**The Future of the Flu Vaccine**

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**Abstract**

Peter Palese’s article, “A broadly protective antibody”, discusses the newly discovered antibody that could revolutionize the influenza B vaccine. Antigens damage a host by rapidly replicating inside the cells before the host’s natural antibodies come in and attack the virus. The new antibody was created by combining 12G6 antibodies with the human IgG1 antibody of humans. C12G6 is different from other antibodies because it binds at what is known as the docking point of the receptor-binding site, preventing the virus from replicating. There is still a lot of research to be done in regard to this newly researched antibody and humans. In the future, this could revolutionize the flu vaccine.

**Introduction**

The revolution of medicine in this century is heavily dependent on the discovery of antibodies and vaccines. In the article, “A broadly protective antibody” by Peter Palese, he discusses a newly discovered single antibody that inhibits the replication of the influenza B viruses. This discovery could lead to a more effective flu vaccine.

**Recent Progress**

An immunologist named Paul Ehrlich created the concept of antibodies that target antigens. It has become common for antibodies to be monoclonal, which means they bind to only one site of the antigen. This led to a creation of a monoclonal antibody that could potentially protect us from all influenza B viruses. Influenza is a very common problem in the United States leading to thousands of deaths each year from both strands A and B. These viruses attack the host through multiple rounds of replication. It can be a difficult and long process for the human immune response to breakdown the virus without these antibodies. A glycoprotein called hemagglutinin helps flu viruses connect to the host cells. Hemagglutinin is a clump mixture of red blood cells and virus particles. Antibodies are responsible for preventing this docking, therefore protecting the host cell. The influenza B virus comes from two different lineages, the Victoria and the Yamagata lineage. These new antibodies would be able to protect the host from both lines. A study was done using mice and ferrets that were immunized with the influenza B virus. They then isolated the monoclonal antibodies that the mice’s immune response produced and analyzed the antibodies blocking the influenza B virus from attaching to the cell. The best antibodies were labeled 12G6, which were then combined with the human IgG1 antibody. The Fc region of the human antibody activates the innate immune system. The researchers developed a chimaeric antibody in this process which they then called C12G6, which would be used in further studies. The C12G6 antibody was able to inhibit the docking of viruses in all the strains of influenza B. C12G6 is different from other antibodies in that it binds at the docking point of the receptor-binding site instead of the head region. This antibody was able to not only protect the mice and ferrets from the virus but they were also able to be used as therapeutic treatments when they host was already infected from the virus. The difference in binding sites is the major difference of this antibody and previous ones. It helps prevent binding of all of the virus strains rather than specific ones. It was also proven that C12G6 inhibits the virus replication through neutralizing and activating the immune system’s antiviral activities. The antibody also stimulates immune response by activating the antibody-dependent cell-mediated cytotoxicity, which results in destruction of the virus. There is still a lot of research on C12G6 to be done in regards to humans, for it has only been studied so far in mice and ferrets. There are other factors that have to be considered such as cost and effectiveness. The duration of this protection along with the cost doesn’t seem worth it to the general population but it could be very beneficial to people that are at high risk of contracting the virus. The study of this antibody can expand in a broader scope than just influenza. The development of this as a vaccine could transform the immune response to influenza forever and the possible elimination of this as an epidemic breakout.

**Discussion**

This article discusses the discovery of a new antibody, C12G6, that could be implemented in the future to protect and treat humans that contract the influenza B virus. The modern day flu vaccine that we get don’t protect us from all strands of the flu. There is influenza A and B with different lineage within those. Scientist have taken the antibody 12G6 from immunized mice and combined that with the Fc region of the IgGI antibody of a human’s immune system. The creation of C12G6 works a lot different from previous antibodies in that it binds at a different spot. C12G6 binds at the docking region rather than the head region, blocking the hemagglutinin binding receptors of the host cells, therefore inhibiting the replication of the virus. The immune cell then comes in and destroys the virus through immune proteins called the complement factors. This newly engineered antibody can revolutionize future vaccines as a whole, but more so specifically an ongoing vaccination such as the influenza vaccine.

This article captured my interest because it is in regards to immune response to virus attacks on the host cells. The topic at hand that I have chosen is the immune system. I think this article discusses the primary topic well and in an organized manner. The author, Palese, discusses the science and foundation behind the discovery of the C12G6 antibody. The discussion of the scientific background is important in understanding how antibodies and viruses affected the immune system prior to integration of the newly discovered antibody. That being said, I feel that a more in depth explanation of how this C12G6 differs from previous antibiotic methods would have been beneficial in understanding the revolutionary discovery. Palese discussed the major difference regarding the binding site being different. It would be nice to learn about how that discovery of a different binding site came to be since it was the major key difference. He also then discusses the possible issues regarding this new antibody. He mentions the cost-benefit factor of implementing this vaccine to humans. For one, it hasn’t really been tested or studied on humans yet since the discovery is still so new. He could have been more specific on what he means by how long the effects would be and why the cost of this vaccine is higher than the previous flu vaccine which is pretty obtainable to the public. He just says that the duration of the effects isn’t worth the cost of production. I would have liked to know why the different elements cost more. Palese also talked about how C12G6 was used as a therapeutic treatment option for infected mice and ferrets. I’d recommend discussing whether this is a possibility for humans in the future or not, or why it was possible for the test animals but maybe not for humans. I would have also liked an explanation on how this vaccine, which is primarily supposed to be preventative, could be used to treat host cells that are already affected by the influenza virus. Typically, an affected individual would have to go through rounds of antibiotics and allow their own immune systems to fight off the viral infection. I questioned how this antibiotic was able to clear off the virus of already infected cells. I assumed that it has something to do with the inhibition of further replication of the virus. These are just a few question that came to my mind after reading the article that could have further enhanced my understanding of the study.

 Overall, this article was very informative and easy to get the main idea of the study. The author did a good job at breaking down the study along with a brief history of previous antibodies in a straightforward manner. He explained briefly how virus attacks an antibody and the immune response that occurs to a viral infection. Because the study is still ongoing, it is hard to go into more detail about the future of the study and how it will affect society. The article gives readers enough information on what the study has discovered so far but allows them to make their own interpretations about the potential studies in the future. I found this article overall interesting and relevant.

**References**

Palese, P. (2017). Influenza: A broadly protective antibody. *Nature,* *551*(7680), 310-311. doi:10.1038/551310a