Georgia Institute of Technology

BioSenSE Report

October 2007

V. V. Tsukruk

BioSenSE
Bio-Sensory Structure Emulation DARPA

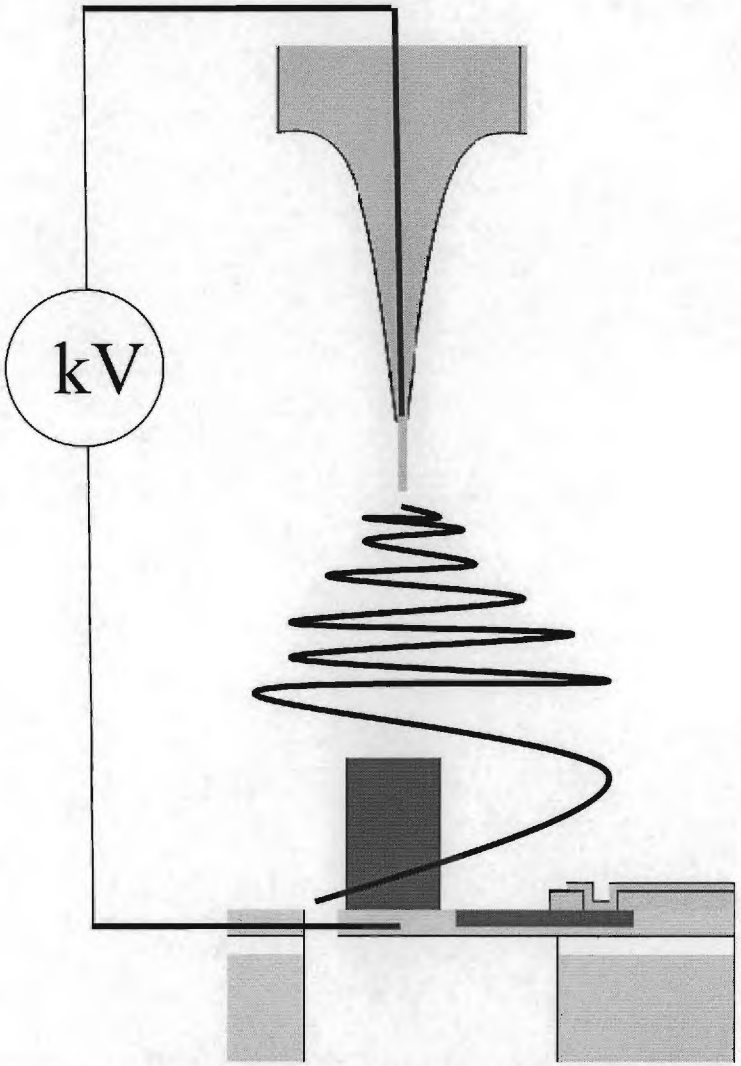
Major Findings

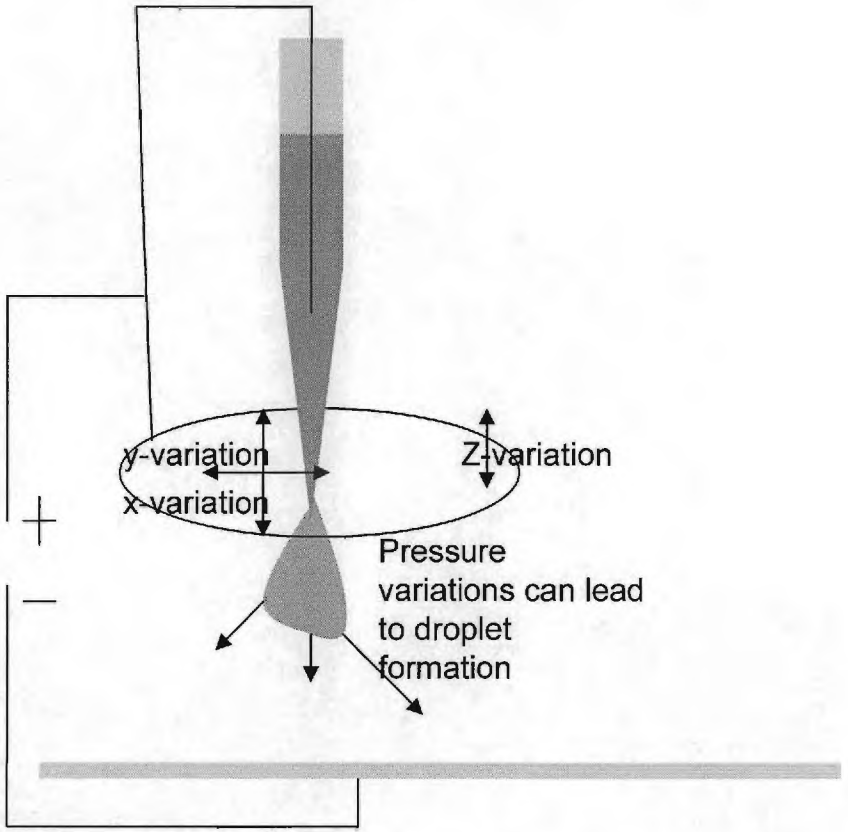
- Electro spinning with biased secondary electrodes can be employed for localized growth of a skeleton for future high-aspect ratio cupula
- Arraye d and shaped controlled cupulae can be grown with a proper photomask selection

Major Technology Advances

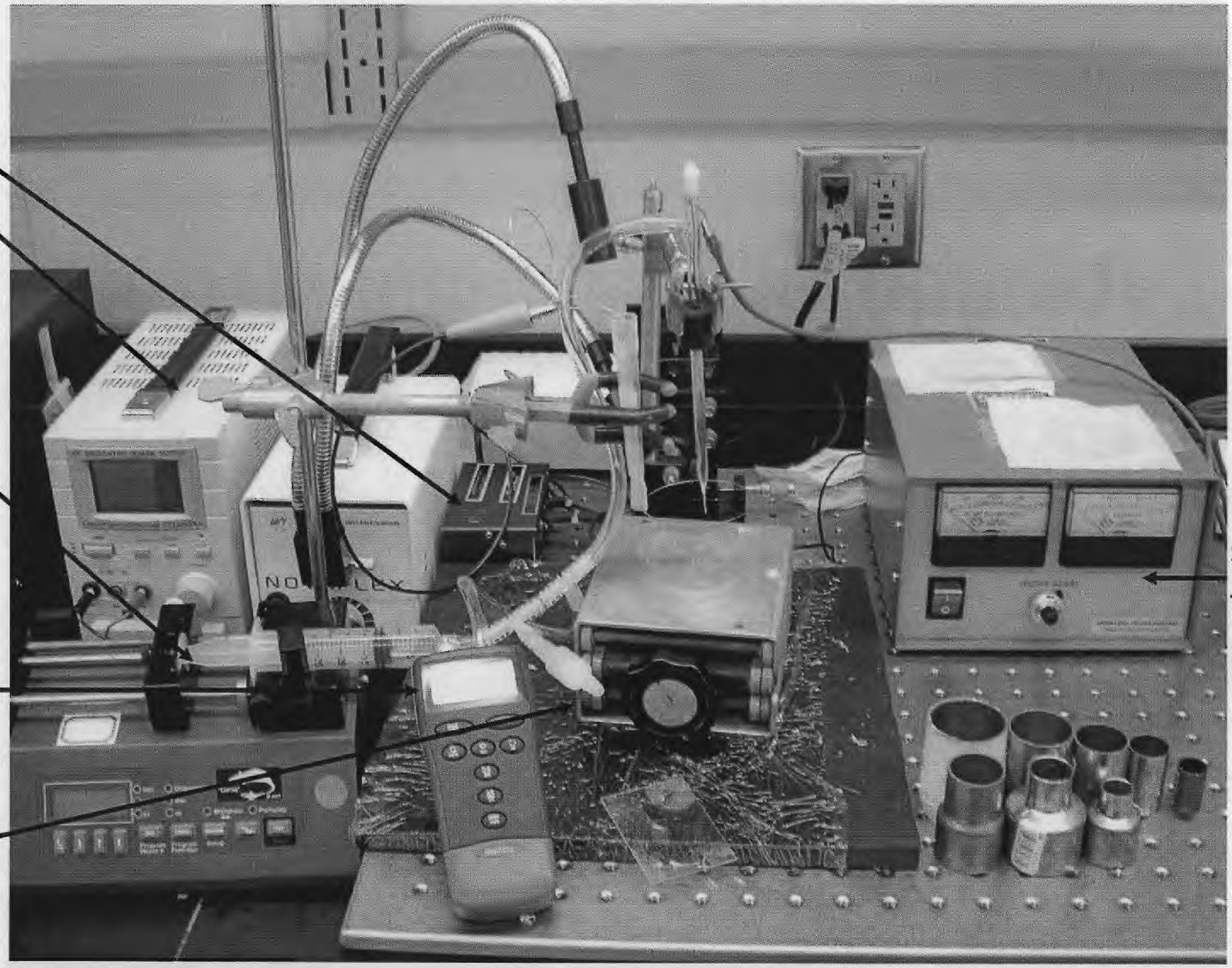
- The development of the lens system allowed the fibers to be spun onto one spot, instead of all over the place. Now control and repeatability of the spot location is the current focus
- Added separate power supply for the focusing lens to control polymer bias and lens bias separate
- Our commercially available cross-linkable PEO was batch-to-batch inconsistent. Hence, we worked to determine the problem and learned that our newest UV lamp had much more reproducible results, and were able to get good results again => Moon shaped and circle arrays successfully fabricated

Localized, hair-centered electrospinning



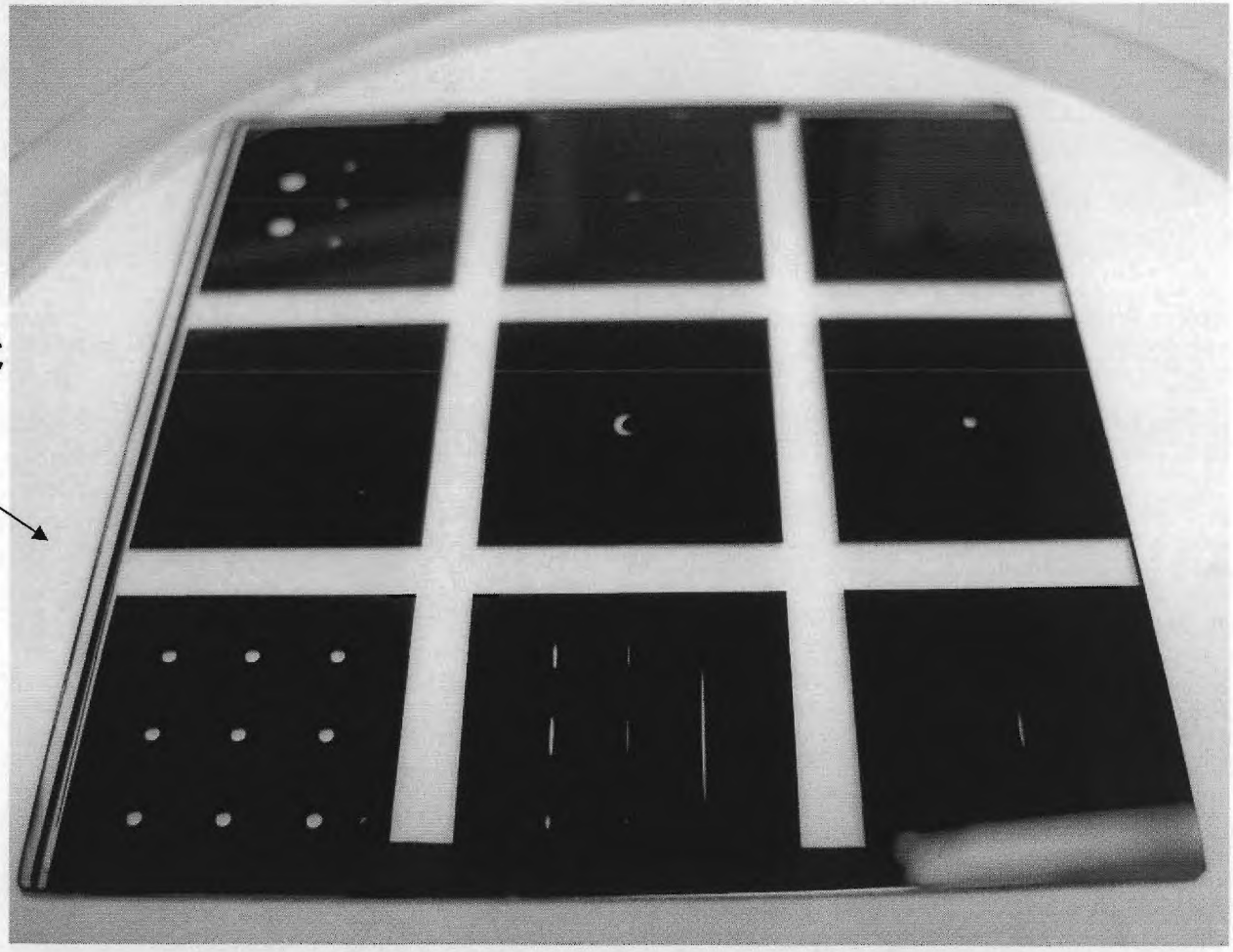


Electrospinning: system upgrade

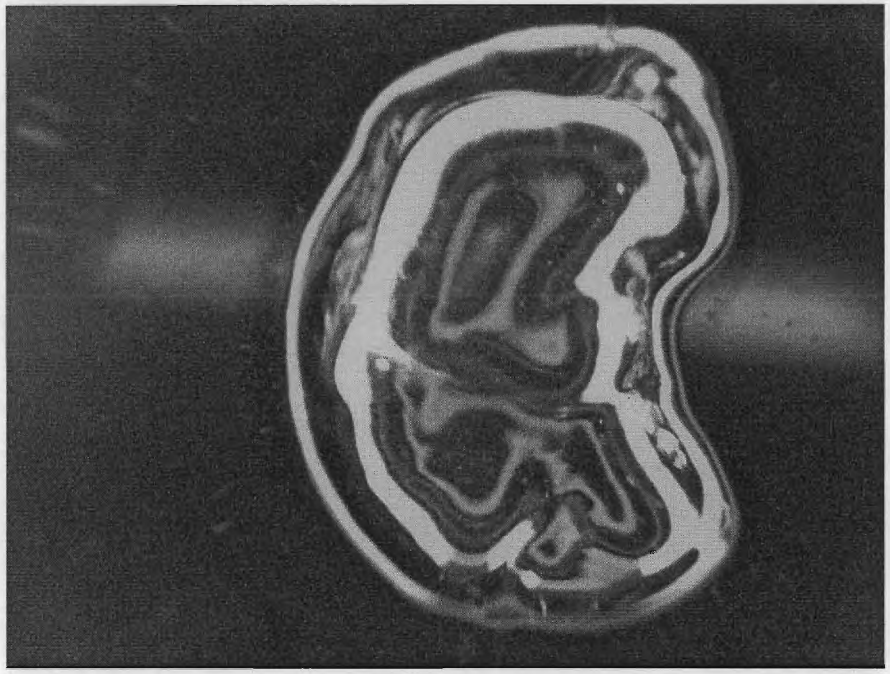


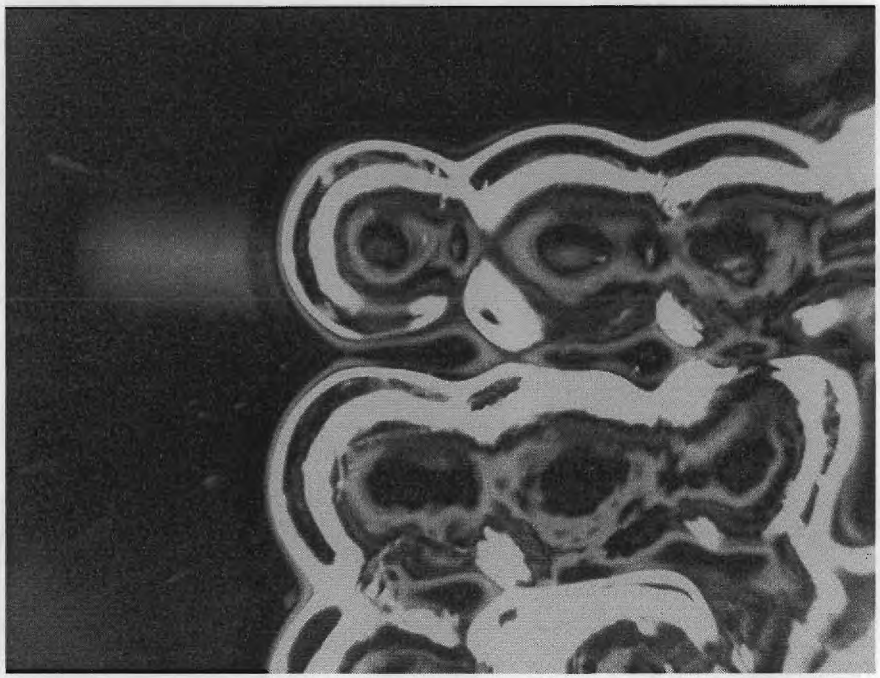
Shape Controlled Cupula

Mask fabricated by UIUC



Different Shaped Cupula





Future Work

- Still trying various polymers for optimized "skeleton" for high-aspect ratio cupula
- Precise shape and dimension control with optimized secondary electrode configuration
- Time/frequency-dependent response of artificial hydrogel materials
- Assist Pepe in cupula FEA modeling
- Plan new water tank testing with new superficial and in-canal cupulae with Chang and Horst
- Finish papers with Frederick/Pepe (spider hairs) and Sheryl (cupulae),

Obstacles and Challenges

- Need many, many more dummy hairs for optimization of cupula growth, now! (Chang)
- Need many dummy hairy sensors for optimization of cupula growth, now! (Chang)
- Need few working hairy sensors for water tank/oscillating ball experiments, October-November (Chang)

- Personal challenge: significant team changes

People Activity Tracker

- Personnel 1: Sergey Peleshanko: helped with cupula fabrication; moved to HP in August
- Personnel 2: Mike McConney: studied cupula properties and did cupula fabrication (high aspect ratio), worked at WPAFB, came back in mid-August
- Personnel 3: Kyle Anderson: a new graduate student, joint the group in August
- Personnel 4: David Lu: a new BS/MS student, joint the groups in August

RESEARCH AGENDA