Tissue engineering

The report will inform you about tissue engineering with embryonic stem cells and an example of its uses. In detail the report will tell you how tissue engineering techniques can be used with embryonic stem cells and how they can repair articular cartilage. Ethical issues will be discussed in the report. Future developments and relevant data will be shown for each aspect. What is tissue engineering? Tissue engineering is where the employment of natural biology allows great success in developing therapeutic strategies aimed at the replacement, repair, maintenance, and the enhancement of tissue function.

How can tissue engineering be used? Tissue engineering can be used for the replacement in different tissue parts of the body. Stem cells can be used with the tissue engineering techniques for in the body. It is especially good to use embryonic stem cells, as they have not yet been assigned a specific role in the body. How it tissue engineering carried out? For tissue engineering to be carried out you need to understand the cell cycle. This is explained below. The cell cycle is a necessary part of tissue engineering as it makes duplicate copies of cells that will later be used for different tissue parts of the body.

The cell cycleThe cell cycle consists of two parts, interphase and mitosis. The first part of interphase is the G1 phase also known as the first gap phase. Here the cell grows; new organelles and proteins are made. In the S phase, also known as the synthesis phase, the cell replicates DNA and prepares the cell so that it is ready to be divided in mitosis. The G2 phase, also known as the second gap phase, continues cell growth.

The proteins needed for cell division are made. After this, only is the cell ready for mitosis. Mitosis consists of five phases; they are prophase, metaphase, anaphase, telophase and cytokinesis. Within prophase, the chromosomes become visible and they condense, the centrioles move to opposite ends and form spindle fibres.

The nuclear membrane breaks down and the chromosomes are now free in the cytoplasm. In metaphase, the chromosomes lie up along the equator and are attached to the spindle fibres by the centromere. Anaphase consists of the centromeres dividing at the chromatids. The spindle fibres contract and pull the chromatids to opposite poles.

This is done pulling the centromere first. Telophase is where the chromatids uncoil. The nuclear membrane forms around each group of chromosomes. The last part of mitosis is called cytokinesis, here the cytoplasm divides making two new daughter cells. How Embryonic Stem Cells are developed and usedEarly EmbryoAfter the sperm has fused with the egg, fertilisation starts.

Fertilisation is then followed by a rapid set of cell divisions. The first few divisions, divides the cell without growing in size. After the cell cycle has undergone three whole cell cycles, it consists of eight similar cells. Each of these cells can expand into a complete, healthy human. A hollow ball of cells forms about five days after conception known as blastocyst. The outer blastocyst cell layer goes on to form the placenta.

The inner cell goes on to form the tissue of the early embryo. Each cell, made in the inner blastocyst, is known as pluripotent embryonic stem cell.

These cells can become like most cell types, though they cannot give rise to all 216 diverse cell types that make up an adult human body. As the embryo develops, it has the potential of becoming a specialised function for the body and there becomes differentiated. Most of these cells could lose the ability to develop into a wide range of cells but do not.

The use of stem cells in medicineStem cells can one day create human donor cells that may provide new cells, tissues or organs for treatment and repair by transplantation. The probability of embryonic stem cells is quite high as it can develop into any cell type that offers the greatest flexibility for development. It is very unlike older adult’s cells that can only commit to doing one thing for the body. In a laboratory, it would be accepted to grow embryos to form blastocysts.

At this point, the embryo can be refined for a further certain amount of time to see if stem cells can be formed. The stem cell is then kept in remote place away from each and the rest of the embryo (which would later be thrown away). Hopefully the stem cells would be cultured and develop into tissues that can be used for transplantation. Problems with using stem cells in medicineEven though scientists may be able to get the stem cells into the body and into the right tissue, it may be rejected by the immune system of the person the cells are needed for.

This is known as transplant rejection and there are many ways to get around it. One of the ways would be to use tissue typing. This type of practice has been used for decades when finding a suitable donor for blood transfusion. Ethical concerns about the use of stem cellsThere are no ethical objections

to using multipotent stem cells copied from adults and this is agreed by just about everyone.

The worry is that most scientists may think that the use of stem cells are likely to become less important, for research and initial new treatments than the pluripotent stem cells, which can only be taken from human embryos. Different people see the status of the human embryo in another way. As stated in the SNAB Biology book, the official UK government committee set up to report on human stem cell research, which stated;'A significant body of opinion holds that, as a moral principle, the use of any embryo for research purposes is unethical an unacceptable on the grounds that an embryo should be accorded full human status from the moment of its creation. At the other end of the spectrum, some argue that the embryo requires and deserves no particular moral attention whatsoever. Others accept the special status of an embryo as a potential human being, yet argue that the respect due to the embryo increases as it develops and that this respect, in the early stages in particular, may properly be weighed against the potential benefits arising from the proposed research.'