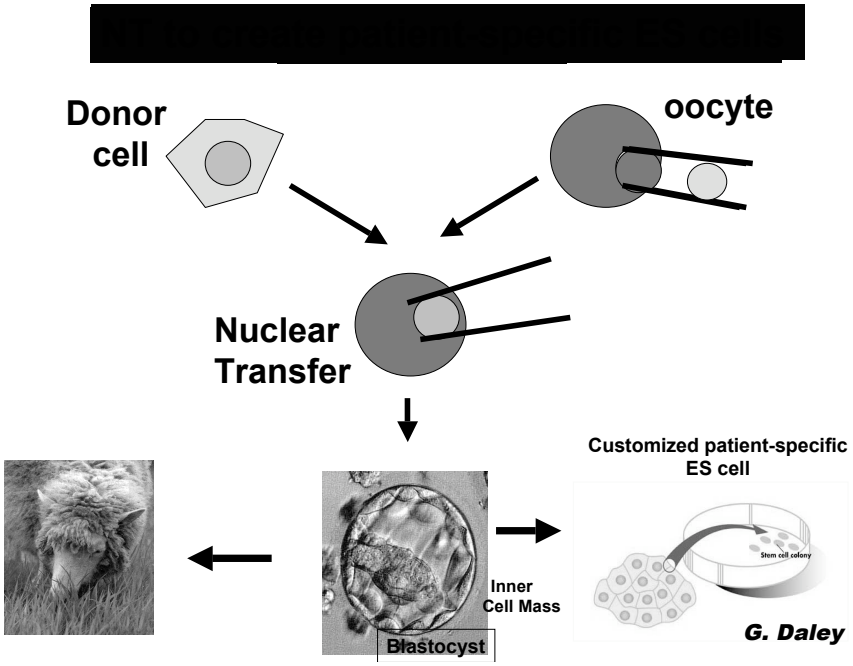
Stem Cells and Cancer

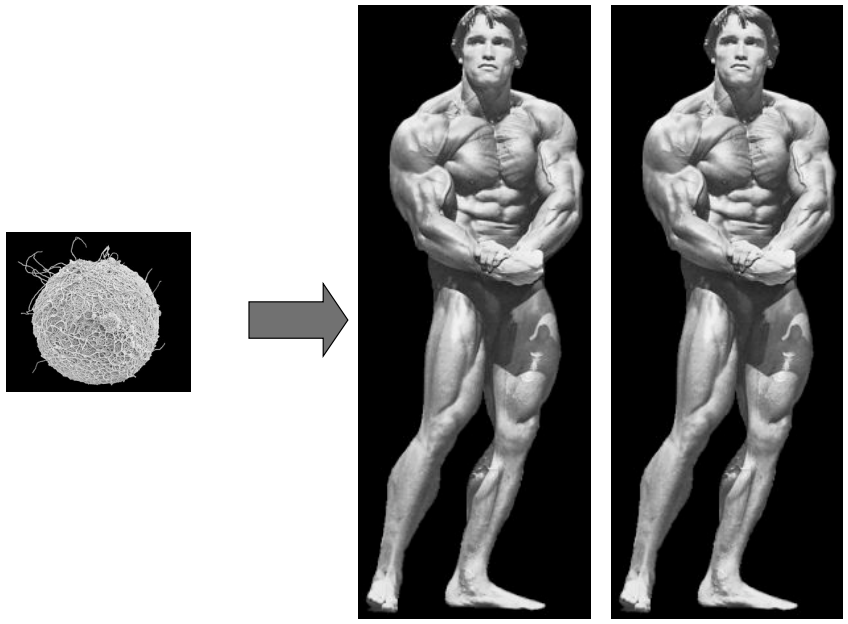
THERAPEUTIC CLONING

ORGANISM CLONING



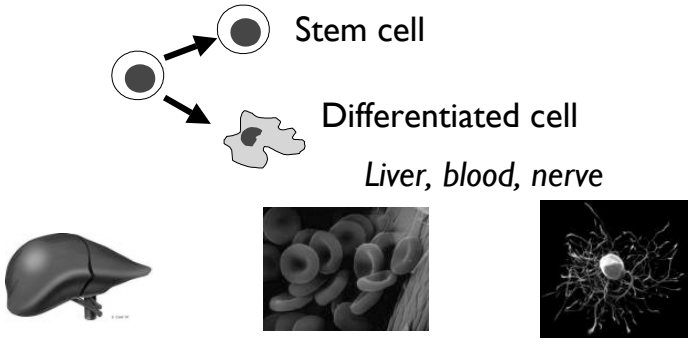
Potential therapeutic uses of stem cells

- **Transplantation of bone marrow for muscular dystrophies**
- **Direct injection of bone marrow stem cells for cardiac regeneration**
- **Bone marrow injections for neurodegenerative diseases**



What are stem cells?

Units of development and regeneration

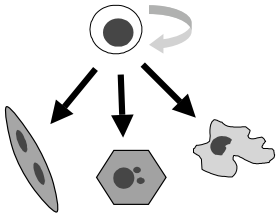


What are stem cells?

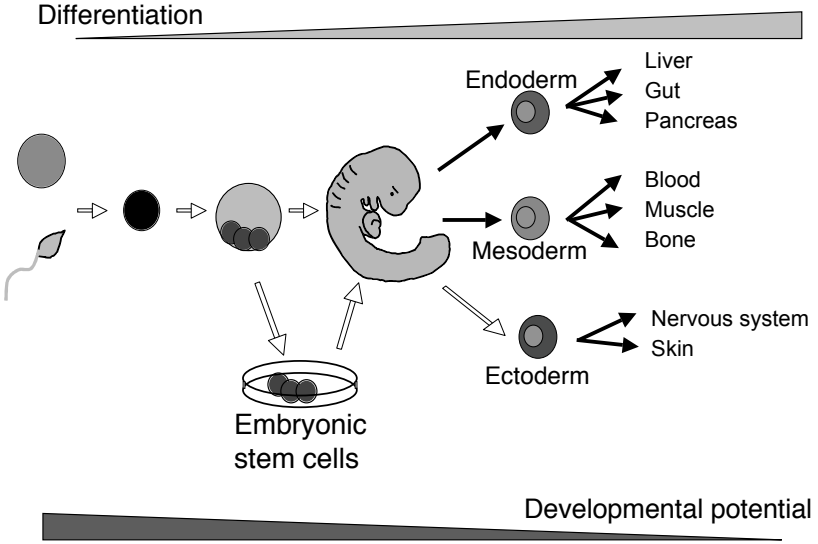
Units of development and regeneration

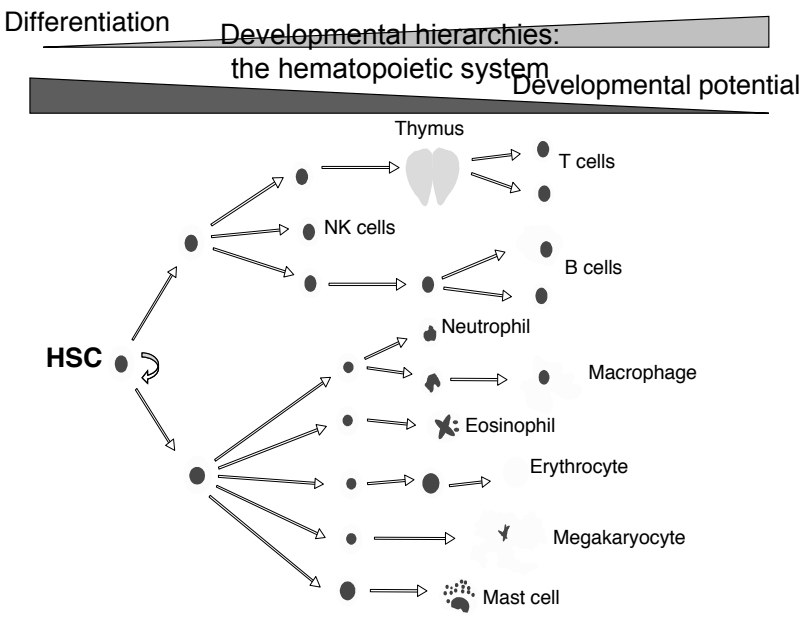
Why are stem cells unique?

1. They are unspecialized
2. The can produce more stem cells
3. They can produce specialized cells



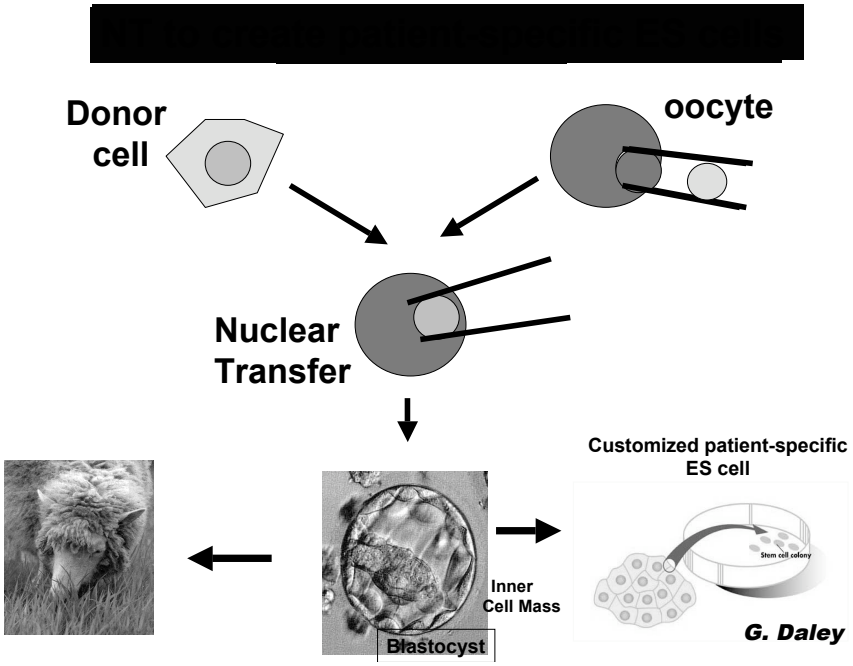
Human development: a stem cell hierarchy





Embryonic versus adult

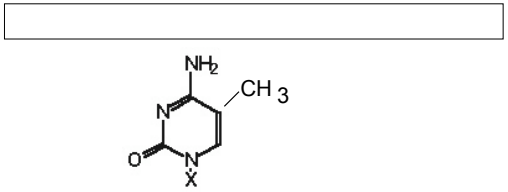
• Isolated from early embryos	• Isolated from adult human tissue
• Can expand indefinitely in culture	• Can not be expanded in culture
• Can give rise to all cell types	• Can only give rise to same tissue



WHY ORGANISM CLONING MIGHT NOT WORK

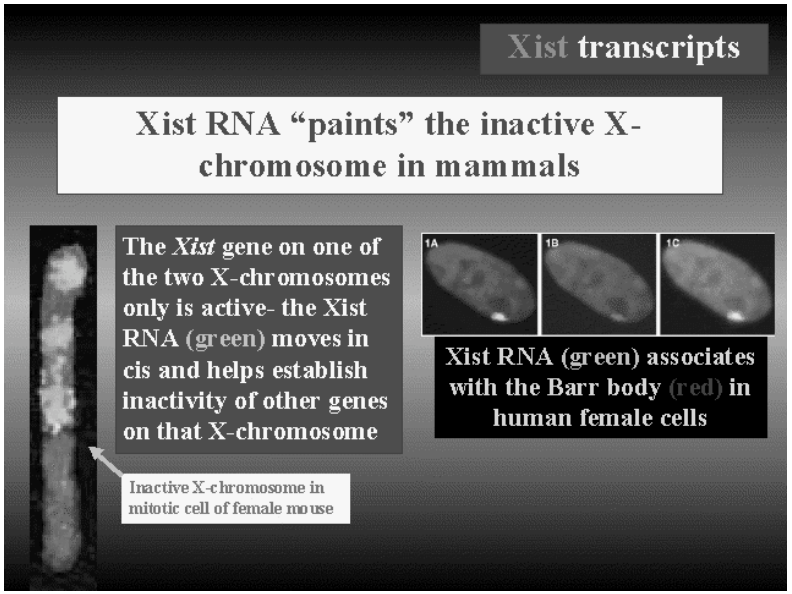
1. **TECHNICAL REASONS---**
2. **GENES OR CHROMOSOMES ARE LOST OR CHANGED IN DEVELOPMENT**

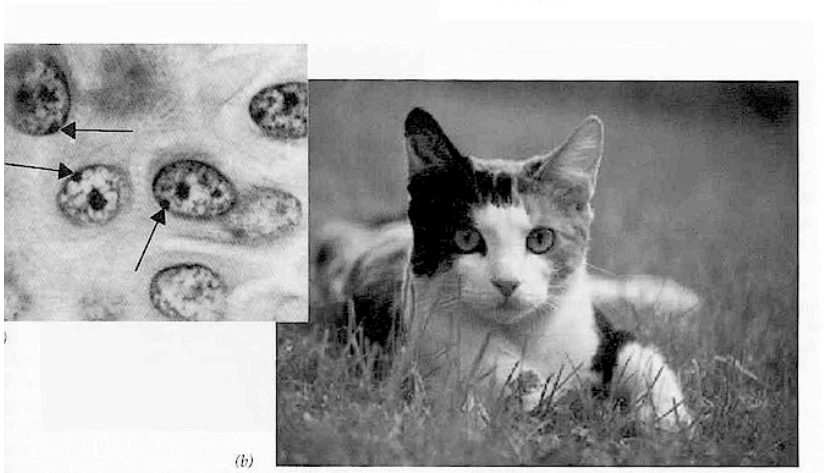
DNA IS MODIFIED DURING DEVELOPMENT



5- methylcytosine

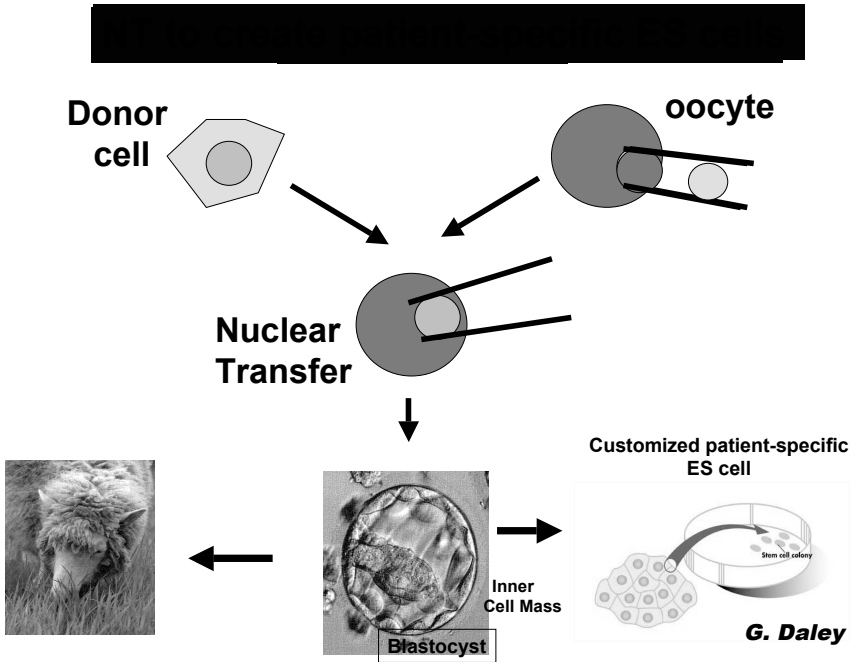
IN HUMAN FEMALES ONE X INACTIVATED IN DEVELOPMENT

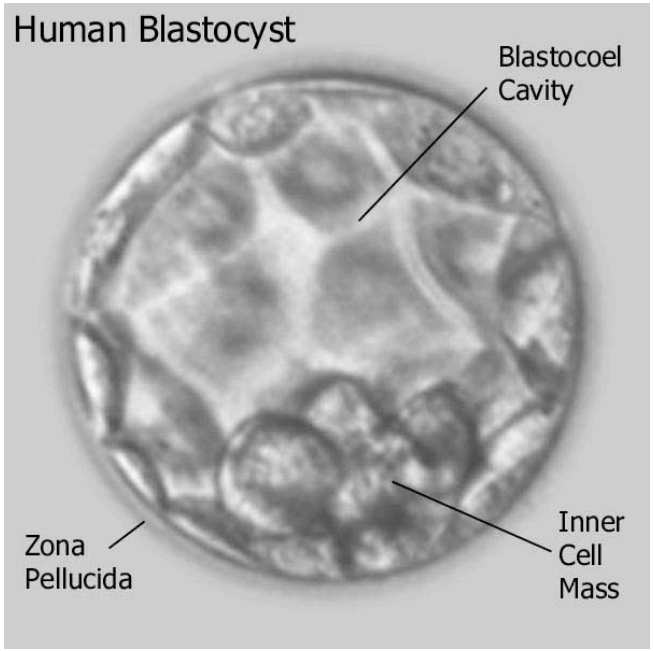


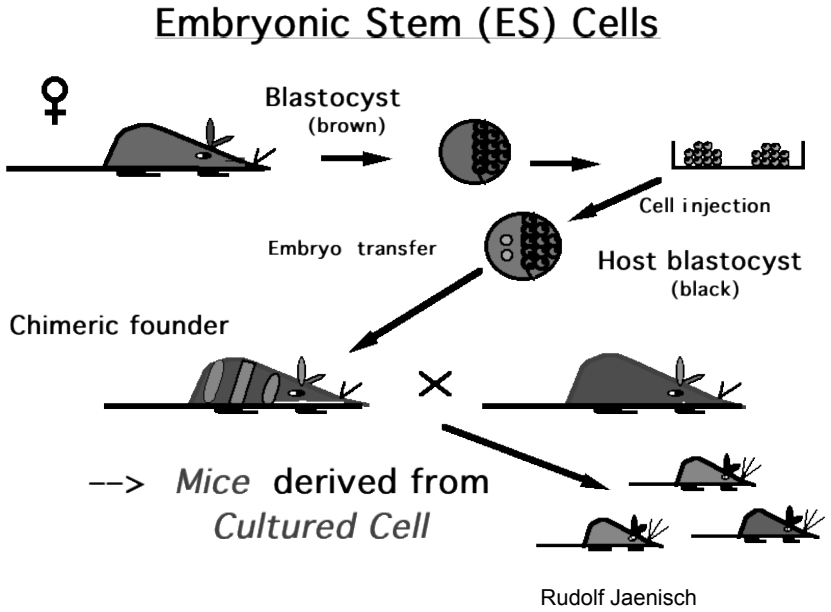


(b)

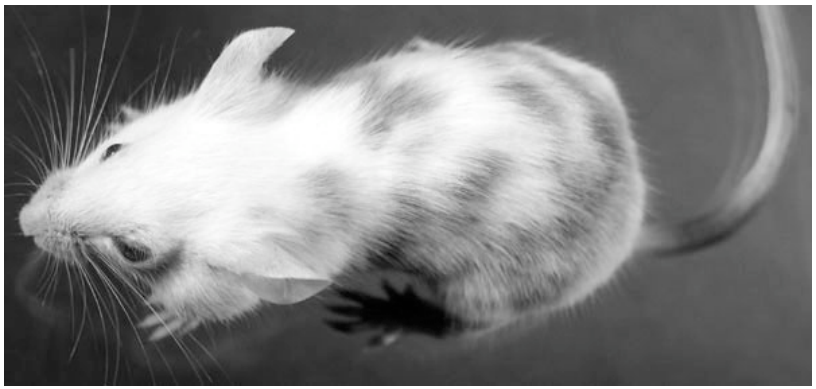
igure 12.14 The inactive X chromosome: an example of facultative heterochromatin.
) The inactivated X chromosome in the nucleus of a woman's cells appears as a darkly
aining heterochromatic structure, called a Barr body (arrows). *(b)* A calico cat. Random in-
tivation of either X chromosome in different cells during early embryonic development
eates a mosaic of tissue patches. Each patch comprises the descendants of one cell that
as present in the embryo at the time of inactivation. These patches are visually evident in
lico cats, which have an allele for black coat color residing on one X chromosome and an
lele for yellow coat color on the other X. This explains why male calico cats are virtually







Rudolf Jaenisch



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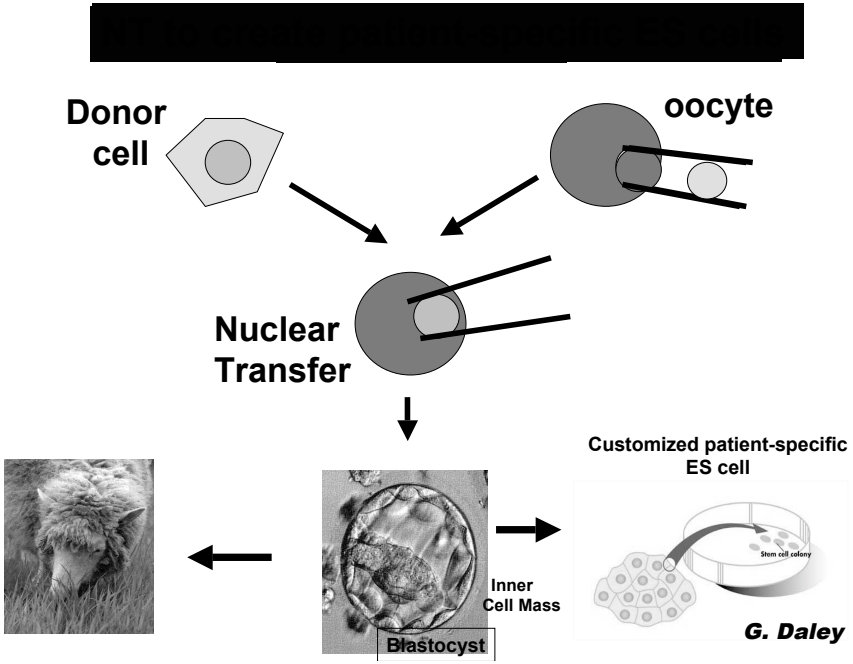
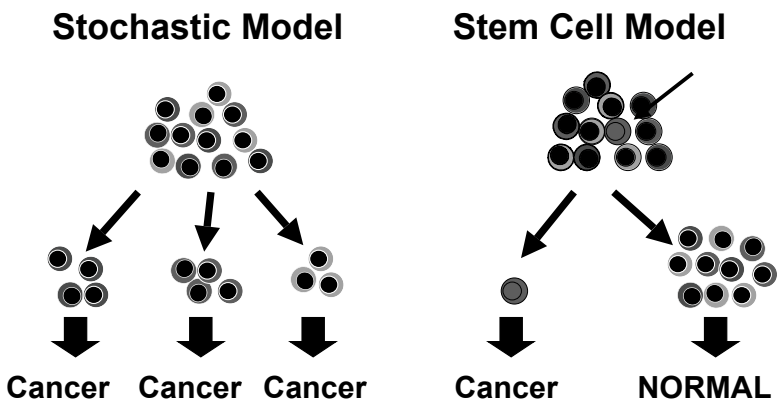


Cancer as a stem cell disease?

- Low clonogenic ability of tumors in vitro
- Most tumors are morphologically heterogeneous

Models of cancer cell growth



Experimental evidence of cancer stem cells

- Acute myeloid leukemia: $CD34^{+}$ $CD38^{neg}$ cells are tumor initiating (only 0.1% of total tumor cells)
- Breast cancer: $CD44^{+}CD24^{neg}$ (2% of all tumor cells)
- Brain cancer: $CD133^{+}$ (~20% of all tumor cells)


TIME
Will There Ever Be Another You?


TIME
HUMAN
CLONING
IS CLOSER
THAN YOU
THINK