Strabismus Research Foundation
Board of Directors Meeting
2017.07.13

Medical Arts Building • 2000 Van Ness Ave • San Francisco
srfsf.org • eidactics.com

Agenda

Tour

Finances

- Budget
- Investments
- Grants
  - “Extraocular Muscle Responses to Bupivacaine Injection” (NIH/NEI • 2009-13 • $3,359,206)
  - “Accurate Injection of Eye Muscles in Children” (Scott Family Foundation • 2014-15 • $81,300)
  - “Treatment of Apraxia by Electrical Stimulation of the Levator” (SFF • 2014-15 • $80,222)
  - “Accurate Injection of Eye Muscles in Children” (Knights Templar Eye Fdn • 2016-17 • $62,312)
  - “Optimizing Injection Treatment of Strabismus” (NIH/NEI R21 • req start date 2018.04 • $428,552)

Facilities

- Eidactics & SRF sharing MAB-209 & 210
- Websites: srfsf.org • eidactics.com

Projects [slides]

- Drug treatment of eye muscle disorders
  - Accurate Injection of Eye Muscles in Children
  - Optimizing Injection Treatment
- Electric stimulation of eye muscles
  - Functional Electrical Stimulation for Lid Apraxia in Blepharospasm

Continuity of SRF

Two Kinds of Biomedical Research

Explanatory Research

AKA: “Controlled Experiments”

Pragmatic Research

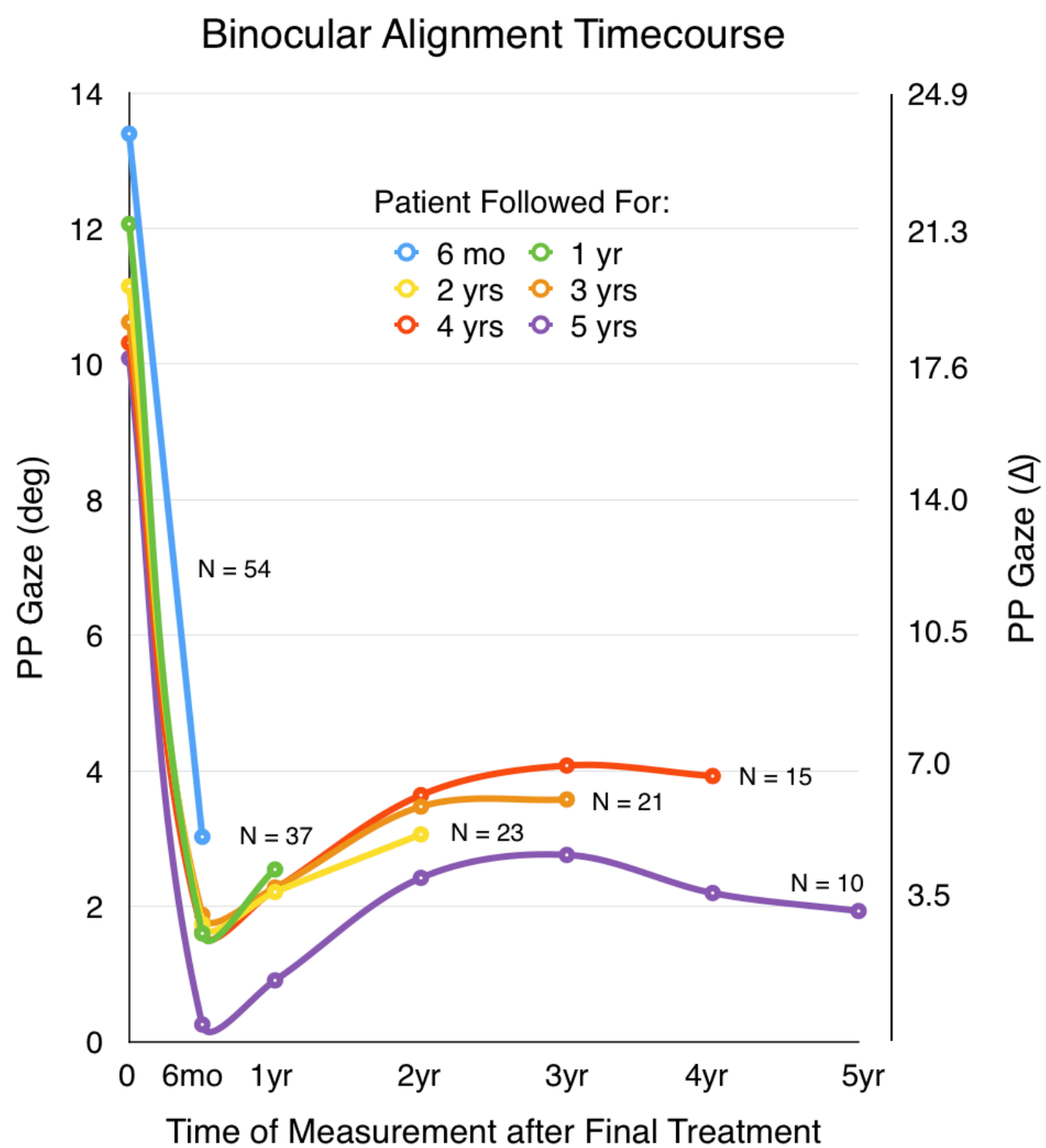
AKA: “Clinical Research”

Clinical research projects are often denigrated as “pilot studies” – useful but not up to rigorous scientific standards. However, this widely & tenaciously held view is false & destructive. There are actually two quite different kinds of biomedical research, each with its own strengths & weaknesses [after Schwartz & Lellouche 1967].

Test hypotheses about underlying processes	↔	Make real-world treatment decisions
Experimental & control groups are large & uniform	↔	Subjects are typical patients
Treatments are strictly controlled	↔	Treatments are flexible, to best benefit each patient
Studies are conducted under laboratory conditions	↔	Studies are conducted in the flow of a physician’s normal practice
Results are assessed with tests of statistical significance	↔	Assessment also considers patient interests and costs
Generally more appropriate for animal subjects (subjects are treated more as means than as ends)	↔	Ethical for human subjects
Drug companies love controlled, large-group tests because they can demonstrate superiority of treatments having little or no practical advantage	↔	Any statistically significant differences found with highly variable subject populations and treatments will be large, with practical significance

Drug treatment of eye muscle disorders

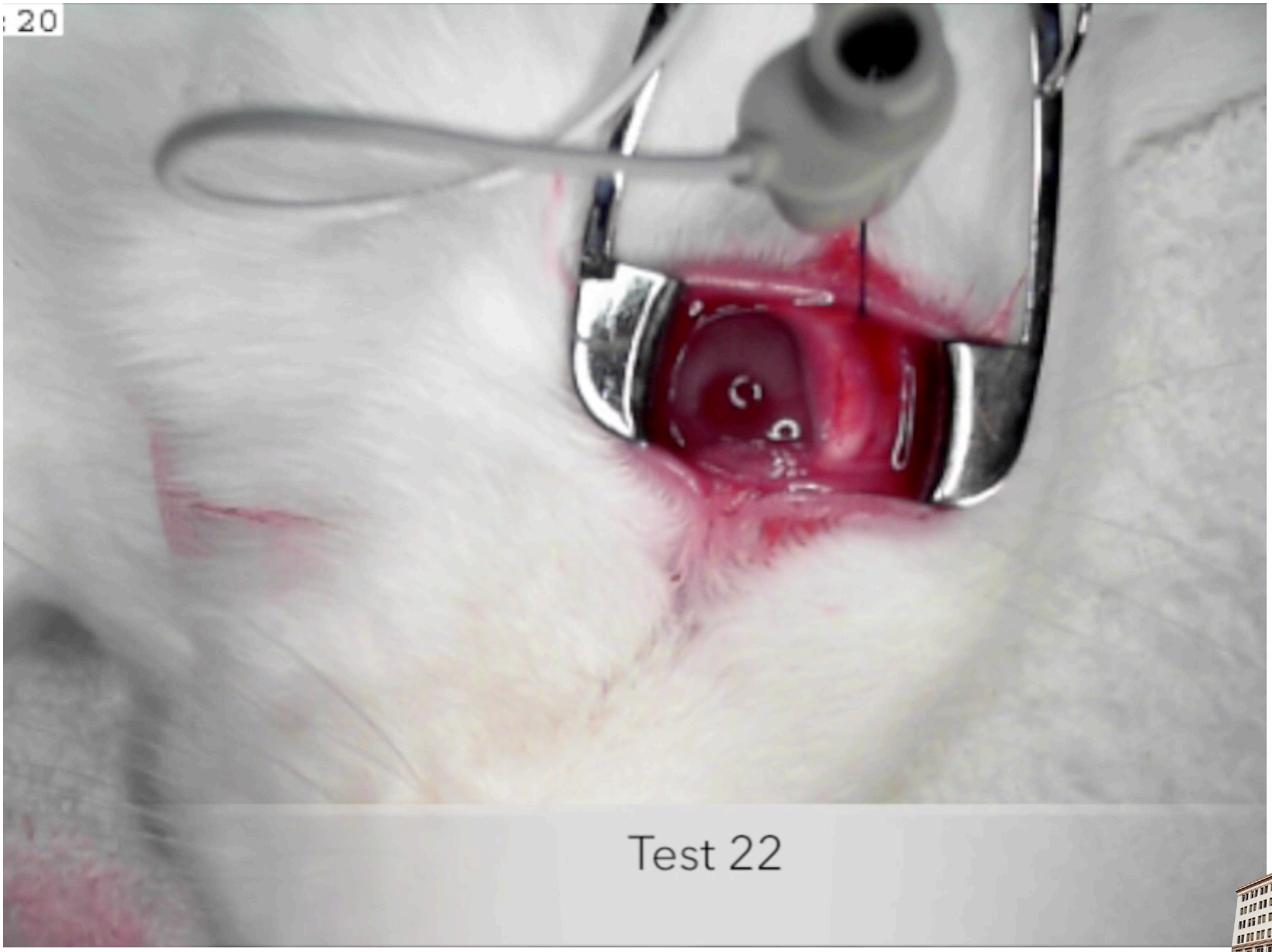
- Botulinum A toxin was the first successful injection treatment for strabismus, and the first therapeutic application of this toxin.
- Bupivacaine, a current interest, is the first clinically proven injection treatment that strengthens and shortens muscles.
- The low intrinsic cost of such injection treatments will help reduce medical expenses domestically, and make strabismus correction available in poor nations, where it would otherwise be unaffordable.



Project:
Accurate Injection of Eye Muscles in Children

- In awake cooperative adults, botulinum toxin – and now, bupivacaine – can be accurately injected into eye muscles by recording electrical activity (EMG) from the tip of the injection needle, which is advanced until the relationship of the signal to the patient's voluntary eye movement indicates desired placement.
- But most strabismus patients are children, who must be briefly anesthetized to accept injection treatment, and no movement-related electrical activity can then be recorded.
- An anesthetized muscle can, however, be readily stimulated, and we have determined the parameters of effective stimulation to produce eye movements characteristic of optimal needle placement. We have developed and manufactured a stimulating device based on there studies, and are evaluating its effectiveness on young strabismus patients.
- [Supported by the Scott Family Foundation, Pacific Vision Foundation, and Knights Templar Eye Foundation]

Anesthetized Rabbit

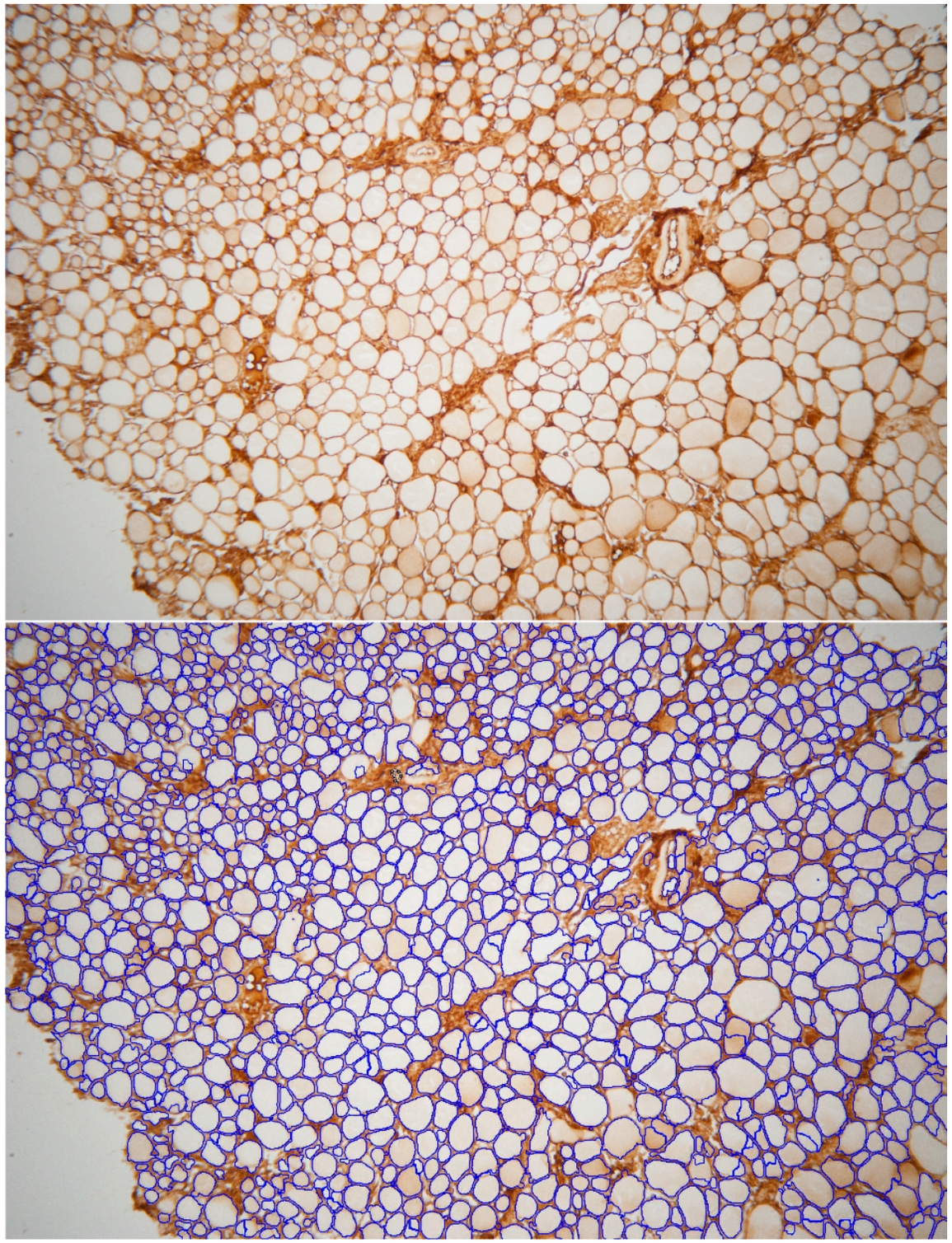


SRF STIM-EMG Device

Project: Optimizing Injection Treatment

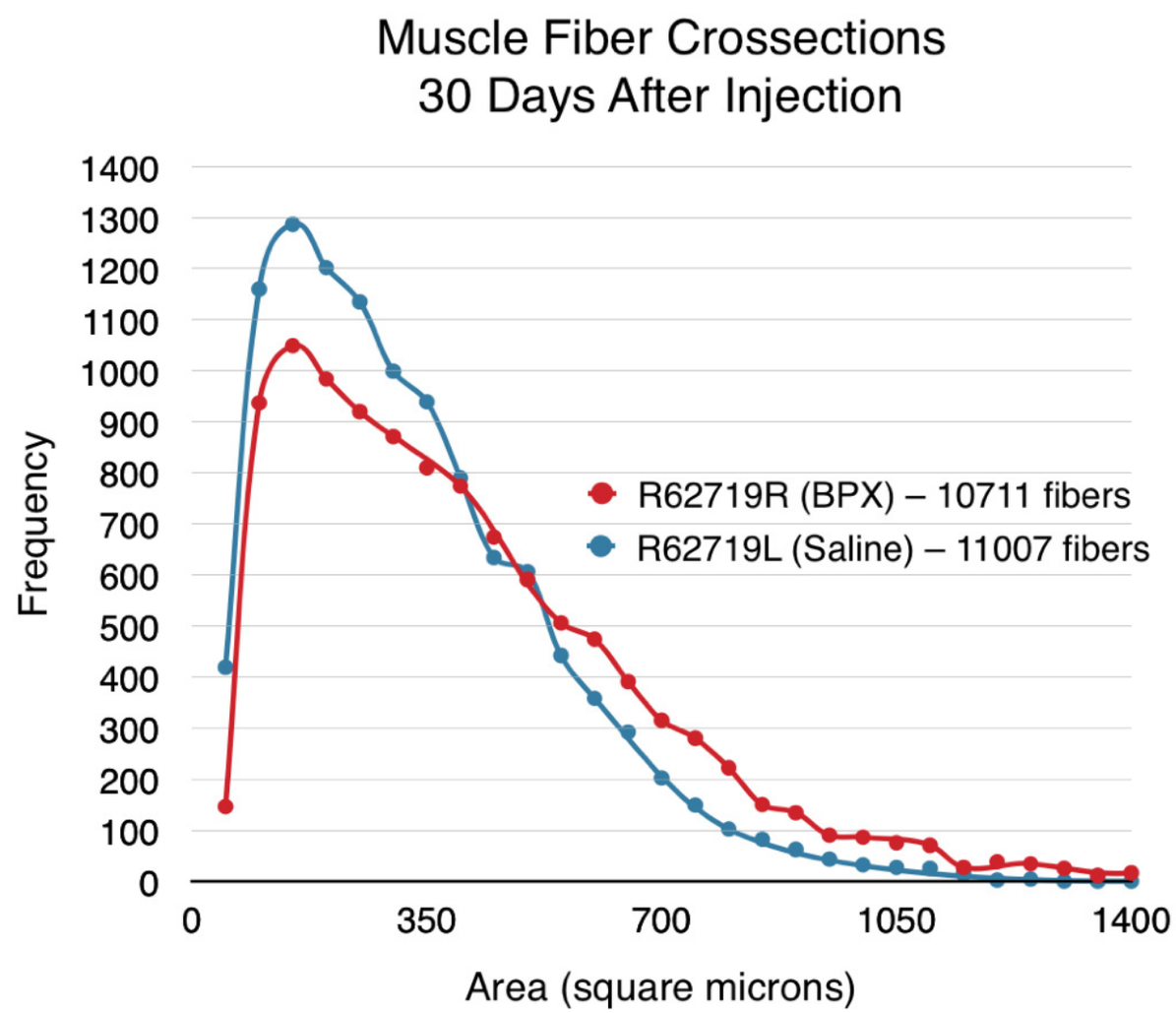
- Bupivacaine injection is a low-cost treatment for some types of strabismus, with success rates comparable to conventional surgery. However, the mechanisms behind its effectiveness are unclear, and the possibilities for therapeutic improvement are therefore limited.
- This project aims to develop a suitable animal model and the related tissue processing and image processing techniques to understand the effects of injection treatments on eye muscles.
- We must develop capabilities and expertise to do high-quality histology and immunohistochemistry.
- "Optimizing Injection Treatment of Strabismus" (NIH/NEI R21 • req start date 2018.04 • $428,552)

Project: Optimizing Injection Treatment



Histology (IHC) &

Computer-Assisted Analysis

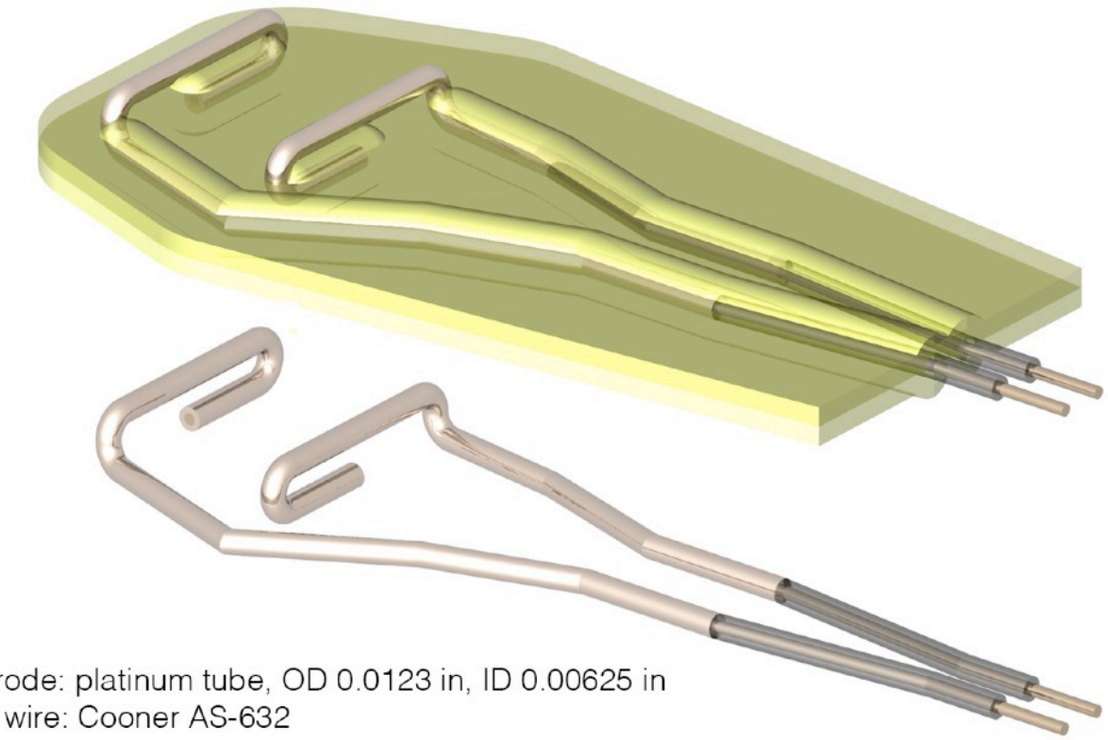


Project:
Electrical Stimulation for Lid Apraxia

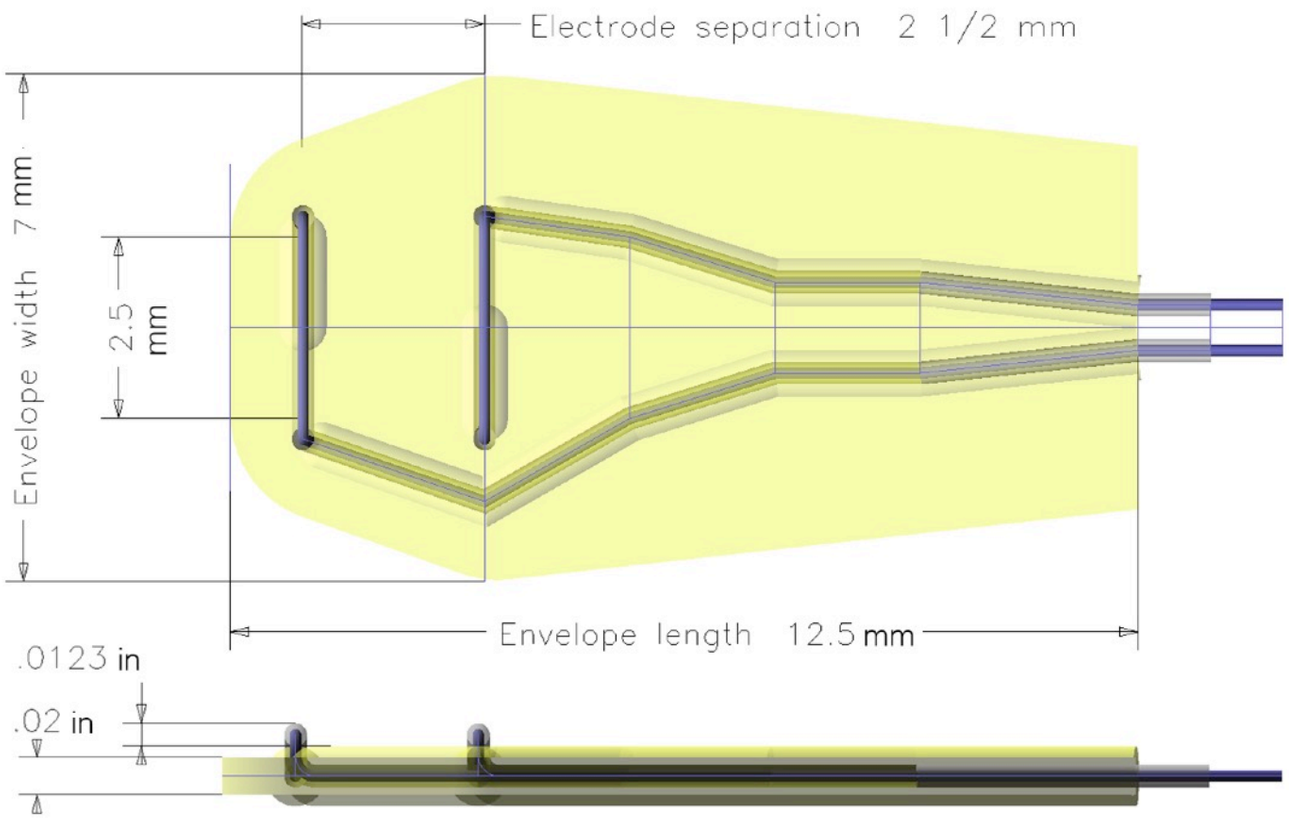
- Benign essential blepharospasm (BEB) deprives sufferers of functional vision, despite having normal visual systems. Uncontrollable spastic eyelid closure can be controlled with botulinum toxin injection, but inability to initiate or maintain eyelid opening (apraxia) remains disabling for many BEB patients. Electrical stimulation of the LPS muscle, which lifts the upper eyelid, should help.
- We have developed electrodes to stimulate the LPS nerve, and have established parameters suitable to lift the upper eyelid 2-3 mm in a rabbit model.
- A realistic stimulation regimen (6 mo, 5 days/wk, 6 hrs/day) resulted in little decline in response, little or no damage to ocular tissues, and no discomfort for the rabbit. A new electrode designed for better reliability must now be developed & tested.
- [Supported by the Scott Family Foundation]

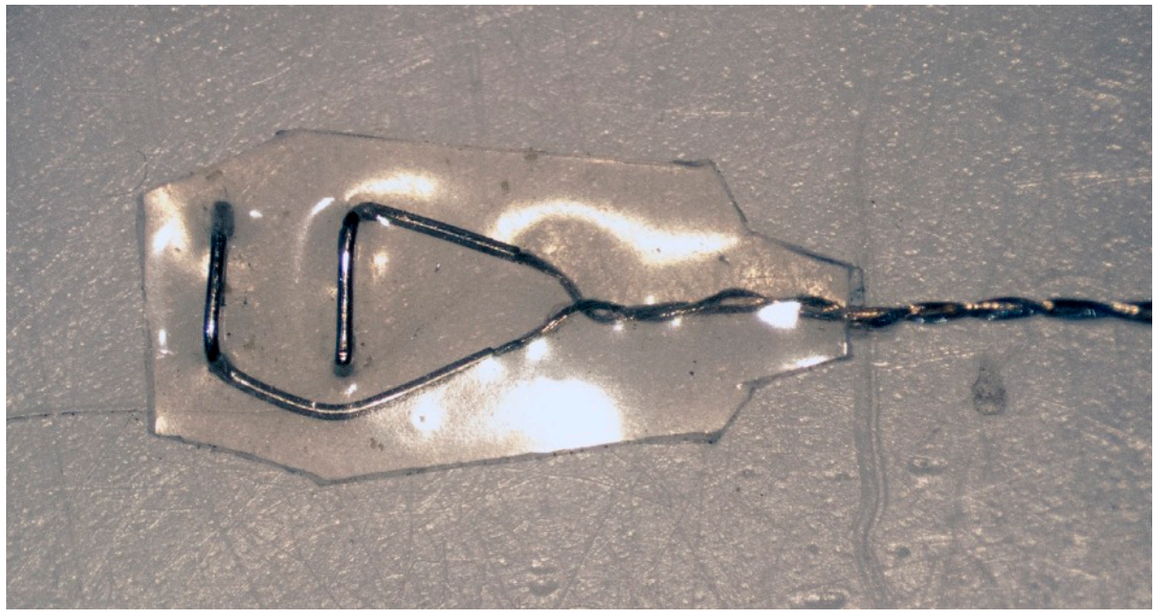
“Snake” Electrode Package

JM Miller • jmm@eidactics.com • 2016.02.06



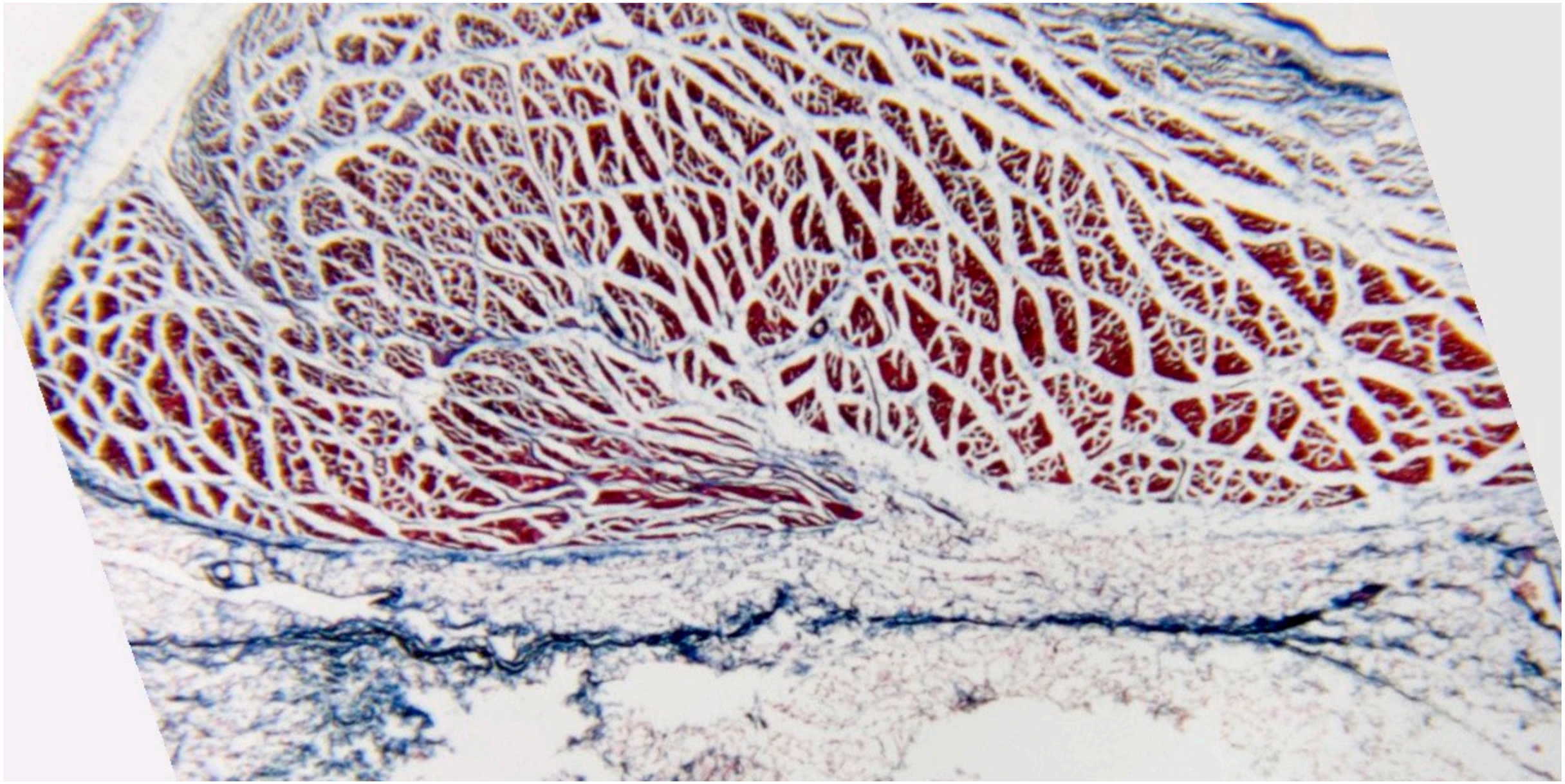
Electrode: platinum tube, OD 0.0123 in, ID 0.00625 in
Lead wire: Cooner AS-632
Envelope: Silicone rubber, thickness 0.010 in (top & bottom)






FES - LPS
Rabbit CRL-32
06.29.2017

Muscle Appears Undamaged by Stimulation



(Electrode on lower surface of muscle).

- Stimulation: ~0.2 mA, 200 Hz, 6 months, 5 days/week, 5½ hours/day.