Introduction to Psychology
Prof. Braj Bhushan
Department of Humanities and Social Sciences
Indian Institute of Technology, Kanpur

Lecture - 31
Behavioral Genetics II

Now that we have talked about behavioral genetics, let us reexamine the entire discussion that we are going through. From the view point of the normal probability curve something that usually whenever you study population you always tend to look at. We are interested in human traits, we are looking for human characteristics, we are trying to see whether the genes or the environment which one influences or is it that the interaction of both these factors they affect the personality of the individual they affect the type of characteristics that we are looking for as a subject matter of psychology.

Now during our initial lectures we did talk about continuous and discrete variables. If you recollect continuous variables were those would have different values in continuum wherein the gap between the two points remains the same. If you look at the measurement process in psychology for most of the variables for most of the constructs you would realize I would rather think that it is perhaps for all constructs that you have continuous variable. So, all the variables that are of the interest of this very subject can be continuous and second if you look at the surrounding and then carefully observe the distribution of various traits you realize that you would come forward which something which resembles to that of the normal probability curve.

So, when we consider human traits many of them might be looked at in terms of their presence or absence means either you have a particular trait or you do not have it. Especially when you look at their spread in the population usually traits are not studied that way in genetics you have presence or absence of a particular trait. Whereas in psychology we do not consider that a particular psychological characteristics would be completely absent. We look at characteristics in terms of degree. Now say for example, you are intellectually a capable human being. So, when I assess your IQ it would have range, say people between say a particular value to some other value would fall in one type of a category based on the their IQ score. Similarly, people from that specific point to some other point would fall in the second category, but that does not mean that intelligence per say as a psychology characteristics is completely absent in you. We do

not talk in terms of absence of the characteristics, whereas traits in genetic would be examine from the view point of their absence or presence.

So, now when you graphically plot you realize that the population variation is expected to follow a normal probability curve. And also remember that any single gene it cannot account for only a small proportion of change in any given trait. So graphically when you plot this curve the normal probability curve it takes a bell shaped position the curve with an assumption that the mean, median and the mode they coincide at a single point. Practically for any given the type compute mean median and mode and that does not happen, the values are not the same, but then this is the assumption of the normal probability curve.

And then this curve declines symmetrically on both the sides. So, you have a very symmetrical type of a bell shaped curve. Before we going to examining human characteristics traits let us first is understand what is normal probability curve.

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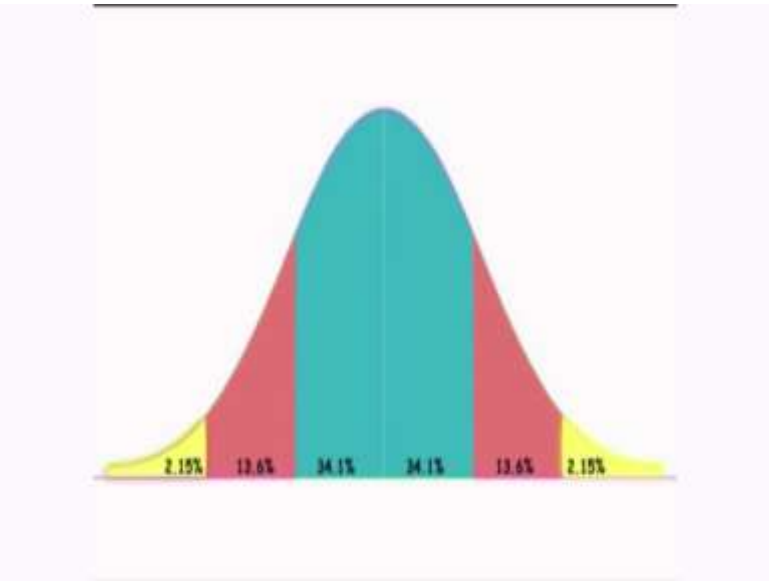

68.2 percent of the population clusters between 0 and plus minus 1 sigma; that is 34.1 percent between 0 and plus 1 sigma and 34.1 percent between 0 and minus 1 sigma. 13.6 percent between plus 1 and plus 2 sigma as well as minus 1 and minus 2 sigma. And finally you have 2.15 percent between plus 2 plus 3 sigma as well as minus 2 and minus 3 sigma. It is important to note that the curve never touches the horizontal access, almost all the values of the observation are within the range of mean plus minus 3 sigma. If you

add the percentage covered under the curve it is actually little less than 100 percent and this gives scope for exceptional cases.

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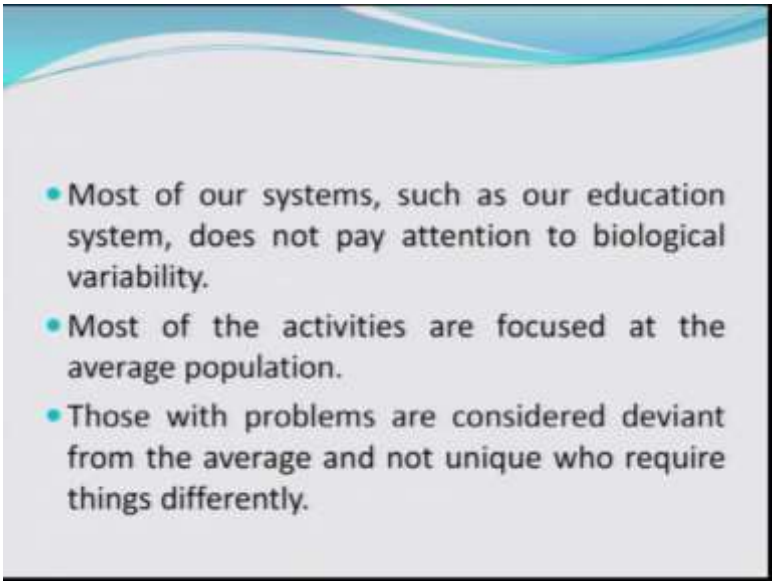

Now, most of our systems if you look at you realize that they are basically designed to cater to the average population. What we were referring to here in the normal probability curve. Say for an example, you take the education system; now education system is designed not to pay attention to the biological variability that is possible actually. So, what you do you have a template, you have syllabus, you have a prescribed book there are certain things that are supposed to be learned within a particular period. So, say 3 months and you have to undergo a test for getting a good score in the test there are certain things that you should master, there are certain things you should remember.

So, the possibility that there is a variation and only 68 percent around that would be able to now achieve what the template actually prescribe that is not taken into account. All those who have some problem, all those who know does not fit into that template they all are considered as deviant from the average, and remember that most of the systems including education system do not consider the unique requirement of these people who have certain degree of biological variability. So, we have been talking about variability, we have been talking about the facts that see we all are made little differently. And this variation actually helps the human race survive or any animal species is survive. But here in this case we realize that when we come to making certain types of systems most of the

systems they cater only to those who are somewhere in the average zone, in the normal probability curve.

The moment you have start deviating on the periphery between say 1 and 2 sigma 2 to 3 sigma or minus 1 to minus 2 minus 2 to minus 3 sigma you realize that you are considered as an exception, you are considered as a deviation and the system is not designed to cater to your need. Coming back to behavioral genetics and understanding the limitation that when we are trying to generalize. Remember psychology would always try to generalize the findings.

So, what you finally come forward with is not a theory that is supposed to explain me as an individual or me and you as member of a smaller group. The theories are supposed to, the processes are supposed to explain overall how human psyche works. So, you would love to generalize the findings. Now for the generalization of the finding you realized that there is a big hurdle. If you look at traits and genes and you try to map it one to one you realize that it is extremely difficult. Even the gene diseases connection is not that straight forward it is not that you can very easily map one gene to one diseases. We took examples yesterday to look at this.

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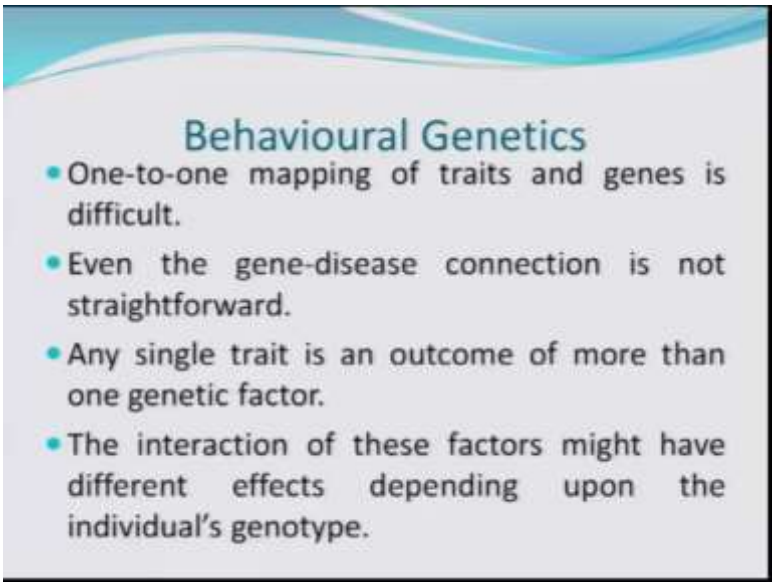

And any single trait is basically not an outcome of one factor. So, what happens when you look at a particular trait, when you look at a particular characteristics you realize that there is an interaction of the factors and there could be a possibility that there are

variation in the factors, there is a variation in the genotype and then there are certain type of environmental compulsions all these they interact together.

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Now let us go back to personality, look at the way traits are looked at in psychology and we are taking only personality here as an example. Now I will put view points when you said that we have three sets of traits the cardinal the central in the secondary traits.

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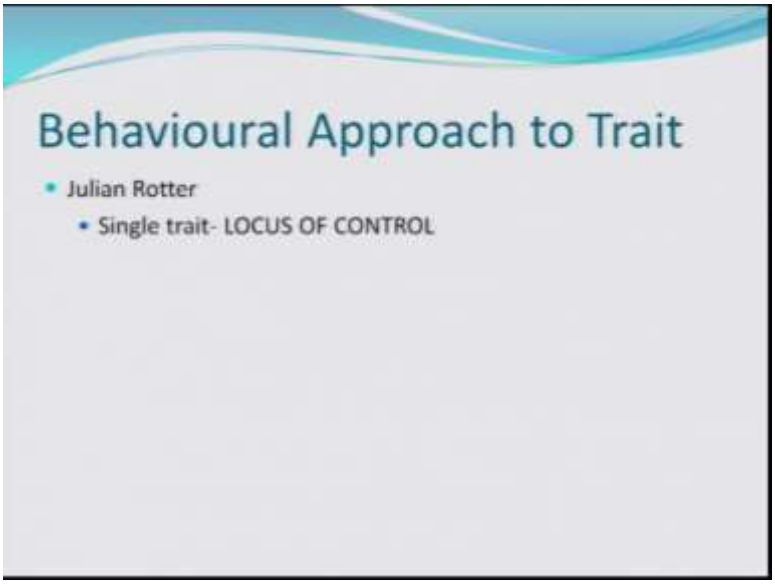

Rotter when he talked about the locus of control again talking about one single trait. Now there is an attempt in psychology either you divide all traits into three broad

category like Allport did or you just look for something which is extremely dominant as a trait. You said that it is locus of control and that determines your personality or you look at combination of factors and reduce them to just 16 curtails ,16 pf.

So, you look at the entire personality and just you reduce it to 16 dominant factors. Whereas, when you look at the genetic makeup it is extremely difficult to have one to one plot you, cannot have the gene trait plotting done even though you are dealing with something as good as personality. So what happens, any single trait basically is an outcome of more than one genetic factor. And the interaction of these factors might have different defect depending on the genotype of an individual. Now when you say that there is one single trait which is extremely important and I consider that to be locus of control and that defines whether you are person who as an internal or an external locus of control you find that the genetic explanation of it is very difficult.

So, is the case when you try to just say that find there are central coordinal and secondary traits extremely difficult. Therefore, I am saying that one to one plotting is close to impossible that cannot be done, even something like genetic diseases. If you try to plot gene and disease you will realize that the relationship is not that straight forward. So, we come to the fact that there is an impact of the environmental factors and we are born with the genetic makeup there are certain environmental factors and then you realize that these factors perhaps determine our behavior.

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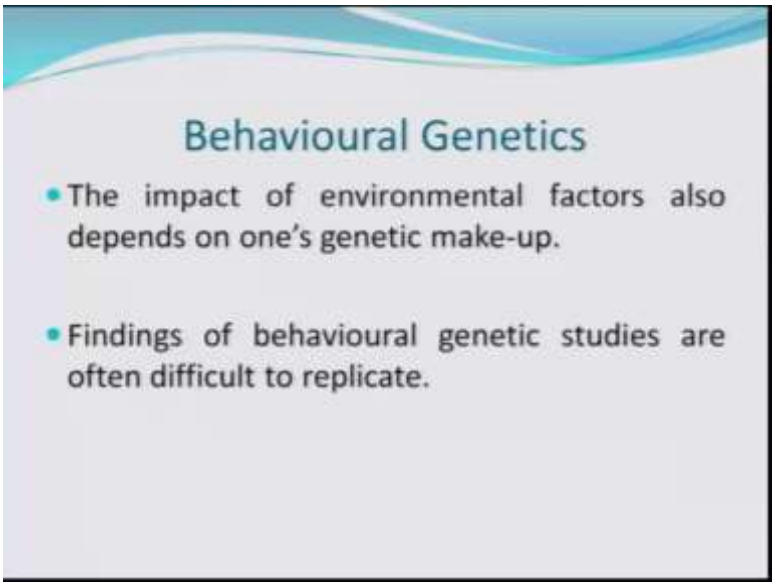

So, the impact of environmental factor they are bound to depend on our genetic makeup, but then there is another problem. The findings of the behavioral genetic study they are often very difficult to be replicated. And that is the reason if you try to look at set of studies to find out the relative impact of a specific environmental factor on specific type of genetic makeup even that becomes extremely difficult.

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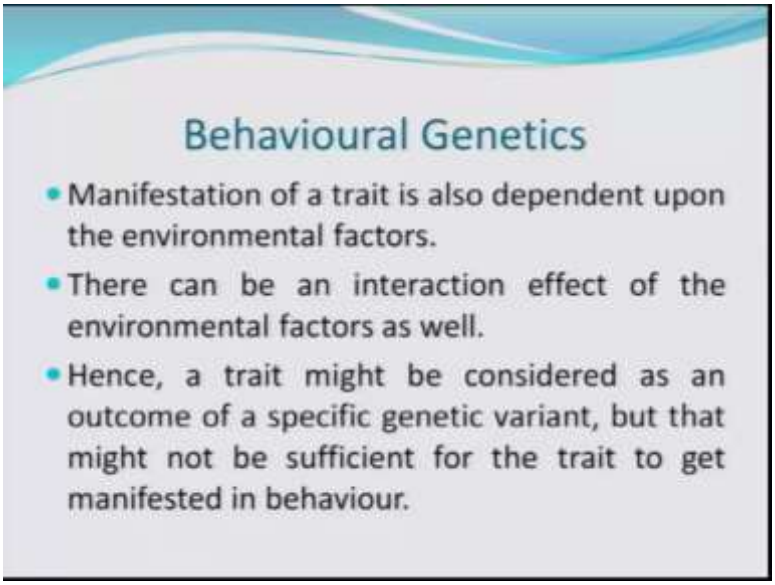

So, manifestation of traits is always dependent upon the environmental factors. There can be an interaction effect of the environmental factors as well. Hence, a trait might be considered as an outcome of a specific genetic variant, but that might not be sufficient for the trait to get manifested in the behavior.

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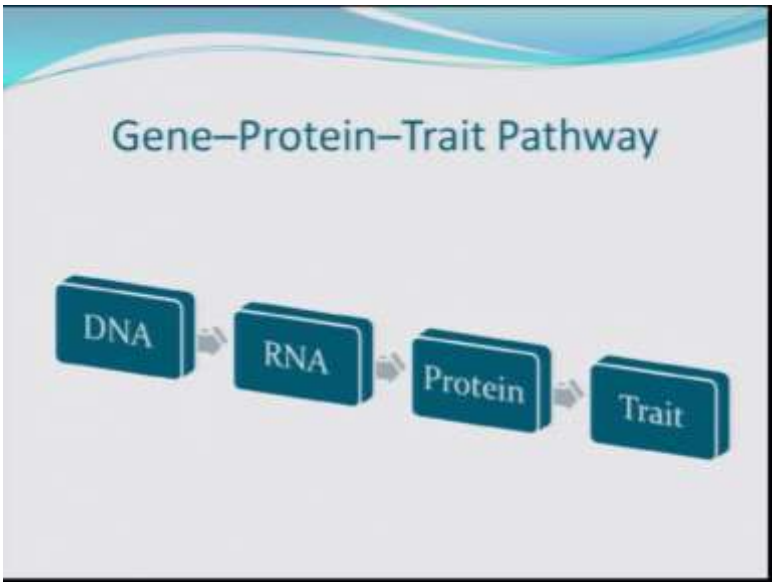

Now, let us now look at the gene protein trait pathway. People have tried doing this also DNA, RNA protein and finally leading to traits. So, people have tried to trace this pathway that this is how you can map the genes and the traits one to one mapping.

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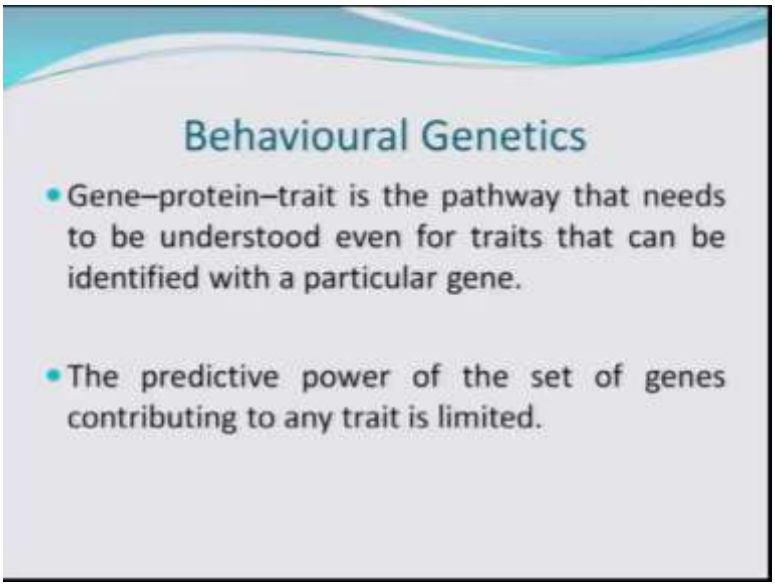

Now, gene protein trait is the pathway that needs to be understood even for traits that can be identified with this particular gene. Remember that the predictive power of the set of the genes contributing to any trait is very very limited.

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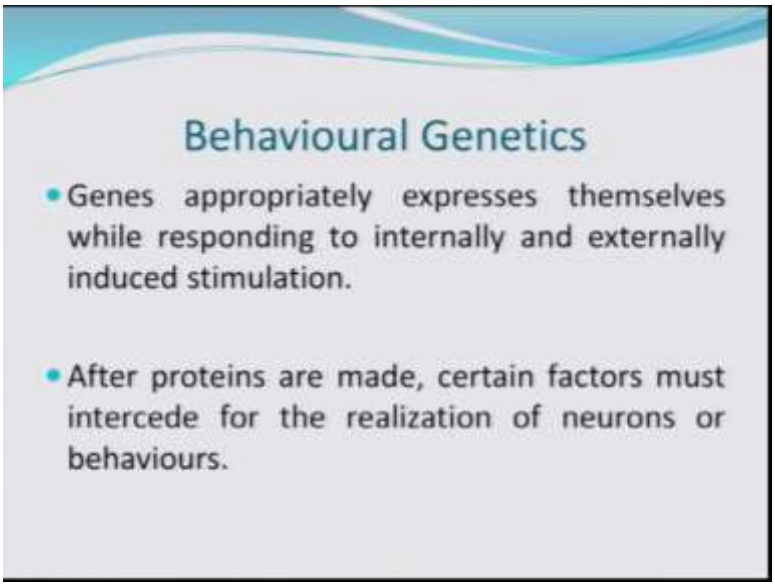

So, genes appropriately express themselves while responding to internally and externally inducing stimulation. And after proteins are made certain factor might intercede for the realization of neurons or behavior.

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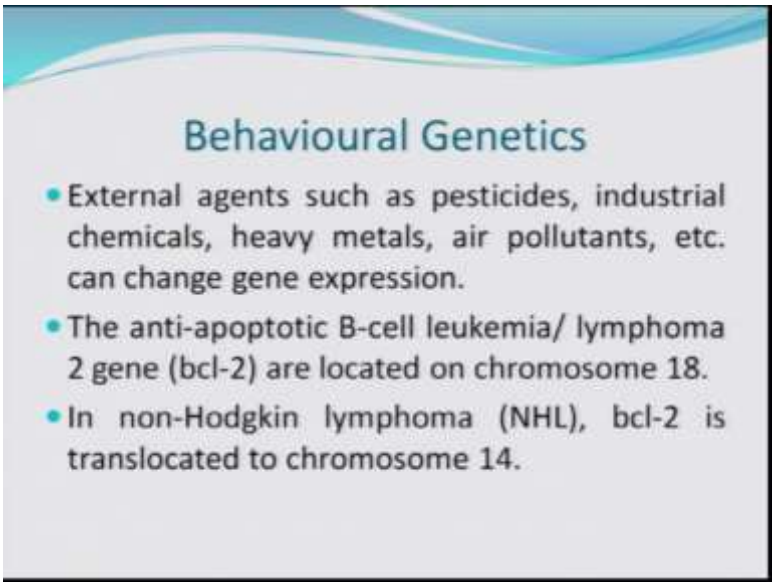

Let us look at certain external factors, external agents such as pesticides, like the chemical waste of the industry, heavy metals, air pollution. They can also change the genetic expression. The anti-apoptotic-B-cell leukemia that is the lymphoma 2 gene bcl 2 it is located on chromosome 18, the non-Hodgkin lymphoma that is NHL.

Now in this case bcl is trans located on chromosome 14. So, when you try to map gene to certain type of diseases and when you look at certain type of external agencies in that context we are talking about it. You see in the in case one, if look at the second bullet it says that the bcl-2 is located on chromosome 18. And here in if you look at the third bullet it says that bcl-2 is located on chromosome 14 for NHL.

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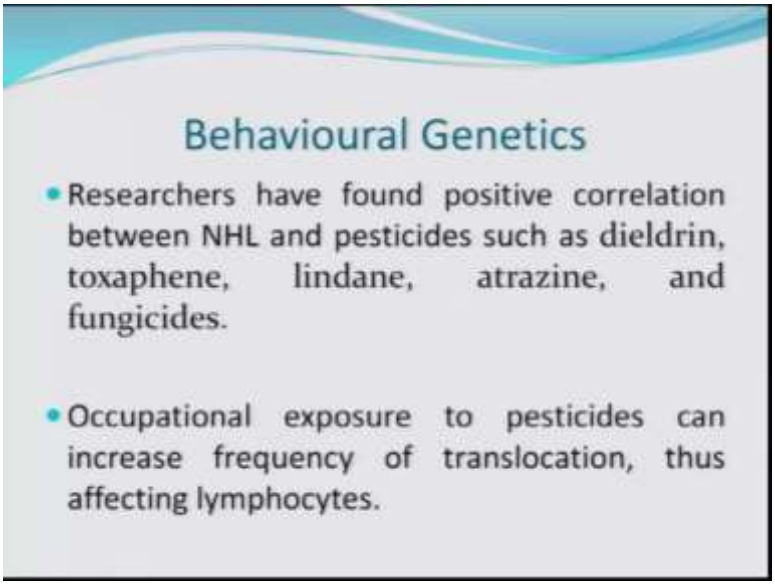

Now, researchers have found positive correlation between NHL and pesticide and there in fact identified pesticides like, dieldrin, toxaphene, lindane, several types of fungicides. Now they have found that there is a correlation between the pesticides and the NHL. And the occupational exposure to pesticides can increase the frequency of translocation and if the genes are translocated in this 18 14 number chromosomes that we were looking at then finally it affects our lymphocytes.

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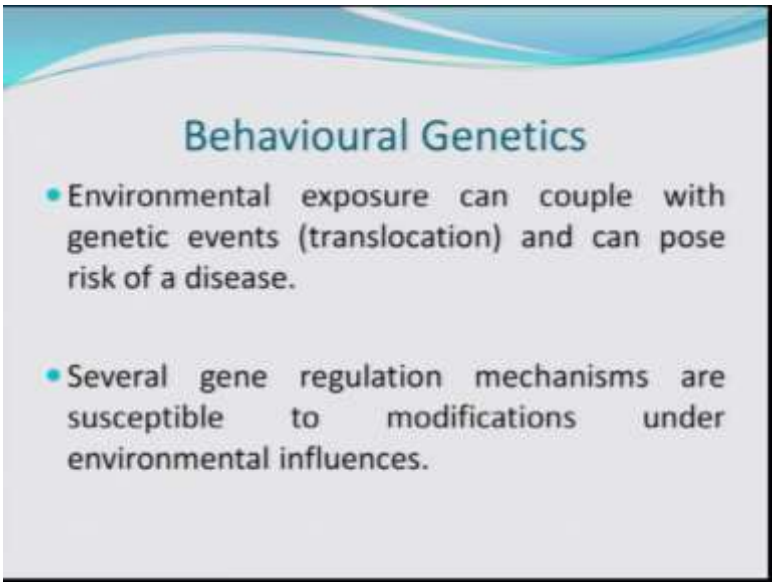

So, environmental exposures can couple with genetic events such as translocation and therefore it can pose greater risk of a particular disease, that they we saw right now. Now several gene regulation mechanisms are susceptible to modifications under environmental influences.

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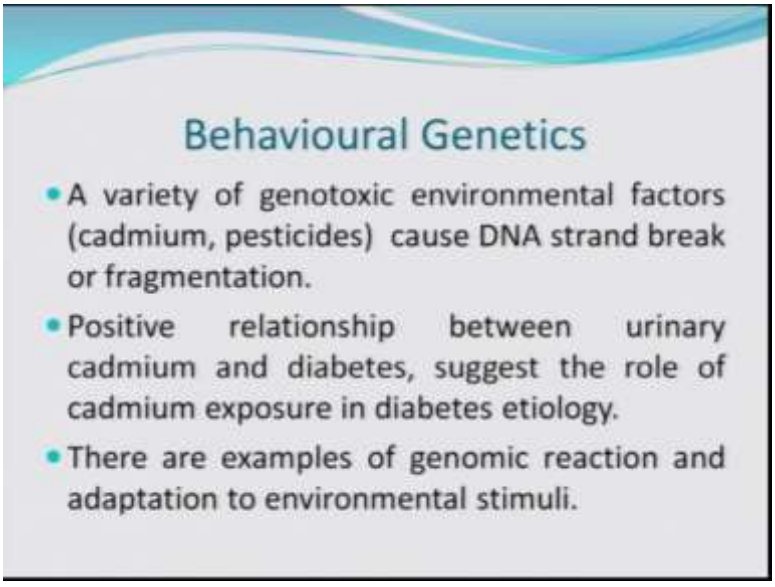

Let us take another example a variety of genotoxic environmental factors such as cadmium such as pesticides they can also cause DNA strand break or fragmentation. So, the 80 cg bond at we saw in the first lecture of this very topic. That DNA strand can get

fragmented it can break and people have found positive relationship between urinary cadmium and diabetes which suggests that there is role of cadmium exposure in diabetes symptomatology.

If you look at the etiology of diabetes, the disease behind thediabetes then you perhaps cadmium also played some role. So, there are examples of genomic reactions and adaptation to environmental stimuli, and you realize that large number of environmental factors they do affect now the overall genetic makeup that we have predisposed with which also makes us venerable to certain types of issues.

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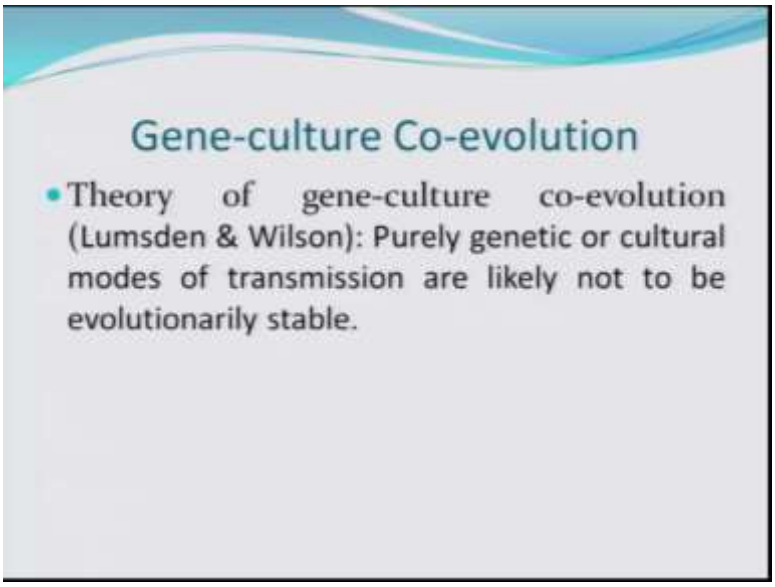

There is this theory of gene-culture co-evolution. The theory of gene-culture co-evolution says that purely genetic or cultural modes of transmission are likely not to be evolutionarily stable.

So, if you want to have a change an evolutionary change which is a stable then you need to take care of the fact that pure genetic models of transmission and pure cultural modes of transmission they would not provide stability to it.

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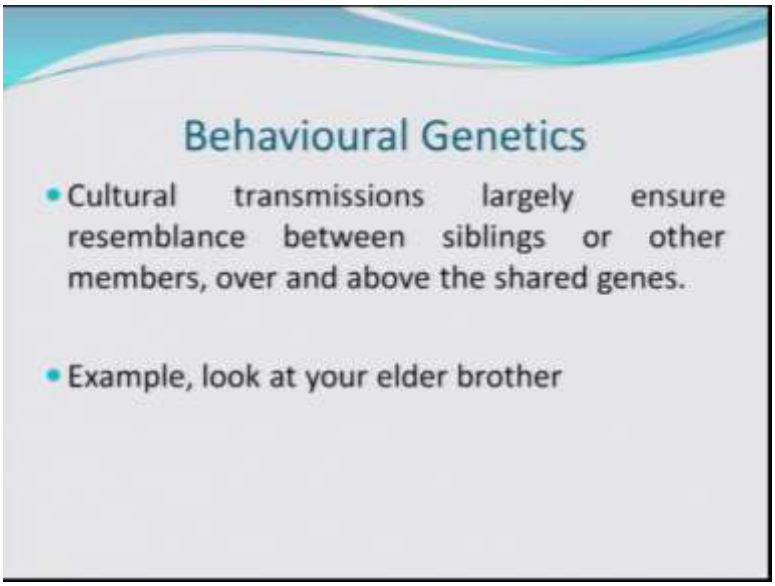

So, cultural transmissions they largely they ensure resemblance between siblings or other members over and above the shared genes. Say for example, if you look at your elder brother for instance. When you look at the resemblance when we started looking at the photographs of two kids brother and sister two siblings across certain developmental stage and we try to look at the resemblance between them.

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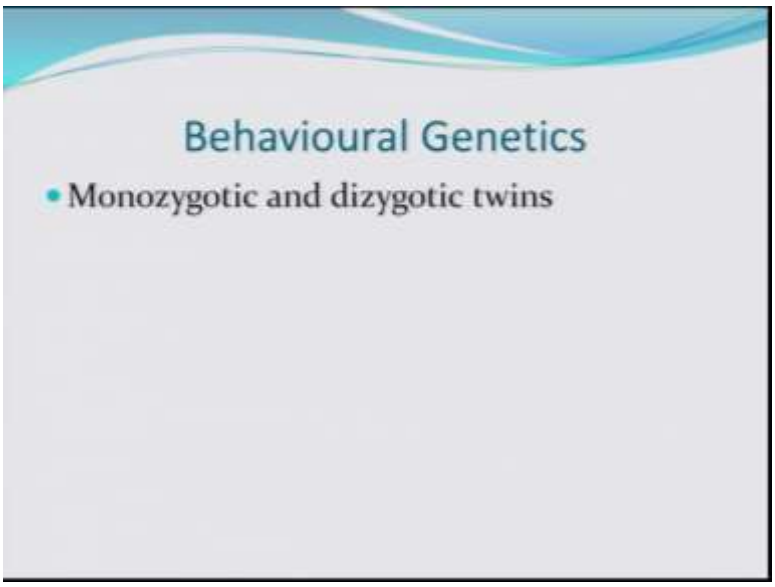

Before we take up of this topic les let us understand what is meant by monozygotic and dizygotic twin, what actually happens and how many types of such combinations are possible. Twins can either be monozygotic or dizygotic.

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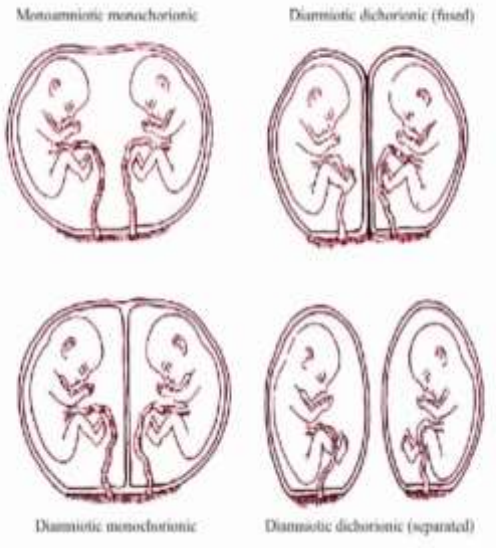

Monozygotic twins are also called as identical twins. They develop from one zygote and from two embryos; usually the identical twins share the same chromosomes. Majority of the monozygotic twin share the same placenta even though they are in two separate amniotic sacs. About 18 to 30 percent of the monozygotic twins have separate placenta as well as a separate amniotic sac about 1 to 2 percent of them a share the same placenta as well as the amniotic sac. Dizygotic twins are also called fraternal twins they develop from two separate x fertilized by two separate sperms.

Each fraternal twin has it is own placenta and amniotic sac. Therefore all dizygotic twins are dichorionic. Dichorionic is a state if twins have separate placenta. Monochorionic is the state when the twins share the placenta, and monochromic diamniotic is the condition if twins share the amniotic sac.

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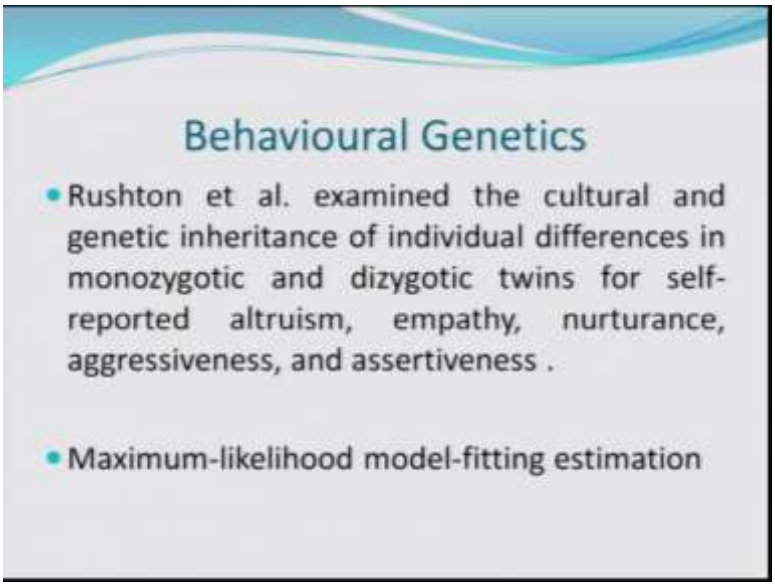

Now, Rushton et al. examined the cultural and the genetic inheritance of individual differences in monozygotic and dizygotic twins for self-reported altruism, empathy, nurturance, aggressiveness, and assertiveness. So, you say all of them are very celebrated psychological constructs. And he now adopted the maximum likelihood model fitting estimation. What did we find?

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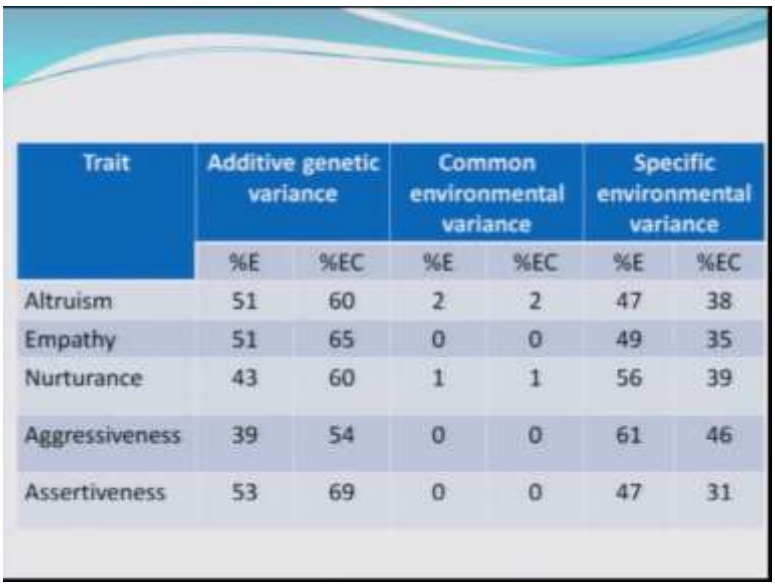

Trait	Additive genetic variance		Common environmental variance		Specific environmental variance	
	%E	%EC	%E	%EC	%E	%EC
Altruism	51	60	2	2	47	38
Empathy	51	65	0	0	49	35
Nurturance	43	60	1	1	56	39
Aggressiveness	39	54	0	0	61	46
Assertiveness	53	69	0	0	47	31

You see the additive genetic variation, you see the common environmental variance and then you see the specific environmental variance. And there is an interesting spread.

Altruism for instance, you have a spread a division so is the case with environmental variance, so is the case with specific environmental variance.

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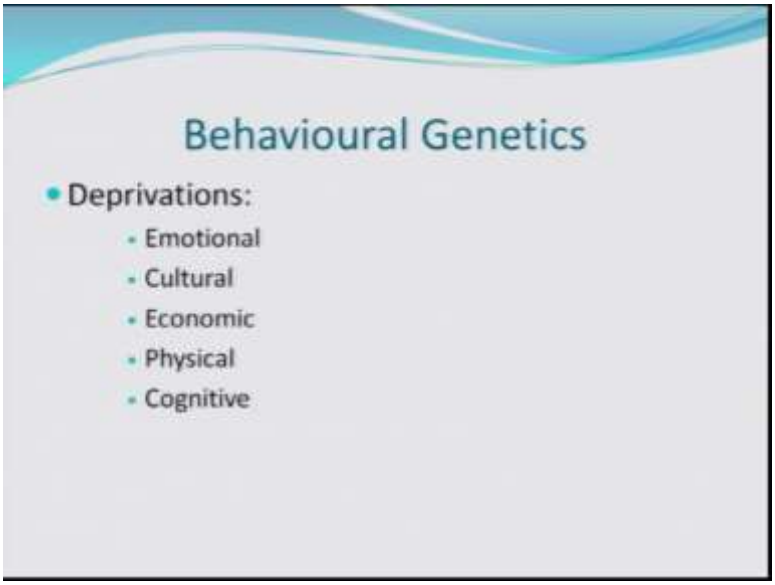

Then there has also been a great deal of discussion on deprivations. Deprivation which is emotional in nature means emotional deprivation that could be cultural deprivation, economic deprivation, physical deprivation, cognitive deprivation. And all of these deprivations have similar type of effect that we were talking with the reference to the environmental factors.

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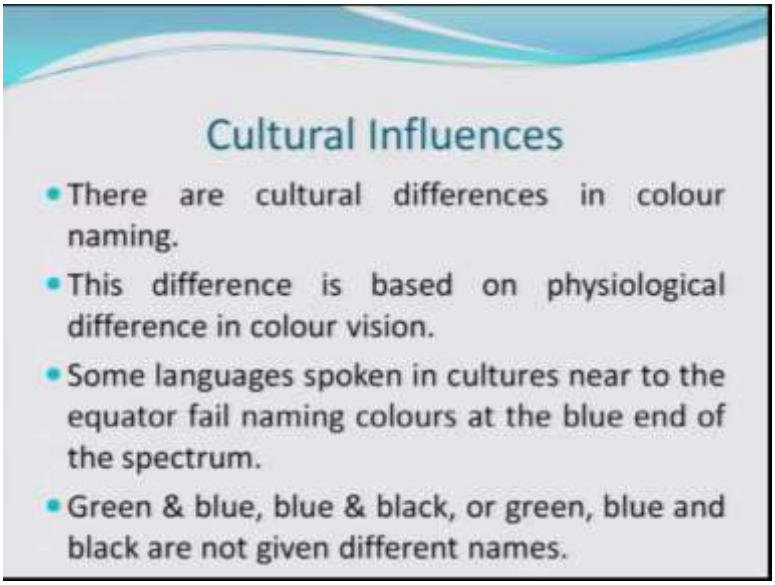

So, there are cultural differences in color naming; that we have talked about during perception. Now this difference is based on the physiological difference in color vision. We realized that there are languages spoken in cultures near to the equator where people fail naming colors at the blue end of the spectrum, so green and blue, blue and black or green blue and black are not given different names. There is a physiological origin; there is a cultural difference here.

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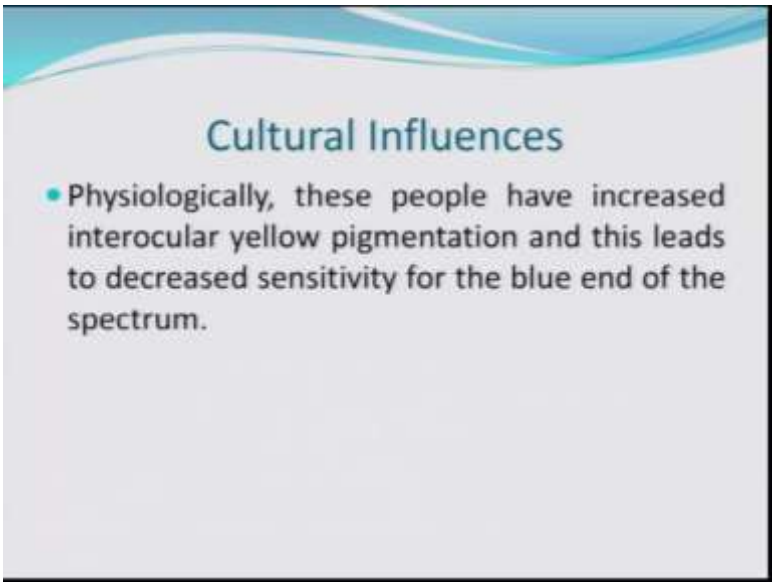

Now, physiologically these peoples have increased intraocular yellow pigmentation and this leads to decreased in the sensitivity for the blue end of the spectrum and that is the reason why they are not able to see specific colors.

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You also took the example of the Zulu tribes in Natal area. Now we all know that in the structured world the constructed world we have certain type of geometric shapes and therefore children who are born and brought up in such type of structured world they are very convenient, they are they feel themselves when they come to looking at the shapes of the objects; especially if I talk of the geometric shapes.

Now it has been realized that when trapezoid illusion studies were conducted on the tribal set up. The rural Zulu people their settings contains very few rectangular objects and therefore Zulu language has the absence of words for window square or rectangle. Whereas in our case the children of the structured world they would very easily be able to decipher and make distinction between square and rectangle.

Now, when this trapezoid illusion was study was conducted it was realized that the rural Zulu children had less illusion compared to their urban counter parts. And most Zulu children did not report illusion at all.

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We also know that there are certain social roles that we learn. And learning basically has to do more with how desired a particular skill is in the social context. So, it is the socially desired skills that we look for and therefore our behavior automatically gets modified.

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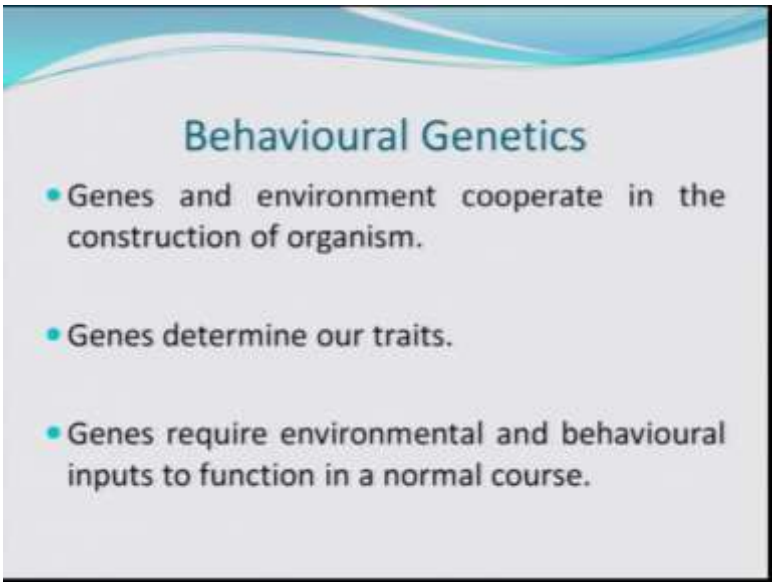

So, overall it seems that the gene and environment they cooperate in the construction of the organism. Gene of course they determine our traits, but gene require environmental and behavioral inputs to function in the normal course.

So, with this we conclude our discussion on behavioral genetics there by trying to understand; what is the effort of the influence of the impact of the genetic factor and the environmental factor, and how nature and nurture both combine together to give us shape as a human being.

Key words - behavioural genetics, gene, protein, trait