

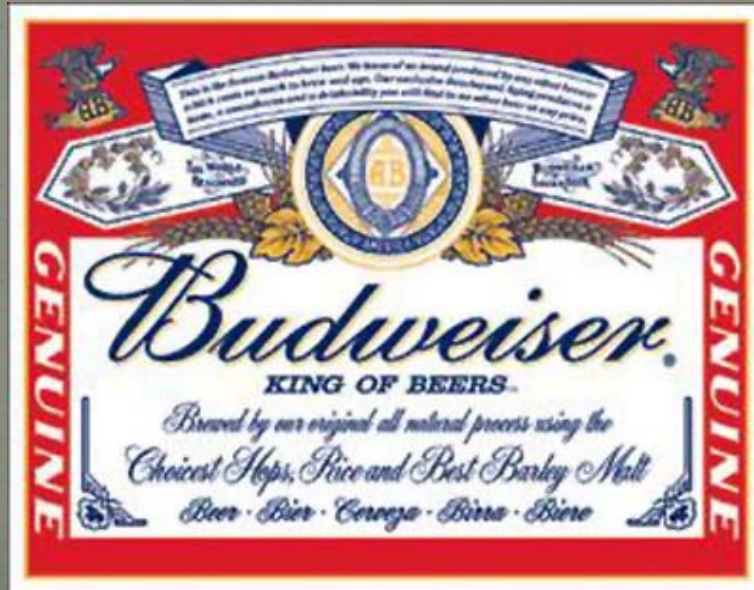
# Introduction to Bone Marrow Transplant

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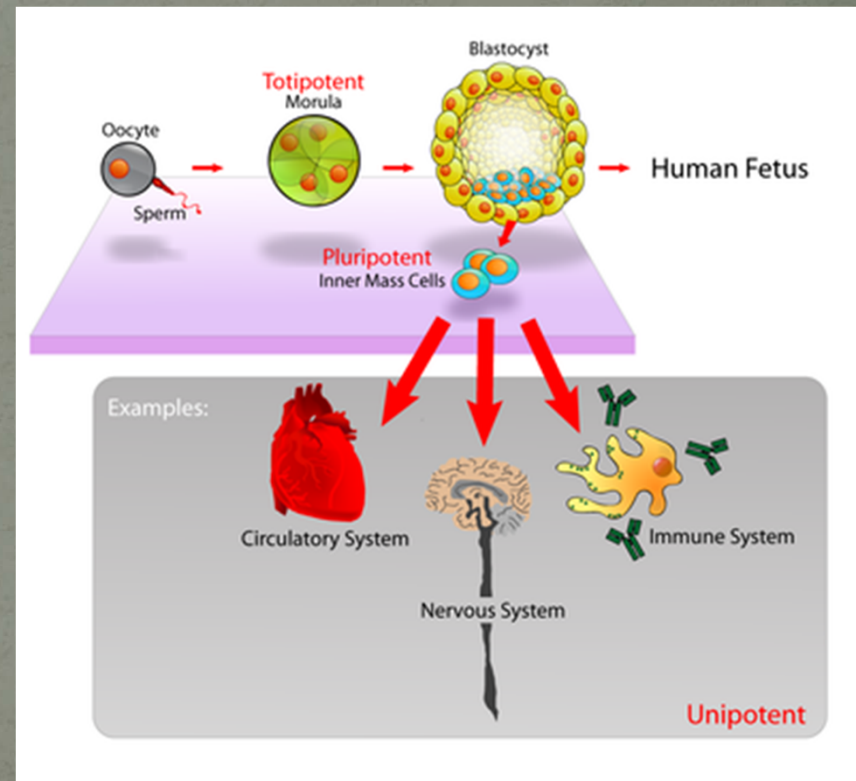


# Overview

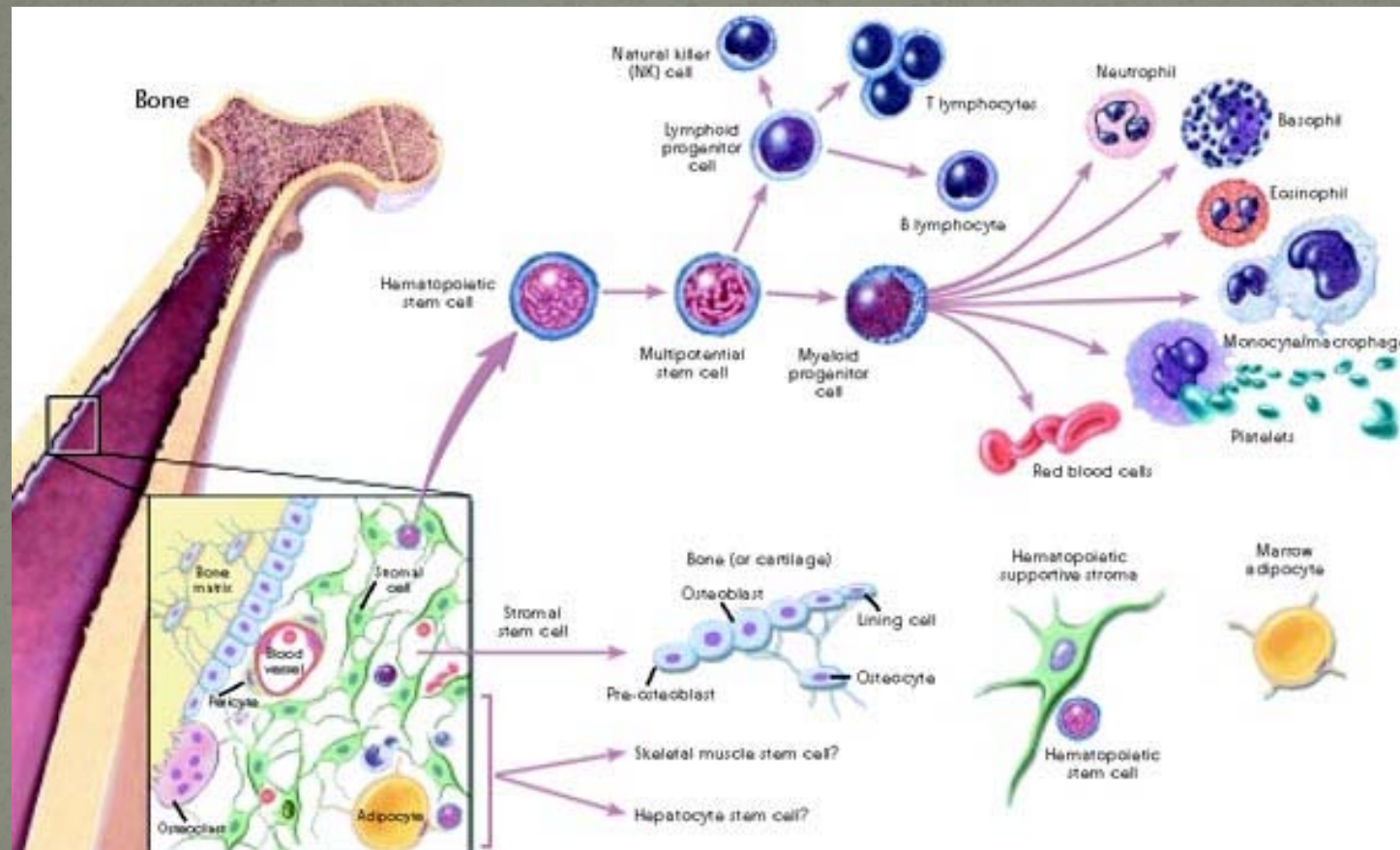
- Introduction to Stem cells
- What is a Bone Marrow Transplant
- History of Stem Cell Transplant
- Impact of Bone Marrow Transplant
- The Future of the process

# What is a Stem Cell?

- 1908: Alexander Maksimov proposed for scientific use
- 2 types:
  - **Embryonic Stem Cell:**
    - taken from early stage of embryo
    - No approved treatment
  - **Adult Stem cell**



# What is an Adult Stem Cell?



# Stem Cell

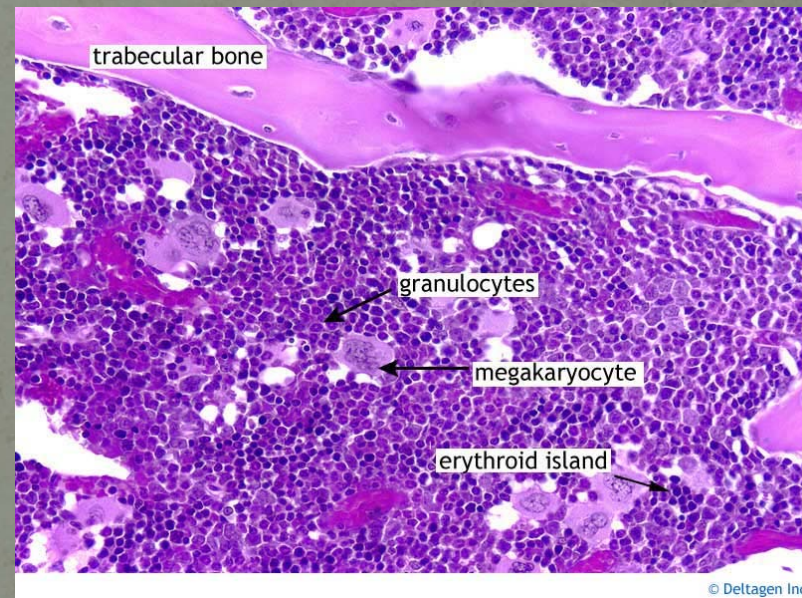
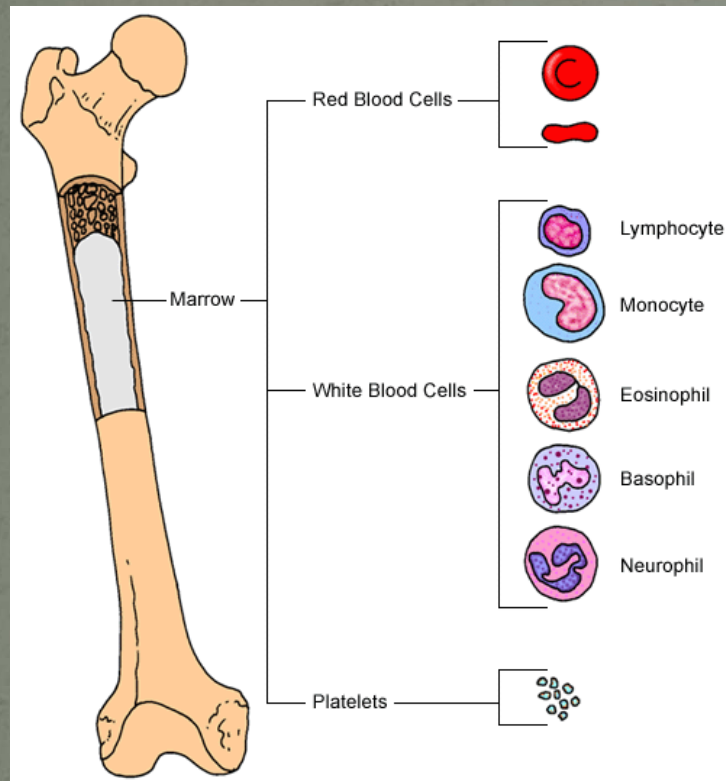
- Adult stem cells: repair system for the body, replenishing adult tissues
  - *Self-renewal*: the ability to go through numerous cycles of division while maintaining the undifferentiated state.
  - *Potency*: the capacity to differentiate into specialized cell types.

# Bone Marrow

- is the spongy material found in the center of your bones
- resides mainly in the large bones like the hip bone and shoulder blade
- produces *hematopoietic* (blood-forming) stem cells



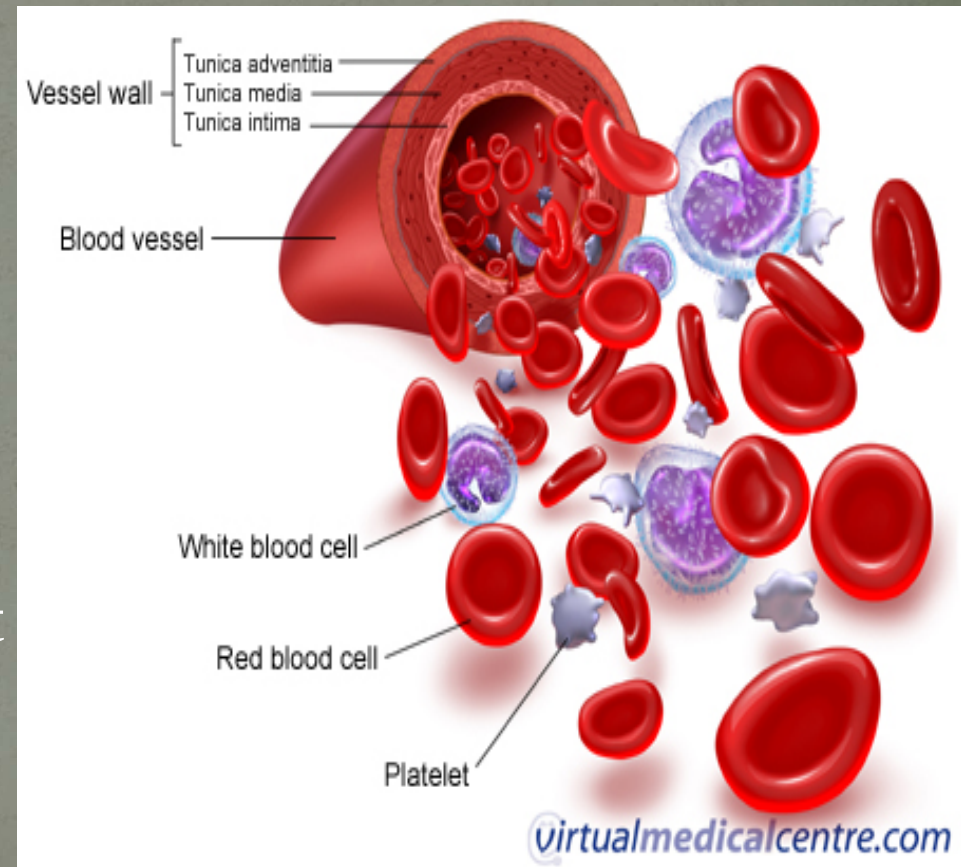
# Bone Marrow





# Cell in Bone Marrow

- **Red blood cells:**
  - distribute oxygen to body's tissues
  - Take CO<sub>2</sub> and other waste products from tissues to the lungs for expulsion.
- **White blood cells:** fight infections.
- **Platelets,** which induce the blood to clot.



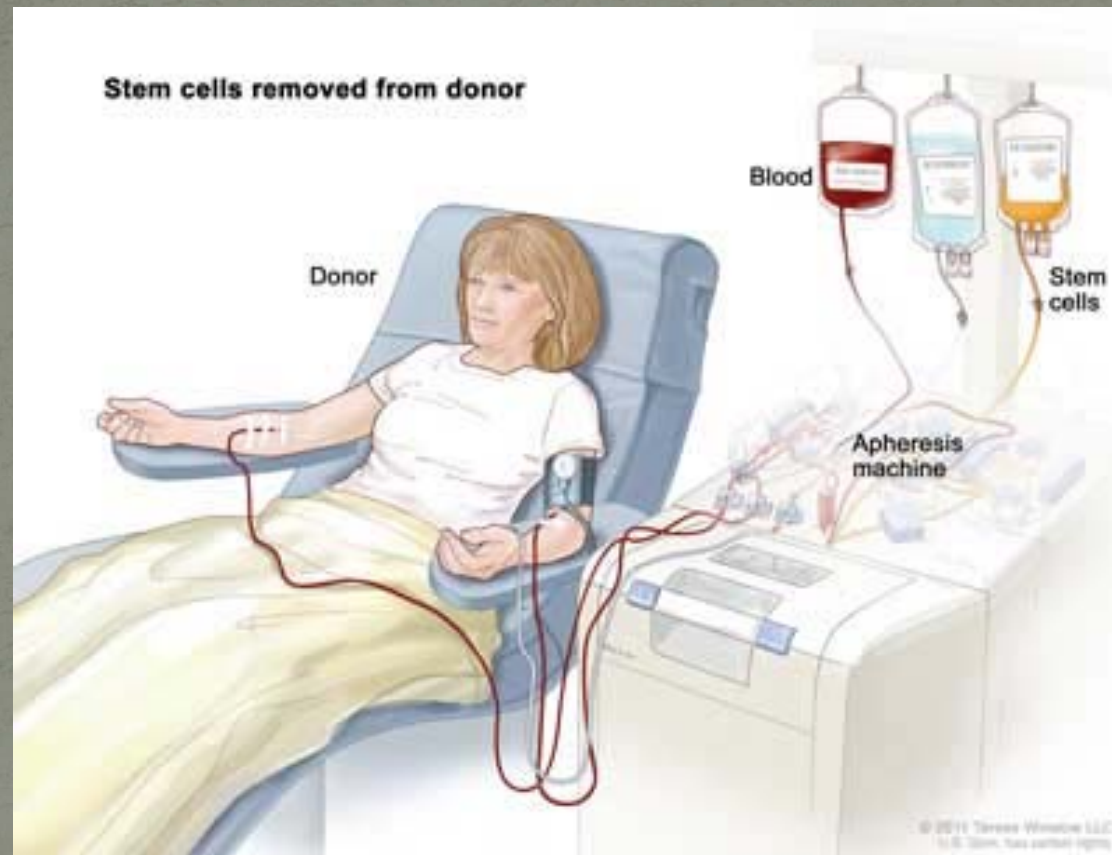
# Bone Marrow Transplant

- Also Known as Hematopoietic stem cell transplantation
- Goal: transfer healthy bone marrow cells into a person after the elimination of his/her own unhealthy bone marrow.
- taking stem cells from the bone marrow, filtering those cells, and providing them back either to the patient or to another person

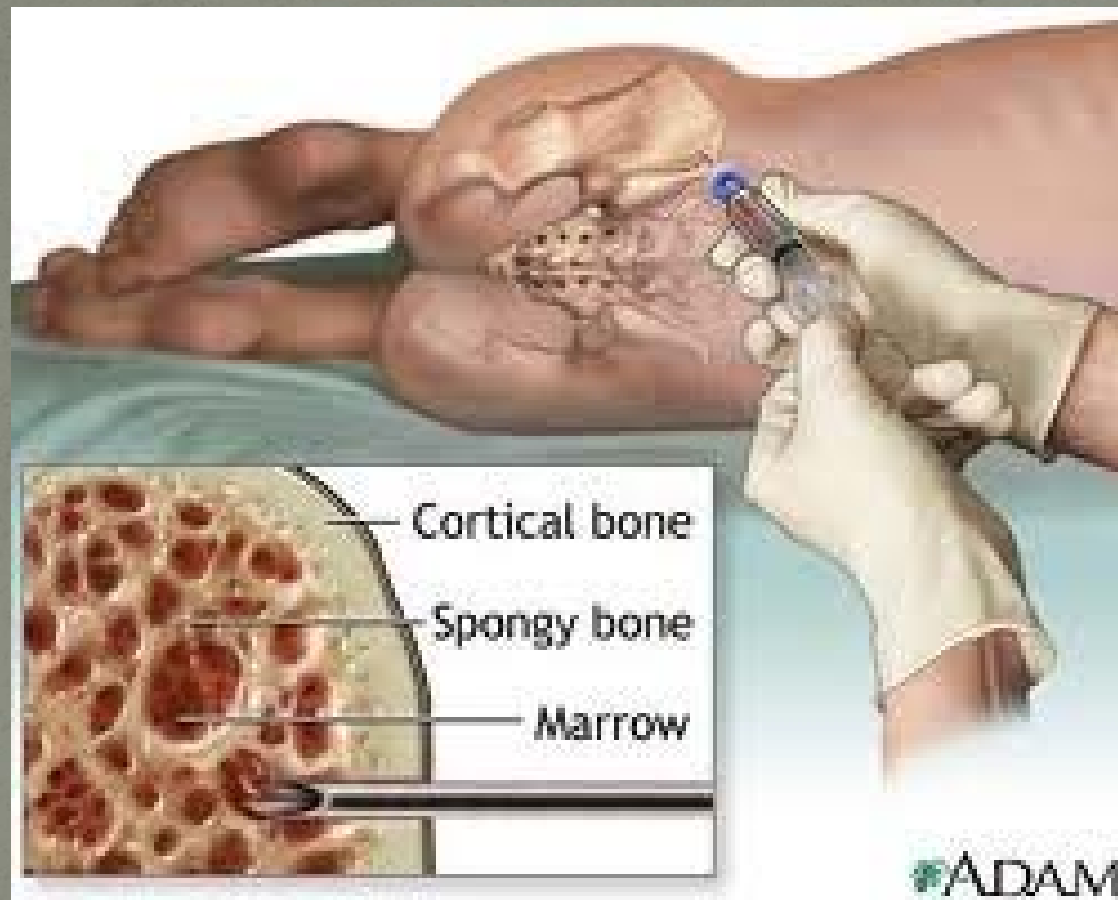
# Why Bone Marrow Transplant is Necessary?

- replace the bone marrow and refurbish its normal function after high doses of chemotherapy or radiation are given to treat a malignancy
  - “Rescue”: lymphoma, breast cancer
- To replace diseased or non-functioning bone marrow with healthy functioning bone marrow
  - Leukemia, sickle cell disease

# How is it done?



# Bone Marrow Aspirate

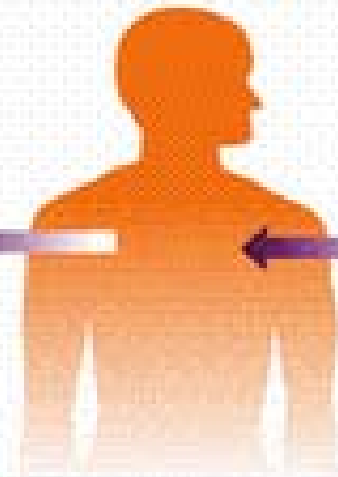
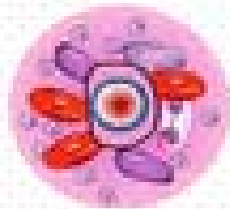


# Types of HSCT

## The Autologous Transplant Process

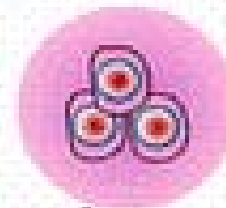
### 1. Collection

Stem cells are collected from the patient's bone marrow or blood.



### 5. Reinfusion

Thawed stem cells are reinfused into the patient.



### 2. Processing

Blood or bone marrow is processed in the laboratory to purify and concentrate the stem cells.



### 3. Cryopreservation

Blood or bone marrow is frozen to preserve it.



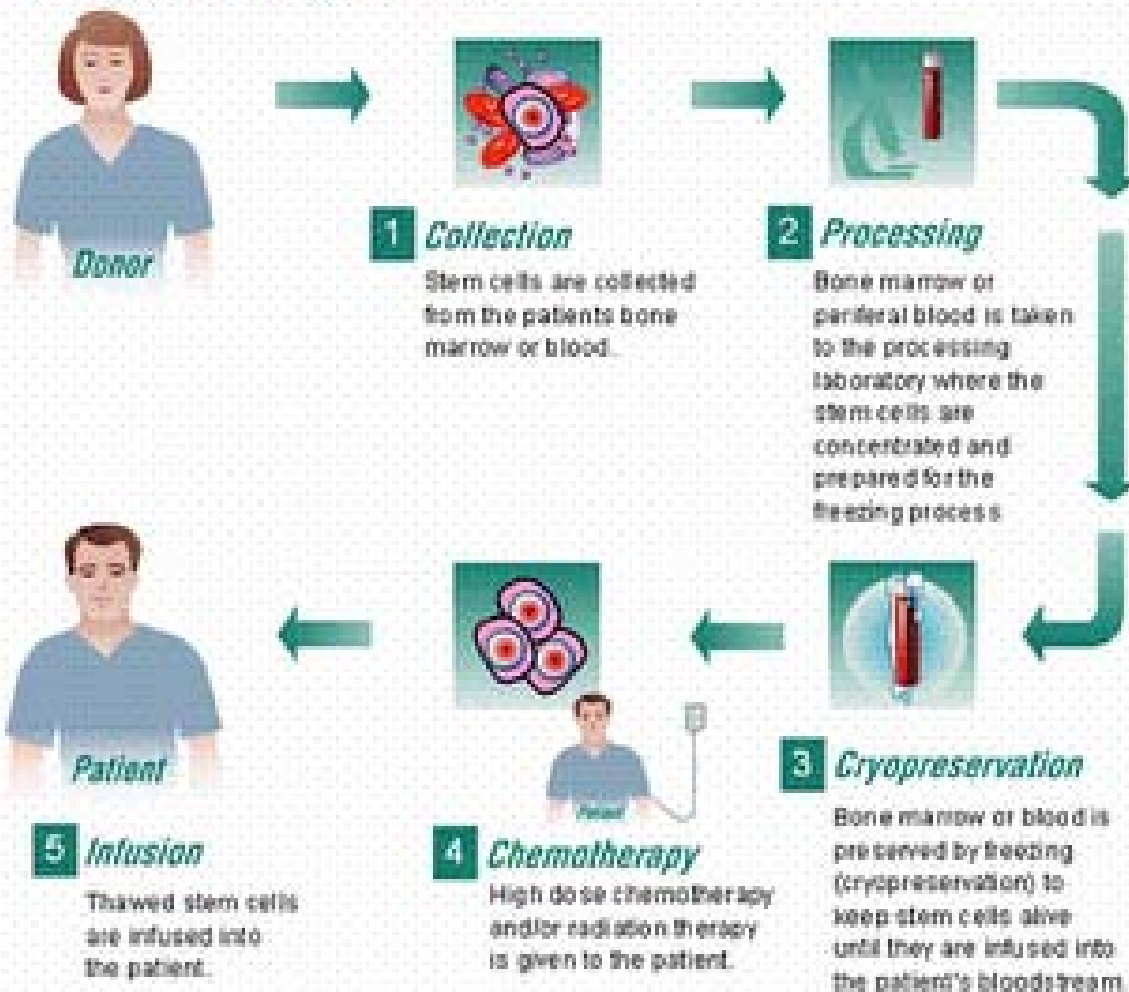
### 4. Chemotherapy

High dose chemotherapy and/or radiation therapy is given to the patient.



# Allogenic

## The Allogenic Transplant Process

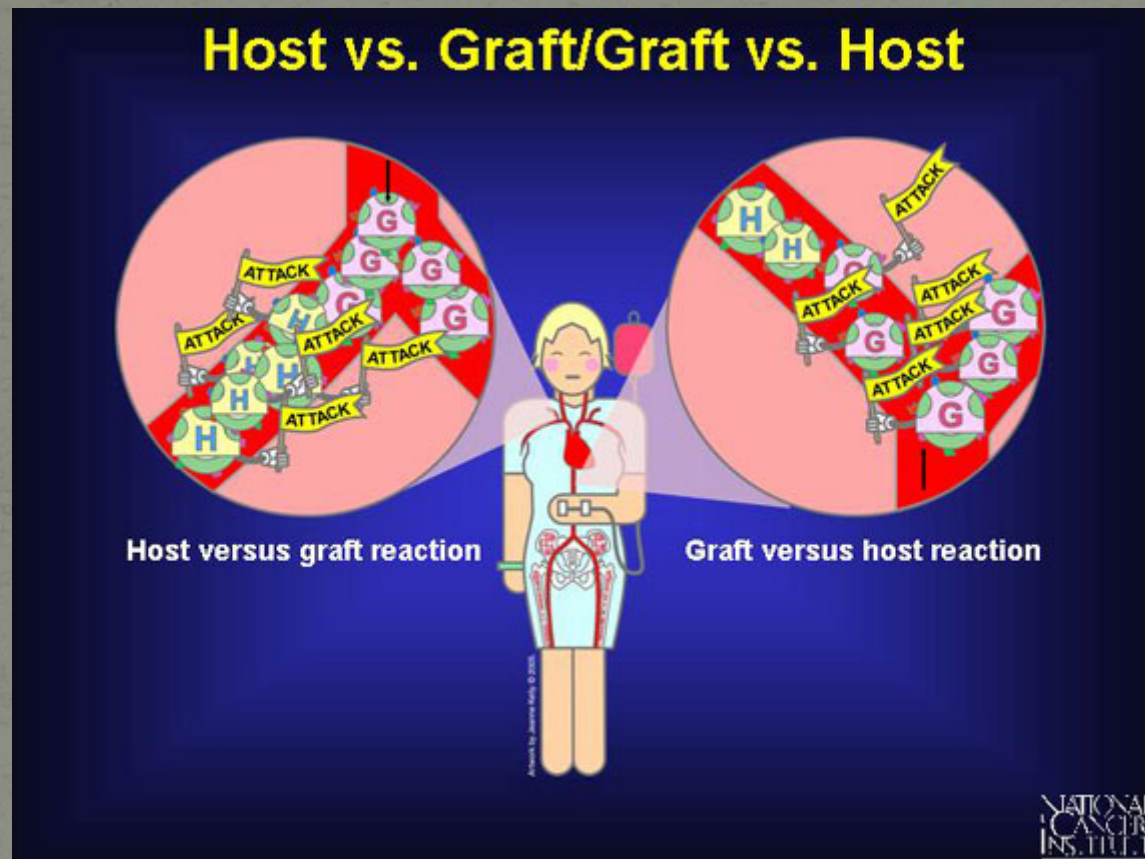


# Not Just Any Blood Stem Cells Will Do

- success of a blood stem cell transplant relies upon the interactions of immune cells of patient and donor
- Normally, all cells within the patient's body coexist peacefully
- Matching patients with similar immune system very important



# Risks



# Other Risk

- Graft vs. Host disease
- Infections
- Need blood transfusions
- spend several weeks in the hospital
- experience nausea, vomiting, diarrhea, mouth sores, and extreme weakness

# Finding a Suitable Donor

- National Marrow Donor Program
- Odds of finding matched unrelated donor approximately 1 in 10,000.
- Over 14 millions potential donors identified.
- Suitable match found for 50% of patients.
- Average weight time 3-4 months.

**NATIONAL  
MARROW  
DONOR  
PROGRAM®**

# Join the Registry

- [www.marrow.org](http://www.marrow.org)
- Its easy to be a donor!
  - Confirm you meet basic registry guidelines.
  - Order registration kit.
  - Follow instructions on kit and collect a swab of cheek cells and return the kit.
- **Japan has highest rate of matched donors**

# Evolution of Transplant

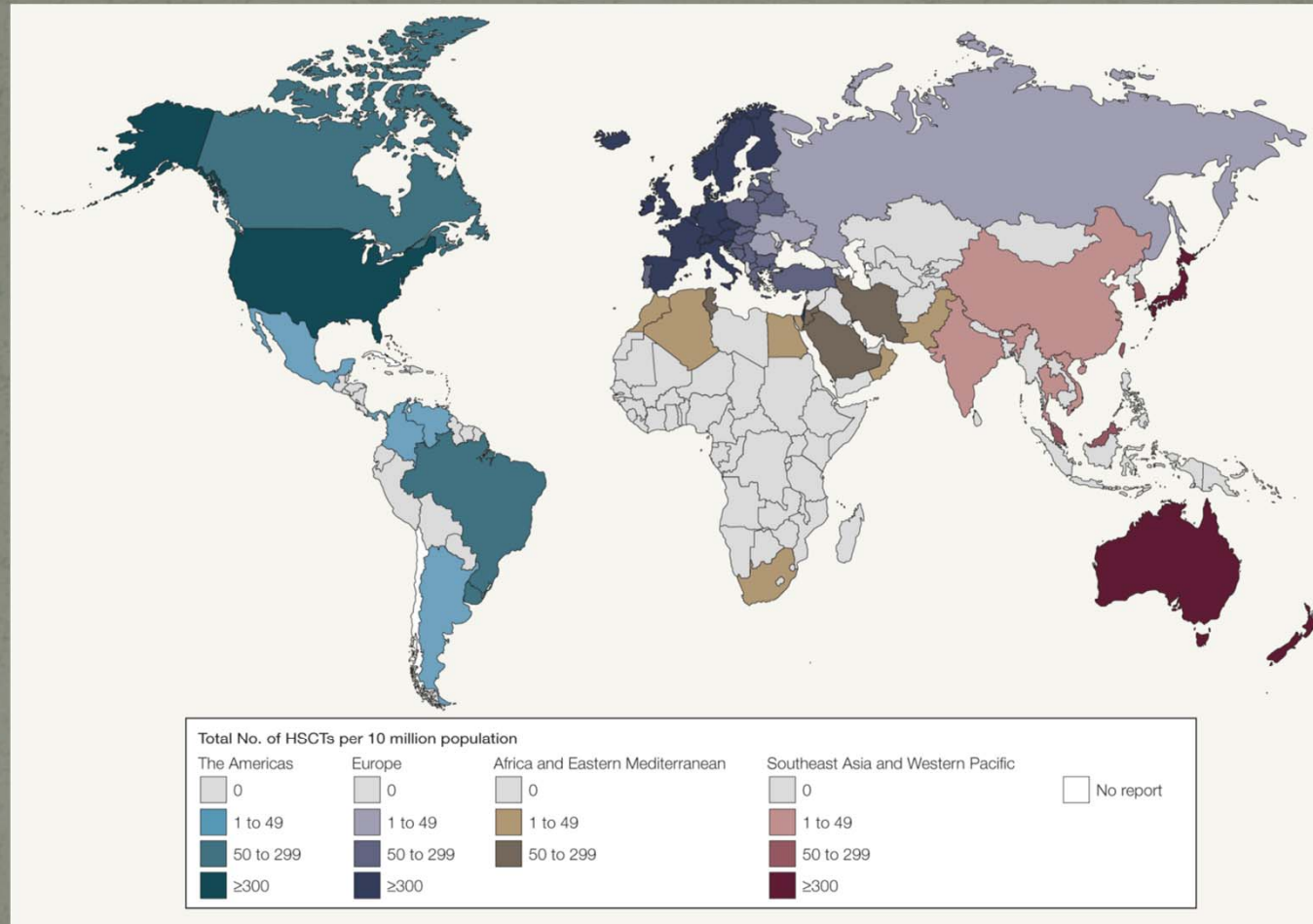
- 1939 first documented human marrow transplant.
  - Not too successful; patient died 5 days later
- 1970s to present
  - Medication used to pre-treat GVHD
  - Better Treatment for infections
  - Improvement in Matching patients
  - 1973: Bone Marrow Registry

# Evolution of Transplant

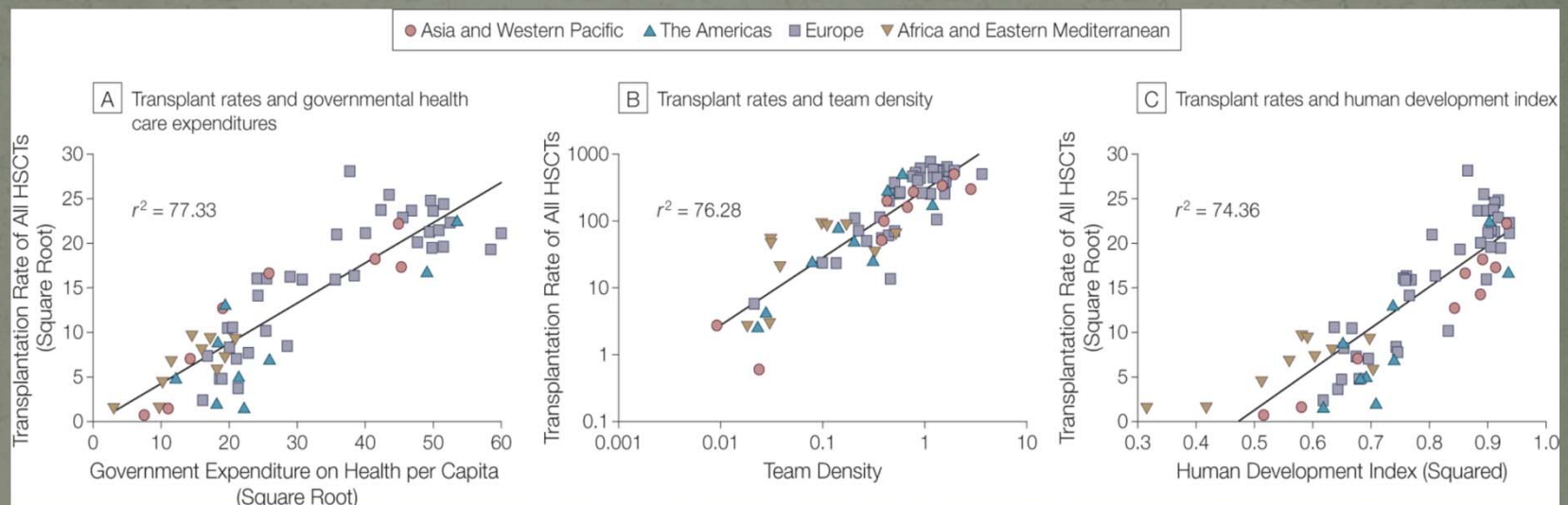
- By 2008, **700,000** patients worldwide had undergone transplantation and more than **125,000** patients survived 5 years or longer after transplantation
- Currently: 50,000 performed/year world-wide
- Over 5,000 transplants at Siteman since 1982. 400/year



# Global Distribution of Transplants

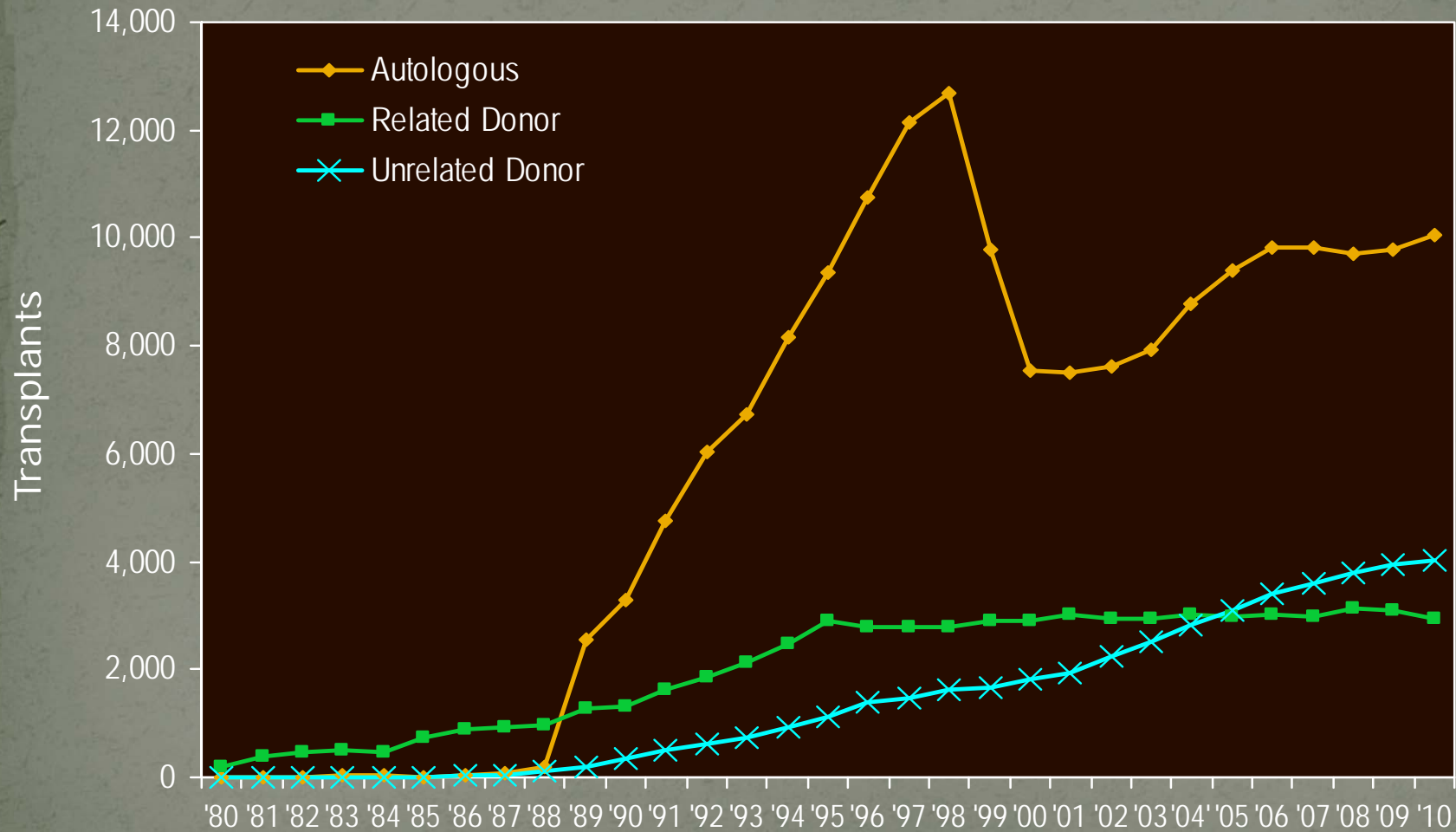


# Macroeconomic Factors and Transplant Rates

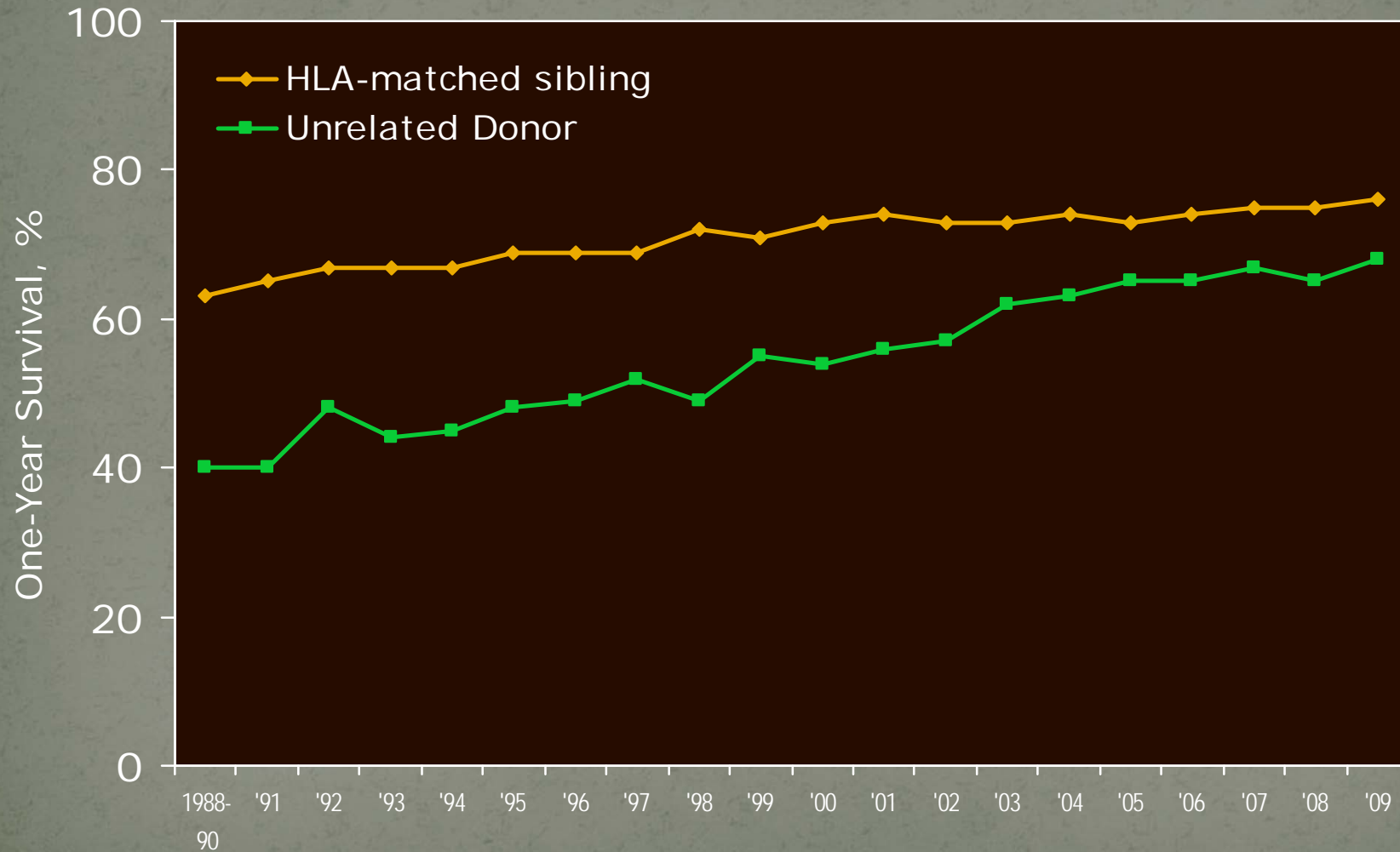


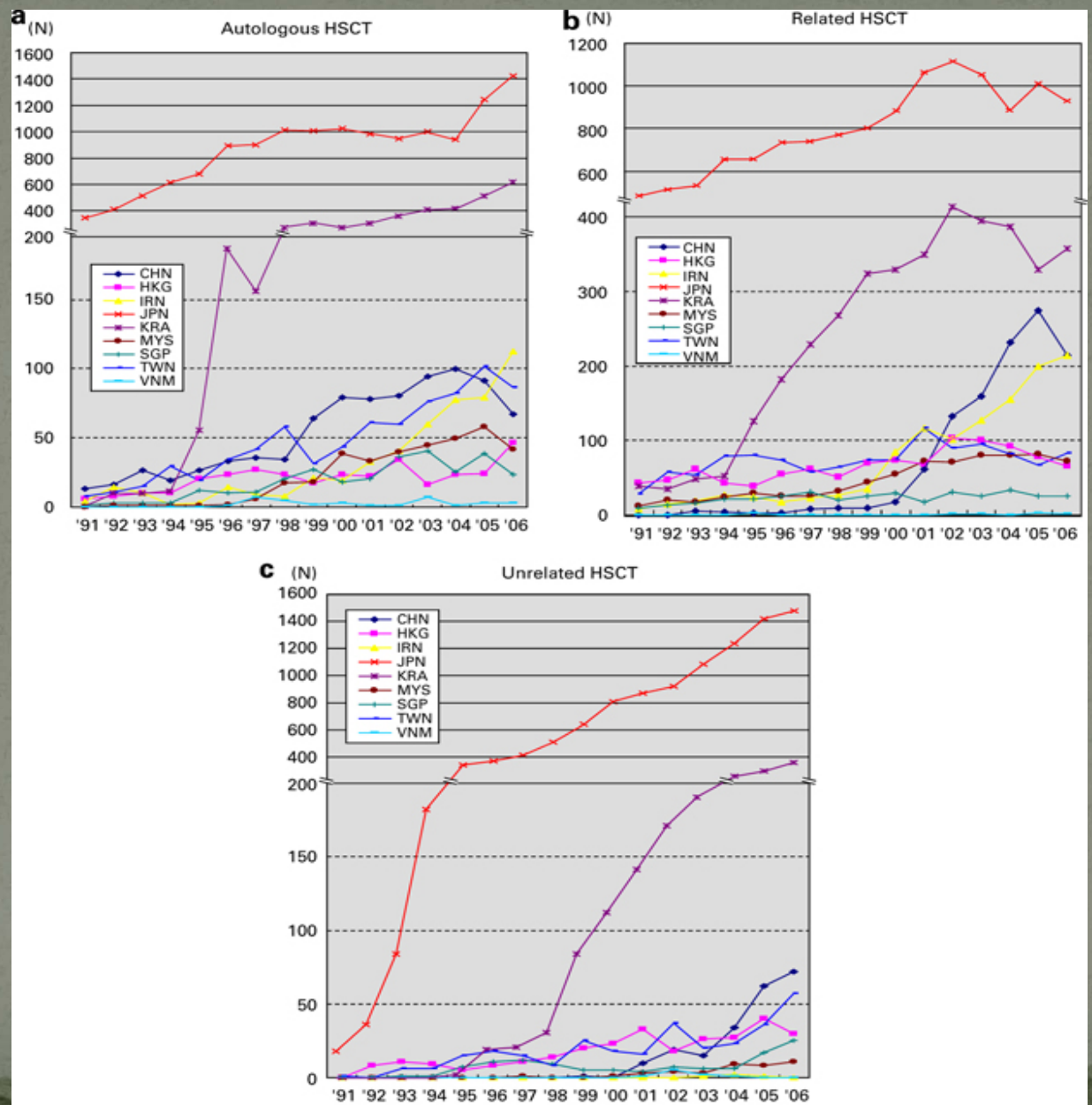


# Transplant Activity in the U.S. 1980-2010



# One-year survival for Acute Leukemias 1988-2009





# Japan and Transplant

- Japan Bone Marrow Donor Program
  - Started in 1991
- Cord Blood Bank Network: started 1999
  - 20,000 units of cord blood collected
- Approximately 3500/year
- 300 000 volunteer donors
- Numbers are increasing each year

# Finances of Transplant

- Total cost may vary depending on region
- Autologous Transplant: \$50-100,000
- Allogenic Transplant: \$150-200,000
  - Donor search fees \$10-25,000
  - Stem cell harvest: \$5-15,000
  - Actual Transplant cost
  - Post transplant cost: variable
  - Lodging fees/Transport
  - Follow up visits
  - Prescriptions
  - Home care

# Cost effectiveness

- Quality Adjusted Life Years (QALY)
  - measure of disease burden to assess value of money for medical intervention
  - Intervention <\$50,000/per QALY effective
  - \$50,000-100,00 intermediate
  - >100,00/year not effective
- Study in Blood on Allogenic transplant cost
  - Cost was \$196,000
  - QALY: \$51,000/year life saved

# The Future

- Embryonic stem cells may become a source of hematopoietic stem cells
- Histocompatibility problems may be solved by establishing comprehensive banks
- Increasing expansion of indications
- Decreasing toxicities
- Future progress depends on our ability to identify safer and better-targeted antitumor therapies

# References

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- Questions??

- Special Thanks to Dr. Kato and Dr. Sato