Characteristic: (Pro/Eukaryotes)
SIZE: P - average diameter 0.5-5um / E - 40um
GENETIC MATERIAL: P - DNA circular and free-floating / E - DNA linear and associated with protein, in the nucleus
CYTOPLASM: P - Contains few organelles / E - contains many organelles
CELL WALL: P - Peptidoglycan / E - No cell wall around animal cells
PROTEIN SYNTHESIS: P - Small free-floating ribosomes / E - Large ribosomes, may be attached to ER
ORGANELLES: P - No membrane-bound organelles / E - membrane-bound organelles
AEROBIC RESPIRATION: P - Mesosomes / E - Mitochondria

DYNAMIC CELLS:

- Cell wall not static & constant movement of molecules within it
- Membrane structures within the cell are continually created and lost

Intracellular - protein used inside cell
Extracellular - protein used outside cell

PROTEIN TRAFFICKING:

1. Transctription of DNA to mRNA
2. mRNA leaves the nucleus via a nuclear pore
3. Protein made on ribosome enter rough ER
4. Protein moves through the ER assuming 3D en route
5. Vesicles pinched off the rough ER contain the protein
6. Vesicles from rough ER fuse to form the flattened sacs of the Golgi apparatus
7. Proteins are modified within the Golgi apparatus
8. Vesicles pinched off the Golgi apparatus contain the modified protein
9. Vesicles fuse with the cell surface membrane releasing the protein

Embryos would be allowed to develop to blastocyst stage, then cultured to get stem cells, then required cell type
Problem - rejection by the person being given the transplant's immune system - use tissue typing

ETHICAL ISSUES
Use of multipotent adult stem cells widely accepted (bone marrow)
HFEA regulates research on human embryos

HOW DEVELOPMENT IS CONTROLLED
As cells divide after fertilisation, they become specialised for functions, working together as tissues in organs
NUCLEUS:
1943 experiment by Joachim Hammering using giant algal cells
Dolly the sheep
Not very successful - adult DNA can't be reprogrammed fast enough to switch on relevant genes

DAWID & SARGENT:
Exracted mRNA from differentiated and undifferentiated frog cells
Made cDNA for all mRNA from differentiated cells (reverse transcription)
Mixed cDNA and mRNA from undifferentiated cells -> double strand hybrids
Separated out - a range of cDNA not hybridised - two cells expressed some of same genes, some different

EPIGEMOME
Chemical markers on histones and DNA make up epigenome
METHYL GROUP:

- often attached to DNA - cytosine
- prevent transcription by stopping RNA polymerase binding
- can attach to histones and affect how tightly wound DNA is around
- tightly wound = inactive
- during replication, the epigenetic markers copied so same cell type is formed

GENE EXPRESSION:
Cells become specialised because only some genes switched on, and produce active mRNA which is translated
Genes in uncoiled accessible regions of eukaryote DNA can be transcribed
RNA Polymerase binds to a section adjacent to the gene to be transcribed
This section = promoter region
Attachment of regulator protein usually required to start transcription
Transcription can be prevented if protein repressor molecule attaches to promoter region
Repressor (stop) molecules may attach to regulator proteins to stop them attaching - gene switched off