

# PHYSIOLOGY



Lec: 23

Done by: Wafae Alharabshen

# General Physiology

## Second semester 2024

### Lecture 23

## Autonomic Nervous System II

Zuheir A Hasan

Department of anatomy , physiology and biochemistry

College of Medicine

Notes :

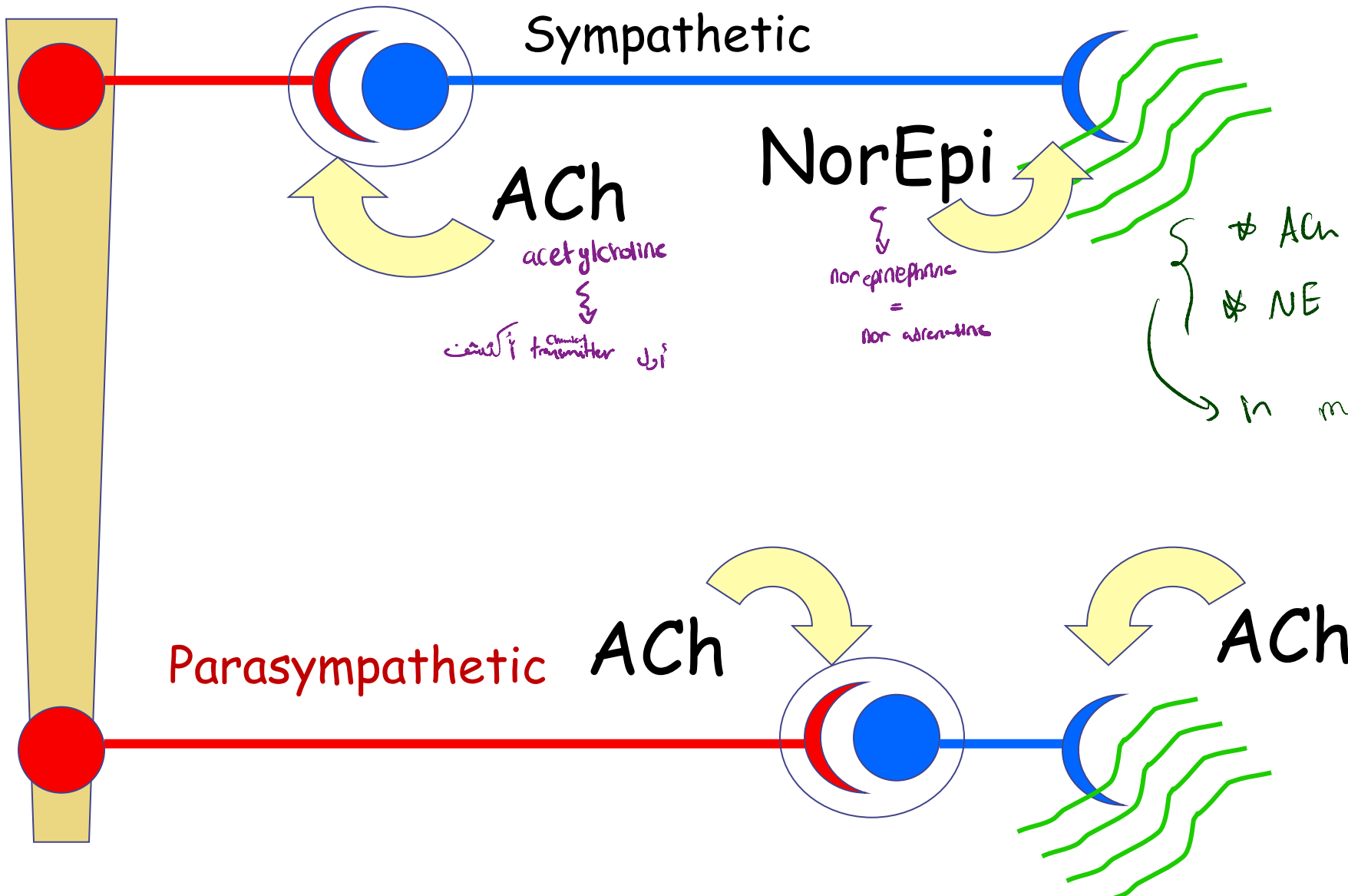
HU

- \* Formation site for neuropeptide transmitters  $\Rightarrow$  soma
  - \* Formation site for ACh & NorEpi  $\rightarrow$  knobs [axon dist]  $\downarrow$  why??
  - \* All are stored as vesicles in knobs & released by: Action potential  $\Rightarrow$  open  $\text{Ca}^{2+}$  gated channels, neurotransmitter released by exocytosis
- Since the formation of proteins occurs on ribosomes that are located in the cell body [soma]

اطاعة الكيمياء الى النقل الى Signal

المكان الى جسم فيه Chemical Transmitter في العنبر

# Transmitters and Receptors of ANS

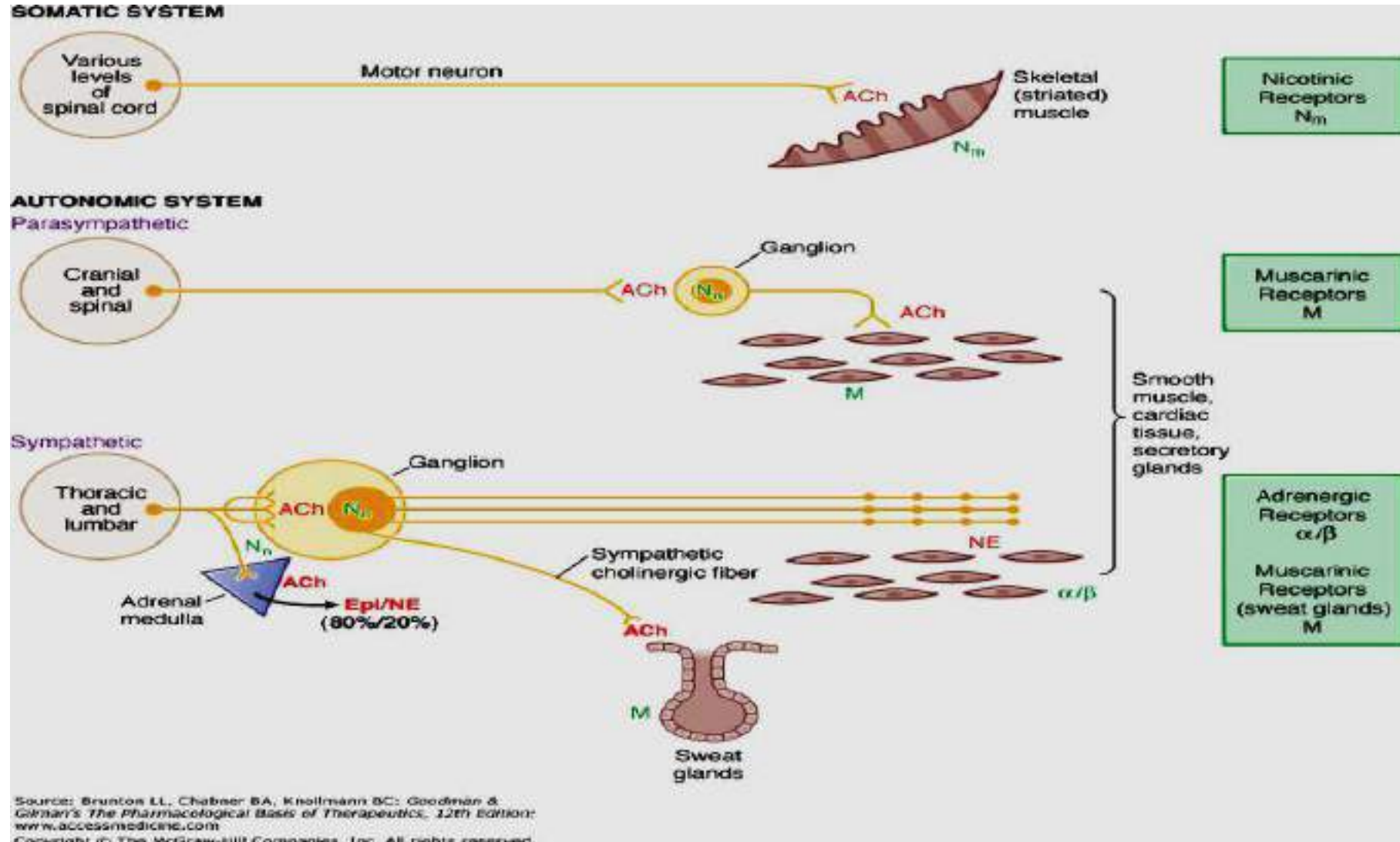


All pre-ganglionic neurons are cholinergic in both PSNS + SNS

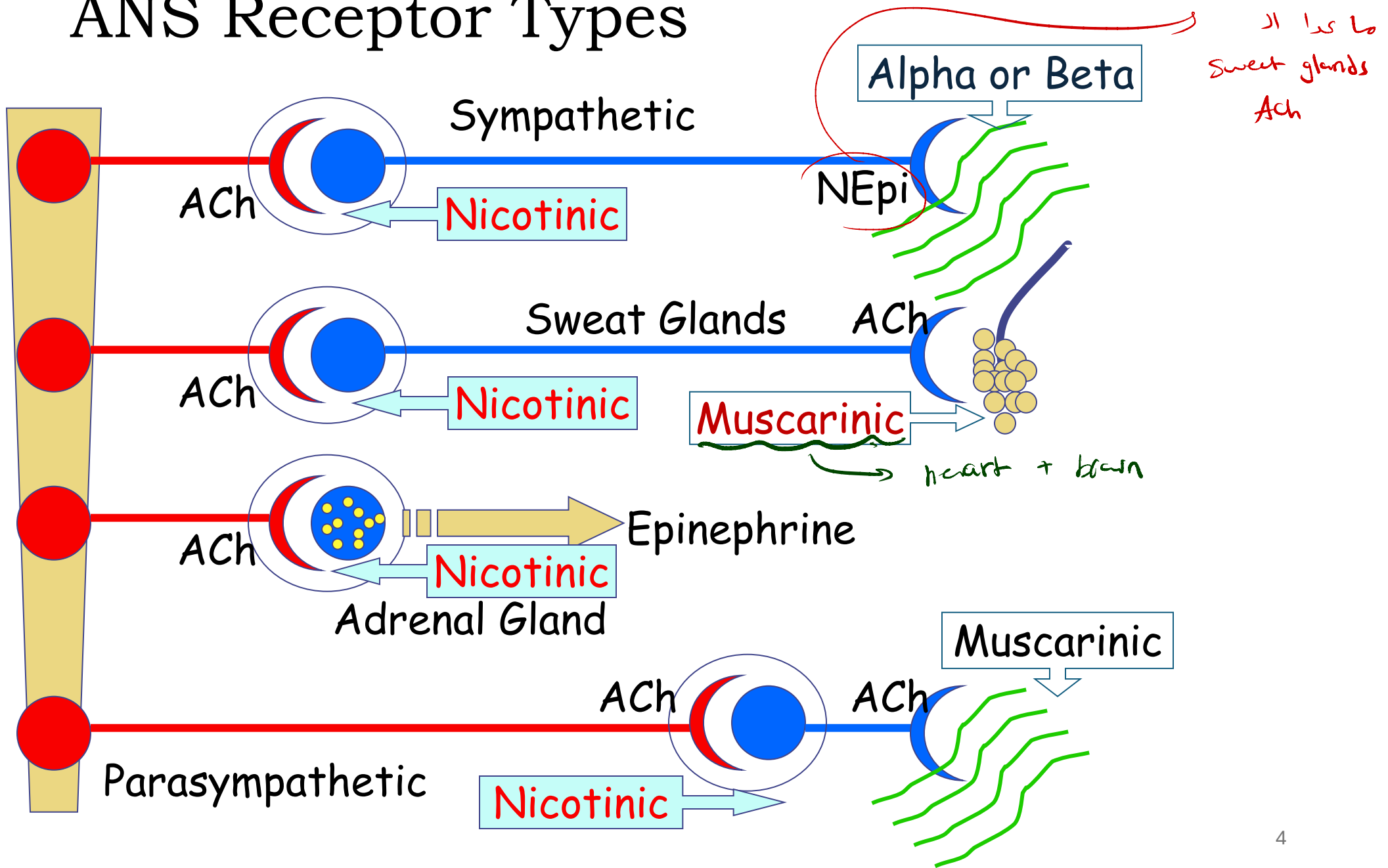
ACh → PSNS NT  
NE → SNS NT  
in most cases

# Somatic and autonomic systems

## Transmitters and Receptors of ANS



# ANS Receptor Types



\* وبت ما عنا neurotransmitter بده يكون عندي  
receptor عنان يقدر لكان ال neurotransmitter يعطيه مغلول .

# Neurotransmitters and receptors

\* The effect of neurotransmitters depends on   
 ① type of neurotransmitter  
 ② type of receptor.

- Neurotransmitter-receptor binding causes changes in post synaptic cell membrane depending on whether it is inotropic or metabotropic
- Autonomic transmitter substance can cause inhibition in some organs or excitation in others.

ارتباط ال neurotransmitter بال receptor يجعل تغيرات على ال membrane للخلية بشرط ما كان نوع للخلية .

ليكون افترسنا انه نفس ال NT

[ This effect is determined by the nature of the receptor protein in the cell membrane.

**Inotropic receptors :** ⇒ عبارة عن ligand gated channels

إني بحدود كم ال عاملين  
إني فوق ال receptor type  
ex : ACh can excite or inhibit depending on receptors bound on cells.

لوال NT يرتبط مع receptors و فتشاه قناة

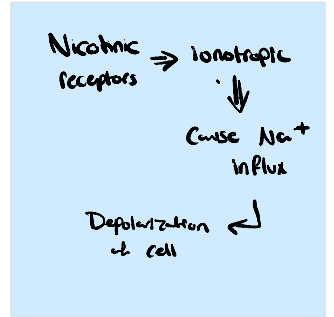
▪ A change in cell membrane permeability to one or more ions. A change in cell membrane permeability results in either opening or closing of an ion channel

▪ Opening of Na<sup>+</sup> and/or Ca<sup>2+</sup> ion channels → rapid influx of the respective ions into the cell → depolarizing the cell membrane and exciting the effector cell. → might reach threshold

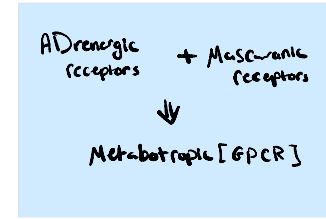
Depolarization

▪ Opening of potassium channels → K<sup>+</sup> efflux → inhibition of the effector cell because of the hyper-negativity inside the effector cell.

hyper-polarization داخل الخلية يصبح سالبة جدا



# Metabotropic receptors



① كما يرتبط neurotransmitter بال receptor ذاك  
 انما يرتبط بال G protein لانه يوجد  
 في انه ان protein ينشغل عن ال receptor  
 α و β تتفك لتمام و يرتبط مع ال GDP حسب نوع  
 ال G protein

## • Metabotropic receptors

⇒ G protein coupled receptors

- Neurotransmitter usually binds with a receptor protein linked to **G protein** located inside the cell. **Activation or inactivation** of an enzyme attached to the intracellular side of the receptor protein.

➤ For example: Binding of NE with its receptor on the outside of many cells acts through the **second messenger mechanism** by increasing the activity of the enzyme adenylyl cyclase on the inside of the cell, which causes formation of **cAMP**.

لكون بكتيلنا انه ال receptors ذاك يرتبطوا مع ال NE لانه  
 metabotropic [adrenergic receptors are metabotropic] فلما يرتبط ال NE مع ال G protein برود

فاز ال α Subunit ذاك يرتبط افورج اسمه Adenylyl Cyclase داخل الخلية  
 ← تحفيز لهذا الانزيم بيزيد تركيز ال cAMP

③ types of G protein coupled receptors:

- G<sub>s</sub> (Depends on tissue)
- G<sub>q</sub> (Stimulatory)
- G<sub>i</sub> (inhibitory)



# Acetylcholine Receptors (Cholinergic receptors)

possible pathology →

عصبية قبل العصبية بتقوم شرايين القلب و مايشيخ فربما يكون بيجلورا في العصبية ككثرة مكان بمرئها لربما بعد أو لاول

medicine: Atropine Blocker

- Two types
  - closes all parasympathetic ⊕ 2 Sympathetic that work similarly to par → sweat gland, Blood vessels of skeletal muscles
- **Muscarinic receptors** : The terminology comes from **muscarine**, a poison from toadstools
  - Muscarinic receptors are metatropic , which use G proteins couple receptors as their signaling mechanism, are found on all **target** effector cells that are stimulated by the postganglionic cholinergic neurons of either the parasympathetic nervous system or cholinergic fibers of the sympathetic system
- **Nicotinic receptor : stimulated by Nicotine**
  - Nicotinic receptors are ligand-gated ion channels = ionotropic
  - Located in **autonomic ganglia** at the synapses between the preganglionic and postganglionic
    - موجودين في Both: pre-ganglionic symp, على ال parasymp
  - These receptors are also found in myoneural junction (Synapse between somatic motor neurons and skeletal muscle fibers)
    - ← \* لدهون بنحاي