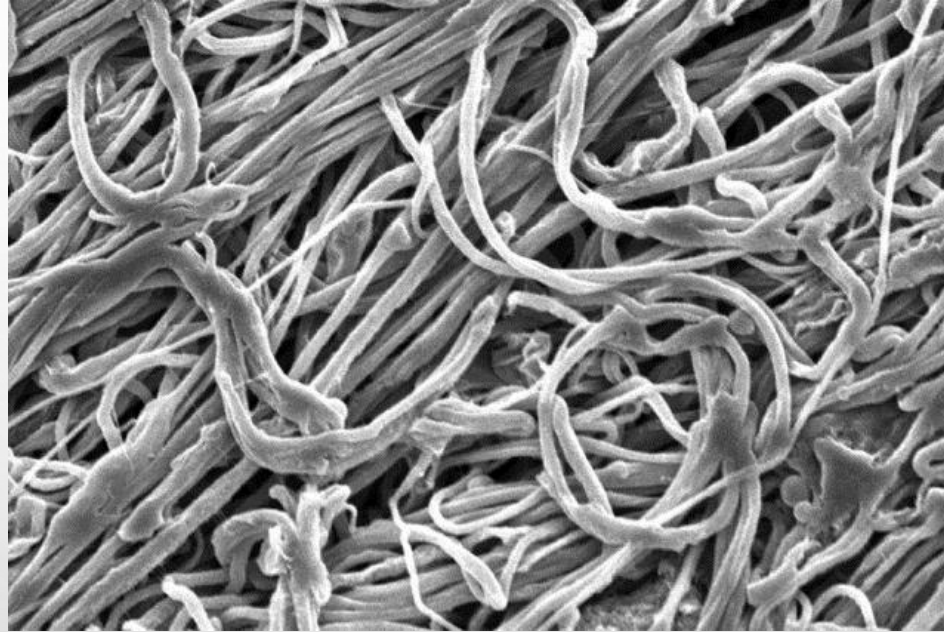


Nanofiber-base Refrigeration

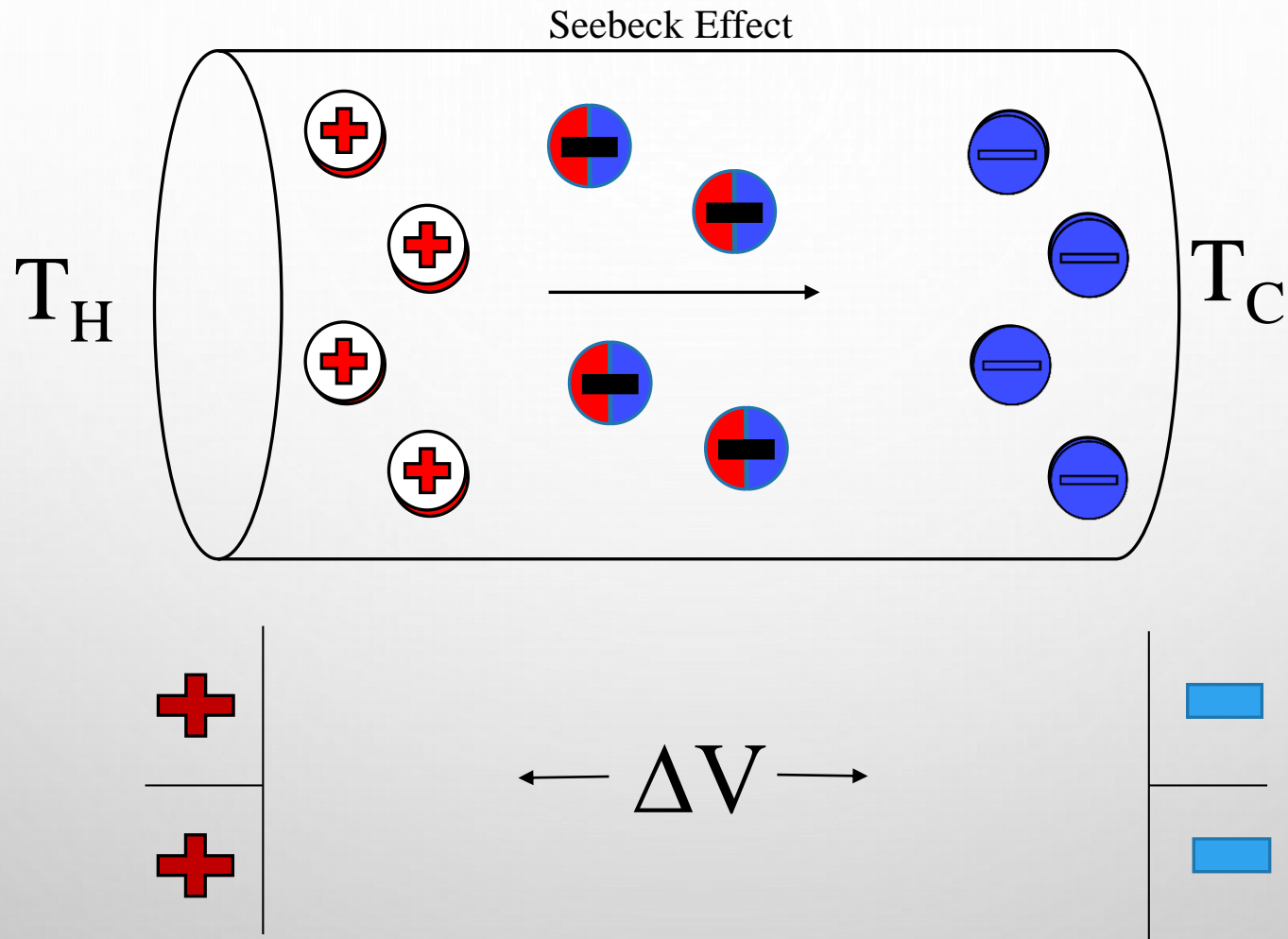


Alexandria Trevino and Bret Flanders

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Kansas State University

Thermoelectric Refrigeration

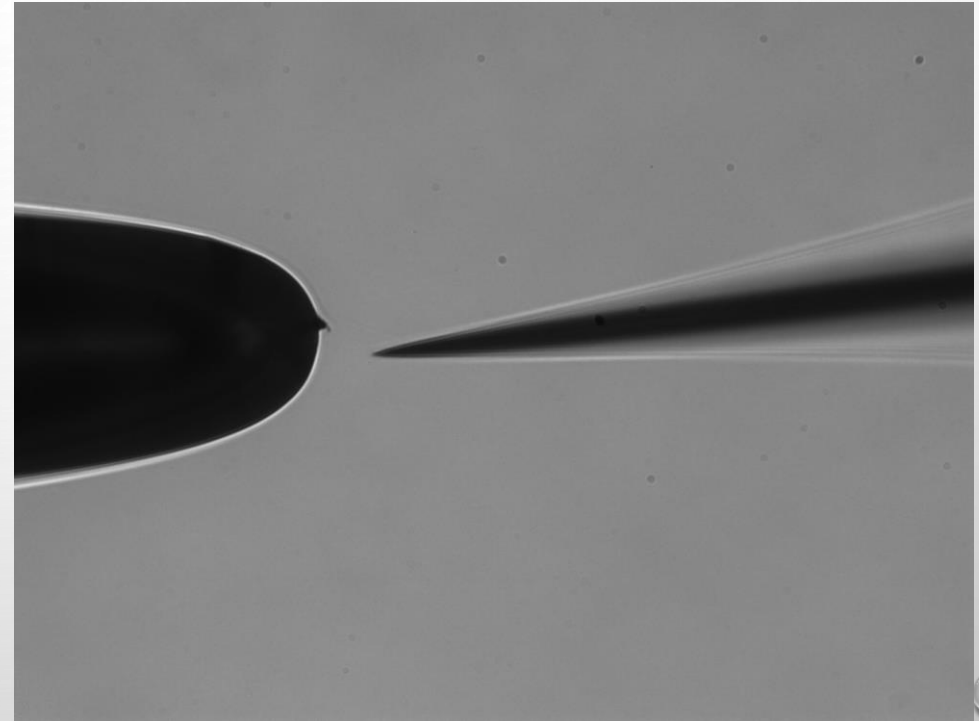
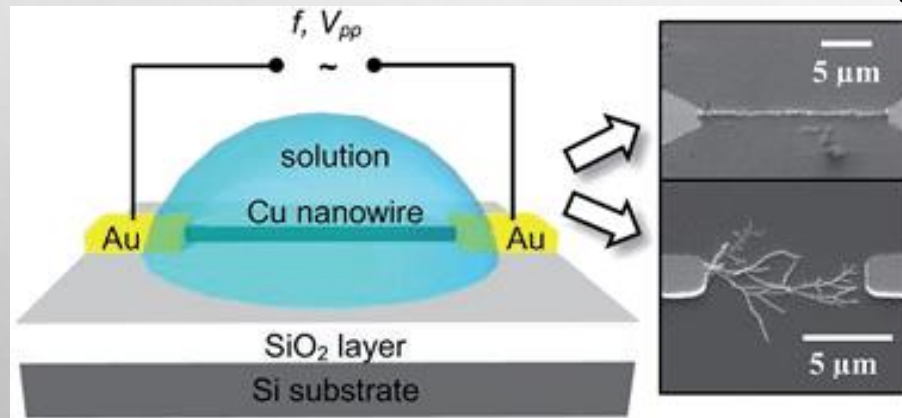


Directional Growth of polypyrrole and polythiophene wires

Prem S. Thapa, Deok Jin Yu, James P. Wicksted, Jeffrey A. Hadwiger, Joseph N. Barisci, Ray H. Baughman, and Bret N. Flanders

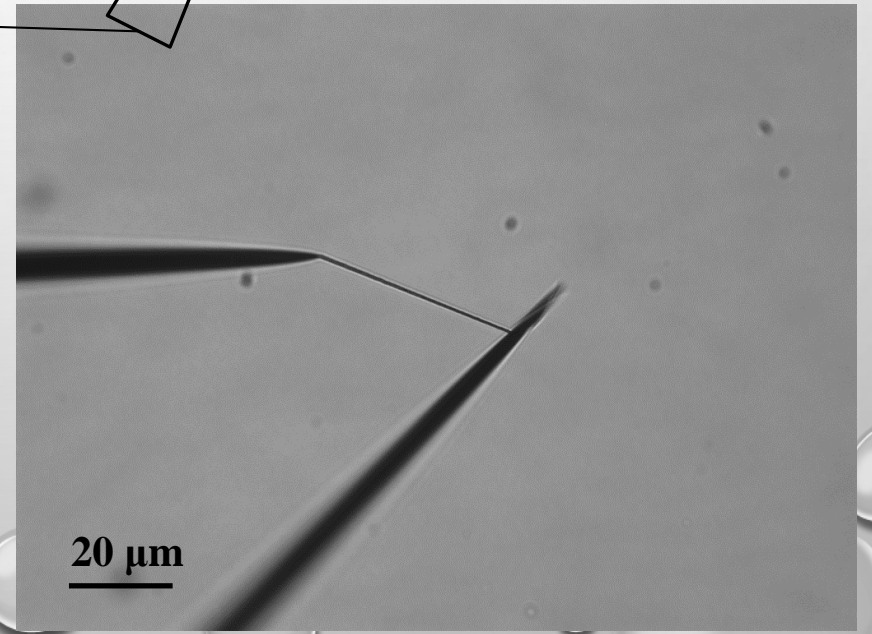
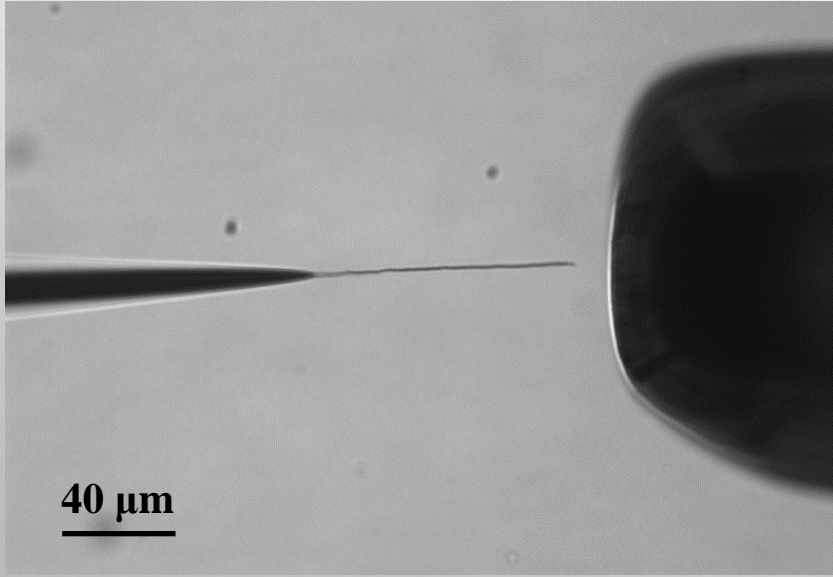
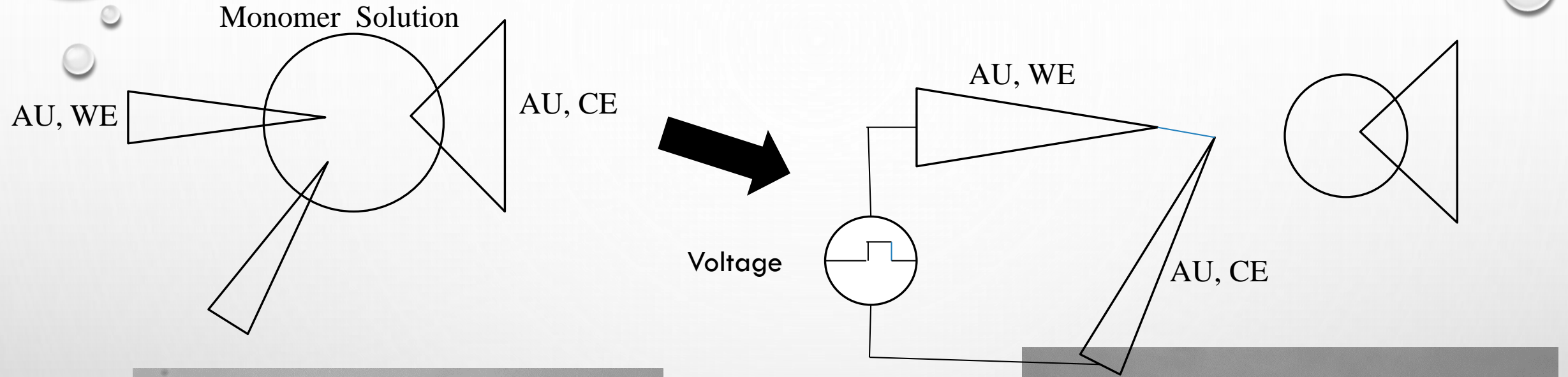
- Voltage-amplitude and frequency induces growth
- Knobby structure
- $Electrical\ conductivity = \frac{l}{RA}$

Directional electrochemical nanowire assembly

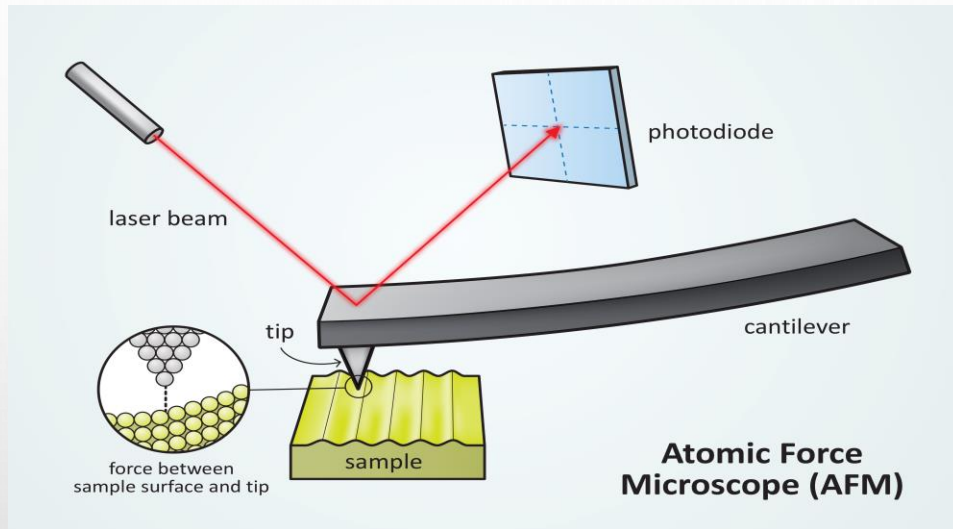


Thapa, P. S., Yu, D. J., Wicksted, J. P., Hadwiger, J. A., Barisci, J. N., Baughman, R. H., & Flanders, B. N. (2009). Directional growth of polypyrrole and polythiophene wires. *Applied Physics Letters*, 94(3), 033104. doi:10.1063/1.3072611

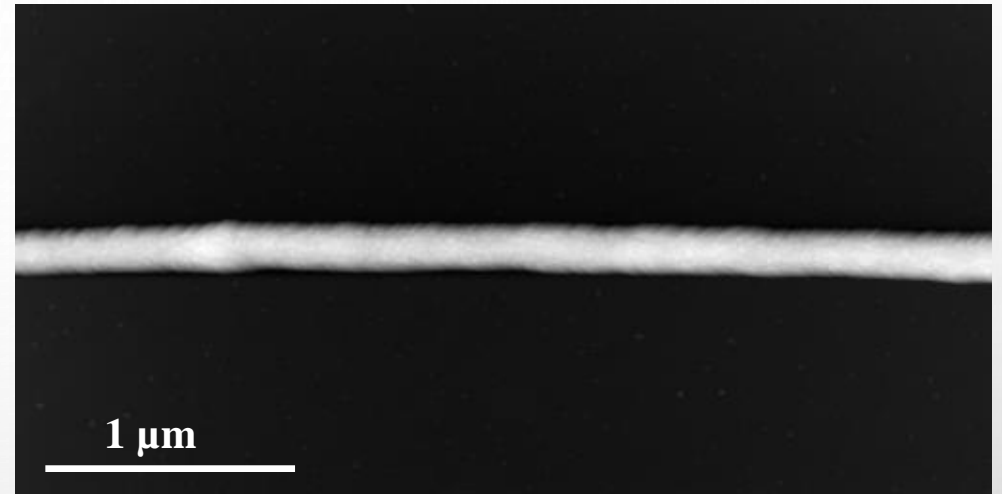
PEDOT:Heparin Growth



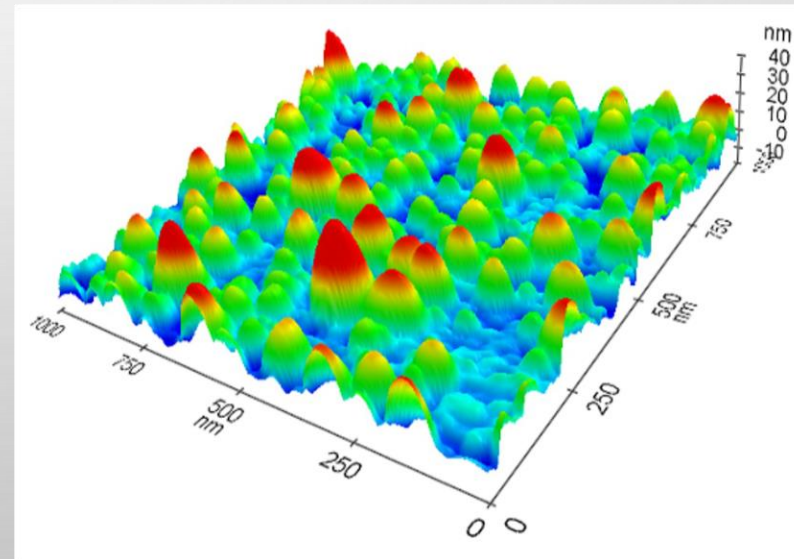
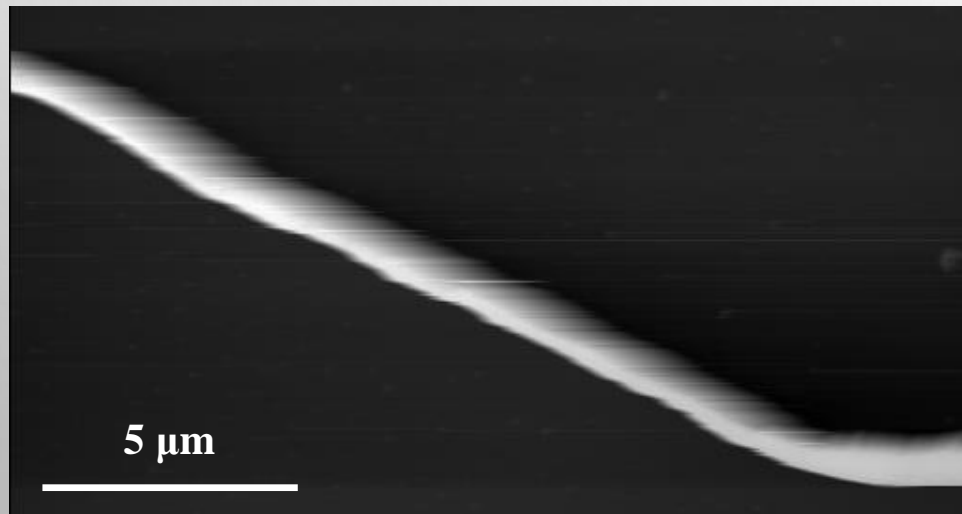
Atomic Force Microscopy (AFM)

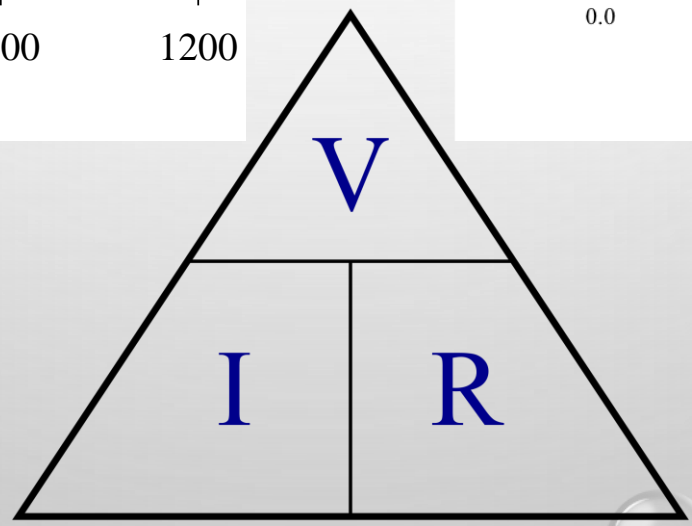
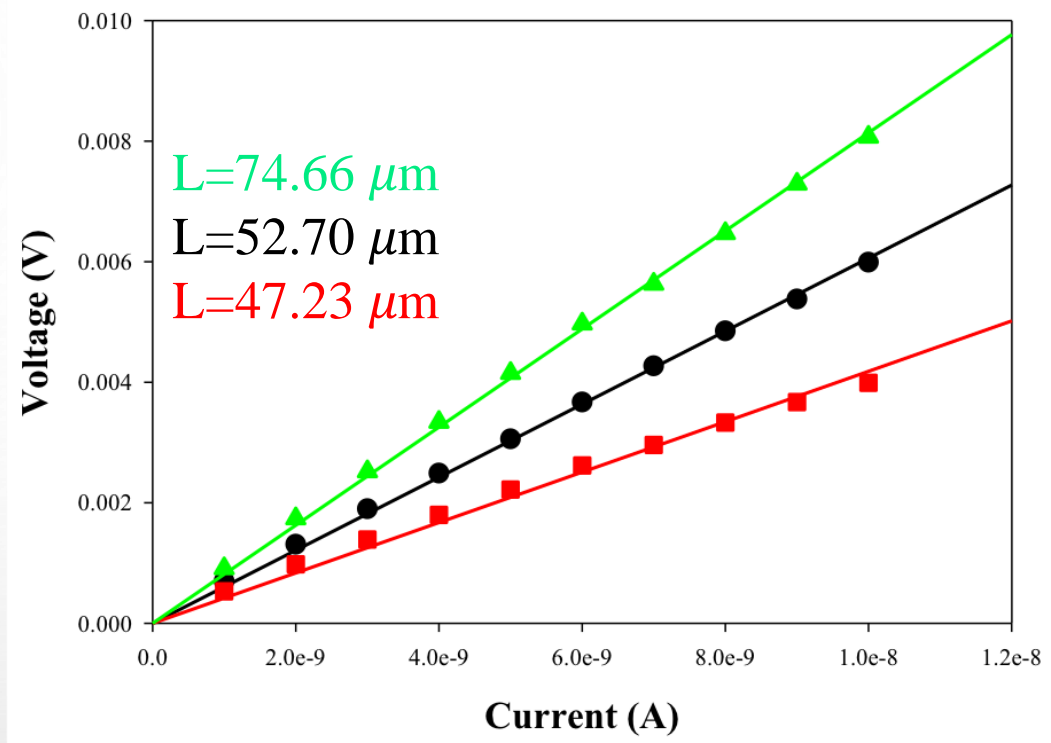
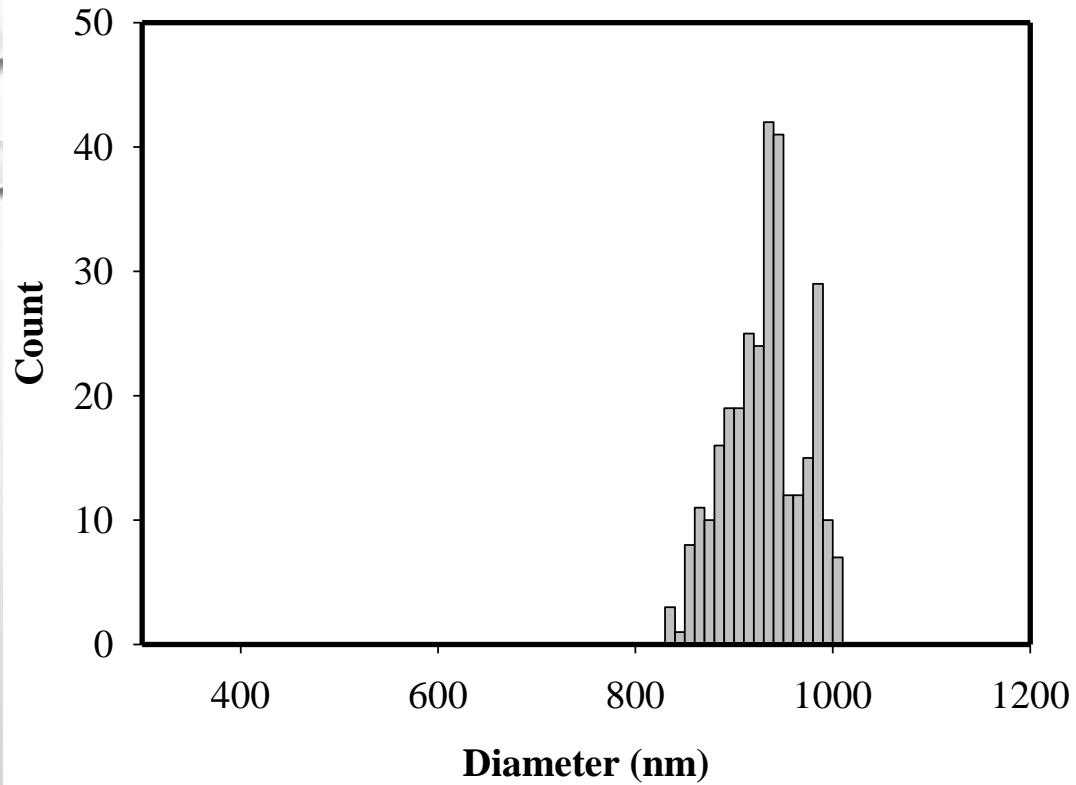


595 nm wire



963 nm wire



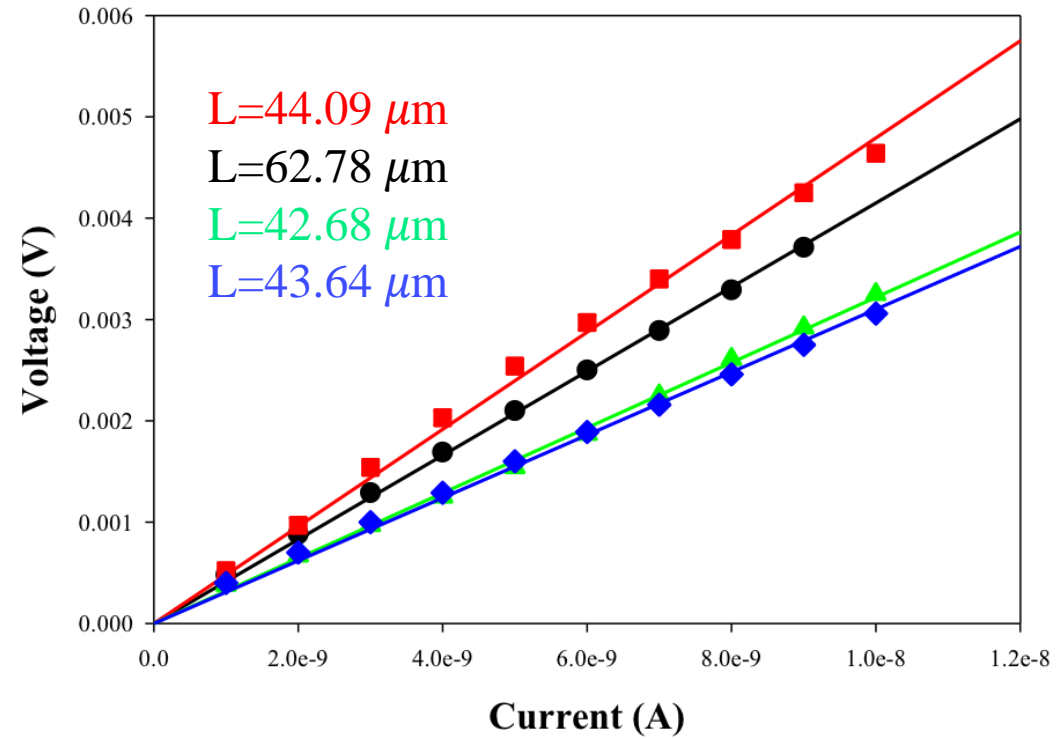
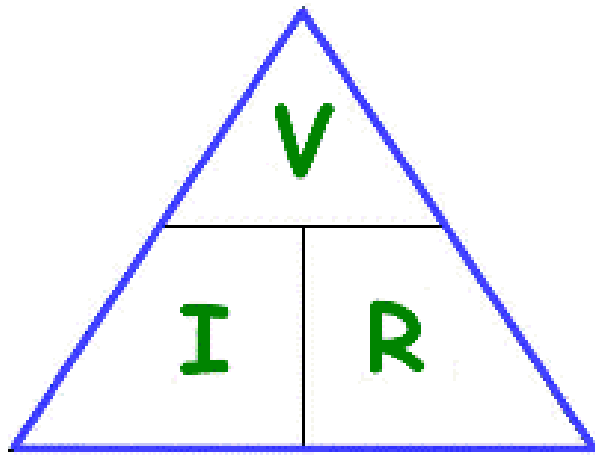


ΔV – The voltage drop across R when I flows through it

100 μM Heparin content

	Length (μm)	Diameter (nm)	Resistance ($\text{M}\Omega$)	Conductivity (S cm^{-1})
Wire 1	64.03	993	1.07	0.770
Wire 2	64.30	830	0.988	1.20
Wire 3	62.96	964	0.813	1.06
Wire 4	44.55	973	0.858	0.698
Wire 5	57.15	960	1.13	0.700
Wire 6	49.81	622	1.26	1.30

10 μm Heparin content



	Length (μm)	Diameter (nm)	Resistance ($\text{M}\Omega$)	Conductivity (S cm^{-1})
Wire 1	42.68	1362	0.322	0.910

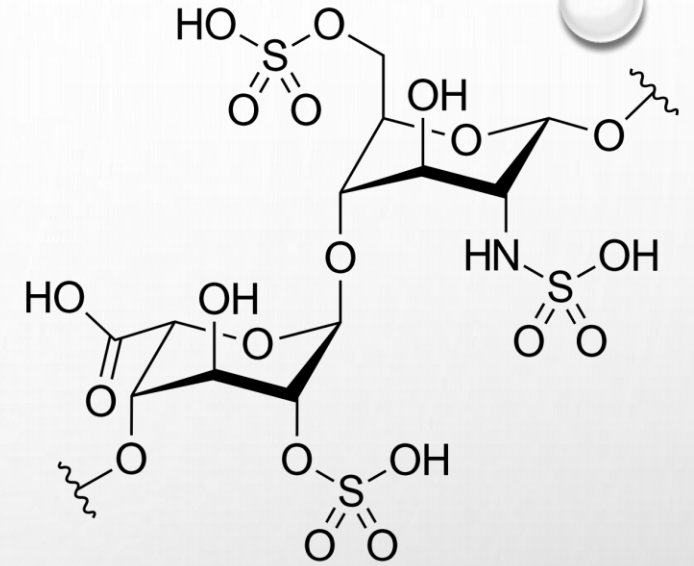
Conclusion

- The electrical conductivity does not depend on diameter, resistance, and length.
- We should see a consistency with the electrical conductivity of wires grown at the same conditions.

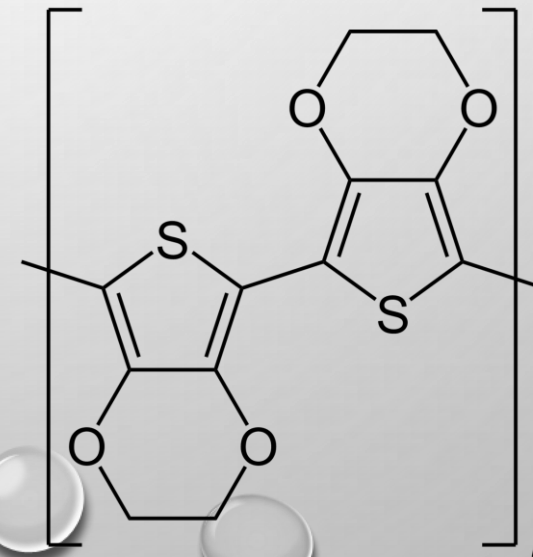
Future Work

- Continue pursuing decreasing the heparin content
- Test the electrical conductivity of PEDOT: Heparin at different temperatures
- Test the thermal conductivity
- PEDOT: Tosylate

Heparin



PEDOT

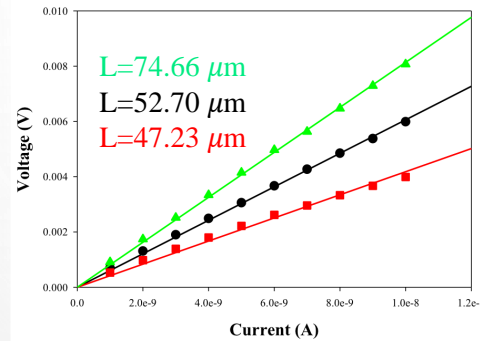
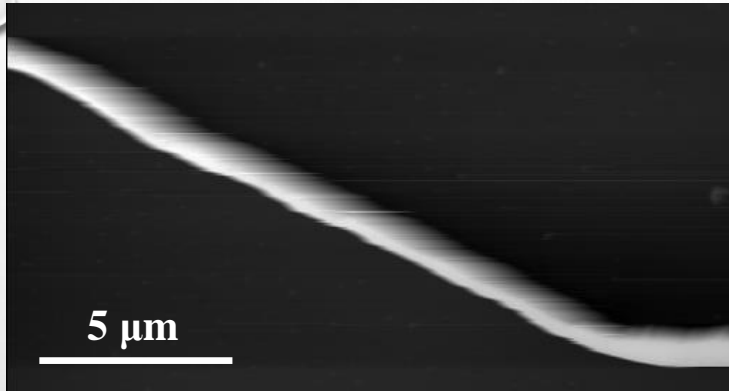


Acknowledgements

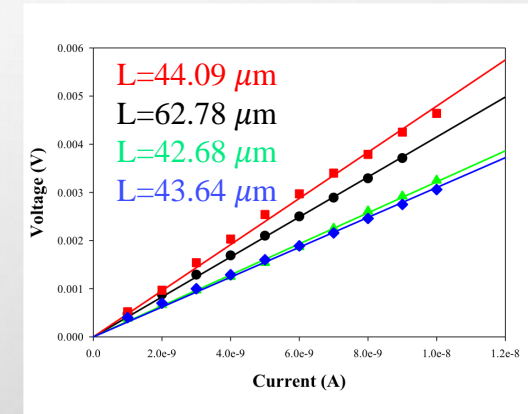
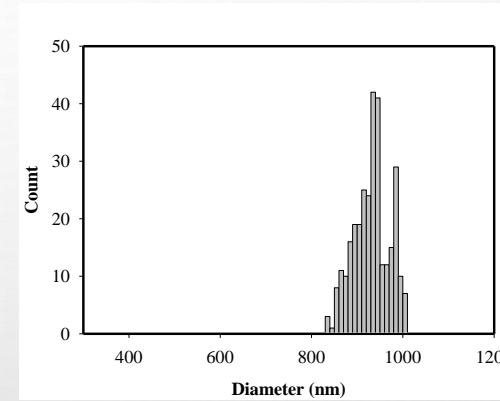
- Bret Flanders
- Krishna
- Gobind
- NSF
- K-State
- REU students



Questions?



	Length (μm)	Diameter (nm)	Resistance (MΩ)	Conductivity (S cm ⁻¹)
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