

# Electronically-Controlled Drug Release for SCI treatment

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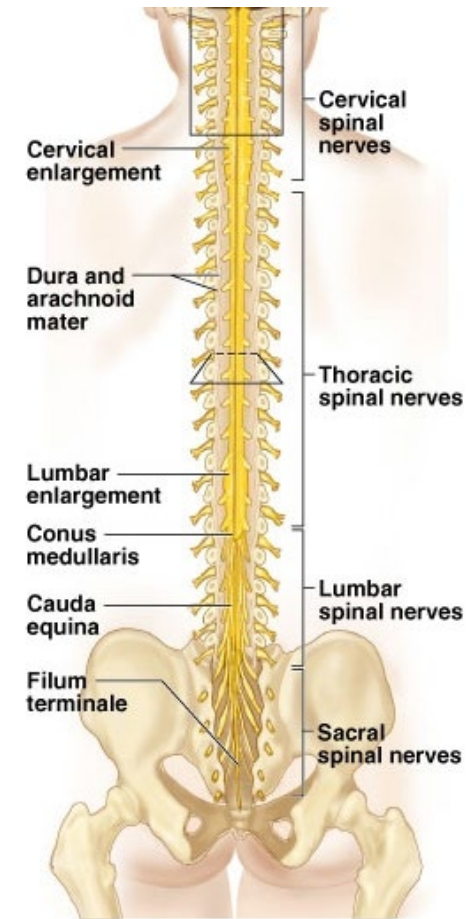
Christine Hau

Neurological Surgery Summer Student Program 2019

PI: Rajiv Saigal, MD PhD

# Introduction: What is Spinal Cord Injury (SCI)?

- > **Damage to any part of spinal cord**
- > **288,000 people live with SCI (NSCISC)**
- > **Primary injury: initial trauma**
- > **Secondary injury: inflammation**



(a)

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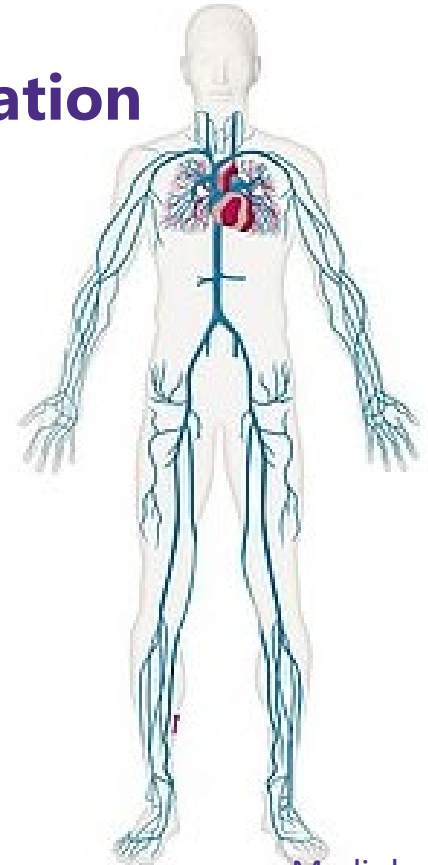
[nscisc.uab.edu](http://nscisc.uab.edu)

UNIVERSITY of WASHINGTON

# Current Treatment Options for SCI

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- > **Early surgical decompression/stabilization**
- > **Elevate blood pressure**
- > **Systemic Steroids**
  - **Controversial**
  - **Systemic side effects**
    - > **Pneumonia**
    - > **Sepsis**
    - > **GI bleed**
    - > **Etc.**



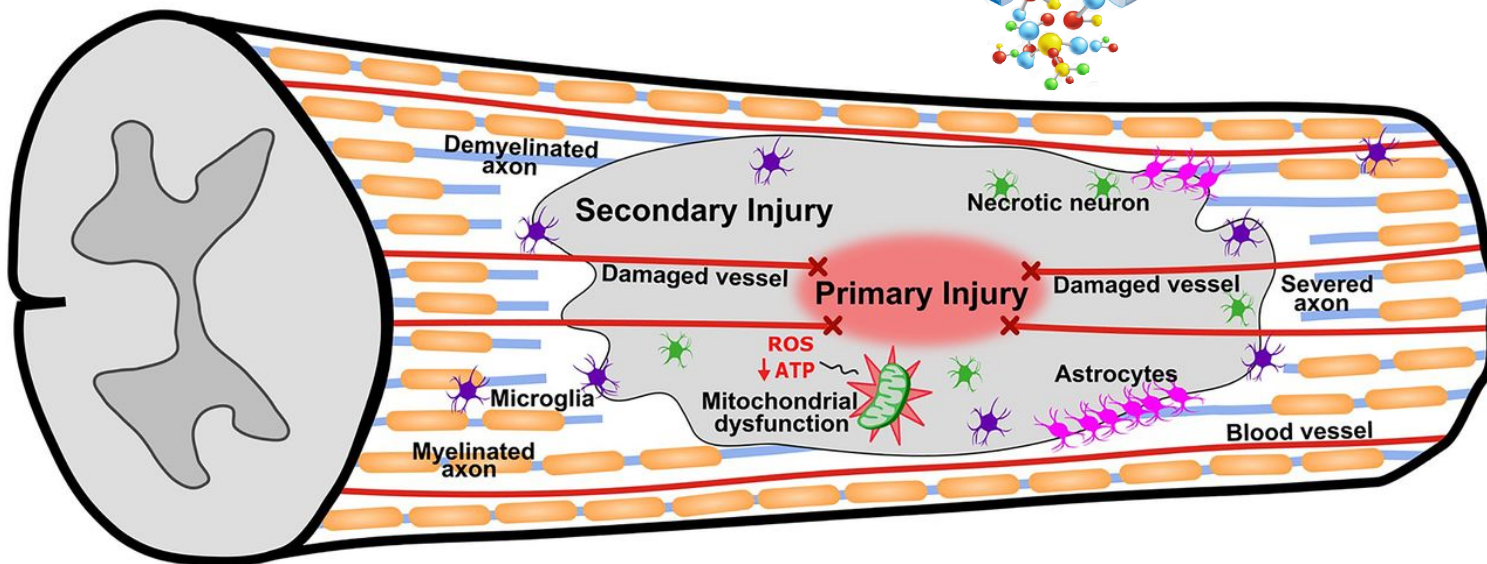
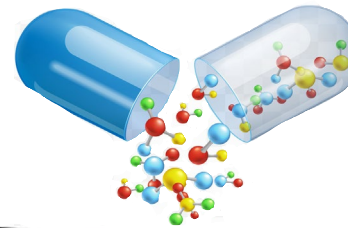
Medi.de



# Focus of the Saigal Lab: Bioengineering materials for Spinal Cord Injury

Goal: local drug delivery

- Lower overall doses
- Higher % of drug to target tissue
- Avoid systemic side effects

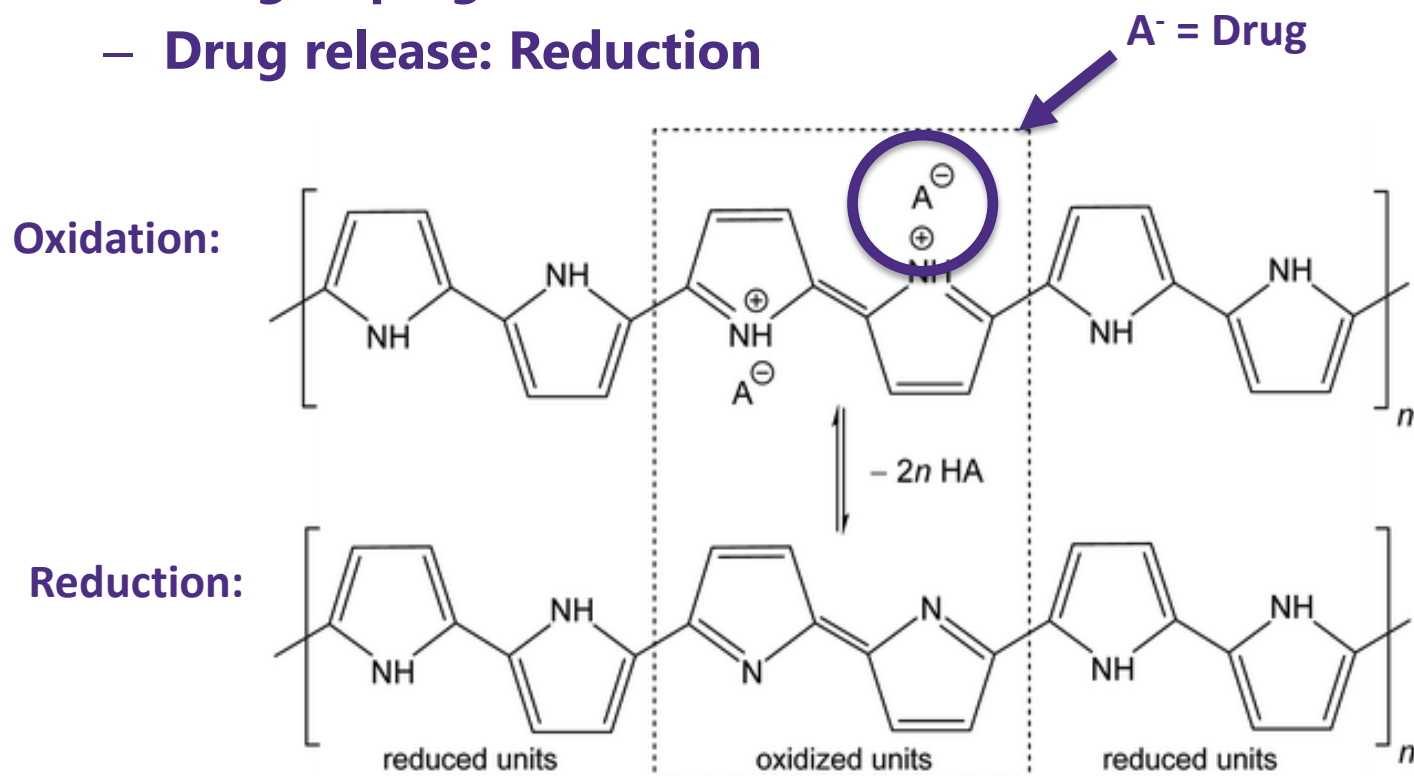


Journal of Pharmacology and Experimental Therapeutics, 2017; Vector Stock Photos

# Electronically-controlled Drug Release

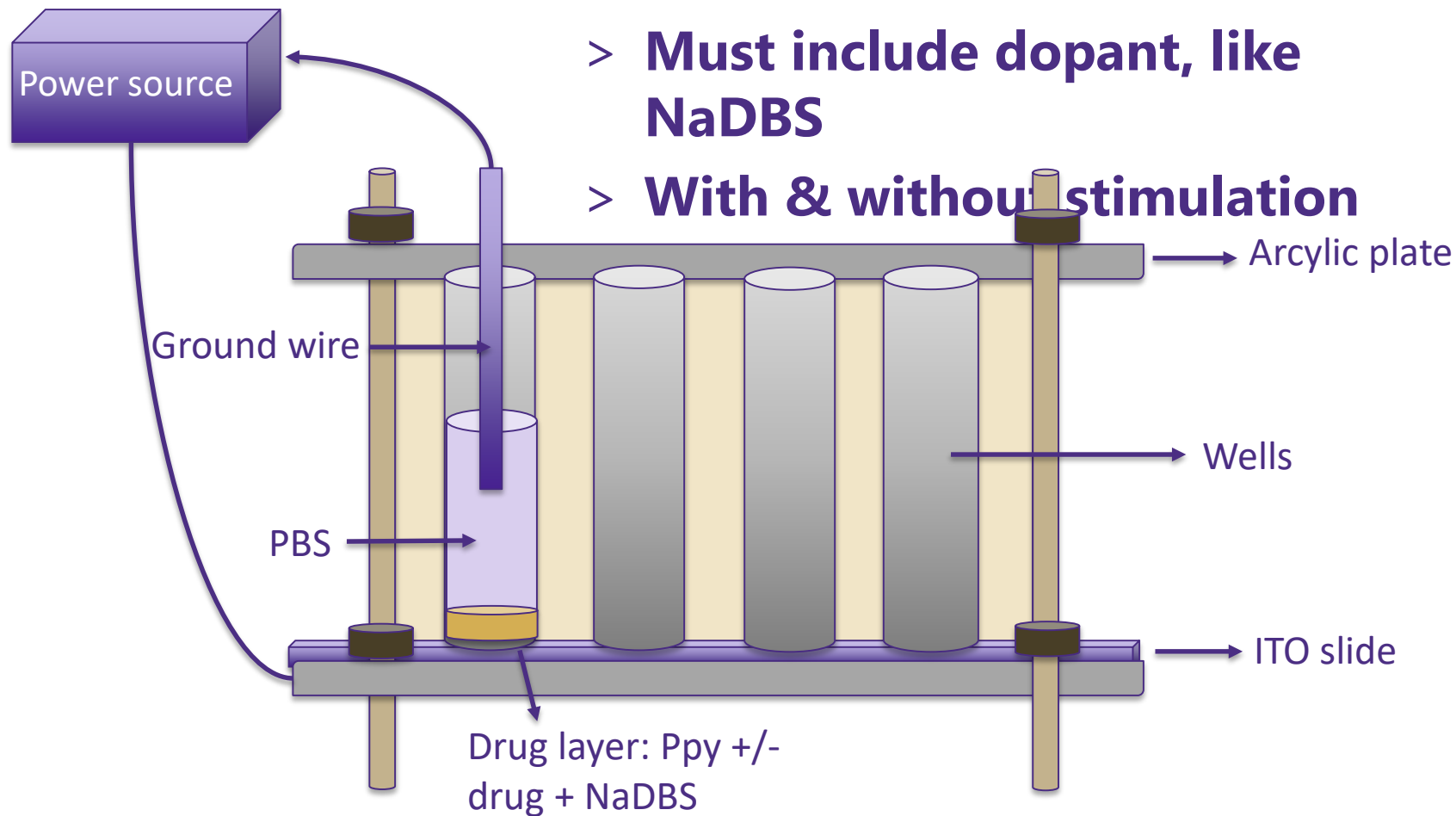
## > Polypyrrole (PPy)

- Conductive polymer
- Drug doping: Oxidation
- Drug release: Reduction



# Methods

- > Redox reactions
- > Must include dopant, like NaDBS
- > With & without stimulation



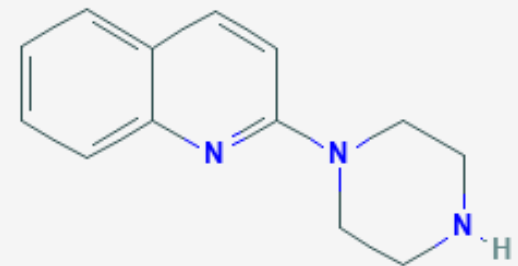
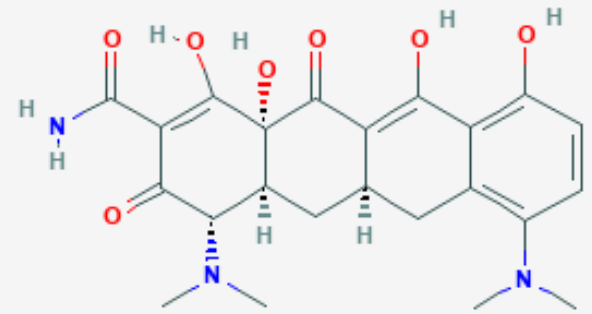
# Experimental Drugs

## > Minocycline

- Anti-inflammatory drug

## > Quipazine

- Serotonin receptor agonist drug
- May assist with rehabilitation post-
  - > Improves locomotion
  - > Enables spinal cord neural circuitry



Experimental question:

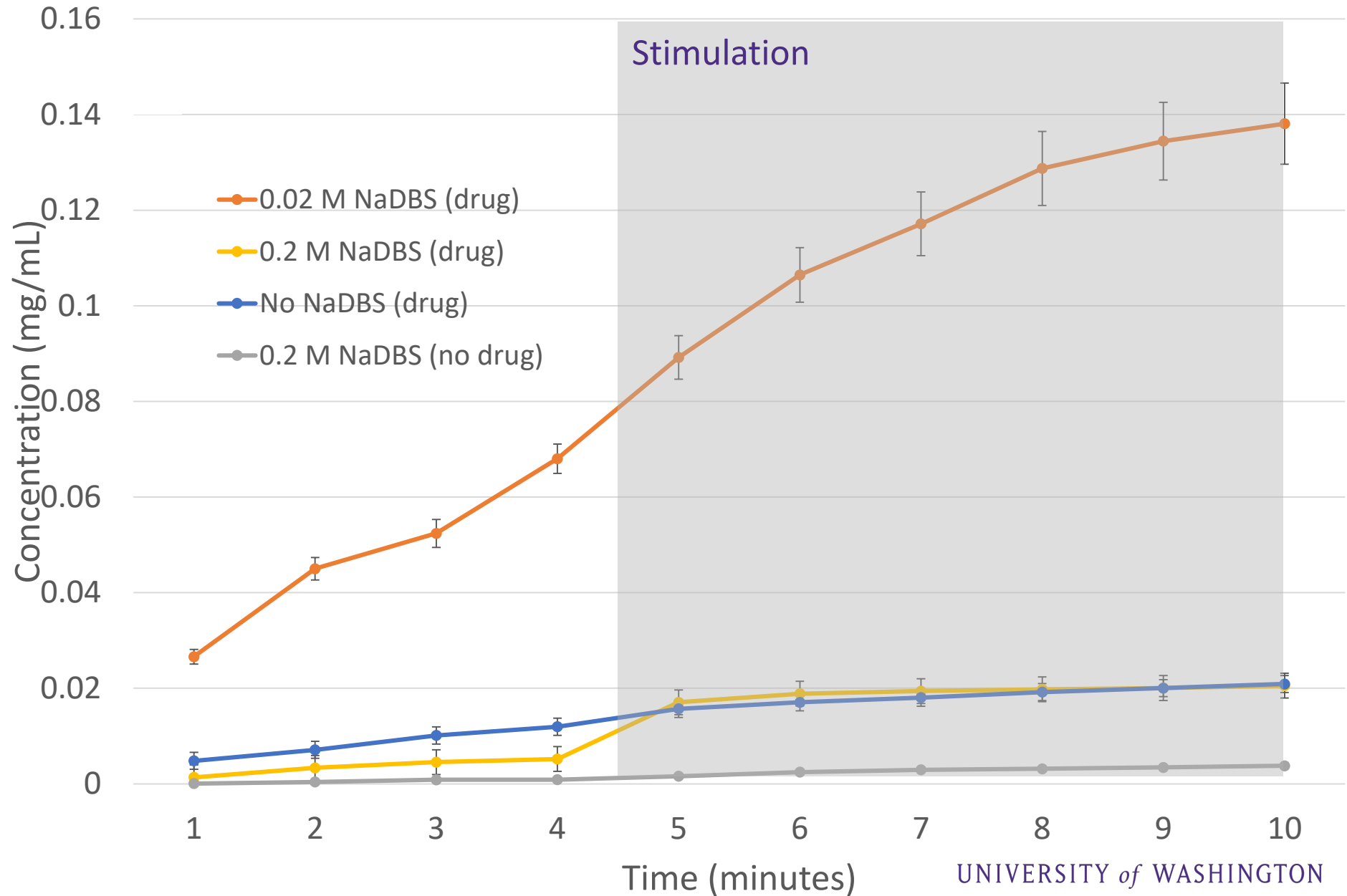
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How do varying NaDBS levels affect controlled drug release?

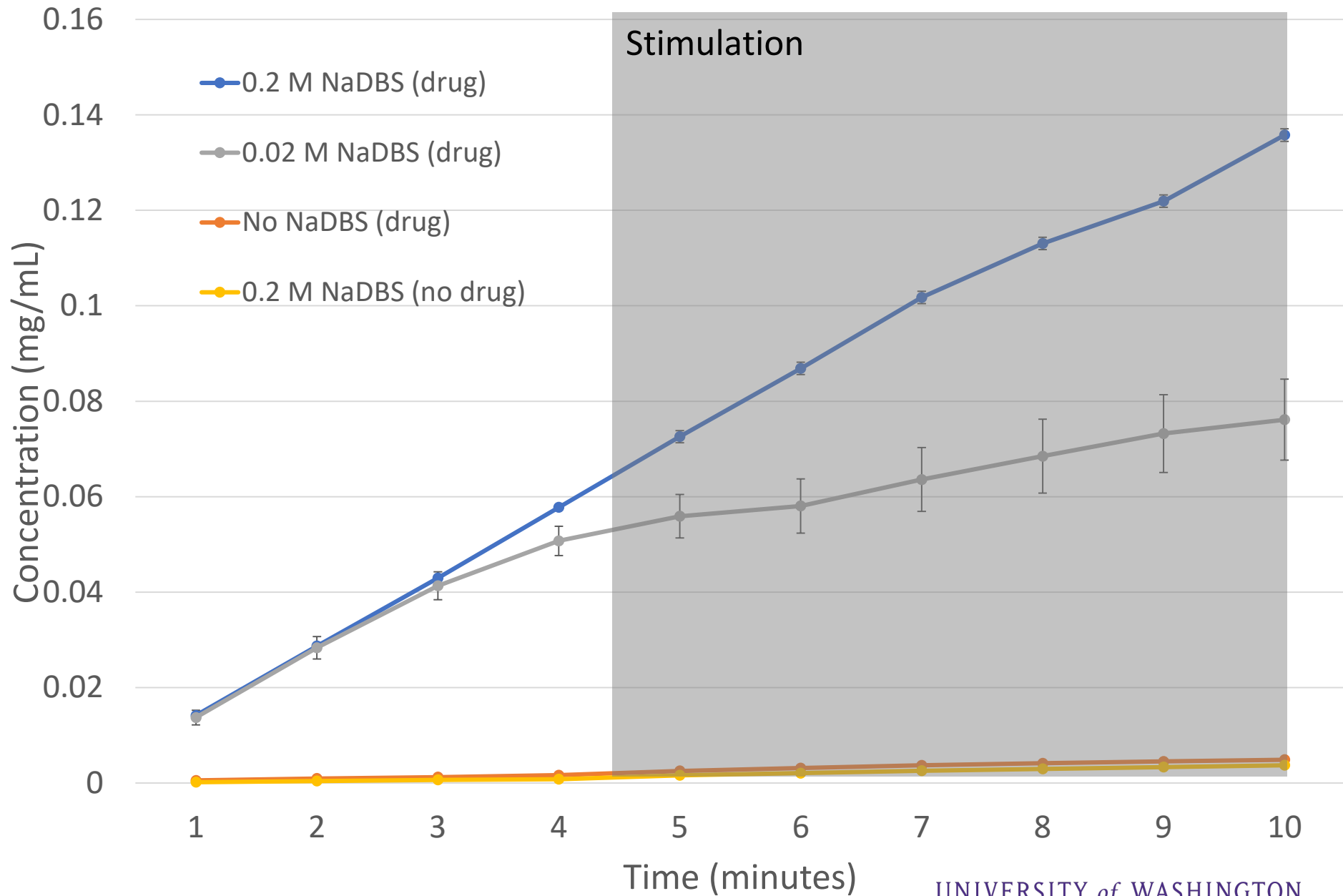
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# 4 mg/mL Minocycline in NaDBS



# 0.5 mg/mL Quipazine in NaDBS





## Conclusion: How does NaDBS affect release?

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### Minocycline

- > **Minimal levels of NaDBS allow maximum drug release**

### Quipazine

- > **High levels of NaDBS may be beneficial**
- > **Release may change with higher initial drug concentration**

### Future Work

- > **Current students are developing implants using polypyrrole**
- > **Further explore parameter space to optimize release**

# Acknowledgements

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# Thank you!

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> Any questions?

