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SPARC - Acute surgery and experimentation of the gastrointestinal tract and vagus nerve in the ferret V.1

PLOS One

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ABSTRACT

This protocol is used for acute surgery and electrophysiological experimentation on the anesthetized ferret, specifically for manipulating the vagus nerve and gastrointestinal tract nerve stimulation and myoelectric recording.

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GUIDELINES

animal should be monitored for stability of respiration, heart rate, blood pressure, and temperature

MATERIALS

MATERIALS

Vetbond 3M corporation

30 ml barostat balloon MUI Scientific Catalog #CT-BP-1017

3-point retractor George Tiemann Catalog #110-3445

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Protocol status: Working
We use this protocol and it's working

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Keywords: surgery, gastrointestinal tract, stomach, intestine, vagus nerve, electrophysiology, emesis

Remove food

1 Remove food from the home cage 3 h before anesthesia 03:00:00

1.1 Measure body weight

Preparation: Before first incision

2 Induce anesthesia using isoflurane in a chamber, then move to a facemask (1 to 2%).

3 Shave abdomen and ventral neck.

- 4 Place ferret supine on table. Connect EKG leads and place rectal probe for recording body temperature (keep at 36 to 40C).
- 5 Monitor heart rate and body temperature throughout procedure and testing.

Equipment

CED Power 1401 running Spike 2 version 7.15	NAME
electrophysiology recording	TYPE
CED	BRAND
CED Power 1401 running Spike 2 version 7.15	SKU

First incisions: Endotracheal tube and blood pressure cathet...

- 6 Make a ~4cm incision in the ventral neck and dissection the trachea.
- 7 Insert an endotracheal tube and connect to pressure transducer to monitor respiration rate.

Equipment

Small Animal Ventilator	NAME
ventilator with expiration pressure transducer	TYPE
CWe	BRAND
SAR-830/AP	SKU

- 8 Make a ~3 cm incision on the medial surface of the right leg.
- 9 Place blood pressure catheter in left femoral artery.

Equipment

Direct Blood Pressure System

pressure transducer

Kent Scientific

DBP1000

NAME

TYPE

BRAND

SKU

Abdominal Surgery: Placement of electrodes and gastric tu...

- 10 Make an incision in the midline abdominal muscle to expose the organs.
- 11 Open abdominal cavity using a 3-point retractor (Balfour pediatric retractor, George Tiemann), applied to the lateral edges of the abdominal incision and sternum. This retractor is elevated using a vertical post attached to a surgical board under the animal.
- 12 Make incision (~0.5 cm) on the left lateral edge of the gastric fundus and insert gastric catheter with the tip resting in the antrum; in parallel with the gastric catheter is a 30 ml barostat balloon. Place a purse-string suture around the incision and tied. And, additional knot is made around the catheter and the free ends of this knot and purse-string suture are tied together. Finally surgical glue (Vetbond) is applied to the incision area.
- 13 In some experiments, a cuff electrode is placed on either the ventral or dorsal abdominal vagus nerve trunk. Suture a ground electrode lead to connective tissue on the greater curvature of the stomach.

- 13.1** This is accomplished by caudal retraction of the stomach and retraction of the liver to the right side of the animal using saline moistened gauze. In this position, the esophagus and vagi become accessible.
- 14** Place planar electrodes on surface of stomach and duodenum using 8-0 silk suture. Suture a ground electrode lead to connective tissue on the greater curvature of the stomach
- 15** Test electrode impedances.

Equipment

Grapevine Neural Interface Processor and a Nano2 recording headstage	NAME
electrophysiological recording and stimulation	TYPE
Ripple LLC	BRAND
Grapevine Neural Interface Processor and a Nano2 r	SKU

Testing

- 16** Following this initial setup various tests can be performed, including testing the effects of stomach distension, nerve electrical stimulation, and emetine infusion on gastrointestinal myoelectric responses. Emetine is a chemical emetic agent that produces retching and emesis when infused into the stomach and small intestine. Because emesis can produce strong abdominal contractions it is recommended that the abdominal incision is securely sutured.

Gastric distension trials

- 17** Measure impedances of electrodes. Record 5 minutes baseline before and after each distension trial.

Equipment

Grapevine Neural Interface Processor and a Nano2 recording headstage

NAME

electrophysiological recording and stimulation

TYPE

Ripple LLC

BRAND

Grapevine Neural Interface Processor and a Nano2 r

SKU

- 18** Fill balloon using a syringe pump with 5 ml, 10 ml, or 20 ml saline. Infusion rate is 10ml/min. Saline is held in balloon for 5 minutes before deflation.

Emetine Trial

- 19** Record 20 min of baseline gastrointestinal myoelectric activity.

Equipment

Grapevine Neural Interface Processor and a Nano2 recording headstage

NAME

electrophysiological recording and stimulation

TYPE

Ripple LLC

BRAND

Grapevine Neural Interface Processor and a Nano2 r

SKU

- 20** Use a syringe pump to infuse 5 mg/kg emetine into the stomach. Record for 1 hour.

Cuff Stim Trials

- 21** Apply desired stimulation parameters (pulse width, current amplitude, frequency) to abdominal

vagus while recording. Record baseline data before and after trials and measure impedances at the end.

Equipment	
Grapevine Neural Interface Processor and a Nano2 recording headstage	NAME
electrophysiological recording and stimulation	TYPE
Ripple LLC	BRAND
Grapevine Neural Interface Processor and a Nano2 r	SKU

22 Open abdomen and remove electrodes, balloon, and catheter.

23 Euthanize animal with intracardiac euthasol injection.