Host-Pathogen Interaction (Immunology)
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Lecture: 50
Adaptive Immunity-Antigen

So, I have introduced with adaptive immunity now let us move on to the more precise adaptive immunity so, before entering in the B cell and T cells. So, I would like to explain you antigend ~~teach them~~. So, there is a little difference there is a similar term which we use it for antigen one term is the antigen and another term is immunogen. So, there is a fine difference it is better to understand those fine differences.

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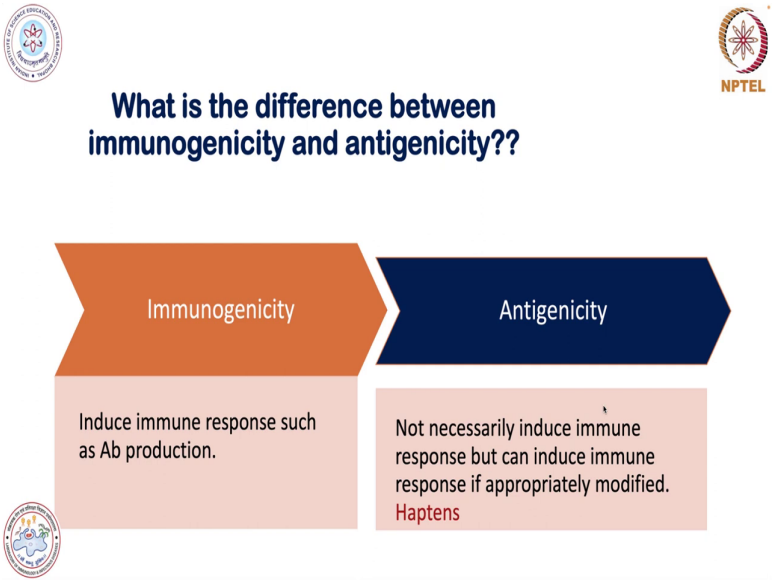

So, there is a the term known as immunogenicity or antigenicity it is basically derived from the immunogen and antigen. So, immunogen is associated with immunogenicity antigen is associated with antigenicity. So, what is immunogen. So, immunogen is basically it induces the immune responses such as mainly the production of antibody that we call it as a immunogen. So, what is antigen that is an obvious question right.

So, antigen is not necessarily induced the immune response as such but it can induce immune responses if it is appropriately modified. So, I will explain you there is a little fine difference for example if you have a rabbit and if you inject the ova albumin a protein ova albumin in

the rabbit then that will produce the antibody against ova albumin but on another hand if you inject some very small molecule for example aniline.

And if you are very small molecule for example if you inject say some hormone the hormone which is not produced by the rabbit if you inject a small molecule a steroid hormone then there will be no development of antibody. So, now you can understand this is small molecule is is an antigen it is foreign it is foreign to the rabbit you make confused with this this hormone molecule instead of hormone.

You can use some molecule which is derived from the bacteria it is a small molecule which is similar to the derivative of a steroid molecule. So, if you inject that bacterial origin that molecule in the rabbit then there will be a no antibody production but this is a foreign right. So, this is the antigen this is not inducing appropriate immune response or in another word it is not inducing the antibody production.

So, this molecule we categorize as a antigen. On another hand if you inject the rabbet with ova albumin albumin protein derived from chicken then there will be a production of antibody against that molecule. So, that ova is immunogen this can induce the appropriate immune response. But if you modify this molecule the small asteroid molecule which is derived from the bacteria or the hormone molecule which is originated from different animal or different host.

Then if you modify this molecule or modify means if you attach this molecule with some bulky protein then if you inject it in the rabbit then you can make an antibody against this small molecule and before modification this small molecule we also call it as a heptane as you can see in this slide there is a term known as heptane. So, heptane is a basically an antigen but it cannot induce the immune response the antibody production.

So, that is why we call it as a heptane and there is a one more term known as carrier which I will explain you in subsequent slide.

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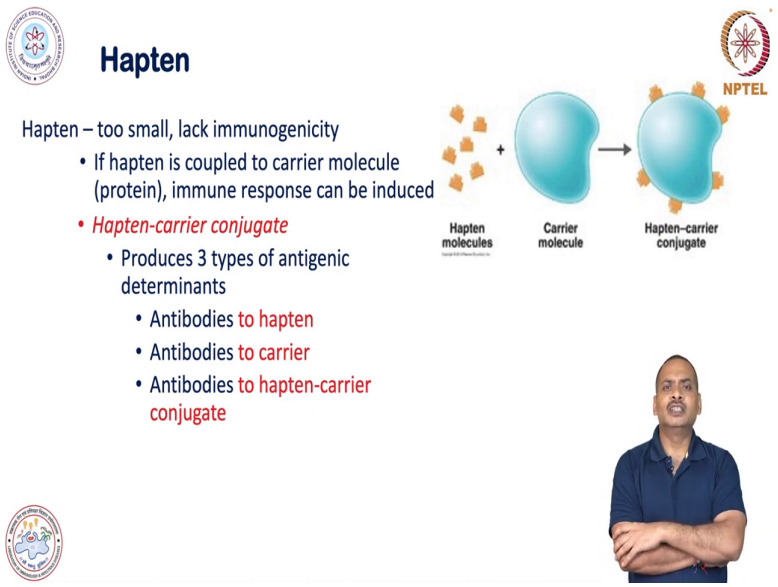

So, here you can see that heptane what is heptane heptane is a two small molecule it is the molecular weight is too small but it lacks the immunogenicity it is foreign but it cannot induce the immune response. If the heptane is coupled with some bulky group as I have explained you a carrier protein then if you inject this conjugated molecule into the in into the appropriate host then you can induce the immune response.

So, when you will do this thing; then heptane carrier conjugate if you inject this heptane carrier conjugate into the appropriate animal. Then there is a development of variety of antibody and these antibody could be a specific against the heptane molecule this is a one another is there will be a antibody which is generated against carrier molecule the bulky group or the bulky protein.

And the third one is the antibody can be generated against this junctional point which is which is in between heptane and carrier molecule. So, this carrier and heptane molecule once it is a it is basically injected then these kind of antibody can be generated. Here this is a very simple schematic here you can see that heptane is a two small molecule and this two small molecule cannot induce the immune response.

And if it is attached with the carrier molecule then there will be a heptane carrier conjugate and if you inject this heptane carrier conjugate into the animal then there will be a development of antibodies.

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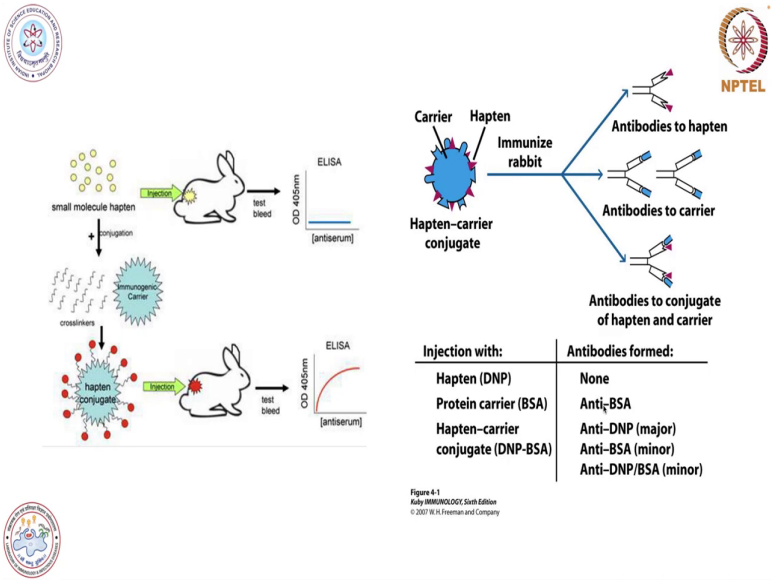

I have another schematic with that the things will be far more clear here you can see that there is a small molecule heptane and when it is injected then there will be a no antibody production here you can see there is a ELISA this is a technique by which you can measure the antibody against your molecule your molecule of Interest but when this heptane is conjugated with this immunogenic carrier molecule by cross linking by chemical mean.

And if you challenge the animal with this cross-linked molecule then you can see there will be a very nice production of antibody here there is a very simple schematic which you can understand very quickly there is a carrier molecule which is shown in blue colour and there is a heptane molecule which is shown in a red colour it is a triangular form. And here you can see you can get the antibody against all kind of these surfaces.

You can get the antibodies against heptane you can get the antibodies again carrier molecule you can get the antibody against both the heptane and carrier molecule. Now why I am talking too much about this haptanepening why it is so important. So, try to understand this heptane is very important particularly it is very much important in order to develop the diagnostics. The estimation of the vitamin in the sample in biological sample how you will estimate the amount of particular small molecule.

For example it is vitamin it could be a some low molecular weight hormone. So, all these things is possible if you understand this heptane carrrieer biology. So, basically this diagnostic use the specific antibody against these small molecule and the antibody is

basically generated when they are conjugated with some carrier molecule. And they play a very important role in diagnostic.

For example estimation of some very low amount of hormone like probably you may know that there is a T3, T4, TSH. TSH is a still bigger molecule T3 and T4 there is a estimation of some vitamins for example vitamin D vitamin B12 all those things are possible by this kind of chemistry as well as biology or a simple Immunology. So, this heptane biology is a very important.

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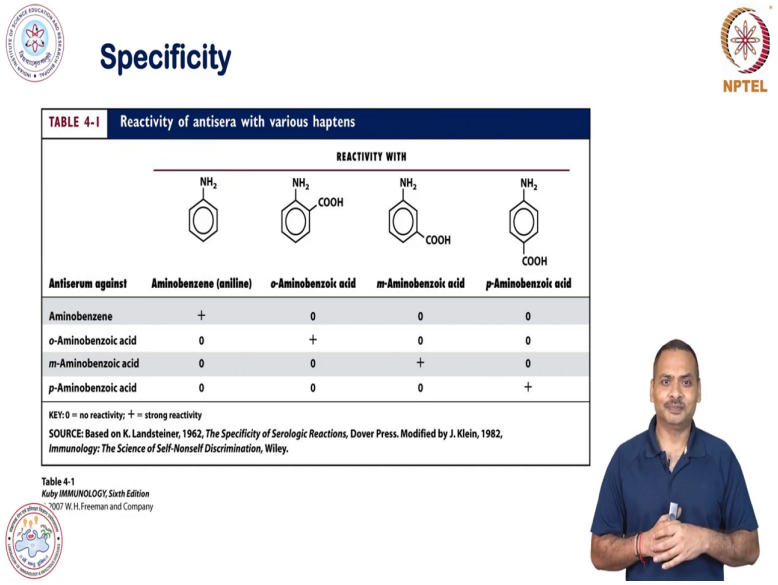

Now I will take you or I will demonstrate you that adaptive immunity is highly specific by this simple experiment this experiment was a basically conducted by ~~l~~landsteiner~~ender strain~~ karl landsteiner~~called lender strain~~ in 1962 and the aim of this thing that here you can see at the bottom the specificity of serological reaction. So, here you will see the antibodies highly specific. So, what he has done he performed a very simple experiment.

What he has done he conjugated these this organic entities~~and Titus~~ here you can see that this is amino Benzene which is an allele. You know very well if you have studied the chemistry and I am sure you have studied the chemistry he also immunized the different group of animals with this Ortho Amino benzoic acid meta-amino benzoic acid and paramino benzoic acid. So, there are four groups of animal.

And each group received this particular molecule which is tagged with some carrier molecule and then he produced the antibody. When he produced the antibody he wanted to check the

specificity here you can see that the antibody which is produced again that particular species reacted with only that species not with another species. For example the antibody produced against aminobenzene can react with only aminobenzene not with ortho Amino benzoic acid metaminobenzoic acid or paraminobenzoic acid.

This is highly specific. Similarly he performed this experiment he he tested this cross reactivity. Now the conclusion from this experiment is very beautiful. If you this is a very simple experiment but conclusion is very very interesting here there is a very little change in the structure and this little change in structure do not cross react with the antibody. For example the antibody which is generated against for example ortho aminobenzoic acid cannot react with metaminobenzoic acid.

There is a little very little subtle~~social~~ difference in the structure in three dimensional but this the three dimensional little change in the structure can distinguished by the antibodies the antibody which is produced against this Ortho aminobenzoic acid cannot react with either metaminobenzoic acid or paraminobenzoic acid or this aminobenzene or aniline. So, this is a very important conclusion that that and that suggests that adaptive immunity is highly specific.

If you have some protein and if you make some amino acid change and the; antibody which is produced against that particular antibody so all antibody will not react with the change protein and this is the distinguishing feature when we are when the ~~indi~~individual~~s~~ is infected with different strains of microbe. So, our immune system can recognize and this is used by the pathogen. So, pathogen can evade the immunity by making small changes because our immunity is highly specific.

So, once there will be a change in some surface protein then the immune response which is generated against previous strain will be not. So, useful that you have seen in current SARS Covid 2 infection also there are different variants and all those variants they are not giving a full protection against one particular variant. And due to this we don't have a very good vaccine against the influenza.

because this influenza is keep on changing every year and that is why they evade our immunity very successfully and some of strains due to making these changes they can they

can be more fatal they can cause even death. So, it is very important to keep an eye on these episodes of infection which is happening all over the world. And there is a way that we can make some kind of we can engineer those changes in one in one pathogen and then we can use it for vaccination.

So, this is all about the antigen. And in next session I will take you further about the antibodies here I am stopping this session and we will see you in next session, thank you.