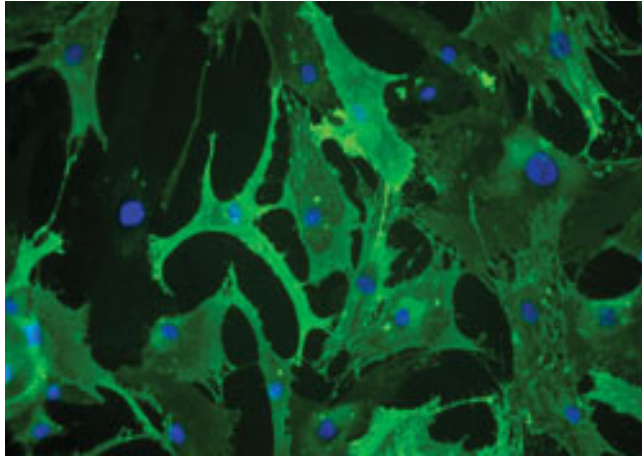


GREG'S GOLD



STEM CELLS FROM FAT



CLONING AND STEM CELLS

A. Cloning

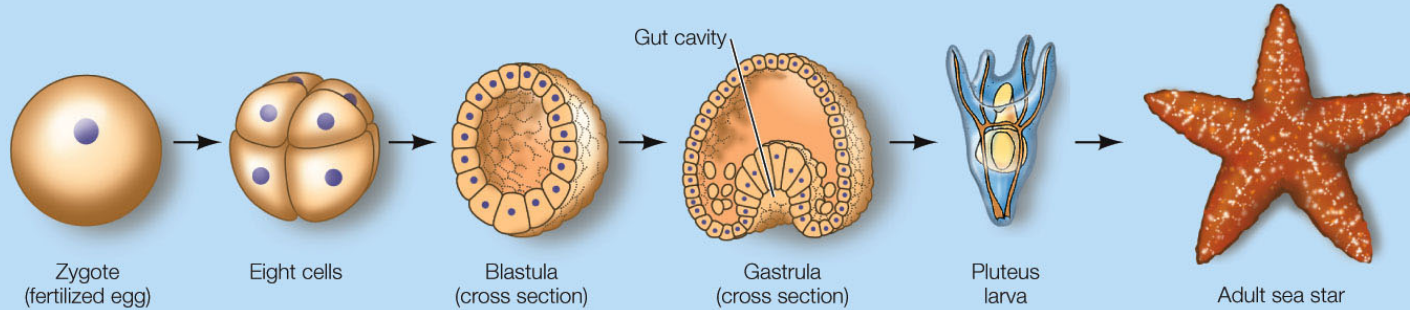
1. ***Biological basis of cloning***
2. Cloning of plants
3. Cloning of animals

B. Stem cells

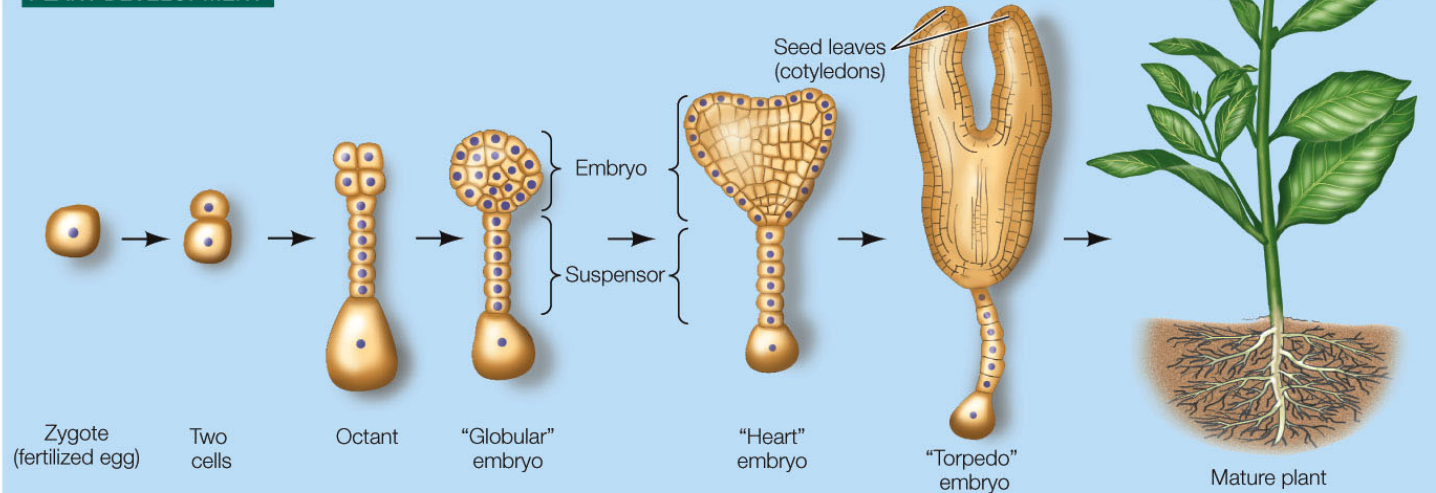
1. Biology of stem cells
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DEVELOPMENT

ANIMAL DEVELOPMENT

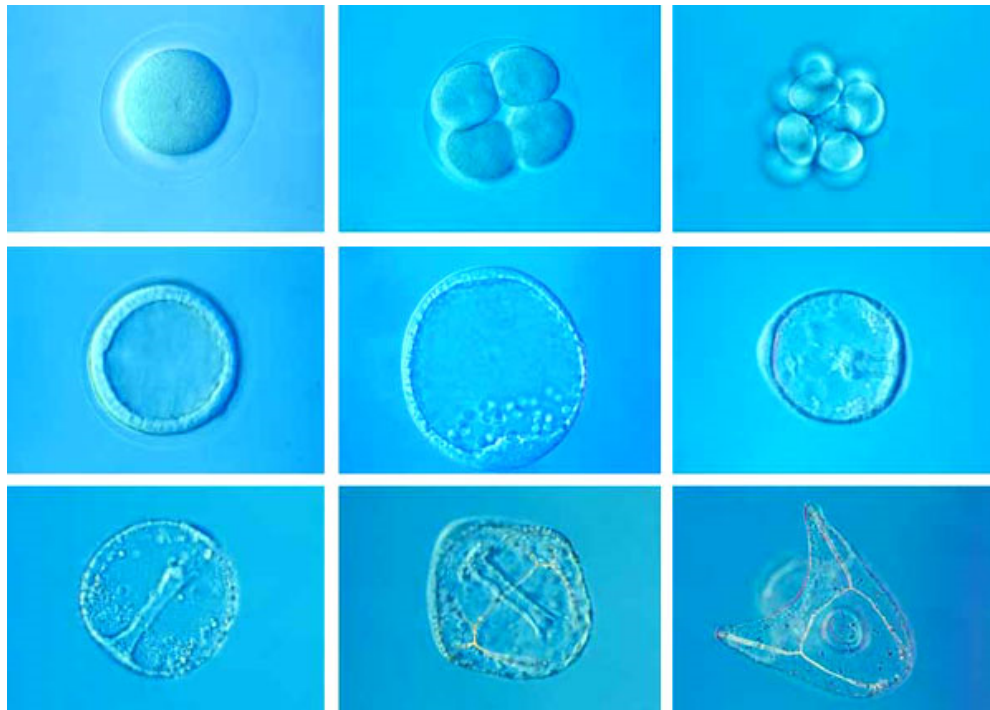


PLANT DEVELOPMENT



DEVELOPMENT

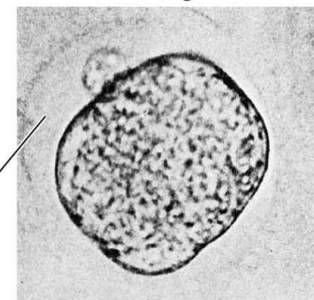
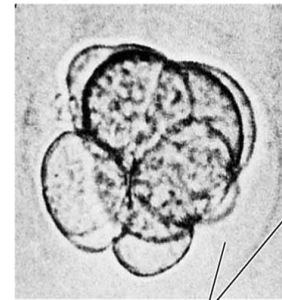
Sea urchin: 5 days



Human: 5 days

Early 8-cell stage

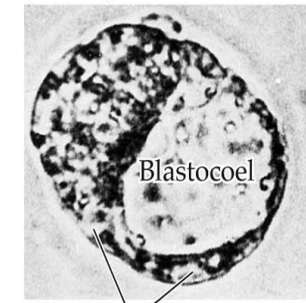
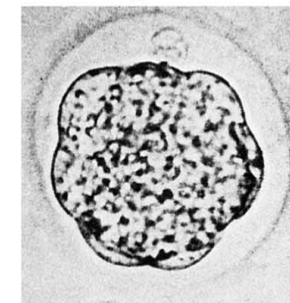
Later 8-cell stage



Zona pellucida

16-cell stage

Blastocyst

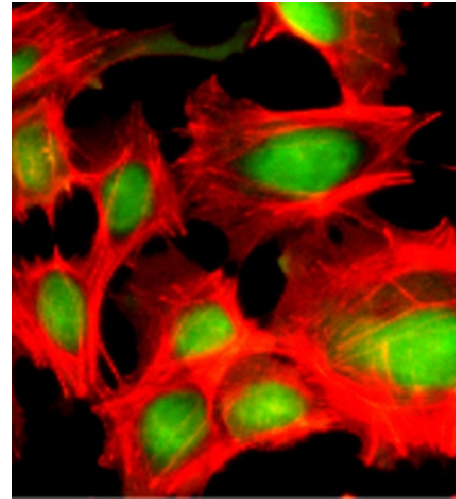


Trophoblast

DIFFERENTIATION



Human fertilized egg:
Totipotent: can make
all types of cells



Human heart cells:
Differentiated:
fully specialized

CLONING AND STEM CELLS

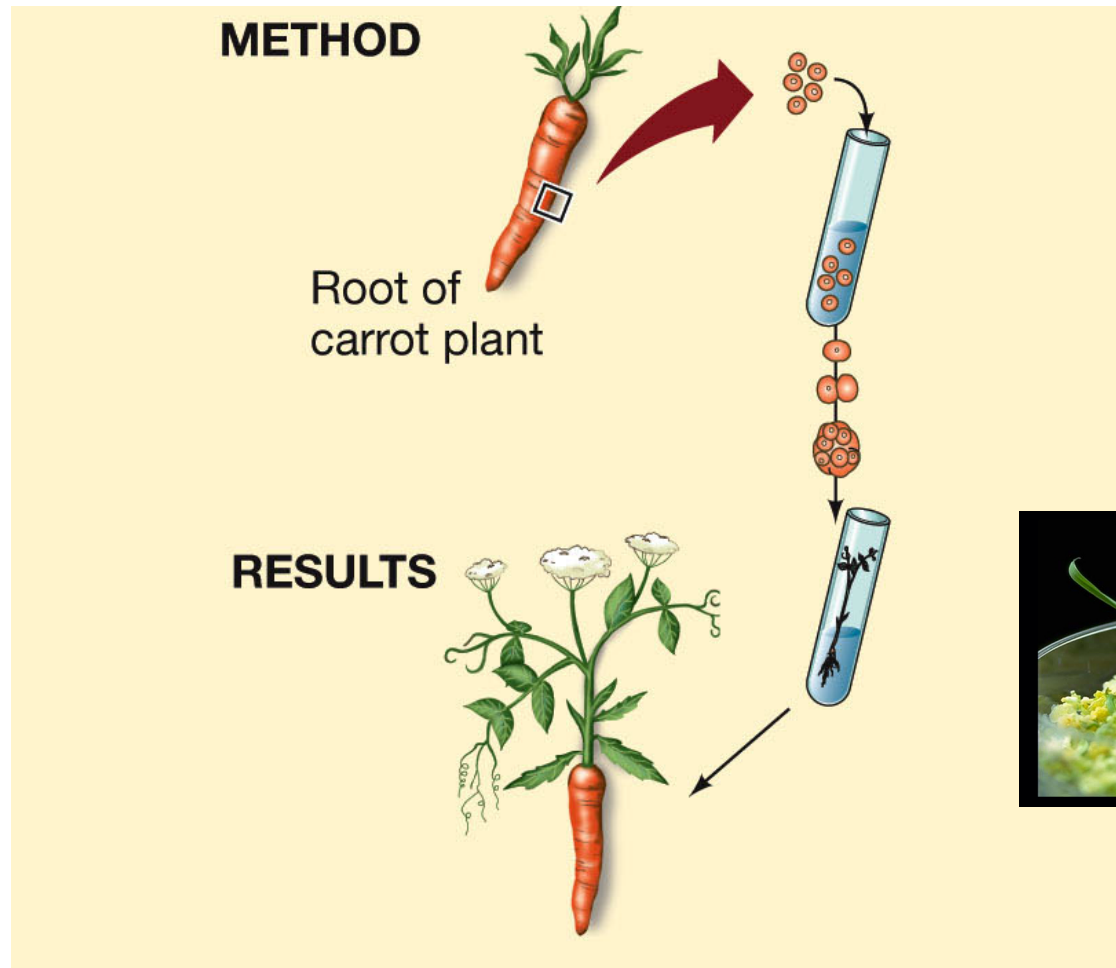
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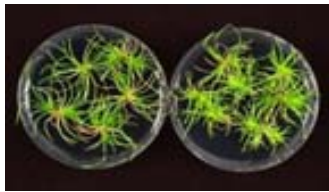
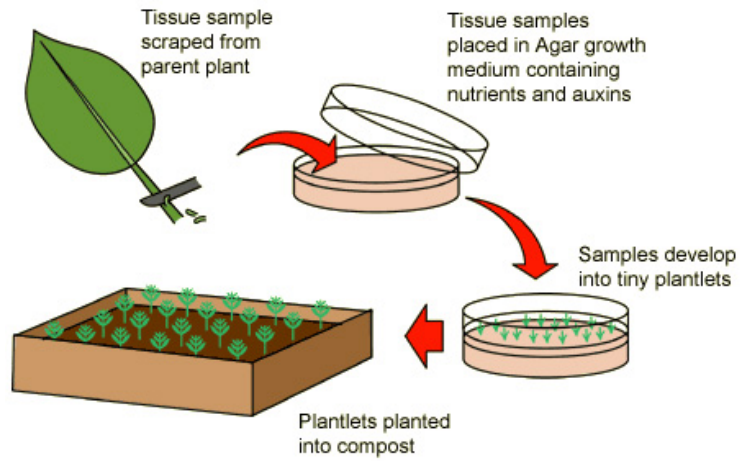
B. Stem cells

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CLONING IN PLANTS



CLONING IN FORESTRY



Pine



CLONING AND STEM CELLS

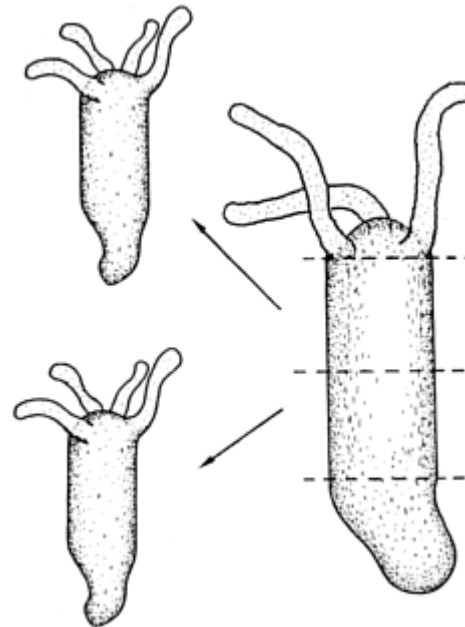
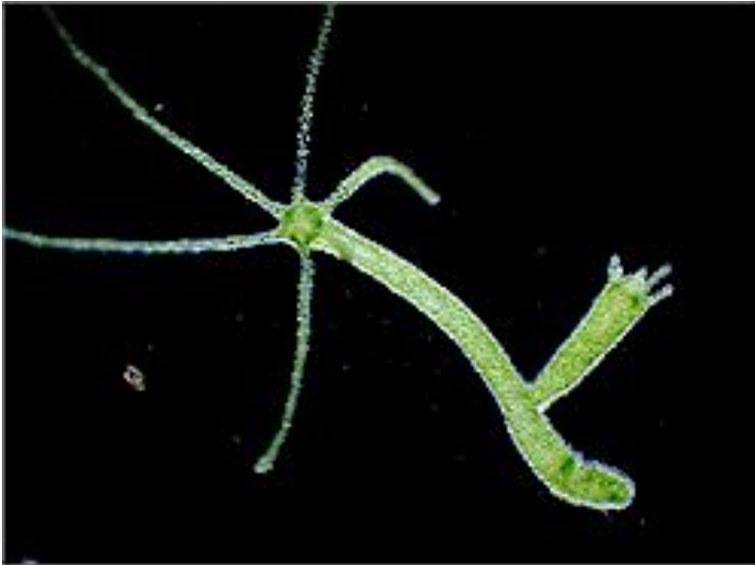
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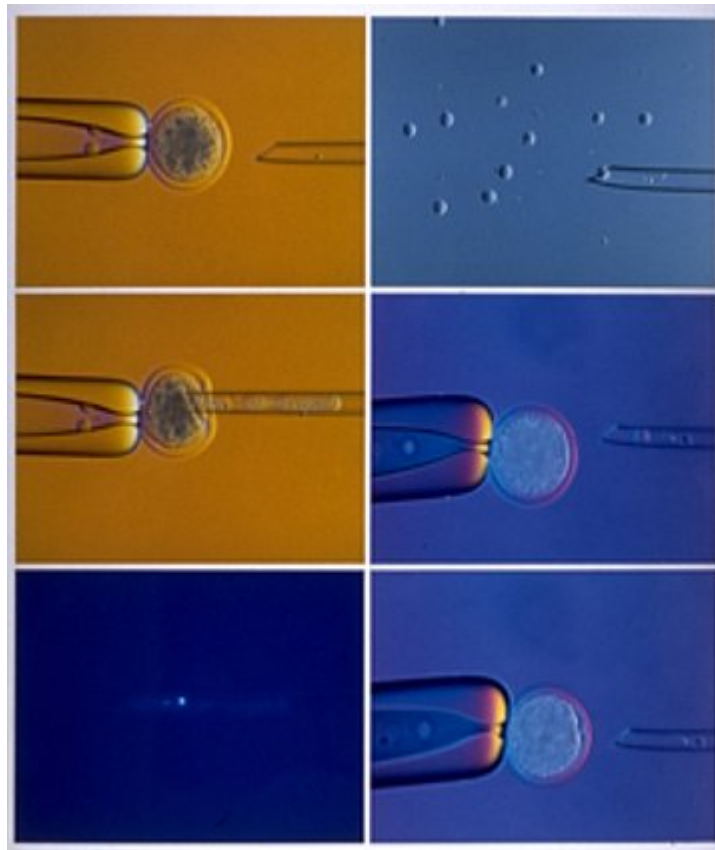
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TOTIPOTENCY IN AN ADULT ANIMAL: HYDRA



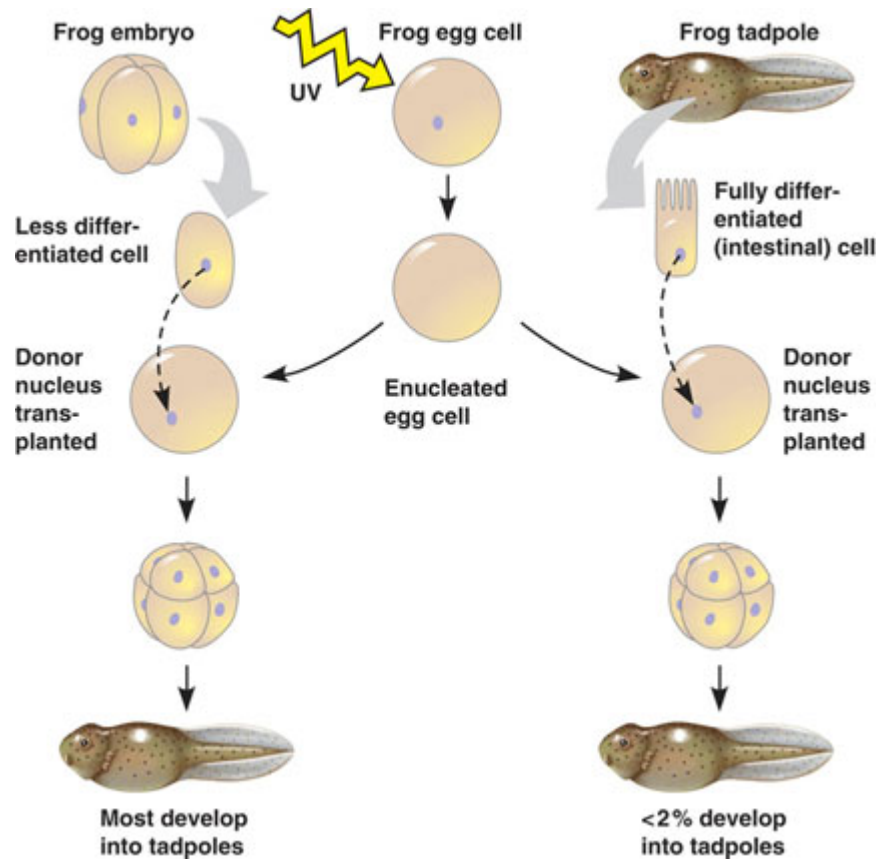
NUCLEAR TRANSFER FOR CLONING

Egg is
enucleated



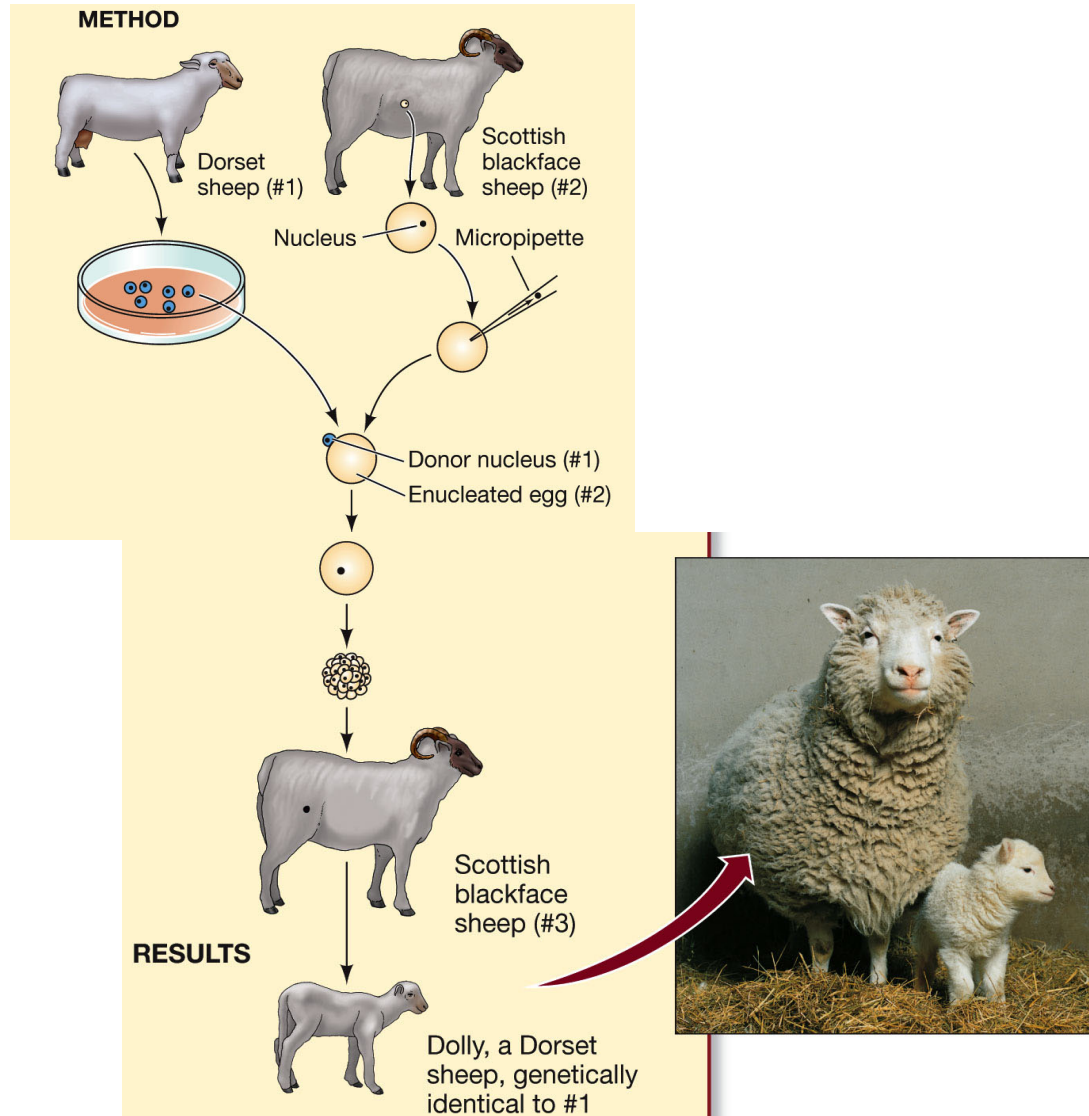
Donor nucleus
inserted into
egg

CLONING A FROG



Cloned albino frogs and their egg donor

CLONING A SHEEP



SOME REASONS FOR ANIMAL REPRODUCTIVE CLONING

- Propagation of valuable animals
- Preservation of endangered species
- Preservation of a pet

CLONING CATTLE



Used for leaner beef
and more milk



Resistant to brucellosis
(bacterial infection
causes abortion)

CLONED PIGS



High levels of omega-3 fatty acids, leaner meat

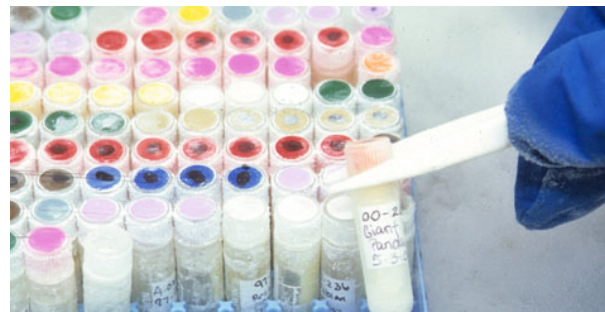


Genetically modified for organ transplants to humans

CLONING FOR SPECIES PRESERVATION



Endangered



Frozen zoo:
San Diego



Bessie, the cow that
carried the cloned guar



CLOINED PETS



CC and her nuclear donor



Nuclear donor

Surrogate mother

Snuppy

CLOINED HORSE

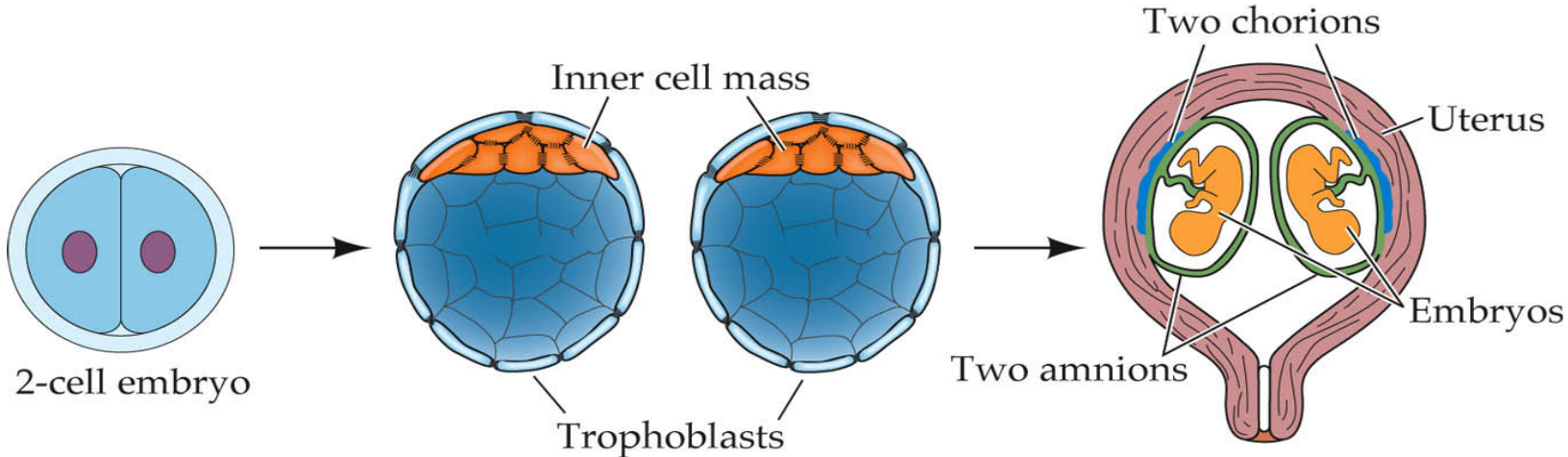
Clone



Surrogate
mother

Powerful horse associations have enacted rules forbidding the registration of clones

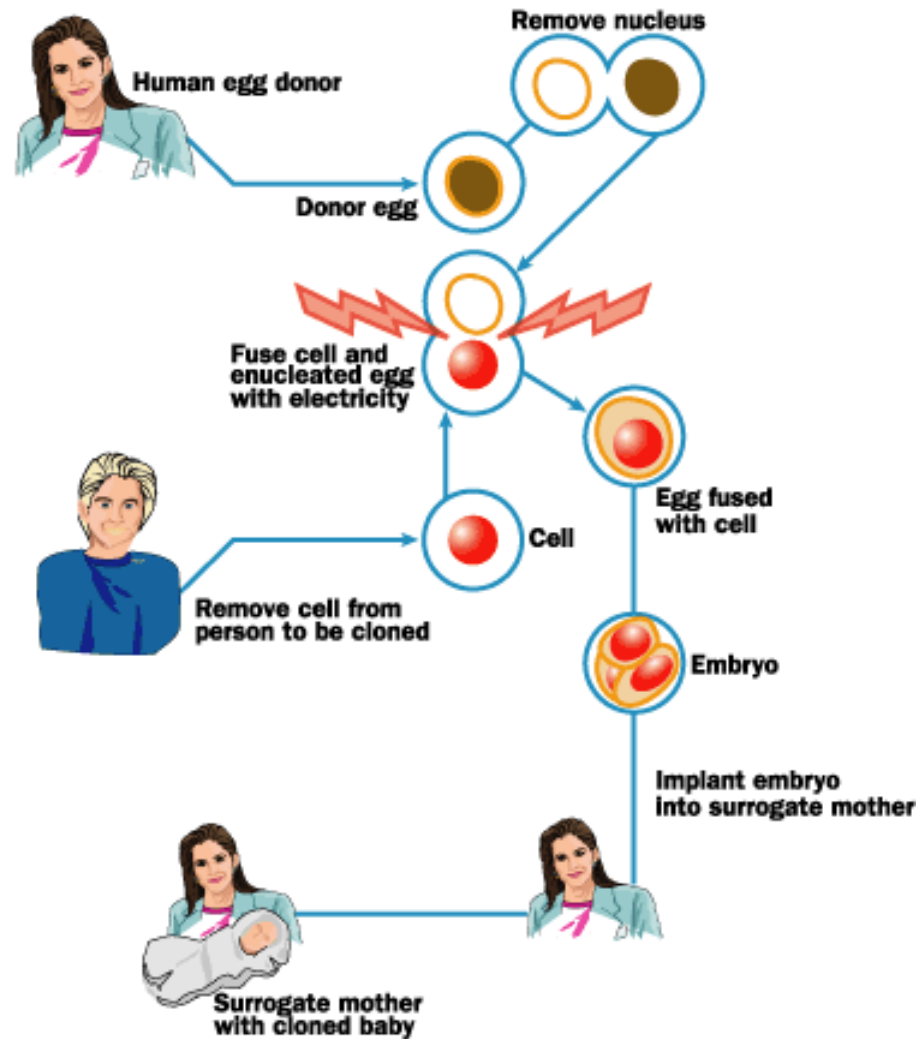
HUMAN CLONES: IDENTICAL TWINS



SOME REASONS FOR HUMAN REPRODUCTIVE CLONING

- Problems with normal reproductive mechanisms
- Perpetuation of valuable genotypes
- Perpetuation of a dying child

HUMAN REPRODUCTIVE CLONING



CLONING AND STEM CELLS

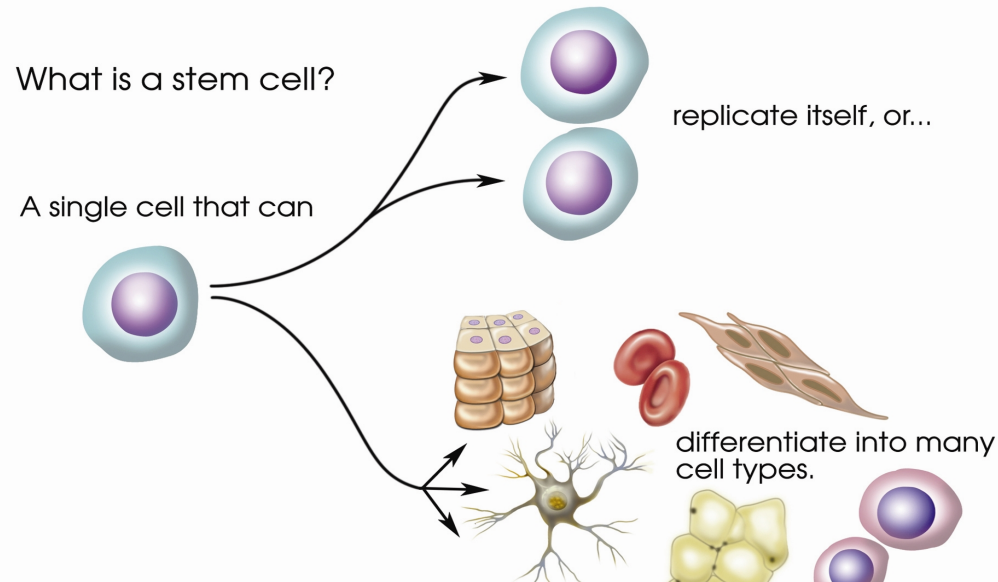
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STEM CELLS



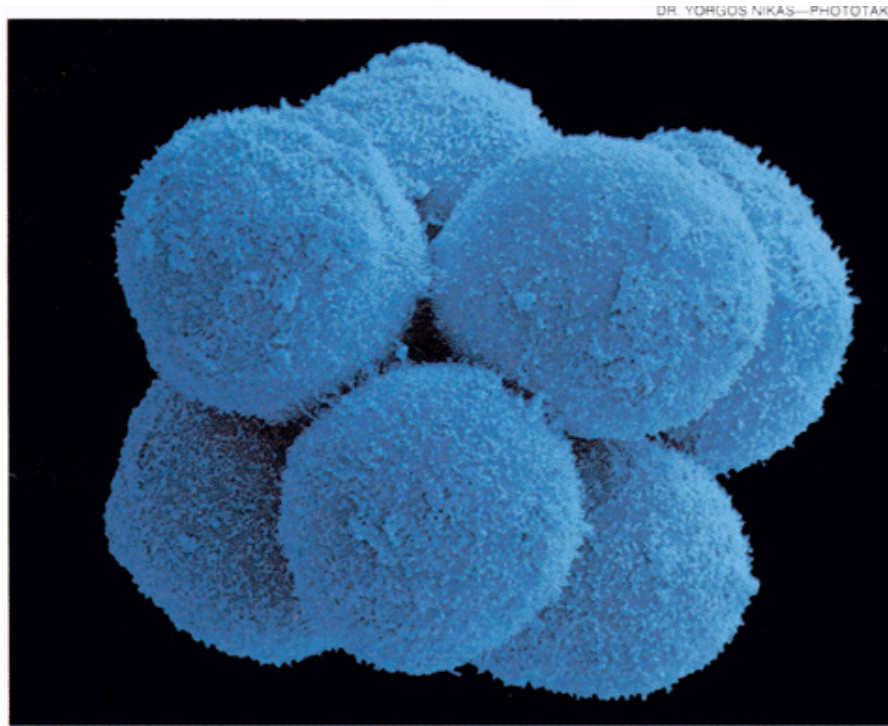
Types of stem cells:

Totipotent: Can produce a whole organism: fertilized egg

Pluripotent: Can produce most cell types: embryonic stem cells

Multipotent: Can produce a few cell types: fat stem cells

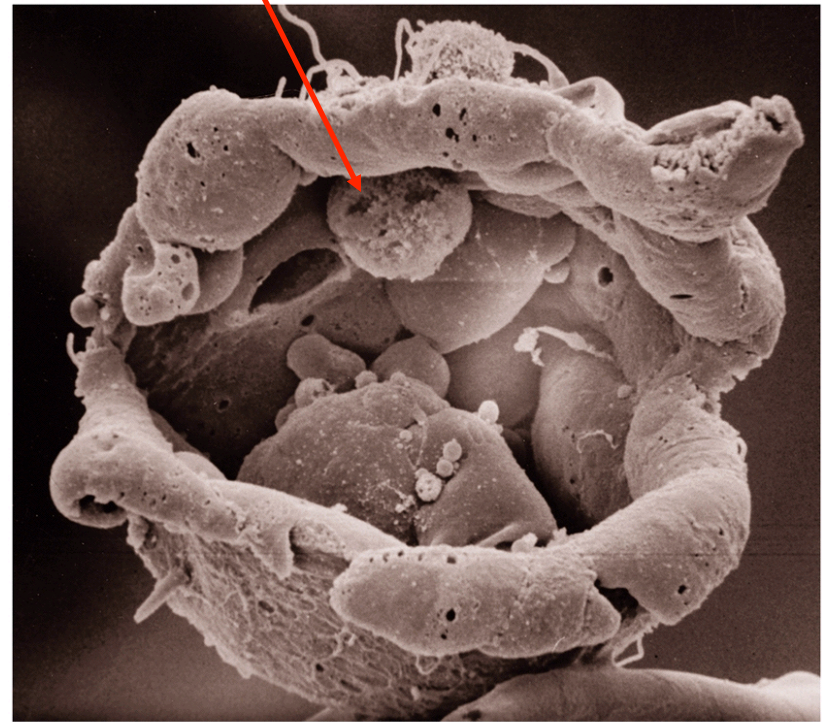
TOTIPOTENT STEM CELLS



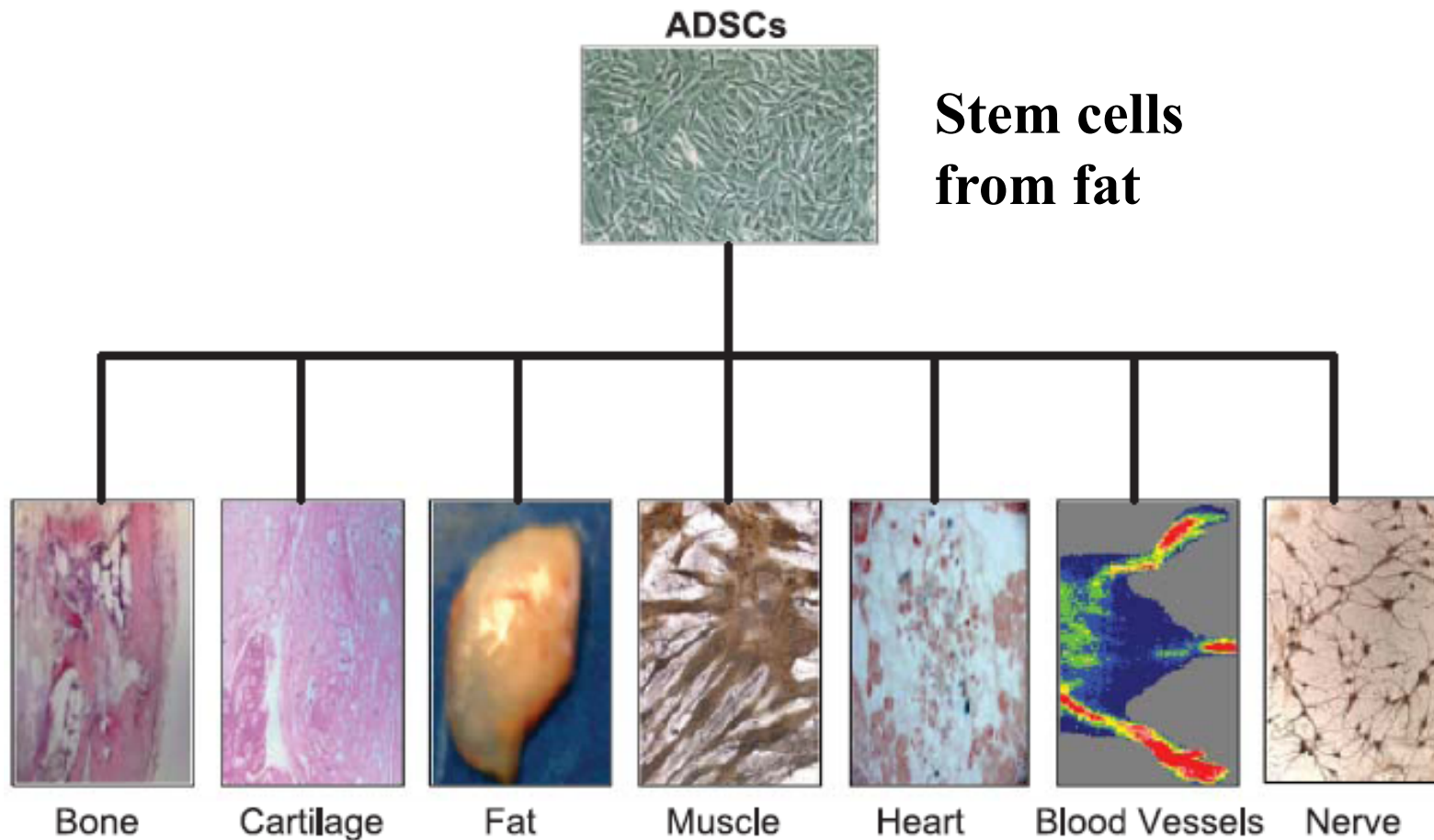
3-day human embryo: Each cell can produce a complete human

PLURIPOTENT STEM CELLS: EMBRYONIC STEM CELLS

Human ES cells



MULTIPOTENT STEM CELLS FROM FAT



CLONING AND STEM CELLS

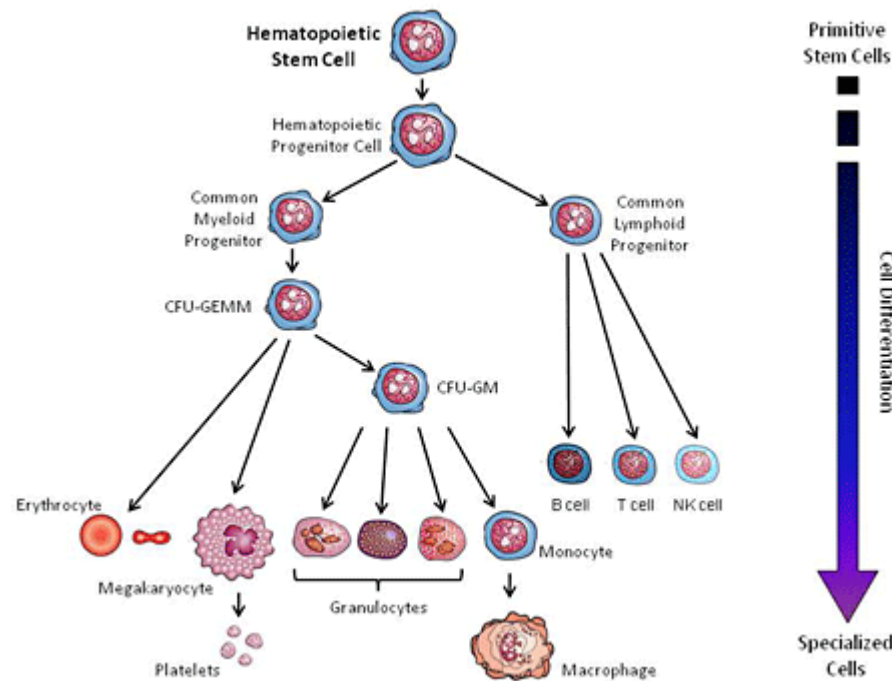
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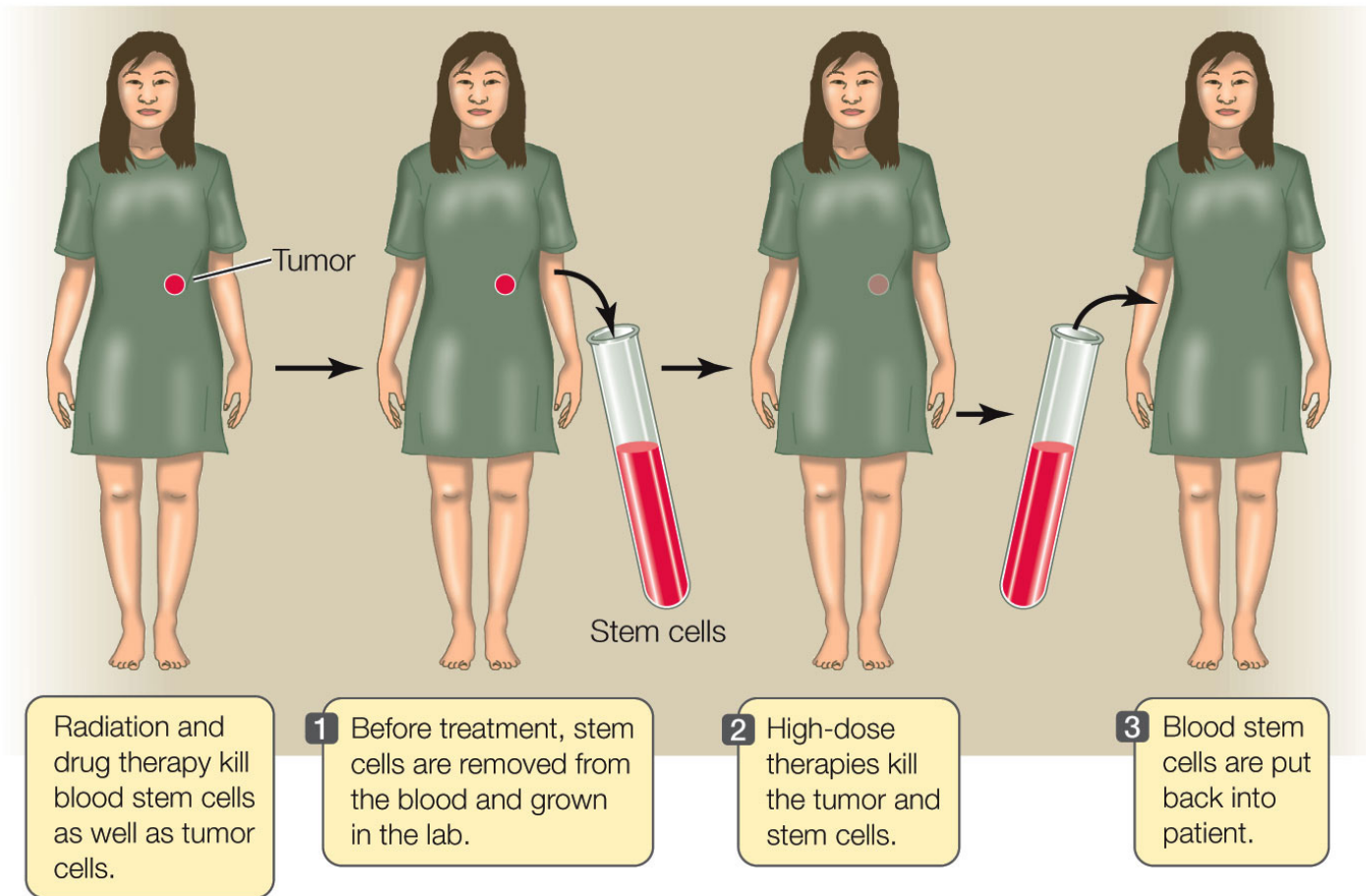
B. Stem cells

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MULTIPOTENT STEM CELLS FROM BONE MARROW



MULTIPOTENT STEM CELL TRANSPLANTATION



THE NEED FOR NEW CELLS

- Heart: attack damage
- Pancreas: diabetes
- Liver: cirrhosis damage
- Brain: Parkinson's

Problems: Source of cells

Rejection of transplants

CLONING AND STEM CELLS

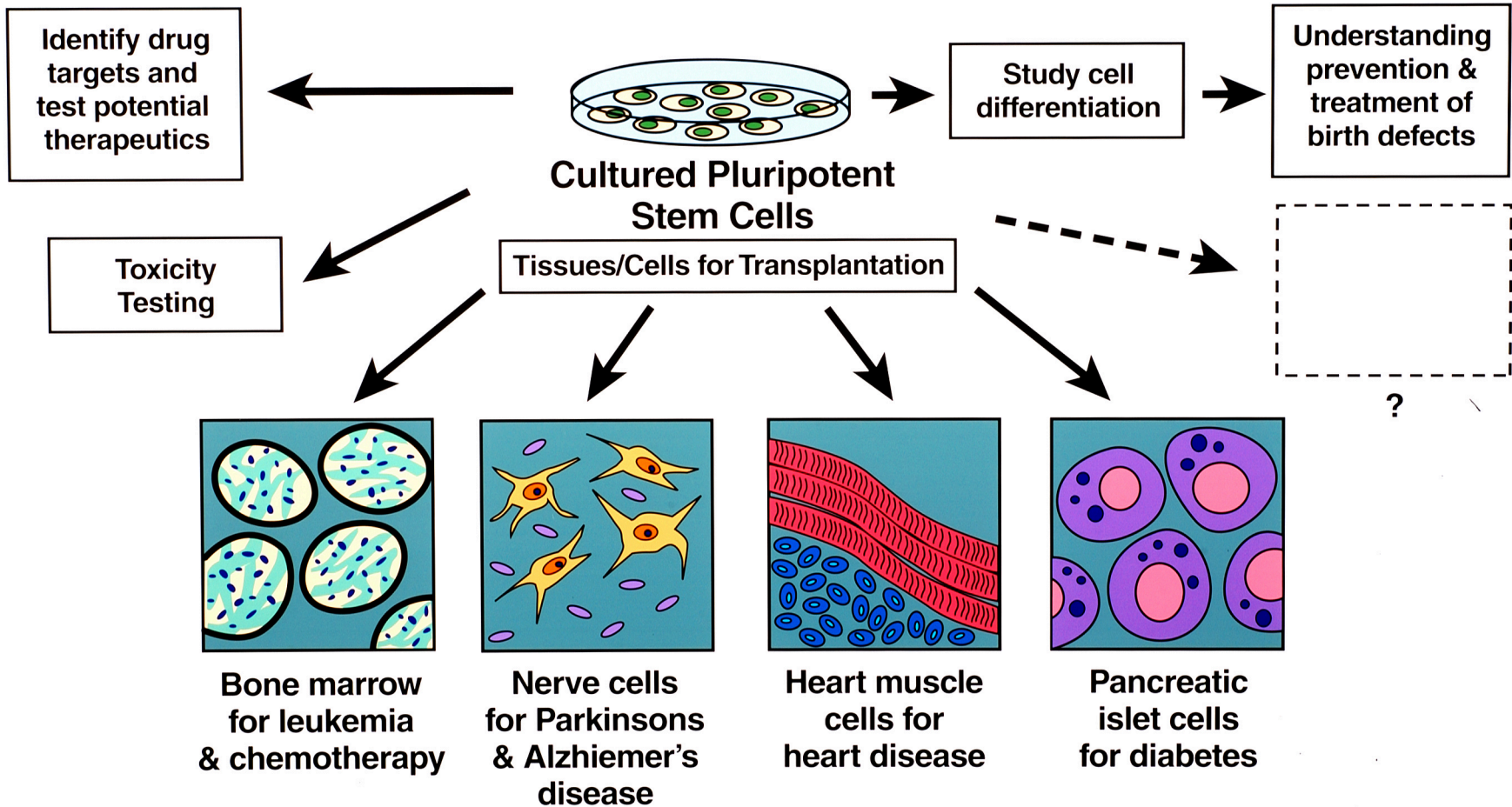
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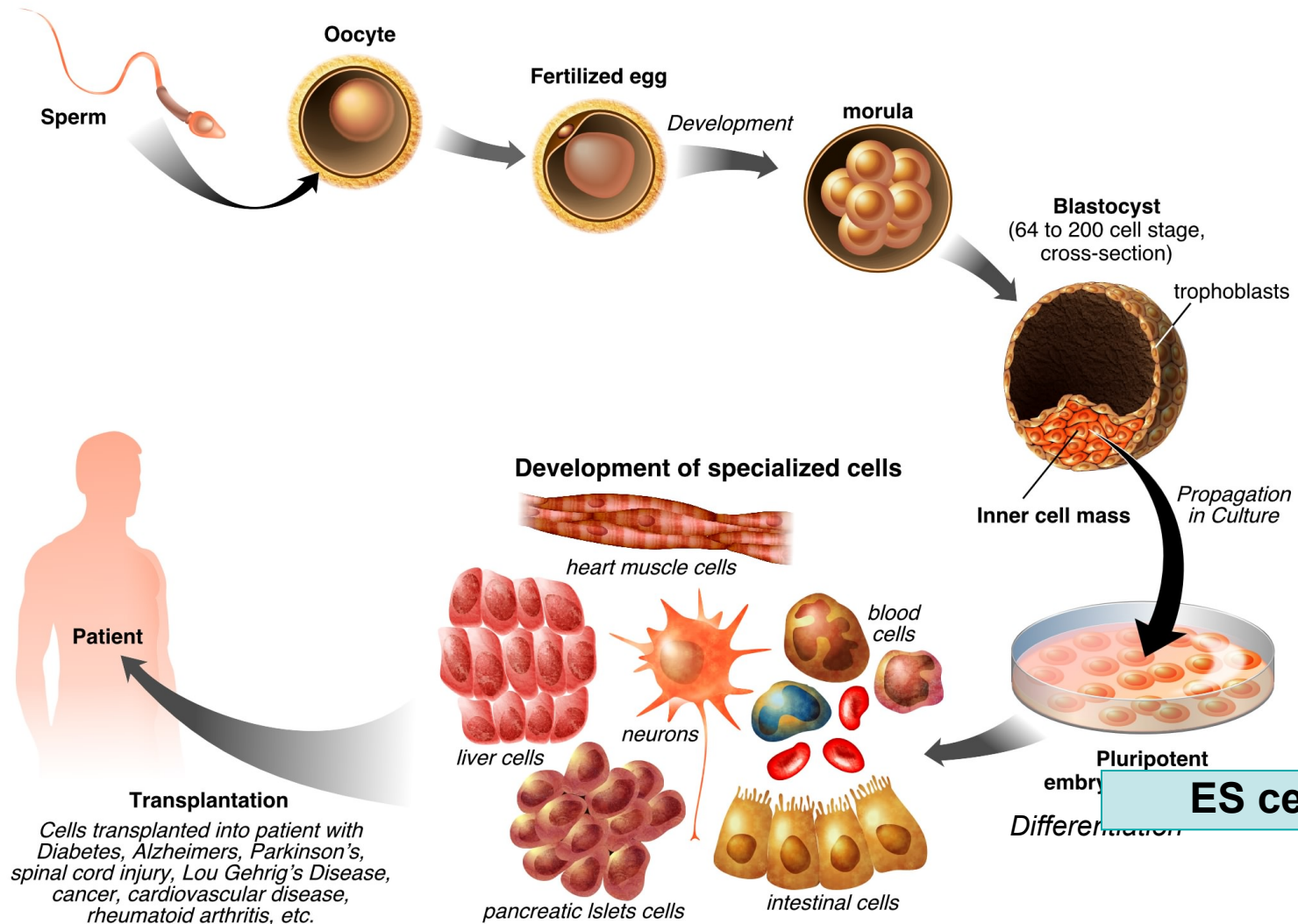
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POTENTIAL USES OF PLURIPOTENT STEM CELLS



PLURIPOTENT STEM CELL THERAPY

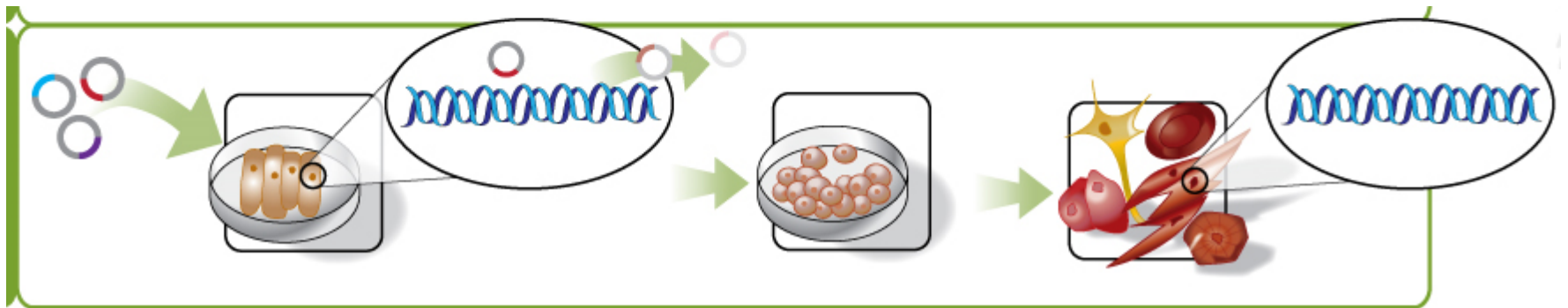
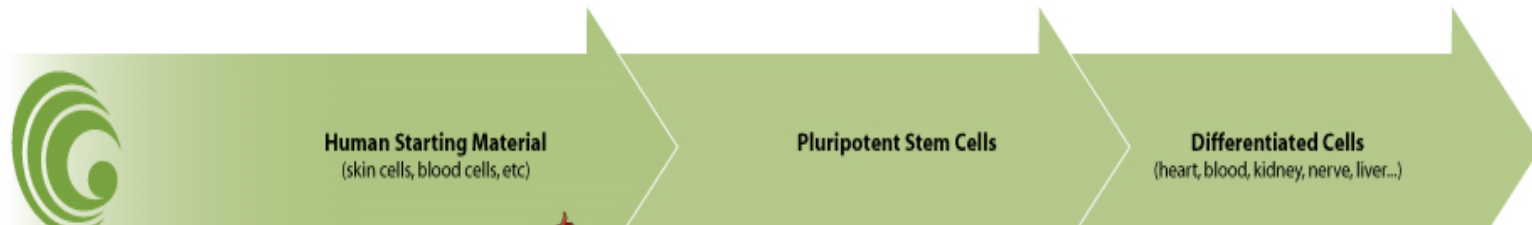


Handwritten signature or mark.

PROBLEMS WITH EMBRYONIC STEM CELLS

- Rejection
- Availability
- Ethical concerns

INDUCED PLURIPOTENT STEM CELLS

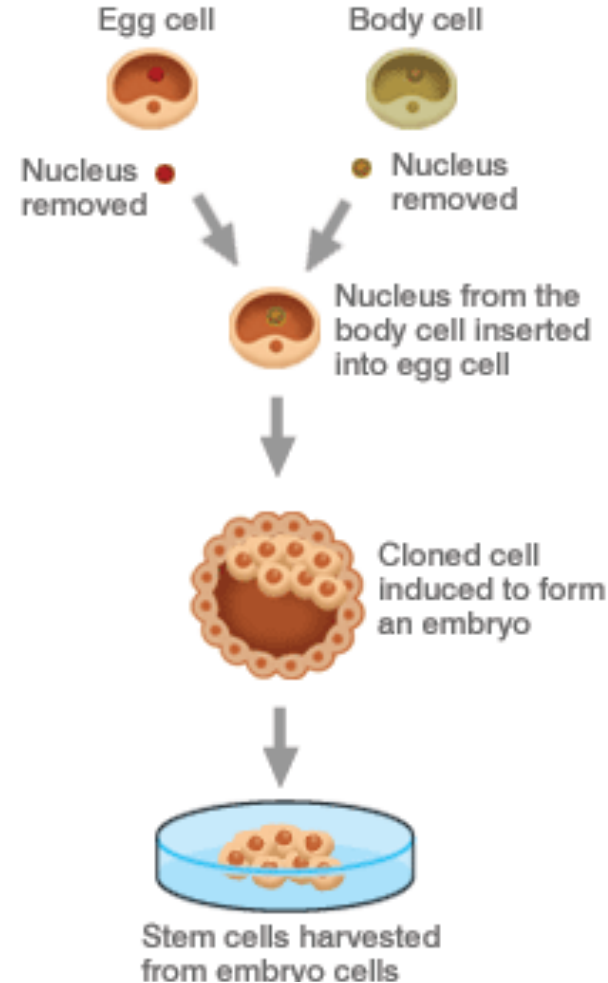


Genes that are expressed embryonic stem cells are added to skin cells in a form that they are expressed

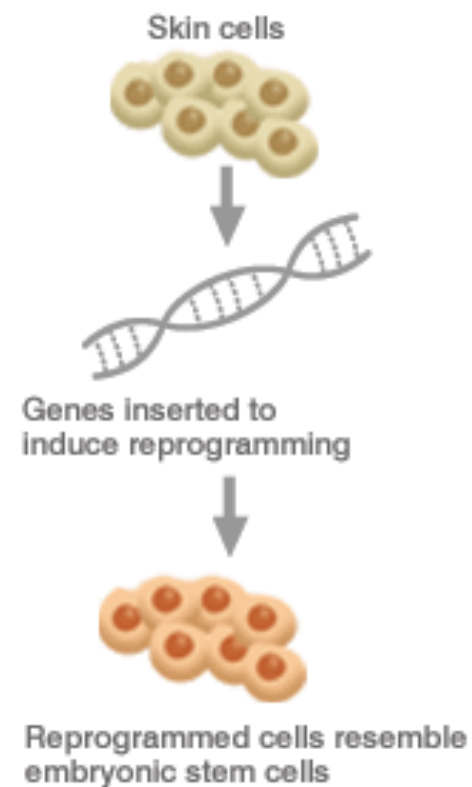
The altered skin cells are pluripotent

PLURIPOTENT STEM CELLS: NOT REJECTED

Therapeutic cloning



Nuclear reprogramming



SOURCE: Science Media Centre

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