Psychology of Stress, Health and Well-Being
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Lecture 4
Module 2; Lecture 1
Stress Health and Non-Infectious Diseases

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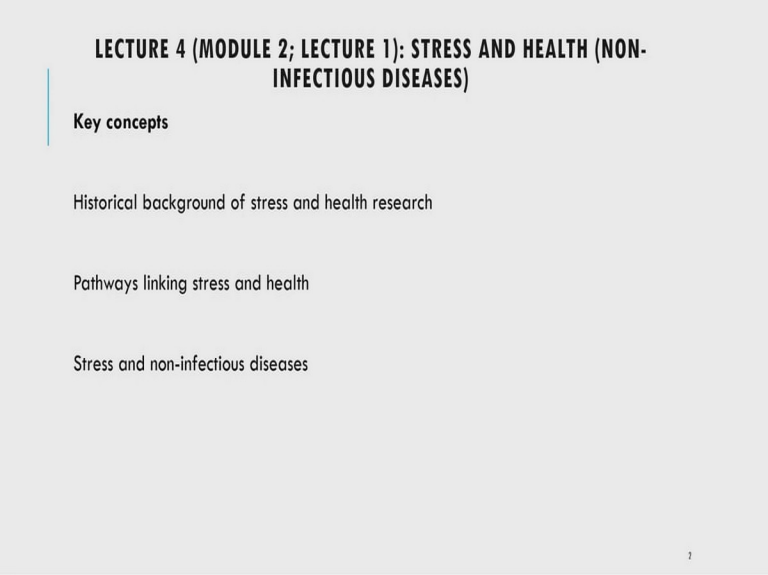

I welcome you to the fourth lecture of this NPTEL MOOC course Psychology of Stress Health and Well-Being. This is the fourth lecture overall and the first lecture for module 2. In today's lecture, we will discuss the relationship between stress and health. The relationship between stress and health will be covered in two lectures. In one lecture, we will talk about the relationship between stress and non-infectious diseases. We will talk about the relationship between stress and infectious diseases in the next lecture. So, today we will talk about stress and health, particularly in the context of stress and non-infectious diseases.

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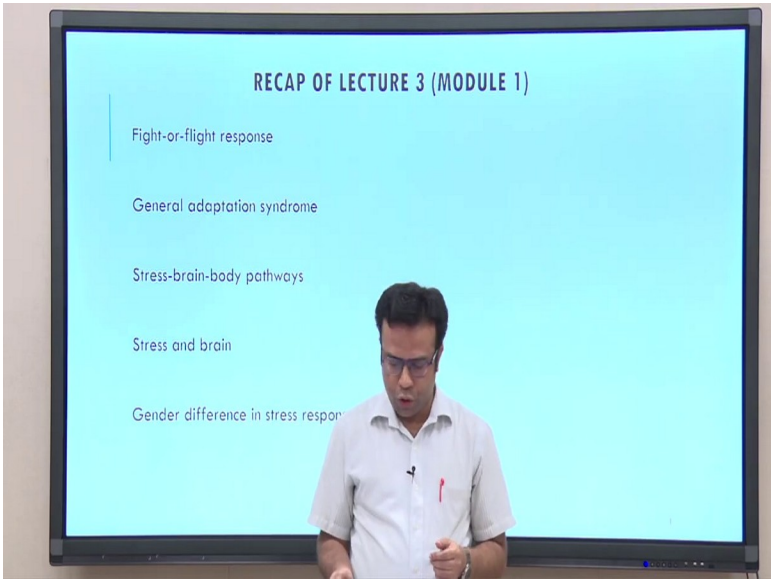

Before we talk about today's lecture, let us have a brief recap of the last lecture, lecture 3 of module 1. In the last lecture, we talked about the physiological aspects of stress; basically, we tried to understand how the experience of stress causes various physiological changes in the body. In that context, we have discussed the fight or flight response, which is also called the acute stress response. Whenever we experience stress, the immediate reaction of the body is fight or flight response, where the body gets aroused and shows symptoms such as an increase in heart rate, perspiration, etc., which gives us extra energy to deal with various threats and dangers in the environment. This is a natural response that we all experience whenever we experience the stress or threat in the environment. We have also discussed general adaptation syndrome. So, in the general adaptation syndrome, we discussed how our body responds to both short-term and long-term stress. We have discussed three stages in which the body goes or body kinds of experiences certain changes when they encounter stressful circumstances. So, we have discussed the alarm reaction stage, resistance stage, and then exhaustion stage. We have discussed how stress is connected to the brain and body particularly in terms of physiological reactions, in that we have discussed particularly that whenever we experience stress, amygdala is activated. Then it further activates the hypothalamus, which then activates two pathways, one is called as SAM pathway and another is called as HPA system or SAM system.

So, there are two pathways by which the body responds to stressful experiences. The SAM system is called the sympathetic adrenal medullary system, where the body activates the medulla

or the inner part of the adrenal gland and which secretes adrenaline, noradrenaline hormones. Similarly, the hypothalamus also activates the HPA system, which is called the hypothalamic-pituitary-adrenal cortical system, which activates the cortex of the adrenal glands and it releases hormones such as cortisol.

So, these hormones are released in response to various stressful experiences, and they have many consequences on the body. Then we have also discussed the connection between stress and the brain. We have discussed stress particularly influences two parts of the brain, that is, one is called the hippocampus. Another is the prefrontal cortex. The hippocampus is mainly responsible for learning memory and emotions. The prefrontal cortex is primarily responsible for higher cognitive functions or executive functions such as regulating thoughts and emotions, decision making, et cetera.

So, stress can influence these two parts and adversely impact these functions. We have also discussed gender differences in the stress response, particularly in the fight and flight response. so some research suggests that females are more likely to show the tend-and-befriend response as compared to the figh-and-flight response. The tending basically means that under stressful circumstances, the females are more likely to show activities for protecting offsprings and dependents to reduce stress and protect the dependents.

The befriending means the females are more likely to create and maintain the social network for protection and reducing stress. We have discussed that this may have an evolutionary reason as females have been given the role of protection of offspring throughout history, and fight and flight response may not be very conducive for such functions. So, tend and befriend probably serve an evolutionary function for the protection of species. So, these are some of the major concepts that we have discussed in the last lecture.

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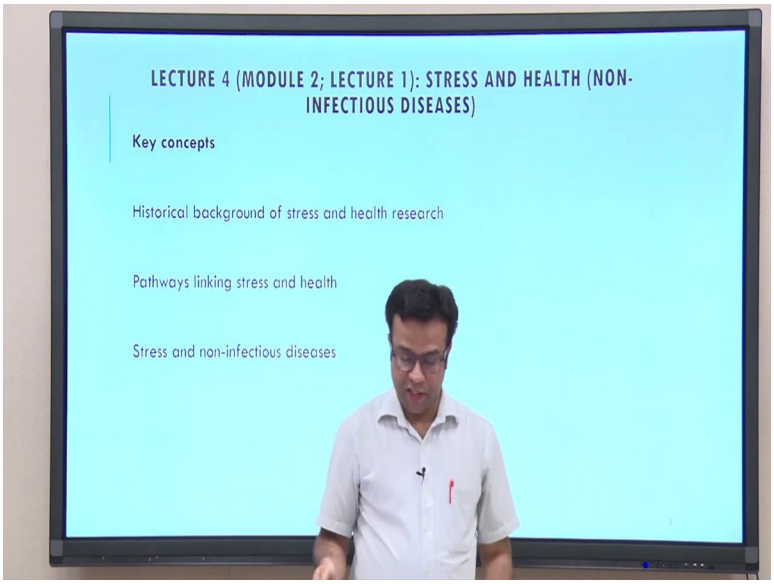

Today we will talk about some of the major concepts, such as we will talk about the historical background of stress and health research, how stress is connected to health, and we will see some of the historical antecedents of research, particularly how research evolved in terms of finding this relationship.

Then we will also discuss various pathways linking stress and health, what are the mechanism by which stress influences our health, particularly physical health. We will also discuss stress and non-infectious diseases, in particular in today's lecture. So let us start.

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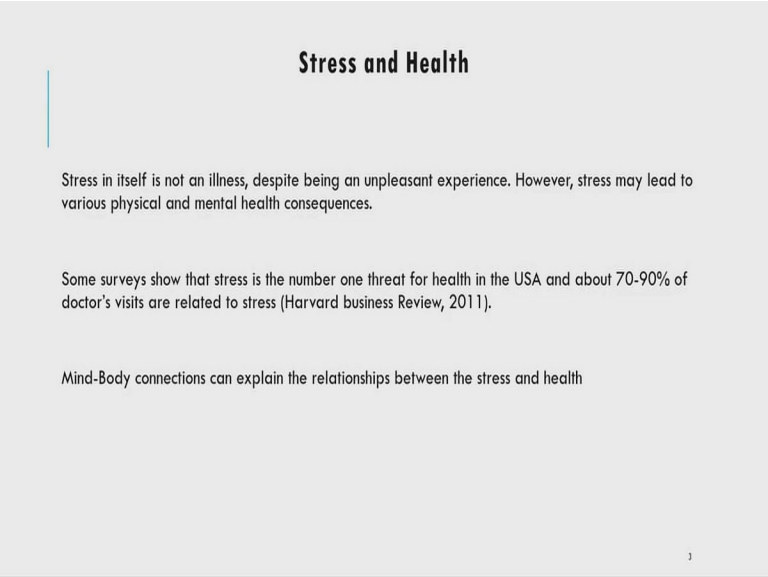

Now, the stress in itself is not an illness; it is more like a response of the body. So, it is a natural response of the body; however, it may be an unpleasant experience as it is mostly associated with negative emotions. Various research has shown that stressful experiences can lead to various physical and mental illnesses or conditions. So in itself, it is not a problem, but when we experience it too much or especially chronic stress, it may lead to various illnesses physical and mental illnesses.

We have already discussed there are many staggering statistics associated with the adverse impact of stress. In the context of health, also we have such statistics. Some surveys show that stress is the number one threat to health in the U.S and about 70 to 90 percent of doctor's visit are related to stress. There are many such statistics, so this is not just for the U.S context but also for most other countries. Now, this relationship between stress and health can be explained primarily from the context of the mind-body connections.

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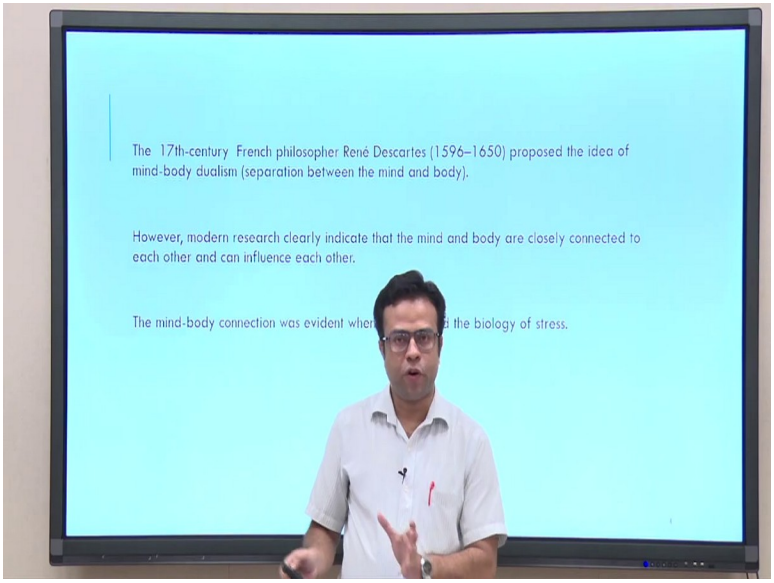

When we talk about the mind-body connection, the idea is that the mind and body are not two separate entities; they continuously influence each other. If you look at historically, 17th-century French philosopher Descartes proposed the idea of mind-body dualism, where he proposed that mind and body are two separate entities. However, recent research clearly indicated beyond doubt that mind and body are not two separate entities; rather, they are very closely connected to each other and continuously influence each other. So, in the context of the mind-body connection, there are many areas of studies that have established this connection, such as mind-body medicine, health psychology, psychoneuroimmunology. All these areas are based on the foundation of the mind-body connection, and researchers are trying to understand from a diverse perspective how the mind-body interact, its consequences, mind-body therapies, and medications.

So, modern research has proved beyond doubt that there is a strong connection between mind and body, and they are not seen as separate functioning entities but as one functional unit. So, mind and emotions can influence the body and the body can influence mind and emotions. So, this is the basic idea in the concept of mind-body connections. Furthermore, when we discussed the physiology of stress in the last lecture, it was evident how the mind and body are strongly and closely connected. We have seen how the mental experience of stress influences our body in so many ways and leads to the release of various hormones, and impacts our body and its various organs such as the heart, endocrine glands, and so on.

So, this was very evident in the discussion of the last lecture particularly when we discussed the biology of stress. Now, in terms of this mind-body connection, we need to understand the concept of psychosomatic diseases.

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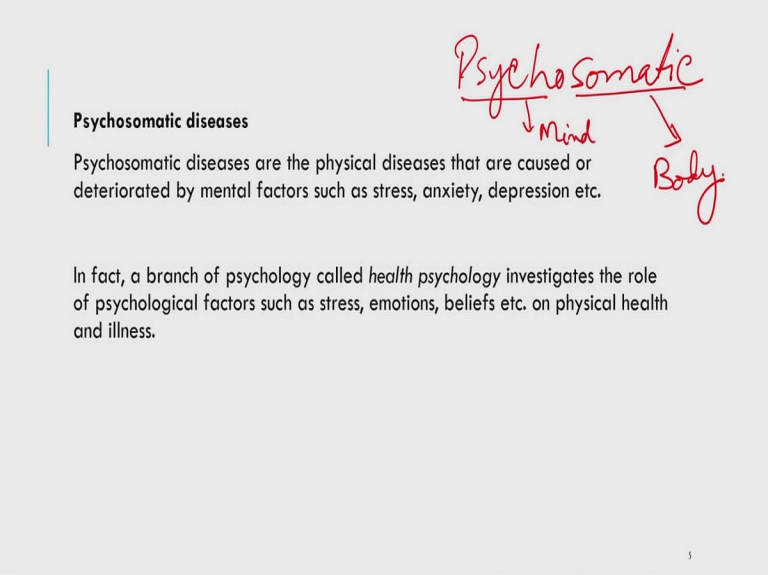

Psychosomatic diseases are physical diseases caused or deteriorated by mental factors such as stress, anxiety, depression, et cetera. Here, the symptoms appear in the body, but the causal reasons could be in mind. In the term psychosomatic, psycho is basically connected with the mind; somatic is connected with the body, soma is the body. So, psychosomatic diseases are basically such diseases, where mental factors play an important role in expressing physical symptoms of the disease. So, researches very clearly show this bi-direction relationship between the body and the mind, and the psychosomatic diseases are an expression of that relationship. So, psychosomatic diseases involve both mind and body, and it refers to physical symptoms that arise from or are influenced by the mind and emotions rather than specific organic causes such as injury. So, there may not be a very specific organic reason in the body in such diseases, such as injury in the body, but mental factors may cause it. So, when we talk about psychosomatic diseases, we need to understand that there are mental aspects in various physical diseases. For example, how we react to a physical disease? How do you cope with a disease? It can differ from person to person. There are mental factors associated with every physical disease. For example, skin diseases or rashes in the body can influence people particularly when it appears in certain body parts such as face; It can influence our mind and reactions very strongly. Furthermore,

whenever we have mental illnesses it may have physical connections. For example, when people suffer from certain mental illnesses such as depression, they may stop eating, taking care of themselves, which may further cause other physical diseases or worsen the existing ones.

So, there is a clear bi-directional relationship between the body and mind; every physical disease has mental aspects, and mental diseases have some physical aspect to them. So, psychosomatic diseases, we need to understand in that context; particularly, some physical diseases are very strongly connected with the mental factors, such as skin diseases, stomach ulcers, high blood pressure and heart diseases. So, we will look into some of them in more detail. In fact, a branch of psychology called health psychology has evolved primarily to understand the psychosomatic aspects of diseases, and it investigates the role of psychological factors such as stress, emotion, beliefs, et cetera, on our physical health and illnesses. So, we have a whole branch of study based on the psychosomatic aspects of diseases, and it clearly reflects how mental factors are in physical diseases, particularly experience of stress.

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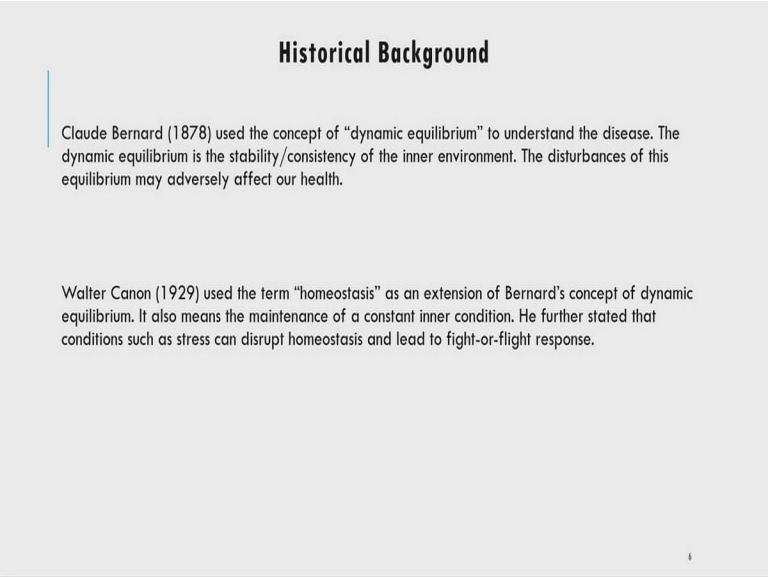

Now, if you look at the history of psychosomatic diseases, there are a few key landmarks that we can discuss. For example, in 1878, Claude Bernard coined the term "dynamic equilibrium" to describe diseases, and he defines dynamic equilibrium as "the stability or consistency of the inner environment." So, it indicates at the physiological level whether your body is stable, consistent or at the equilibrium stage. It basically shows your state of health so that disturbances in the equilibrium state may adversely affect your body and may cause diseases. So, this was one of the first concepts in terms of understanding psychosomatic diseases proposed by Barnard. Walter Cannon, in 1929 also used another term called "homeostasis" as an extension of the term dynamic equilibrium concept of Barnard. He meant the same thing using the term homeostasis. So, by homeostasis, he is talking about the maintenance of a stable inner condition. So, maintenance of homeostasis of the body is maintaining constant inner conditions of the body. However, some experiences such as stress may lead to a fight-and-flight response and may disturb this homeostasis and can lead to diseases.

So, Barnard said that maintenance of life is dependent on this maintaining of homeostasis in our body, which is crucial for maintaining life. Hans Selye used the term to represent this effect that stress is the condition that disturbs that homeostasis and may lead to various diseases.

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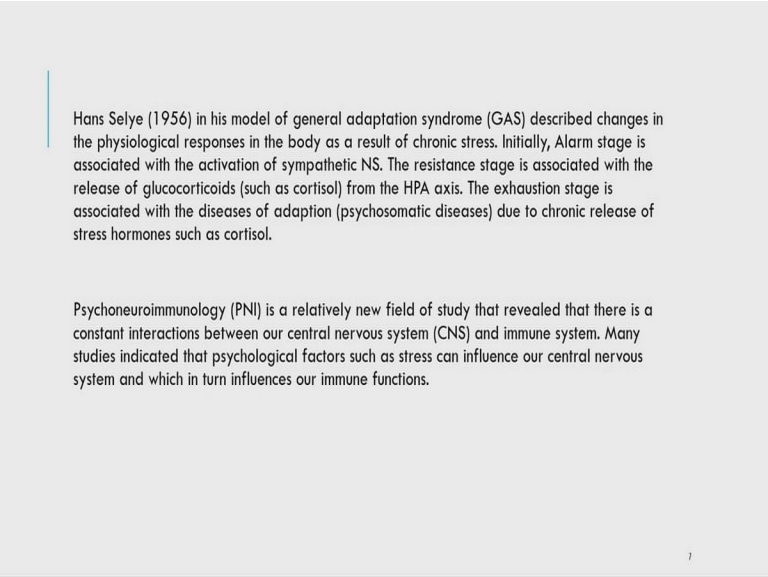

Then there's Hans Selye, who did a lot of stress research in the 1960s and 1970s and proposed the idea of general adaptation syndrome, in which he identified a physiological response of the body in terms of stress, both acute and chronic stress, as we've already discussed. So he talked about the alarm stage, which is more like activation of fight or flight and activation of the sympathetic part of the autonomic nervous system; and the resistance stage, which was linked to the release of cortisol and other stress hormones, especially cortisol from the HPA axis. The exhaustion stage was basically associated with various diseases of adaptation, which are particularly called as psychosomatic diseases. As a result, this exhaustion stage is associated with a decrease in the body's resistance, which can sometimes collapse, and as a result, the body expresses this decrease in resistance in the form of various diseases known as psychosomatic diseases or adaptation diseases. Recently, a field of study known as psychoneuroimmunology, or PNI, has emerged, which is based on this mind-body connection and reveals that there is a constant interaction between our central nervous system and immune system. Our mental processes influence our nervous system, which can further influence our immune system.

So, many studies indicated that psychological factors such as stress can influence our central nervous system and which in turn can influence our immune system. So, this area of study is clearly kind of evolving this whole idea of psychosomatic diseases and playing very important role. So, we will look into this particular branch of study in more detail in the next lecture when

we will talk about stress and infectious diseases, where we will specifically look into the connection between stress and immune system.

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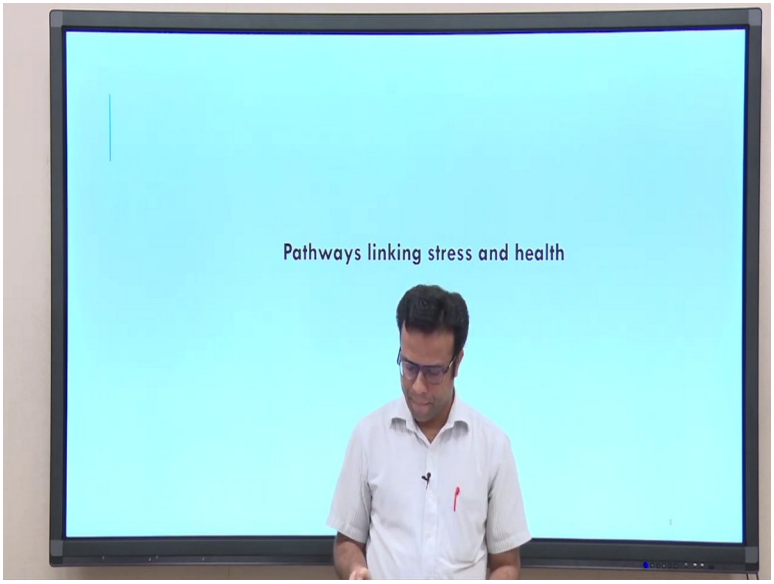

Now, we have kind of tried to understand and gave you a historical background about the psychosomatic diseases and how stress can cause as well as worsen the physical disease. Now, we will talk about the pathways that can link stress and health, mechanism by which stressful experiences can influence our physical health.

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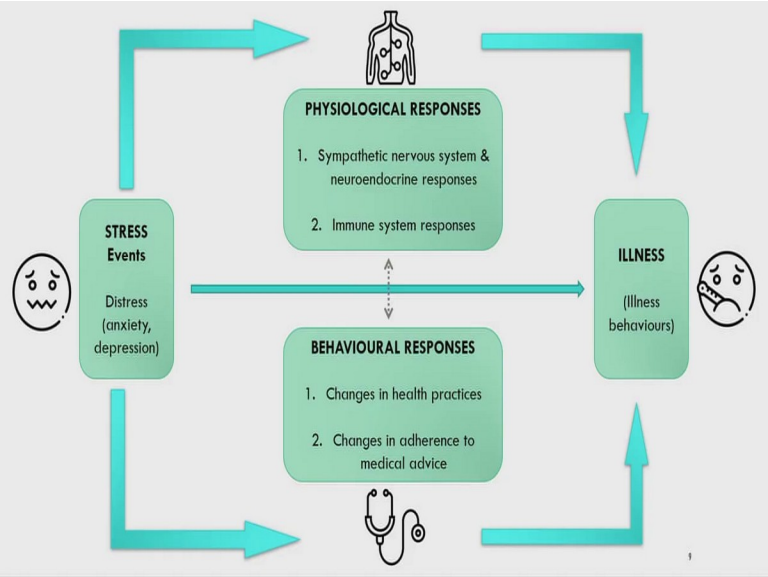

So, this is a diagrammatic representation of mechanisms. So here you can see there are two pathways by which stress can influence physical health or illnesses. One is stress particularly the distress can directly influence our physiological reactions of the body or physiological mechanisms including sympathetic nervous system and neuroendocrine system which we have already discussed in the last lecture. Stress may also influence our immune system, this we will discuss in more detail in the next lecture.

So, by influencing our physiology particularly nervous system, endocrine system and immune system, stress can cause physical illnesses. Another way is stress can influence our behavioural reactions or responses particularly by changing our behaviour such as changes in the health practices or lifestyles, changes in the adherence to medical advices. We will look into this in more details. So, many behavioural changes may be associated with the stressful experiences, which may further worsen the diseases. So, these are two pathways by which stress can influence physical health. So, in more simpler way it can be shown like this.

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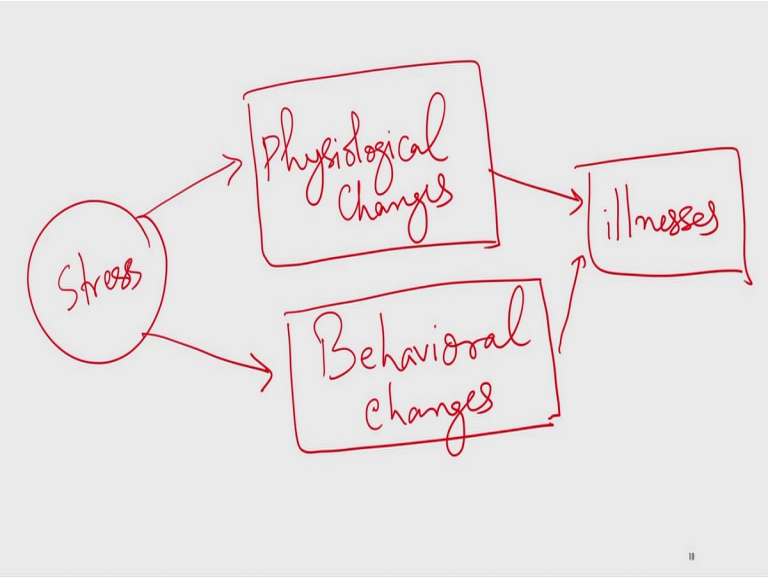

So, there are two pathways, one is physiological changes and the other is behavioural changes in response to stress which can lead to physical illnesses.

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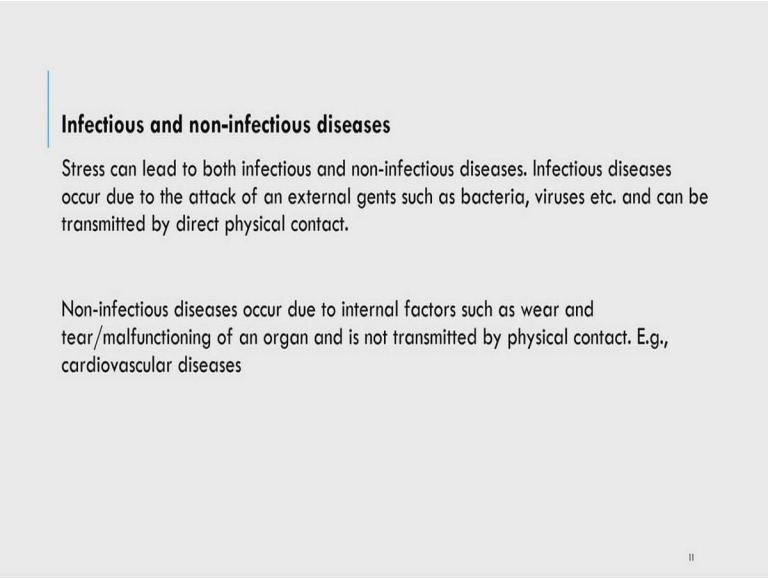

Stress now has the potential to affect or cause both infectious and non-infectious diseases. In general, we may classify physical diseases into infectious or communicable diseases and non-infectious or non-communicable diseases. So, stress can cause both infectious and non-infectious diseases. Infectious diseases are caused by a foreign agent such as bacteria or viruses, so they primarily come from the outside and can be spread from one person to another.

Since the agents are bacteria and viruses, they can spread from person to person. As a consequence, they're also known as communicable diseases. Non-infectious diseases, on the other hand, occur primarily because of internal factors such as wear and tear or malfunctioning in certain organs of the body, and these are not transmitted from one person to another person. So, they are also called as non-communicable diseases. So, actually, there are malfunctions in the body's organs, and we have illnesses like heart disease and diabetes, which are non-communicable or non-infectious diseases. Flu, on the other hand, is likely to be a communicable disease because it can be caused by germs like viruses. So, while stress can affect or cause all types of diseases, the emphasis of today's lecture will be on non-communicable diseases and how stress is related to them.

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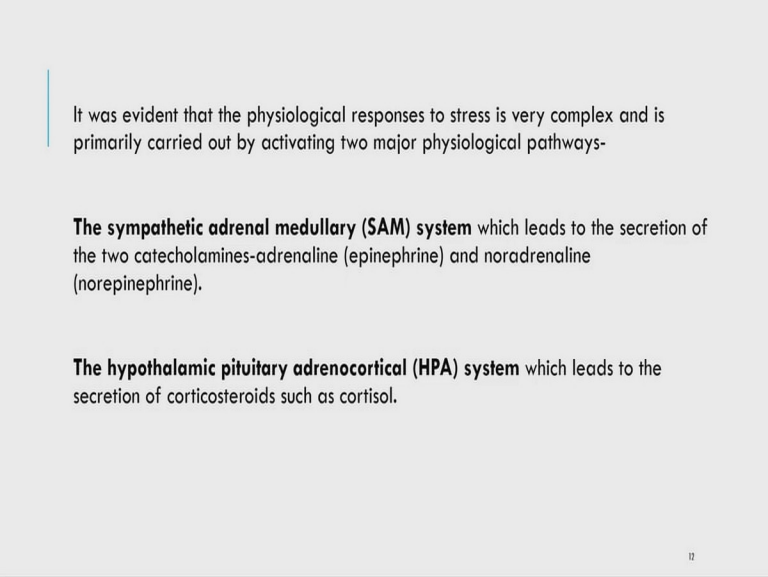

Now, it is clear that the physiological response to stress is extremely complex, and we don't know everything about it, but we do know that it is primarily mediated by two pathways: the SAM system and the HPA system, both of which release hormones such as adrenaline, non-adrenaline, cortisol, and so on.

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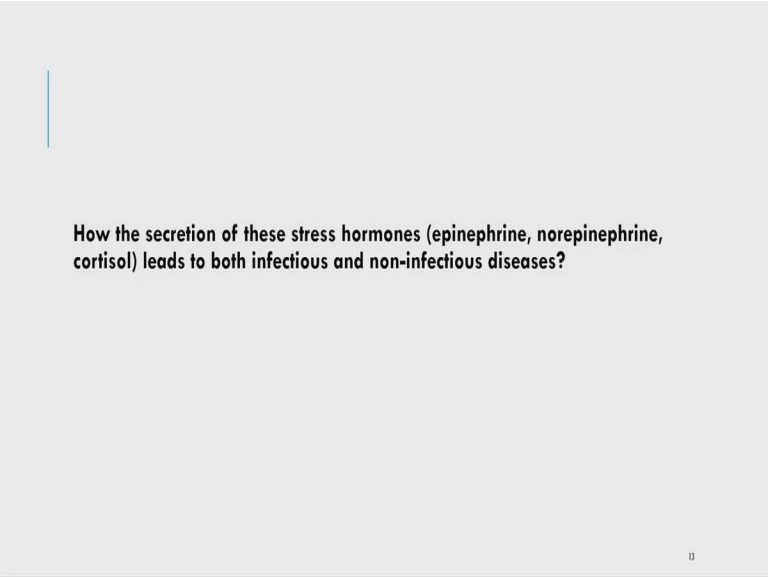

Now, the question is, how the secretion of these hormones or stress hormones can lead to both infectious as well as non-infectious diseases. So, we will try to understand, today we will try to understand non-infectious diseases aspects in todays lecture.

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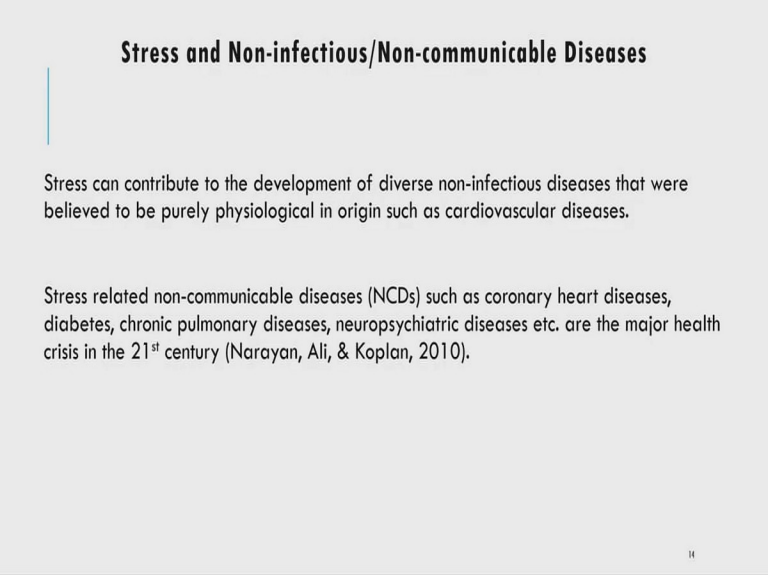

Stress can play a role in the development of a variety of non-infectious diseases that were previously thought to be purely physiological in nature, such as cardiovascular diseases. So, previously, people thought these diseases were primarily caused by physiological or physical

factors, but recent research clearly shows that mental factors can contribute to such diseases in a significant way, making them psychosomatic diseases.

Stress and diseases, especially non-infectious diseases, are related by staggering statistics. For example, stress-related non-communicable diseases (NCDs) such as coronary heart disease, diabetes, coronary pulmonary disease, neuropsychiatric diseases, and so on are the major health crisis of the twenty-first century, as they are the leading cause of death from a variety of physical diseases, and as a result, they are causing a major crisis in disease management in the twenty-first century.

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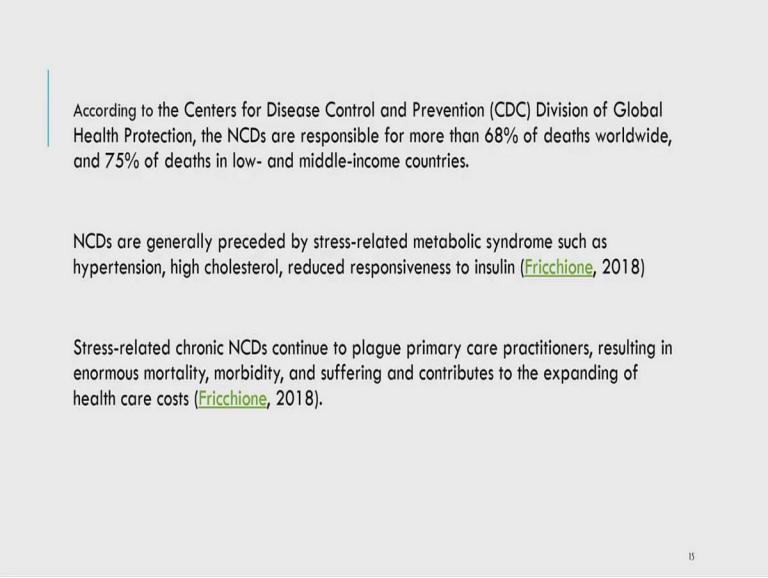

According to the centres for disease control and prevention CDC division of global health protection, the NCDs or non-communicable diseases are responsible for more than 68 percent of deaths worldwide and 75 percent of deaths in low and middle-income countries. So, you can understand the enormous impact such diseases have on people's lives and are mostly caused by factors such as stress.

NCDs are generally preceded by stress-related metabolic problems such as hypertension, high cholesterol, reduce responsiveness to insulin. So, all this metabolic changes happens by the stress and they ultimately causes all this non-communicable diseases particularly psychosomatic diseases. So reduced responsiveness to insulin may lead to diabetes, high cholesterol may lead to

heart diseases, high blood pressure lead to hypertension. All these metabolic changes are caused by stress-related factors, and they may further lead to various non-communicable diseases.

Stress-related chronic non-communicable diseases continue to plague primary care practitioners resulting in enormous mortality, morbidity and suffering and contribute to the expansion of healthcare costs. So, they are a huge burden on the primary healthcare system and the overall disease burden of various countries. So these are a major chunk of diseases that we all experience, and interestingly they maybe influence very strongly by stress-related factors.

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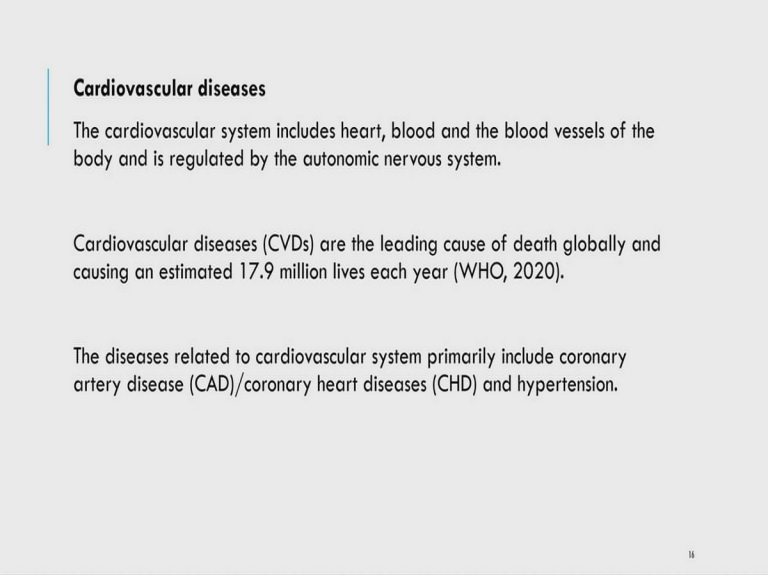

So, let us talk now more about cardiovascular diseases because this is one category of disease where stress seems to play the most important role. The cardiovascular system basically includes the heart, blood, and blood vessels and is primarily regulated by the autonomic nervous system. So, now you can understand the connection because these are regulated by the autonomic nervous system, and the autonomic nervous system can be influenced by stress.

Cardiovascular diseases are the leading cause of deaths globally and causing an estimate of 17.9 million lives each year, as per statistics given by WHO in this year only. So cardiovascular disease are really a considerable category of disease that is causing one of the most extensive death globally. So, diseases related to the cardiovascular system primarily include coronary artery diseases, coronary heart diseases, and hypertension. So, primarily heart diseases and hypertension or high blood pressures are included under cardiovascular diseases.

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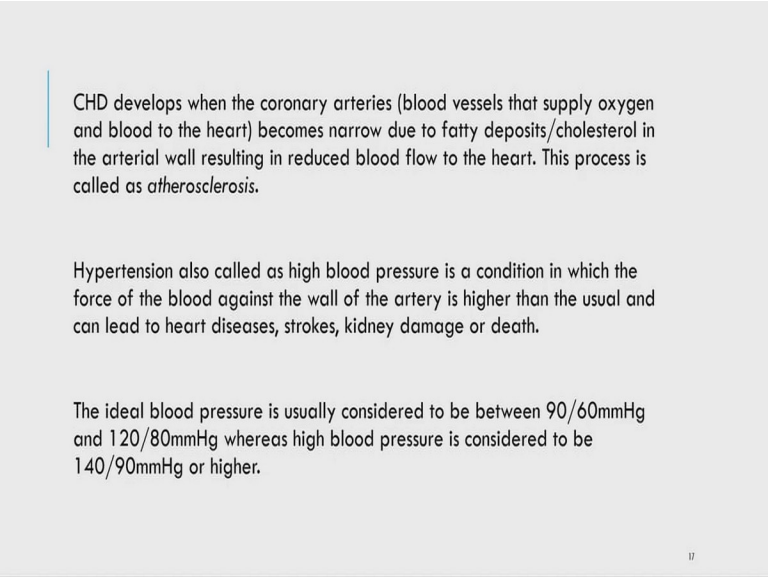

Coronary heart disease develops particularly when the arteries of the heart (blood vessels that supply oxygen and blood to the heart) become narrow due to fatty deposits of cholesterol in those arterial walls. Consequently, blood is not able to freely flow from the heart and to the heart, which is called atherosclerosis. We will also look a little bit more-deeper into this also.

One of the primary reasons for heart disease is the blockage in the artery by the cholesterol or fatty deposits. Hypertension, on the other hand, is basically high blood pressure. It is a condition in which the blood force basically against the wall of the artery generally becomes higher than the normal situation and can lead to heart diseases, strokes, kidney diseases, et cetera, sometimes death also. For example, the normal blood pressure is between 90 by 60 mmHg or millimeter of mercury, which is the unit of measuring blood pressure. So, 90 by 60 to 120 by 80 mmHg is the normal range of blood pressure. Anything above that is considered higher particularly if it is 140 by 90 mmHg or more, can be considered as hypertension. The top count is basically systolic blood pressure, and the bottom is called diastolic blood pressure. So, systolic blood pressure is basically when blood pressure when the heartbeats, and diastolic is when the heart is not beating. So, 90 by 60 blood pressure means 90 is systolic, and 60 is the diastolic measure.

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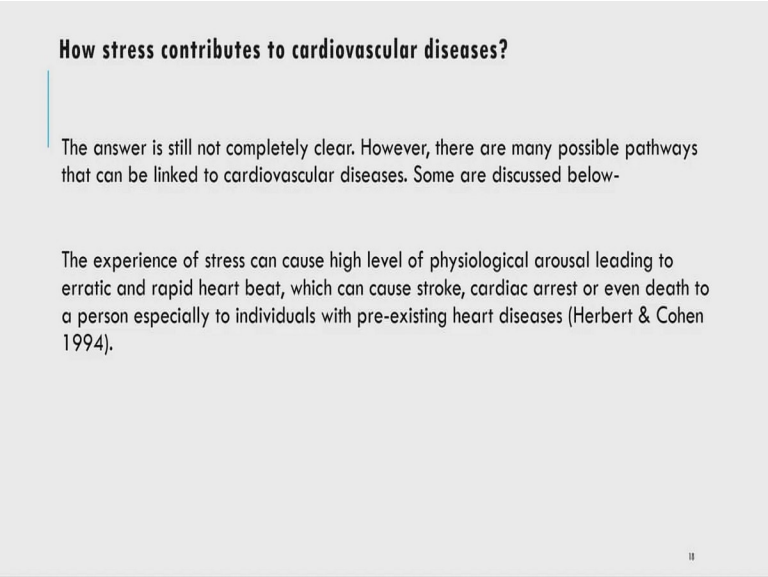

So, how does stress play a role in cardiovascular diseases, particularly heart disease? So, although the mechanisms are complicated and uncertain, there are a variety of potential pathways that have been related to cardiovascular disease and stress. For example, stress can trigger high levels of physiological arousal, which can lead to irregular and rapid heartbeats, which can lead to stroke, cardiac arrest, or even death, particularly in people with pre-existing heart conditions or diseases. So, one thing is very clear: when you feel stress, your heartbeats get faster. Especially when you're in the fight or flight response, your heartbeats get very irregular and faster, and this, when repeated, can cause wear and tear in the system, particularly in the muscles of the heart, and can lead to heart-related problems. This may be one of the direct mechanisms by which stress can cause heart-related issues by causing wear and tear in the system due to repetitive fight-or-flight responses.

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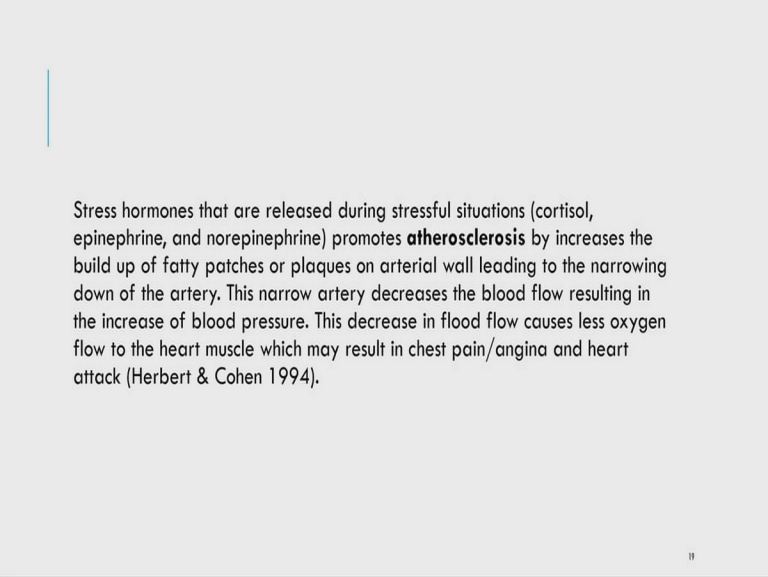

Another way that stress is related to heart disease is by stress hormones, which are hormones that are released during stressful conditions, such as cortisol, epinephrine, and norepinephrine. Now, studies have shown that stress hormones facilitate atherosclerosis, which essentially means that it narrows the arteries by raising cholesterol levels and increasing the build-up of fatty patches or plaques on the arterial wall, which contributes to the narrowing of the artery. So, the artery is narrowed down because of the built-up of plaques and fatty patches in the arterial wall. This narrow artery decreases the blood flow resulting in an increase in blood pressure. This decreases the blood flow causes less oxygen flow to the heart muscles, which may result in chest pain which is also called angina, and heart attack.

So, stress hormones can promote atherosclerosis which ultimately can block the arterial wall and increase blood pressure by decreasing the flow of the blood and less oxygen in the heart. So, this can be shown like this.

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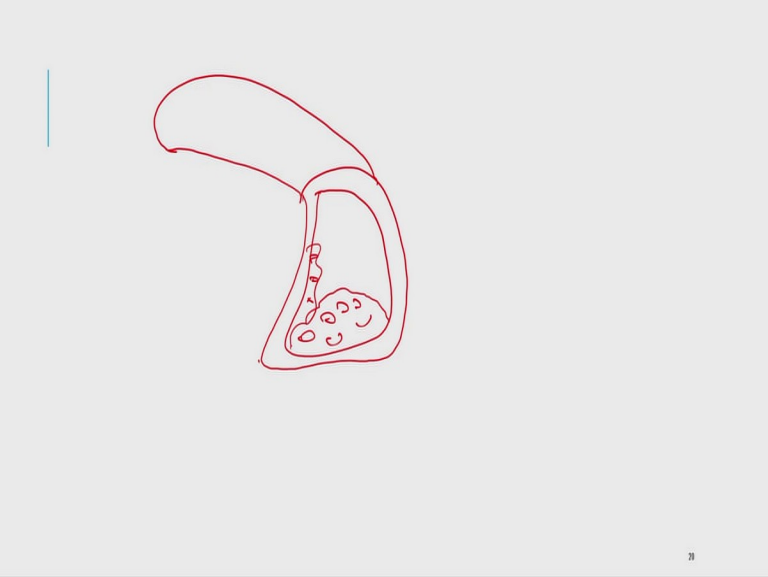

So, let's assume this is a cross-section of an artery. This is a regular opening of the artery, but when atherosclerosis happens, fatty cholesterol patches build up around this artery, reducing the area available for blood flow, which increases blood pressure even further.

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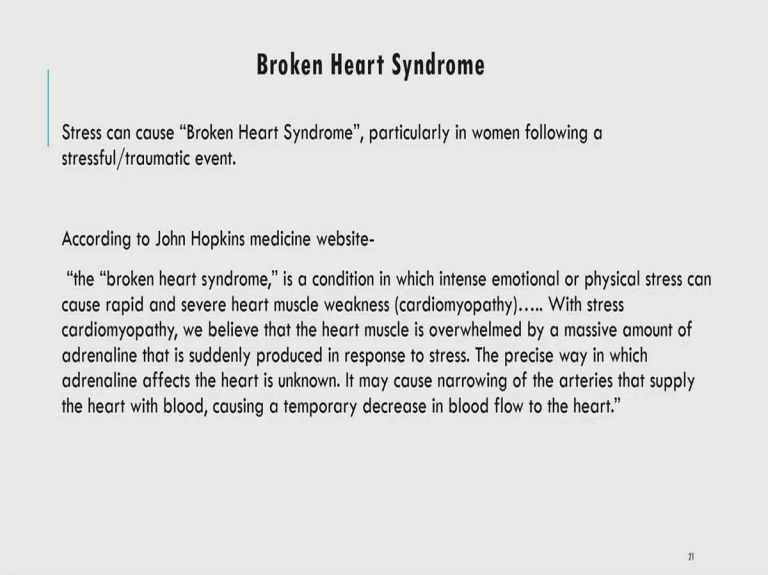

Broken heart syndrome is another symptom that is related to stress and heart failure. Stress can now lead to broken heart syndrome, which is more common in women after stressful or traumatic events. So, according to the John Hopkins Medicine website, broken heart syndrome is a disorder in which extreme emotional or physical stress may cause rapid and serious heart

muscle weakening. So, under stress, the heartbeats so quickly, particularly if it is a very traumatic, extremely stressful event; the pulse increases so fast that it weakens the heart muscle, which is technically called is cardiomyopathy. It is further reported that with cardiomyopathy, we believe that heart muscle is overwhelmed by a massive amount of adrenaline, release of adrenaline that is suddenly produced in response to stress. So, suddenly there is a high intensity of stress, and there is too much stress hormone and too much erratic movement in the heart, which can overwhelm the functioning of the heart. However, the precise way in which adrenaline affects the heart is unknown. But it may cause narrowing of the arteries that supply the heart with blood, causing a temporary decrease in the blood flow of the heart. So, it is possible that kind of shrinks arteries temporarily because of this erratic movement and the effect of causing symptoms of a heart attack.

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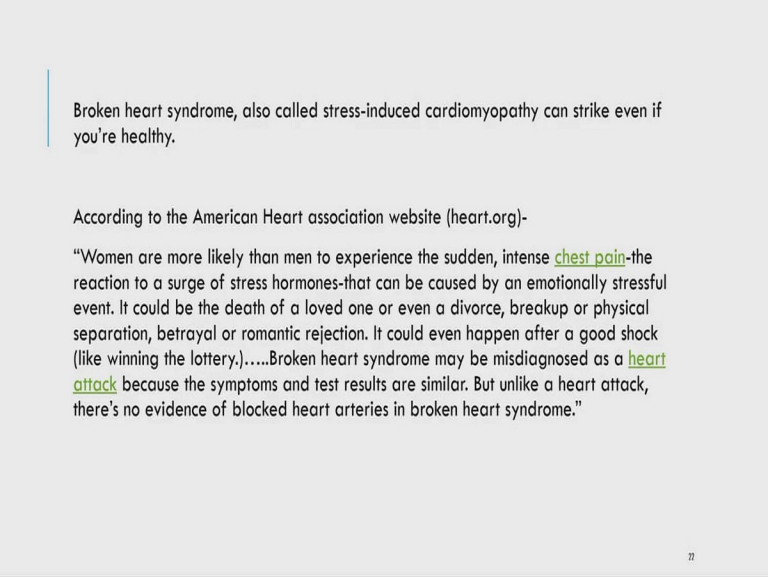

Broken heart symptom is a stress-induced symptom that can happen to a normal and healthy person. According to the American Heart Association website, women are more likely than men to experience sudden intense chest pain, which is basically a reaction to a sudden surge of stress hormones. It could be due to the death of a loved one's, suddenly you hear about such traumatic events or even a divorce, break up or physical separation, betrayal or romantic rejection. These

are some of the traumatic events, and in response to such events, broken heart syndrome can happen.

Sometimes it could even happen after a good shock, suddenly winning a lottery, so it can also overwhelm your physiological response. So, broken heart syndrome may be misdiagnosed as a heart attack. However, it is not exactly a heart attack. It's symptoms are very similar to heart attack, but heart attack happens primarily because of blockage of the artery. However, broken heart symptoms may not be connected with the blockage, but may happen suddenly. So, it can happen to a healthy person in response to a highly traumatic event.

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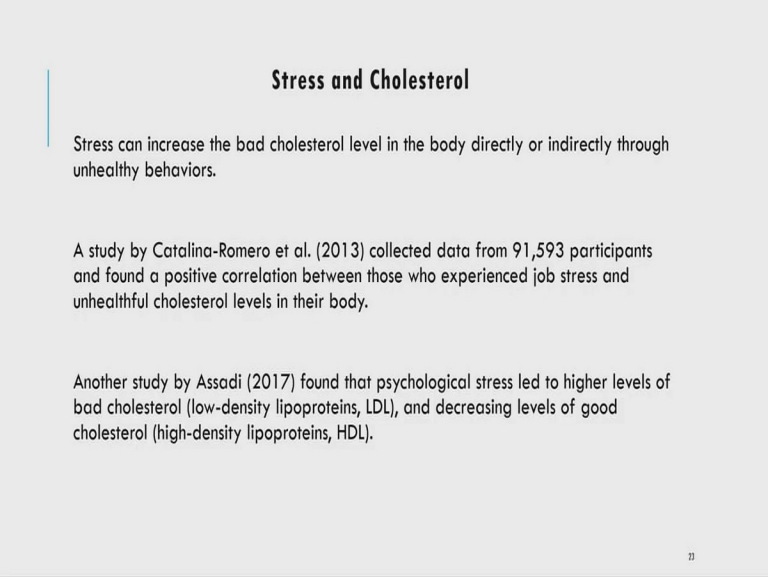

Now, another important connection between stress and heart diseases is the connection between stress and cholesterol. Stress can increase bad cholesterol. There are two types of cholesterol one called bad cholesterol, and another is called good cholesterol. Bad cholesterol is basically called LDL or low-density lipoproteins, and good cholesterols are called high-density lipoproteins or HDL. So, stress can increase the bad cholesterol level of the body directly or indirectly. Stress can directly stimulate the production of cholesterol in the body or indirectly through unhealthy behaviors, such as eating unhealthy foods. For example, a study by Catalina Romero and colleagues in 2013 collected data from more than 91,000 participants and found a positive correlation between those who experienced high job stress and bad cholesterol level in their body.

So, those who have experienced higher stress in their life, their blood cholesterol, particularly the bad cholesterol level in their blood, were much higher than those who experienced less stress. Another study by Assadi 2017 found that psychological stress can lead to higher levels of bad cholesterol, which are low-density lipoproteins, and a decrease in good cholesterol. So, it can functions in both ways by increasing bad cholesterol levels and decreasing good cholesterol levels.

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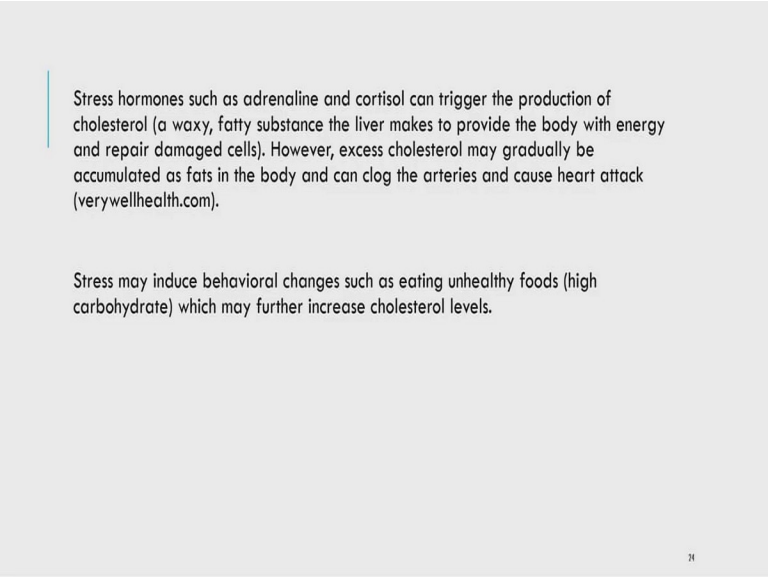

Now, stress hormones such as adrenaline and cortisol can trigger the production of cholesterol. Cholesterol is a waxy and fatty substance produced by the liver, and it is produced primarily to give you extra energy during stressful circumstances. However, when it is released too much because of excessive stress experiences, there may be excess cholesterol; and excess energy when not used may get accumulated in the body as fats. This excess cholesterol can clog the arteries or block the arteries and cause atherosclerosis and which ultimately may cause heart disease or heart attacks.

This is the direct mechanism and another way stress can induce various behavioral changes, particularly eating behaviors and eating unhealthy foods such as carbohydrates, which may further increase the cholesterol level in the body. So, through these mechanisms, stress can influence cholesterol levels in the body, particularly the bad cholesterol, which can then further lead to heart disease.

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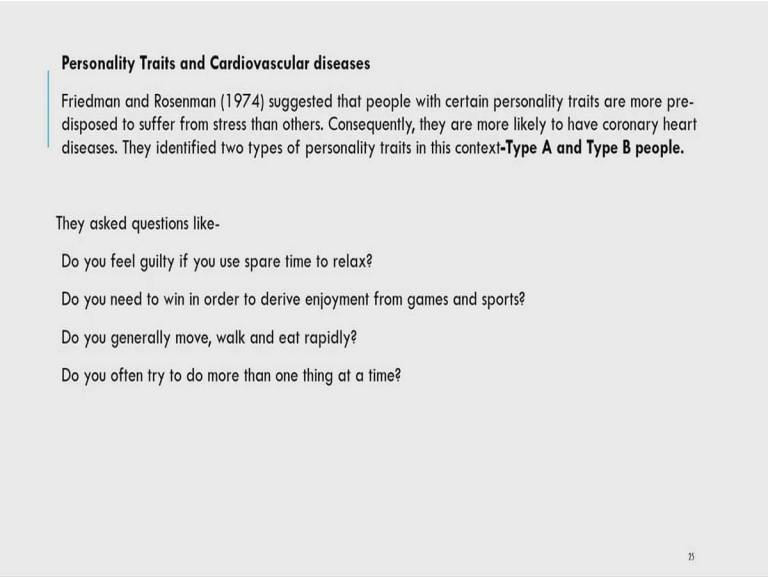

Another important connection between stress and heart diseases is through personality traits. Two researchers and heart doctors named Friedman and Rosenman in 1974 suggested that people with a certain personality, characteristics, or traits are more predisposed or more vulnerable to suffer from stress than other people. Consequently, they are more likely to have heart disease because they are more likely to experience stress in their life. In that context, they identified two personality traits called type A and type B traits. They assessed these two types of personality traits by asking simple questions such as, do you feel guilty if you use spare time to relax? Do you need to win in order to derive enjoyment from games and sports? Do you always need to win to derive enjoyment? Do you generally move, walk and eat rapidly? Do you often try to do more than one thing at a time? So these are some of the sample questions used by them to identify type A and B people.

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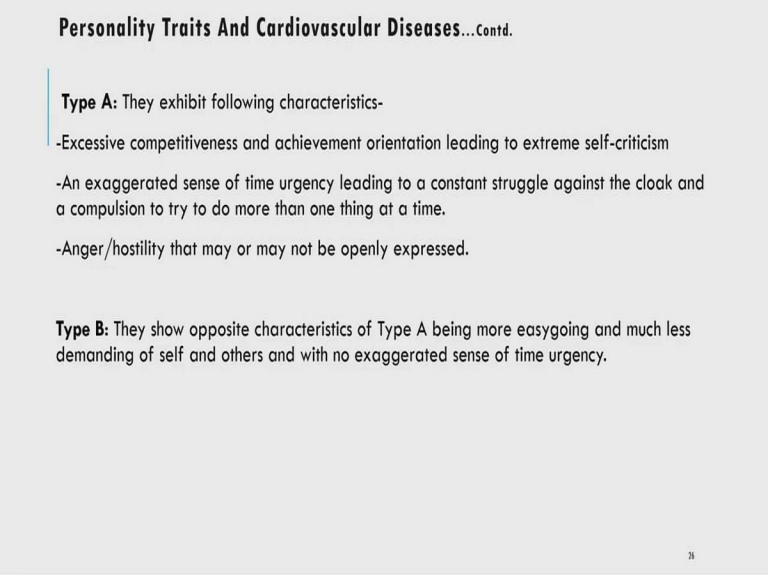

So, they discovered that type A people have excessive competitiveness and achievement orientation, which leads to extreme self-criticism. They also show an exaggerated sense of time urgency, which leads to constant struggle against the clock and the compulsion to do more than one thing at a time. Then the third factor is anger hostility that may or may not be openly expressed. These are the three essential or the prime characteristics of type A individuals. Type B people show opposite characteristics. They are very easygoing and much less demanding of themselves and others, and they do not have an exaggerated sense of time urgency.

So, type B people are more relaxed kinds of people. Type A people, because of their nature they are more likely to be stressed most of the time in their life. So, these are two different types of people. There is nothing wrong with being type A or type B. These are only different types of people with different psychological makeup.

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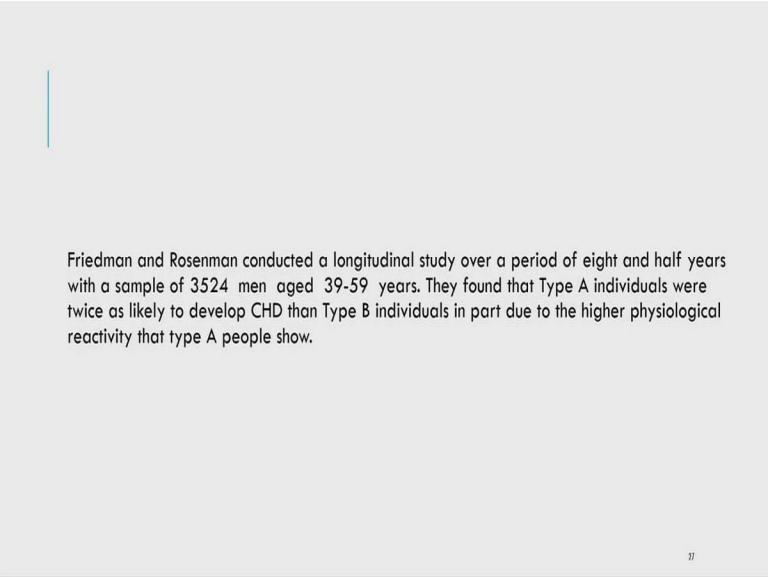

So, Freidman and Rosenman conducted a longitudinal study which basically means studying a group of people over a period of time. They studied for eight and half years with a sample of 3524 men who were aged between 39 to 59 years and they found that type A individuals were twice as likely to develop coronary heart disease, then type B individuals, primarily due to higher physiological reactivity of type A people then type B people. So, the type A characteristic makes these people more vulnerable to heart diseases primarily because of their frequent stress reactions and its associated physiological arousals. That does not mean type A people will automatically experience heart disease. It only means that they are more likely to experience heart diseases because they are more likely to experience stress, and we know stress can increase the chances of heart diseases.

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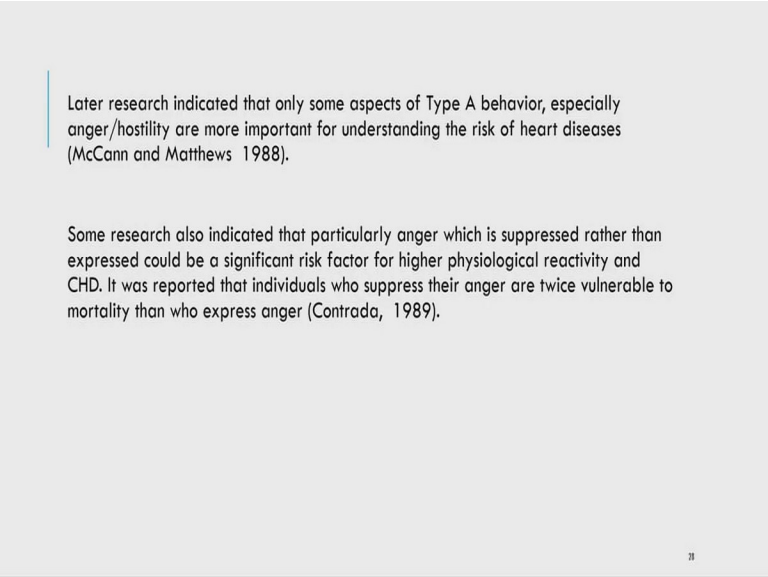

Later research indicated that only some aspects of type A behavior, particularly anger and hostility, are more important in understanding heart disease. So other aspects may not be that strongly connected to heart disease, but anger and hostility are particularly more strongly connected to heart diseases.

Some research also indicated that particularly anger, which is suppressed, is more significant in heart diseases. Some people suppress their anger more which may get accumulated in the physiological system. So, suppressed anger may be more significantly the risk factor for higher physiological reactivity and coronary heart disease. It was also reported that individuals who suppress their anger are twice vulnerable to mortality than the expressed anger. So, it is possible that not be all the characteristics of the type A people, but only some characteristics, particularly the anger and the suppressed anger, could be more important in terms of causing heart diseases.

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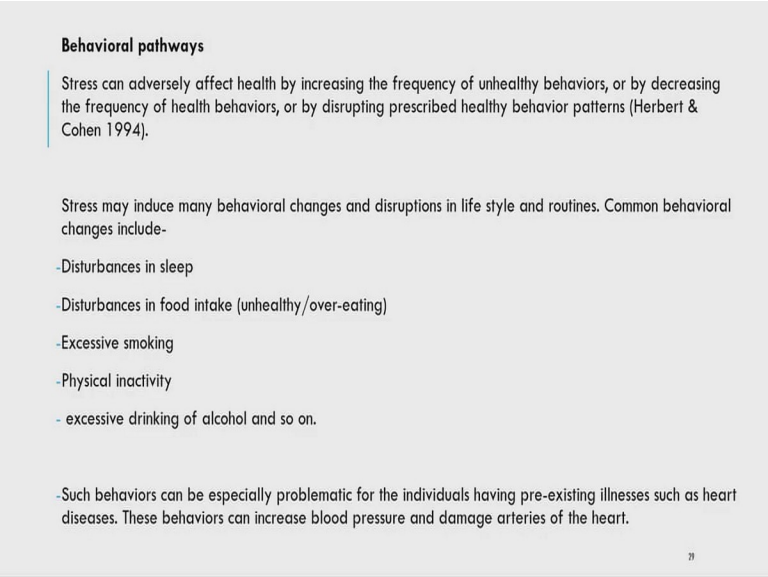

Now, the last thing that we will discuss is the behavioral pathways by which stress may cause non-infectious diseases. So, stress can adversely affect health by increasing the frequency of unhealthy behaviors. So, under stressful circumstances, people are more likely to behave or be involved in unhealthy behaviors, and healthy behaviors are likely to decrease or disrupt prescribed healthy behavior patterns.

So, under stressful circumstances, all these things can be disrupted. So, the frequency of unhealthy behavior may increase, frequency of healthy behavior may decrease, or healthy behavior patterns may be disrupted by stressful circumstances of life. All these may ultimately cause further complications in the physical diseases.

So, stress can cause a number of behavioral changes and disruptions in people's lives and habits, such as sleep disturbances, food intake disturbances or inappropriate food intake, overeating, excessive smoking or other addictive behaviours may increase, physical inactivity may increase, people may participate in excessive drinking of alcohol, and so on. So, all such behaviors are problematic, we all know and especially for people with pre-existing illnesses such as heart diseases, can further complicate the physical diseases and what is in those symptoms and also cause physical diseases. So, these are the behavioral pathways through which stress can influence non-infectious diseases.

So, the relationship between stress and health is very complex and there are many possible mechanisms. We tried to understand some of the major pathways by which the stress is connected to non-infectious diseases or non-communicable diseases. In the next lecture, we will talk about how stress is connected to infectious diseases specifically how it is linked to the immune system. So, with this, I end today's lecture. Thank you.