Tissue engineering

* restore health tissue or organs for patients
* assemble functional constructs that restore, maintain or improve damaged tissue

Gene Therapy

* gene therapy is introduction of normal/healthy genes into cells in place of missing or defective ones in order rot correct genetic disorder od disease
* vector genetically engineered to deliver desired gene
* infect desired cell
* viruses used as vectors
* injected or intravenously given or particular cells removed, exposed to vector in lab and reintroduced
* vector packaged into vesicle and vesicles breaks down releasing vector into cell ie. retrovirus integrate their RNA into chromosome or adenoviruses integrate their DNA into nucleus of cell (not chromosome so not passed on)
* Gene therapy is using a vector to transport a healthy gene to replace a dead/mutated cell that is unable to produce its function properly
* vector (typically a virus) introduced desired gene into the body to transport into nucleus of desired cell
* introduced into body via injection or in the lab
* these target cells now contain the gene to perform such action

e.g. cystic fibrosis

* + genetic disorder
  + affect lung and digestive system
  + build up of mucous impairs breathing
  + CF results when an individual inherits the recessive allele for the condition from each parent
  + mutation is single gene result in disease
  + disease is slow to progress, enable gene therapy to begin before significant lung damage
  + modify common cold virus to act as vector to carry normal gene to CFTR cells in airways of lung

e.g. diabetes

* + reprogramming cells to produce insulin
  + gene for insulin introduced into vector
  + vector used to infect desired cells e.g. alpha cells of islets of langerhans
  + these cells incorporate new DNA into nucleus and are able to use protein synthesis to produce insulin

Cell Replacement Therapy

* Replacement of dysfunctional/dead cells with healthy functional new ones
* Need to use stem cells
  + Ability to differentiate into particular cell type
  + Use totipotent or pluripotent stem cell
  + Totipotent: complete potency to turn into any cell (from zygote)
  + Pluripotent: potency to turn into any cell in the adult body, just not placenta or umbilical cord (from inner cell mass of the blastocyst)
  + Induced pluripotent stem cells
  + Correct the stem cells with gene therapy, reintroduce stem cells into body

e.g cystic fibrosis

* + harvesting adult stem cells from lungs of CF patient
  + correct them with gene therapy
  + reintroduce cells back into patient
  + new transplanted adult stem cells pass healthy gene to daughter cells
  + constant replenish airways with health cells

Synthetic hormones

* + diabetes (insulin)
    - gene for human insulin inserted into DNA of bacterium Escherichia coli. bacteria cultured and transgene allowed bacterial cells to produce protein of human insulin
    - this extracted and used to treat people
    - produced from recombinant DNA
  + hypothyroidism (thyroxine)
    - levothyroxine manufactured form of thyroxine
    - oral and injectable form
    - common prescribed drug for thyroid hormone replacement