Cryobiology and cryopreservation

- **Cryobiology** study of life at low temperatures
- Cryopreservation of cells, tissues, gametes, embryos
- Preservation of organs under hypothermic conditions for transplantation
- **Cryopreservation** technique by which viable cells, tissues, organs, even organisms can be sustained at a low temperature
 - Liquid nitrogen at -196°C
- Required that changes in genetic material is prevented, patterns of gene expression reliably reproduced in recovered material
- Cell suspensions and thin tissue sections can be stored almost indefinitely in liquid nitrogen
- Large organs are usually stored and transported for short times at cool but not freezing temperatures
- Cryopreserved human sperm, eggs and embryos routinely used in infertility treatments
- Cryopreservation of gametes and embryos of cattle, sheep, goats, pigs, birds, reptiles, amphibians, fish conservation
- Cryobanks cryopreservation of gametes and embryos of endangered animal species. Also plants and seed banking.
- Freezing injury solidification of ice destructive and content of the first of the solid sector of the solid sec
 - Ice formation occur (1) iquid solutions first
 - If cooled whickly, cell will freeze and will are intracellular ice formation
 - cell, change in osmolarity resulting in shrinking of cell viable upon thawing
 - \circ $\;$ Idea of reaching optimum cooling rate $\;$
- Chilling injury many cells and tissues damaged when cooled to temperatures close to or below 0°C without freezing – no crystal ice formation
 - Direct chilling injury 'cold shock', cellular viability dependant on cooling rate, more injury observed following rapid cooling, not affected by thawing rate
 - Indirect chilling injury relative to exposure time; usually evident in cells with a relatively long exposure period
 - More prominent in rapid developing organisms such as Zebra fish embryos and *Drosophila*
- Thawing injury to cells can be damaged during recrystallisation; can be lethal
- Rapid thawing improves survival; it has been shown that some cells with intracellular ice can survive if thawed very rapidly
- Cryoprotectants additives which can be provided to cells before freezing to increase post-thaw survival