Chemical Signals

- **Intercellular messengers**
  - Direct transfer from one cell to another
  - Animal cells
    - **Gap junctions**
    - Membranes of opposing cells are joined by cylindrical channels called **connexons**
    - Provide connection and allow diffusion of MW < 2000
    - Can transfer signals (IP3, AMP, Ca2+)
    - Also metabolic co-operation (sharing of metabolites)
    - Decrease in cytosolic pH or increase in Ca2+ reversibly decreases permeability (important to minimise cell-death damage)
  - Plants cells
    - **Plasmodesma**
    - Specialised junctions in plant cells
    - Tubular extension of plasma membrane through cell wall
    - Allows diffusion of molecules up to 1000 daltons
- **Cell-surface molecules**
  - In multicellular organisms, many surface molecules are present
  - Function in cell **adhesion**
    - Cell-cell
    - Cell-extracellular matrix
  - Some also have signaling function
    - Allows to communicate with each other or receive information from matrix
    - e.g.: between macrophages and T-cells
      - Macrophage uses **major histocompatibility compex** (MHC) to present antigen
      - T-cell receptor (TCR) binds it
      - Recognition results in T-cell proliferation
- **Neurotransmitters**
  - Released from nerve endings to activate other cells
  - Neurone
    - **Dendrites** - receive signal
    - **Cell body** - contains nucleus
    - **Axon** - long, thin fibre - transmits potential
    - **Axon terminals** - where neurotrasmitters are stored and released
  - See diagram
- **Pherormones and chemoattractants**
  - Frequently important in sexual reproduction
  - Insects
    - Female silkworm has a pair of scent glands --> synthesise bombykol
    - Volatile --> carried in air
  - Mammals
    - Odorants play important roles in all kinds of things
    - Debates if affected by pherormones
  - Slime mould
    - **Dictyostelium discoideum** exists in two forms
      - *Vegetative* - free living amoeba move over forrest floor, feed on bacteria and divide every few hours
      - When food is scarce, they being to agregate forming a *fruiting body* which develops to contain dormant spores. In suitable conditions, they germinate
    - Agregation dependent on **chemotaxis**
    - Founder cells secrete **cAMP** which attracts cells to centre
      - Induces **pseudopod** to form in that direction
    - Can be induced experimentally
- **Hormones**
  - Chemical signals release from one cell to influence activity of distant target cells
  - Plants
    - Spread by bulk movement of water and photosynthate
  - Animals
    - Dispersed by circulatory systems
    - Protein hormones (including GF) synthesised and secreted by ER-golgi pathway
    - Hydrophobic steroid hormones synthesised by enzymes on smooth ER and diffuse into circ
- **Local hormones**
  - Act only in the immediate vicinity
  - Diffusion either to other cells close-by (**paracrine**) or to themselves (**autocrine**)
  - Effect limited due to rapid inactivation
  - Examples
    - NO in smooth muscle contraction
    - Prostaglandins in blood clotting

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