Host-Pathogen Interaction (Immunology)
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Lecture: 3
History of Immunology - 3

Hi so in previous session we have seen various plagues or a disease and there we people learned how to protect from these infections. So, after that the scientific community or those who are interested in understanding the basis of this protection they further moved and they have found out there are several School of thoughts. And so, in this session basically we will see how this Immunology basic Immunology field was initiated established.

And thereafter we will also discuss about the all those great works which received the Nobel Prize maybe in this session or maybe next session.

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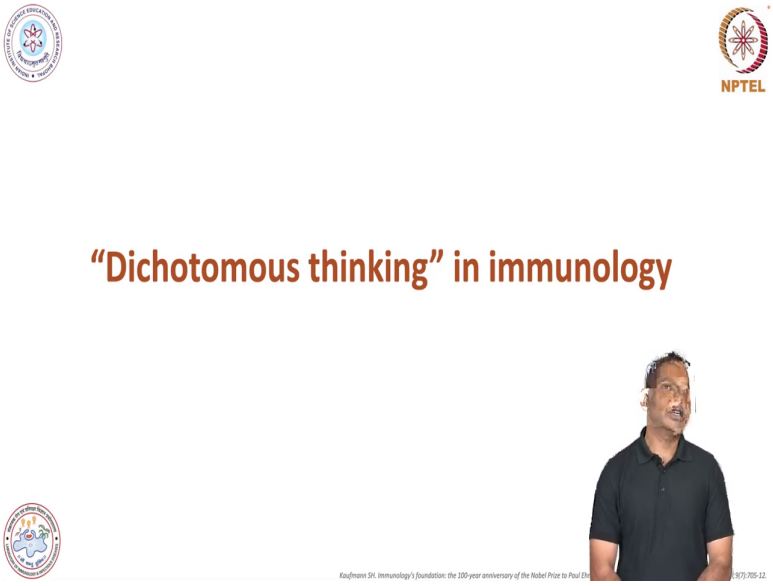

So, there was a there was a dichotomous thinking in Immunology dichotomous means there are two opposite or quite polarized thought uh was there that the defence whatever we have or the animal have they some people thought that or some people say that this is due to some cellular component some cell. And another school of thought is that no there is a some factor which is present in Blood and that is giving a protection.

So, this we call it as a dichotomous thinking and both school of thought they are very against each other it is not that uh they do not want to compromise at any cost. So, I will take you through those two school of thought and now you are also may be aware that both theories were correct. The difference is not only by some cells but it is also there are some soluble factors which is also playing a very important role in defence against any infection.

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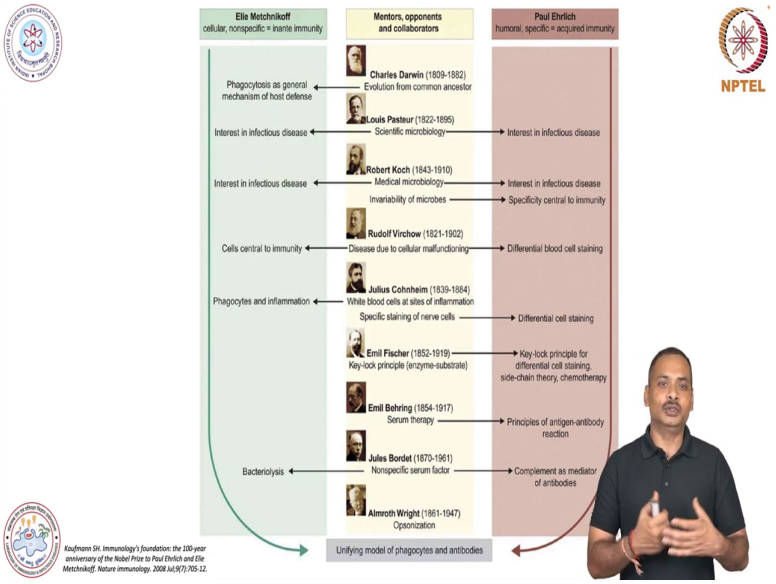

So, let us look at this; what is this dichotomous thinking who are the main proposers and who are the supporters for these two school of thoughts. So, here you can I have a very nice slide which is a which I have taken from this article if you want to see this article then you can take this article and go through. Anyway I am going to talk about what are the two school of thought. So, one school of thought is we call it as a cellularists. Cellularists means all those scientists who believe that there are some cellular component.

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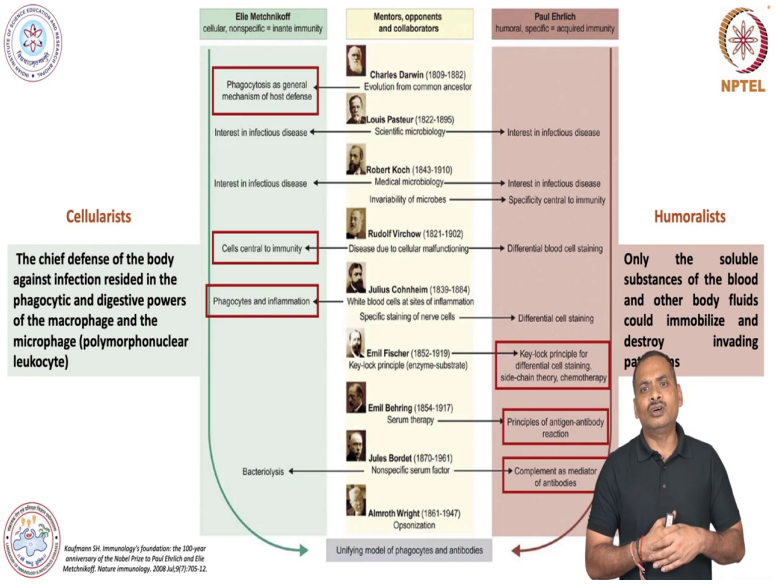

And this theory was uh was not theory this observation was given by Elie~~Amil~~ Metchnikoff~~mactinkov~~ here you can see there is a on top he gave this theory after observing some of his work. So, basically his theory was that the chief or the key difference in the individual or in animal is uh by some specialized cell which eat the pathogen and this they call this cells as a phagocytic cells.

And these phagocytic cells digestive property imparts the immunity in the host. He also said that there are some microphage. Microphage is basically a polymorphon~~-~~nuclear leukocytes these are the type of blood cell which I will discuss in great length when I will take the cells of immunity. So, basically this macrophage is playing a key role in immunity and their digestive capacity or digestive power gives the ~~ah~~ the strong immune response.

And who all are the supporter of this theory one is the Charles Darwin who was saying that this phagocytosis as a general mechanism of host defence he was a one of the ~~supporter~~supporters. Another is that Rudolf~~ph~~ Virchow~~ff~~ he also he also supported this theory by saying that cells are the central in immunity in defence. There is a Julius Cohnhe~~l~~im he also supported this theory who discovered white blood cells which is present at the site of inflammation.

So, we will discuss all these white blood cells and inflammation in great length in future sessions of this course. On another hand there are another school of thought we call it as a humoralists and these basically the hume~~o~~ral means the soluble component. The soluble

component which is present in body fluid mainly blood. This school of thought was basically supported or initiated by Paul Ehrlich.

And this person is a basically showed that there is a some soluble substance which is present in the blood and other body fluid they are basically destroying the ~~i~~Invading~~novative~~ pathogen. So, this was his concept and there are several supporter of his concept one is that you can see that Emil Fischer who basically gave this concept. So, there is a pathogen and there is a some unique molecule which fit with this pathogen like a lock and key there is a unique molecule. And this unique combination basically ~~eradicate~~eradicates the pathogen from the host.

Another is a Emil Behring so, he basically gave this concept of antigen. Antigen is any substance which is foreign to the host. Antigen and he gave the principle of antigen antibody interaction or reaction and he was also one of a very strong supporter of this theory. Another is a Jules Bordet. So, Jules Border also a very strong supporter of this theory and his work also resulted to support this school of thought.

That there is some soluble component which interacts with pathogen and then that will kill the pathogen. So, let us ~~uh~~ look at about the work of Metchnikoff and Ehrlich.

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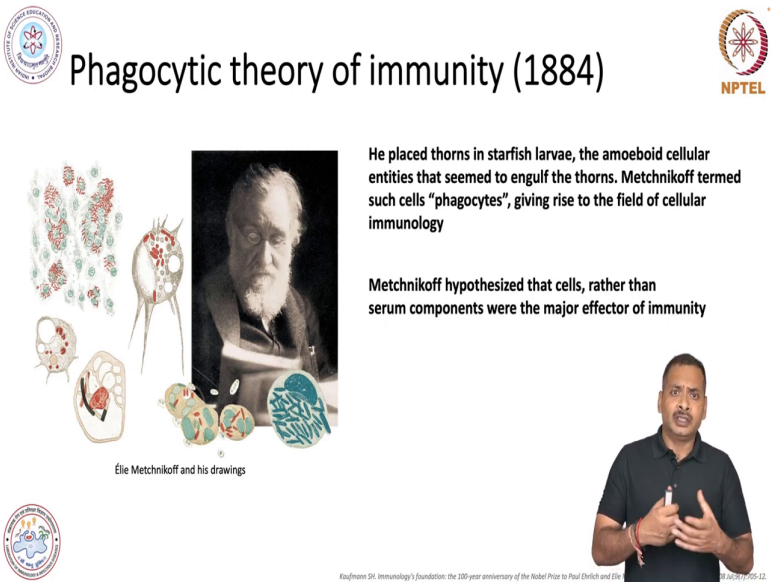

So, phagocytic theory of immunity basically given by the Metchnikoff~~Metchnikoff~~ around 1884 and he observed that when the starfish he introduced some throne in a starfish larvae and the amuboid cellular entity that seems to be engulfed the throne. So, he observed that

there are some amoeboid kind of cell which is taking of this throne and basically digesting this throne. And Metchnikoff gave a term of phagocytes the cell which eats they he called it as a phagocytes.

And then his theory got a lot of support because he demonstrated that there are there are some cell which eat the pathogen or eat the foreign thing. So, this gives the concept of cellular immunity. Metchnikoff basically hypothesized that the cells the rather than the soluble component is playing an important role in defence. So, he was against that all those school of thought which is supporting that there is a some soluble component and giving a defence. So, in that way Metchnikoff~~Metchenkoff~~ work he also received the Nobel Prize for this work.

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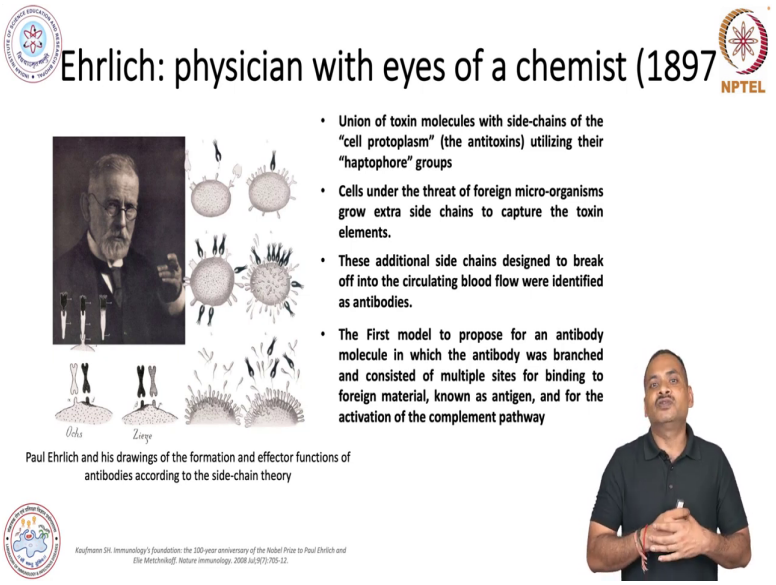

Another is a Paul Ehrlich work basically he was a physician and he is more interested in chemistry component and he also gave one theory which is we call it as a side chain theory. So, basically when there is a toxin in the host and then there will be a some molecule will be generated over the cell which he call it as a side chain. This side chain is basically a cell protoplast which is basically anti-toxin in nature and he also call it as a heptophore.

This heptophore because there is a no clear word about like antibody. So, initially we call it as an antitoxin. So, the molecule which is generated over the over the cell and this molecule is binding with the ~~ah~~ say the foreign substance or toxin he call it as a heptophor and this molecule basically neutralizes this ah the foreign substance or pathogen or molecule. So, cell under threat of foreign microorganisms grow this extra side chain to capture the toxin or to capture the microbe.

So, he gave so, you can understand at that time uh the field was just a beginning the Immunology field was just beginning and you can understand this is what kind of thinking people had. There is a molecule which binds and basically this captures the antigen or Toxin and then basically it neutralizes. And you can think that in 1897 this was quite correct. Now there is a B cells they express the antibody molecule, ok, and then these B cells basically differentiate to the plasma cell and produce antibody.

So, these ~~uh~~ additional side chains ah basically designed to break. So, the cell is making this side chain and when this side chain will bind with antigen then this will break and then this will present in the circulation or in the blood and this is quite very or very well supported this theory was very well supported by many workers. So, the first model ~~of~~ to propose for an antibody molecule in which uh the antibody was branched and consists of multiple site of binding to foreign material known as antigen.

You now we know we call it as antigen and for the activation of complement pathway. So, this was uh now we know that this molecule is expressed and then this is a binding with the antigen and eliminating and in addition this is also used for the activation of complement. So, these were~~are~~ another school of thought and by this work there was a two school of thought and there are several people who supported this thing because in their observation they found out similar things.

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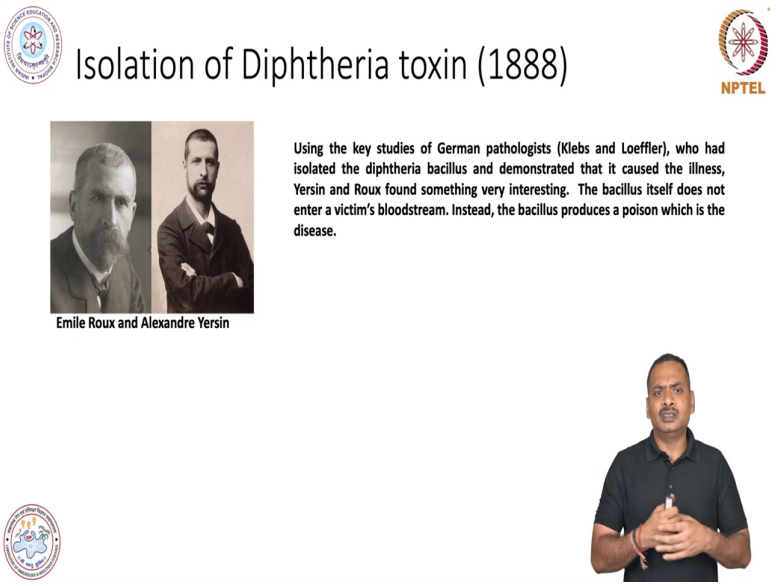

So, now I will talk about the isolation of diphtheria toxin which is a basically um given by the Emil Rox and Alexandr~~ia~~ Yersin~~Easing~~. So, so basically they have collected the bacteria diphtheria bacteria from K~~e~~lub and L~~l~~oa~~e~~ffler and they observed that this bacteria is not causing the illness rather the some toxin produced by this bacteria is responsible for causing disease. And his work was a quite well accepted by at that time immunologist and now we know that diphtheria toxin plays a very important role in pathogenesis.

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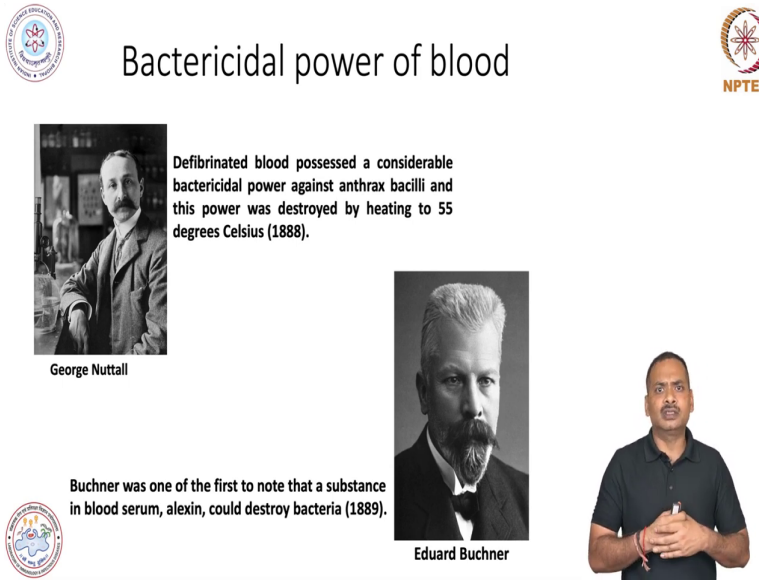

Thereafter there was a other discoveries like people showed that there is a some factor present in the blood and this factor is having a bacterial lysis property or bacteria~~-Sce~~ide~~a~~l property. So, this work was a basically initiated by George nuttall~~ettle~~ and he basically provided that there is a some factor which is present in a fluid ~~of~~ or body fluid and this basically kills the anthrax bacilli.

And when we take this blood and heat it to 55 degree Centigrade then this capacity is disappeared. And if we heat~~it~~ this blood at 55 degree but again if you replenish the reaction with fresh blood or ~~flush~~ fresh blood serum then this killing capacity is again the bacteria will be killed again regain this killing capacity. So, here you can see that the concept of complement is emerging by his work.

And basically, there is another supporter who Edward B~~ookner~~buchner he called this Factor as a alexin~~Elixir~~ and which is basically destroying the bacteria.

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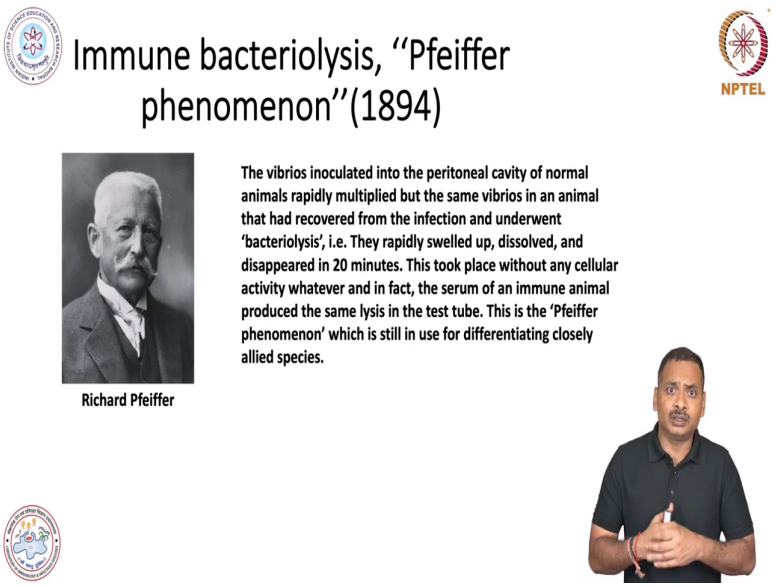

So, there is one more scientist Pfeiffer he basically showed that in animal who received this vibrio and cleared this infection if you inoculate again the bacteria then this bacteria will disappear from this animal and he also demonstrated the similar property in vitro condition. He have taken the fluid and then he put this bacteria and then there will be a lysis of bacteria and basically,- his observation got a lot of recognition and people recognize this phenomena as a Pfeiffer's phenomenon and this is this is basically used for differentiating closely related uh pathogen.

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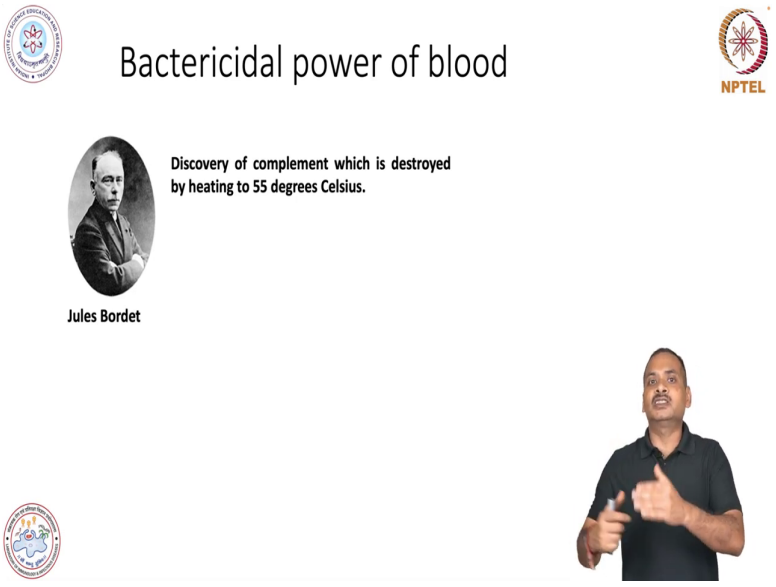

So, finally all this theory was a well explained by and this Jules Bordet who was the discoverer of the compliment and he showed that when ~~you when~~ the blood serum is heated at 55 degree Centigrade then this protein or there is a group of protein later on it was called as

a complement was basically losing its property and this can be replenished if we provide the fresh blood serum.

So, the complement word is a basically a set given for the family of protein and we will discuss a lot about the complement. We will study the pathways of complement. So, why complement word is there for this family of protein? So, here just I would like to tell that this complement basically complements the blood property. So, if you have a little knowledge this complement is also activated by antibodies.

And so, when there will be a lysis of bacteria and if you put the complements it complements this lysis property. So, that is why this complement name came.

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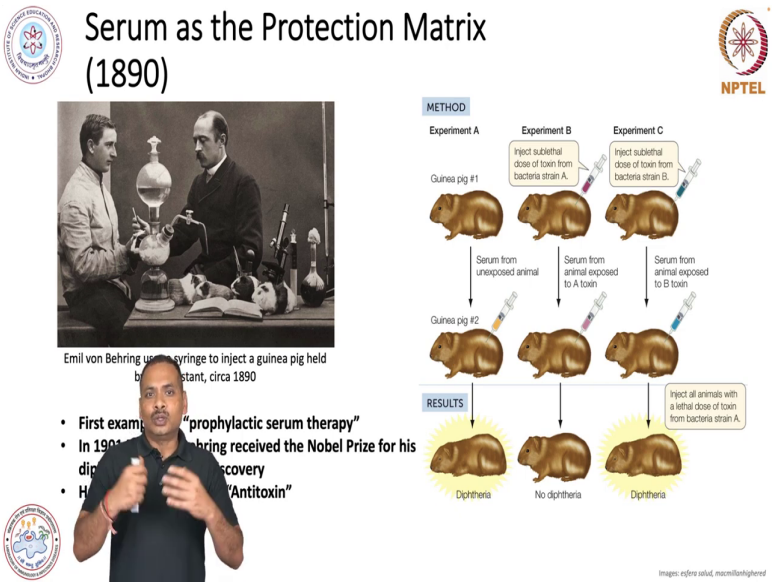

Now there is a serum as a protection Matrix basically this is a work of uh Emil Behring~~ordet~~ and he basically gave the concept of prophylactic serum therapy and for his this work he received the Nobel Prize and at that time this prophylactic serum therapy is considered as there is a some antitoxin which is giving the protection. And this is a one of his very beautiful experiment here I would like to explain this experiment.

Here you can see that there are three groups of a guinea pig here you are seeing only one guinea pig and one the first guinea pig did not receive any toxin. And the second group they received the toxin from strain A~~a~~ and please remember this is a sub lethal dose not very lethal dose. And the third group of guinea pig received the toxin from strain B after that what they have done they have isolated the serum from these ~~uh in this~~ challenged guinea pigs.

And then they introduced this serum in another group of guinea pig the first group here you can see that it the serum is from uninfected or unexposed animal. In second group you can see that the serum is taken from those group which receive the sub-lethal dose of toxin A and in third group you can see that the serum is taken from the animals which is challenged by strain B toxins. And then after that they have infected all these three groups of guinea pig with this strain of challenged by basically the lethal dose of this toxin A.

And then they have observed that the guinea pig which received earlier received the serum from uh the from the animal which is giving which are challenged by the sub lethal dose of toxin A got protected but not other. So, this shows that this is quite specific the response is very specific. So, and this response is basically present in the blood because they have used the serum.

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Thereafter there was a other work in 1896 in which they have showed this agglutination of bacteria by Max Vone gGroupber and Herbert Durham. So, basically they showed that a bacteria of similar size cluamped together in serum in very specific to or determined by each serum. So, basically agglutination assays and all those things were came in picture and one very good um example of this agglutination essay is the WVidal test which is given by George Fernand IsoSO doer VWidal.

And this wVidal test we use still we use the use for this typhoid. So, here I gave you a kind of a middle age overview of Immunology and now towards end I will discuss about the or in

next session I will discuss about all those work which receive the Nobel Prize. And then finally I will discuss about the different branches of Immunology thank you thank you very much.