

BME 201: BIOMEDICAL ENGINEERING DESIGN

PRODUCT DESIGN SPECIFICATIONS

– Neurochemical Team 2009 –

Project Title: Development of a Device for Neurochemical Sample Collection from Freely Moving Monkeys
(Project # 18)

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Revised Problem Statement

To improve on the device created last semester that protects microdialysis apparatuses used during cranial experiments on non-human primates. This involves continued efforts to reduce the weight of the device, secure it around the monkey's head, and better able to cushion the microdrive unit.

Client Requirements

- Material must be effectively lightweight so as not to impose too much weight on the monkey's head.
- Material must be strong enough to withstand forces that the monkey may apply.
- The device must not interfere with the data collection process.
- The device must be able to be easily integrated with the current microdialysis apparatus being used.
- The monkey must be able to move freely with the device attached to it.
- There should be limited space between the device and the microdialysis apparatus.
- The device must be detachable from the apparatus after use.
- The device should be sterile and reusable.

Design Requirements

1. *Physical & Operational Characteristics:*

- a. **Performance Requirements:** The device must be strong enough to withstand 100 N (based on human arm strength estimate) to protect the microdrive unit from any forces that the monkey may apply.
- b. **Safety:** The device must not contain sharp edges or other protrusions that may injure the monkey or researcher. The materials that are used must not be toxic.
- c. **Accuracy & Reliability:** The device must provide reliable protection for the microdrive unit by being able to withstand a force of 100 N for 10 consecutive hits within a time period of 10 s.
- d. **Life in Service:** The device must be able to withstand at least 12 hours of use at a time, and must be sterilizable so that it can be reused.
- e. **Shelf Life:** At least 5 years.
- f. **Operating Environment:** Standard laboratory environment for non-human primate research.
- g. **Ergonomics:** The device must not restrict the monkey's motion except for the head and neck.
- h. **Size:** The base of the device should have an approximate diameter of 3 1/4 in and a maximum height of 2 7/8 in (height differs due to the shaping of the base to provide a custom fit for the Rhesus monkey's head). The upper cylinder should have a diameter of 2 in (with a 1/8 in lip around the bottom) and a height of 6 in. The size and shape of the existing model is under review.
- i. **Weight:** Less than 0.5 kg so as not to impose too much weight on the monkey's head (as determined by client). Tests conducted last semester proved the original 0.5 kg maximum weight too high; the effective weight of the apparatus must be reduced so that the test subject no longer labors under the weight of the device.
- j. **Materials:** Aluminum alloy 5052 for the outer casing and soft foam for the form-fitted interior. Current materials are subject to review; titanium and tough plastics are under review.
- k. **Aesthetics, Appearance & Finish:** The device must be aesthetically pleasing and look "humane" so as not to create a public outcry.

2. Production Characteristics:

- a. **Quantity:** 1 reproducible device.
- b. **Budget:** Up to USD1000.

3. Miscellaneous:

- a. **Standards & Specifications:** The design and construction of the device must comply with USDA regulations and NIH guidelines, subject to approval from the attending veterinarian.
- b. **Customers:** Primarily the client, but can be potentially extended to any research institution that is involved with cranial microdialysis studies on non-human primates.

- c. **Patient-Related Concerns:** The device must be sterilized before use with a different primate. It should not cause more discomfort to the monkey than the current experimental apparatus (i.e. the primate chair).

Competition: No currently known products specifically address the need to protect the microdrive unit during cranial microdialysis studies on non-human primates.