

Heating Pad for a microPET/CT scanner

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Problem Statement:

During anesthesia, metabolism slows down which can lead to hypothermia and eventual death. For prolonged microPET or microCT scans, where animals are kept for an extended period of time under anesthesia, it is important to keep the animals at steady temperature. Currently heating lights are used to provide a solution, however, these lead to non-uniform and poorly controlled temperature regulation. Therefore, we proposed to design a heating pad that could be used to provide controllable and steady temperature during prolonged scans. Because of the imaging requirements, the heating pad cannot contain metal parts.

Client Requirements:

- Temperature should be close to the body temperature of a mouse
- Temperature should be controllable adjustable?
- The device should provide temperature feedback
- Device should be able to provide heat for roughly one hour

Design Requirements:

- All metal parts must be out of the field of view
- Liquid may be used but if so, device must be completely sealed (no leaking)
- Limit the use of moving parts. Slight motion may be acceptable, but significant motion may destroy image results
- The part of the device that the mouse is sitting on should be somewhat firm so the mouse does not sink into the device

1. Physical and Operational Characteristics

a. Performance Requirement: The device will need to produce temperatures close to the body temperature of a mouse. The output temperatures should be variable and the device should provide live temperature feedback.

b. Safety: The device will likely operate at high temperatures, thus a warning label must be displayed so the consumer uses care during operation. We should use a temperature fuse to automatically turn the device off if the temperature becomes too high. The device will employ a typical electrical plug. Standard safety precautions regarding electrical plugs and outlets should be followed.

c. Accuracy and Reliability: The device should provide variable heat control accurate within 3-

5 degrees Celsius of the temperature desired by the operator. Repeatability does not apply as the user will likely make changes to the device during operation.

d. Life in Service: The device should be capable of providing heat throughout the typical length of a microPET/CT scan, about one hour. The device should be able to withstand multiple uses within one day. The product life of the device depends on the working parts used in the design.

e. Shelf Life: Shelf life will not likely be an issue with this device.

f. Operating Environment: The device will be used at the UW hospital in the room where the microPET/CT scan machine is located.

g. Ergonomics: The temperature control of the device should be straightforward so that the user can easily shift temperature without extensive training. Also, the body temperature of the mouse should be attainable and prominently displayed.

h. Size and Shape: The device must be small enough to fit inside the imaging chamber (4 ¾") of the microPET/CT scanner. The device can be a flat pad, or a design in which the mouse is heated from all sides.

i. Weight: The weight of this device is not of concern.

j. Materials: Features of the device that go inside the imaging chamber cannot have any metal parts. Metal parts may be used on aspects that will not be inside the imaging chamber.

k. Aesthetics, Appearance, and Finish: The device should clearly indicate a warning of the high temperatures the device may produce.

2. Product Characteristics:

a. Quantity: One device is required.

b. Target Product Cost: The prototype should cost less than \$500 to build.

3. Miscellaneous:

a. Standards and Specifications: The device should comply with all regulations established by the FDA for medical instruments. More information can be found on the FDA website, <http://www.fda.gov/>.

b. Customer: The customer for this device will be researchers who desire a more controllable means to keep the body temperature of a mouse constant during imaging.

c. Patient-related concerns: There are no patient related concerns at this time.

d. Competition: [Are there similar ones out there?](#)