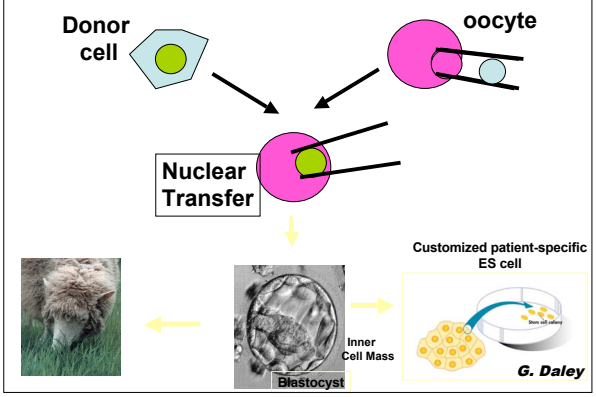
Stem Cells and Cancer

THERAPEUTIC CLONING

ORGANISM CLONING

NT to create patient-specific ES cells



Potential therapeutic uses of stem cells

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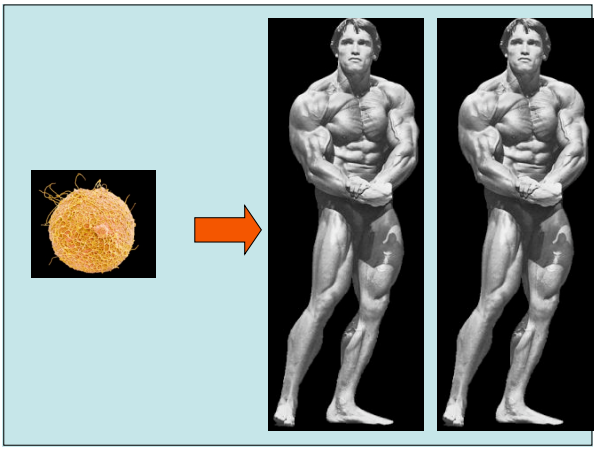
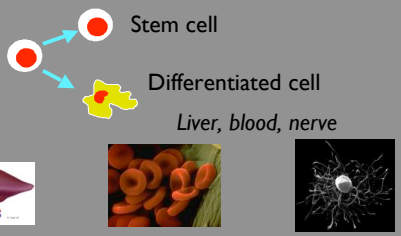
- **Direct injection of bone marrow stem cells for cardiac regeneration**
- **Bone marrow injections for neurodegenerative diseases**



What are stem cells?

Units of development and regeneration

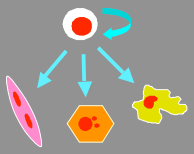


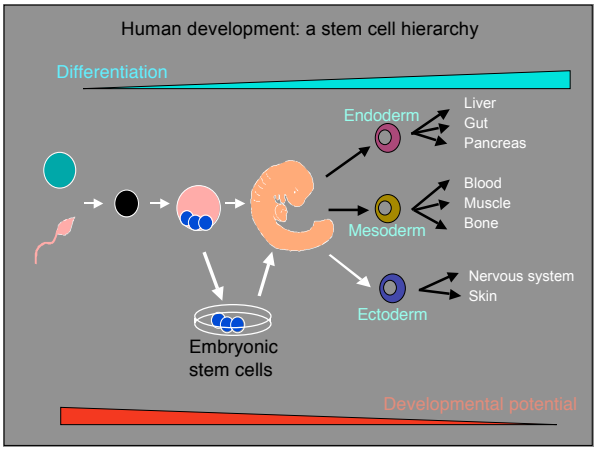
What are stem cells?

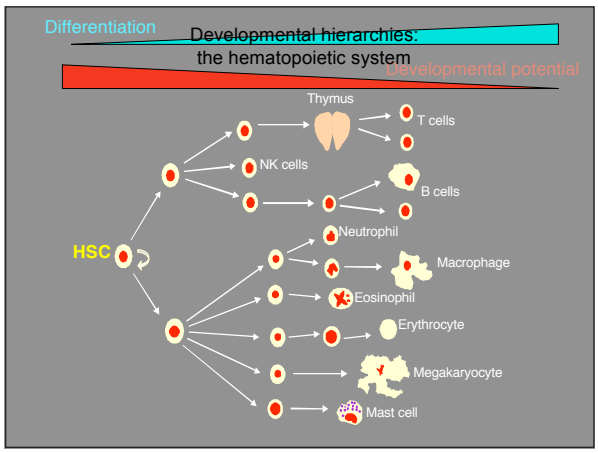
Units of development and regeneration

Why are stem cells unique?

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

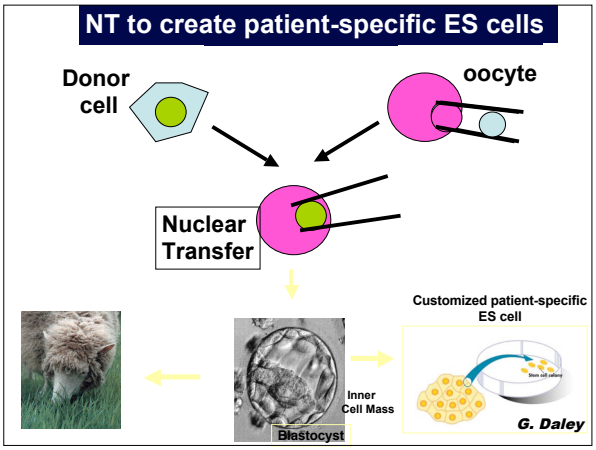






Embryonic versus adult

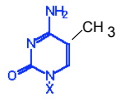
- Isolated from early embryos
- Can expand indefinitely in culture
- Can give rise to all cell types
- Isolated from adult human tissue
- Can not be expanded in culture
- Can only give rise to same tissue



WHY ORGANISM CLONING MIGHT NOT WORK

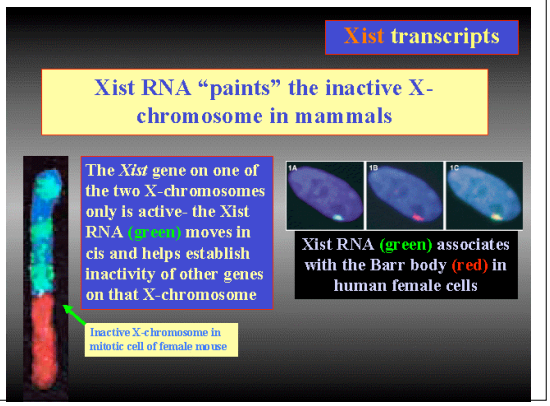
1. TECHNICAL REASONS---
2. GENES OR CHROMOSOMES ARE LOST OR CHANGED IN DEVELOPMENT

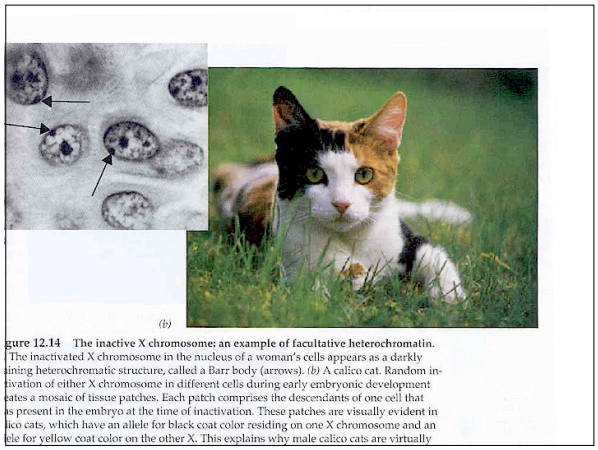
DNA IS MODIFIED DURING DEVELOPMENT



5- methylcytosine

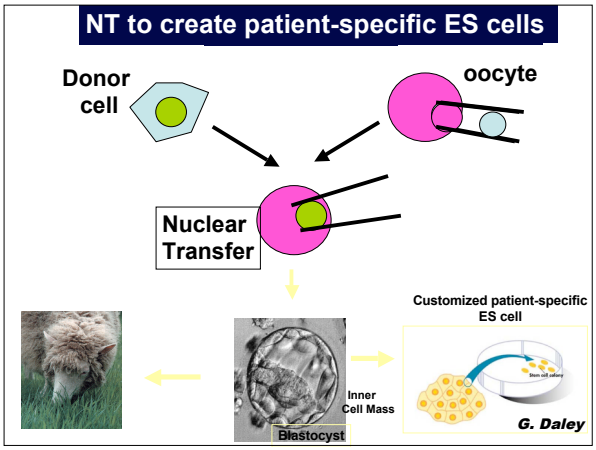
IN HUMAN FEMALES ONE X INACTIVATED IN DEVELOPMENT

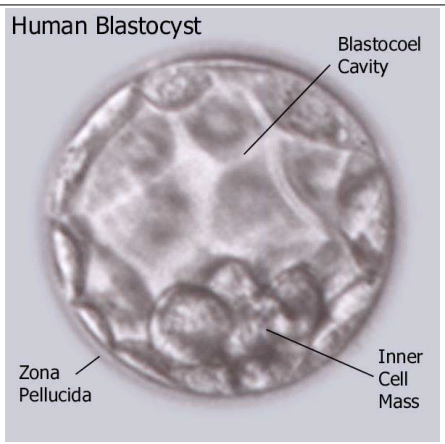


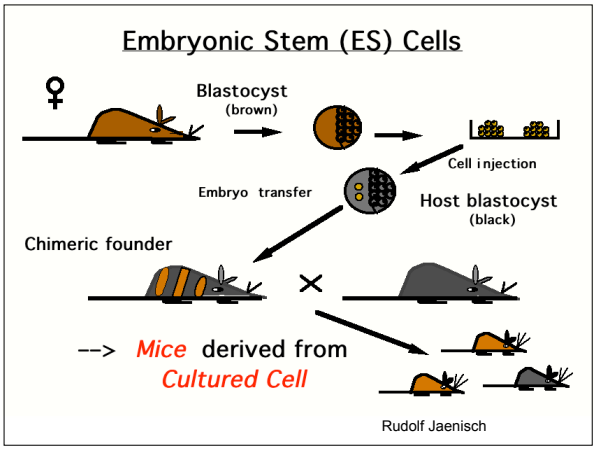


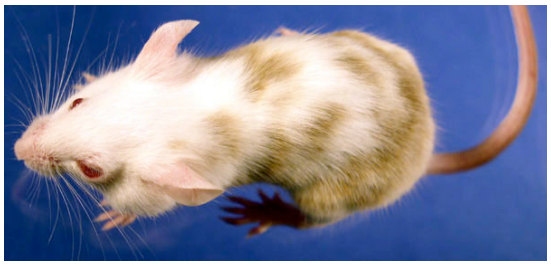
(b)

gure 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 ining 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 ele for yellow coat color on the other X. This explains why male calico cats are virtually









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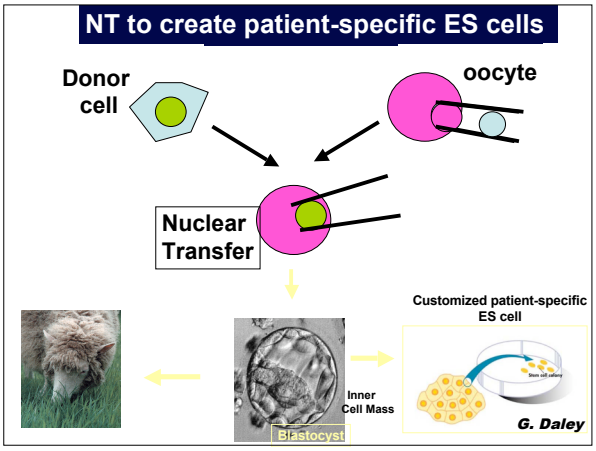
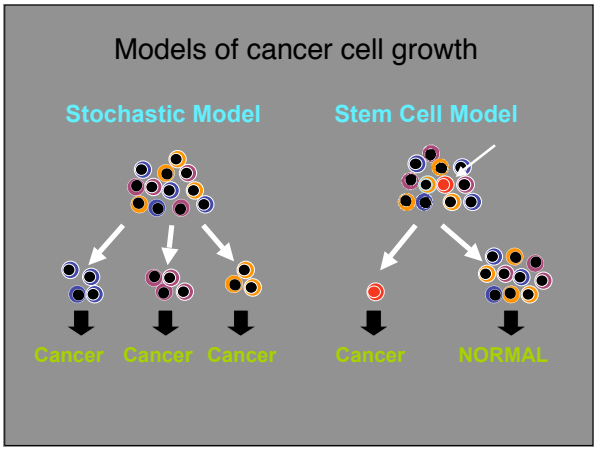


Cancer as a stem cell disease?

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



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