Breakthrough in stem cell culturing

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(PhysOrg.com) -- For the first time, human embryonic stem cells have been cultured under chemically controlled conditions without the use of animal substances, which is essential for future clinical uses. The method has been developed by researchers at Karolinska Institutet and is presented in the journal *Nature Biotechnology*.

Embryonic stem cells can be turned into any other type of cell in the body and have potential uses in treatments where sick cells need to be replaced. One problem, however, is that it is difficult to culture and develop human embryonic stem cells without simultaneously contaminating them. They are currently cultured with the help of proteins from animals, which rules out subsequent use in the treatment of humans. Alternatively the stem cells can be cultured on other human cells, known as feeder cells, but these release thousands of uncontrolled proteins and therefore lead to unreliable research results.

A research team at Karolinska Institutet (Sweden) has now managed to produce human stem cells entirely without the use of other cells or substances from animals. Instead they are cultured on a matrix of a single human protein: laminin-511.

"Now, for the first time, we can produce large quantities of human embryonic stem cells in an environment that is completely chemically defined," says professor Karl Tryggvason, who led the study. "This opens up new opportunities for developing different types of cell which can then be tested for the treatment of disease."

Together with researchers at the Harvard Stem Cell Institute, the researchers have also shown that in the same way they can culture what are known as reprogrammed stem cells, which have been converted back from tissue cells to stem cells.

Laminin-511 is part of our connective tissue and acts in the body as a matrix to which cells can attach. In the newly formed embryo, the protein is also needed to keep stem cells as stem cells. Once the embryo begins to develop different types of tissue, other types of laminin are needed.

Until now, different types of laminin have not been available to researchers, because they are almost impossible to extract from tissues and difficult to produce. Over the last couple of decades, Karl Tryggvason's research group has cloned the genes for most human laminins, studied their biological role, described two genetic laminin diseases and, in recent years, even managed to produce several types of laminin using gene technology. In this latest experiment, the researchers produced the laminin-511 using recombinant techniques.

More information: Long-term self-renewal of human pluripotent stem cells on human recombinant laminin-511, *Nature Biotechnology*, online 30 May 2010, doi:10.1038/nbt.1620

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