Glossary of Terms in the Stem Cells Space

Adult (or somatic) stem cell—An undifferentiated cell found in a differentiated tissue that can renew itself and differentiate (with certain limitations) to give rise to all the specialized cell types of the tissue from which it originated. It is important to note that scientists do not agree about whether or not adult stem cells may give rise to cell types other than those of the tissue from which they originate.

Astrocyte—a type of supporting (glial) cell found in the nervous system.

Blastocoel—The fluid-filled cavity inside the blastocyst of the developing embryo.

Blastocyst—A preimplantation embryo of about 150 cells produced by cell division following fertilization. The blastocyst is a sphere made up of an outer layer of cells (the trophoblast), a fluid-filled cavity (the blastocoel), and a cluster of cells on the interior (the inner cell mass).

Bone marrow stromal cells—A mixed population of stem cells found in bone marrow that does not give rise to blood cells but instead generates bone, cartilage, fat, and fibrous connective tissue.

Cell division—Method by which a single cell divides to create two cells. There are two main types of cell division: mitosis and meiosis.

Cell-based therapies—Treatment in which stem cells are induced to differentiate into the specific cell type required to repair damaged or destroyed cells or tissues.

Cell culture—Growth of cells in vitro in an artificial medium for experimental research.

Clone—Generate identical copies of a molecule, cell, or organism. When it is used to refer to cells grown in a tissue culture dish, a clone is a line of cells that is genetically identical to the originating cell. This cloned line is produced by cell division (mitosis) of the originating cell. The term clone may also be used to refer to an animal produced by somatic cell nuclear transfer (SCNT).

Cloning—See Somatic cell nuclear transfer (SCNT).

Cord blood stem cells—See Umbilical cord blood stem cells.

Culture medium—The liquid that covers cells in a culture dish and contains nutrients to feed the cells. Medium may also include other growth factors added to produce desired changes in the cells.

Differentiation—The process whereby an undifferentiated embryonic cell acquires the features of a specialized cell such as a heart, liver, or muscle cell.

Directed differentiation—Manipulating stem cell culture conditions to induce differentiation into a particular cell type.

DNA—Deoxyribonucleic acid, a chemical found primarily in the nucleus of cells. DNA carries the instructions or blueprint for making all the structures and materials the body needs to function.

Ectoderm—Outermost germ layer of cells derived from the inner cell mass of the blastocyst; gives rise to the nervous system, sensory organs, skin, and related structures.

Embryo—In humans, the developing organism from the time of fertilization until the end of the eighth week of gestation, when it is called a fetus.

Embryoid bodies—Rounded collections of cells that arise when embryonic stem cells are cultured in suspension. Embryoid bodies contain cell types derived from all 3 germ layers.

Embryonic germ cells—Pluripotent stem cells that are derived from early germ cells (those that would become sperm and eggs). Embryonic germ cells (EG cells) are thought to have properties similar to embryonic stem cells.

Embryonic stem cells—Primitive (undifferentiated) cells derived from a 5-day preimplantation embryo that have the potential to become a wide variety of specialized cell types.

Embryonic stem cell line—Embryonic stem cells, which have been cultured under in vitro conditions that allow proliferation without differentiation for months to years.

Endoderm—Innermost layer of the cells derived from the inner cell mass of the blastocyst; it gives rise to lungs, other respiratory structures, and digestive organs, or generally "the gut".

Enucleated— A cell with its nucleus removed.

Feeder layer—Cells used in co-culture to maintain pluripotent stem cells. For human embryonic stem cell culture, typical feeder layers include mouse embryonic fibroblasts (MEFs) or human embryonic fibroblasts that have been treated to prevent them from dividing.

Fertilization—The joining of the male gamete (sperm) and the female gamete (egg).

Fetus—A developing human from approximately eight weeks after conception until the time of its birth.

Gamete—An egg (in the female) or sperm (in the male) cell. See also Somatic cell.

Gene—A functional unit of heredity that is a segment of DNA found on chromosomes in the nucleus of a cell. Genes direct the formation of an enzyme or other protein.

Germ layers—Fertilization of an egg stimulates cell division, and the resulting cells are organized into three different layers, called germ layers. The three layers are the ectoderm, the mesoderm, and the endoderm.

Hematopoietic stem cell—A stem cell that gives rise to all red and white blood cells and platelets.

Human embryonic stem cell (hESC)—A type of pluripotent stem cell derived from the inner cell mass (ICM) of the blastocyst.

In vitro—Latin for "in glass"; in a laboratory dish or test tube; an artificial environment.

***In vitro* fertilization**—A technique that unites the egg and sperm in a laboratory, instead of inside the female body.

Inner cell mass (ICM)—The cluster of cells inside the blastocyst. These cells give rise to the embryo and ultimately the fetus. The ICM cells are used to generate embryonic stem cells.

Long-term self-renewal—The ability of stem cells to renew themselves by dividing into the same non-specialized cell type over long periods (many months to years) depending on the specific type of stem cell.

Mesenchymal stem cells—Cells from the immature embryonic connective tissue. A number of cell types come from mesenchymal stem cells, including chondrocytes, which produce cartilage.

Meiosis—Cell division of a gamete to reduce the chromosomes within it to half the normal number. This is to ensure that fertilization restores the full number of chromosomes rather than causing aneuploidy, or an abnormal number of chromosomes.

Mesoderm—Middle layer of a group of cells derived from the inner cell mass of the blastocyst; it gives rise to bone, muscle, connective tissue, kidneys, and related structures.

Microenvironment—The molecules and compounds such as nutrients and growth factors in the fluid surrounding a cell in an organism or in the laboratory, which play an important role in determining the characteristics of the cell.

Mitosis—Cell division that allows a population of cells to increase its numbers or to maintain its numbers.

Multipotent—Ability of a single stem cell to develop into more than one cell type of the body. See also pluripotent and totipotent.

Neural stem cell—A stem cell found in adult neural tissue that can give rise to neurons and glial (supporting) cells. Examples of glial cells include astrocytes and oligodendrocytes.

Neurons—Nerve cells, the structural and functional unit of the nervous system. A neuron consists of a cell body and its processes—an axon and one or more dendrites. Neurons function by starting and conducting impulses. Neurons transmit impulses to other neurons or cells by releasing neurotransmitters at synapses.

Oligodendrocyte—A supporting cell that provides insulation to nerve cells by forming a myelin sheath (a fatty layer) around axons.

Passage—A round of cell growth and proliferation in cell culture.

Plasticity—The ability of stem cells from one adult tissue to generate the differentiated cell types of another tissue.

Pluripotent—Ability of a single stem cell to give rise to all of the various cell types that make up the body. Pluripotent cells cannot make so-called "extra-embryonic" tissues such as the amnion, chorion, and other components of the placenta.

Preimplantation—With regard to an embryo, preimplantation means that the embryo has not yet implanted in the wall of the uterus. Human embryonic stem cells are derived from preimplantation stage embryos fertilized outside a woman's body (*in vitro*).

Proliferation—Expansion of cells by the continuous division of single cells into two identical daughter cells.

Regenerative medicine—A treatment in which stem cells are induced to differentiate into the specific cell type required to repair damaged or destroyed cell populations or tissues. (See also cell-based therapies).

Reproductive cloning—The goal of reproductive cloning is to create an animal being identical to the animal that donated the somatic cell nucleus. The embryo is implanted in a uterus and develops into a live being. The first animal to be created by reproductive cloning was Dolly the sheep, born at the Roslin Institute in Scotland in 1996. See also Somatic cell nuclear transfer (SCNT).

Signals—Internal and external factors that control changes in cell structure and function.

Somatic cell—any body cell other than gametes (egg or sperm). See also Gamete.

Somatic cell nuclear transfer (SCNT)—A technique that combines an enucleated egg (nucleus removed) and the nucleus of a somatic cell to make an embryo. SCNT is the scientific term for cloning. SCNT can be used for therapeutic or reproductive purposes, but the initial stage that combines an enucleated egg and a somatic cell nucleus is the same. See also therapeutic cloning and reproductive cloning.

Somatic stem cells—Non-embryonic stem cells that are not derived from gametes (egg or sperm cells).

Stem cells—Cells with the ability to divide for indefinite periods in culture and to give rise to specialized cells.

Stromal cells—Non-blood cells derived from blood organs, such as bone marrow or fetal liver, which are capable of supporting growth of blood cells in vitro. Stromal cells that make the matrix within the bone marrow are also derived from mesenchymal stem cells.

Subculturing— Transferring cultured cells, with or without dilution, from one culture vessel to another.

Surface markers—Proteins on the outside surface of a cell that are unique to certain cell types, which are visualized using antibodies or other detection methods.

Teratoma— Scientists verify that they have established a human embryonic stem cell (hESC) line by injecting putative stem cells into mice with a dysfunctional immune system. Since the injected cells cannot be destroyed by the mouse's immune system, they survive and form a multi-layered benign tumor called a teratoma. Even though tumors are not usually a desirable outcome, in this test, the teratomas serve to establish the ability of a stem cell to give rise to all cell types in the body. This is because the teratomas contain cells derived from each of the three embryonic germ layers.

Therapeutic cloning—The goal of therapeutic cloning is to create cells that exactly match a patient. By combining a patient's somatic cell nucleus and an enucleated egg, a scientist may harvest embryonic stem cells from the resulting embryo that can be used to generate tissues that match a patient's body. This means the tissues created are unlikely to be rejected by the patient's immune system. See also Somatic cell nuclear transfer (SCNT).

Totipotent—A totipotent stem cell can give rise to all the cell types that make up the body plus all of the cell types that make up the extraembryonic tissues such as the placenta. (See also Pluripotent and Multipotent).

Transdifferentiation—The process by which stem cells from one tissue differentiate into cells of another tissue. See also Plasticity.

Trophectoderm—a term used to refer to trophoblast cells in mice.

Trophoblast—The extraembryonic tissue responsible for implantation, developing into the placenta, and controlling the exchange of oxygen and metabolites between mother and embryo.

Umbilical cord blood stem cells—stem cells collected from the umbilical cord at birth that can produce all of the blood cells in the body (hematopoietic). Cord blood is currently used to treat patients who have undergone chemotherapy to destroy their bone marrow due to cancer or other blood-related disorders.

Undifferentiated—A cell that has not yet generated structures or manufactured proteins characteristic of a specialized cell type.