sources of stem cells

Stem cells are vital for human development and tissue regeneration.
They exist in embryos and adult stem cell niches, providing a supply of cells that can adopt many cell fates through the influence of factors *in vivo* or *in vitro*.

in vivo human development

HeLa
1951

in vivo cells to in vitro

GASTRULA
day 14
Further differentiation into four germ layers:
ENDODERM
MESODERM
ECTODERM
& GERM CELLS.
Each germ layer gives rise to a different subset of cell populations in the body.

MULTIPOTENT *cells*

BLASTOCYST
day 5
~150 cells
First stage of differentiation
Trophoblast will support placental development.
Inner cell mass will develop into embryo.

PLURIPOTENT & MULTIPOTENT *cells*

BLASTOMERE
day 3
8 cells
Clonal population via mitosis.

TOTIPOTENT *cells*

ZYGOTE
Fusion of egg and sperm provides a complete human genome.

FERTILIZATION

in vitro stem cell technologies

EMBRYO

FERTILITY INDUSTRY SCIENCE

IVF EMBRYO

MORAL STATUS OF THE EMBRYO
- ▷ PRESIDENT BUSH VETO
- ▷ VIDAL. IVF ANIMATION
- ○ 1998 THOMSON, J. A. ET AL.
  PLURIPOTENT
  hESCs

EUGENICS & SAVIOR SIBLINGS
- ○ INFORMED CONSENT
- ▷ SAVIOR SIBLINGS
- ○ 1998 VERLINSKY, Y. ET AL.
  PLURIPOTENT
  hESCs

EGG COMMODITIES & HEALTH RISKS
- ○ PROCEDURAL JUSTICE
- ○ BIOPOLITICS
- ○ 2011 EGLI, D. ET AL.
  PLURIPOTENT
  hESCs

Research

PGD

Extranumerary

FETUS

GENETICALLY MODIFIED EMBRYO

CLONES

○ MISTAKEN IDENTITY	▷ UK ALLOWS CLONING	○ PICCININI. WE ARE FAMILY
▷ NOAH'S ARK	▷ ETHICAL CLONES	○ SPECIES BOUNDARIES
○ 2007 REVAZOVA, E. ET AL.	○ 2013 MITALIPOV, S. ET AL.	○ 2003 SHENG, H.Z. ET AL.
PLURIPOTENT	**PLURIPOTENT**	**PLURIPOTENT**
phESCs	ntESCs	intESCs

Parthenote

Somatic Cell Nuclear Transfer

Cybrid

"CLONE"

ABORTION & MISCARRIAGE
- ○ PRICELESS RESOURCE
- ○ FETAL TISSUE TRANSPLANT
- ○ 1998 GEARHART, J. ET AL.
  MULTIPOTENT **PLURIPOTENT**
  hNSCs & EGCs

Fetal Tissue

EXTERNAL

ADULT CELL SOURCE

PATIENTS

PUBLIC & PRIVATE CELL BANKS
- ○ CORD BLOOD BANKS
- ○ PDSC: 2008 PAROLINI, O. ET AL.
- ○ UCB: 1974 KNUDTZON, S.
  MULTIPOTENT
  PDSCs & UCB
- ▷ THE RESIDENT
- ▷ BRIGANTI. MADEMOICELL
- ○ 2007 MENG, X. ET AL.
  "PLURIPOTENT"
  ERCs
- ▷ BONE MARROW DIVERSITY
- ▷ FLYNN v. HOLDER
- ○ 2013 SHEN, H.
  MULTIPOTENT
  HSCs
- ▷ STEM CELL FRAUD
- ○ WHY BREASTS?
- ○ 2002 HEDRICK, M. ET AL.
  MULTIPOTENT
  ADSCs
- ○ 2013 MAGNESS S. ET AL.
  MULTIPOTENT
  ISCs
- ○ REGULATING BIOLOGICS
- ○ FDA LAWSUITS
- ○ 2013 KONGER, K.
  MULTIPOTENT
  HFSCs
- ○ DISTRIBUTIVE JUSTICE?
- ○ PAYING PATIENTS
- ○ 2012 TILLY ET AL.
  MULTIPOTENT
  OSCs
- ▷ CNBC OVASCIENCE
- ▷ OVARIAN STEM CELLS

Placenta & Umbilical Cord

Menstrual Blood

Bone Marrow

Fat

Gut

Hair

Ovaries

ENDODERM
MESODERM
ECTODERM
GERM

ADULT

GENETICALLY REPROGRAMMED

iPSCs: *Induced Pluripotent Stem Cells*

ECTODERM — Brain (Neuron)
MESODERM — Skin (Fibroblast)
ENDODERM — Liver (Hepatocyte)

REPROGRAMMING METHODS
Chemical or Protein or Genetic or RNA

CELL CULTURE

iPSCs	iPSCs	iPSCs
"PLURIPOTENT"	"PLURIPOTENT"	"PLURIPOTENT"
	○ 2007 YAMANAKA ET AL.	▷ METHOD OF THE YEAR
	▷ WADDINGTON LANDSCAPE	▷ REDIRECTING LIFE
○ DISABILITY JUSTICE	○ GERMLINE ENGINEERING	
○ iPSC PUBLIC BANK		

DISEASE, DISABILITY, & IMMORTALITY

in vitro cells to in vivo

CELL LINE
CELL TYPE
POTENCY
BIOLOGICAL REFERENCES
ETHICAL, LEGAL & SOCIAL REFERENCES
○ READINGS/OTHER ▷ VIDEOS

TISSUE COMMODITIES, NOTA, FDA, & EMERGING MARKETS

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