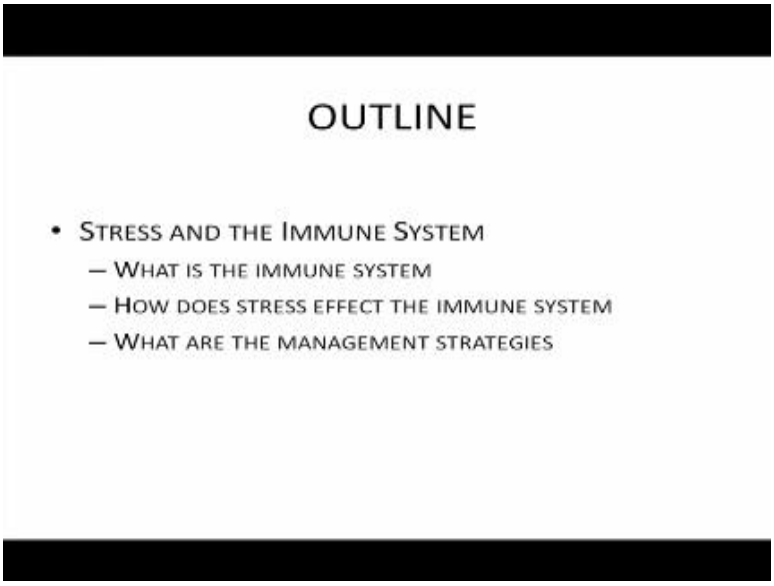

On stress psychophysiology in today's session we shall discuss the effect of stress on the immune system. So we are going to study what is the immune system, how the stress affects the immune system, and what are the management strategies. That is how we lead, with the immune system by dealing with stress.

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We will start off with, a one of the one-liners where, that are very common in our regular lives. Most often than not many people ask us, are you stressed out, are you depressed, and then definitely you are going to come out come down with something. So they are actually meaning some psychological factor, causing a physiological illness. Now this is actually a very common thing in today's world. Whenever we there is somebody is suffering from a psychological problem there is an immunological problem that follows. In fact "psychoneuroimmunology" is a field of research that has come up very actively in the recent past. It has shown that the state of mind, actually affects one state of health.

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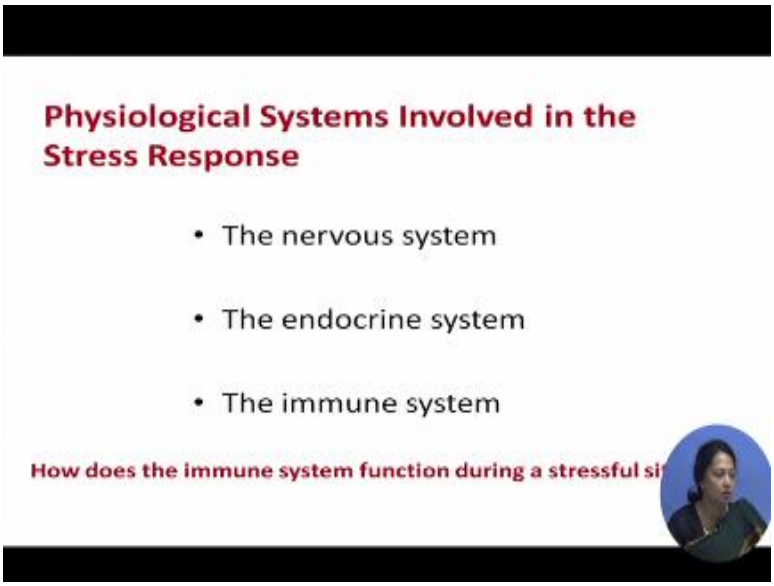

So that brings us to our favorite old slide, that the physiological systems involved in the stress response are the nervous system, the endocrine system, and the immune system. Now we have already studied the nervous system, and the endocrine system. Today we are going to see, how the immune system functions, during a stressful situation.

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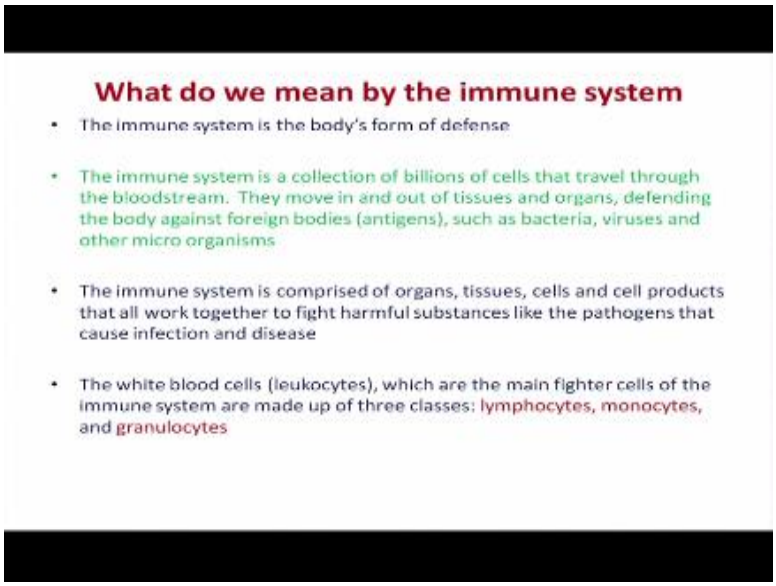

So what do we mean by the immune system, the immune system as the term itself tells us, is the body's form of defense. So it is a collection of a billion of cells that travel through the bloodstream. They move in and out of tissues and organs, defending the bodies against foreign bodies that could be viruses, bacteria or other several microorganisms. It is comprised of organs tissues cells, and cell products, that all work together to fight the harmful substances like, the pathogens that causes the infections and disease. As you can well understand these are, the foreign bodies that are affecting the cell, from outside, and what exactly happens within the body there.

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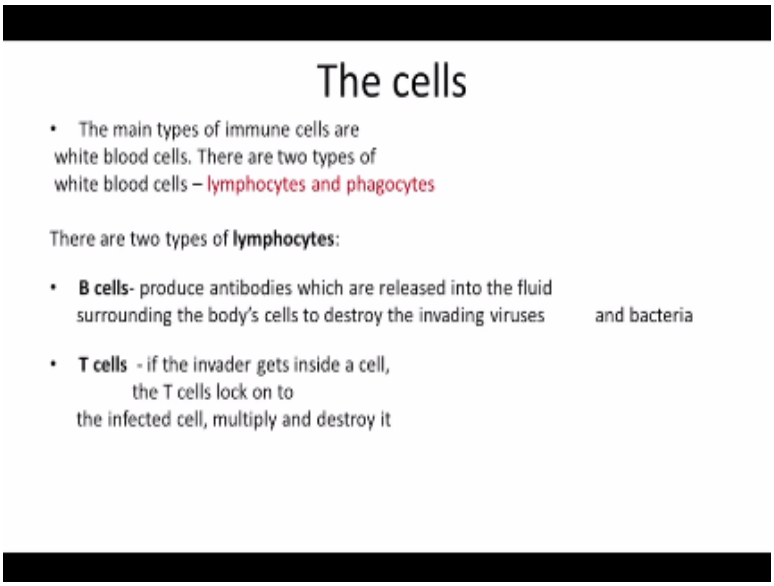

There are something called white blood cells, I am sure you come across a term which is also known as leukocytes. And these are the main fighter cells of the immune system, and these leukocytes are made out of lymphocytes, monocytes, and granulocytes. We will just touch this very briefly in today's session, because I believe that you must understand what the individuals system is actually going through, when we are talking about the specific cells.

Now what are the these cells, when we are talking of lymphocytes, we must understand that there are two types of lymphocytes, one is the b-cells, and the other is the t-cells. The B cells produce antibodies which are released into the fluid, surrounding the body cells. So if there is a cell, it destroys the invading virus, and bacteria outside the cell. And the t-cells are more active if the invader gets inside the cell.

So there are two protective mechanisms, one is outside the cell that is the B cell. So it protects the invaders or the foreign bodies to enter the cell and if the invader gets inside the same, then there are the t cells they lock on to the infected cells. So it locks on like this, and they multiply, and destroy it the unfortunate part is that several times these cells also work against the body's mechanism. We will get into that later.

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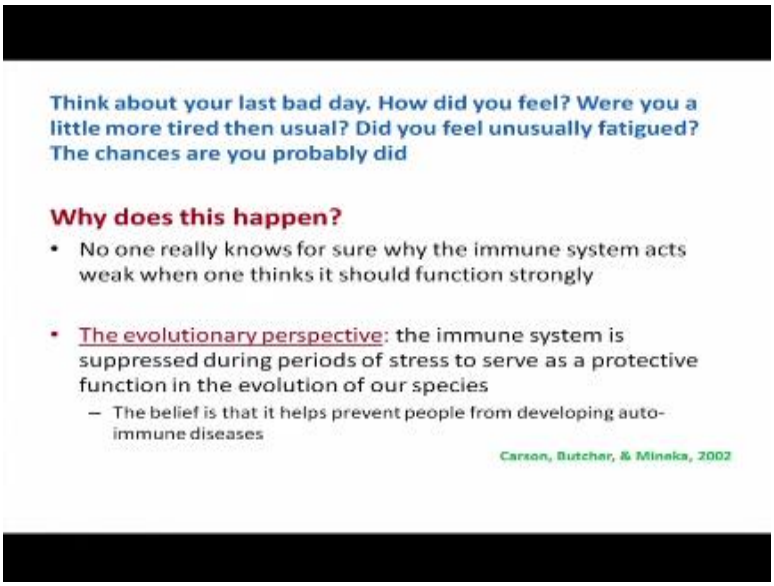

Now let us think about our last bad day, think about your last bad day, that happened to you and how did you feel. Why you a little more tired than usual did you feel unusually fatigued? The chances are that you probably did, now what is actually happening the point is it's very strange that, when the immune system is supposed to be more active it becomes more week. Now there are various perspectives to this the evolutionary perspective, holds the strongest point of view and it says that the immune system is suppressed during periods of stress to serve as a protective, protective function in the evolution of our species.

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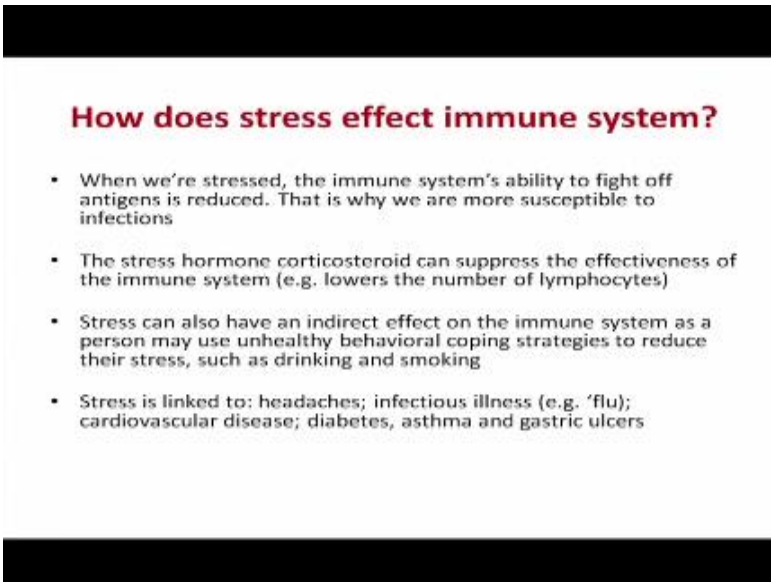

That is it helps prevent the development of autoimmune diseases as, I was talking of the cells going active becoming active against the own or the organism itself. So we will see that several times this happens and we will understand this a little later, when we study the cortisol levels now how does stress affect the immune system. When we are stressed the immune system's ability to fight off the antigens are reduced that is, why we become more susceptible to infections the stress hormone cortisol steroid can suppress the effectiveness of the immune system. And what does this mean this means that it reduces the number of white blood cells, or in this case the number of lymphocytes stress can also have an indirect effect on the immune system.

As a person may use unhealthy behavioral, coping strategies to reduce their stress We often we come across people who get into drinking, or smoking, or many other maladaptive behaviors like, lying down on the bed for a long time not performing the daily actions. To stay well, like exercise, maintaining personal hygiene, etc these also affect the immune system and stress very often is linked to headaches, infectious diseases, cardiovascular disease, diabetes, asthma, gastric, ulcers etc.

Now the specific illnesses that are related to stress will be studied in the next module, but to remember this we'll have to understand that the immune system works well, when we also adapt and adopt positive behavioral strategies.

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That is where the stress management comes in, now to understand a little about the research in stress and immune system. In the early 1980s keyhole class Glaser, he was she was a psychologist and Ronald laser and immunologist from The Ohio State University studied animals unlinked it linked their stress and infection. So far a period of a decade they saw, they also studied the medical students and it was seen that, the student's immunity went down every year during their exam time. So just before three days exam, period they saw that the, the students had fewer natural killer cells so the WBC's were less and there were fights of tumors, and viral infections.

So they almost stopped producing immunity boosting gamma interferon, and interview infection-fighting t-cells responded only weakly, to test tube simulation. We will not get into the details if you wish to I will forward this link, you can go through, the whole research later. But what you can see from this study is that, several stress affects the immune system, and a small examination

can also be so stressful to an individual because it is not considered as small it has a very important impact in an individual slide.

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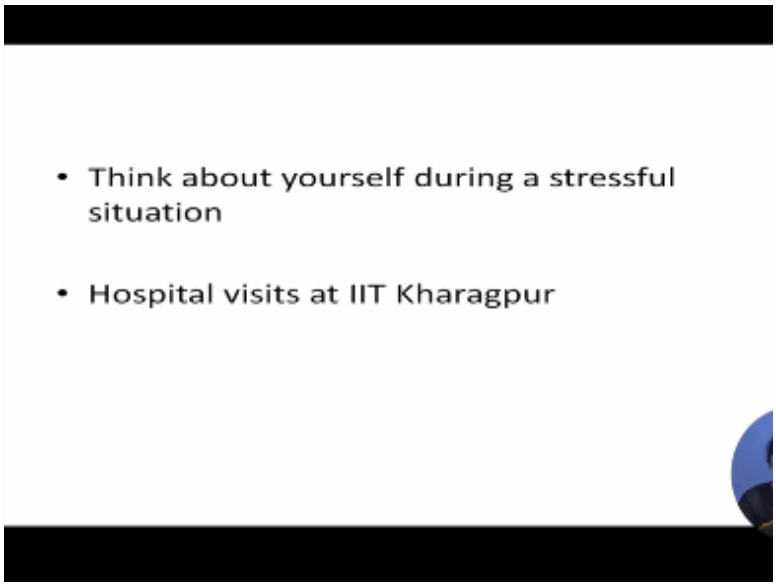

Especially a student's life and that is why many times we consider these affect our body. Now individual differences also exist when, we are talking of stress, and the immune system, again going back to our old sessions. Where we study that it is not only the stressor, but also how the individual perceives the stressor, that becomes that causes stress to that individual. Now think about yourself during a stressful situation, we have discussed this a little earlier so do you see that it is affecting your body in a particular way. You see that you are coming up with flu's, or regular colds, and coughs during a stressful period if you are going through a period of chronic stress for some time, or have you seen tension headaches.

We now, now we know what tension headaches are, or any other symptom that is affecting you. An interesting thing is I was just talking to our chief medical officer, in IIT Kharagpur and she was telling me that during the exams, several students are infected with viral infections. So we also see this happening to students before the exams when the stress period is high. And this is

they come up with several problems like headaches, stomach upsets, that is dead digestion, problem scolds, and coughs, and fever of course.

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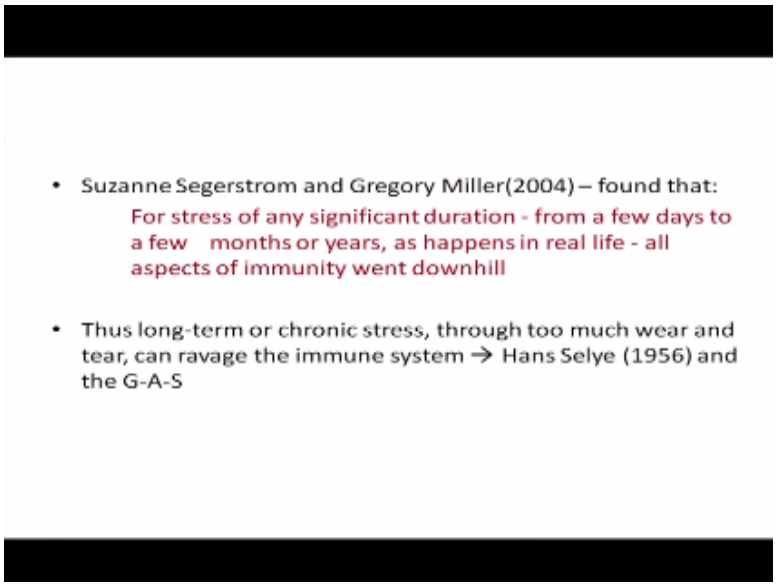

Now this is another area research that was done, and Susan Sager DOM, and sexed Roman mehleb Miller in 2004 found that for stress of any significant duration from a few days to a few months or years as happens in real life affects all aspects of immunity, and immunity goes down him. Now this brings us to hand Shelly and his general adaptation syndrome just to remind you once again, think about Sally in 1956 he spoke about the general adaptation syndrome where he spoke about the resistance and the period of exertion. So we see that after the period of resistance when the phase of exhaustion's comes in the due to long-term stress, or chronic stress there is too much very air and this can ravage the immune system.

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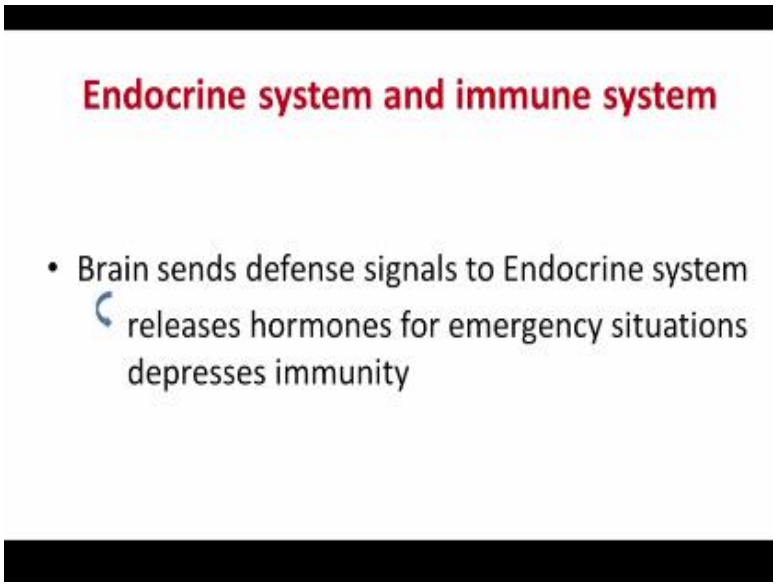

How does it do it now we will just see the relationship between the endocrine system, and the immune system, ongoing stress makes us susceptible to any illness and disease because a brain sends defense signals to the endocrine system, which then releases an area of hormones. We know these hormones we have studied the HPA axis earlier and that not only gets us ready for emergency situations but severely depresses high immunity at the same time The way it does this is by triggering chemical reactions and flooding the body with cortisol that among other things decreases inflammation decreases the WBC's and the NK cells.

Now these cells are very important for cancer and increases tumor development and growth and it also increases the rate of infection, and tissue damage so just imagine that, if there is this regulation of cortisol level in the body. How could it how hugely it could affect the body systems. So this is a way the endocrine system and the immune system are related now this will take us to a very important factor when we talk, about the immune system that is the allostaticload a very important why I am saying important is that a low stasis is a very important for survival.

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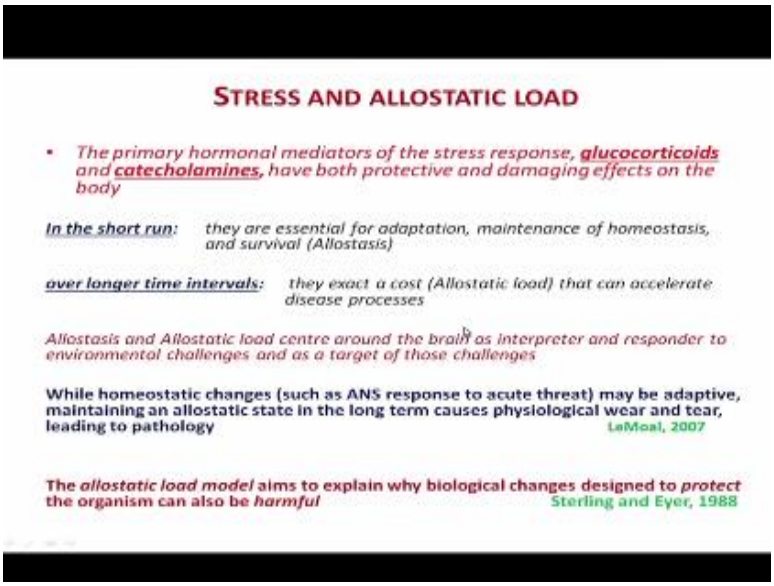

While allostaticload can accelerate the disease process, how does this happen the primary hormonal midi of the stress response that is the glucocorticoids, and the catecholamines have both protective, and damaging effects on the body so what happens how is it protective and how is it damaging. So it is protective in the short run so that is during the short run of stress they are essential for adaptation. So when the glucocorticoids and catecholamines are being released.

We have studied earlier in the previous section these help to maintain restore balance to actually help the individual in the fight, or flight response, and after a period of time the cortisol level is reduced and the glucocorticoids and the catecholamines. These are restored into balance and then the homeostasis is maintained so these actually affect or hair are helpful in the short run but over longer periods of time what happens is they cause an aloestaticload that is there is a cost, and that can accelerate the disease process. So what are happening is the aloe stresses and the allostaticload center around the brain as interpreter, and responder to environmental challenges.

And as a target of those challenges, so while at times they are helpful, they can also be damaging. Now the allostaticload model aims to explain, why biological changes designed to protect the organism can also be helpful. And while homeostatic changes may be adaptive

homeostatic changes, I was just mentioning right now, about the fight-or-flight response during a threatful situation. May be adaptive but maintaining that same state for a longtime causes physiological wear, and tear, and leads to different illnesses, and diseases.

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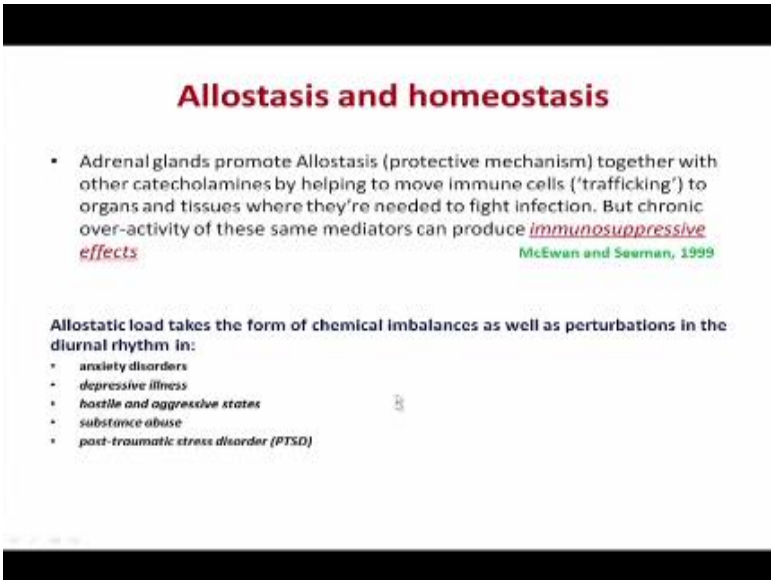

Now at the adrenal glands promote, a low stasis that is the protective mechanism together with other cats the mines by helping to move, immune cells to organs and tissues. Where they are needed to fight infection but chronic over activity of these same mediators, can produce immune suppressive effects. So if there is an allostaticload or if there is n is a long-term stress what happens there are perturbations in the changes in the Daniel rhythm, so Daniel rhythm means the way we the time we get up, and the time we go to sleep, and the digestive mechanisms are also related to the body.

Body mechanisms as in the body time that it keeps and we come across several anxiety disorders, depression, hostility, and aggressive state substance abuse, and post-traumatic stress disorders. When these allostaticload set in or rather if I should say in simple words, when the chemical imbalance is set in.

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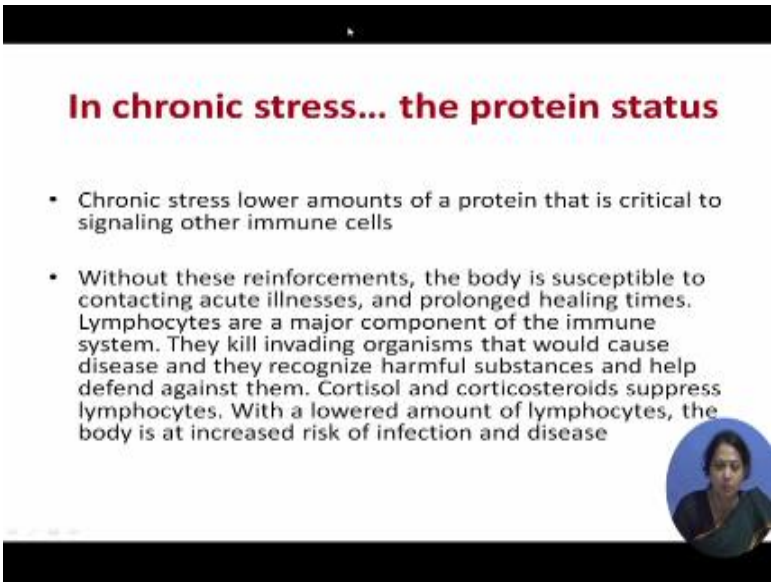

The protein status of the body is also affected during; chronic stress so what happens is the chronic stress lowers the amount of a protein. That is critical to signal the immune cells the protein levels actually signal the immune cells to work but during chronic stress there is a fatigue and these cells are not signaled to work effectively. So without these reinforcements the body is susceptible to contacting acute illnesses and takes long time to heal the, the lymphocytes which are the major component of the immune system kill the invading organisms that would cause disease and they recognize harmful substances and help defend against them.

Now what happens, the cortisol and the corticosteroids suppress the lymphocytes so what will happen when the lymphocytes are suppressed they will not protect the body so there is an please of infectious diseases, and foreign bodies to attack the body. So what happens during a stressful situation to in there are two main ways that stress has a direct negative effect on the immune system,

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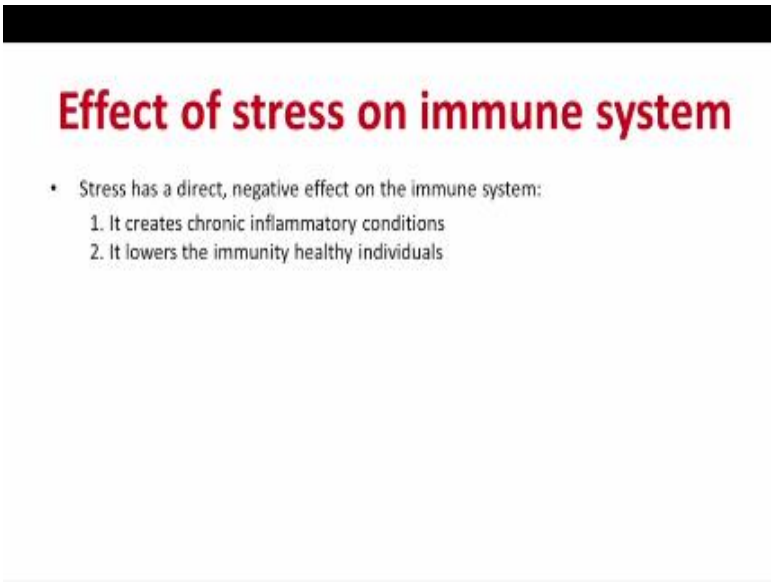

It creates chronic inflammatory conditions and it lowers the immunity of those who otherwise might have a healthy immune system. So how does it create inflammatory conditions?

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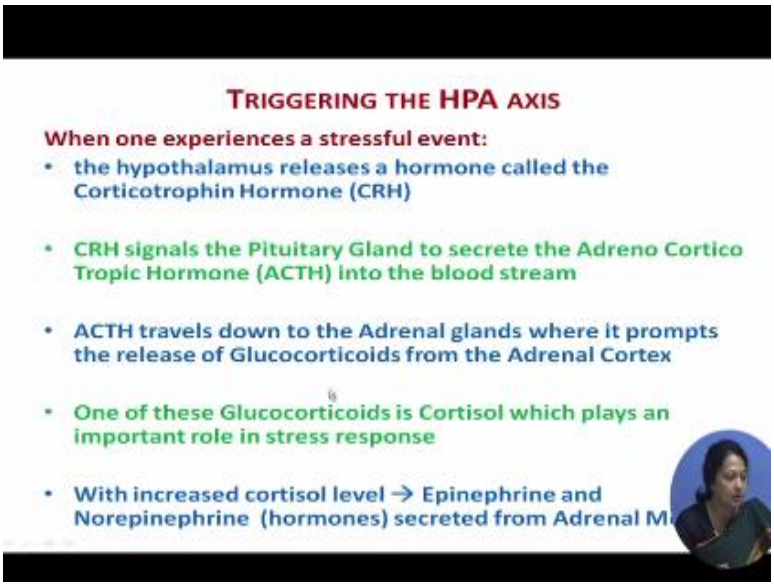

Now we will just look at this once again, the HPA axis just to for refreshment to your memory. So we know that the hypothalamus releases corticotrophin hormone, corticotrophin releases helps to release ACTH into the bloodstream ACTH moves down to, the adrenal glands, and releases glucocorticoids. One of the glucocorticoids is cortisol okay this is why I am stating this is because we will now get into how hot is all is affects the immune system.

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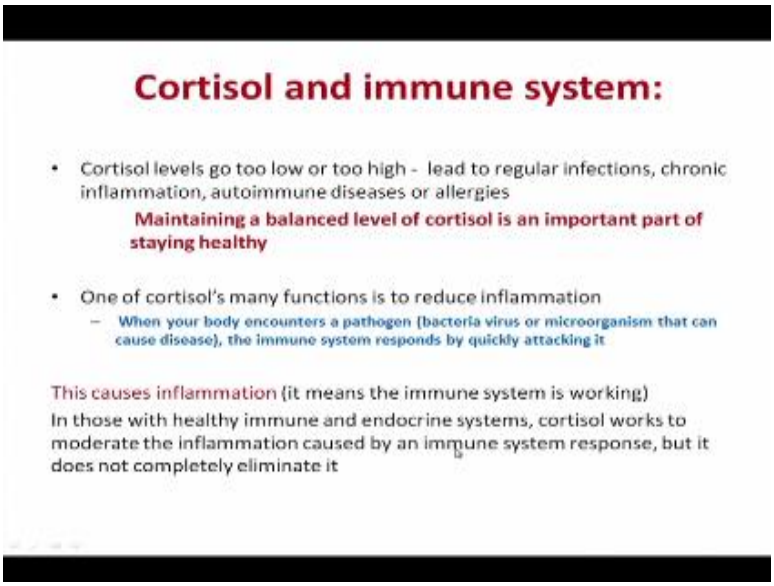

Now caught is all we know that during a stressful situation cot is always released now cortisol levels, could go too high, or too low. And these may lead to regular infections, chronic inflammation, and auto immune diseases or allergies. Now that is why maintaining a balance of the court is all is very important to stay healthy. So what happens one of cot easels main functions is to reduce inflammation, we have spoken about inflammation earlier now what, what how is the cortisol affecting inflammation.

When the body encounters a pathogen now what is a pathogen it is a virus or a bacteria or any other microorganism that is attacking, attacking the body we often come across viral fevers there are several people who will tell you. That oh you know he catches viral fever very quickly if there is anybody in the class who has viral infection he will catch it so the reason is that his immune system is not working properly.

Now this is increased during a stressful situation, or during chronic stress now what is happening in the cortisol situation okay. So when the body encounters a pathogen or microorganism from foreign organism the immune system responds by quickly attacking it we know that, now this causes inflammation. So inflammation just shows that the body's immune system is working, so

now cortisol works to moderate the inflammation caused by an immune system response but it does not completely eliminate it.

Now when cortisol level becomes can become imbalanced when cortisol levels largely depend on which condition of stress one is in, so in the early, early stages of adrenal fatigue cortisol levels are likely to be elevated, along with epinephrine, and norepinephrine. We have seen that epinephrine, and norepinephrines are CA released by the adrenal medulla during stressful situation as when we study the HPA axis. And in the later stages of adrenal fatigue cortisol levels are much, much lower. So neither is beneficial for the immune system

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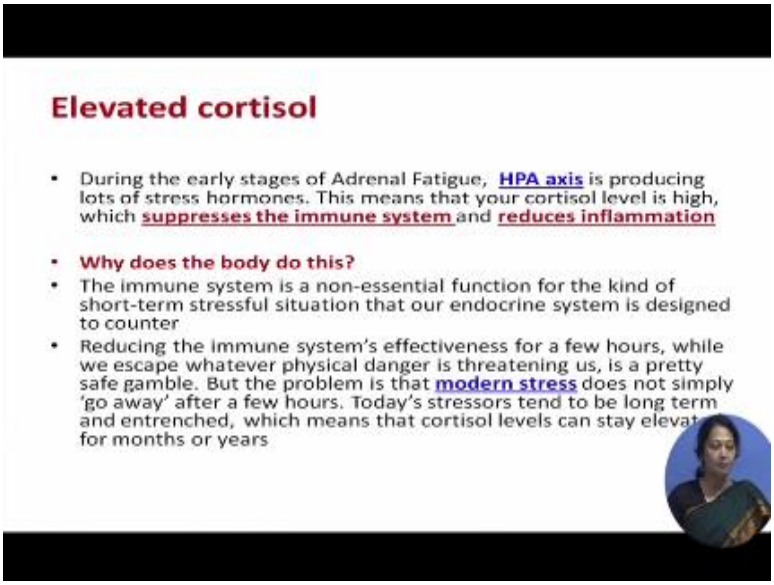

So what happens during elevated cortisol, so when the cortisol level is high during the early stages of at renal fatigue. So HPA axis is producing lot of stress hormones and this suppresses the immune system, and reduces inflammation. Now why does the body do this, the immune system is anon essential function for short-term stressful situation that our endocrine system is designed to encounter. So reducing immune systems effectiveness for a few hours helps us to act during a stressful situation, but imagine that if the stress continues for long so that is joining

them for the modern stresses say, if there is a person is having a marital discord, or problem in his adjustment issues with a student having adjustment issues.

And going through problems in the new college that he has joined, their stresses can not only go for a few hours where the endocrine system is active to deal with it, but it may go on for days, and months, and years together. So the cortisol cell levels in this case stays elevated for long so now that is a little dangerous,

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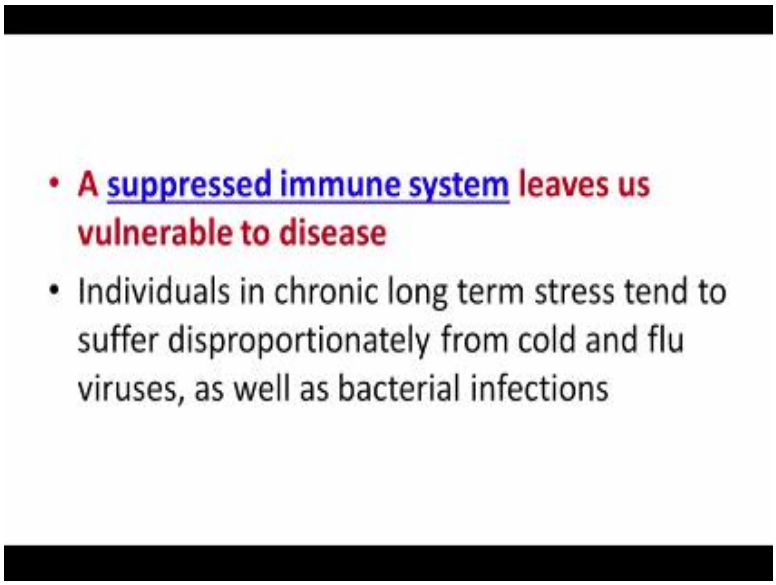

So there the suppressed immune system leaves us vulnerable to disease and individuals in chrome we have seen that individuals and chronic long-term stress tend to suffer disproportionately from cold, and flu as well as bacterial infections. I was just talking about students in colleges residential colleges and I was specifically mentioning our college, where we come across a lot of viral and bacterial infections just before exams.

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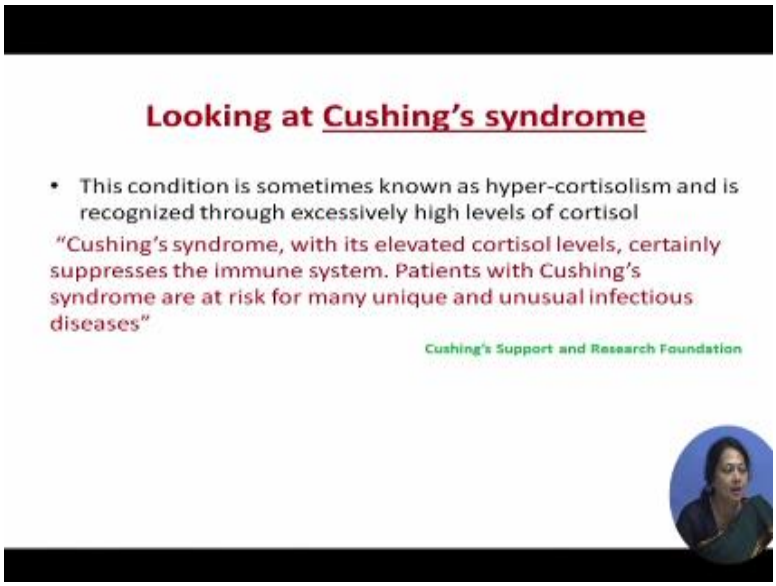

Now this is a Cushing syndrome is a condition where there is hypercortisolism or increase of cortisol level and what happens they do to the elevated cortisol levels the patients with Cushing syndrome are at risk for many unique and unusual infectious diseases.

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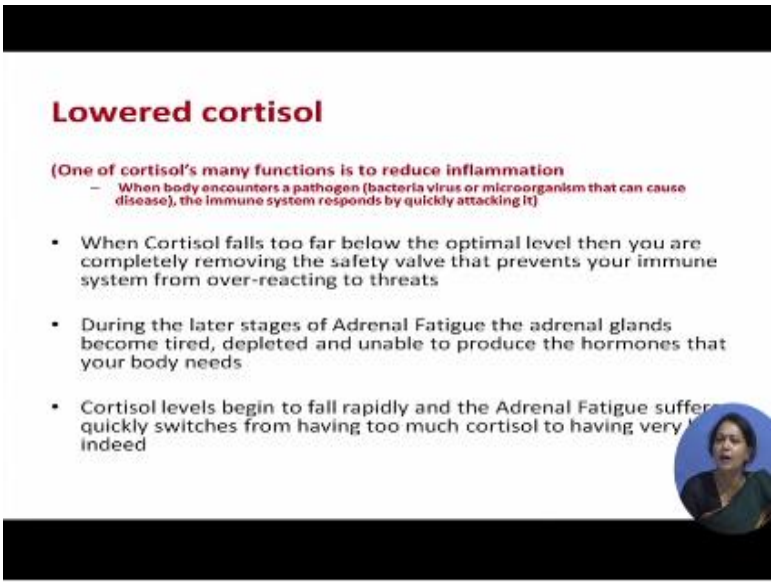

Now what happens when there is a lower cortisol, so we have seen that got easels may one of the main functions is to reduce inflammation now when cortisol falls far two levels below below the optimal level then, the you are completely removing the safety valve that prevents your immune system from overreacting to strip threats. So during the later stages adrenal fatigue the adrenal glands become tired depleted and unable to produce these hormones that the body needs, so when the cortisol level falls rapidly the sufferer Elise witches from having too much cortisol 22 les cortisol.

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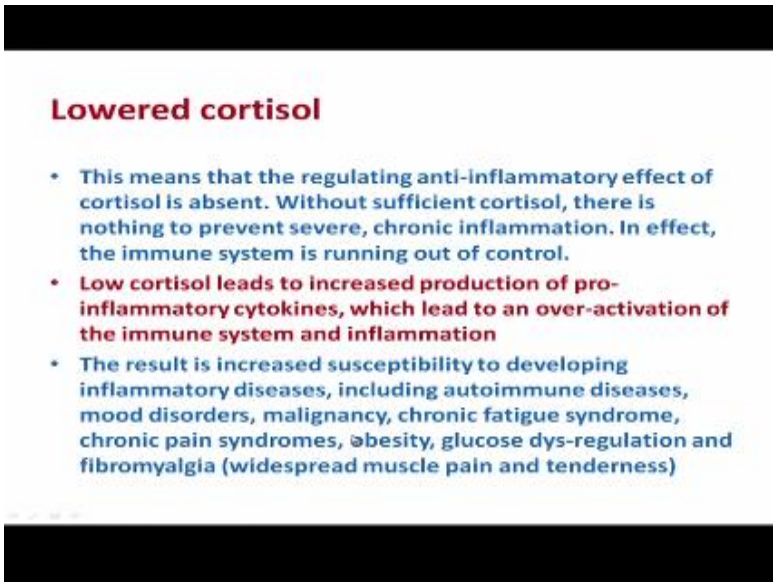

So as you can understand there is this regulation of cortisol and this means that the regulating anti-inflammatory, effects of cortisol is absent. So without sufficient cortisol there is nothing to prove prevent severe chronic inflammation, and what happens is there is nothing to prevent diseases from attacking from outside. So this is a little bit of technical terms, I will not get into details but I will just go through it, so low cortisol leads to increased production of pro-inflammatory cytokines which leads to an over activation of the immune system and inflammation. You do not need to know this very much because our focus is not primarily on understanding the details of the immune system, but actually to understand how stress affects the immune system.

So getting back to this the result is increased susceptibility, developing inflammatory diseases, mood disorders, malignancy, chronic fatigue syndrome, chronic pain syndromes, obesity, and several other glucose test regulations, and also fibromyalgia. Fibromyalgia is a very important factor that must be seen in chronic stress, now in fibromyalgia we come across individuals complaining of wide spread pain muscular pain, and tenderness, and excessive fatigue over the body. So these are also resulting due to lower cortisol levels,

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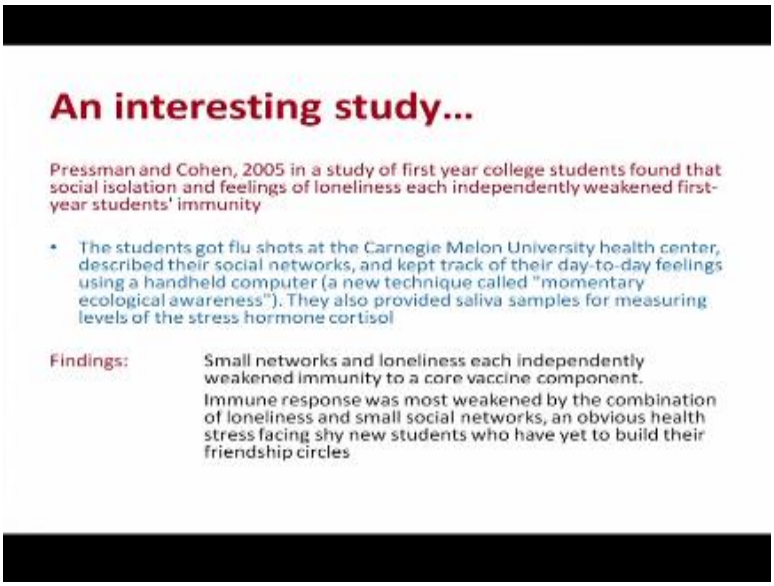

So what you just need to remember about cortisol is higher cortisol, or lower cortisols neither are very important neither is good for the immunes system. So cortisol is important for the immune system, but if there is a disregulation of cortisol then it affects immune system. So it is very important to maintain a balance, now how does the body maintain a balance, now we will get into that a little later but before that we will just see a very interesting study that was done by Pressman and kohan in2005 in a study of first-year college students.

Who found that social isolation, and feelings of loneliness each independently weakened first-year student's immunity. Many of you who are students right now, and who are listening to this lecture may have seen this yourself; you may have suffered because of adjustment issues at the very beginning of your college.

And it may have affected stress may have affected the way you have, the way your body has responded, and you maybe have been a victim of several diseases, and illnesses or you may have come across people who have undergone long term stressors. And who have also been equally susceptible to diseases, so this study actually reiterates the same phenomena the students got flu

shots and they also describe their social networks kept track of their day-to-day feelings using a handheld computer.

And they also provided saliva samples for measuring their stress hormone cortisol the findings showed that, small networks and loneliness each independently weakened immunity to a core vaccine component, and an immune response was most weakened by the combination of loneliness, and small social networks. So as you can understand the shy students shiny new students who did not build up their friendship circles or who had adjustment issues, were having less cortisol, and this regulation of cortisol.

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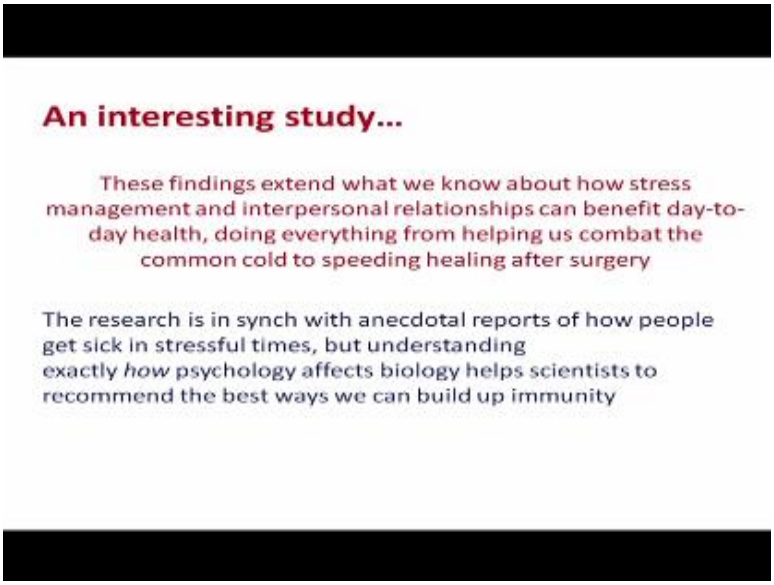

So now these findings extend, what we know about how stress management and doing interpersonal can benefit in day-to-day health doing everything from helping us to combat the common cold, to speeding healing after surgery. So what does this tell you that if you are going through an illness a good idea would be to interact with friends a good idea would be to expand your social circle get involved in more activities, naturally not affecting your health as in taking in excessive amount of work that might also in addition fatigue you, but otherwise interactions, and interpersonal relationships once increased also helps your immunity system to build.

So this is a very good example of mind-body relationship so if you are happy then, you are well now so this is.

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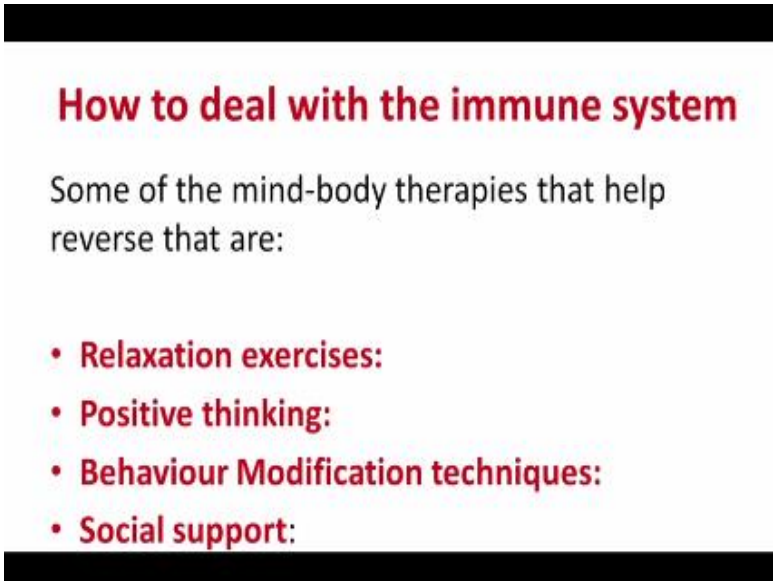

So this brings us finally to how do we deal with the immune system, so we have seen that, even ordinary day-to-day activity can lead to various serious health issues so it's important to be aware of the simple daily stresses in our lives. What you can do today is sit down with a sheet of paper and writes down the points the stresses that are affecting you today, and maybe in the last week then you can actually find out what are the ways you could deal with the stresses.

We will get to other techniques of dealing with them but first you note yourself whether these stresses can be dealt with by you. Whether they are long-term stresses, are there short-term stresses whether they are affecting your health, in any way or is it just that you are not you just know that you are stressed.

So it's just a short-term stressor now some of the techniques that help the immune system are exercises, now I have just mentioned relaxation exercises here but also physiological

cardiovascular X sighs physical exercise helps build the immune system. Now what is cardiovascular exercise, so anything that actually helps you to increase your heart rate, so it could be something like skipping, jumping, hopping, swimming, running, and brisk walk, or cycling. So all these would be cardiovascular exercise this actually helps build your immune system.

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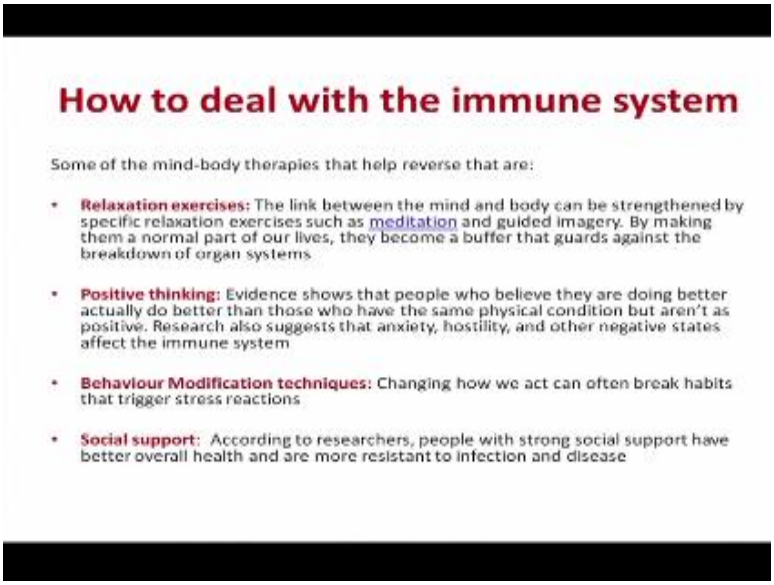

And in this way this can also help you to fight diseases it also helps to increase help a positive build a positive mood. We will get into this in the next week sessions, positive thinking. So as I started when I started I said that you know if you feel that there is this stressor is going to this is scary, this is dangerous, and how you perceive the stressor is more important in how to weather if we affect your bodily system. Definitely when we are talking of viruses, and bacteria that is a foreign agent so adaptive Excelactive strategies like maintaining personal hygiene, exercise and not taking resort to maladaptive techniques like alcohol smoking other substances, substance use these will help you.

So adaptive techniques will help you to deal with stress, along with that what helps very much is the positive thinking styles. So we will talk about how to change pulse you thinking step was

thinking styles, but right now in this brief I will tell you that if you are more interactive more social and more hopeful about life and if you are just planning your day and moving each day with a goal in mind. And maybe you have short-term goals that we will help you deal with stress and also help your immune system there are several behavior modification techniques that are very important to that need to be learned to deal with stressful situations.

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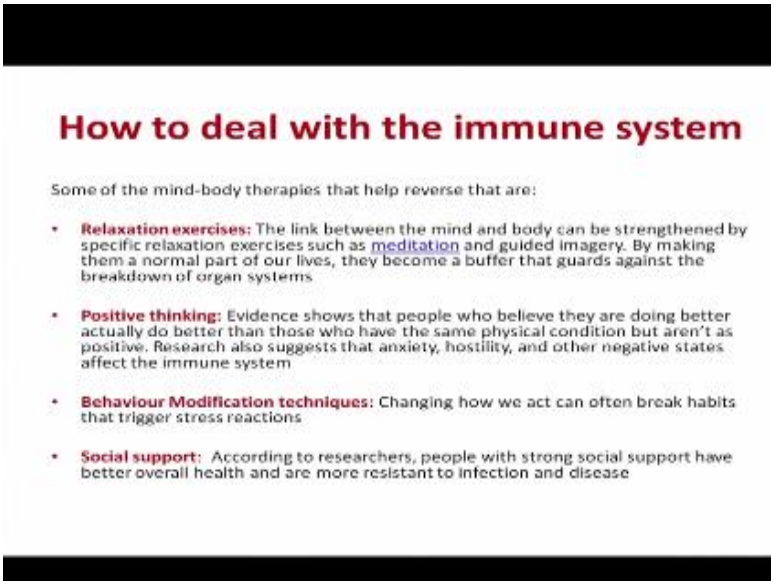

So we and it comes from breaking habits so there are some maladaptive habits that we resort to during a stressful situation that may actually aggravate the stress. Now we can I will teach you some behavioral strategies to break these bad habits deal with stress effectively, and of course social support. We have spoken about social support several times so we know that increasing so staying in an isolated condition maybe you have several virtual friends over social networks online social networks does not help. So increasing interpersonal interactions and face-to-face interactions with people help build your immunity, and make you more resistant to infections and disease.

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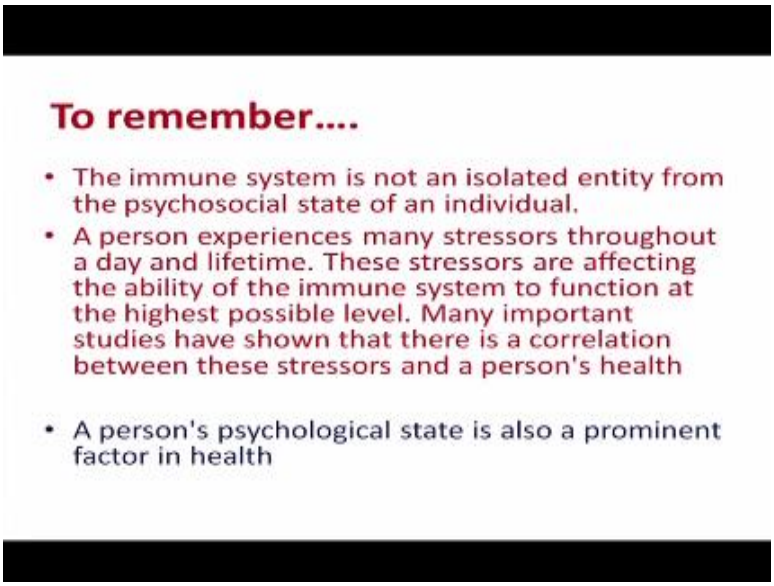

So finally to remember the immune system is not an isolated entity from the psychosocial state of an individual a person experiences many stresses throughout a day and life thing. Now these stresses are affecting the ability of the immune system to function at the highest possible level many important studies have shown that, there is a correlation between the stresses, and a person's health. So a person psychological state is also a prominent factor in health so today's in today's session we have understood what the stress, and immune system, how it works, how the stress is related to the immune system, and what are the major how the immune system works and what are the major strategies to deal with the stresses and to increase our immunity thank you.