Piezoelectric Polyvinylidene Fluoride Nanofibers

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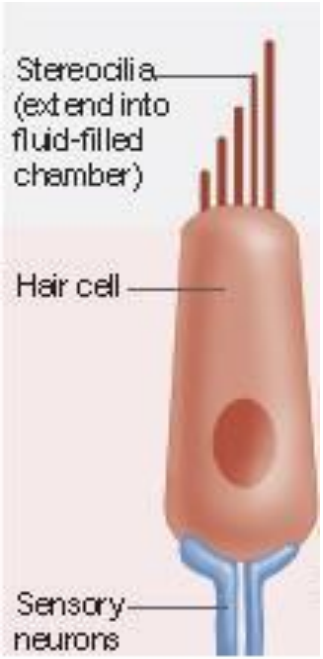
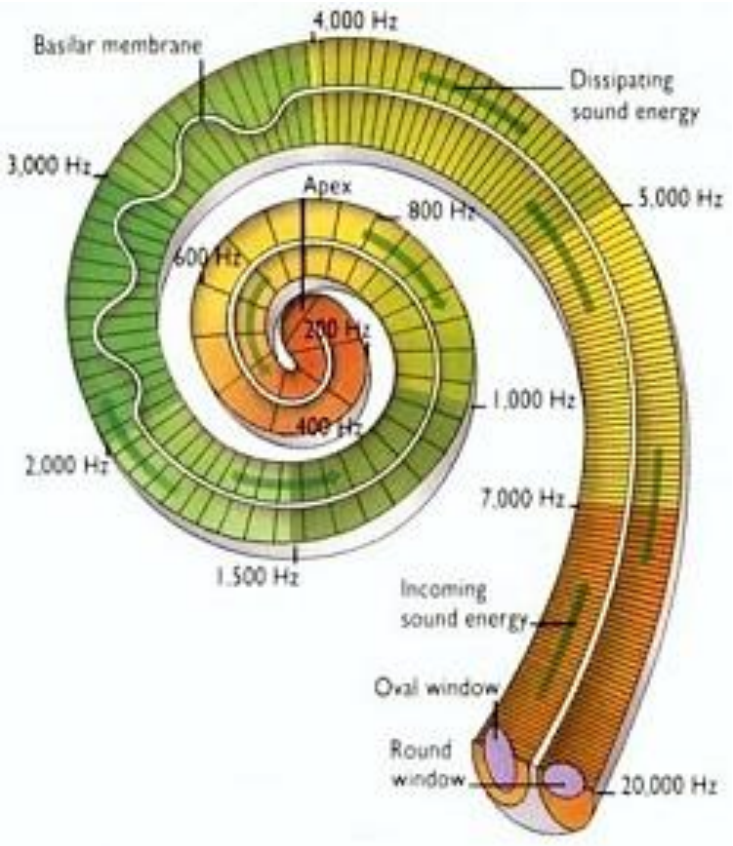
Purpose

- Piezoelectric nanofibers will be tested as a replacement for hair cells in the cochlea.
- The overall project is designing a solution for hearing loss using nanofibers.
  - Applicable when the patient has missing or dead hair cells.
  - Requires the auditory neurons to be undamaged.

Application

- The nanofibers would be used for the 200-2000 Hz range.
  - Human speech.





Competition

- A current solution for hearing loss is cochlear implants but they require an invasive surgery.
- Both solutions provide a way to stimulate the auditory neurons.

Preparation

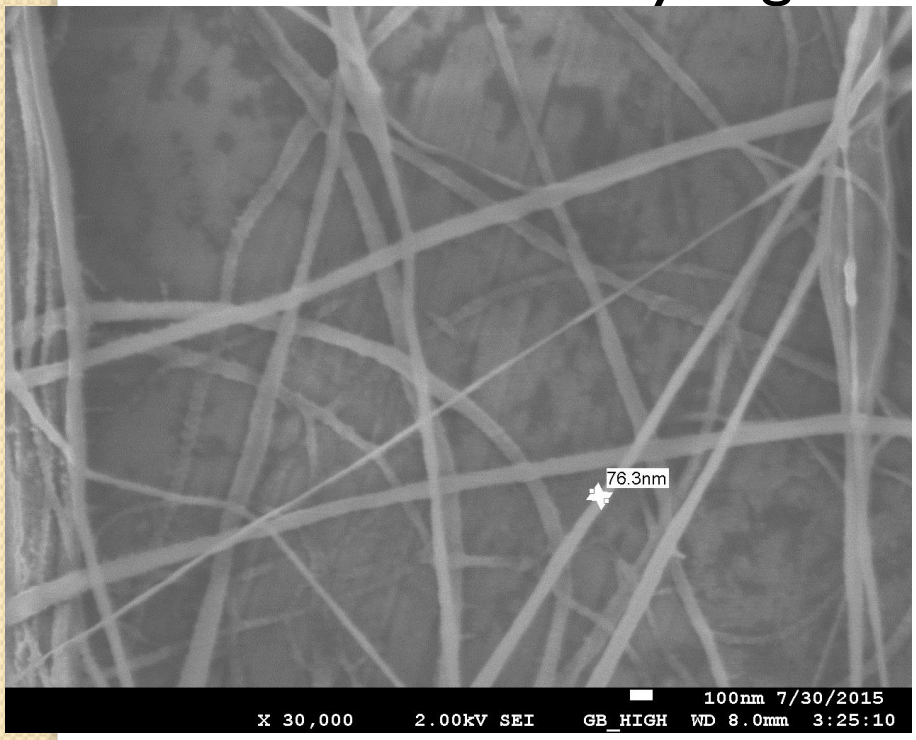
- Electrospinning was used to create nanofibers of PVDF.
- Requires a collector, syringe, solution, and a high voltage source.

END

Goal

- What did I want?
  - Piezoelectric nanofibers for a medical application.
    - Needed fibers with a diameter of 100 nm to promote self-poling in PVDF.
    - (Aligned structure of the fibers that provides the piezoelectric response we need.)
- How did I approach it?
  - Used electrospinning.
    - Good for fiber fabrication.
      - Expect size distribution to be log-normal

- How Did I characterize?
  - Scanning Electron Microscopy. (SEM)
  - Notice the randomly aligned fibers after disposition.



16 weight percent PVDF dissolved in DMF.

- Hair cell picture from http://wps.prenhall.com/wps/media/objects/489/500888/images/FG43_04.JPG
  Cochlea picture from https://classes.lt.unt.edu/Spring_8W1_2014/CECS_5420_080/epb0021/tonotopic_cochlea.jpg

Material

- My responsibility is to produce the piezoelectric nanofibers for the project.
  - Polyvinylidene Fluoride is an attractive choice for the fiber material.
    - Considered a biocompatible polymer.
  - Desire self-poled fibers to provide a good piezoelectric response.
    - The domains of the material should be well aligned.
    - This leads to a size constraint. A fiber diameter of 100 nm.