Al-Mustaqbal University College
Department of Pharmacy
4th stage
Practical Pharmacology II
Lab: 3

Effect of Parasympathomimetic Drugs on Glandular Secretions

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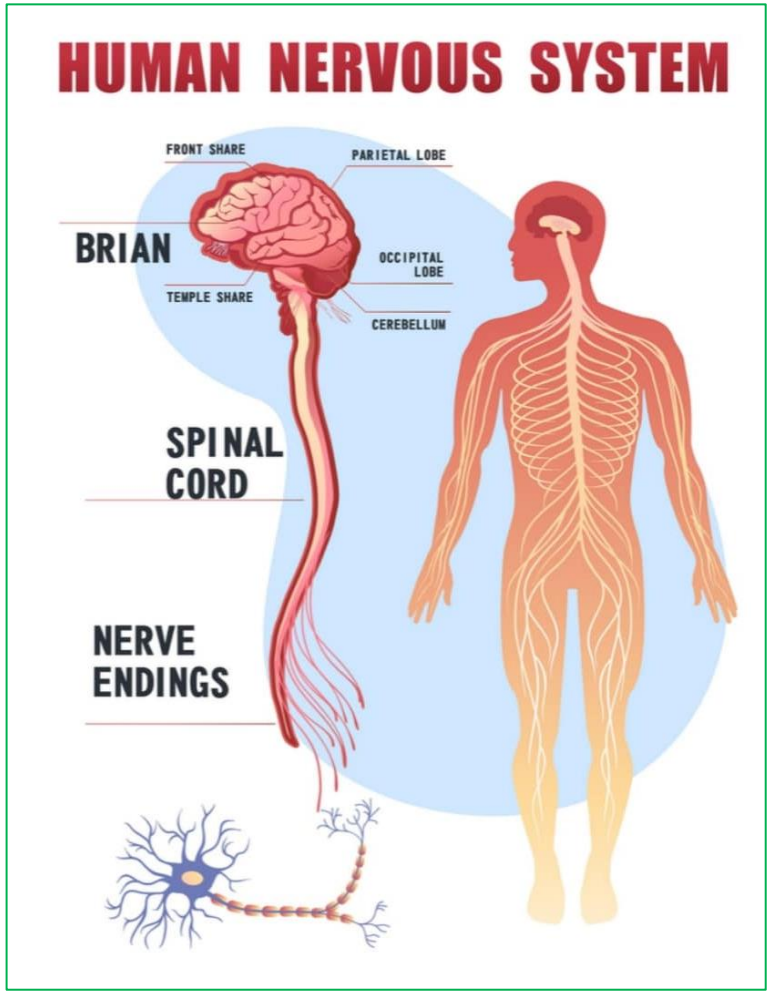
NERVOUS SYSTEM

- The **nervous system** consists of the brain, spinal cord, sensory organs, and all of the nerves that connect these organs with the rest of the body.
- The **brain and spinal cord** form the control center known as the **central nervous system (CNS)**, where information is evaluated and decisions are made.
- The **sensory nerves** and **sense organs** of the **peripheral nervous system (PNS)** send information to CNS and regulate organs functions by efferent and afferent nerves.



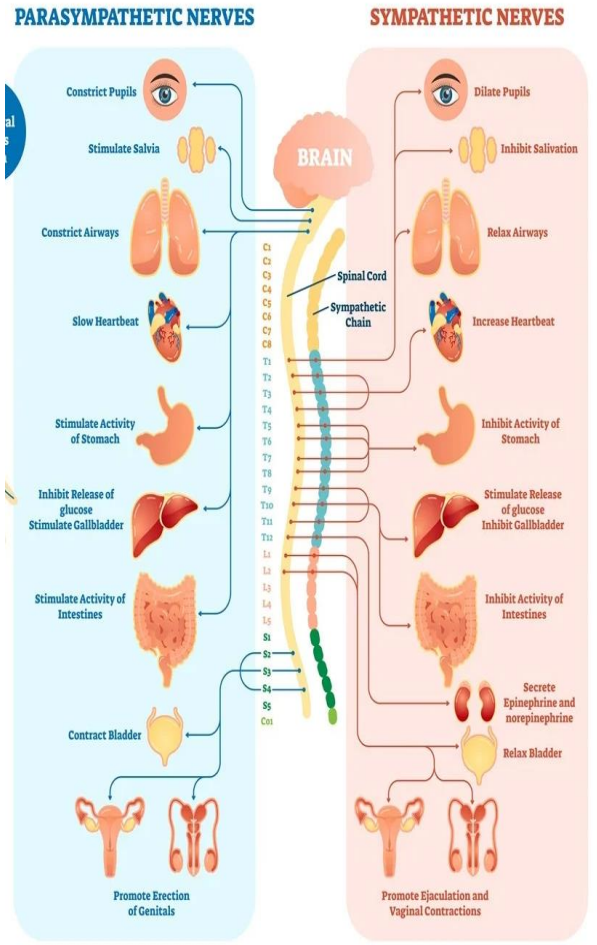
AUTONOMIC NERVOUS SYSTEM

- The **autonomic nervous system** conveys all the outputs from the CNS to the rest of the body, **except** for the motor innervation of **skeletal muscle.**
- **Compose** of two neurons, the **pre-ganglionic neuron** with a cell body in the CNS and the **post-ganglionic neuron** with a cell body in the autonomic ganglia.
- Three main parts
  1. Sympathetic
  2. Parasympathetic
  3. The enteric nervous system

AUTONOMIC NERVOUS SYSTEM

- The main processes that it **regulates** are:

1. **Control** circulation, respiration, digestion, and body temperature.
2. **Contraction** and **relaxation** of vascular and visceral smooth muscle.
3. **All exocrine** and **certain endocrine** secretions.
4. The **heartbeat**
5. **Energy metabolism**, particularly in the liver and skeletal muscle.



PARASYMPATHOMIMETIC NERVOUS SYSTEM

- The **parasympathomimetic nervous system** innervates a large number of organs.
- The neurotransmitter **acetylcholine** (Ach) mediates the transmission of impulses from the preganglionic neurons to postganglionic neurons **as well as** the transmission of impulses from postganglionic nerve terminals to the effector organs.
- The action of Ach at the effector organ can be **mimicked** by drugs like Carbachol , methacholine, or muscarine.
- **The sites** at which Ach and the Parasympathomimetics act are called **Muscarinic receptors** (M receptors) and they are sensitive to **block by atropine.**

MUSCARINIC RECEPTORS

G. protein-coupled receptors, include **five** types of these receptors (M1-M5)

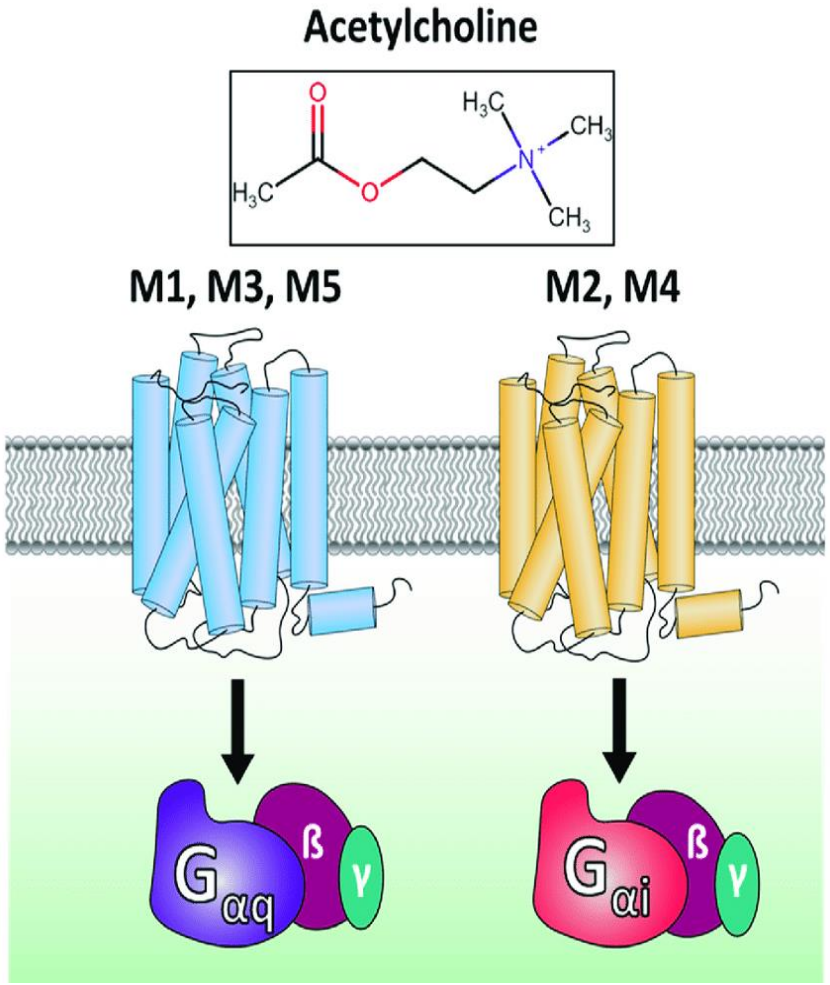
M1 receptors (**neural**): C.N.S., gastric parietal cells, they mediate an **excitatory** effect resulting in an increase in acid secretion

M2 receptors (**cardiac**); present in the heart, they exert an **inhibitory** effect causing bradycardia

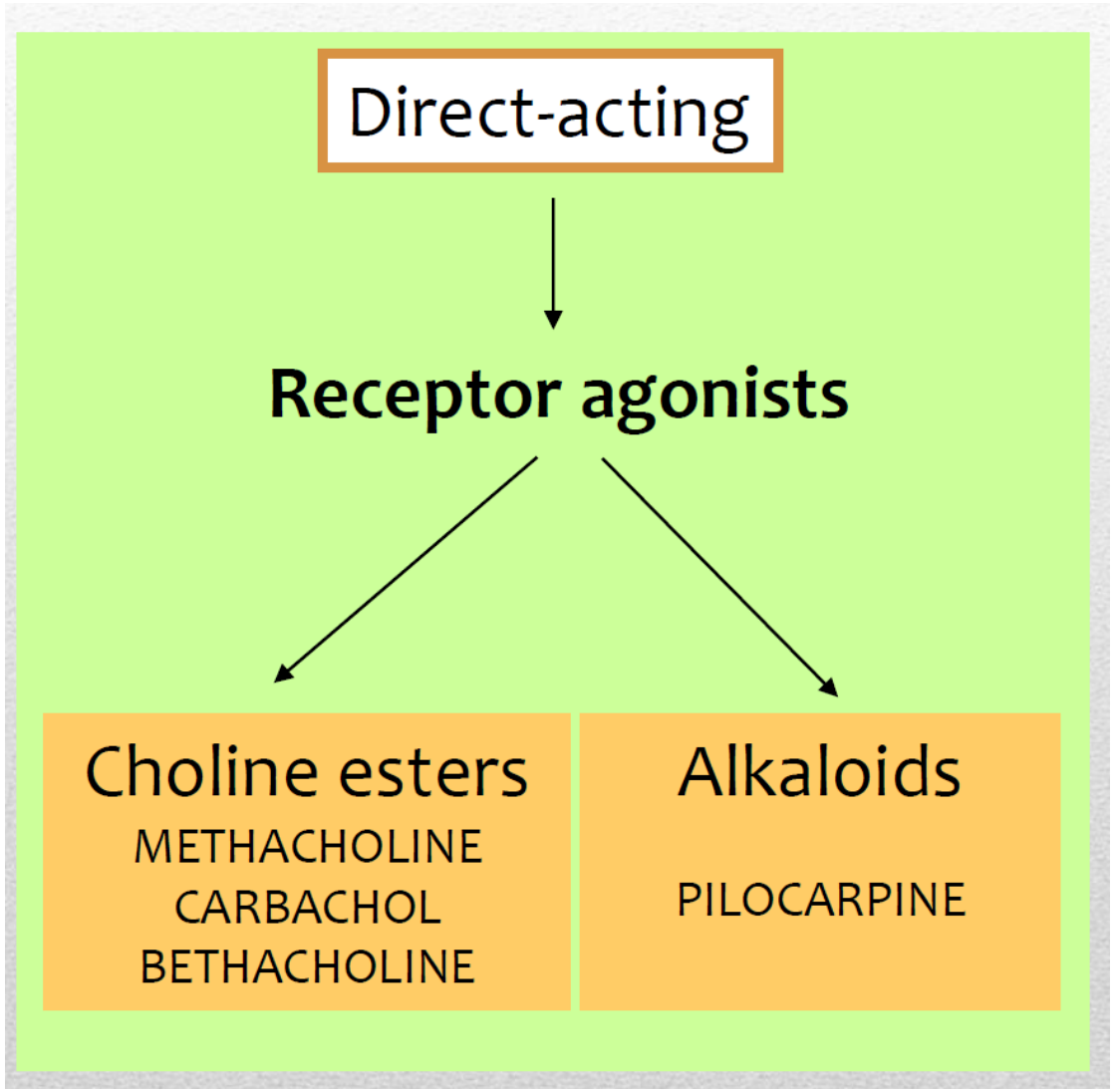
M3 receptors (**glandular**); present in the smooth muscle of G.I.T., bronchial, bladder and exocrine glands; like sweat gland, salivary and lacrimal gland.

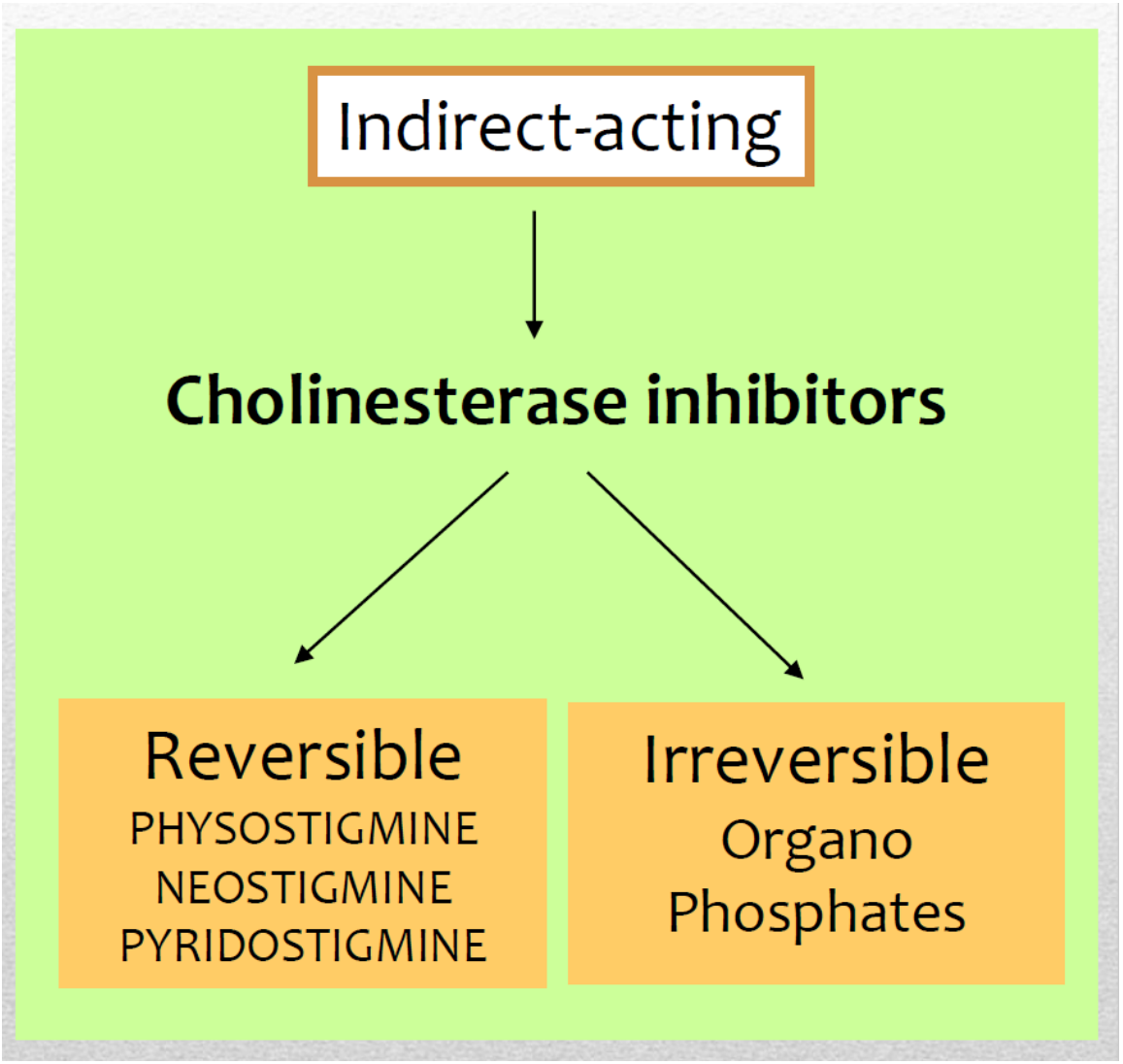
They mediate **excitatory** effect which increases the glandular secretion and contraction of visceral smooth muscle

M4 and M5 receptors ; present in C.N.S. but their functions are **not fully** identified.



PARASYMPATHOMIMETIC DRUGS





ANTIMUSCARINIC AGENTS

- **Block** M.R. cause **inhibition** of all M. function
- Have **little or no** action at **skeletal** N.M.J. or **autonomic ganglia**, they do not block N.R.
- **Reverse** excessive **cholinergic** effects (reverse **DUMBBELLS**)

(DUMBBELLS)

D – Defecation (diarrhea)
U - Urination (peeing)
M - Miosis (constriction of the pupil of the eye)
B - Bradycardia (slow heart beat)
B - Bronchospasm (difficulty breathing)
E – Emesis (excite skeletal muscle and CNS, vomiting)
L - Lacrimation (tearing)
L - Lethargy (fatigue)
S - Salivation (excessive drooling)

ANTIMUSCARINIC AGENTS

Atropine: Orally absorbed , cross BBB, Competitive antagonist to Ach at all muscarinic receptors

Scopolamine: anti motion sickness

Pirenzepine: block M.R. of the gastric parietal glands; hence it is preferred in the treatment of gastric ulcer

Ipratropium: useful in the treatment of asthma to decrease secretion & dilate obstructed air ways

Effect of Pilocarpine on Glandular Secretions

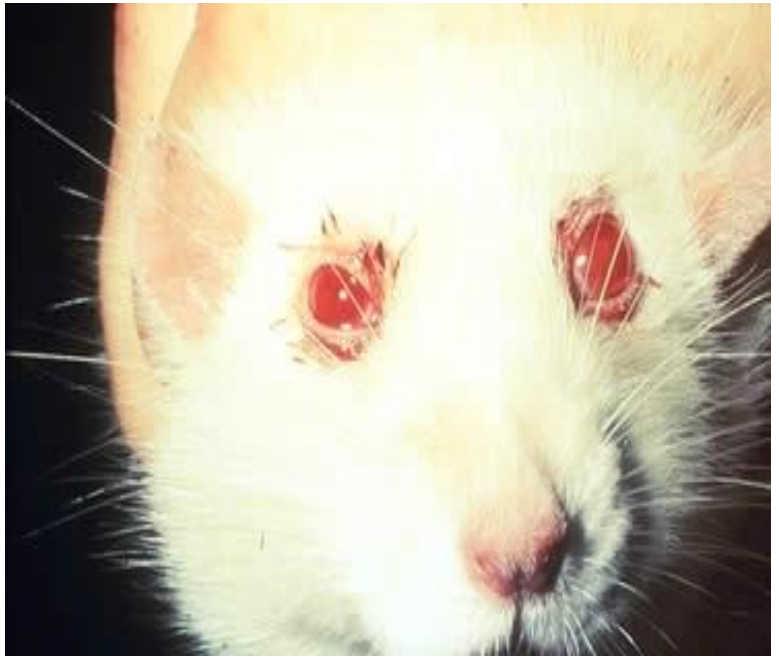
PRINCIPLE

- **Ach** and **parasympathomimetics** stimulate the secretion of different **glands** in the body, like mucous, sweat, salivary, and tear glands as well as **secretory activity** of the stomach, intestine, and pancreas.
- In the rat, there is a special **horseshoe-shaped gland** is located within the **bony orbit** called the **Harderian gland**, this gland involves **muscarinic receptors**.

AIM OF THE EXPERIMENT

- This exp. was designed to:

1. Show the **stimulatory** effect of the cholinergic drug on glandular secretion
2. Prove that these glands are **parasympathetically** innervated and contain a **muscarinic** type of receptors

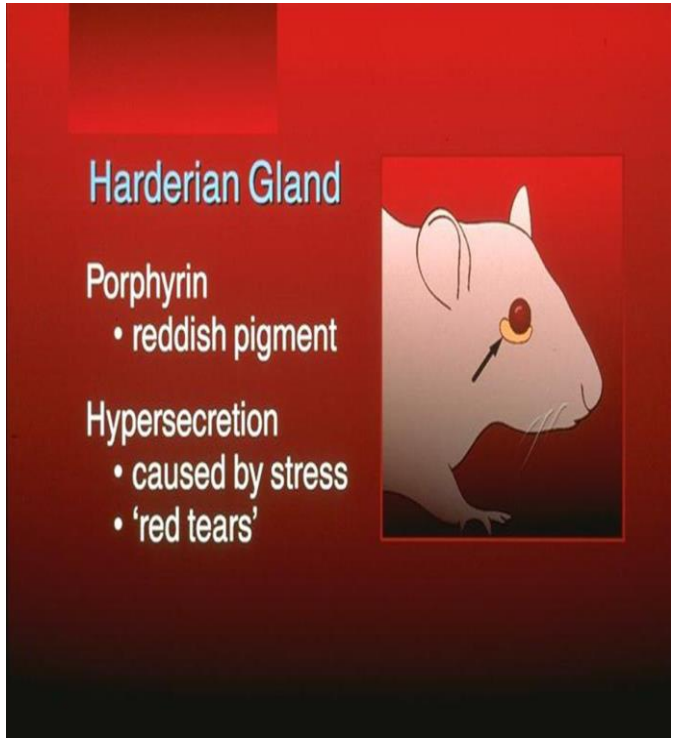


HARDERIAN GLAND

- It is an **exocrine gland**, horseshoe-shaped located within the bony orbit, secretions from this gland include the **reddish pigment porphyrin**.
- Rats **overproduce** porphyrin when they are:

1. Stressed, ill, or poorly fed
2. Water deprivation
3. Joint pain, morphine withdrawal
4. Acetylcholine injections

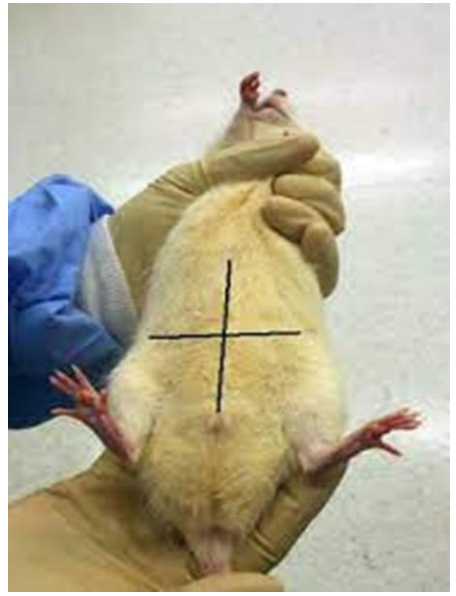
- After injection with acetylcholine, for example, profuse amounts of porphyrin were secreted almost immediately and overflowed the eye to stain the eyelids within minutes.



EXPERIMENTAL PROTOCOL

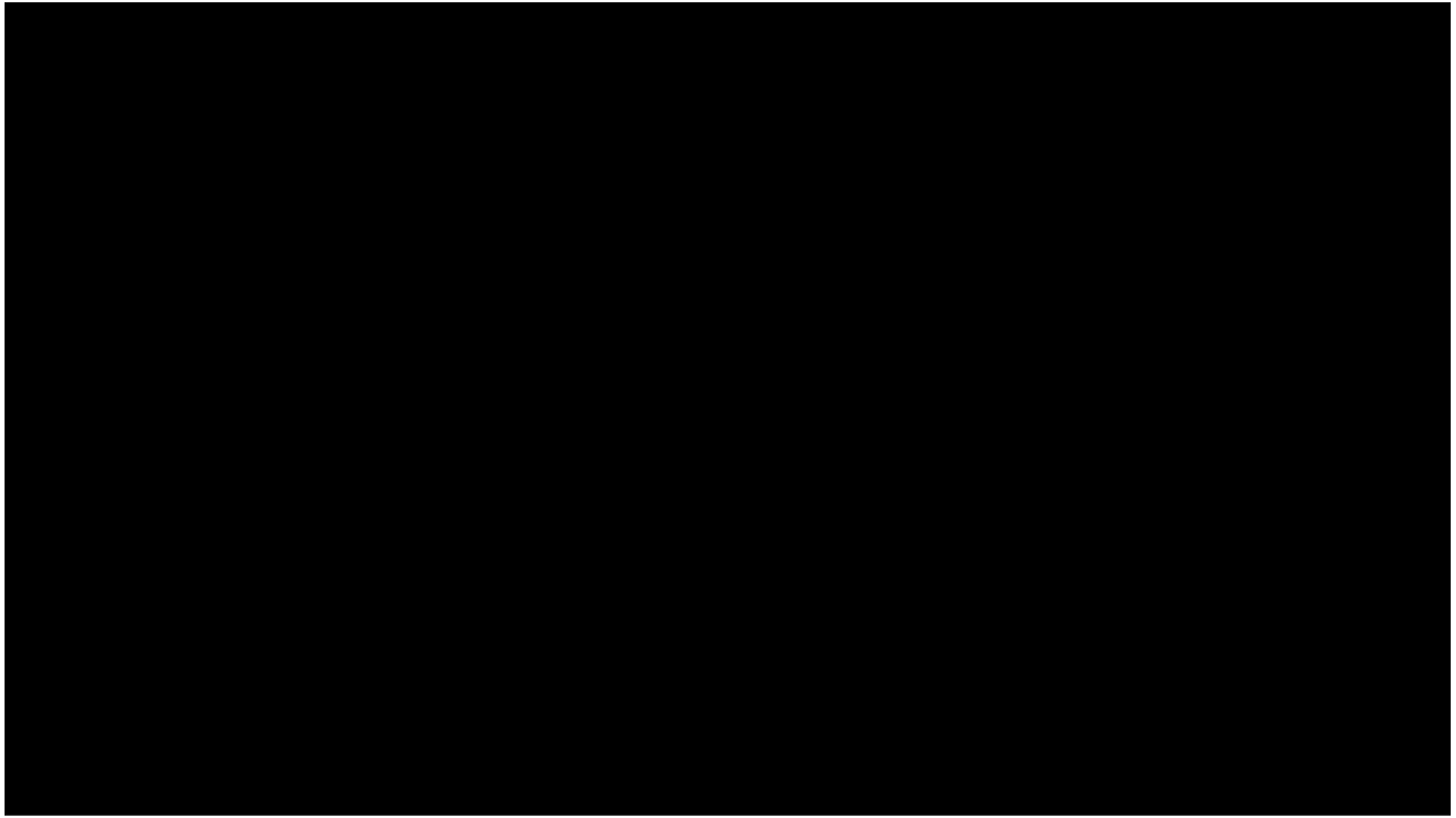
- **Procedure:**

1. Inject 100 mg/kg of Pilocarpine I.P into a rat.
2. Examine the eyes for tears by wiping the eyelids with cotton to detect the bloody tears. Note salivation and nasal secretion…..etc.
3. Inject another rat with 1 mg/kg of atropine I.P, wait about 15 25 minutes, and inject the rat with Pilocarpine 100 mg/kg I.P.
4. Examine for bloody tears, salivation and nasal secretion….etc



EXPERIMENTAL PROTOCOL

- **IP injection in rats:**



RESULTS

Parameters	Pilocarpine	Atropine+ Pilocarpine	Effectors organ/gland	Receptor
Bloody tears				
Salivation				
Urination				
Defecation				
Tremor				
Sk.M. contraction				

THANK YOU FOR YOUR ATTENTION