

Stem cell research has been very controversial. Many ethical objections have been raised. There are most objections to the use of embryonic stem cells, because current techniques usually involve the death of the embryo when the stem cells are taken. The main question is whether an early stage embryo is as much a human individual as a new-born baby, in which case killing the embryo is undoubtedly unethical.

When does a human life begin? There are different views on this. Some consider that when the sperm fertilizes the egg, a human life has begun. Others say that early stage embryos have not yet developed human characteristics and cannot suffer pain, so they should be thought of simply as groups of stem cells. Some suggest that a human life truly begins when there is a heartbeat, or bone tissue or brain activity. These stages take place after a few weeks of development. Another view is that it is only when the embryo has developed into a fetus that is capable of surviving outside the uterus.

Some scientists argue that if embryos are specially created by **in vitro fertilization (IVF)** in order to obtain stem cells, no human that would otherwise

have lived has been denied its chance of living. However, a counterargument is that it is unethical to create human lives solely for the purpose of obtaining stem cells. Also, IVF involves hormone treatment of women, with some associated risk, as well as an invasive surgical procedure for removal of eggs from the ovary. If women are paid for supplying eggs for IVF this could lead to the exploitation of vulnerable groups such as college students.

We must not forget ethical arguments in favour of the use of embryonic stem cells. They have the potential to allow methods of treatment for diseases and disabilities that are currently incurable, so they could greatly reduce the suffering of some individuals.



▲ Figure 22 Harvesting umbilical cord blood

1.2 Ultrastructure of cells

Understanding

- Prokaryotes have a simple cell structure without compartments.
- Eukaryotes have a compartmentalized cell structure.
- Prokaryotes divide by binary fission.
- Electron microscopes have a much higher resolution than light microscopes.



Nature of science

- Developments in scientific research follow improvements in apparatus: the invention of electron microscopes led to greater understanding of cell structure.



Applications

- The structure and function of organelles within exocrine gland cells of the pancreas.
- The structure and function of organelles within palisade mesophyll cells of the leaf.



Skills

- Drawing the ultrastructure of prokaryotic cells based on electron micrographs.
- Drawing the ultrastructure of eukaryotic cells based on electron micrographs.
- Interpretation of electron micrographs to identify organelles and deduce the function of specialized cells.