Module 12

Chapter 18 Practical Applications of Immunology

Active vs Passive Vaccination

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ vaccination: introduction of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to stimulate immune response
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ protection
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ vaccination: introduction of protective or neutralizing \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ protection

Vaccines

* Vaccine: suspension of \_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_ of organisms that induce \_\_\_\_\_\_\_\_
  + Early 1700’s, exposed smallpox \_\_\_\_\_\_\_\_\_ to veins
  + Edward Jenner developed \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ vaccine in 1798
* Development of vaccines most important application of microbiology
  + Jenner’s work won him Nobel Prize

*Principles and Effects of Vaccination*

* Main purpose of vaccination 🡪 stimulate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ production
  + Vaccine for small pox was infection with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Closely related to smallpox, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Stimulates \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ against cowpox and smallpox
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ works by immunizing most of a population
  + Protect the susceptible individuals by limiting spread
* Several types of vaccines

*Types of vaccines and their characteristics*

Attenuated whole-agent vaccines

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ but attenuated (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) microbes
* Live vaccines \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ infection more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Can achieve \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ immunity, especially against \_\_\_\_\_\_\_\_\_\_\_\_\_
* Attenuated microbes derived in lab from many \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* But, possibility of “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_” to \_\_\_\_\_\_\_\_\_\_\_\_\_\_ strain
  + Not used on people with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Inactivated whole-agent vaccines*

* Microbes that have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Usually killed by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, formalin or phenol
* Often used in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ people

*Toxoids*

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ toxins
* Directed at \_\_\_\_\_\_\_\_\_\_\_\_\_ produced by pathogen
* Require occasional \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: periodic shots given to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ effectiveness of vaccine

*Subunit vaccines*

* Use only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of microorganisms
* Aka \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or recombinant vaccines
* Choose antigen of pathogen that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ immune response
* \_\_\_\_\_\_\_\_\_\_\_ - cannot \_\_\_\_\_\_\_\_\_\_\_\_, fewer \_\_\_\_\_\_\_\_\_\_\_\_ effects

*Conjugated vaccines*

* Antigens attached to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Polysaccharides help \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ response

*Nucleic acid vaccines*

* \_\_\_\_\_\_\_\_\_\_\_\_ vaccines
* Newest, most promising
* No commercial vaccines yet
* Injection of “\_\_\_\_\_\_\_\_\_\_” DNA, often as \_\_\_\_\_\_\_\_\_\_\_\_\_\_, into \_\_\_\_\_\_\_\_\_\_\_\_
  + Results in production of \_\_\_\_\_\_\_\_\_\_\_ that \_\_\_\_\_\_\_\_\_\_\_\_ immune response
* DNA can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_, so it may not have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ effectiveness

*The development of new vaccines*

* Vaccine development decreased until recently
* Introduction of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ techniques (cell culture, chick embryos) has allowed the growth of viral vaccines
* The ideal vaccine would include:
  + \_\_\_\_\_\_\_\_\_\_\_ instead of \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ immunity from \_\_\_\_\_\_\_\_\_ dose
  + Stable without \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Affordable
* New vaccines for drug addictions, Alzheimer’s disease, cancer
* Currently, 20 injections required for children
  + Additional \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ vaccines would be beneficial
  + Routes other than injection
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ spray for influenza, \_\_\_\_\_\_\_\_\_\_\_\_\_ patches
* No vaccination is 100% safe
* Some \_\_\_\_\_\_\_\_\_\_\_\_ involved in receiving vaccines
* Sometimes they cause \_\_\_\_\_\_\_\_\_\_\_
  + Rota virus causes infant diarrhea
  + In some cases, vaccine caused severe \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Some tried to link MMR to \_\_\_\_\_\_\_\_\_\_\_
  + Links \_\_\_\_\_\_\_\_\_\_\_\_\_
* Overall, very low risk is worth the great gain of immunity

Chapter 19 Disorders Associated with the Immune System

Hypersensitivity

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ induced response
  + An undesired reaction of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Aka \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Antigen is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Occurs when individual is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by \_\_\_\_\_\_\_\_\_\_\_\_ exposure to allergen
  + Generates \_\_\_\_\_\_\_\_\_\_\_\_ against \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Second exposure to allergen \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reaction
* Reactions fall into 4 categories
  + Type I, II, III, IV

*Type I (Anaphylactic) Reactions*

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: “the opposite of protected”
* Occurs when \_\_\_\_\_\_\_\_\_\_\_\_\_ combine with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + IgE plus allergen binds to \_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Binding triggers release of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Histamine triggers \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Other effects are mucus \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in nose, difficulties in breathing

*Systemic Anaphylaxis*

* Aka \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Results upon second exposure to *\_\_\_\_\_\_\_\_\_\_\_\_\_\_* allergens
* Blood vessels \_\_\_\_\_\_\_\_\_\_\_\_ 🡪 drop in blood pressure 🡪 \_\_\_\_\_\_\_\_
* Reaction can be fatal in minutes
* Treatment involves \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ injection 🡪 constricts blood vessels
* Allergens include penicillin, insect stings, \_\_\_\_\_\_\_\_\_\_\_\_\_ stings

*Localized anaphylaxis*

* Associated with \_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ allergens
* Inhaled allergens sensitize \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells in respiratory tract
  + Re-exposure 🡪 congested nasal passages, sneezing
  + Antihistamines can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the effects of histamine
* Ingested allergens into gastrointestinal tract can sensitize individual
  + Result in gastrointestinal \_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_
  + May result in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ if serious
  + Most common food allergens are eggs, peanuts, tree-grown nuts, milk, soy, seafood, wheat, and peas

*Prevention of anaphylactic reactions*

* Avoiding contact is best method
* Desensitization: series of gradually \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dosages of allergen 🡪 \_\_\_\_\_\_\_\_\_\_ vs \_\_\_\_\_\_\_\_\_\_\_\_
* IgG acts as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ antibodies
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be used to diagnose sensitivities
  + Scrape small amounts of allergen \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 positive test

*Type II (Cytotoxic) Reactions*

* Involve activation of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by \_\_\_\_\_\_ or \_\_\_\_\_\_
  + Antigen is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cell, or sntigen bound to \_\_\_\_\_\_\_\_\_\_\_\_\_ cell
* Activation of complement \_\_\_\_\_\_\_\_\_\_\_\_\_ affected cell
* Most common involves blood group system
  + ABO, RH blood group systems
* Another type is drug-induced cytotoxic reactions

*The ABO blood group system*

* A person’s ABO blood type depends on \_\_\_\_\_\_\_\_\_\_\_\_
  + “\_\_\_\_” or “\_\_\_\_” antigens
  + Presence of antigen A 🡪 Type \_\_\_\_\_ blood
  + Antigen B 🡪 Type \_\_\_\_\_ blood
  + Antigens A and B 🡪 Type \_\_\_\_\_ blood
  + No antigens 🡪 Type \_\_\_\_\_ blood
* A person has \_\_\_\_\_\_\_\_\_\_\_\_\_\_ against other blood antigen
  + Recognized as “\_\_\_\_\_\_\_\_\_\_\_\_”
  + Type A blood 🡪 antibodies against \_\_\_\_ antigen (anti-\_\_\_\_)
  + Type B blood 🡪 anti-\_\_\_\_
  + Type AB blood 🡪 \_\_\_\_ antibodies
  + Type O blood 🡪 anti-A and anti-\_\_\_\_
* When blood transfusion is incompatible, antigen-antibody complex activates \_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 cells \_\_\_\_\_\_\_\_\_
  + When Type A blood is transfused into person with Type B blood
  + Presence of antibodies against A antigen (found in Type B blood) react with Type A blood

*Rh blood group system*

* Another blood antigen is Rh factor
* Those that have Rh factor are called \_\_\_\_\_\_\_\_, vs \_\_\_\_\_\_\_\_\_
* Rh- individuals do \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ against Rh factor
* Exposure to Rh+ blood can \_\_\_\_\_\_\_\_\_\_\_ individuals 🡪 produce \_\_\_\_\_\_\_ antibodies
* \_\_\_\_\_\_\_\_\_\_\_\_ exposure to Rh+ blood causes reaction with Rh factor 🡪 serious \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ develops

*Drug-induced cytotoxic reactions*

* Cytotoxic reactions caused by \_\_\_\_\_\_\_\_
* Drugs bound to blood cells cause complement \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Thrombocytopenic purpura - drug coats \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (important for blood clotting)
  + Loss of platelets result in purple spots on skin
* Hemolytic anemia: drug coats \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Agranulocytosis: drug coats granulocytic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Type III (Immune complex) Reactions*

* Involve antibodies against \_\_\_\_\_\_\_\_\_\_\_\_\_ antigens
* Immune complex: complex of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Form only under certain conditions
* Can activates complement and cause \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Glomerulonephritis: inflammatory damage of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ due to infection

*Type IV (Delayed cell-mediated) Reactions*

* Type IV is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, mainly T cells
* After sensitization, reaction is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for days
  + Time required for T cells to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Most common mechanism involved in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rejection
  + Mediated by \_\_\_\_\_\_\_\_\_\_
  + Sensitization occurs when foreign antigens are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, presented to \_\_\_\_\_\_\_\_\_\_\_\_
  + T cells mature into \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Re-exposure results in “delayed hypersensitivity reactions”
  + Memory T cells activate \_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_ antigens
* TB skin test is a type of delayed hypersensitivity
  + *M. tuberculosis* in macrophage \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ individual
  + Injection of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ results in delayed reaction
* Allergic contact dermatitis: caused by small molecules that combine with \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Include reactions to poison ivy, cosmetics, metals, latex

Autoimmune Diseases

* Autoimmune disease: immune system responds against \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Cause damage to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Occur when there is a loss of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Immune’s ability to discriminate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Cell-mediated autoimmune reactions*

* Attack of own tissues by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Multiple sclerosis: autoimmune attack of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells
  + Progressive loss of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ function
* Insulin-dependent diabetes mellitus: destruction of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ -secreting cells in pancreas

Reactions to transplantation

* Foreign tissue transplants are “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_”
  + Attack by \_\_\_\_\_\_\_\_\_\_\_\_, macrophages, antibodies
* Immunosuppression: suppression of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Often to prevent rejection of \_\_\_\_\_\_\_\_\_
* Favorable to suppress \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ immunity
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ not suppressed, can still resist many microbe invasions
* Cyclosporine: drug that suppresses activation of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + - No effect on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The immune system and cancer

* Immune surveillance: cancer cells develop frequently, but are removed by \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Surface of tumor cells develop “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ antigens” 🡪 recognized as \_\_\_\_\_\_\_\_\_\_\_
  + Can be destroyed by \_\_\_\_\_\_\_, NK cells, activated macrophages
* Tumors can evade immune system if:
  + Tumor-associated antigen fails to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ immune system
  + Tumor cells grow \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Tumor cells grow in \_\_\_\_\_\_\_\_\_\_\_\_ and move to bloodstream

*Immunotherapy for cancer*

* Use of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to prevent or cure disease
  + Stimulate immune response against \_\_\_\_\_\_\_\_\_\_\_\_ cells
* Attractive therapeutic 🡪 avoids damage to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* One approach is to mix \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with genetic material from a tumor
  + Dendritic cells are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that activate CTLs
* Another is use of Immunotoxins: combo of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and antibody
  + Could be used to specifically kill tumor cells
  + Requires that \_\_\_\_\_\_\_\_\_\_ can reach tumor cells – difficult with large tumor \_\_\_\_\_\_\_
* Therapeutic vaccine: used to treat \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cancer
* Therapeutic vaccine follow two approaches
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_-cell vaccines – prepared from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_-type vaccines – antigens \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on cancer cells
* Prophylactic vaccines: used to prevent \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of cancer
* Hepatitis B (liver), HPV (cervical) are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that can cause cancer
* Vaccine against virus is indirect \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ vaccine

Immunodeficiencies

* Absence of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ response
* Can be either congenital or acquired

*Congenital immunodeficiencies*

* Determined by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ genes
* DiGeorge’s syndrome: lack of \_\_\_\_\_\_\_\_\_\_\_\_ gland
* Agammglobulinanemia: growth of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is blocked

*Acquired immunodeficiencies*

* Acquired via \_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_, infectious agents
* Many \_\_\_\_\_\_\_\_\_\_\_\_\_ can infect and kill \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + HIV infects \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ T cells