

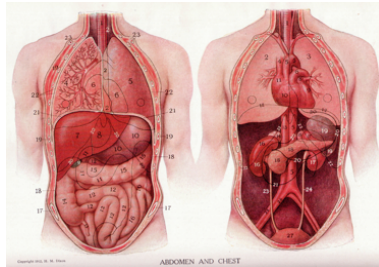
Alternatives to human organ transplants

US275 Scientific Ethics
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Arcadia University



The body is made up of smaller and smaller structures

- Organ Systems
- Organs
 - Tissues
 - Cells
 - Molecules

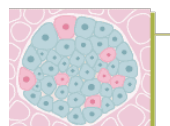
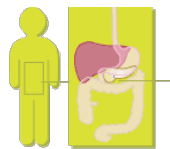


Abdomen
The Home and School Reference Work, 1917

2

Special cells in the pancreas release insulin to control sugar levels in the blood.

- Type I Diabetes mellitus
 - patients don't produce enough insulin
 - strict diets with limited sugar intake effective for only a few years.
 - patients would often die from diabetic ketoacidosis



Insulin isolated from fetal calf pancreas used to treat diabetic patients (1921)

- Eli Lilly (medical firm)
 - large scale production of pancreas extract by 1923
- Cow and pig pancreas were the only source of insulin until early 1980's
 - recombinant DNA technology allowed for synthesis of human insulin



Frederick G. Banting and John Macleod were awarded the Nobel Prize in Physiology or Medicine in 1923 "for the discovery of insulin." www.nobelprize.org

DNA technology is used to create bacteria that produce human insulin.

- animal insulin
 - can trigger allergic reactions in some people
- human insulin
 - not allergenic

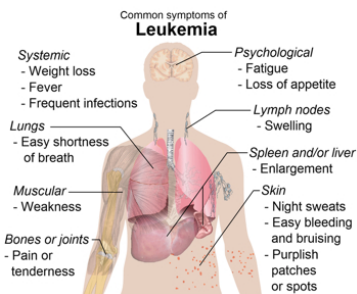


Photo courtesy of Eli Lilly and Company, Indianapolis, Indiana. Photo credit: David J. Terrell, 2008

http://blog.sstrumello.com/2008/01/biodel-announces-manufacturing-plans_04.html#.T2fL-Zgm_Hg

Blood cell diseases

- leukemia
 - cancer affecting blood cells and bone marrow
- lymphoma
 - cancer affecting immune system cells
- aplastic anemia
 - disease where bone marrow doesn't produce enough new red blood cells.



Symptoms of Leukemia
Wikimedia Commons

Cells for transplantation can come from a variety of sources.

- Bone marrow
- Peripheral (circulating) blood
- umbilical cord



Bone marrow harvest.
U.S. Navy Photo

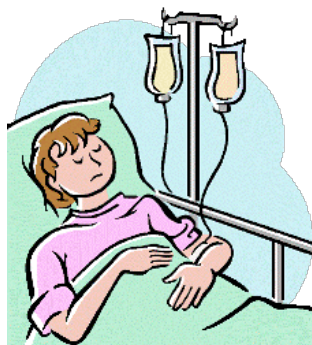
To prepare for a bone marrow transplant, the diseased cells must be killed.

- After a matched donor is identified,
- the patient (recipient)
 - chemotherapy or radiation therapy kills cancerous cells
 - also destroys
 - blood forming cells
 - immune system cells



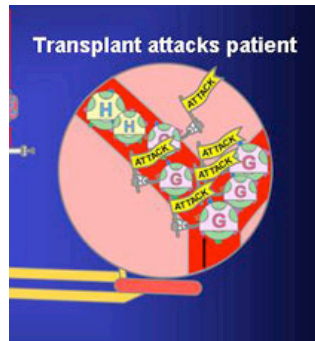
The bone marrow transplant process is similar to receiving a blood donation.

- transplant cells are in blood bags
 - intravenous (IV) line used to get cells into the body
 - cells migrate to the bone marrow on their own.



In bone marrow transplants, the match between the donor and the recipient is crucial.

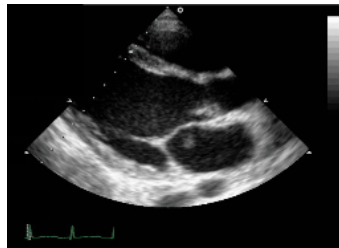
- implanted immune system cells establish “new” immune system
 - graft-versus-host disease
 - donated cells attack the patient’s (host) body cells.



cancer.gov

Valves in the heart keep the blood flowing in the proper direction.

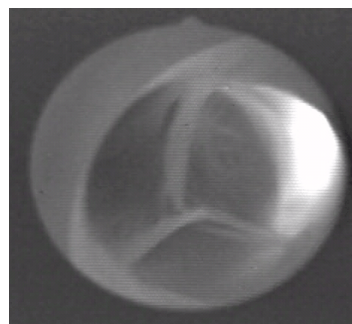
- Regurgitation
 - valve that does not close properly
 - heart murmur
- Stenosis
 - valve that does not open fully
 - limits blood flow



Ultrasound image sequence from a study of valves in a patient's heart. Generated by Kieran Maher using OsiriX and ImageJ. Wikimedia Commons

Biological valves

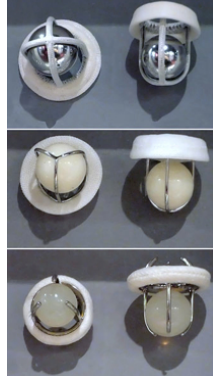
- human or animal tissue
 - pig, cow, horse
- generally last 8 - 20 years
 - will wear out or calcify
 - risk of blood clots forming on valve



Pig Aortic valve from beating heart. Wikimedia Commons, 1989

mechanical heart valve

- man-made materials
 - stainless steel, titanium, ceramic
- long-lasting
 - must take blood-thinning medication for rest of life
 - Coumadin or aspirin



1. Starr-Edwards Valve, Steel ball
2. Starr-Edwards Valve, Silicone Rubber Ball
3. Smeloff-Cutter Valve, Silicone Rubber Ball
Mirko Junge, Wikimedia Commons, 2008

TO BE CONTINUED

- lecture continued in:

Alternatives to human organ transplants: Part II: Xenotransplants