BENG 100 Frontiers of Biomedical Engineering Professor Mark Saltzman

Chapter 15

SUMMARY

- One of the most important advances in medical science over the past 200 years is the use of vaccines to prevent infectious disease.
- The immune system responds to the presence of many foreign antigens by producing specific antibodies. Antibodies vary in specificity as well as class; the ability to make a range of antibodies is important in health and creates many opportunities in biotechnology.
- A variety of approaches to vaccine production have been developed, including the use of attenuated or killed viruses, protein subunits, engineered viruses, and DNA as the vaccine component.
- Despite important progress in disease prevention, there is still much to learn about how to make vaccines and how the immune system responds to different vaccine preparations.

KEY CONCEPTS AND DEFINITIONS

antibodies – a large Y-shaped protein that is used in the immune system to identify and counteract invaders such as viruses, bacteria, or transplanted organ by binding to the antigen.

antigen – a substance introduced into the body that can stimulate the production of antibodies.

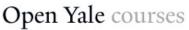
antiserum – a serum composed of antibodies that has been inoculated into an animal for use in a second animal to provide immunity against a particular disease.

ascitic tumors – a tumor caused by the accumulation of fluid in the peritoneal cavity.

attenuated – retaining the immunological properties, in reference to a virus, without the diseasecausing characteristics.

B cells – lymphocytes that develop in the bone marrow that produce antibodies against specific antigens. Also called B lymphocytes.

cirrhosis – a disease of the liver where healthy cells are replaced by scar tissue, leading to the loss of liver function.



cysteine - a naturally occurring amino-acid that contains a thiol group

dimeric – consisting of two similar molecules, or monomers, that have been linked together.

effector region – a position where a small molecule is bound to a macromolecule in an antibody.

enterovirus – a virus that infects through the intestinal tract and so is primarily contracted by the fecal-oral route.

glycoprotein – a group of macromolecures that all contain a protein connected to a carbohydrate.

glycosylation – the an enzyme directed addition of a glycosyl group to a protein to form a glycoprotein.

half-life – the time required for a quantity to decay to exactly half of the initial amount present.

hybridomas – cells that produce large amounts of specific antibodies, formed by the fusion of a normal cell with a cancer cell.

immune system – a system of the body made up of cells and tissues that protects the body from foreign invaders through destruction and removal.

immortalized cell line – cells that have been altered to grow indefinitely under proper culture conditions, unlike primary and secondary cells.

immunosuppressive – capable of reducing the normal function of the immune system.

immunotoxin therapy – treatment method for cancer and viruses that uses substances capable of altering the normal function of the immune system to protect against toxic compounds.

immunotoxins – chemicals that can cause the malfunction of the immune system by destroying specific cells.

lymphocytes – a particular type of white blood cell in charge of fighting infection and disease, including natural killer cells, B cells and T cells.

monoclonal antibody – antibodies that have been derived from the same clone.

monomers – a molecule that has the ability to combine with other molecules to form a polymer.

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parenteral – a method of entering the body other than through the oral cavity.

pathogens – a disease producing agent.

pentameric – consisting of five identical molecules, or monomers, that have been linked together.

pharmacokinetics – the process by which a drug enters the human body.

plasma cell – a B cell that has matured into an antibody-producing cell.

polymerization – the process of forming a polymer.

recombinant DNA - a DNA molecule that has been created from the insertion of one or more gene segments resulting in a new genetic sequence.

secretory piece – a polypeptide chain with the ability to bind to secretory IgA molecules.

sera – the liquid portion of blood after all clotting factors have been removed.

titers - of high concentration.

trimeric – consisting of three identical molecules, or monomers, that have been linked together.

vaccines – a preparation of a pathogen that has been weakened or killed with the ability to stimulate antibody production when administered to the human body.

QUESTIONS

1. Design an experiment to determine whether or not a vaccine has been effective.

2. Explain the difference between a subunit vaccine and a DNA vaccine.



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