READING NOTES: SIGNALLING

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Caveat Emptor

1. Signals and Responses

- Receptors can be extracellular or intracellurlar
    - Extracellualr receptors activate intracelluar cascades that affect protein activity or transcription
    - Intracelluar receptors initiate transcription
- Extracelluar ligands can act locally or through long distance pathways
- Many proteins don't move into the cell but they can initiate efficient signalling
- If a protein is hydrophillic it won't move into the cell without some additional help (e.g., a channel, a chaperone protein)
- Hydrophobic and some gases can permeate the cell membrane and thus don't necessarily require chaperones or channels
- Hydrophobic molecules work through intracelluar receptors to often direct nuclear transcription
- **Steriods** are large hydrophobic molecules which are developmental signals

1.1. Cell-cell communication.

- **Contact dependent** cells touch each other
- **Paracrine** acts through nearby cells (e.g., local mediators and signal cells interact with local targeted cells)
- **Synaptic** often in neurons which acts more locally
- **Endocrine** most common in mamalian cells where a endocrine cell enters blood stream, interacts with a receptor, then triggers target cell.

1.2. Response Rates.

- **Gene expression** is generally slower (minutes to hours) due to the number of steps (transcription, translation, error checking)
- **Altered protein function** are fast. Typically phosphoration.

Molecules with rapid turnover can in concentration much more dramatically. Also describes inherit stability. Many RNAs and proteins are unstable so they have a typically smaller halflife. Smaller/ shorter half-lives have a more drastic impacts to signalling.

Extracellular ligands can act locally or long distance.

2. Aspects of receptor function

- Specificity
    - Signal molecules fits binding site on its complementary receptors while other signals do not fit
    - Protein structures define the specific binding and associated affinity
    - Influenced both the hormone and receptors
- Amplification
    - Amplification occurs when an enzyme activate enzymes and the number of affected molecules increases geometric in an enzyme cascade
    - Amplification can within signal transduction cascades

    - For example coupled protein receptors, activates a G-protein, activates 20x cyclic AMP, binds to enzymes
    - **Kinase** adds a phosphate
- Desensitization/ Adaption/ Feedback
    - Receptor activation triggers a feeeedback circuit that shuts off the receptor or removes it from the
- Integration
- Protein complex formation
- Concentration depdendent action

References

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