



Harvard Apparatus General Surgery Training

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What is surgery?

Medical specialty that commonly uses operative techniques on a patient to investigate and/or treat a pathological condition such as disease or injury, or to help improve bodily function or appearance.

What is small animal surgery?

Small animal surgery often takes place in research in order to test techniques, drugs, or to cause conditions that can be subsequently treated and studied.



Applications

Regenerative studies

Glucose Clamp

Lung Transplant

Gastric Bypass

Hepatic Cell Isolation

Sepsis

Organ Isolation

Cardiomyocyte Collection

Tumor removal/implantation

Kidney Transplant

Microdialysis Implantation

Exploratory Tracer Studies

Ischemia Reperfusion

Ablation studies



Aspects Good Surgical Practices

- Surgical Preparation
- High Quality Surgical Instruments and Equipment
- Anesthesia
- Ventilation
- Temperature Control and Vital Sign Monitoring
- Post Operative Recovery
 - Temperature control
 - Analgesia



Surgical Instruments

- Full line of surgical instruments available
- Made of Stainless steel
 - Also available in the Tungsten Carbide and Titanium
- Made in a German *ISO*-certified facility
- Preconfigured kits available for convenience
- Variety of absorbable and non-absorbable sutures



Surgical Preparation

Identification



Trimmers and Clippers



Animal Weighing



Operating Tables for Rodents



- Available in 2 sizes: Size 1 for Mice and Size 5 for Rat
- Tripod or flat angle base
- Non-heated, heated, homeothermic options available
- Scalloped edges for securing holders, stays, and electrodes

Note: Operating tables for larger animals also available



Anesthesia (Inhalation Anesthesia)

Rebreathing

Includes Soda-Lime to remove CO_2 from the exhaled air and allows researcher to recirculate anesthetic agent, reducing the overall use of your halogenated gas.

For animals >10lbs

Non-Rebreathing

A non-rebreathing system does not recirculate the exhaled air and are designed to be low resistance systems.



Anesthesia

Small Animal Anesthesia

Mobile Set Up



Table-Top Set Up



Vaporizers

Funnel-Fill Adapter



Key-Fill Adapter



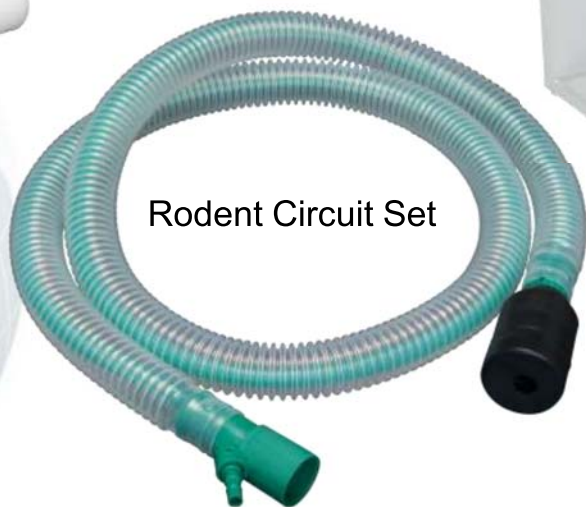
End Caps



Anesthetic Gas Delivery



Nose Cone



Rodent Circuit Set



Induction Box



Waste Gas Management

Every Anesthesia Set-up Must Have Proper Evacuation!!

- Passive Scavenging
 - Halogenated gasses are pushed through the set up and to filter canister
 - Activated charcoal scrubs anesthetic agent from air flow
- Active Scavenging
 - Halogenated gasses are pulled through the set up and to the filter canister
 - Activated charcoal scrubs the anesthetic agent from the air flow



Passive Scavenging

F/air Canister

- Activated charcoal canister that filter halogenated gasses
- Cleaned oxygen exits through the bottom and is safe to re-enter the room
- Each canister lasts about 12-13hrs of surgery
 - depending on flow and percentage of gas used
- Once the canister gains 50g, it is exhausted and can be thrown away in the regular trash.

Fluosorber Canister

- Activated charcoal canister
- Lasts about 4x's longer than the F/air canister
- Should be treated similarly to the F/Air canisters
 - Once they gain 200g they are exhausted
- Can be paired with our Fluovac system, which is an active system



Active Scavenging

Active Evacuation System

- A negative pressure is created inside the canister
- Waste gas is pushed to your ventilation system, fume hood, or directly outside via PVC piping



Fluovac System

- A fan actively pulls the waste gas through the Fluosorber charcoal canister
- Requires the same attention that using the Fluosorber canister does alone



A Typical Anesthesia Set-Up: Nose Cone Only, Passive Scavenging



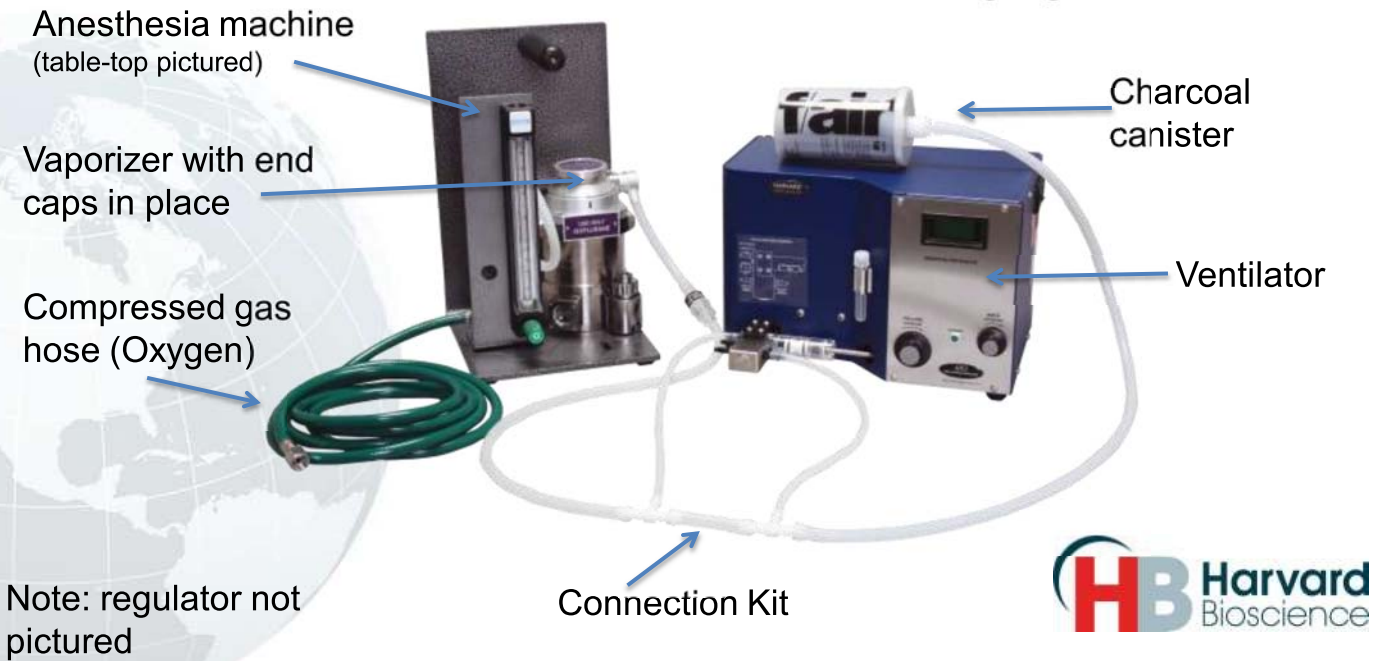
A Typical Anesthesia Set-Up: Nose Cones for 2 animals, Active Scavenging



A Typical Anesthesia Set-Up: Nose Cone and Induction Box, Passive Scavenging



A Typical Anesthesia Set-Up: Ventilator, Passive Scavenging



Tips for Proper Anesthetizing

- Choose right gas source and know the pressure of the tank or wall supply.
- Make sure you are using high pressure hosing connected properly.
- Good rule is to replace tubing with E-3603 tubing which is less gas permeable than Silicone. Silicone is less gas permeable than natural rubber.
- Choose how you will be introducing the anesthesia and if you will need an induction box.
- Active scavenging is safer, but a greater investment for a researcher. Passive scavenging is a low cost alternative, but suffers from a higher halogenated gas residual in the research space than active scavenging.
- Always check your settings with your vet! Induction settings tend to be higher than maintenance. Remember to reduce the percentage of halogenated gasses down!



Ventilators

A Ventilator is any machine designed to mechanically move air into a subject's lungs.



MiniVent Ventilator for Mice



- Ideal for mice up to 50g
- 30-350 μ l volumes
- 60-400 bpm
- Small footprint
- Whisper quiet

Also Available – MicroVent (for neonatal mice) and the MidiVent (for large mice and small rats)

Remember!

When used with Gas Anesthesia a Connection Kit is Needed



Inspira ASV Models

- Ideal mice through 10kg animals
- Volume and pressure modes available
- Available with or without inspiratory hold
- Sigh
- Trigger in
- Analog out/Sync out
- Adjustable Phase
- Pressure mode allows you to safely use a PEEP with using gas anesthesia



Remember!

When used with Gas Anesthesia a Connection Kit is Needed



Special Note: Connection Kits

Closed off to room air for
passive scavenging.
Open to room air for
active scavenging

From Vaporizer

From Ventilator

To Ventilator

To Scavenging



Tips for Proper Ventilation

- Decide if you need a mechanical ventilator such as the Minivent, or if you will need a microprocessor ventilator such as the Inspira. The experiment, weight and type of the animal, plus the anesthesia choice will be factors in the right decision.
- Use appropriate size cannula for animal.
- Use appropriate lengths of tubing and appropriate connectors.
- When using gas anesthesia be sure to use proper evacuation.
- Vital Sign monitors are imperative to ensure that the animal is healthy.
- Confirm with your animal facility for proper settings for your animal, i.e. tidal volume, rate and blood gas levels.



Cannula Selection Guide.

Animal's Weight Range	Animal	Size Cannula	Intubation Cannula with Y Adapter	Tracheal Cannula with Y Adapter	Y Adapter Size for Connection to Ventilator
20 – 30 g	Mouse	1.0 mm OD	73-2737	73-2731	3.0 mm
30 – 40 g	Mouse	1.1 mm OD	73-2843	73-2830	3.0 mm
40 – 50 g	Mouse	1.2 mm OD	73-2844	73-2730	3.0 mm
75 – 125 g	Small Rat	1.5 mm OD	73-4115	73-4112	7.5 mm
125 – 200 g	Small Rat	1.8 mm OD	73-4116	73-4113	7.5 mm
200 – 350 g	Rat	2.0 mm OD	73-4117	73-4114	7.5 mm
350 – 450 g	Rat	2.3 mm OD	73-2847	73-2834	7.5 mm
450 – 600 g	Rat/Guinea Pig	2.5 mm OD	73-2739	73-2732	7.5 mm
600 – 750 g	Rat/Guinea Pig	3.0 mm OD	73-2740	73-2733	7.5 mm
750 – 1 kg	Rat/Guinea Pig	3.5 mm OD	73-2741	73-2734	10.0 mm



Thank you!

Have any questions or need a quote?
Please email support@hbiosci.com

