The Immune System

and

Deviation From Health

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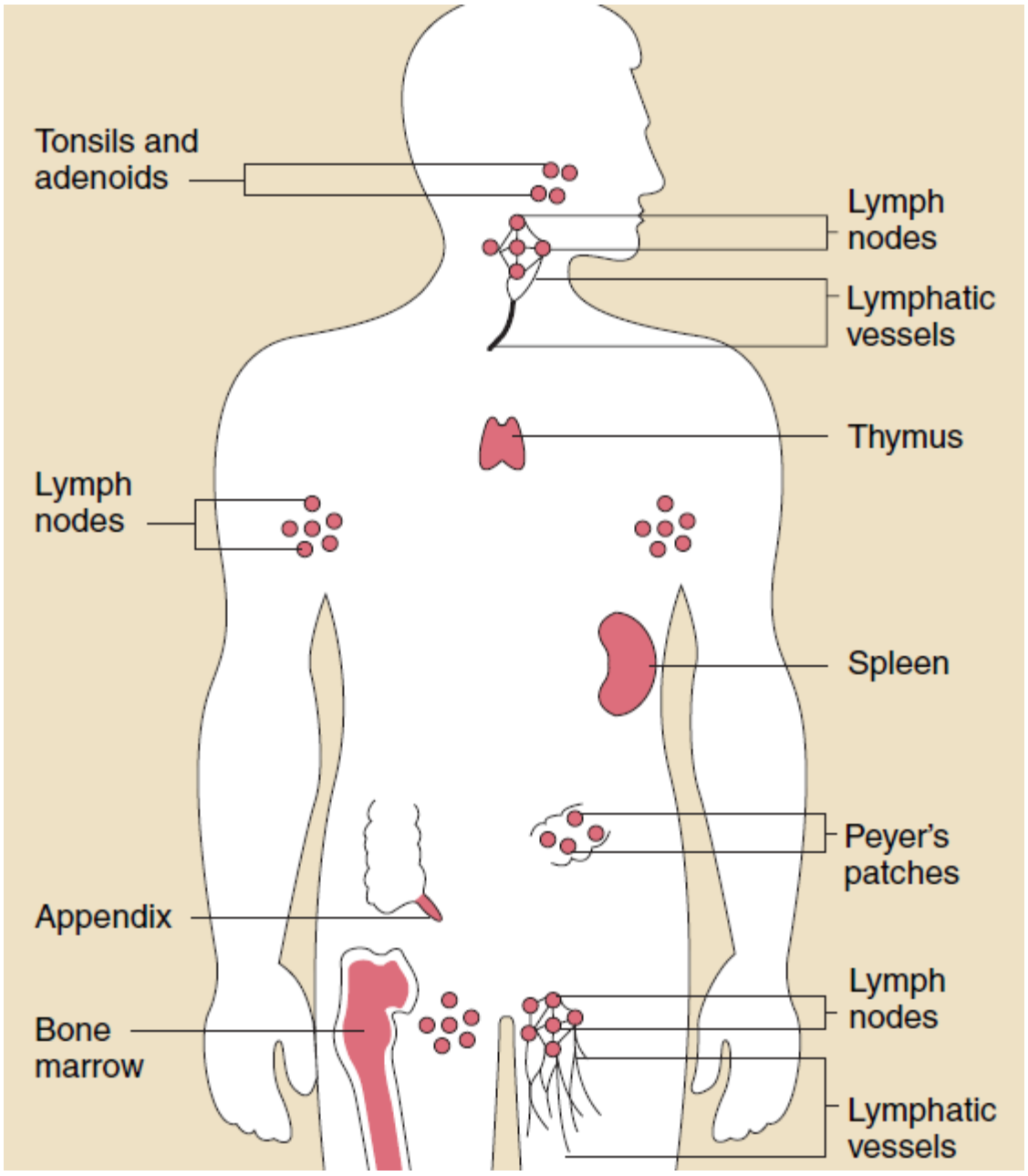
The immune system is a network of cells, tissues, and organs that work together to defend the body against attacks by "foreign" invaders. These are primarily *microbes* (germs)—tiny, infection-causing *organisms* such as *bacteria*, *viruses*, *parasites*, and *fungi*.

Because the human body provides an ideal environment from any microbes, they try to break in. It is the immune system's job to keep them out or, failing that, to seek out and destroy them.
The immune system is amazingly complex. It can recognize and remember millions of different enemies, and it can produce secretions and cells to match up with and wipe out each one of them.
The key to a healthy immune system is its remarkable ability to distinguish between the body's own cells—self—and foreign cells—non self.
Anything that can trigger this *immune response* is called an *antigen*. An antigen can be a microbe such as a virus, or even a part of a microbe.
In abnormal situations, the immune system can mistake self for non self and launch an attack against the body's own cells or tissues. The result is called an *autoimmune disease*. Some forms of arthritis and diabetes are autoimmune diseases.

The Structure of the Immune System
The organs of the immune system are positioned throughout the body. They are called *lymphoid organs* because they are home to *lymphocytes*, small white blood cells that are the key players in the immune system.
***Bone marrow*, the soft tissue in the hollow center of bones, is the ultimate source of all blood cells, including white blood cells destined to become immune cells.**
The *thymus* is an organ that lies behind the breastbone; lymphocytes known as *T lymphocytes*, or just "*T cells*," mature in the thymus.
The *spleen* is a flattened organ at the upper left of the abdomen. Like the lymph nodes, the spleen contains specialized compartments where immune cells gather and work, and serves as a meeting ground where immune defenses confront antigens.
Clumps of lymphoid tissue are found in many parts of the body, especially in the linings of the digestive tract and the airways and lungs—territories that serve as gateways to the body. These tissues include the *tonsils*, *adenoids*, and *appendix*.


Tonsils and adenoids
Lymph nodes
Lymphatic vessels
Thymus
Lymph nodes
Spleen
Peyer's patches
Appendix
Lymph nodes
Bone marrow
Lymphatic vessels

All immune cells begin as immature *stem cells* in the bone marrow. They respond to different signals to grow into specific immune cell types, such as T cells, *B cells*, or phagocytes.

B Lymphocytes

B cells and T cells are the main types of lymphocytes.

B cells work chiefly by secreting substances called *antibodies* into the body's fluids. Antibodies ambush antigens circulating the bloodstream. They are powerless, however, to penetrate cells. The job of attacking target cells—either cells that have been infected by viruses or cells that have been distorted by cancer—is left to T cells or other immune cells
Each B cell is programmed to make one specific antibody. For example, one B cell will make an antibody that blocks a virus that causes the common cold, while another produces an antibody that attacks a bacterium that causes pneumonia.

Antibodies belong to a family of large molecules known as *immunoglobulins*. Different types play different roles in the immune defense strategy.

Immunoglobulin G, or IgG, works efficiently to coat microbes, speeding their uptake by other cells in the immune system.
IgM is very effective at killing bacteria.
IgA concentrates in body fluids—tears, saliva, the secretions of the respiratory tract and the digestive tract—guarding the entrances to the body.
IgE, whose natural job probably is to protect against parasitic infections, is the villain responsible for the symptoms of allergy.
IgD remains attached to B cells and plays a key role in initiating early B-cell response.

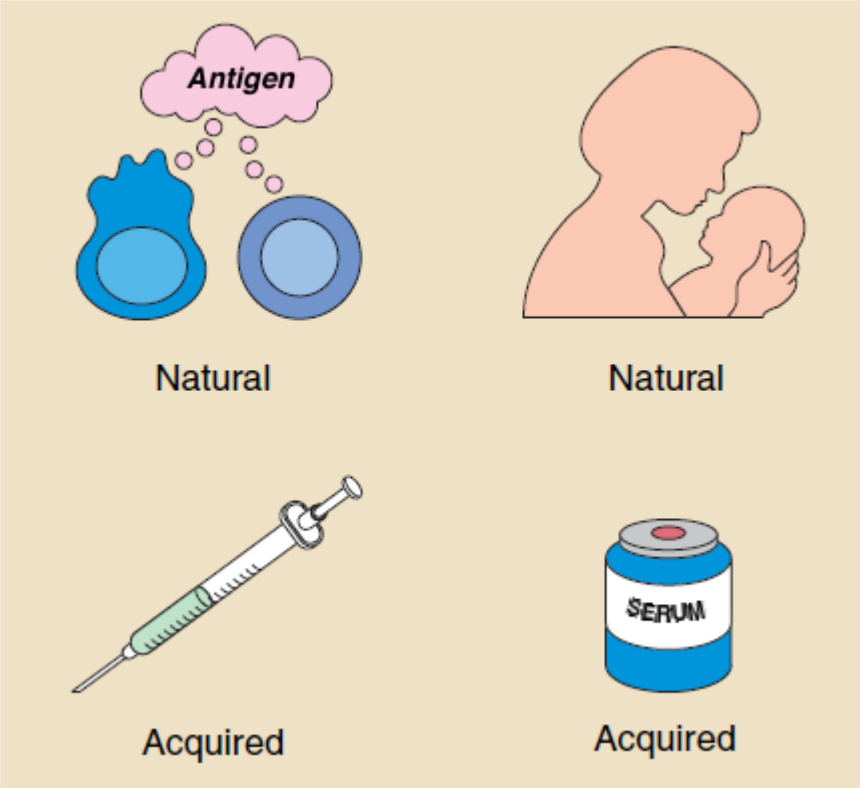
T Cells

Unlike B cells, T cells do not recognize free-floating antigens. T cells contribute to immune defenses in two major ways: some direct and regulate immune responses; others directly attack infected or cancerous cells.

Immunity: Natural and Acquired

Long ago, physicians realized that people who had recovered from the plague would never get it again—they had acquired immunity. This is because some of the activated T and B cells become *memory cells*. The next time an individual meets up with the same antigen, the immune system is set to demolish it.

Immunity can be strong or weak, short-lived or long-lasting, depending on the type of antigen, the amount of antigen, and the route by which it enters the body.



Immunity can also be influenced by inherited *genes*. When faced with the same antigen, some individuals will respond forcefully, others feebly, and some not at all.

An immune response can be sparked not only by infection but also by immunization with *vaccines*. Vaccines contain microorganisms—or parts of microorganisms—that have been treated so they can provoke an immune response but not full-blown disease.

Immunity can also be transferred from one individual to another by injections of *serum* rich in antibodies against a particular microbe (*antiserum*).
For example, immune serum is sometimes given to protect travelers to countries where hepatitis A is widespread. Such *passive immunity* typically lasts only a few weeks or months.

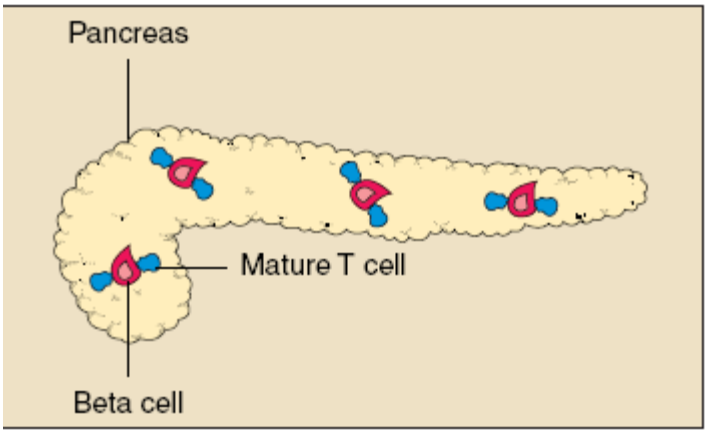
Infants are born with weak immune responses but are protected for the first few months of life by antibodies received from their mothers before birth. Babies who are nursed can also receive some antibodies from breast milk that help to protect their digestive tracts.

Vaccines consist of killed or modified microbes, components of microbes, or microbial *DNA* that trick the body into thinking an infection has occurred. An immunized person's immune system attacks the harmless vaccine and prepares for subsequent invasions. Vaccines remain one of the best ways to prevent infectious diseases and have an excellent safety record. Previously devastating diseases such as smallpox, polio, and whooping cough have been greatly controlled or eliminated through worldwide vaccination programs.

Autoimmunity
The immune system's recognition breaks down and the body begins to manufacture T cells and antibodies directed against self antigens in its own cells and tissues thus causing disease.

AUTO IMMUNE DISEASES

- **Causes: genetic , hormonal and infectious agents as viruses**
- **Examples: Diabetes, rheumatoid arthritis, psoraisis, etc**



Misguided T cells can attack insulin-producing cells of the pancreas, contributing to an autoimmune form of diabetes.

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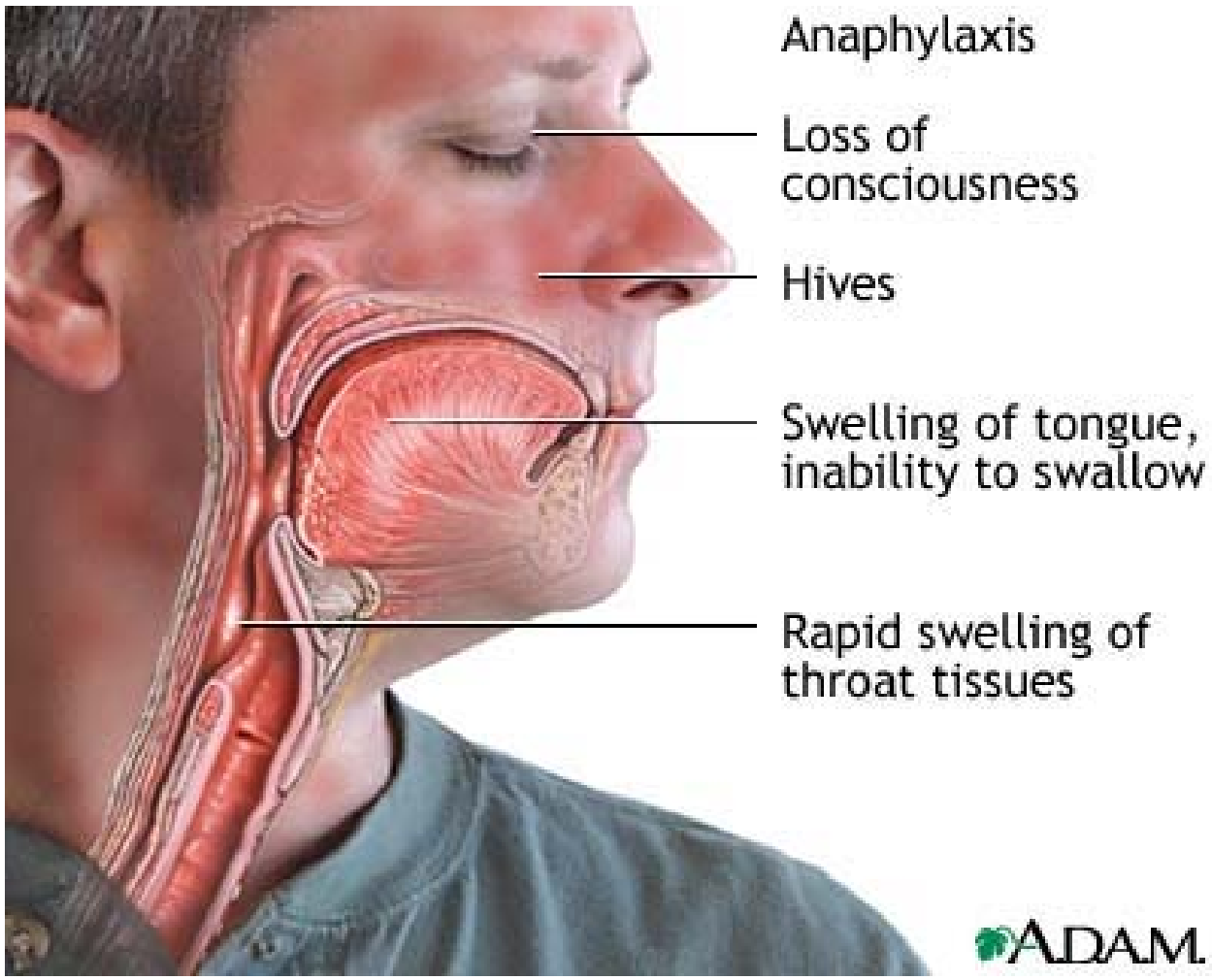
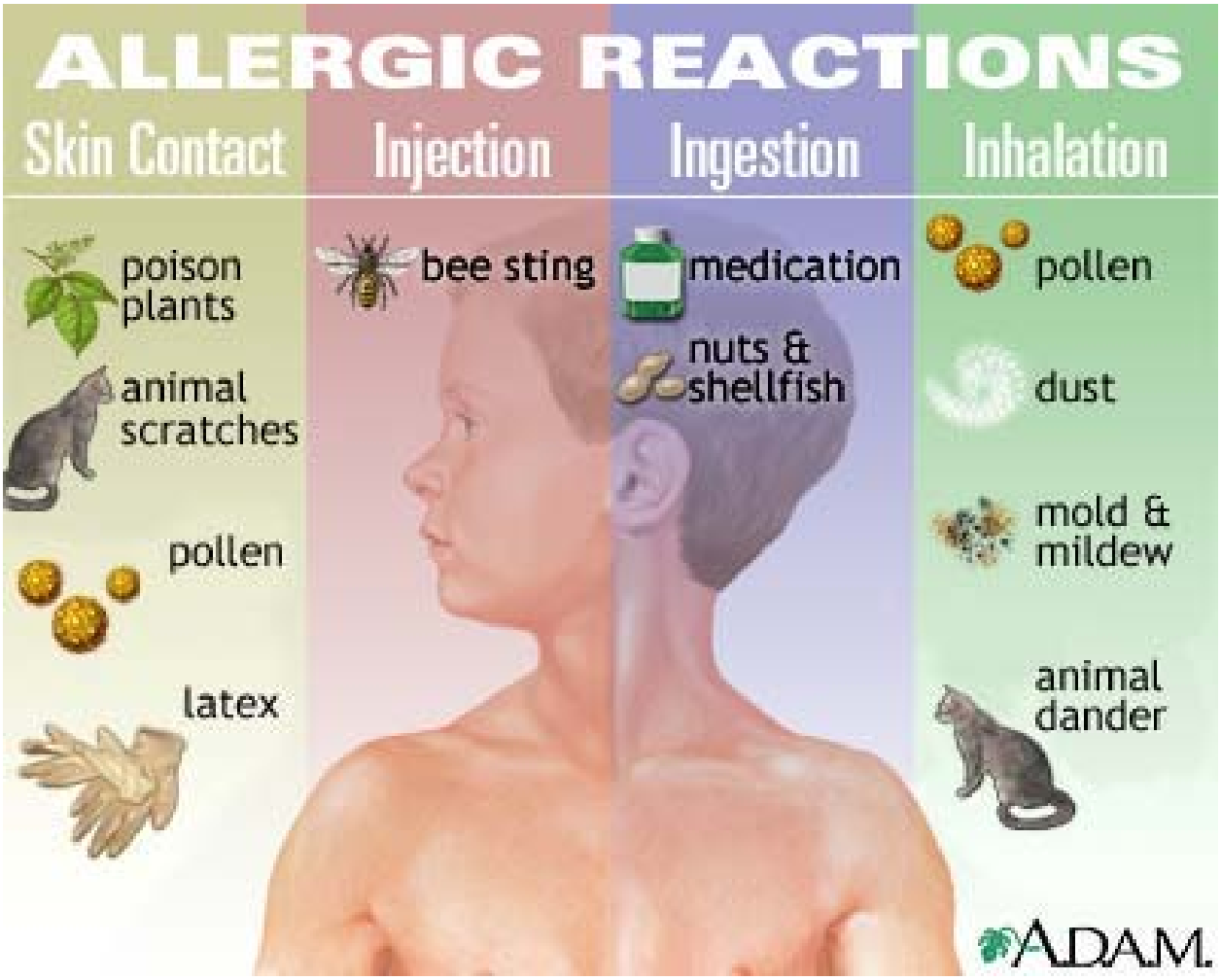
ANAPHYLAXIS

- **Immediate hypersensitivity of cellular sites with antigens and specific antibody**
- **Immunologic sensitivity to antigens occurring within minutes after antigen antibody reaction**
- **May lead to death from generalized anaphylaxis**


Anaphylaxis
Loss of consciousness
Hives
Swelling of tongue, inability to swallow
Rapid swelling of throat tissues
A.D.A.M.


ALLERGIC REACTIONS
Skin Contact
Injection
Ingestion
Inhalation
poison plants
animal scratches
pollen
latex
bee sting
medication
nuts & shellfish
pollen
dust
mold & mildew
animal dander
A.D.A.M.

Factors That Affect Immune System

Nutrition: Nutritional deficiency and obesity alter the immune response.
Aging: increase the susceptibility to infectious and cancer diseases.
Hormonal: immunostimulation by estrogen and inhibition by androgens.

Why the fetus is not attacked by the immune system of the mother?

- **Not fully known**
- **The body produces *blocking antibodies* which preserves the fetus by being attacked**

Immunosuppression

- **Used in organ transplant**
- **The organ behaves as a foreign material to the body and hence is attacked by the component of the immune system**
- **Medications are given but would increase the risk of infection and malignancy**

Diseases

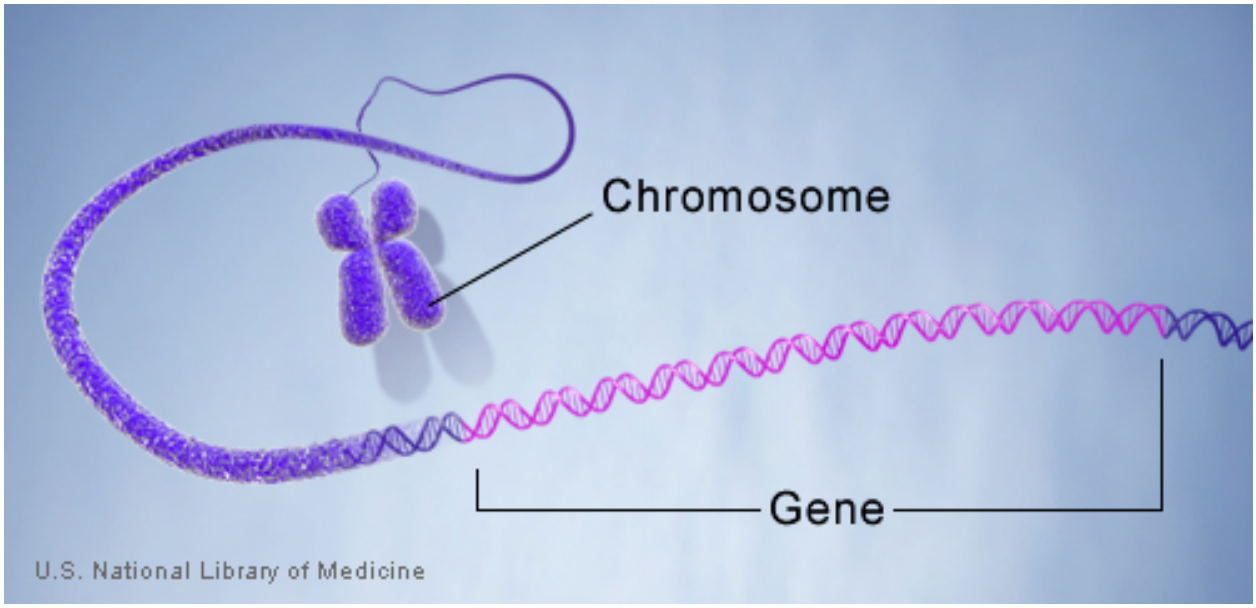
- **Illness is feeling unwell and is subjective**
- **Disease is when abnormal body function is detected**
- **A person may feel ill without a disease being evident , and likewise a person may have a disease without experiencing an illness**

Causes of a disease

- **Hereditary**
- **Infectious**
- **Accidents and trauma**
- **Poisons and toxic chemicals**
- **Life style and personal habits**

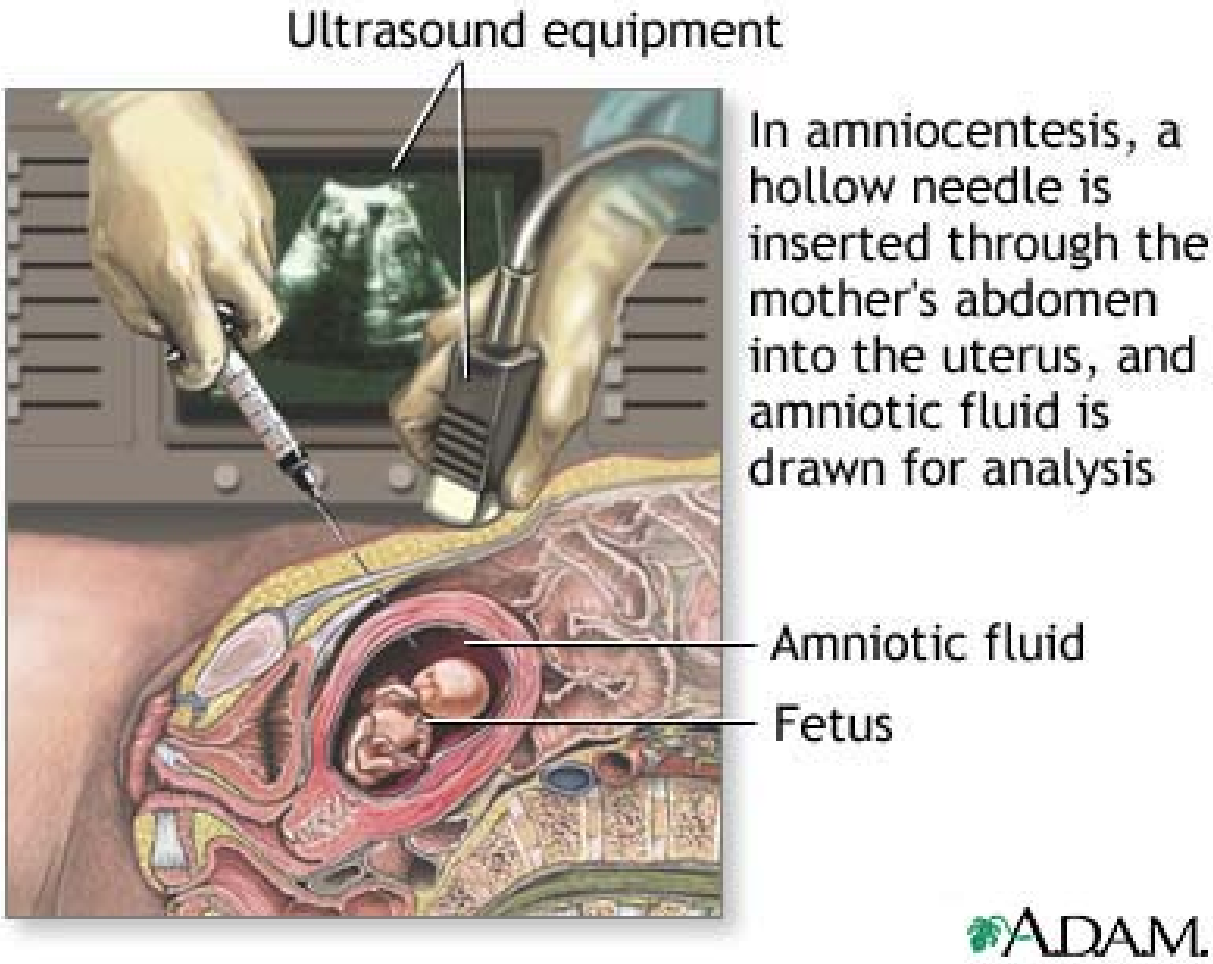
Genetic Disease

- **Abnormalities in genes and chromosomes**
- **Could be inherited**
- **Basic biomedical defect must be found**



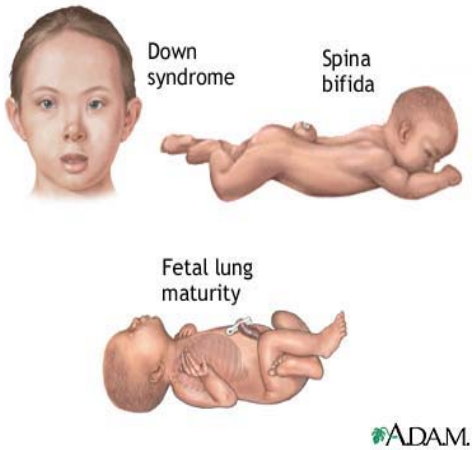
Early detection of genetic disease

- **Amniocentesis: amniotic fluid is obtained early in pregnancy in high risk people for hereditary disease.**
- **Fluid is analyzed for chromosomal or biochemical disorders.**



Congenital defects

Any abnormality present at birth
Can be due to genetic abnormality, exposures to drugs , radiation or toxins.



Infectious disease

- **Microbial agents infect the human body**
- **These agents may be viral ,bacterial ,parasitic or fungal**
- **Called communicable or contagious diseases because they are transmitted from one person or species to another**