Rodent Rotation and Translation Stage (RRaTS)

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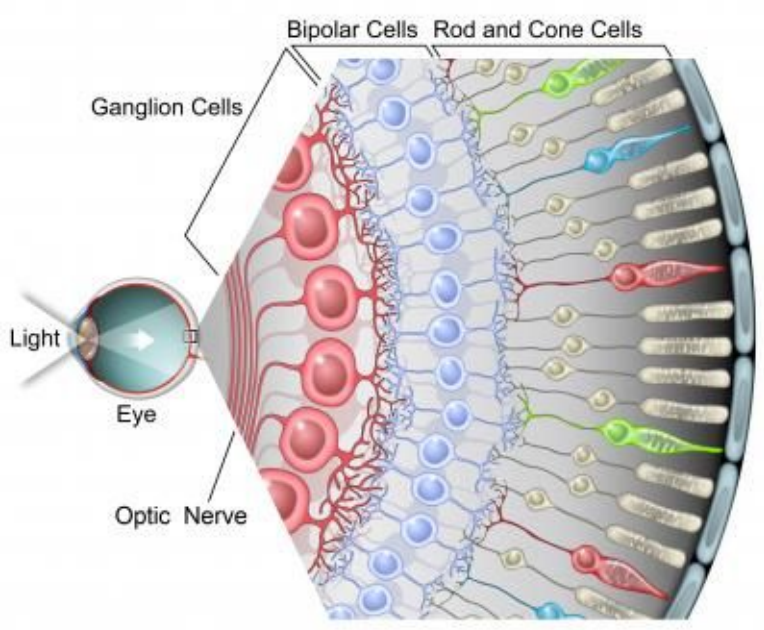
Problem Statement

- The retina is frequently viewed through a stationary device
- Need 5 degrees of freedom
- Create a stage to hold a human eye or rodent which allows translational and rotational movements
- Pupil as the center of rotation



Background

Three main image subjects

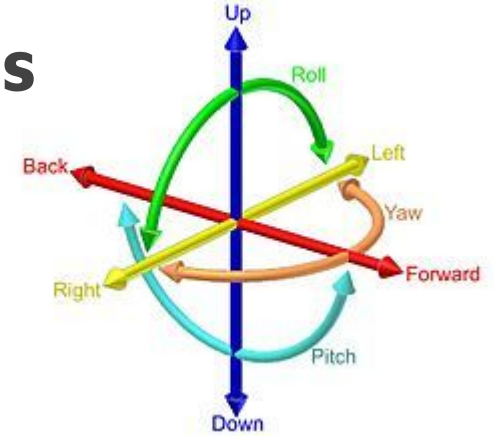
- Laboratory mouse
  - 12.5 - 20 cm long and 12 -30 g
- Thirteen-lined ground squirrel
  - 33 cm long and 227g
- Ex-vivo human eye
  - 24 cm diameter

Existing Equipment

- TMC vibrationless microscopy table
- Kent infrared warming pads
- Adaptive optics scanning laser ophthalmoscope imaging (AOSLO)

Product Design Specifications

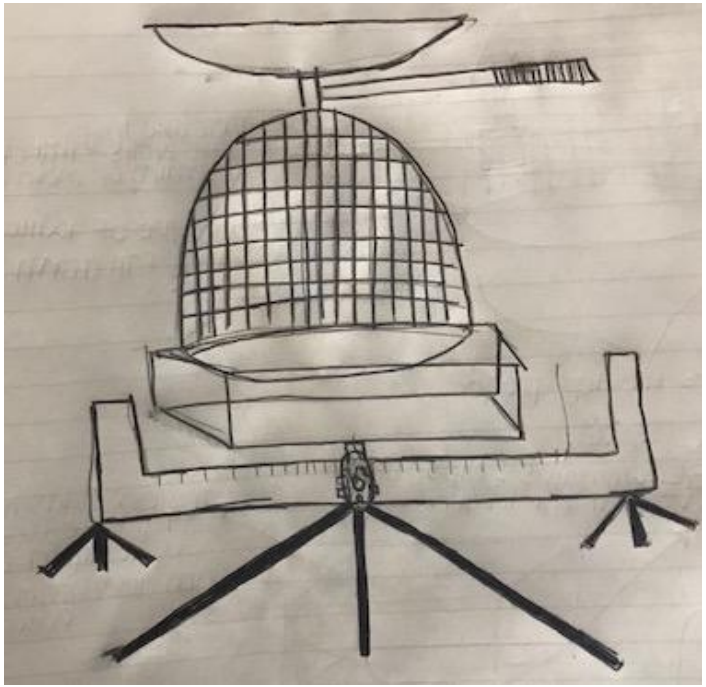
- 5 degrees of freedom:
  - Y and z rotation
  - Translation along all three axis
- 100 micron precision
- Interchangeable stages for different subjects.
  - detached human eye
  - a thirteen lined ground squirrel
  - a white mouse
- Sterilizable



Design Criteria

- Precision
  - How accurate within 1 mm
- Usability
  - How easily stage can be adjusted (rotational/translational)
- Height
  - Below 15 cm
- Amount of Rotation
  - Amount that device can rotate around the focal point (pitch/roll)
- Ease of Build
  - For us to make and someone else to fabricate
- Cost
  - $250 (manufacturing and testing included)
- Safety
  - How safe the device is for the user

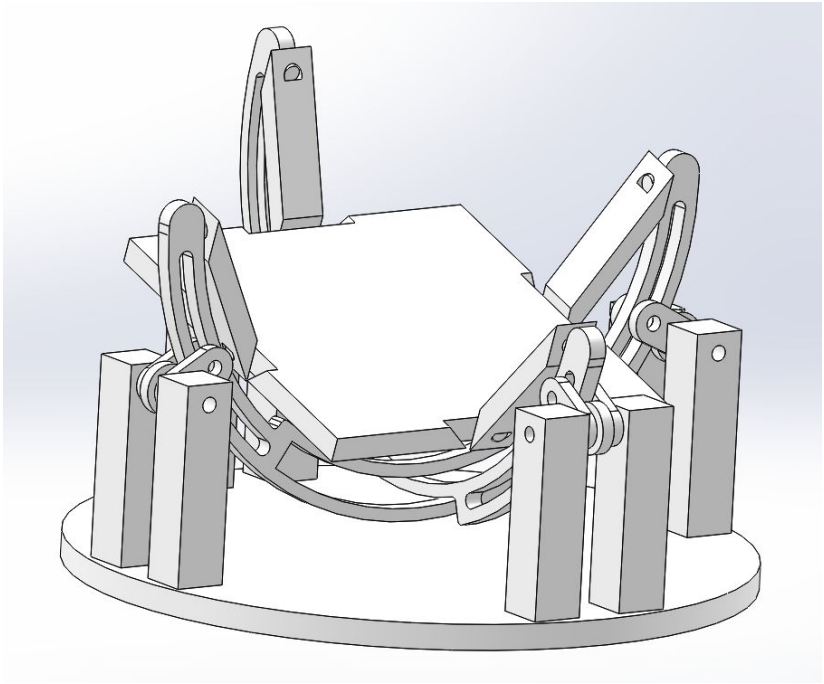
Design 1 - The Park



Design Features:

- A handle for precise rotational movement
- A hollow Semi-Circle for Rotational movement
- Small Rounded walls for movement and setting capabilities
- A gear track attachment for and translation.
- Tripod legs used for stability of the whole device

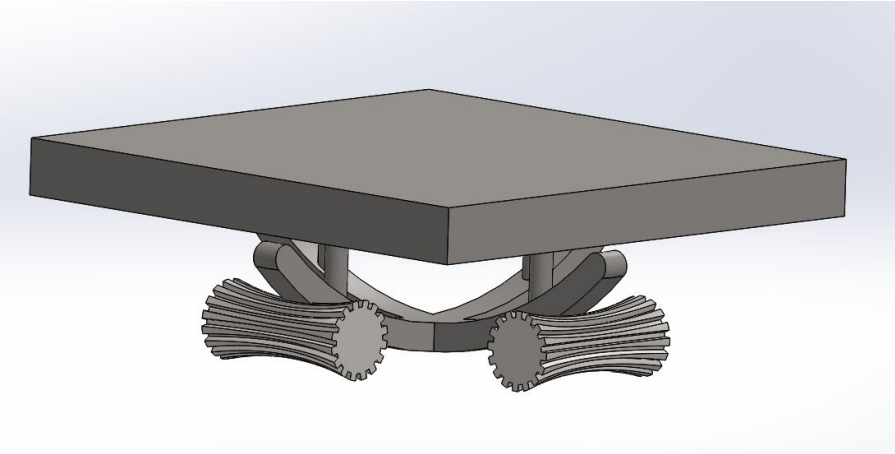
Design 2 - The Rigamortis



Design Features:

- Fine and coarse adjustment knobs
- Sliding tracks for rotational movement
- Hollow section in curved rack for the insertion of other curved rack piece
- Large square base
- Modular attachment for varying sized subject holders

Design 3 - The Rocking Chair



Design Features:

- Large, wide square stage
- Stage rests atop curved rack
- Curved gears allow rotation about the x and y axes
- One axis acts as a gear while the other acts as a sliding track.

Design Matrix

Design Aspect	Weight	**Design 1: The Park Rank (1-5)**	Weighted Rate	**Design 2: The Rigamortis Rank (1-5)**	Weighted Rate	**Design 3: The Rocking Chair Rank (1-5)**	Weighted Rate
Precision	35	3	21	4	28	4	28
Usability	25	3	15	5	25	2	10
Height	15	4	12	2	6	2	6
Amount of Rotation	10	2	4	3	6	1	2
Ease of Build	5	3	3	3	3	3	3
Cost	5	4	4	5	5	5	5
Safety	5	5	5	5	5	5	5
Total:	**100**		**64**		**78**		**59**

Future Work

- Draw up Solidworks designs for the translational movement in the x, y, and z coordinates
- Integrate The Rigamortis design into a piece for rotation around the z axis.
- Modify the current rotational designs
- Add modular pieces for imaging different subjects
- Test design

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References

1. E. S. Perkins and H. Davson, “Human eye,” Encyclopedia Britannica, 22-Jun-2018. [Online]. Available: https://www.britannica.com/science/human-eye. [Accessed: 21-Sep-2018].
2. E. C. Cleary and S. R. Craven, “Thirteen-lined Ground Squirrels and Their Control,” Internet Center for Wildlife Damage Management. [Online]. Available: http://icwdm.org/handbook/rodents/13linedgroundsquirrel.asp. [Accessed: 21-Sep-2018].
3. L. Ballenger, “Mus musculus (house mouse),” Animal Diversity Web, 1999. [Online]. Available: http://animaldiversity.org/accounts/Mus_musculus/. [Accessed: 21-Sep-2018].
4. Techmfg.com. (2018). CleanBench Laboratory Table. [online] Available at: https://www.techmfg.com/products/labtables/cleanbench63series [Accessed 1 Oct. 2018].
5. Kentscientific.com. (2018). Far Infrared Warming Pads | Mouse & Rat Warming | Kent Scientific. [online] Available at: https://www.kentscientific.com/products/far-infrared-warming-pads/ [Accessed 1 Oct. 2018].
6. Merino, D. and Loza-Alvarez, P. (2018). Adaptive optics scanning laser ophthalmoscope imaging: technology update.