

PDS

Neonatal Rat Gastrostomy Procedure (PDS)

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Function: The purpose of this project is to increase the survival rate of rat pups being tested for the effect of iron deficiency on their physiological development. Our task is to adapt the current gastrostomy procedure by designing a mechanism and/or technique to secure a feeding tube inserted through the abdominal wall into the rat's stomach.

Client requirements:

- Repeatable and simple
- Noninvasive procedure (as humane as possible)
- Stable/secure (Won't move out of Stomach)
- Improve survival rate (80%)

Design requirements:

1. Physical and Operational Characteristics

- a. *Performance requirements:*
 - i. 8-10 days continuous use (to fruition)
 - ii. 20 minutes per hour milk is pumped to Rat
 - iii. Needs to be secured in stomach for entire time
- b. *Safety:*
 - i. Can't puncture through opposite side of stomach wall
 - ii. Shouldn't expand insertion hole
- c. *Accuracy and Reliability*
 - i. Repeatable fabrication
 - ii. Repeatable surgical procedure
 - iii. Consistent initial securement for each rat
- d. *Life in Service:*
 - i. 8-10 days for each procedure
- e. *Shelf Life:*
 - i. Sterile before use
- f. *Operating Environment:*
 - i. Inside Rats Stomach: volume 1-2 mL
 - ii. Temperature (38-39° C)
 - iii. Acidity (pH = 3-4)
 - iv. Minimal friction and tension on stomach wall
- g. *Ergonomics:*
 - i. Form to Rats body
- h. *Size:*
 - i. Fit in Stomach (1-2)mL without impeding digestive tract
 - ii. *Current PE-20 tubing dimensions:*

1. .38 mm inner diameter
2. 1.09 mm outer diameter
- iii. Catheter Dimensions: 16 Gauge (1.68 mm)
- i. *Weight:*
 - i. Light weight (does not harm rat pup)
- j. *Materials:*
 - i. Metal catheter
 - ii. Razor blade
 - iii. 18 cm Polyethylene tubing (PE 20)
 - iv. Small copper wire
 - v. Needle nose pliers
 - vi. Pipette tip
 - vii. 100 degree boiling water bath
 - viii. ice bath
- k. *Aesthetics, appearance, and finish:*
 - i. Function over aesthetics

2. Production Characteristics

- a. *Quantity:*
 - i. Surgical Procedure with prototype
- b. *Target Product Cost:*
 - i. Saving a Rats life: Priceless (\$250)

3. Miscellaneous

- a. *Standards and Specifications:*
 - i. Do not handle rats without rat handling class
- b. *Client:*
 - i. Client must be able to perform procedure
- c. *Patient-related concerns:*
 - i. Survival Rate
 - ii. Milk Leaking from Stomach
 - iii. Procedure
 - iv. Control of the research
- d. *Competition:*
 - i. Feeding Tube through mouth procedure
 - ii. Modifying current procedure