SECOND MESSENGER MECHANISM

SECOND MESSENGER :- ARE SUBSTANCES THAT HELP COMMUNICATE SIGNALS FROM CELL SURFACE TO SPECIFIC TARGET SITES WITHIN CELL (CYTOPLASM/NUCLEUS)

EXAMPLES :- 1) cAMP 2) cGMP 3) IP_3 (INOSITOL TRIPHOSPHATE)
4) DAG (DIACYL GLYCEROL) 5) Ca^{++}

TYPES OF MESSENGER SYSTEMS :-

(i) ADENYLYL CYCLASE - cAMP SECOND MESSENGER SYSTEM.
(ii) CELL MEMBRANE PHOSPHOLIPID SECOND MESSENGER SYSTEM.
(iii) Ca^{++} - CALMODULIN SECOND MESSENGER SYSTEM.

① ADENYLYL CYCLASE - cAMP SECOND MESSENGER SYSTEM

➡ **HORMONES USING THIS SYSTEM :-**

- ACTH
- ANGIOTENSIN II (EPITHELIAL CELLS)
- CALCITONIN
- CATECHOLAMINES (β-RECEPTOR)
- FSH, LH
- HCG
- GLUCAGON
- PTH
- TSH
- SECRETIN
- SOMATOSTATIN
- VASOPRESSIN (V_2 RECEPTORS, EPITHELIAL CELLS)

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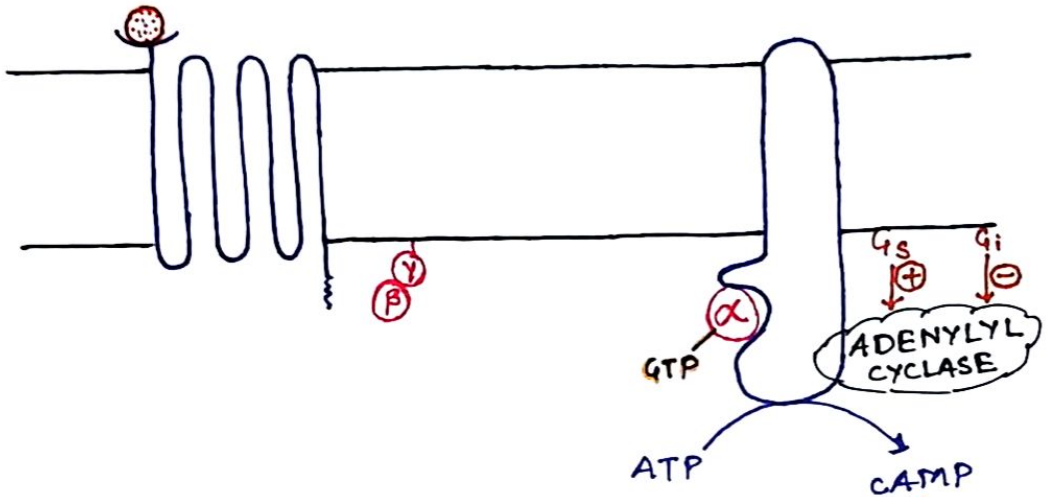
MECHANISM:-



INACTIVE CAMP DEPENDENT PROTEIN KINASE → ACTIVE CAMP DEPENDENT PROTEIN KINASE

PROTEIN + ATP → PROTEIN-PO4 + ADP

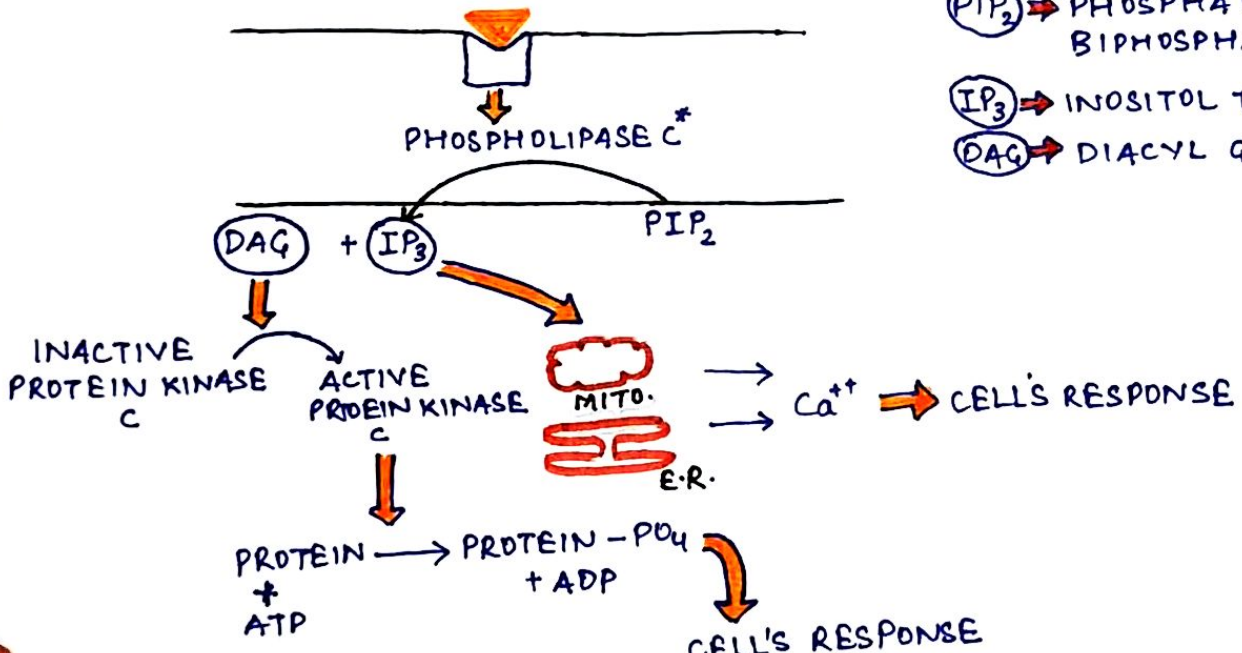
CELL'S RESPONSE

② CELL MEMBRANE PHOSPHOLIPID – SECOND MESSENGER SYSTEM

➡ HORMONES USING THIS SYSTEM :-

- ANGIOTENSIN II (VASCULAR SMOOTH MUSCLE)
- CATECHOLAMINES (α RECEPTOR)
- GnRH
- GHRH
- OXYTOCIN
- TRH
- VASOPRESSIN (V1 RECPTOR, VASCULAR SMOOTH MUSCLE)

➡ MECHANISM :-

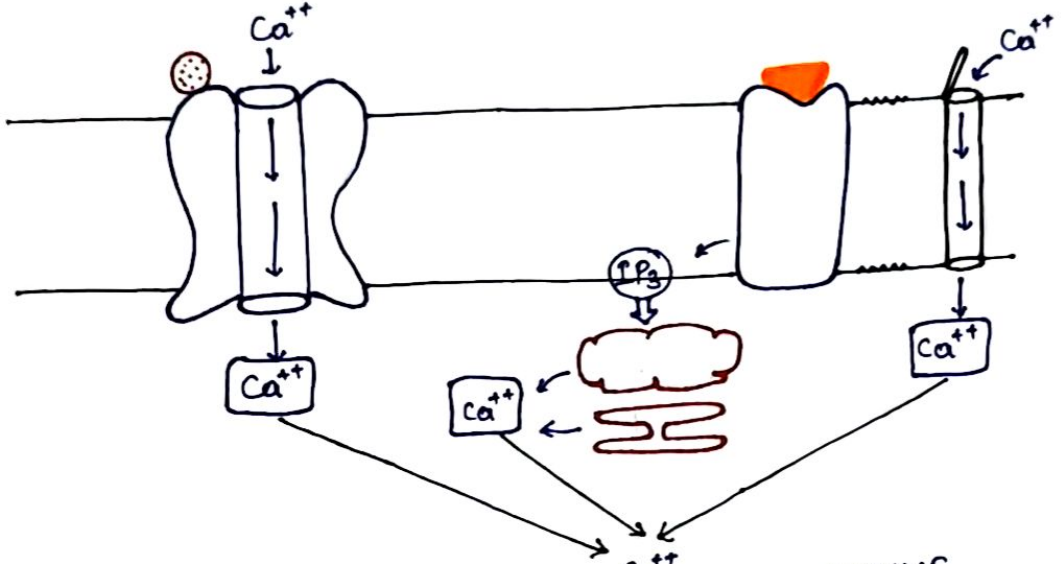


PIP2 ➡ PHOSPHATIDYL INOSITOL BIPHOSPHATE

IP3 ➡ INOSITOL TRIPHOSPHATE

DAG ➡ DIACYL GLYCEROL

③ Ca - CALMODULIN SECOND MESSENGER SYSTEM



Normal Ca^{++} in cell (10^{-8} TO 10^{-7} mα/L)

⇓

Not enough to activate Calmodulin System.

Ca^{++}

INACTIVE CALMODULIN → ACTIVE Ca^{++} CALMODULIN

INACTIVE CALMODULIN DEPENDENT PROTEIN KINASE → ACTIVE CALMODULIN DEPENDENT PROTEIN KINASE

PROTEIN + ATP → PROTEIN-PO_4 + ADP

SMOOTH MUSCLE (CONTRACTN) ← CELLULAR RESPONSE.

Ca^{++} raises in cell to 10^{-6} to 10^{-7} M

⇓

Causes almost all intracellular actions of calmodulin.