
The rigorous definition of a stem cell requires that it possesses two properties: - Self-renewal which is the ability to go through numerous cycles of cell division while still maintaining its undifferentiated state - Multipotency or multidifferentiative potential which is the ability to generate progeny of several distinct cell types, (for example glial cells and neurons) as opposed to unipotency which is the term for cells that are restricted to producing a single-cell type. (However, some researchers do not consider multipotency to be essential, and believe that unipotent self-renewing stem cells can exist) &#65533; &#65533; <h4>Lineage</h4> To ensure self-renewal, stem cells undergo two types of cell division (see Stem cell division and differentiation diagram). Symmetric division gives rise to two identical daughter cells, both endowed with stem cell properties, whereas asymmetric division produces only one stem cell and a progenitor cell with limited self-renewal potential. Progenitors can go through several rounds of cell division before finally differentiating into a mature cell. It is believed that the molecular distinction between symmetric and asymmetric divisions lies in differential segregation of cell membrane proteins (such as receptors) between the daughter cells. <h4>Multi-drug resistance</h4> Adult stem cells express transporters of the ATP-binding cassette family that actively pump a diversity of organic molecules out of the cell.[1] Many pharmaceuticals are exported by these transporters conferring multidrug resistance onto the cell. This complicates the design of drugs, for instance neural stem cell targeted therapies for the treatment of clinical depression. <h4>Signaling pathways</h4> Adult stem cell research has been focused on uncovering the general molecular mechanisms that control their self-renewal and differentiation. <h4>Notch</h4> The Notch pathway has been known to developmental biologists for decades. Its role in control of stem cell proliferation has now been demonstrated for several cell types including haematopoietic, neural and mammary[2] stem cells. <h4>Wnt</h4> These developmental pathways are also strongly implicated as stem cell regulators.[3]