13.2E: Neutralization of Viruses

Skills to Develop

1. Discuss how antibodies defend the body by way of neutralizing viruses. (Include what classes or isotypes of immunoglobulins are involved, the role of the Fab portion of the antibody, the role, if any, of the Fc portion of the antibody, and the role of any complement proteins, if any, involved.)

2. Briefly describe 2 different ways viruses may resist neutralizing antibodies.

In order for viruses to infect a cell and replicate, they must first adsorb to receptors on the host cell's plasma membrane. Antibodies are made against viral capsids or envelope glycoproteins where the Fab portion binds to and covers the viral attachment molecules. This prevents viral adsorption to host cells. (Figure 1). Neutralizing antibodies are especially important in preventing viral reinfection. IgG neutralizes viruses in tissues while IgA neutralizes viruses at mucosal surfaces within the body.
The Fab portion of the antibodies made against epitopes of the virus attachment site blocks the virus from adsorbing to the receptor site on the host cell membrane. As a result, the virus can not penetrate and replicate.

However, as learned in Unit 4, some viruses by means of the activities described below are able to overcome this antibody defense.

- The influenza viruses undergo what is called antigenic drift and antigenic shift. With antigenic drift, mutations cause a gradual change in the hemagglutinin antigen that adsorbs to receptors on host cells. Antigenic shift is caused by a human influenza virus acquiring a new genome segment from an influenza virus capable of infecting other animals such as a ducks or swine. This new genome segment causes a major change in the hemagglutinin antigen. Antibodies made against the original human influenza virus can no longer bind to the new strain of virus or stick the virus to phagocytes.

- Likewise HIV, because of its high rate of mutation and its intracellular recombination with other strains of HIV, as mentioned earlier in this unit, produces altered gp120 to which antibodies made against the earlier strains of HIV can no longer bind.

- The hepatitis C virus (HCV) frequently, through mutation, produces viral variants ("escape mutants") to resist antibodies.

Exercise: Think-Pair-Share Questions

A child is fully immunized against measles, mumps, and rubella with the MMR vaccine. The child is subsequently exposed to measles but doesn't get the disease. Explain why the virus was unable to replicate and cause disease symptoms.

Summary

In order for viruses to infect a cell and replicate, they must first adsorb to receptors on the host cell's plasma membrane. Antibodies are made against viral capsids or envelope glycoproteins where the Fab portion binds to and covers the viral attachment molecules. This prevents viral adsorption to host cells. Neutralizing antibodies are especially important in preventing viral reinfestation.
Questions

Study the material in this section and then write out the answers to these questions. Do not just click on the answers and write them out. This will not test your understanding of this tutorial.

1. Discuss how antibodies defend the body by way of neutralizing viruses. (Include what classes or isotypes of immunoglobulins are involved, the role of the Fab portion of the antibody, the role, if any, of the Fc portion of the antibody, and the role of any complement proteins, if any, involved.) (ans)
2. Describe one way a virus can resist virus-neutralizing antibodies and give an example. (ans)
3. Multiple Choice (ans)

Contributors

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