- Severe combined immunodeficiency disease - Duchenne's muscular dystrophy
- Parkinson's disease
- Cystic fibrosis
- Hypercholesteremia (excessively high cholesterol)
- Hemophilia

Other applications of recombinant DNA

- Technology

1. Forensics
   - DNA fingerprinting
   - Develop DNA probes
   - Develop to non-coding region
   - Process
     - Get DNA sample
     - Clone non-coding DNA
     - Compare with other samples (gel electrophoresis)

Environmental - engineered organisms
Ex. Bacteria that eat oil, heavy metals

Bioremediation

- The use of biological agents, such as bacteria, fungi, or green plants, to remove or neutralize contaminants, as in polluted soil or water

Alternative source of energy

- Bacteria that produce electricity
- Fungi that can be used as fuel

Cloning copies of an organism

- What can we currently do in science?
- We can: clone - DNA, cells, entire organism

Cloning an entire organism

1. Embryo splitting - used previously in agriculture - tam am 8 celled stage embryo and split into (4 celled) stages termed "artificial twinning"
2. Somatic cell nuclear transfer (nuclear transplantation)

Historical overview - Somatic cell nuclear transfer

- July 5, 1996 - Dolly the sheep

Medical potential

- It has been used to treat
- Gene therapies:
  - Severe combined immunodeficiency disease - Duchenne's muscular dystrophy
  - Parkinson's disease (loss of dopiame nerves
  - Cystic fibrosis
  - Hypercholestremia (excessively high cholesterol)
  - Hemophilia

Other applications of recombinant DNA
Technology

1. Forensics

- DNA fingerprinting
- Develop DNA probes
- Develop to non-coding region - segments of protein between DNA formation segments
- Process:
  A. Get DNA sample
  B. Clone non-coding DNA
  C. Compare with (gel electrophoresis)

Environmental-engineered organisms:
Ex. Bacteria that eat oil, heavy metals

- Humans have a huge factor on environment

Ex. Pollution - waste of ?

Bioremediation

- The use of biological agents, such as bacteria, fungi, or green plants, to remove or neutralize contaminants, as in polluted soil or water

Alternative source of energy

- Bacteria that produce power-electricity
- Fungi that can be used as fuel

Cloning copies of an organism

- What can we currently do in science?
  - We can clone DNA, cells, entire organisms

Cloning an entire organism

1. Embryo splitting - used previously in agriculture - take an 8 called stage embryo and split into (4 called) stages termed "artificial twinning"
   - Induce split in embryo for potential embryo with same content
2. Somatic cell nuclear transfer
   - For nuclear transplantation

Historical overview - somatic cell nuclear transfer

- Sheep Dolly
  - Was somatic cell nuclear transfer

A. Cloning (kion = "twig", greek):

- Process of producing similar populations of genetically identical individuals
- Natural in bacteria, plants, and some insects

Human cloning are:

A. Therapeutic cloning
   - First approach: Somatic cell nuclear transfer (SCNT)
     - Involve cloning cells from a human for use in medicine and transplants
   - Second approach: Induced pluripotent cells
     - Type of pluripotent stem cell that can be generated directly from adult cells

B. Reproductive cloning

- Platelets - play room in blood clotting
- White blood cells (leukocytes) - two types:
  1. Granulocytes
     - Neutrophils
     - Eosinophils
     - Basophils
  2. Agranulocytes
     - Monocytes
     - Lymphocytes (B and T)
       - T: destroy cancer cells
         - Problem: tumor is usually growing too fast
     - Cells working against pathogens

  Red blood cells (erythrocytes)

Antigen (Ag), or antibody generator

- Is any substance which provokes an adaptive immune response
- Antibody, also called immunogobulin, is a protective protein produced by the immune system in response to the presence of a foreign substance (an antigen)
- Antibodies recognize and latch onto antigens in order to remove them from the body
- A wide range of substances are regarded by the body as antigens, including disease-cause organisms and toxic materials such as venom

Blood types

The immune system (Chapter 13)

- Introduction to
- Pathogens
  - A disease causing organism
- Bacteria
  - A prokaryotic organism
- Viruses
  - Minute infectious agent that consists of a nucleic acid encased in a protein. A virus cannot replicate outside a living host cell

Bacteria

- Larger versus viruses
- Reproduce by binary fission (splitting)
- Commonly called prokaryotes
- Other: fungi, protozoans, parasites

Lines of defense - Fig 13.1

- First line of defense: nonspecific physical and chemical barriers -- (innate defenses) if pathogen penetrates barriers--> second line of defense: nonspecific internal cellular and chemical defense -- (adaptive acquired defenses) if pathogen survives nonspecific internal defenses --> third line of defense: immune response
- First line: not specific - doesn't allow foreign bodies to enter in body