Advanced Cognitive Processes
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Lecture – 36
Cognitive Development

Hello and welcome to the course introduction to advanced cognitive processes. I am Doctor Ark Verma from IIT Kanpur and this is the final week of the 8 week course, and in this week I am going to talk to you about various aspects of development. So, what I was planning to do, covering this week over a various aspects of how particularly cognitive functions evolved and developed during the lifespan of an individual. What are the abilities that you were born with, when and how do these abilities develop into fully fledged cognitive functions.

Now, because I wanted to do that, I also thought it might be a good decision to cover other aspects of development as well. So, I will also be talking a little bit about very briefly biological development, emotional development and social development though the focus in a sense will be on cognitive development. Hence the title of the week, but we might, because we understand and that is the sense that you get is that. Cognitive development is actually very closely linked to so many other aspects of biological and other kinds of development as well.

So, before I kind of begin, talking about cognitive development, I will try and spend today's lecture in talking about some other aspects and some basic aspects of development and some basic questions that surround the notion of development, as far as you are talking about human being. So, let us begin. Now the field that kind of does this investigation into developmental spans is referred to as developmental psychology.

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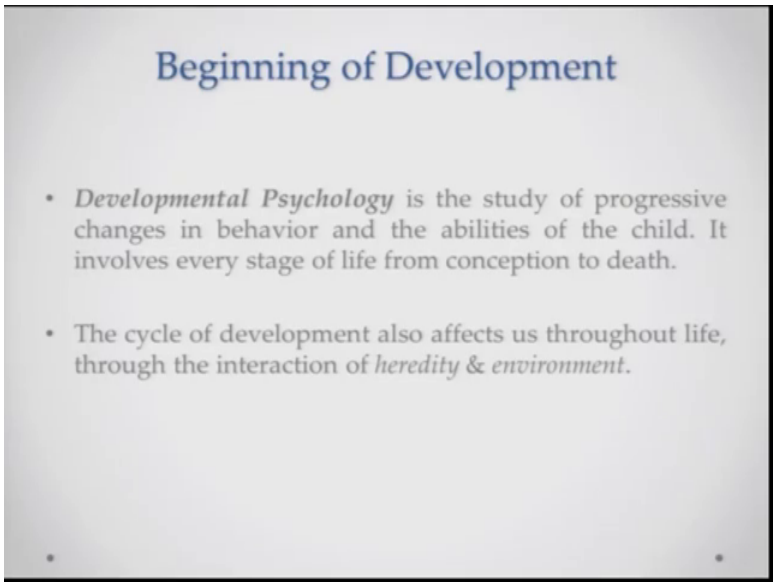

Now developmental psychology is the study of progressive changes in behavior and the abilities of a child. So, there are two things you have to understand here, when I am talking about abilities of the child, I am talking about physical abilities emotional, social, other kinds of abilities, what are the basic perceptual abilities, how well can he see here, how well can he put together two pieces of information, how does the he understand the social constructs, you know morals and you know theory of mind other kind of people and the development and sum total of all of these developments. All of these abilities that the child acquires through its lifespan, is what kind of reflects in the child's behavior.

So, developmental psychology parse tries to take into account both of these aspects in more in, you know in a kind of an unfolding way. So, it is like a story that is unfolding. In the first chapter you see that the child is you know just born with very limited perceptual capabilities as well. So, the child cannot see properly, the child you know does not really understand, concepts language is not there, but eventually all of these abilities start developing one over another and a lot of these developments are so much linked with each other.

During the course of this development is what you know you can also see that there are changes in the behavior of the child that are coming up. So, both of these things are very linked together and this is what basically forms the subject matter of what developmental

psychology does. It basically involves every stage from the conception of the child to the death of the child.

Now, this cycle of development, this is a slightly different issue the cycle of development, also you know kind of keeps affecting us throughout the life and there are two major factors that we will talk about shortly or the factors of heredity; that is the nature issue and environment that is the nurture part. So, very shortly I will just ask you to wholly about this topic for a minute. I will just come back to this after I have talked about who does developmental psychology.

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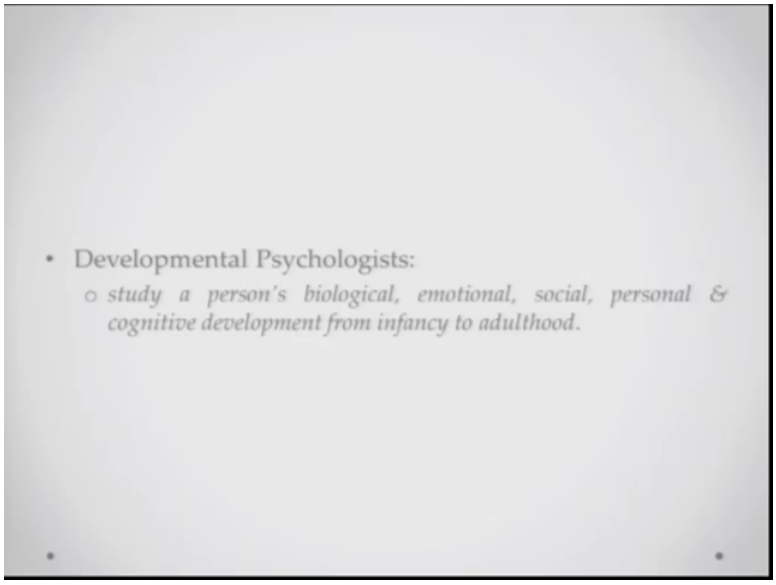

Developmental psychologists basically are the ones who are interested in the questions of development and they are the ones who study a person's biological, emotional, social, personal and cognitive development. So, that this is basically the 5 aspects of development, that we might talk about and this developing a spans from infancy from the time the child is born to adulthood and you know till the senile stages as well.

So, we talked about what developmental psychology is. We talked about developmental psychologists do, but then coming back to something I was referring to. In the last slide is one of the very important questions, one of the most important questions, actually that are asked when you talk about developmental patterns in human behavior.

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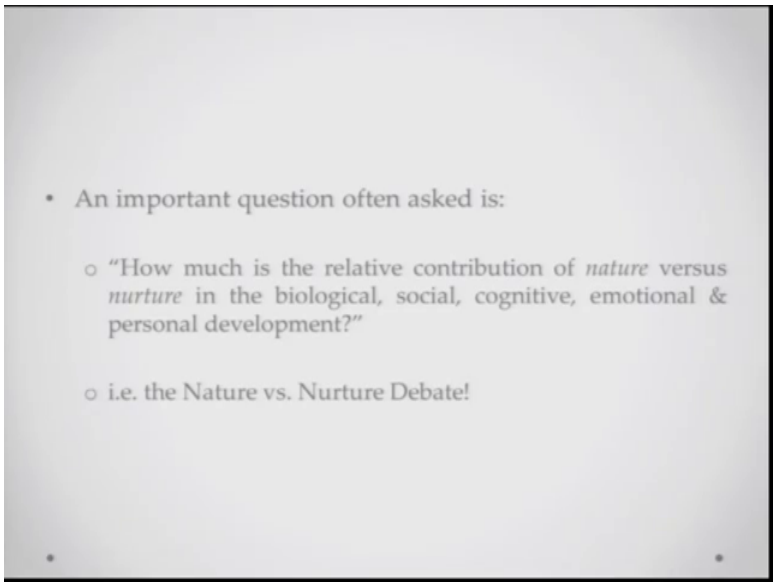

And when you talk about developmental patterns and how the abilities of the human being evolve, is the question about the relative contribution of nature; that is the biological makeup of the. And when I am talking about biological makeup, I can be talking at two levels, I can be talking at the fact that what is the biological makeup of the human being as a member of a particular species, the homo sapiens. What is it, what is the sum total of the evolution that this person has gone through over the last millions of years.

That is also a very important aspect of biological makeup. The fact that we do not have tails, is basically not you know in somebody's personal biological history, but that is basically you know the history of the biological history of the entire species. So, we can talk about when you are talking about nature, we can talk about those effects species level effects as well. Other kinds of effects that we would talk about, when you are talking about individuals in question, then you could talk about things like their genetic makeup ok. I will talk about some of these aspects in the lecture later as well, but then when you are talking about the personal aspects of the nature question, you are talking about genetic makeup.

You know what are the environments, what is, you know what kind of genes the parents of the person had, what were you know the environment, how did they bring this person up, whether those genes manifested or not, how much of the persons behavior can be

actually you know explained back to the kind of genetic makeup that this person would have had and again biology is a very you know is a very prominent factor in explaining somebody's behavior, it is a prominent you know reason about why a person, why people behave in the ways they do.

So, this is the nature part of the question and then you come to the next part. The next part is the nurture part, what is the nurture part. Now the nurture part again, it can be looked at variously, you can talk about microcosms, you can talk about say for example, what kind of nutrition the child is getting, what are the parents you know, how are the parents bringing up the child.

you can talk about say for example, how was the child interacting with the environment, what are the things he is getting encouraged for, what are the things he is getting you know a scolded for. So, that he does not really do it and then there are slightly larger questions, you know you taught you go above just the immediate family to the larger family, you know relatives and friends and those people and then you can actually look at the society at large.

So, when I am talking to you about and you will discover their various things, you know during the course of this week about this nature versus nurture debate, I would actually appreciate if you could actually, you know try and pin the development of various abilities to nature and nurture, and I am sure what you might get at the end of it, is the fact that both of these questions, both of these aspects of development, both of these you know major factors that attempt to explain human development kind of work together.

And I will not really spill all the beans in, in the first lecture itself, but that is pretty much the sense I get, when I am kind of you know looking at this vast developmental data and that is pretty much what I would also appreciate you doing. So, multiple perspectives, I mean just kind of for a minute going to the background of this question, multiple perspectives have been proposed to tackle this nature and nurture debate.

It starts long back as the 70th century, 70th century philosopher John Locke, he rejected the notion that babies are miniature adults, you know I mean earlier people might think or people used to think that babies are just miniature forms of adults, just that they are smaller and just that they have less abilities in terms of talking and other things, but

typically there will be mental functioning, there will be cognitive functioning, exactly the same as adults.

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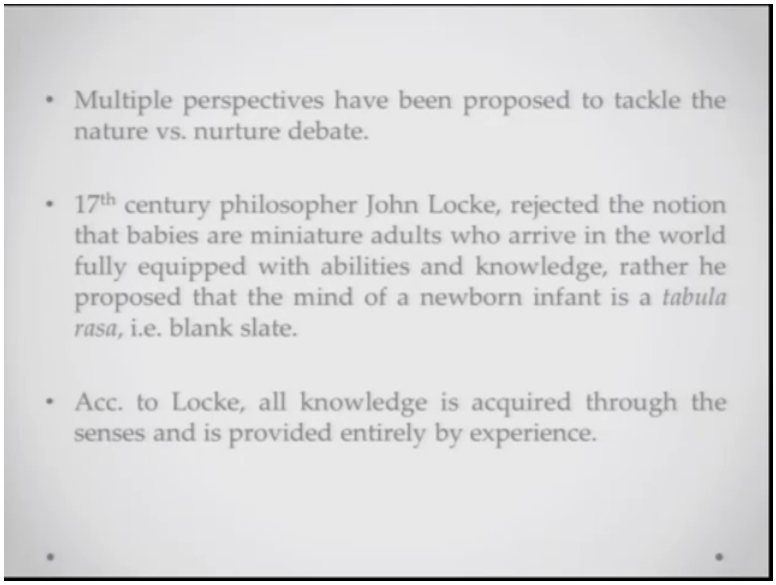

Now, this is something that John Locke kind of rejected and he said, that it is a very probable that the mind of a newborn infant is like a blank slate. So, he does not really assume anything that the child already brings him, you know brings with himself or herself. According to John Locke all knowledge is acquired through the senses and its provided entirely by experiences.

So, the child when he comes into this world does not really have a lot of you know knowledge or attitudes or preferences and those kind of things, but the child interacts with the environment using the 5 senses and then the child basically learns by hit and trial by experience. Suppose the child wants to you get you want to get a cup of milk to the child and you know that milk is hot the tile will touch it in the first part.

But then quickly realize that this is, you know this is hot and probably I should you know not touch this at the moment, next time you bring a cup the child has already learned that ok, the liquid inside may be hot. So, I will not touch it, I will kind of wait till somebody introduces me to it. So, these are these are the kind of questions that have been asked and a very extreme version I have talked about this in much detail.

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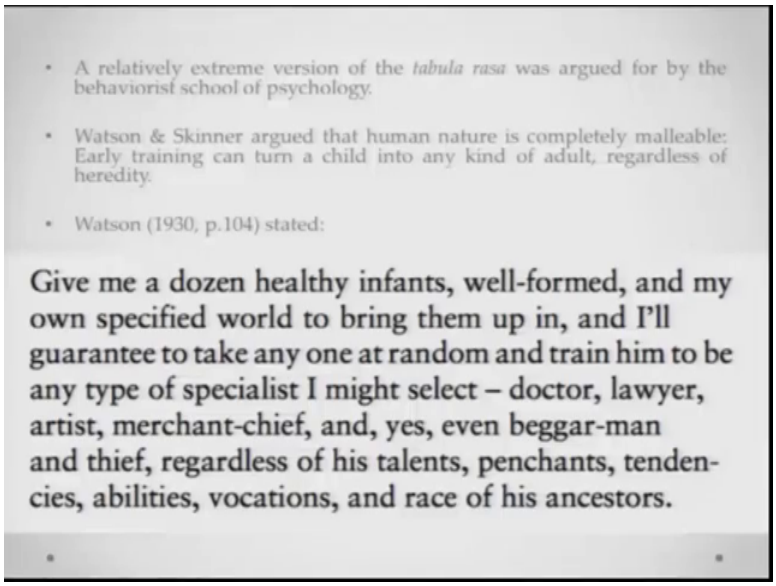

When I have talked about you know history of cognitive psychology in the earlier course now. So, a slightly more you know slightly more extreme version of the tabula rasa concept was argued for, by the behaviorist a school of psychology you know, you could remember John Watson and BF Skinner and some others Edward Thorndike for that matter. Now Watson and skinner argued that human nature is completely malleable, you can kind of you know get people to do whatever they want, if you are just manipulating the rewards and consequences, the rewards and punishments.

Now, early training; so what they believed was that early training can turn a child into any kind of adult, regardless of heredity. So, they are kind of these people are giving a lot of importance on the nurture part and not really so much on the nature part. They would assume that given the correct kind of training and I will just kind of demonstrate this with a quote that you know Watson famously said.

So, Watson says give me a dozen healthy infants well formed and my own specified world to bring them up in, and I will guarantee you know anyone at a to take any one at random and train him to be any kind of specialist that I might want him to be. So, you could make them doctors, lawyers, merchants, chief etcetera and even yes, you know even beggars or you know thieves or you know regardless of the talents, the tendencies, abilities, vocations and race of the ancestors.

So, what Watson is trying to say is that given the right kind of conditions, given that you can manipulate the condition that somebody is being brought up in, you can kind of you know get whatever effect out of the you know individual, you can mold the individuals to be whatever they are. And the idea is, the philosophy behind this is that people are some, adjust the sum and total of what their environment wants him to be.

So, given any kind of, you know in given any kind of environment, the persons behavior or what the person turns out to become, is just as a consequence of that environment. So, there is something which you know Watson has said. Now, there is another theory, I was talking about the nature part, I was talking about the species history.

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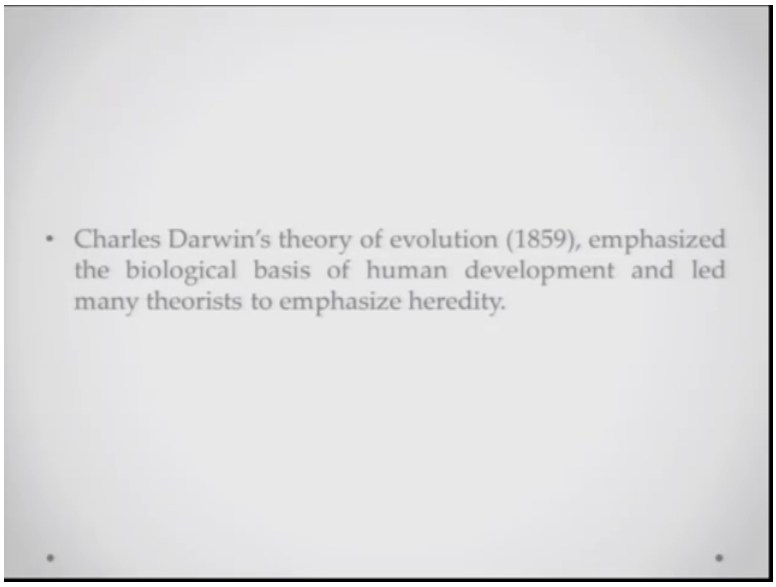

So, Charles Darwin you know the, he is given the famous theory of evolution 1859 the origin of species. So, Charles Darwin emphasizes in that book, and very many other places the biological basis of human development and kind of you know its triggered a lot of others here is to start looking more seriously at heredity and the biological factors that make up individuals. So, these are the two, you know these are the two basic concepts.

These are how they weigh against each other and during the course of this chapter what you will realize is, you know how, what is the relative contribution of each of these things. Now, let us go a little bit more into detail about the biological evolution part.

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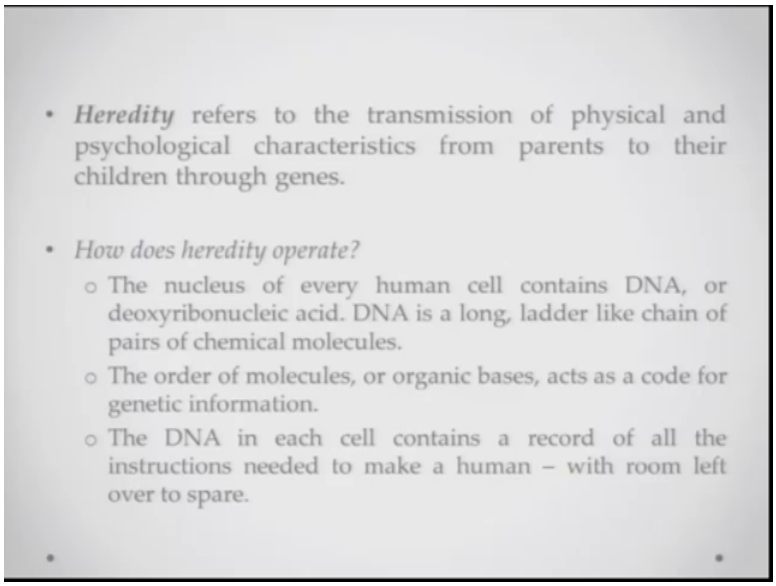

So, heredity; heredity basically refers to the transmission of physical and psychological characteristics from parents to their children through genes. So, I will talk about what genes also. There are two things; physical characteristic, how tall you are going to be, what is the color of your hair, eyes, what is the shape of your ears, those kinds of things. And also psychological characteristics, if you are you know generally a happy person; if you are generally you know angry kind of a person.

A lot of times you will see people making these kinds of comparisons you know my son has a temper which kind of you know resembles my temper and those kinds of things. So, heredity is kind of trying to include both of these things physical characteristics and psychological characteristics and this is happening through genes. Let me come, let me elaborate what genes are. So, I will just take a bit around that.

Now, how does heredity operate? The nucleus of every human cell contains what is called the DNA or the full form is deoxyribonucleic acid. Now DNA is basically a long ladder like chain of chemical molecules. The order of these molecules or the organic bases basically acts as a code of genetic information. I am sure you must have seen this helix like figure of the DNA and everywhere else and you will see that these sequences or these components are at (Refer Time: 13:51) like that, and the sequence of these particular molecules kind of encodes in itself, the particular information that the gene is

supposed to or that is the DNA supposed to transmit from one, you know in a one generation to the other.

Now, the DNA basically is, in each cell contains a record of all the instructions that are needed to make a human being and there is; obviously, much more room left to spare. So, the idea is, all the physical characteristics, how from the conception the combination of the genes from the mother and the parent are combined and what kind of individual biologically will be formed, is also coded into genes, what kind of individual psychologically will be formed is also coded into these genes.

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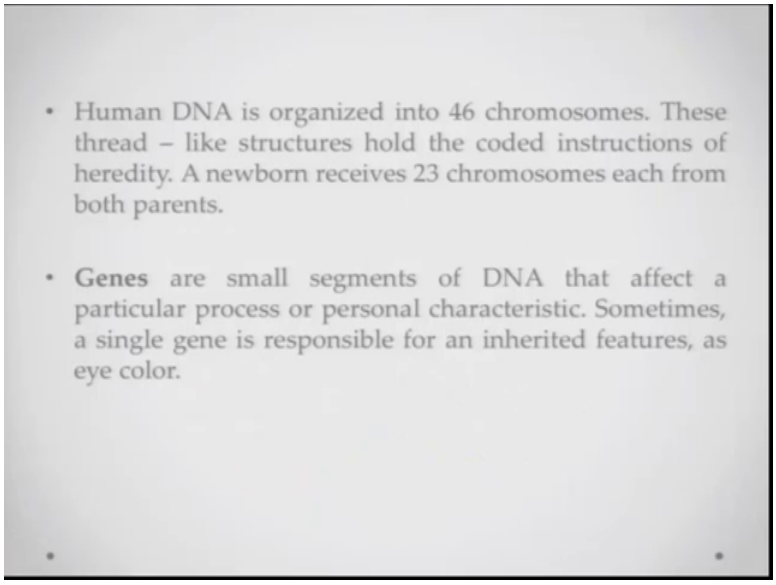

So, human DNA has like 46 chromosomes. These are basically 23 pairs of chromosomes, and new, newborn basically receives 23 chromosomes from the mother, 23 chromosomes from the father and that is why he get around 46 chromosomes. Now, coming to what genes are. Genes are a really small segments of DNA that affect a particular process or a personal characteristics. Suppose for example, you can talk about the color of the eye, or you can say for example, talk about the psychological characteristic for that matter.

We will at some point I could refer to; so there is this you know psychological disorder, which is called schizophrenia. Schizophrenia basically the symptoms are largely behavioral, the there are biological underpinnings for that kind of disease. We will we will talk about these things in a bit more detail as we move ahead.

Now, sometimes there could be a single gene that is responsible for you know inherited features. For example, eye color. So, there is a single gene that governs what kind of eye, color of eyes you are going to have however there. So however, there could be many other characteristics which basically are polygenic. So, many genes combine to kind of give you those characteristics, I will come to that in a bit.

Now, genes basically how do they manifest. So, genes could be dominant genes or recessive genes. A dominant gene is one that every time it kind of features, it kind, every time it appears, the features that it controls will be present every time. So, for example, and that is one, so that is a dominant gene and then there is a recessive gene. Recessive gene basically that is one that must be paired with the second recessive gene before its effect will be expressed.

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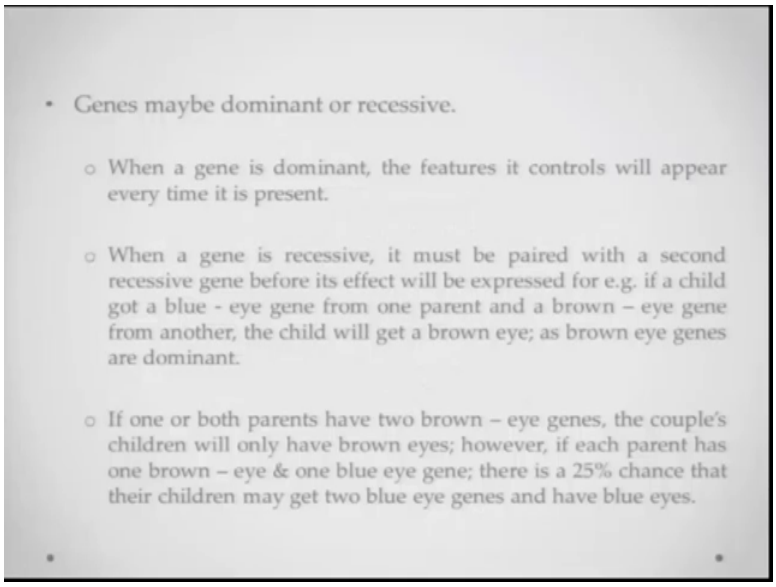

For example if the child gets one blue eyed one blue eyed gene and one brown eyed gene from both parents and you know he has one blue one brown eyed gene, the child will always end up getting the brown colored eyes, because the brown color of eyes is basically. The brown eyed gene is basically the dominant gene. So, it will express itself every time it is present in the genetic makeup of somebody.

Now, if one or both parents have brown eyes, the couple children will only have brown eyes, because they are apparently only brown eyed genes. Now if each parent has one brown and one blue eyes ok. So, then what is the child getting. The child is getting

basically probably you know one blue eye one, one blue eye gene, one brown eye gene and permutation of that. There is therefore, a 25 percent chance that the child gets both blue eyed genes and ends up having eyes of blue color ok. So, that is how this dominant and recessive aspect of genes work.

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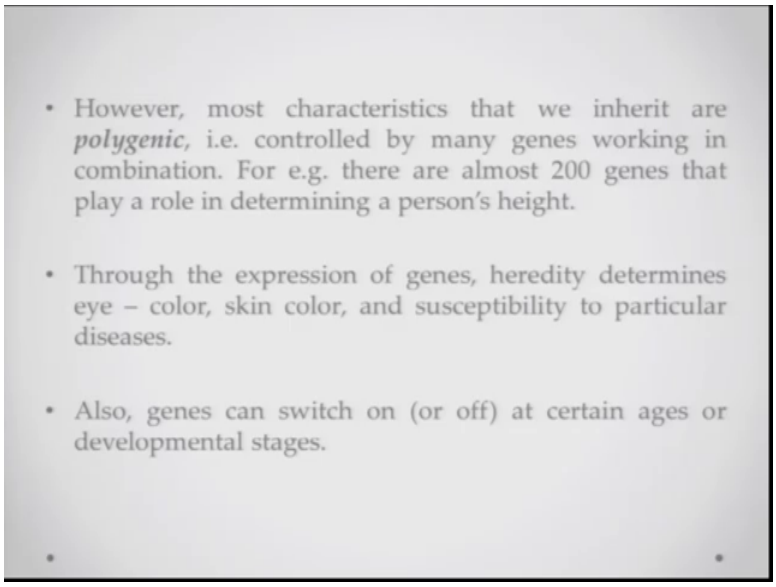

Now, as I was saying, most characteristics; however, that we inherit are polygenic, and they are controlled by many genes in combination. For example, there are almost 200 genes that play a role in determining a person's height. Now through the expression of genes, heredity kind of determines your physical characteristics; like eye color, skin color, and susceptibility to particular diseases. Also genes can switch on or switch off. What is switch on or switch off mean.

It basically says that this is a chronological instruction. So, at particular time the gene might manifest itself, at a later age the gene might not be able to manifest itself. So, these are some informations about how the gene thing works. Now, there is some other concept that I would like you to know.

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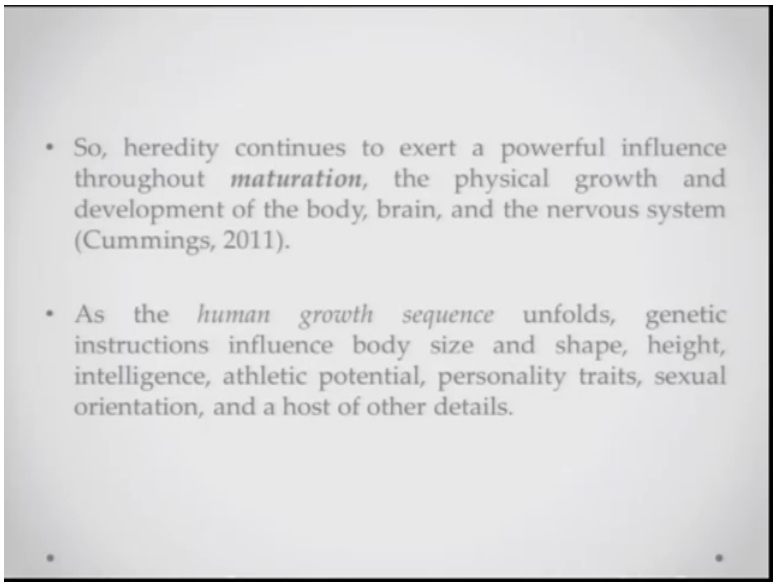

Heredity continues to exert a powerful influence throughout the maturation of the individual; that is the physical growth; however, the organs coming up; however, the different ability is happening, happening, which are basically tied to both the development of the body, the development of the brain and the nervous system. So, I am talking about from the time that a child is born, till the time that a child kind of matures completely. The physical maturation goals are complete, the psychological maturation goals are complete, the nervous system is completely developed.

Now, as the human growth sequence ; that is encoded in the DNA as it unfolds genetic instructions influence the body characteristics; like size and shape, height intelligence, athletic potential, personality traits somehow a sexual orientation and a host of other details. So, given that the child inherits these you know 23 pairs of chromosomes from both their pay, from combined from both their parents the chromosomes have genes they have a DNA structure; that is what kind of you know will unfold with time as the child is growing up.

Obviously, with the interaction with nutrition and environment; that is what will lead to kind of determine, the different aspects of the different ways in which you know on the physical characteristics and psychological characteristics will develop. Now, one of the important factors have just referring to in all of this, all of these genes you know governing how you are kind of going to become, is the environment.

The environment basically refers to the sum of all external conditions that affect a person. Or external conditions are everything that is outside the individual; so for example, the kind of food that the person is eating or the kind of instruction that a person is getting and those kinds of things. Now, individuals, so you can, you should think of the human brain as a very active organ, it is not really a passive organ that is sitting and just receiving all the you know inputs that we that you are getting.

So, this brain interacts with the environment in various ways. Suppose for example, I will, I will just tell you that the new born brain has a very few dendrites and it has, it makes very less synapses than an adult brain. So, if I tell you what the, what a neuron is, the structure of neuron is that it has a cell body there are dendrites which are branching structures and there is an axon which kind of release the signal.

Now, the number of dendrites basically kind of tell you how many branches, how many connections that is neurons of made, and then you can talk about synapses that are basically, you know connections that the two cells are making.

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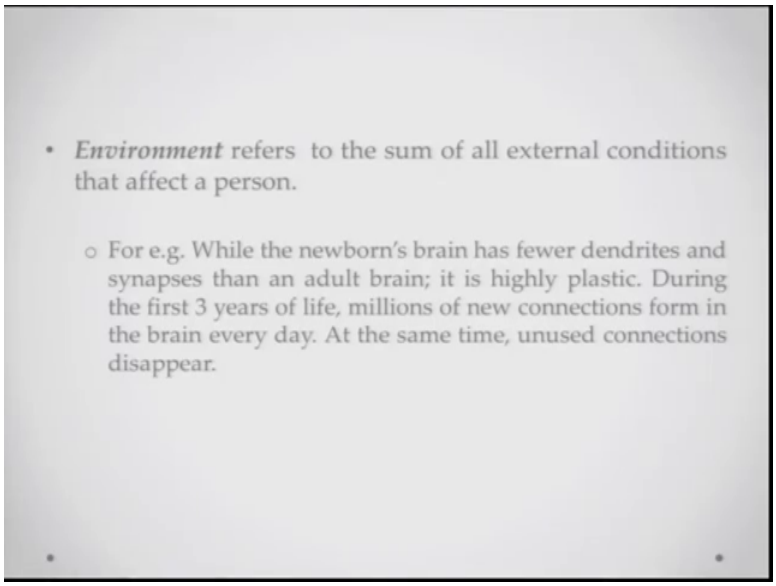

Now, when the child is born there are very few dendrites and very few connections that these cells have made. As the child grows during the first 3 years of life millions of new connections are getting formed in the brain every day. How these connections being formed? These connections are being formed in response to whatever the child is learning how, whatever he is experiencing, how is he interacting with the environment.

At the same time as the child grows up, a lot of unused connections kind of disappeared. So, a lot of things that a child is not really done, is not really interacted, is not really grasped that kind of information, those redundant connections kind of get away, they are not there anymore. Now, during this interaction between heredity and environment and this interaction kind of starts very early; so we will talk a little bit about prenatal influences.

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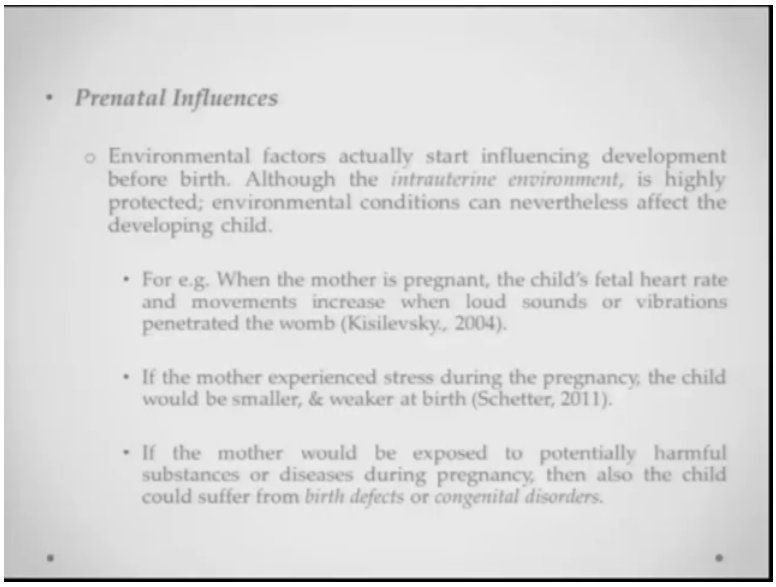

What a prenatal influences. Prenatal influences are that you know things that are happening with the child, even before the child is born. So, as I said developmental psychology, actually starts from the conception. The initial parts; obviously, are more in the purview of biology, neurobiology, what I am kind of just trying to give you a brief glimpse of them here.

So, environmental factors, as I was saying, they actually start influencing the development even before birth ok. Although the intrauterine environment you know where the child is the mother's womb is highly protected, environmental conditions can still affect the developing child. Let us take some examples now for example, when the mother is pregnant and the child's fetal heart rate you know when the mother is pregnant, the child's fetal heart rate and movements can increase and do increase very often, whenever there is a loud sound or vibrations you know around the around the mother.

suppose for example, that is one of the reasons why pregnant woman would you know like to avoid going to very crowded places or places where there is high, no its because its thought that the child is not really, is not perceiving those things and reacting to those things. So, even though the environment is kind of, insulated in some sense, it cannot stop things like you know sound and other things I will refer to very shortly in reaching the child.

Another very interesting thing is that if the child, if the mother is experiencing, a lot of stress, a lot of tension during the pregnancy, the child you know these this kind of affects the child's growth both physical and psychological very adversely. So, mothers whose found, who have been found to be you know tense and highly you know in depressed for example, during their pregnancy, the children turn out to be much smaller and weaker at birth.

So, they are not only their physical development is affected and there are also studies that tell you, that tell you the fact that, this is a children this is a children's psychological, development you know development in terms of intelligence and other things, is also very severely affected. Another example could be a say for example, if a mother is exposed to potentially harmful substances or say for example, diseases during the pregnancy, then also the child could suffer from things like you know birth defects or congenital disorders.

Birth defects are basically when the child is born with particular anomalies and congenital disorders are may be the physical things are ok, but there is a particular disorder that the child you know is born with. I will refer to some of those kinds of things now.

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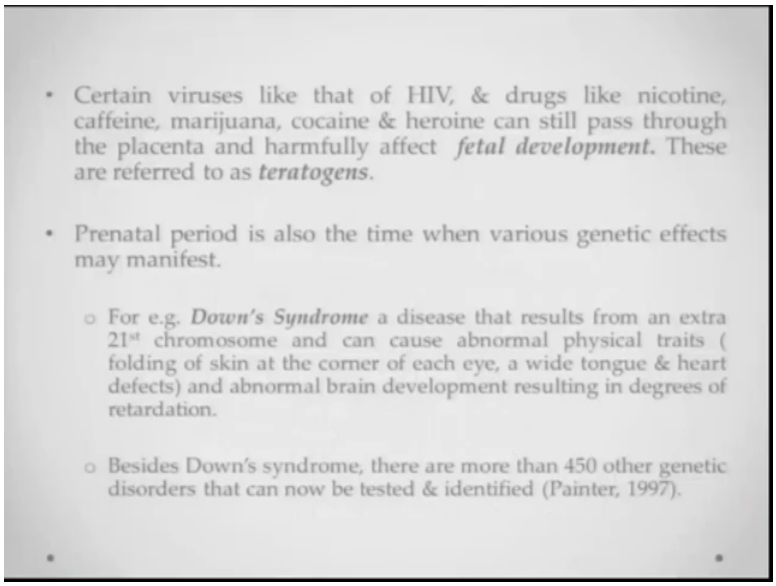

Now, certain viruses like that of the, you know the human immune virus, the aids virus that is and drugs like for example, nicotine, caffeine, Mariana, cocaine and heroine can still pass through the placenta and harmfully affects the fetal development. It can cause disastrous effects for the developing child. So, you might kind of remember that pregnant women are advice very heavily against using a lot of you know caffeine, using a using any kinds of drugs for that matter, any kind of alcohol for that matter.

Now, these agents which can actually still penetrate you know the mother's womb and they can still affect the child's development are referred to as Teratogens. So, Teratogens are object and they are substances that can harm the healthy development of the child. Now, this period, this prenatal period is also a time, where various genitive effects might you know show up the various genetic effects, might manifest.

For example, there is this disease called Down's syndrome, and I am sure you might have heard of down syndrome somewhere. This is a down syndrome is basically a disease that results from an extra 20 first chromosome and can cause you know physical anomalies. It can cause abnormal physical traits. Some of the abnormality is a physical anomalies that can be manifested things; like there are folding of the skin at the corner of each eye, where the tongue is much wider than normal and there are you know defects with respect to how the heart is, you know supposed to function.

Also Down syndrome has a severe effects on the development of the brain and which basically you know this abnormal development of the brain, because of this extra chromosome can result in various degrees of mental retardation as well. So, again these are genetic effects, these are you know congenital disorders that the child might be born or born with. And Down syndrome is not the only disorder, it is not the only you know congenital disorders or genetic disorders that a child might be born with.

There are almost around 450 different kinds of genetic disorders that are now you know can be tested and identified even during the, you know the person is pregnant, even during the mother is pregnant. So, these are some of the ways and I was just trying to kind of tell you. These are some of the ways that can you know affect a child's physical and its psychological development, even before the child is really come into the world.

You know even before the child is born these are some of the things biologically that might you know create problems for the child. I will just talked about some of more you know evidence is some of the most studies about these things. Now, researchers have reported that you know females women who are pregnant, women who have admitted using cocaine and other combinations of drugs like alcohol or marijuana or other kinds of opiates, have a high risk of having infants, which will have lower birth rate.

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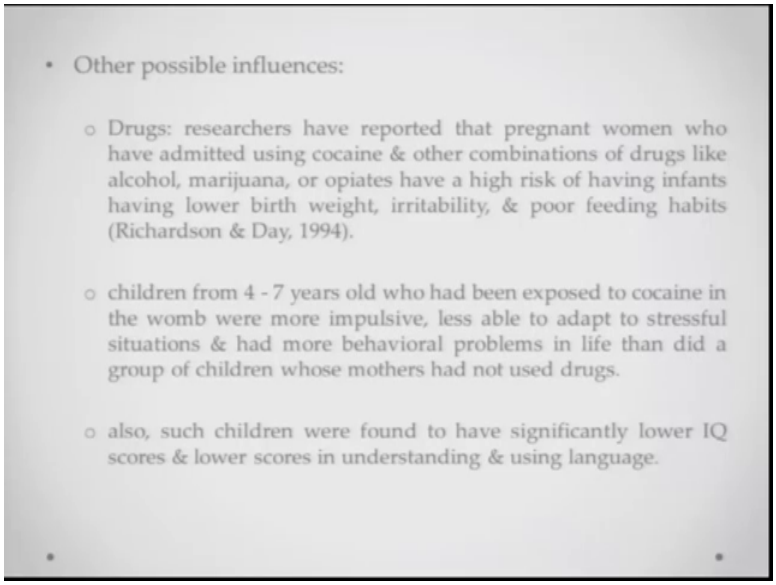

They will have a lot of irritability, they will be very difficult children to really you know bring up and also poor feeding habits, which will anyways leads to you know the child

being weaker and you know the development not being normal. So, that is one of the things. Children from about 4 to 7 years old who had been exposed to cocaine, vial they were in their mother's womb were found to be more impulsive, they were found to be less able to adapt to stressful situations and they were also had a lot more behavioral problems in life, than did children you know than did children from a group of mothers who had not used drugs during their pregnancy.

So, for example, you know there are things that can decide how the development will turn out even before the person is born. So, there is no, you know there is nothing that the child can do about this. This is something that has biologically pre specified the course of development. So, this is one of the things that I would want to specify that the biological factors that we will talk about and that we are talking about at the moment as well have a very important role to play. You can talk about the effects of nurture once the child is you know born in the world.

Let us say with a you know or with a all right nutrition with every all the vitals being healthy, all the development of organs being healthy, but then if you talk about these kind of effects, the effects of Teratogen. So, the effects of genetic disorders, this is where you are saying that even before the child is born, even before there is nurture to interact with, the child is already, the behavior of the child or there are things that are already pre specified.

Because of these kind of seems. So, such children 4 to 7 years old children, whose mothers had admitted to using you know different kinds of drugs, when they were pregnant have also been found to have significantly lower IQs and lower scores and understanding and using language, so overall. So, these kind of things are having overall impacts on peoples development.

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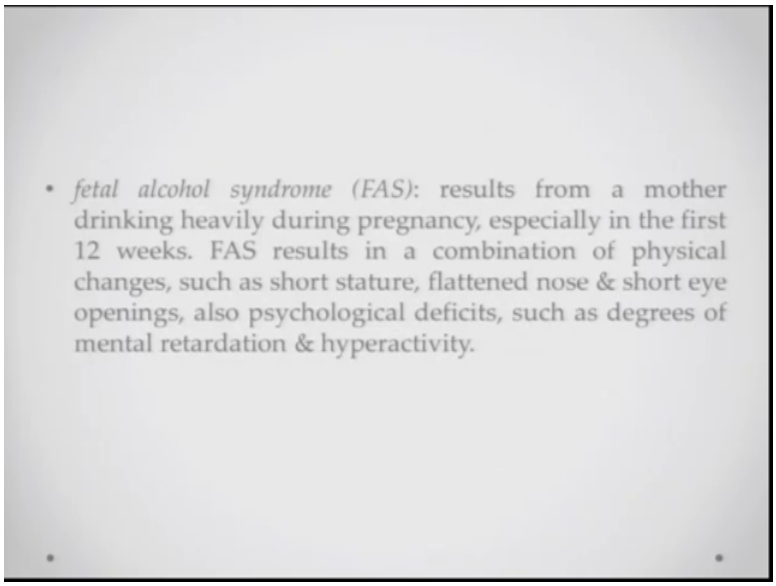

One of the major diseases that people have identified, is basically something called the fetal alcohol syndrome. The fetal alcohol syndrome results from a mother drinking heavily during pregnancy, especially in the first 12 weeks. Now the fetal alcohol syndrome basically results in a combination of physical changes and their physical changes include things like shorter stature, flattened nose and short eye openings.

It also kind of brings itself brings with itself psychological deficits as degrees of you know mental retardation, hyperactivity etcetera. So, fetal alcohol syndrome is basically a direct consequences of mother drinking heavily during pregnancy, especially in the first few weeks, because that is the time when that when the child or when the fetus is most susceptible to you know drug influences and these make these kinds of things.

Now, there are some other concepts that I would like to kind of you know prime you with, with respect to how the biological development or the, how the you know how the biological development kind of pans out. Now you can talk about readiness.

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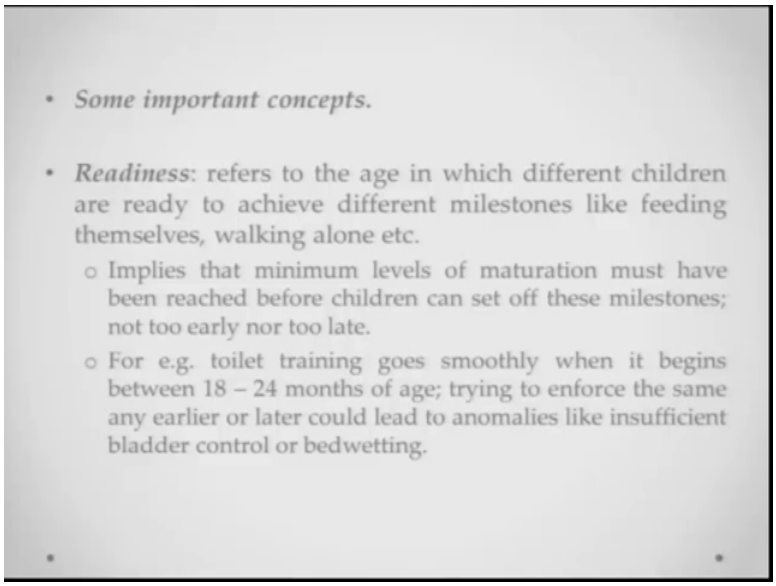

Readiness basically refers to the age in which children are ready to achieve different kinds of milestones, you know like feeding themselves, walking alone, starting to speak, starting to understand you know particular different concepts. So, this basically the readiness of the individual, the readiness of the child implies the minimum levels of maturation physical and psychological that the child must have reached before the children can you know set off to achieve these different milestones.

You might say for example, if you were ever around you know anxious parents, if you are ever around you know new parents who have just had a kid. They are generally slightly you know anticipated, slightly apprehensive about how the development of the child is panning out and one of the ways that doctors kind of counseled them, with is to try and you know try and tell them to keep track of these developmental milestones.

If is the if the child is like 3 months old whether the child does these activities, in the child is 6 months or 9 months or 12 months old what are the kind of activities that the child does, and this is typically how the doctors kind of keep track of a healthy development of the child. I will give you one example; for example, toilet training, goes smoothly when it kind of begins around 18 to 24 months of age, and they could be; obviously, a plus minus a few months month here or month there, but if say for example, over anxious parents are trying to enforce the same any earlier or even any later for that matter.

This could lead to particular kinds of anomalies you know, insufficient blood control or bedwetting, because the child is not really being trained to control it in you know when they are trying to do toilet training much later or insufficient or you know other kind of things.

I can actually I will talk about this at some later point Sigmund Freud for that matter, actually played a special place a special emphasis on toilet training and said that you know, it is one of the things that kind of defines how the child is going to you know pan out in the rest of his life again, that was kind of a you know a longshot, but it is something that is very important that parents do not try you know, do not force the child to overachieve or underachieve with respect to these developmental milestones.

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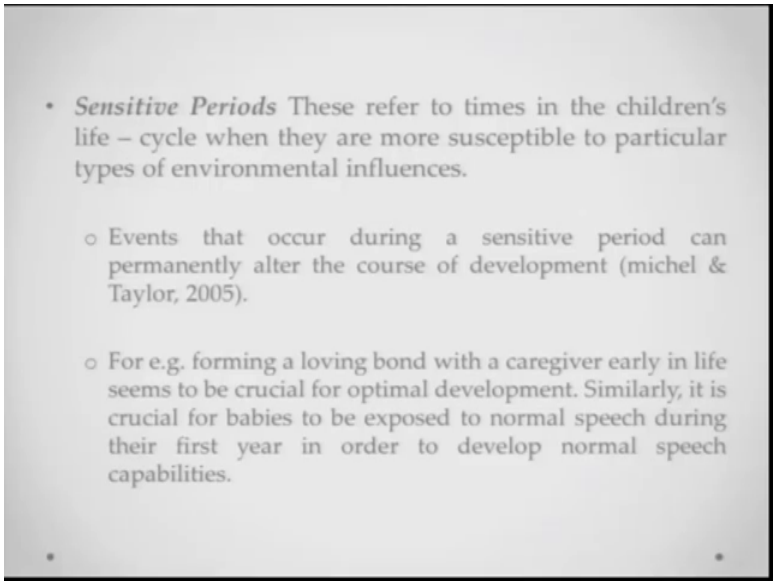

Now, another important aspect that I could talk to you about is, the sensitive periods. Sensitive periods basically refer to times in the children's life cycle in their lives, when they are more susceptible to particular types of environmental influences. Against that occur during a sensitive period can permanently alter the course of development. For example, the very important aspect of forming a lover a loving bond with a caregiver early in life, is supposed to be very crucial for the optimal development, you know psychological emotional development of the child.

Similarly, it is also very crucial for babies to be exposed to normal speech during the first year, in order to be able to develop you know normal speech capabilities. If you

remember I have talked to you about this in much detail when we were doing you know the acquisition of language, there was an entire I think a couple of lectures that I have talked to you about these things.

So, this is the concept of critical period, you know if the child is not received human speech during the first one year one and a half years of life, they will not be able to acquire the phonological characteristics and then language eventually. Other concepts I can talk to you about is deprivation and enrichment.

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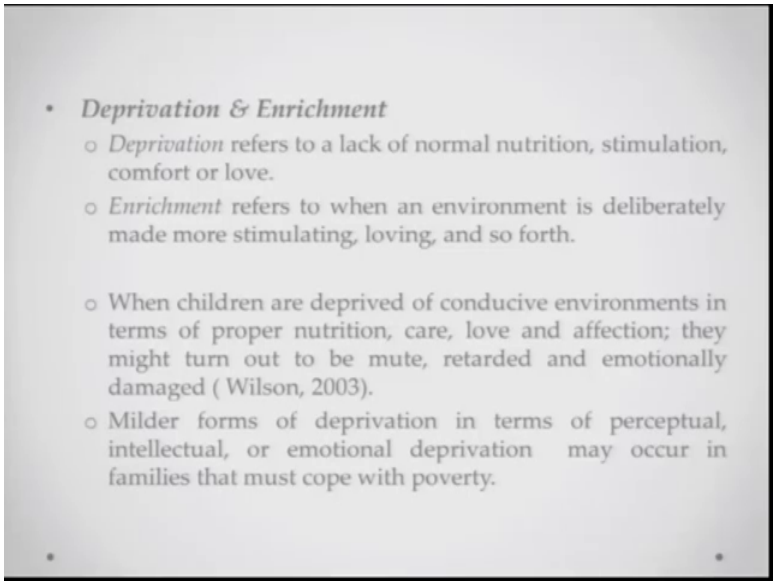

Now what can happen is, that the child's might suffer a lack of this normal nutrition, normal stimulation, comfort or love during those sensitive periods and that can have adverse consequences for the child's healthy development. Or the there is this concept of enrichment when an environment is deliberately made more stimulating, loving and caring, helping the child to develop in a proper way to achieve those milestones at proper times time spans and those kind of things and both of these things are possibly, both of these things can happen with you know when children are growing up.

Say for example, and these things have consequences. So, when children are deprived of conducive environments in terms of proper nutrition, care in love and affection, they might turn out to be mute, retarded and emotionally damaged. So, it is a very important it is a highly challenging and it is a highly important that the right kind of stimulation be provided to the child, the best kind of nutrition we provided to the child. And also the

you know the kind of social environment the caring love affection, that the child needs during its formative years.

Another aspect milder forms of deprivation, not really something as versus this milder forms of deprivation, in terms of perceptual, intellectual or emotional aspects may occur in families that are trying to cope with poverty. If a child is born to very poor parents; one of the things that might happen is you know say for example, there is nutritional deprivation. If the family is not really able to you know get food on it plate, leave alone talking about that you know the kind of nutrients that should be available the kind of vitamins and minerals that the child needs.

So, this is something about biologically part also family is coping with poverty, characteristically sometimes do not really have a very conducive psychological climate as well. They might be you know corals and they might be strangers and they might be struggles, which; obviously, in some sense will have an impact on the way the child is going to develop. So, this is one of the aspects of, say for example, how these things, you know how these very small, but very significant things can alter a person's you know entire life span and causes of these kind of things maybe you know maybe a variety.

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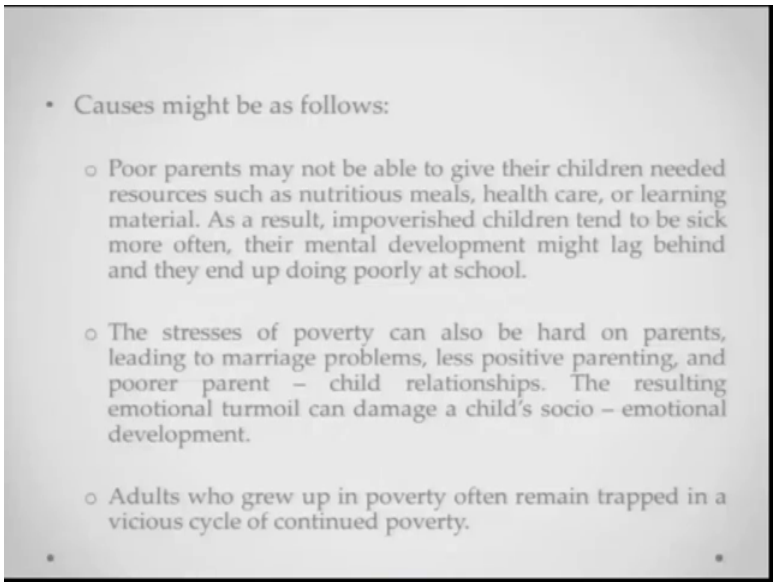

So, for example, poor parents may not be able to give their children the needed resources; such as nutritional meals, health care or even learning material, the kind of toys and the kind of material that child interacts with. Also have a very important role to

in a role to play in the overall cognitive and you know social emotional development of the child. As a result of you know when the poor parents cannot really provide that, as a result impoverished children tend to be sick more often, their mental development sometimes lag behind age controlled peers and they often end up doing this you know poorly at school.

Now, you could actually look at this, take a step back and think. This is nothing to do with the child, this is not really the child's mistake, its just that the situations are like that. So, in some sense the biological factors are very important to you know keep account of. Also the stresses of poverty can be, can also be very hard on parents leading to marriage problems, less positive parenting and poorer parent child's dynamics, poorer parent child relationships.

Now, these things also you know these results in emotional turmoil that a child will experience and that will also damage the child's socio emotional development as I was saying earlier. Adults who grow grown up in property, often remain trapped in a viciousal vicious cycle of continued property, because one of the things can happen is that you they are not really understanding the world in a particular way, they are you know, they are not really cognitively as developed as a some of the other.

You know more privileged peers and those kind of things kind of we will have consequences, you know if you are not really being able to do very good at school, you are not really going to end up at you know higher social standing and because you are again you are you are not going to reach that you are, your own children might also end up in the same you know in the same circle of poverty, and the these kind of things kind of reinforce each other, other than so many other things.

So, this is also very you know disturbing, but let us move to the enriched environment part. Say for example, sometimes more fortunate parents you know they can take initiative and they can especially design novel complex and stimulating environments. These are referred to as enriched environments that may lay the foundation of their child, you know that may lay the foundation of the child developing in optimal manner you know. They can actually help the child develop in a brighter fashion, they can actually lead to brighter and more intelligent and more responsive children.

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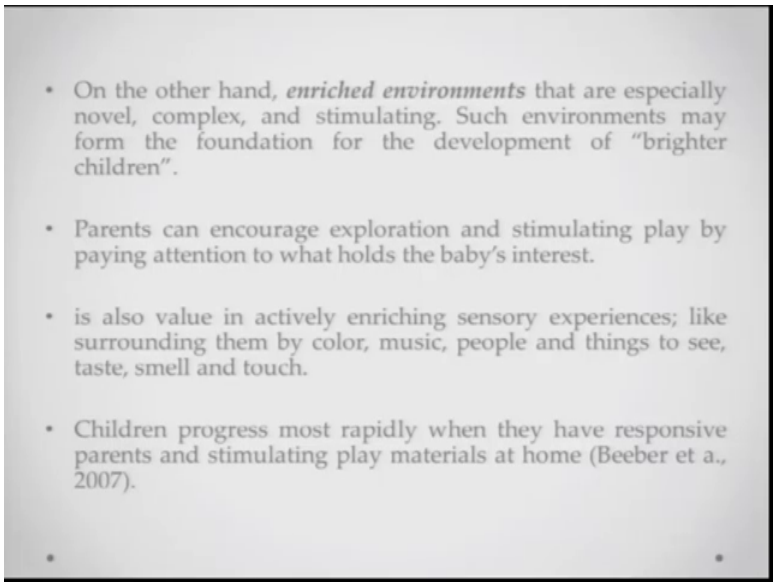

Parents can say for example, encourage exploration and stimulation play, by paying attention to what is holding the child's interests, what is, what are the initial things that are affecting him, what does he like to do, what does he or she does not like to do. In that sense encourage the child interact with the environment and discover for himself. Also this enriched environment, there is also a lot of value in actively enriching things like sensory experiences.

Say for example, it might be a good idea to surround children with so many different colors, different kinds of music and different times, people who will interact with the child and things that a child would make kind of you know interact with touch, taste, smell. So, this is basically what encourages or you know enhances the child's interest in the environment.

A lot of what the child is going to do when the child grows up, is interact with the environment and if in the forward of years the child gets familiar and interested, let us say intrigued by different aspects of the environment, that might also have a good consequences for the child's development. Children and it has been seen children progress most rapidly when they have responsive parents, and they when they have stimulating play materials at home.

So, this is also been shown in research has been reported, that children you know their course of development is more rapid, they kind of tend to be more you know, say for

example, they could have higher IQs, they could have higher other kinds of skills. If the parents are very responsive they are attending to the child you know more often and there is they are providing the child with stimulating materials.

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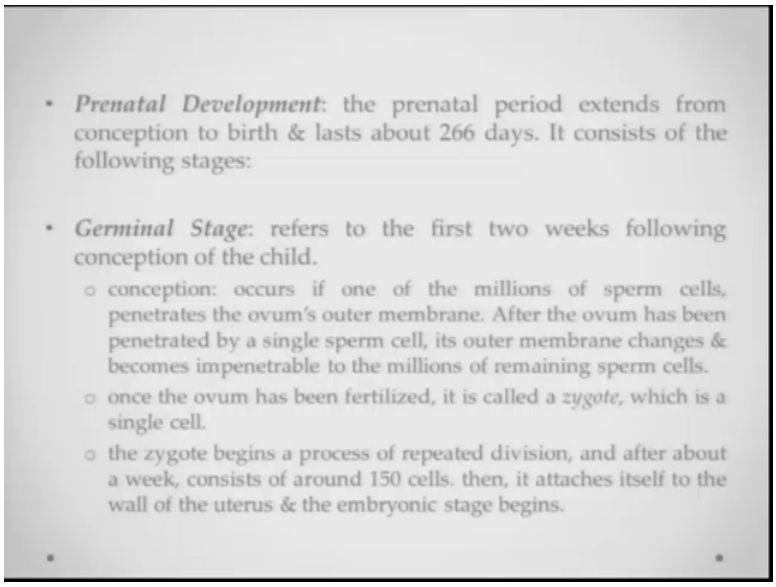

Let us talk a little bit about prenatal development. The prenatal period basically exchange from conception to birth and lasts for about 266 days. It consists of the following series, I will just briefly run to you run through, a run you through this developmental series. The first stage is referred to as the germinal stage, it refers to the first 2 weeks following the conception and the, so the conception basically happens if one of the millions of sperm cells penetrates the ohms outer membrane and if it has been fertilized, this turns to form a zygote, which is basically a single cell.

Now, the single cell, the zygote starts dividing goes through a process of repeated division, which after a week consists of around 150 cells and these cells again start dividing, to actually lead to the formation of the child. Starting from 2 to 8 weeks is the embryonic stage that basically follows conception.

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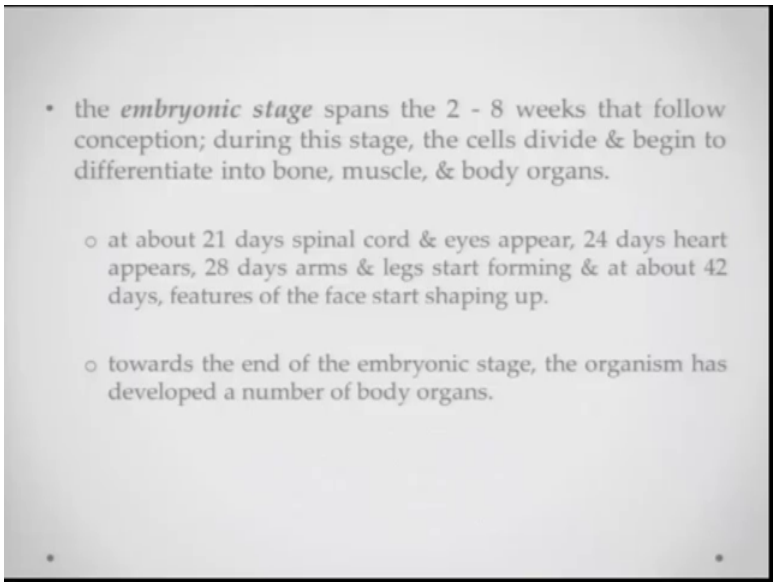

During this stage the cells divide and they begin to differentiate into different kinds of body parts; like bones, muscles and different body organs. At around 21 days the spinal cord and eyes start to appear 24 days, heart starts to appear 28 days, arms and legs start forming and at about 42 days, features of the face start shaping up. Towards the end of this embryonic stage, the organism has developed a number of different body organs.

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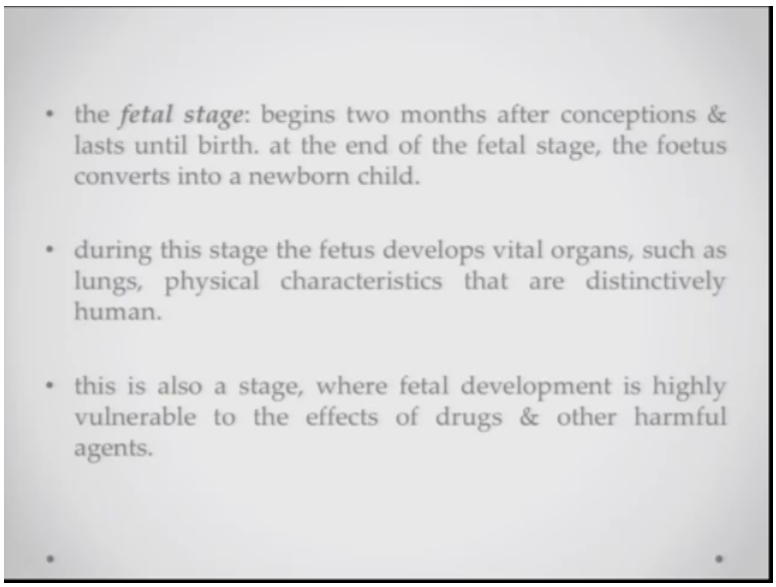

Then there is the fetal station. The fetal stages is a is the more, its a slightly important stage, it begins from 2 months after the conception and lasts until birth. So, at the end of

the fetal stage, the fetus converts into a nub new born child's. So, this is the final stage. During this stage the fetal develops vital organs; such as lungs, physical characteristics that are distinctly human and this is also stage where fetal development is highly vulnerable to effects of drugs and other harmful agents. So, the Teratogens I was talking to you about, this is one of the stage, this is the stage that you know the effects are most felt.

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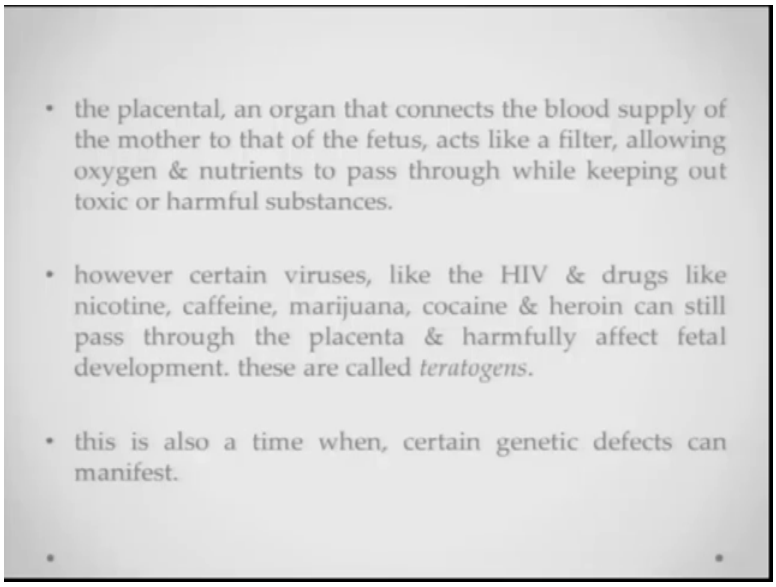

Now, the placenta an organ that connects the blood supply of the mother to the fetus acts like a filter, allowing oxygen and nutrients to pass through while keeping out toxic or harmful substances, Teratogens as I was saying. How certain viruses you know HIV etcetera can really affect the child's development, a kind of and they can you know a hamper the child's overall development, I have talked to you about this over a while.

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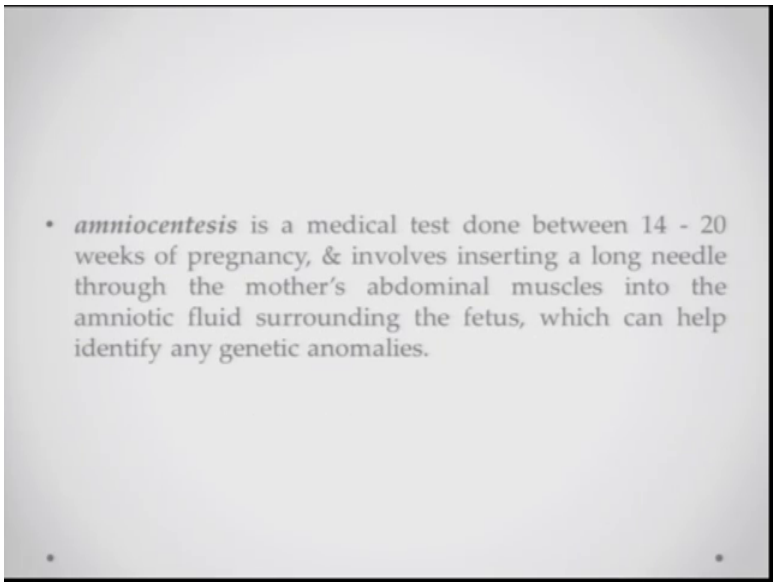

Now, there is this test called amniocentesis which is a medical test done between 14 to 20 weeks of pregnancy. This basically involves inserting a long needle through the models abdominal muscles into the amniotic fluid in which the child is, which is surrounding the fetus which can help identify many genetic anomalies.

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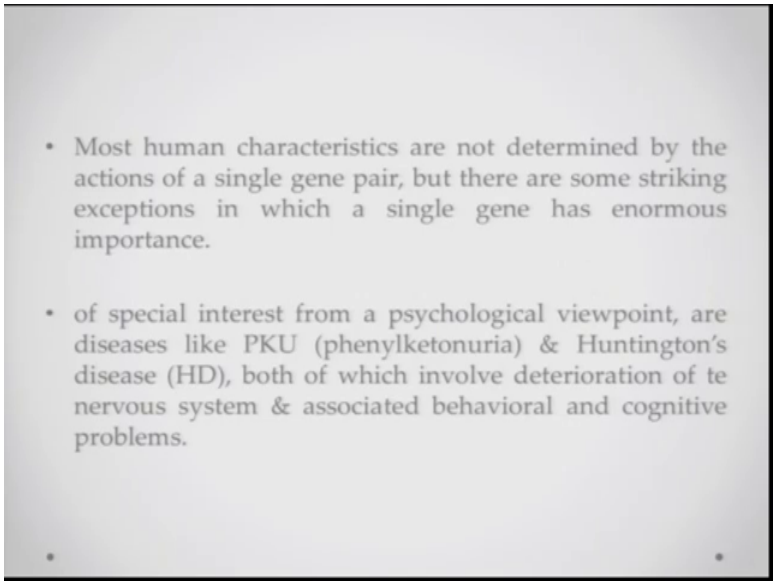

So, this is one of the things that kind of you know can help people testing for and ruling out particular genetic anomalies that might be present, and taking effect, you know taking precautionary actions.

Now, most human characteristics are not determined by the action of a single gene pair, but there are some striking exceptions, as I was saying single genes can affect something. So, one of the special interests from the psychological view viewpoint are diseases like you know phenylketonuria in Huntingtons disease. Both of which involve deterioration of the nervous system and also are linked with associative behavioral and cognitive problems.

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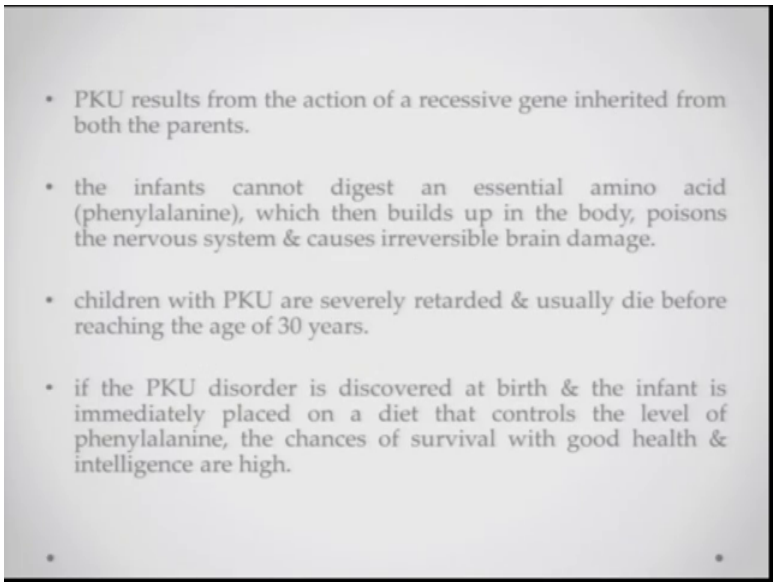

Let us, let us talk about this disease a little bit. Now, phenylketonuria results from action of a recessive gene inherited from both the parents n. The infants here cannot digest an essential amino acid that is phenylalanine, which causes the buildup of this thing in the brain, and it kind of is poisonous to the nervous system and it causes irreversible brain damage.

Now, children with a phenylketonuria are severely retarded and generally you know the lifespan is around the age of 30 years. If PKU is discovered at birth and the infant is immediately placed on a diet that on a diet that controls the levels of phenyl alanine, there are chances of survival with good health and also proper intelligence.

So, this is one of the things that you know a thing tests like a amniocentesis can help us do that. If you can kind of figure out that you know this gene is missing that, there is a high chances of having phenylketonuria. Doctors along with the parents can work

together regimen that will save the child from the you know harmful effects of PKU you also another example a single dominant gene causes Huntingtons disease.

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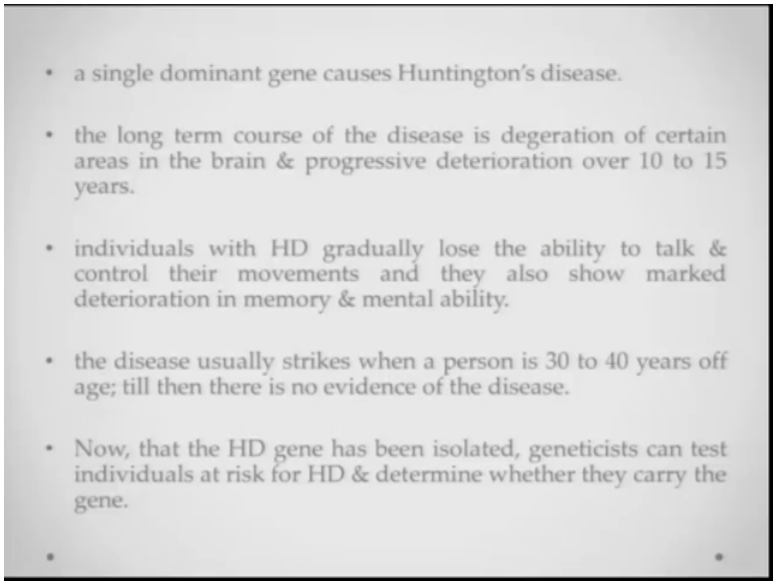

Now the long term course of the disease basically leads to degeneration of certain areas in the brain and in progressive degeneration of you know, which happens continuous for over 10 to 15 years. Now, individuals with Huntingtons disease gradually lose the ability to talk and control their movements and they show marked deterioration in memory and mental ability.

So, this is something they the problem is both in terms of motor abilities and also other mental abilities. Now this disease usually kind of strikes when a person around is around 30 to 40 years of age, till then there is no evidence of the disease. So, if you remember I was talking about certain genes being on and off, you know for particular periods. Huntingtons disease is one such example that does not manifest itself till the person has achieved age of around 30 to 40 years.

Now, that the Huntingtons, you know actually the Huntingtons disease gene has also been isolated. Geneticists can test you know individuals that are at risk for Huntingtons and can determine whether they carry that Huntingtons gene or not and that is a very important. That is very nice way of you know, kind of a you know testing earlier and saving people from these kinds of things. I am just kind of still going to talk a little bit

more about the hereditary part. One of the very important things that has been done or say for example, that people study.

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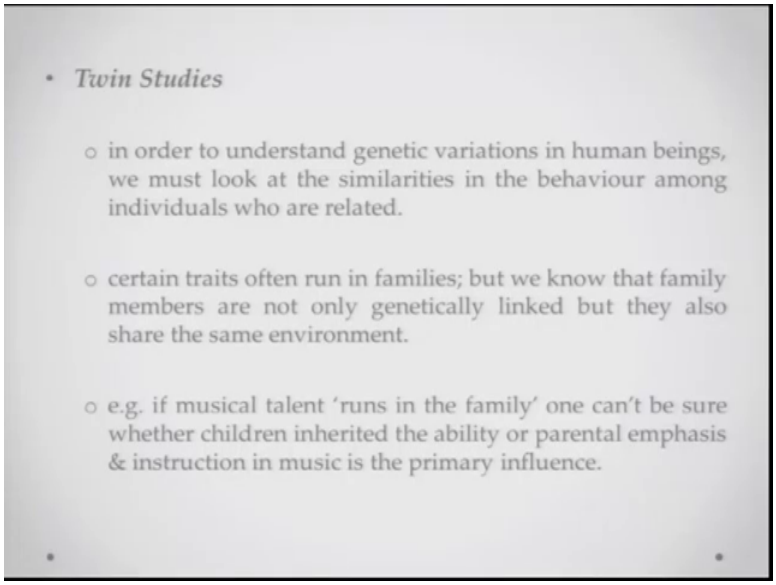

In order to understand the effects of genetic variation is to look at the similarities in behavior among individuals who are related. Say for example, you know that, you will see here people talking about things like you know certain traits run in the family, but if we know the family members, you know we know that the fact that family members are not genetically linked, but they also share the same environment.

So, you can talk about you know these two siblings behaved in much the same way or for example, the child behaves like the father or the mother. When the fact is, you cannot not be sure, whether it is biological or it is environmental, because the fact is that even though they shared the genetic makeup, they also share the same house, the child might be learning all of these things just through the nurture or the siblings might be learning from each other, just because they are spending so much time with each other.

Now, for example, if musical talent runs in the family, you know one cannot be sure whether the children inherited this thing from their parents or because their parents were practicing and encouraging music; that is why they have just you know grasp it by way of nurture. So, I am just trying to lead to solve this problem.

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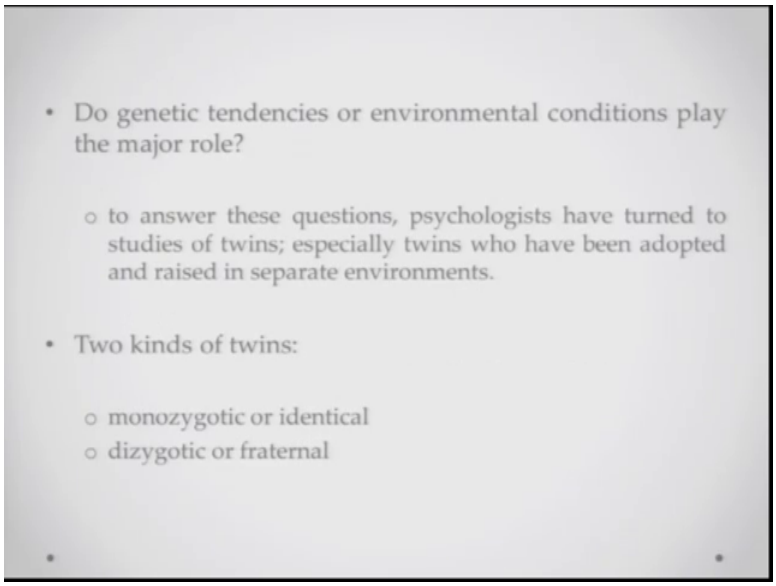

So, the question could be, do genetic tendencies or environmental conditions play the more important role. To answer this question what psychologists have done, is they have turned to studies of twins, especially twins who have been adopted and raised in separate environments. Now this is something which takes a lot of effort, very hard to do, but this is something that can actually help solve this problem. There are two kinds of twins possible monozygotic or identical, which share the exact same genetic structure or dizygotic or fraternal, which basically are very closely related, but do not have identical genetic structure.

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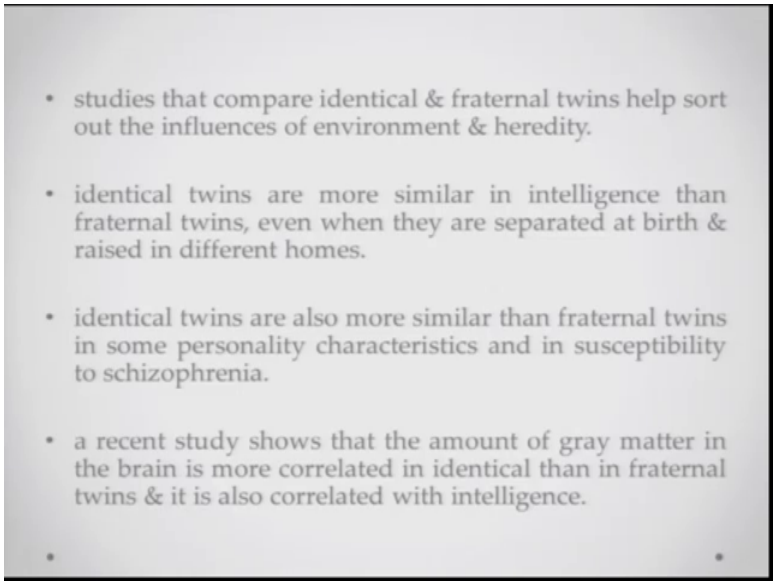

Studies that compare the identical and fraternal twins have helped sort out some of the influences of environment and heredity. Identical twins are more similar in intelligence than fraternal twins, even when they are you know separated at birth and raised in different homes. Identical twins are also more similar than fraternal twins in some personality characteristics and also in susceptibility to things like schizophrenia.

A recent study has shown that amount of gray matter, you know even in the brain, amount of gray matter in the brain is more correlated in identical twins than in fraternal twins and also there is a correlation with the overall intelligence; so if you look at all of these kinds of evidences that have kind of accrued from studies of identical twins versus studies of fraternal twins.

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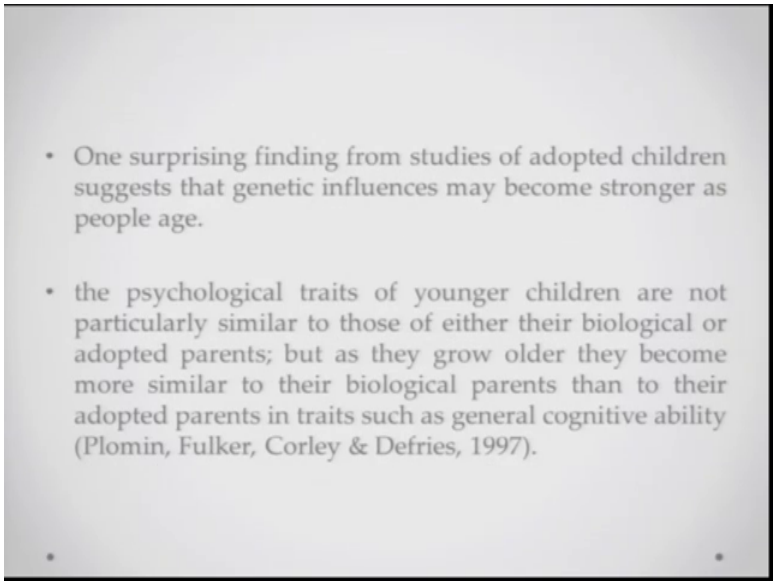

This kind of tells you that you know biology is playing a very important role in how individuals are actually shaping out to be. One of the surprising studies of adopted children suggest that genetic influences may become much stronger as people age. You know one of the things I have seen people remark a lot, is that when say for example, you know daughters or you know sons as and when they are aging, they start to resemble at least facially their fathers a lot.

I mean you know the dominant parent a lot. So, that is one of the things that you can say and its kind of goes around in common knowledge as well that these genetic influences, the influence of biology start playing a much more stronger as the individuals are aging.

Similarly, psychological traits of younger children are not really particularly similar to those, either of the biological or adoptive parents, but as they grow older they become more similar to their biological parents than to their adopted parents, in such things as general cognitive ability.

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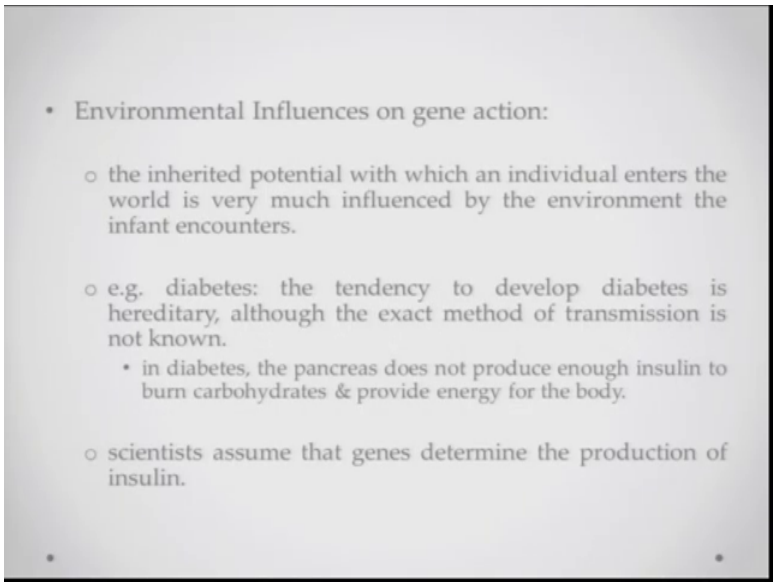

So, these are some of the things that you know are very important, but then what does the environment do here, you know what is the environmental influence on gene action. The inherited potential which an individual enters the world with, you know the gene genetic makeup, is also very much influenced by the environment its, it is kind of encountering. One of the examples that I have taken is the thing called you know is the disease called diabetes.

Now the tendency to develop diabetes is hereditary its, its heredity in a lot of people. Although the exact method of transformation is not really known, but this is something that is the pancreas are not producing enough insulin to burn the carbohydrates and provide energy for the body. So, there are residual you know residual carbohydrate, residual sugar that is you know floating in to blood and causing a lot of damage.

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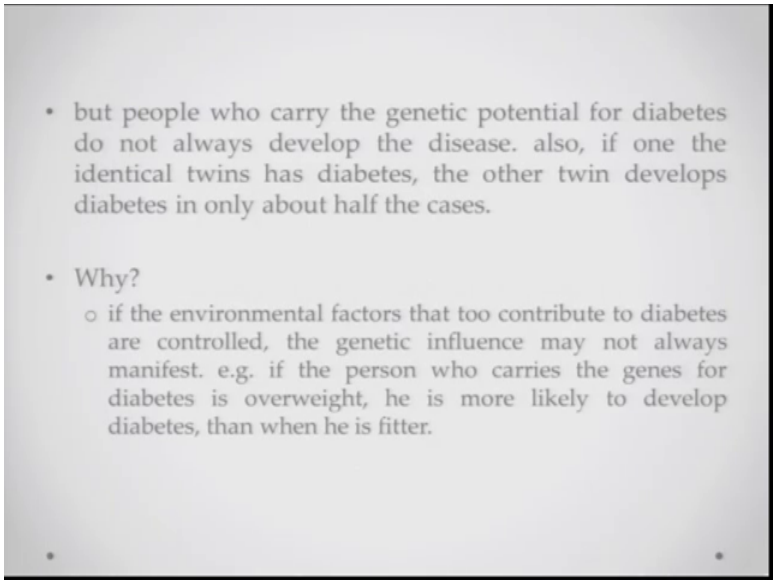

Now, scientists assume that genes determine the products of insulin. So, that is how this link between heredity, but then people who carry the genetic potential for diabetes, do not always develop the disease. It is like you know say for example, for some cases, if both parents are diabetic, its highly likely that the child might also have diabetes, but the child loses or uses or chooses or adopts lifestyle that kind of you know, it does not end up having diabetes, how can this happen.

So, this could happen say for example, if the environmental factors that also contribute to diabetes are controlled. For example, the genetic influence may not really always manifest, if the person is following a particular lifestyle you know proper diet, proper exercise and you know avoiding the environmental features that leads to, you know the person having the disease. So, I have talked to you about a lot of these things.

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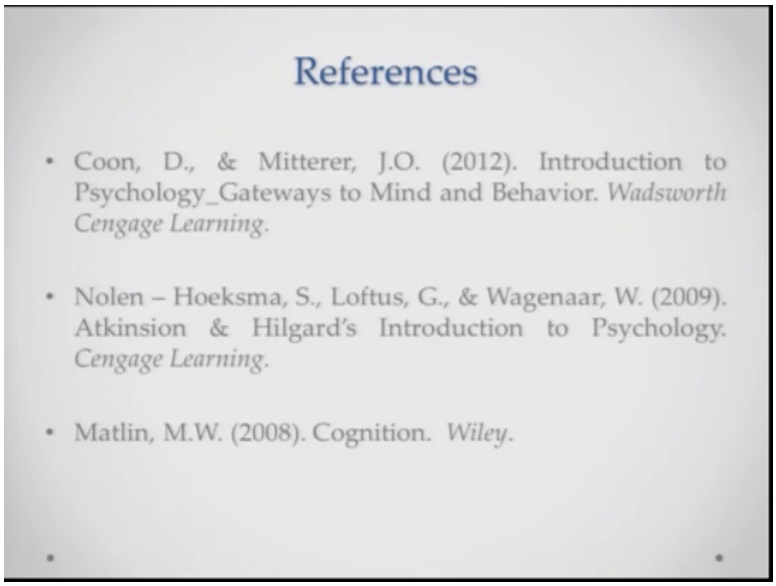

Basically I talk predominantly about biological aspects of evolution today, biological aspects of development today, but there is also a lot of stress on the environment part. When you talk about other kinds of development, emotional, social and other things you will see that there is a kind of a tradeoff there.

But, certainly today I hope you kind of appreciate the fact that there are a lot of biological factors that affect the course of human development.

Thank you.