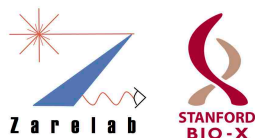


Electroresponsive Polypyrrole Nanoparticles for Controlled Drug Delivery



Aidan McCarty, Devleena Samanta, Niloufar Hosseini-Nassab, Richard Zare

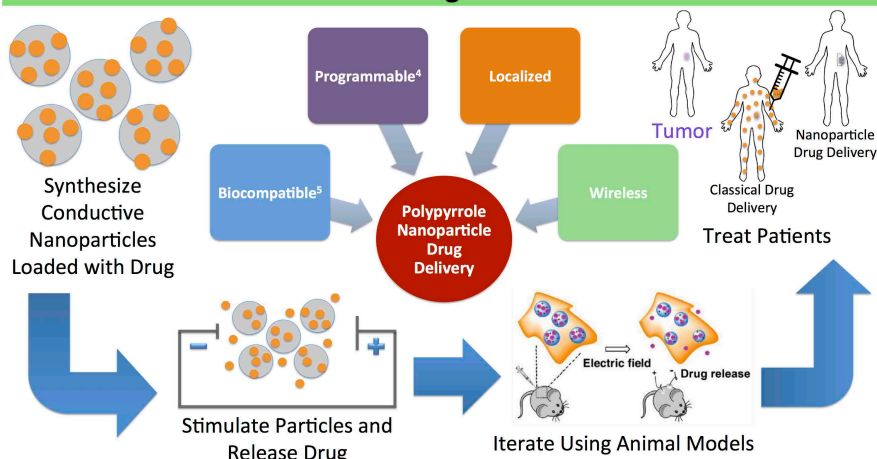
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Motivation

29.1 million Americans— about one of every eleven people— have diabetes,¹ and 20.3 million have been diagnosed with cancer.² For such chronic diseases, spatial and temporal control over drug release is vital.³

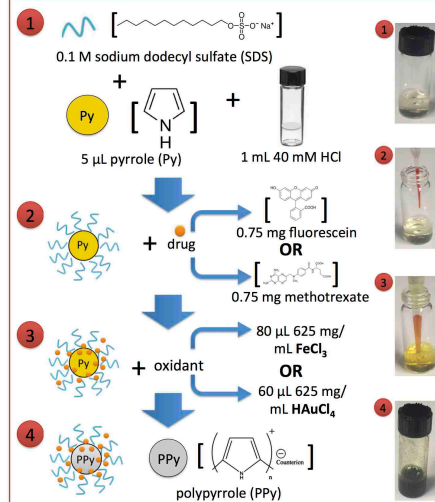
The Big Goal



Research Questions

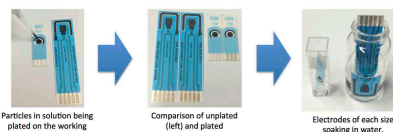
1. How can we maximize drug release from polypyrrole (PPy) nanoparticles?
2. What is the minimum voltage required for significant drug release?
3. Can an anti-cancer drug be loaded and released in relevant concentrations?

Synthesis



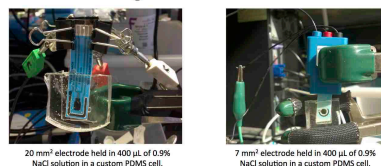
Plating and Washing

- Particles drop cast onto working electrode
- Two sizes (7 mm², 20 mm²)
- Electrodes soaked in water

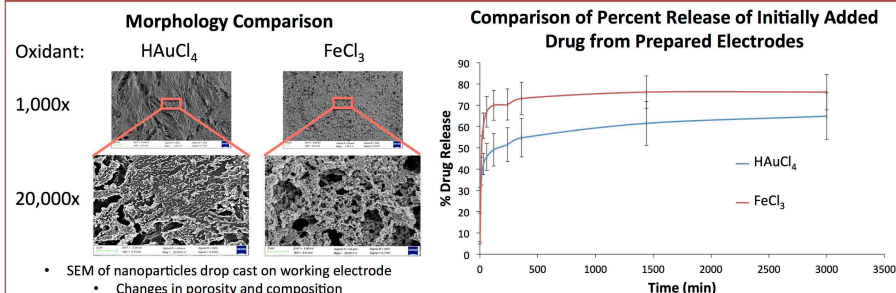


Stimulation

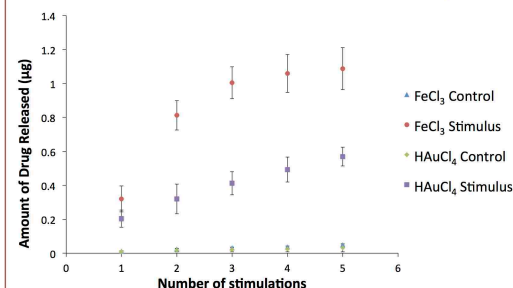
- Immersed in 0.9 % NaCl
- Constant Voltage



Results and Discussion

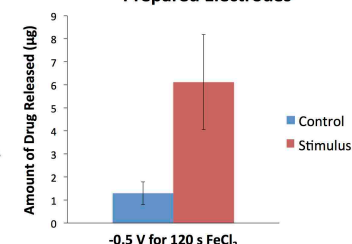


Multiple Stimulation Release (-0.5 V for 20 s.)



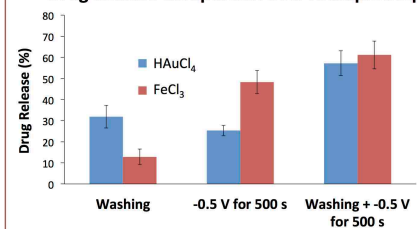
- Consistent 20x drug release difference between control and stimulus

Methotrexate Release from Prepared Electrodes



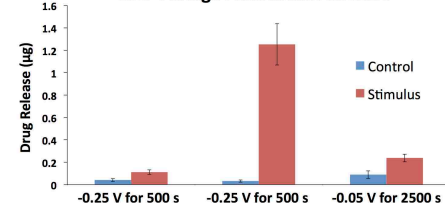
- Methotrexate is a common chemotherapeutic

Drug Release Comparison over Multiple Steps



- Plated electrodes were washed in 2 mL water for 24 hours

Low Voltage Fluorescein Release



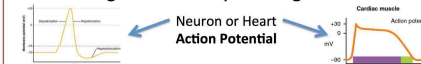
- -0.05 V is 10 x lower than the lowest reported voltage for release

Summary

- New synthesis yields 20x difference between stimulus and control
- Release at -0.05 V (10x lower than lowest reported voltage for significant drug release)
- Loaded and released methotrexate

Future Work

- Investigate porosity and conductivity
- Use voltages in the body for drug release



References

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Acknowledgments

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