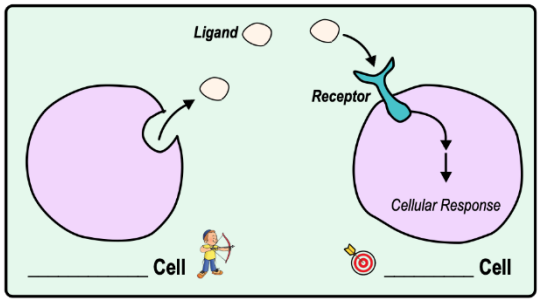
CONCEPT: INTRODUCTION TO BIOSIGNALING

●_____: the ability for all *cells* to produce, receive & respond to external signals/conditions.

□ Allows for the *response to stimuli* & effective cellular *communication*.



Types of Signaling Molecules:

Antigens
Growth Factors
Hormones
Light
Mechanical Touch
Neurotransmitters

Signal Transduction

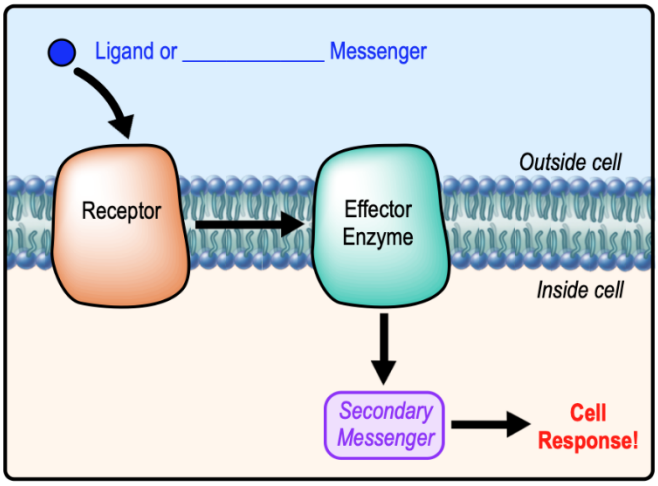
●*Signal* _____: cell process that _____ *signals/information* into a *chemical change/response*.

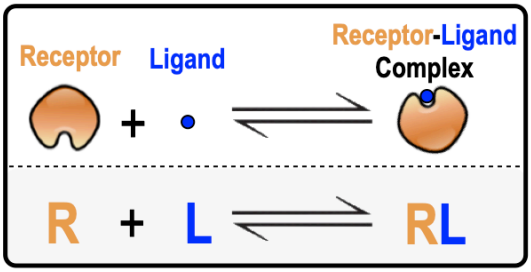
□ Requires a *minimum* of _____ key components:

1) a _____: a small molecule that specifically binds & forms a complex with a *biomolecule/receptor*.

2) a _____: typically, an integral membrane protein that changes *conformation* upon ligand binding.

●NOTE: *receptor-ligand* interactions are *protein-ligand* interactions, so be sure to check out those previous videos!





$$K_d = \frac{[R]\,[L]}{[RL]}$$

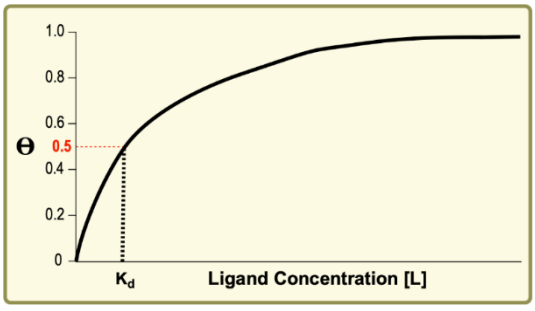
PRACTICE: A sample of cells has a total receptor concentration of 10 mM and a free ligand concentration of 15 mM. If 25% of the receptors are occupied with ligand under these conditions, calculate the receptor-ligand dissociation constant (K_d).

a) 7 mM.

b) 38 mM.

c) 12 mM.

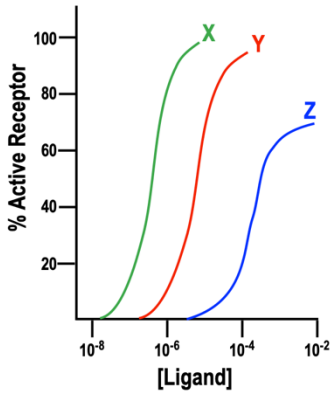
d) 45 mM.



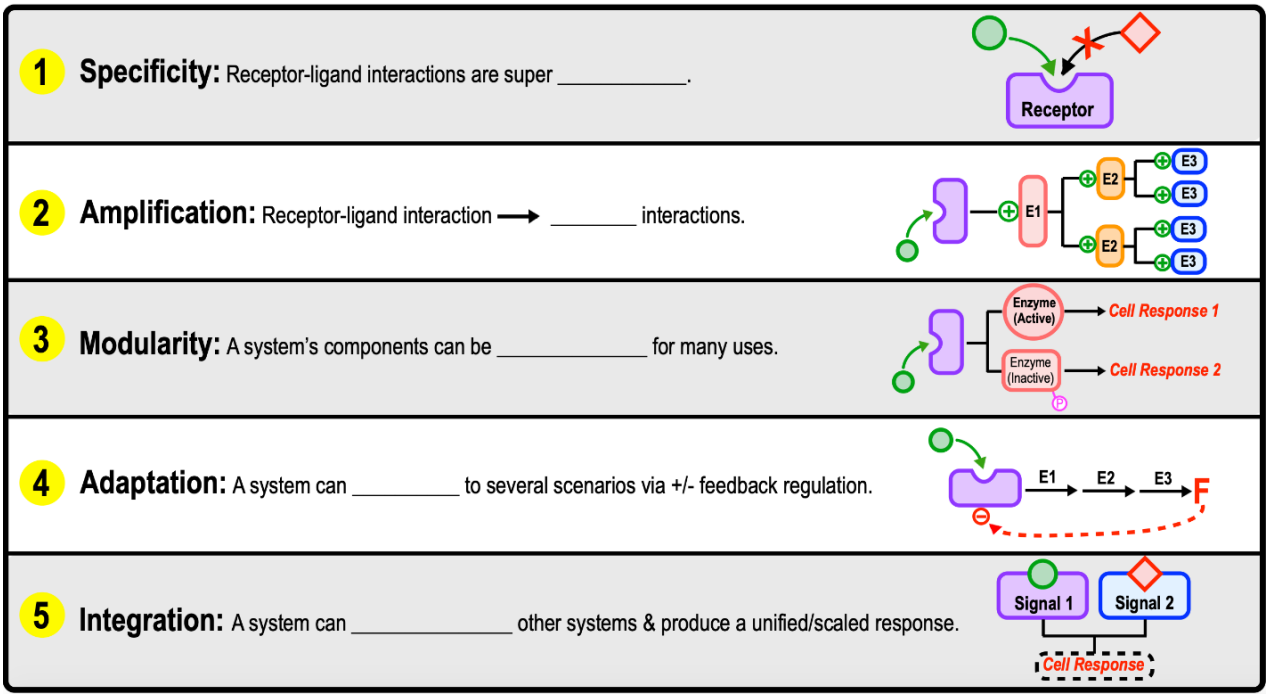
CONCEPT: INTRODUCTION TO BIOSIGNALING

PRACTICE: Which hormone from the plot below shows the highest binding affinity for the receptor?

a) Hormone X.
b) Hormone Y.
c) Hormone Z.



5 Features of Biosignaling Transduction Systems



PRACTICE: Which of the following statements regarding signal transduction pathways in cells is FALSE?

a) A ligand, such as a hormone, binds to a specific cell surface receptor on a target cell.
b) Signal transduction cascades, often involving protein kinases, amplify a signal intracellularly.
c) A receptor changes conformation upon ligand binding, transmitting a signal across the cell membrane.
d) Signal transduction cascades directly transmit a single stimulus to one, single target, identically in all cells.
e) Phosphatases remove phosphoryl groups from polypeptides, regulating a cell's response.

CONCEPT: INTRODUCTION TO BIOSIGNALING

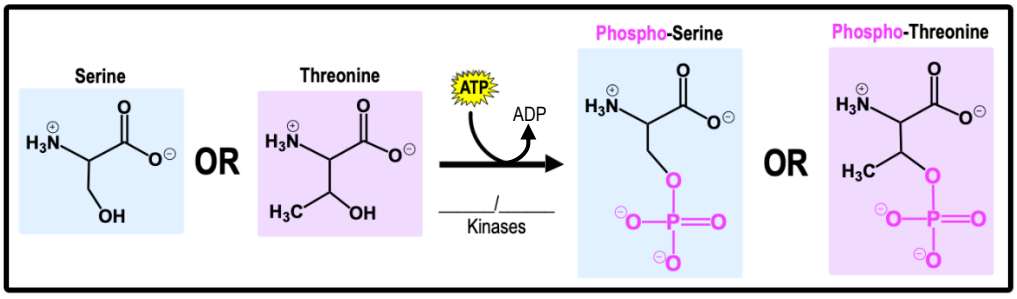
Types of Kinases

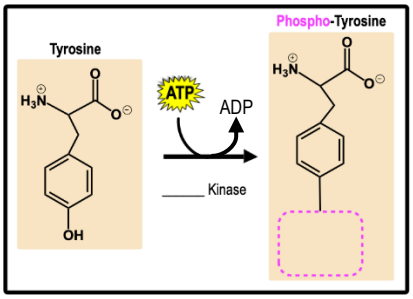
●Moving forward, we will see that _____ play a large role in biosignaling to create the cell response.

- □ Recall: *Kinases*: enzymes that _____ their substrates (utilizing ATP).
- □ Phosphorylation leads to _____ *activity* of the target (activation or inhibition).

●Two of the most common classes of kinases are _____/_____ *Kinases* & _____ *Kinases*.

- □ *Ser/Thr Kinases*: phosphorylate _____ & _____ residues on their targets (make up ~25% (¼) of all kinases).
- □ *Tyr Kinases*: phosphorylate _____ residues on their targets.





PRACTICE: Why is the activation of a protein kinase an important step in signal transduction?

a) Kinases bind to receptors and prevent binding of the ligand.
b) Kinases prevent signal amplification by degrading specific enzymes in the cell.
c) Kinases can activate or inactivate proteins by phosphorylation.
d) Kinases are secreted by a cell as a signaling molecule.

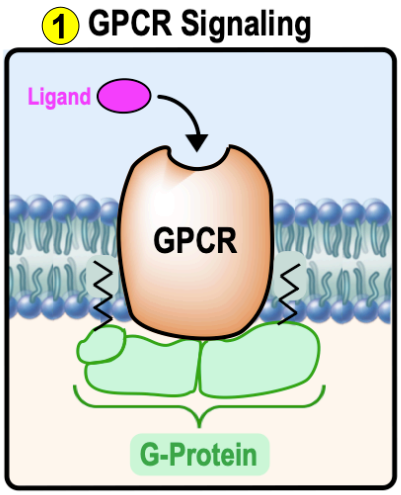
Types of Biosignaling Receptors

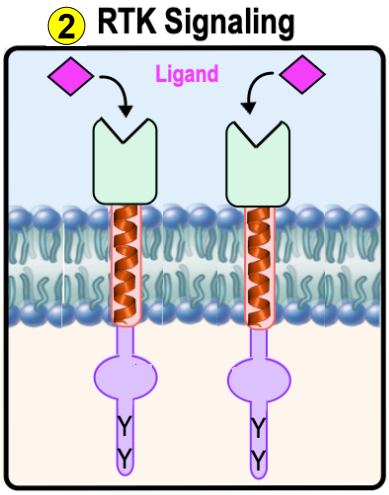
●_____ major types of integral membrane protein receptors involved in most signal transduction pathways:

1. **G P**rotein-**C**oupled **R**eceptors (_____).
2. **R**eceptor **T**yrosine **K**inases (_____).

●GPCRs & RTKs transduce extracellular signals via fundamentally _____ mechanisms.

EXAMPLE: GPCRs vs. RTKs.





CONCEPT: INTRODUCTION TO BIOSIGNALING

Map of Lesson on Biosignaling Pathways