Effects of drugs on isolated ileum motility in guinea pig

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Enteric nervous system
Modulation of motility of small intestine

- Motility in the small intestine, as in all parts of the digestive tube, is controlled predominantly by excitatory and inhibitory signals from the enteric nervous system.

- These motility are however modulated by inputs from the central nervous system (sympathetic nerve, parasympathetic nerve).

- A number of gastrointestinal hormones (Gastrin, Cholecystokinin) or other mediators (Histamine) appear to affect intestinal motility to some degree.
Intestinal smooth muscle contraction

Parasympathetic nerve release Acetylcholine

Atropine

\[\text{(-)}\]

Activate M receptor

Intestinal smooth muscle contraction

Sympathetic nerve release noradrenaline

Activate \(\alpha_2\) receptor

Parasympathetic nerve release Acetylcholine

Intestinal smooth muscle contraction
The Enteric Nervous System (SNS/PSNS)
Motility in the small intestine, as in all parts of the digestive tube, is controlled predominantly by excitatory and inhibitory signals from the enteric nervous system.

These motility are however modulated by inputs from the central nervous system (sympathetic nerve, parasympathetic nerve),

A number of gastrointestinal hormones (Gastrin, Cholecystokinin) or other mediators (histamine) appear to affect intestinal motility to some degree.
Intestinal smooth muscle contraction

chlorpheniramine

Histamine

(-)

Activate H₁ receptor

Activate PLC

intracellular Ca²⁺
activate PKC

Intestinal smooth muscle contraction
BaCl_2

Ba^{2+} influx by Ca^{2+} channel

Parasympathetic nerve release Acetylcholine

Intracellular potential ↑

sarcoplasmic reticulum Ca^{2+} release ↑

Intestinal smooth muscle contraction ↑↑

Atropine

Activate M receptor
[Principle]

- The isolated intestinal tract from many species of animal can maintain active rhythmic movements for a long time under suitable conditions.

- By using different drugs that bind to the receptors on intestinal smooth muscular cells, we can observe the actions of drugs and analyze their action mechanism.

- In this experiment, the effects of acetylcholine and histamine on the motility of isolated ileum in guinea pig are investigated. Atropine and chlorpheniramine are used as tool drugs to analyze the underlying mechanisms.
[Materials]

- Animal: guinea pigs, 300-400 g
- Drugs: 1:100000 acetylcholine chloride (ACh), 0.1% atropine sulfate, 1:100000 histamine phosphate, 1:1000000 chlorpheniramine, 1% barium chloride (BaCl₂), Tyrode’s solution.
- Instruments: biological signal collection system, force transducer, surgical instruments, beaker (10 ml), volumetric cylinder (30 ml), syringes (50 ml, 1 ml)
**[Method]**

1 Preparation of isolated intestine

- Take a guinea pig, stun it to cause death, immediately open the abdominal cavity with surgical scissors and clip off 10 cm of ileum, starting at or near the ileocecal junction.
- Wash out the contents inside the intestine with Tyrode’s solution aerated with 95% oxygen and 5% carbon dioxide.
- Cut the intestine into several sections, 1-1.5 cm per section, and put them in Tyrode’s solution aerated continuously with 95% oxygen and 5% carbon dioxide.
Effects of several drugs and extracellular pH on isolated small intestinal muscle

Objectives and principle

Materials
- rabbit
- Magnus' bath
- syringe
- scissors
- scalpel and surgical scissors
- forceps
- mallet
- Tyrode's solution
- reagent and drug
- tension transducer
- recording instrument
- temperature thermostat

Wooden hammer is used to strike the rabbit's head to make it unconscious.
2. Record

- Fix the specimen (1-1.5 cm) in the isolated organ bath. The specimens are mounted vertically, one end is connected to the lower hook of the bath and the other end is connected to a force transducer.

- Tyrode’s solution, 10 ml (37±0.5°C), is added into the bath. The specimens are allowed to equilibrate at 2-3 g tension for 30 min.

- Observe the rhythmic contraction and tension level of the intestinal muscle, trace out the normal contraction curve until the specimen becomes stable.
Objective and principle

Materials
- rabbit
- Magnus' bath
- syringe
- scissors
- scalpel and surgical scissors
- forceps
- mallet
- Tyrode's solution
- reagent and drug
- tension transducer
- recording instrument
- temperature thermostat

用玻璃吹制的双层麦氏浴槽，内层标本槽装有灌流液，内置离体组织、器官标本；外层用恒温热水循环以维持标本槽温度的恒定。超级恒温器提供恒温热水的循环。
Effects of several drugs and extracellular pH on isolated small intestinal muscle.

Objectives and principle

Materials
- rabbit
- Magnus' bath
- syringe
- scissors
- scalpel and surgical scissors
- forceps
- mallet
- Tyrode's solution
- reagent and drug
- tension transducer
- recording instrument
- temperature thermostat

Close

超级恒温器规格型号很多，用途广泛，其主要功能是保持容器内水的温度恒定，并有水泵和进出水管，提供恒温水循环。
Effects of several drugs and extracellular pH on isolated small intestinal muscle.

Objectives and principle (实验目的原理)

Materials (实验材料)
- rabbit
- Magnus' bath
- syringe
- scissors
- scalpel and surgical scissors
- forceps
- mallet
- Tyrode's solution
- reagent and drug
- tension transducer
- recording instrument
- temperature thermostat

换能器（Transducers）在生物医学中将传感器称为换能器。换能器是一种能将机械能、化学能、光能等非电量形式的能量转换为电能的器件或装置。

张力换能器，它能将各种张力转换成电信号，可用来测量动物在体和离体组织、器官的...
按上面框图连接线路，张力换能器输出线接第一通道（亦可选择其它通道），选择直流偶合方式（DC）。
微机生物信号处理系统参数设置：采样间隔2～5ms；连续记录显示模式；第一通道放大倍数200～500，高频滤波选择“无”。“
3. Administration

- Add a drop of ACh into the bath solution and observe for 2-3 min, record the peak of the change of the contractive tension, and then wash off.

- Add a drop of ACh into the bath solution. When the contraction of intestinal smooth muscle reaches the peak, add a drop of Atropine. After the contraction of intestinal smooth muscle becomes stable, record the tension and then wash off.
3. Administration

- Add a drop of Histamine into the bath solution, observe and record the peak of the change of the contractive tension, and then wash off.
- Add a drop of Chlorpheniramine into the bath solution and then add a drop of Histamine. Record the tension of the contraction peak and then wash off.
3. Administration

- Add a drop of \( \text{BaCl}_2 \) into the bath solution. When the contraction of intestinal smooth muscle reaches the peak, record the tension and then add a drop of \text{Atropine}. After the contraction of intestinal smooth muscle becomes stable, record the tension and then wash off.
Ach  wash  Ach  Atropine  Wash  His  wash  BaCl$_2$  atropine  Wash
Chlorpheniramine  His  wash  BaCl$_2$  atropine  Wash
Chlorpheniramine
Table 1 Experimental records of drug actions on isolated intestinal smooth muscle of guineas pig.

<table>
<thead>
<tr>
<th>Dose (Drug)</th>
<th>Tension (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:100000 Ach</td>
<td></td>
</tr>
<tr>
<td>1:100000 Ach</td>
<td></td>
</tr>
<tr>
<td>+ 0.1% Atropine</td>
<td></td>
</tr>
<tr>
<td>1:100000 Histamine</td>
<td></td>
</tr>
<tr>
<td>1:100000 Chlorpheniramine</td>
<td></td>
</tr>
<tr>
<td>+ 1:100000 Histamine</td>
<td></td>
</tr>
<tr>
<td>1% BaCl₂</td>
<td></td>
</tr>
<tr>
<td>0.1% Atropine</td>
<td></td>
</tr>
</tbody>
</table>
[Discussion]

- Try to compare the actions on isolated intestinal smooth muscle of acetylcholine, histamine and barium chloride with or without adding Chlorpheniramine (H₁ receptor antagonist) or Atropine (M receptor antagonist), and analyze the mechanisms of action of acetylcholine, histamine, barium chloride on intestinal smooth muscle.

- What is clinical significance of the effect of atropine on intestinal smooth muscle motility?
Writing an experimental report

- **Subject:** This is the title of the experiment.
- **Aim:** This is a short introduction to indicate why the experiment was done.
- **Materials and methods:** This section shows the detailed procedure of how the experiment was carried out and what components were needed.
- **Result:** This is the core of the report, usually using figures and/or tables.
- **Discussion:**
- **Conclusion:** A short summary of the whole experiment.