
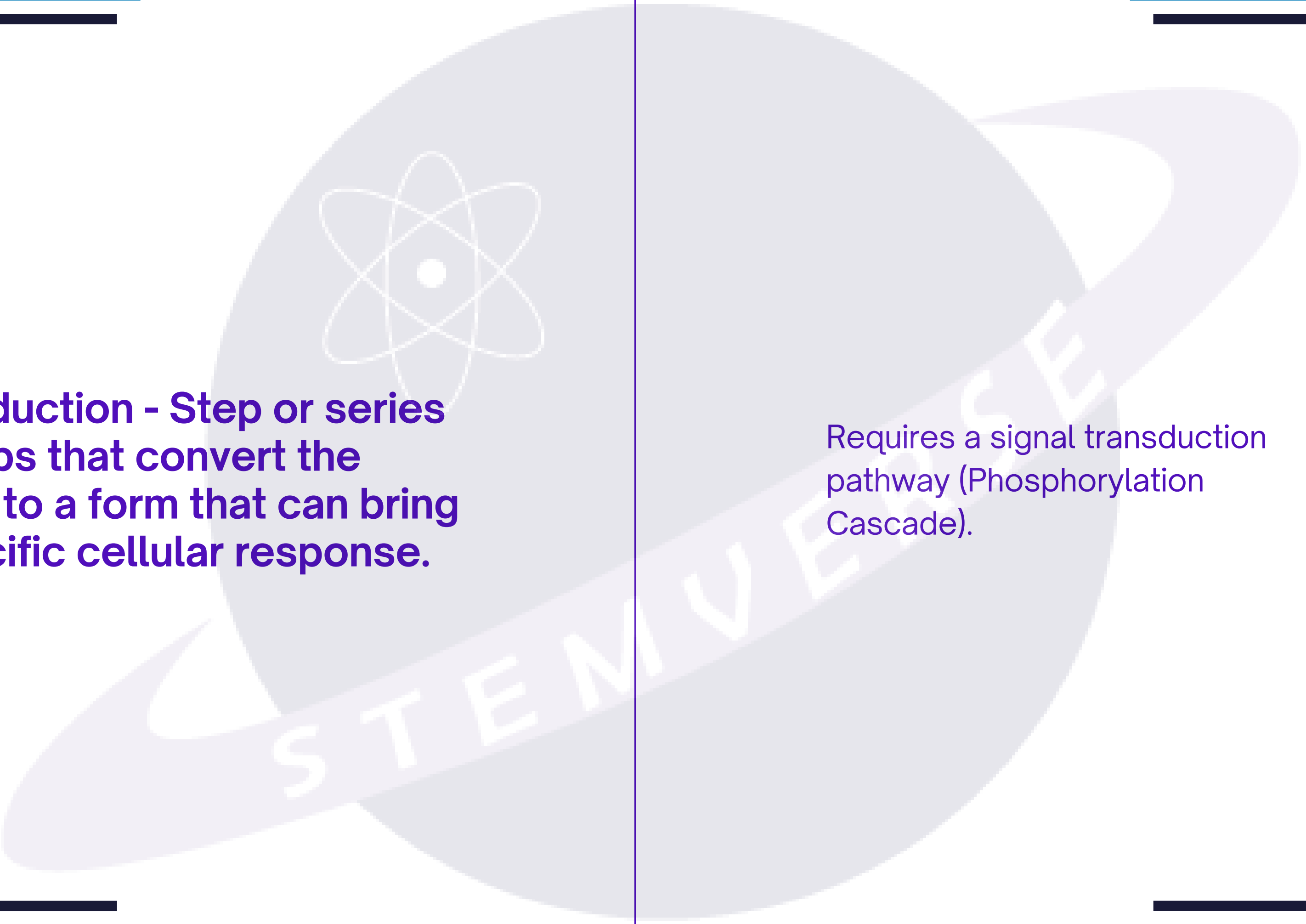

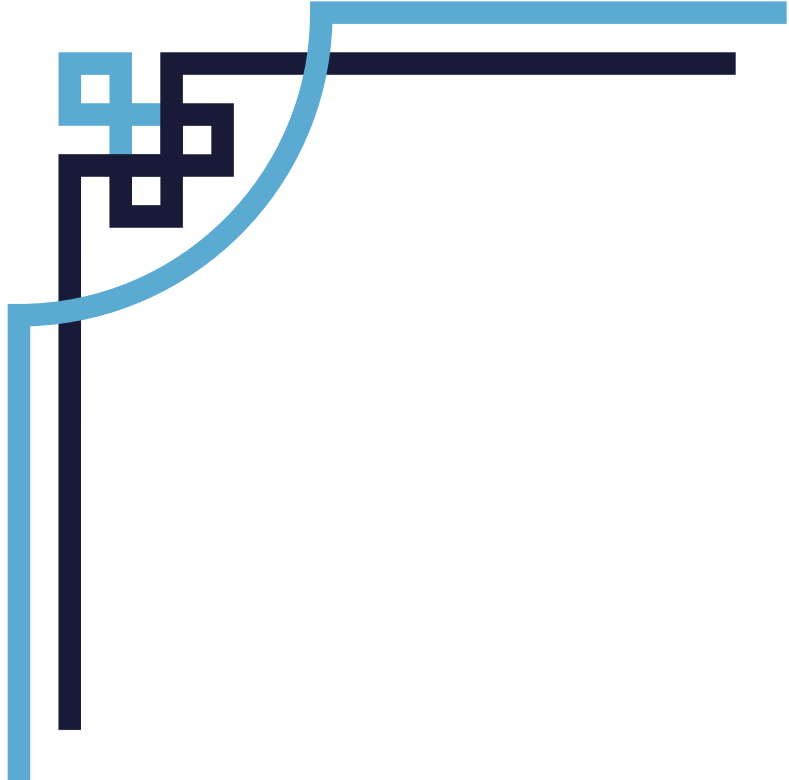




# 3 Stages of Cell Signaling




Reception - The target cell's detection of a signaling molecule coming from outside the cell.



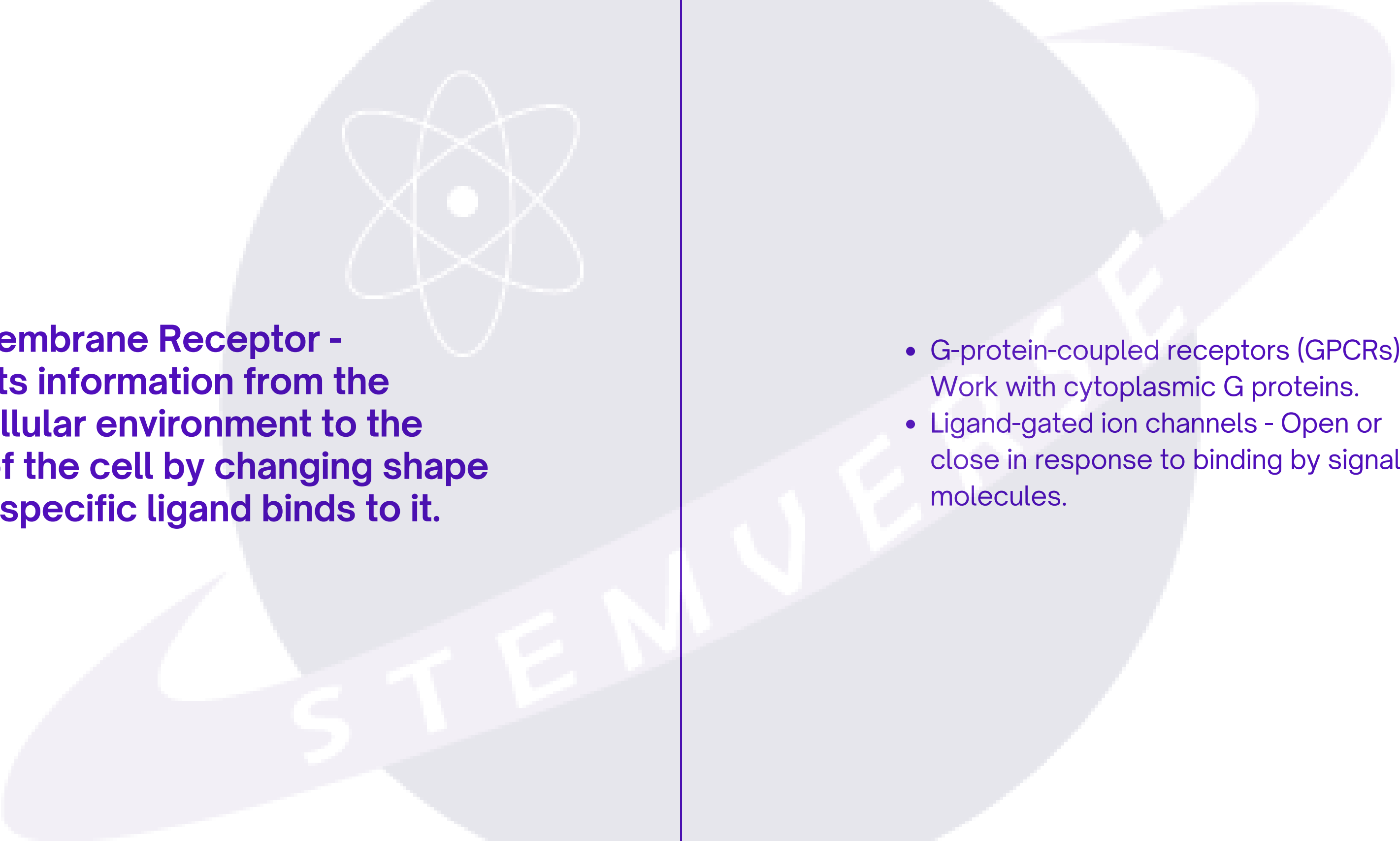

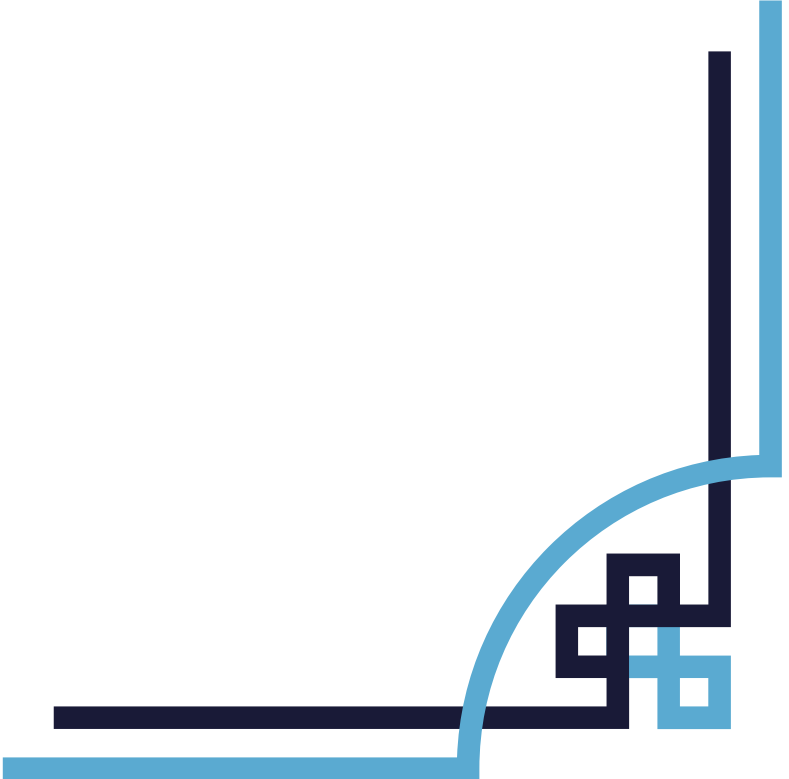


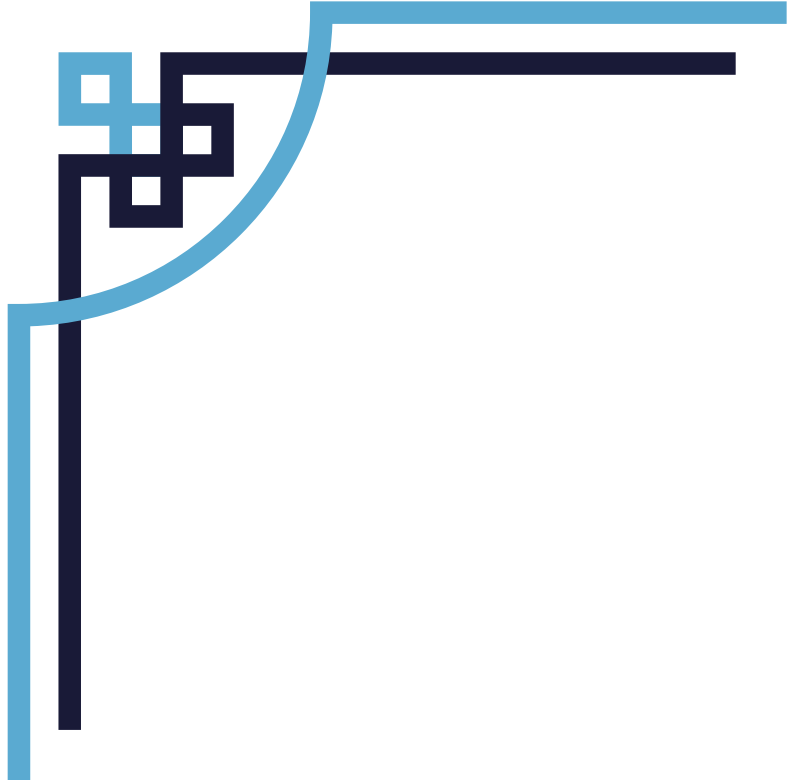
**Transduction - Step or series of steps that convert the signal to a form that can bring a specific cellular response.**

Requires a signal transduction pathway (Phosphorylation Cascade).



Response -  
Cellular response  
triggered by the  
transducer signal.

Ligand - A  
molecule that  
specifically binds  
to another  
molecule.

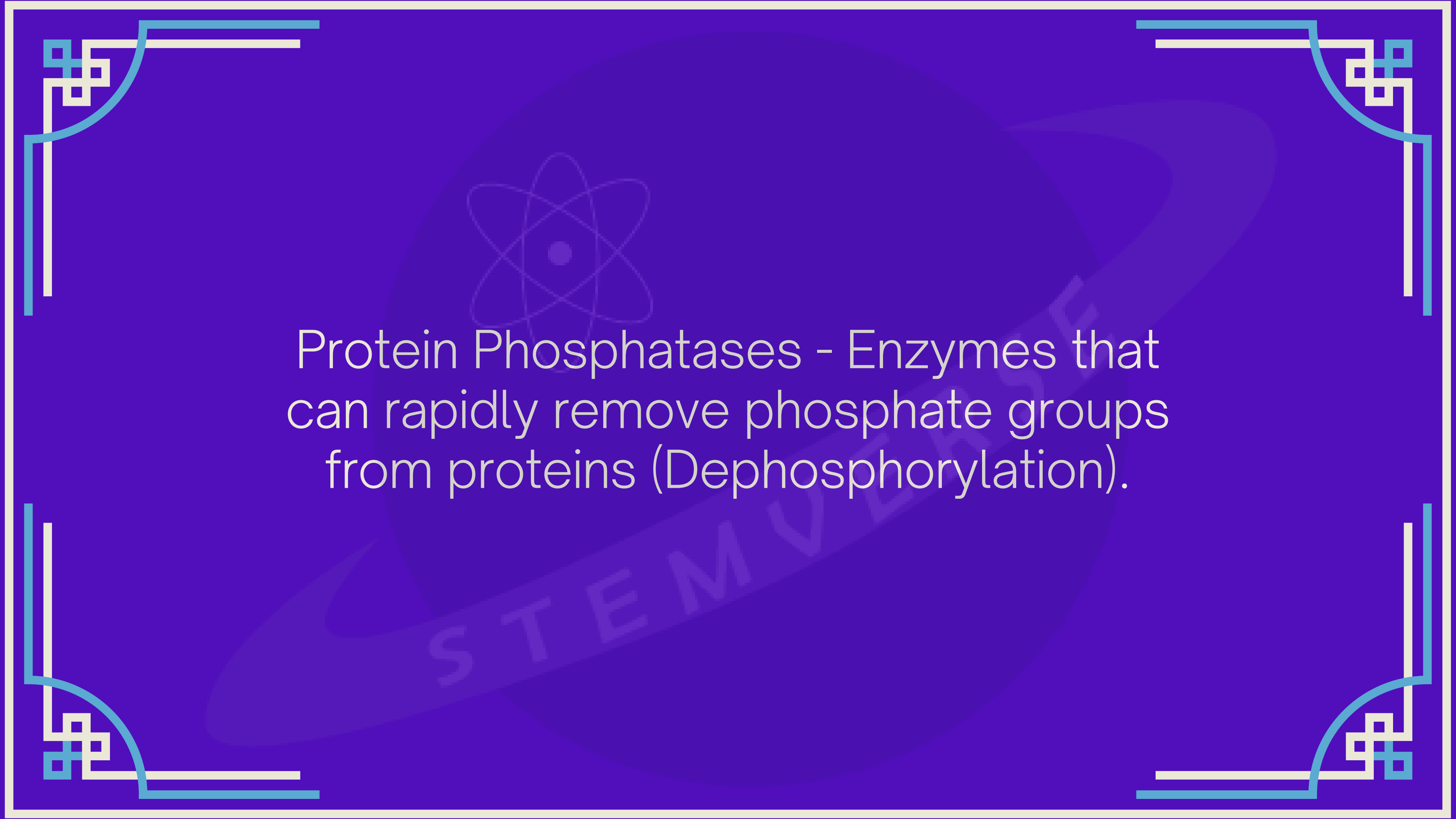


**Transmembrane Receptor -  
transmits information from the  
extracellular environment to the  
inside of the cell by changing shape  
when a specific ligand binds to it.**

- G-protein-coupled receptors (GPCRs) -  
Work with cytoplasmic G proteins.
- Ligand-gated ion channels - Open or  
close in response to binding by signaling  
molecules.



Protein Kinases - An enzyme that transfers phosphate groups from ATP to a protein (Adds phosphate to protein).



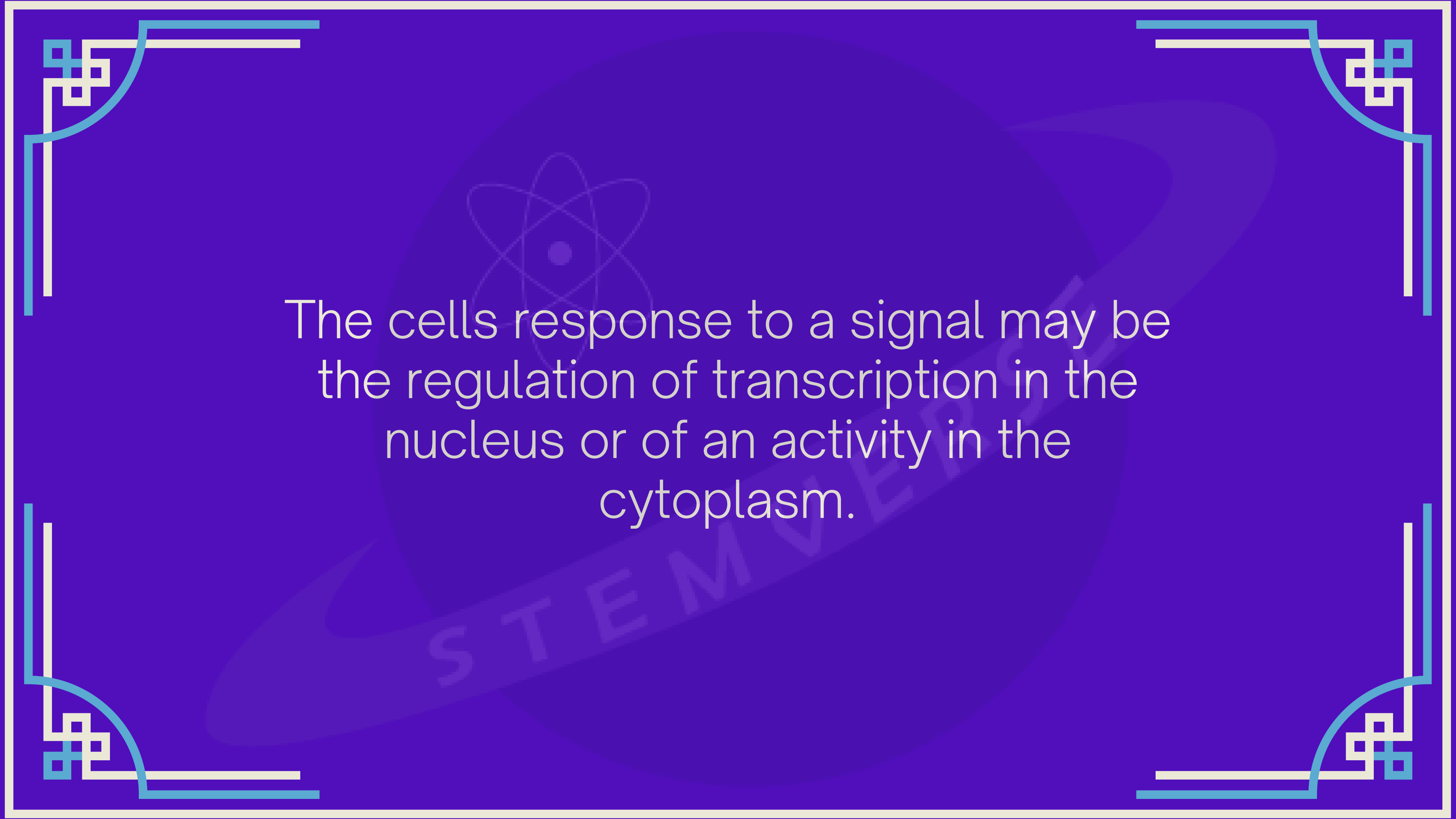
Protein Phosphatases - Enzymes that can rapidly remove phosphate groups from proteins (Dephosphorylation).





**Second Messengers -**  
**Small, nonprotein, water-**  
**soluble molecules or ions**  
**involved in signaling**  
**pathways.**

- Ex. Cyclic AMP (cAMP)
- Ex. Calcium ions ( $\text{Ca}^{2+}$ )



The cells response to a signal may be  
the regulation of transcription in the  
nucleus or of an activity in the  
cytoplasm.