Stem Cells, the Source of Life

What is a Stem Cell?
Stem cells are the cells that have a capacity for self-renewal (producing more of the same cell type) and differentiation into other cell types. Two major stem cell types are present in mammals, embryonic stem cells and adult stem cells.

Embryonic Stem Cells

Embryonic stem cells are found early in the development in the inner mass of blastocyst, and possess properties of both self-renewal and potency. The embryonic stem cells are pluripotent cells, meaning they can give rise to unlimited number of other cell types.

Pluripotent embryonic stem cells are identified by expression of several pluripotency markers, including OCT4, SOX2 and NANOG. These transcription factors suppress the genes that lead to differentiation and thus maintain the pluripotency of the cells.
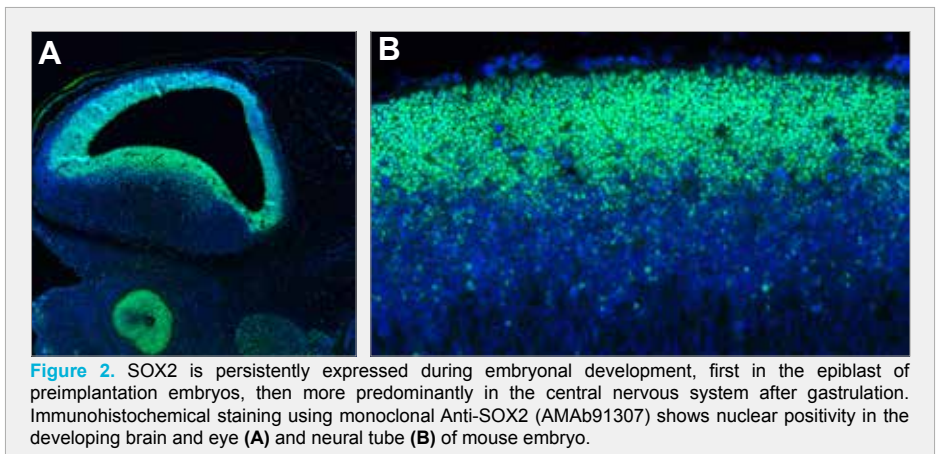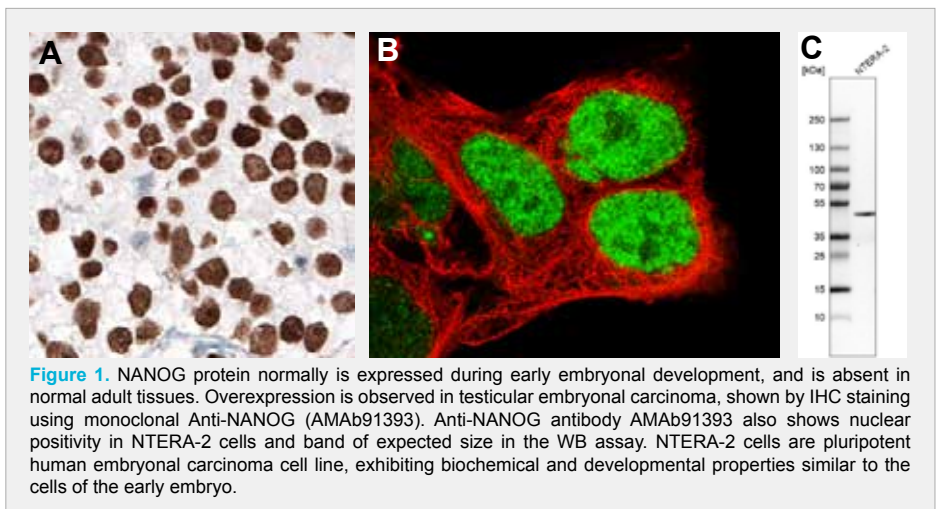
During embryonal development, the embryonic stem cells differentiate and give rise to the three germ layers, including ectoderm, endoderm and mesoderm, from which all the tissues and organs are ultimately formed. For instance, the dorsal part of ectoderm will specialize into neuroectoderm, which later will undergo neurulation and encephalization and will finally develop into the central nervous system.

The neural stem cells are multipotent cells, and generate various types of neural cells in a process of neurogenesis, including neurons, astrocytes and oligodendrocytes.

Adult Stem Cells

Adult (or somatic) stem cells are found in various tissues of the organism after birth. Adult stem cells are lineage-restricted (multipotent), and produce only the cells representing the tissue of origin. Together with progenitor cells, they contribute to normal turnover of cells in adult tissues or may act as a repair system.

Figure 1. NANOG protein normally is expressed during early embryonal development, and is absent in normal adult tissues. Overexpression is observed in testicular embryonal carcinoma, shown by IHC staining using monoclonal Anti-NANOG (AMAb91393). Anti-NANOG antibody AMAb91393 also shows nuclear positivity in NTERA-2 cells and band of expected size in the WB assay. NTERA-2 cells are pluripotent human embryonal carcinoma cell line, exhibiting biochemical and developmental properties similar to the cells of the early embryo.

Figure 2. SOX2 is persistently expressed during embryonal development, first in the epiblast of preimplantation embryos, then more predominantly in the central nervous system after gastrulation. Immunohistochemical staining using monoclonal Anti-SOX2 (AMAb91307) shows nuclear positivity in the developing brain and eye **(A)** and neural tube **(B)** of mouse embryo.

Figure 3. PAX6 is an essential transcription factor for overall eye development. Immunohistochemical staining using monoclonal Anti-PAX6 (AMAb91372) shows positivity in the developing eye of mouse embryo **(A)** and adult rat retina **(B)**. ICC-IF staining in HEK-293 cells shows nuclear immunoreactivity **(C)**.

ATLAS ANTIBODIES

Table 1. Cell Surface Pluripotency Markers

Target	Catalog No	Clonality	Validated Application	Sequence Identity Mouse/Rat
NACC1	HPA062245	Polyclonal	IHC, WB*, ICC-IF	71%/73%
NANOG	AMAb91393	Monoclonal	IHC, WB, ICC-IF	-
NES	AMAb90556	Monoclonal	IHC, WB*, ICC-IF	47%/42%
OCT4/POU5F1	HPA058267	Polyclonal	ICC-IF	76%/76%
SALL4	HPA015791	Polyclonal	IHC*, ICC-IF	74%/74%
SOX2	AMAb91307	Monoclonal	IHC, WB*, ICC-IF	99%/99%
TCL1	HPA016604	Polyclonal	IHC*, WB	52%/53%
FUT4/SSEA4/CD15	AMAb91414	Monoclonal	WB	-

Table 2. Transcription Factors Markers

Target	Catalog No	Clonality	Validated Application	Sequence Identity Mouse/Rat
c-MYC	HPA055893	Polyclonal	IHC, ICC-IF	92%/89%
KLF2	HPA055964	Polyclonal	IHC, ICC-IF	87%/91%
KLF4	AMAb91389	Monoclonal	IHC, WB, ICC-IF	-
KLF5	HPA040398	Polyclonal	IHC, WB, ICC-IF	93%/96%
NANOG	AMAb91393	Monoclonal	IHC, WB, ICC-IF	-
OCT4/POU5F1	HPA058267	Polyclonal	ICC-IF	76%/76%
SALL4	HPA015791	Polyclonal	IHC*, ICC-IF	74%/74%
SOX15	HPA067196	Polyclonal	IHC*, ICC-IF	52%/52%
SOX2	AMAb91307	Monoclonal	IHC, WB*, ICC-IF	99%/99%
SOX3	AMAb91312	Monoclonal	WB	82%/31%
TCF3	HPA062476	Polyclonal	IHC, WB*	75%/73%
TCL1	HPA016604	Polyclonal	IHC*, WB	52%/53%

Table 3. Induced PSCs Markers

| Target	Catalog No	Clonality	Validated Application	Sequence Identity Mouse/Rat
ANPEP/CD13	HPA004625	Polyclonal	IHC*, WB, ICC-IF	78%/78%
FUT4/SSEA4/CD15	AMAb91414	Monoclonal	WB	-
NANOG	AMAb91393	Monoclonal	IHC, WB, ICC-IF	-

Table 4. Germ Cell Markers (during specification)

Target	Catalog No	Clonality	Validated Application	Sequence Identity Mouse/Rat
c-KIT/CD117	AMAb90904	Monoclonal	IHC, WB	66%/72%
DAZL	HPA019777	Polyclonal	IHC*, WB*	92%/92%
DDX4/MVH	HPA037764	Polyclonal	IHC*	99%/99%
GDF9	HPA069146	Polyclonal	IHC	59%/58%
IFITM1	HPA004810	Polyclonal	IHC*, WB, ICC-IF	56%/56%
OCT4/POU5F1	HPA058267	Polyclonal	ICC-IF	76%/76%
TEKT1	HPA062285	Polyclonal	IHC	80%/85%

Table 5. Ectoderm and Endoderm Markers

Target	Catalog No	Clonality	Validated Application	Sequence Identity Mouse/Rat
CHRD	HPA035827	Polyclonal	IHC	90%/91%
FOXJ3	HPA067284	Polyclonal	ICC-IF	95%/98%
GBX2	HPA067809	Polyclonal	WB, ICC-IF	96%/96%
NES	AMAb90556	Monoclonal	IHC, WB*	47%/42%
NOG	HPA061318	Polyclonal	IHC	100%/100%
OTX2	HPA000633	Polyclonal	IHC	100%/100%
P63/TP73L	AMAb91224	Monoclonal	IHC, WB	99%/94%
PAX2	HPA070751	Polyclonal	IHC*, ICC-IF	100%/100%
PAX6	AMAb91372	Monoclonal	IHC, ICC-IF	100%/100%
TUBB3	AMAb91395	Monoclonal	IHC, WB, ICC-IF	-

* Products with enhanced validation for indicated application
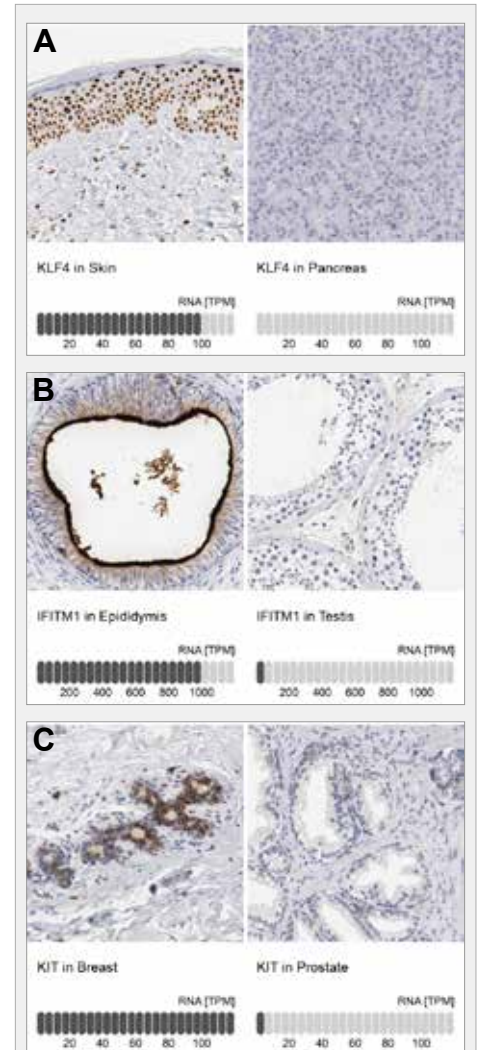
Figure 4.
Representative examples of Orthogonal Antibody Validation. Immunohistochemical staining using polyclonal Anti-KLF (HPA002926) **(A)**, Anti-IFITM1 (HPA004810) **(B)** and Anti-KIT/CD-117 (HPA004471) **(C)** antibodies. Note the specific expression in tissues with high RNA levels and absence of positivity in tissues with no/low RNA levels.

Enhanced Validation

AAA POLYCLONALS

PrecisA MONOCLONALS
DESIGNED BY RESEARCHERS FOR RESEARCHERS