

Calibrated Eye Dropper

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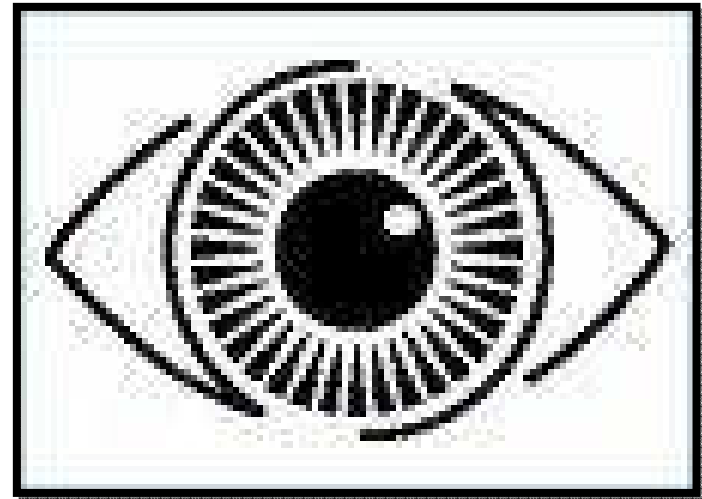
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Points of Interest

- Problem Statement
- Motivation
- Design Criteria
- Current Devices
- Design Alternatives
- Final Design
- Potential Problems
- Future Work
- References
- Questions



Problem Statement

- Department of Ophthalmology & Visual Sciences
- Glaucoma therapy testing using animals
- Use micropipettes to deliver drugs in 5 μ L volumes
 - Time consuming
 - Endangers the animals
 - Inaccurate placement of drops
- Must optimize accuracy, efficiency, and animal safety in drug delivery

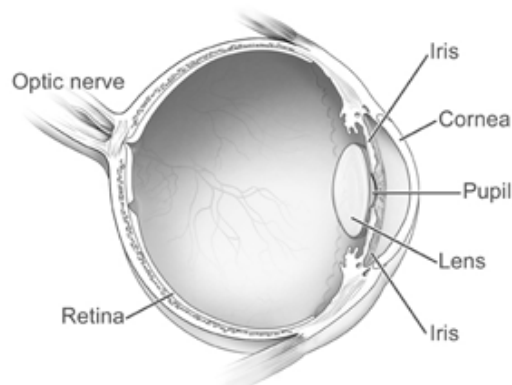


<http://www.biotech.ucdavis.edu/TBCWebsites/TBC07/Forensics/Thatcher&Vejnovic-Benicia/site/tools.html>



Motivation

- What is Glaucoma?
 - Eye disease where pressure slowly rises
 - Causes optic nerve damage which may lead to vision loss
- Medication available in the form of drops or pills
- Drops must be delivered to central cornea
- Animal testing to learn effects of drugs in the treatment of glaucoma



http://www.nei.nih.gov/health/glaucoma/glaucoma_facts.asp



Design Criteria

- Delivers 5 μ L with less than 1% error
- At least 3.5" length
- Prevents eye injury
- Minimize time per delivery
- Delivers different viscosities
- 2,000 uses per month
- \$200 budget



Current Devices

MiniFIX from Dynalab



http://www.dynalabcorp.com/news_micropipette.asp

Microzipette Hand Held Dispenser



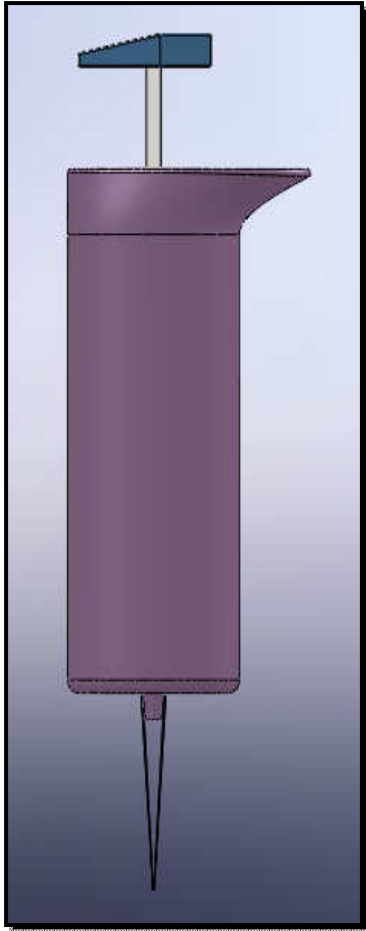
<http://uk.vwr.com/app/Header?tmpl=/jenc ons/microzip.htm>

Micropipette Plus from Eppendorf



<http://www.eppendorfna.com/script/binres.php?RID=88121>

Miniaturized Pipette



- Retains 5 μL drop accuracy
- Increases stability in hand
- Condense spaces between internal elements
- Prefabricated spring and piston calibrated to 5 μL
- Shortened shaft for piston
- Reduced but ergonomic gripping area



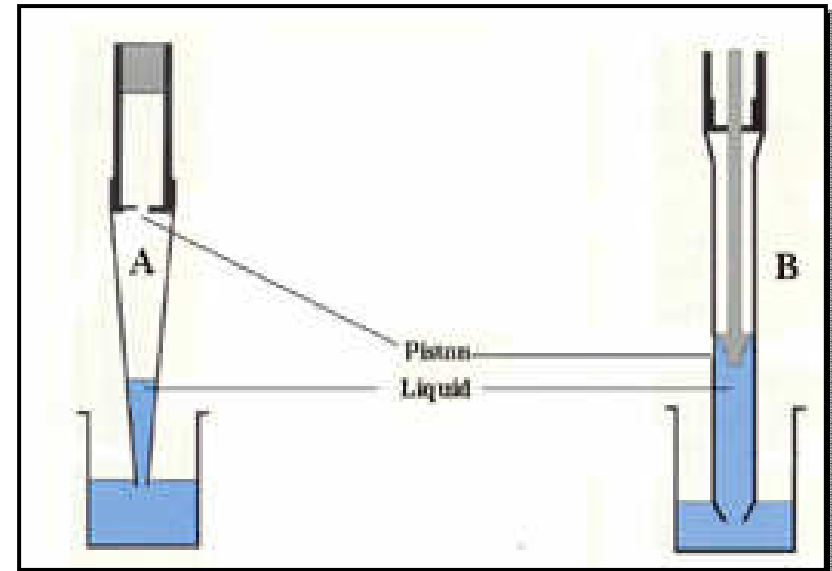
Flexible Straw



- 5-15 mL holding tank
- Flexible tubing from tank to pipette tip
- One-way valve to prevent spilling
- Move to tip to draw up drug
- Move away to dispense
- Disposable holding tank and tubing

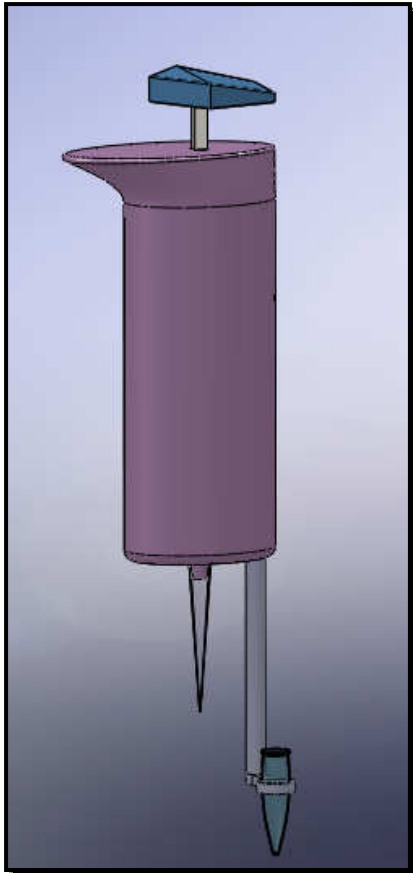
Positive Displacement

- 5-15 mL reservoir with tube
- Displacement by disposable piston
- Drug flows from reservoir into tip due to gravity
- Piston forces liquid out
- High accuracy



http://www.calibrationtech.ie/admin/UserFiles/Image/tech_info_pipette_5.JPG

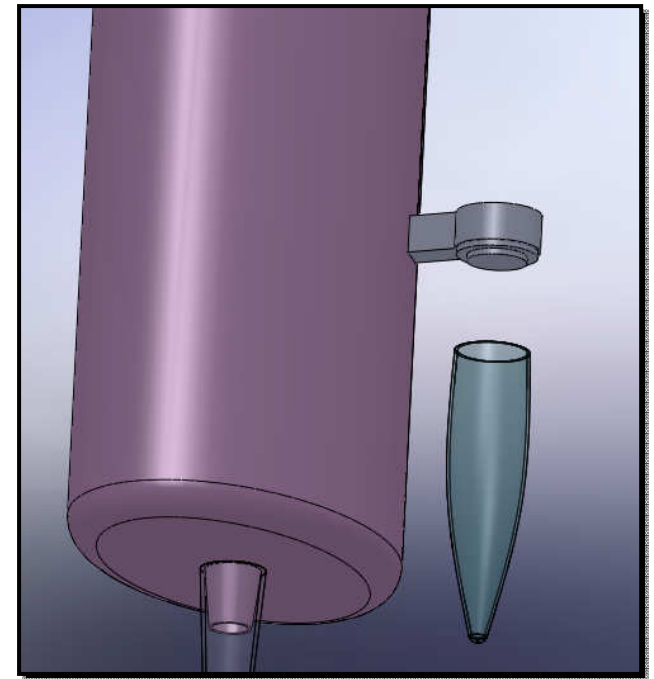
Sliding Reservoir Design



- Track incorporated into micropipette
- Reservoir attached to sliding track
- Track extends manually
- Rotation allows correct reservoir position

Eppendorf Clip

- Removable Eppendorf on side of pipette
- Attaches to a cap shaped part
- Secure fit, can be set on side
- Pipette refilled normally
- Eppendorf returned to cap during dispensing
- Air displacement, standard tips and Eppendorfs



Design Matrix

Criteria (possible points)	Flexible Straw	Eppendorf Track	Positive Displacement	Eppendorf Clip
Accuracy (30)	27	30	24	30
Speed (25)	20	18	25	22
Size/Safety (20)	17	17	17	17
Cost (10)	5	8	3	10
Feasibility (10)	6	8	1	9
Ease of Use (5)	3	4	3	4
TOTAL (100)	78	85	73	92

Potential Problems

- Location of Eppendorf cap on pipette
 - Interference with hand and tip visibility
- Removal of Eppendorf cap
- Miniaturizing the pipette/fabrication
 - Very tight tolerances
- Calibration



Future Work

- Finalize Design Specifics
 - Dimensions
 - Eppendorf cap connection
 - Placement of eppendorf
 - Overall shape/aesthetics
 - Incorporate all factors of ergonomics
- Build a Prototype
 - Adaptation/modification of commercially available parts
- Testing
 - Water Test
 - Assembly/disassembly
 - User compatibility



References

- Department of Ophthalmology & Visual Sciences
- http://www.nei.nih.gov/health/glaucoma/glaucoma_facts.asp
- http://www.calibrationtech.ie/admin/UserFiles/Image/tech_info_pipette_5.JPG
- http://www.dynalabcorp.com/news_micropipette.asp
- <http://uk.vwr.com/app/Header?tmpl=/jencons/microzip.htm>
- <http://www.eppendorfna.com/script/binres.php?RID=88121>



Questions?

