Induced Immunity: Active and Passive Immunity

- Induced immunity is brought about by intervention from either within the individual's own body or from an outside source
- If the body takes an active role in producing the antibodies it is considered <u>active immunity</u>
- If the antibodies are introduced to the body directly (as in from mother to child through the placenta) it is <u>passive immunity</u>
- In the case of mother→ child antibodies, the baby maintains some resistance for up to 6 months after birth
- If you are exposed to tetanus, you can receive passive immunity to the toxin by receiving a tetanus shot which contains antibodies from a horse

<u>Vaccination</u>

- Vaccines are one of the most effective methods of inducing active immunity
- They work by introducing a weakened or dead microbe to the body so that the body can produce the antibodies needed to fight it off if infected
- A microbe at full strength might reproduce in the body faster than the immune system can produce antibodies against it
- Genetic engineering now allows scientists to create a protein that has a similar shape to the harmful antigen to induce an immune response with little risk
- No antibody lives in the body forever and some vaccines require a booster, providing a second exposure to the antigen (see Fig.1, p. 483)

<u>Chemical controls</u>

- The ideal treatment for some pathogens would be a chemical that would target the microbe without interfering with the patient
- This would target the organism directly, without stimulating the host's immune system to produce antibodies

<u>Antibiotics</u>

- The most common examples of chemical agents are antibiotics
- Antibiotics are usually obtained from living organisms which produce toxins to attack potential competitors
- The first antibiotic to be commonly used was penicillin, which was discovered by accident, by Sir Alexander Fleming, when a bacteria colony became contaminated with mould
- The mould was secreting a chemical that was allowing it to overtake and destroy the bacteria
- The chemical was extracted and later discovered to interfere with bacterial cell walls, weakening them and causing them to burst under the pressure of their own cytoplasm
- Ideally, an antibiotic should kill the invading bacteria without interfering with a person's normal body functions
- Some individuals, however, have very sensitive helper T cells, which identify the antibiotic as a harmful antigen, initiating an immune response
- Allergies to an antibiotic can be more dangerous than the bacteria itself

<u>Antibiotic-Resistant Bacteria</u>

- Bacterial populations can double ever 20 minutes under optimal conditions, resulting in high numbers of mutated cells over a short period of time
- Some of these mutations have allowed microbes to become resistant to penicillin and a wide-range of other antibiotics
- Once one of the cells has produced a resistant mutation, it can pass on its resistance to other cells via plasmids (see Fig.6, p.486)
- This is increased when a large population of organisms is given low dosages of antibiotics (ex/ cattle given antibiotics against mastitis)
- A secondary problem is that any milk or other food product taken from these cattle is eaten the antibiotics are also passed on, increasing resistant bacteria even further
- Antibiotics are also over-prescribed in humans, increasing the likelihood of resistant bacteria

Monoclonal Antibodies
- When an invader enters the body, it often takes a long time to make the correct antibody and to make enough copies of it to make a difference
- Using cloning, we can isolate an antibody producing cell from one source and fuse it with a cancer cell
- The new cell, called a hybridoma, has the characteristics of each type of cell – it produces antibodies like a lymphocyte, while reproducing at the rate of a cancer cell (see Fig. 7, p.487)
- These monoclonal antibodies are a promising new weapon in fighting disease

Biological Warfare
- Biological warfare dates back to about 600 B.C.
- Modern bio warfare began with the development of anthrax, spores released from a bacteria
- In order for a microbe to become a good biological weapon it has to:
    - Live for long periods of time
    - Be contagious
    - Be very toxic or deadly
    - Be resistant to variety of environmental factors
- Almost any disease-causing agent can be exploited for biological weaponry
- The microbe doesn't even need to be harmful to humans, if it damages farm plants or animals it could still create food shortages and economic ruin
- Fortunately their are few microbes that are highly contagious, powerfully poisonous and long lived in a variety of conditions
- However, through gene recombination, a "superbug" could be created that fits with all the criteria

Advanced Drug Delivery Systems
- A drug or hormone can be placed in a synthetic polymer capsule, designed to release their target molecules at specific target tissues at optimum rates (see Fig.9, p.489)
- One of the problems with traditional drugs or hormone therapy is maintaining an optimum level of the substance in the body over long periods of time without producing side effects
- Through burgeoning technology, these problems can be overcome

Homework

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