

# Detection of Antibiotic Metabolites

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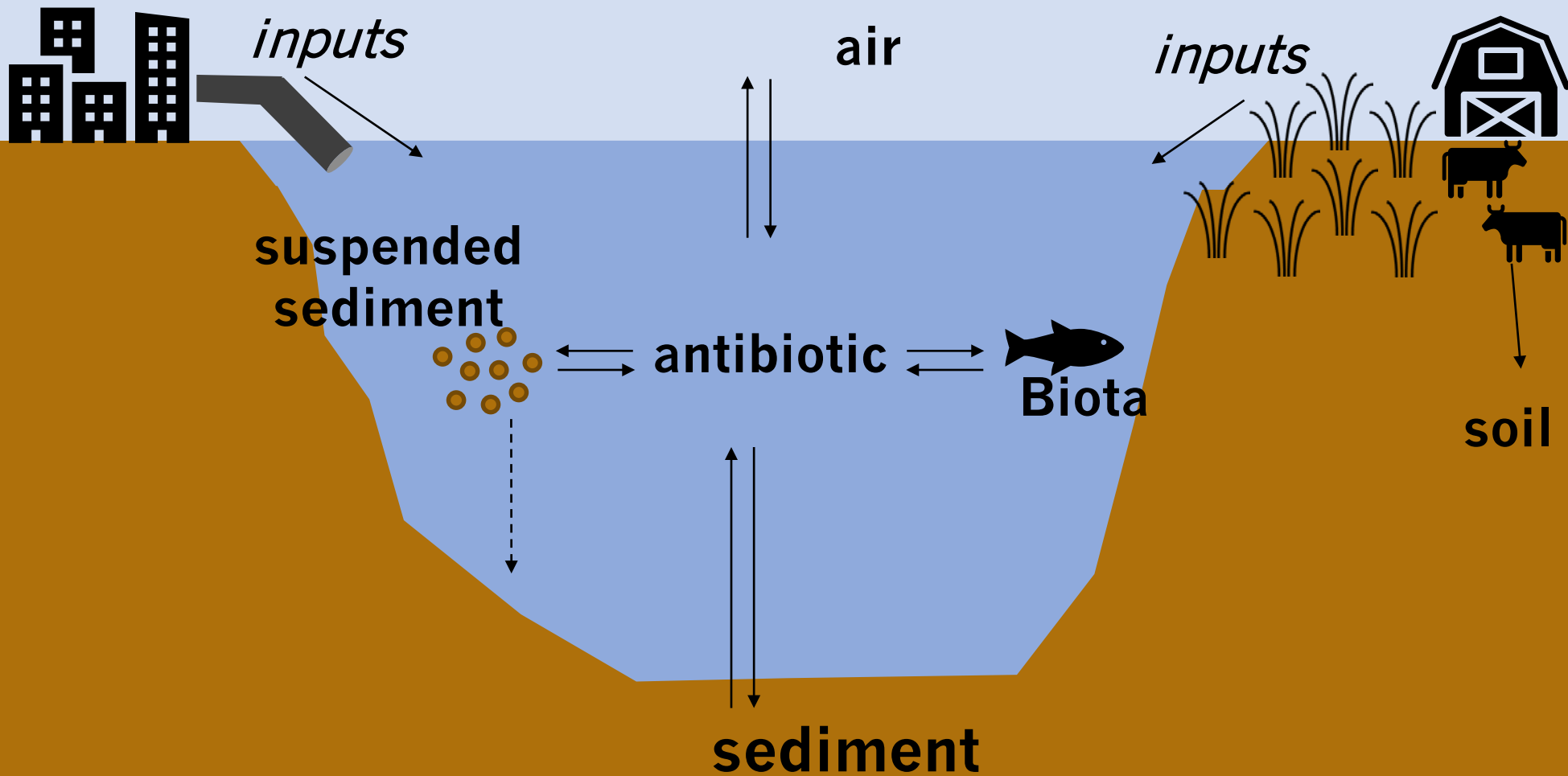
**UNIVERSITY OF MINNESOTA**  
**Driven to Discover<sup>SM</sup>**

# Challenges:






many chemicals

various sources





several environmental compartments







## Sulfonamides

Sulfachloropyridazine   
Sulfadiazine   
Sulfadimethoxine   
Sulfamethoxazole   
Sulfamethazine   
Sulfapyridine 




## Fluoroquinolones

Ofloxacin   
Norfloxacin   
Ciprofloxacin   
Enrofloxacin 




## Tetracyclines

Tetracycline   
Oxytetracycline   
Chlortetracycline   
Doxycycline 

## Macrolides

Erthyromycin   
Tylosin   
Roxithromycin 

## Others

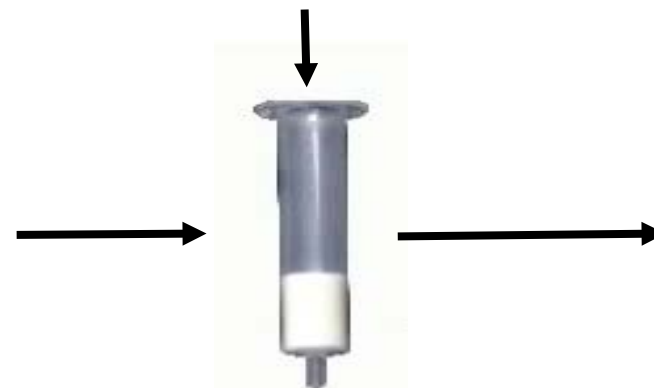
Trimethoprim   
Carbadox   
Lincomycin 



water sample



Extraction

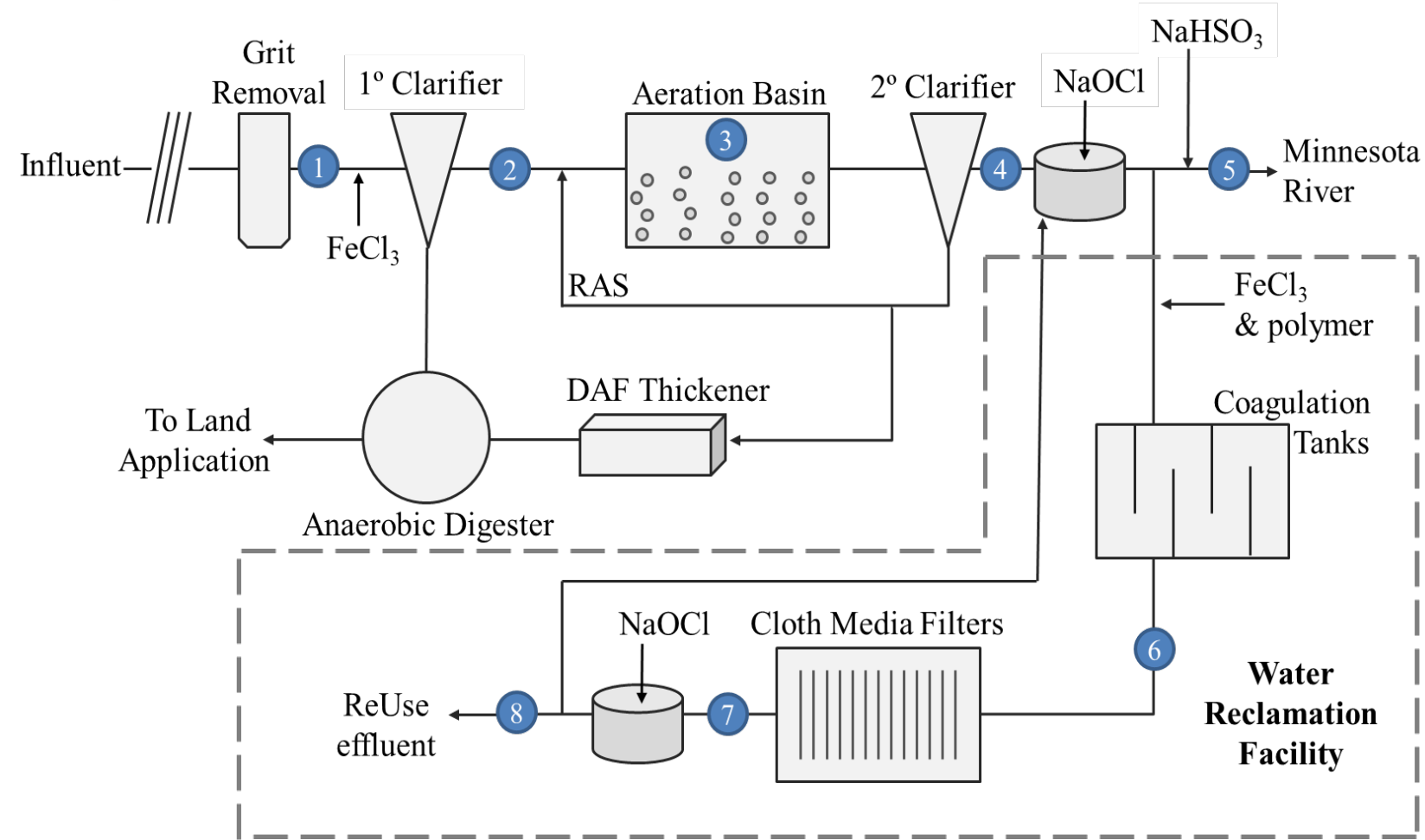


Extraction/  
Clean up



UPLC-MS/MS  
Analysis

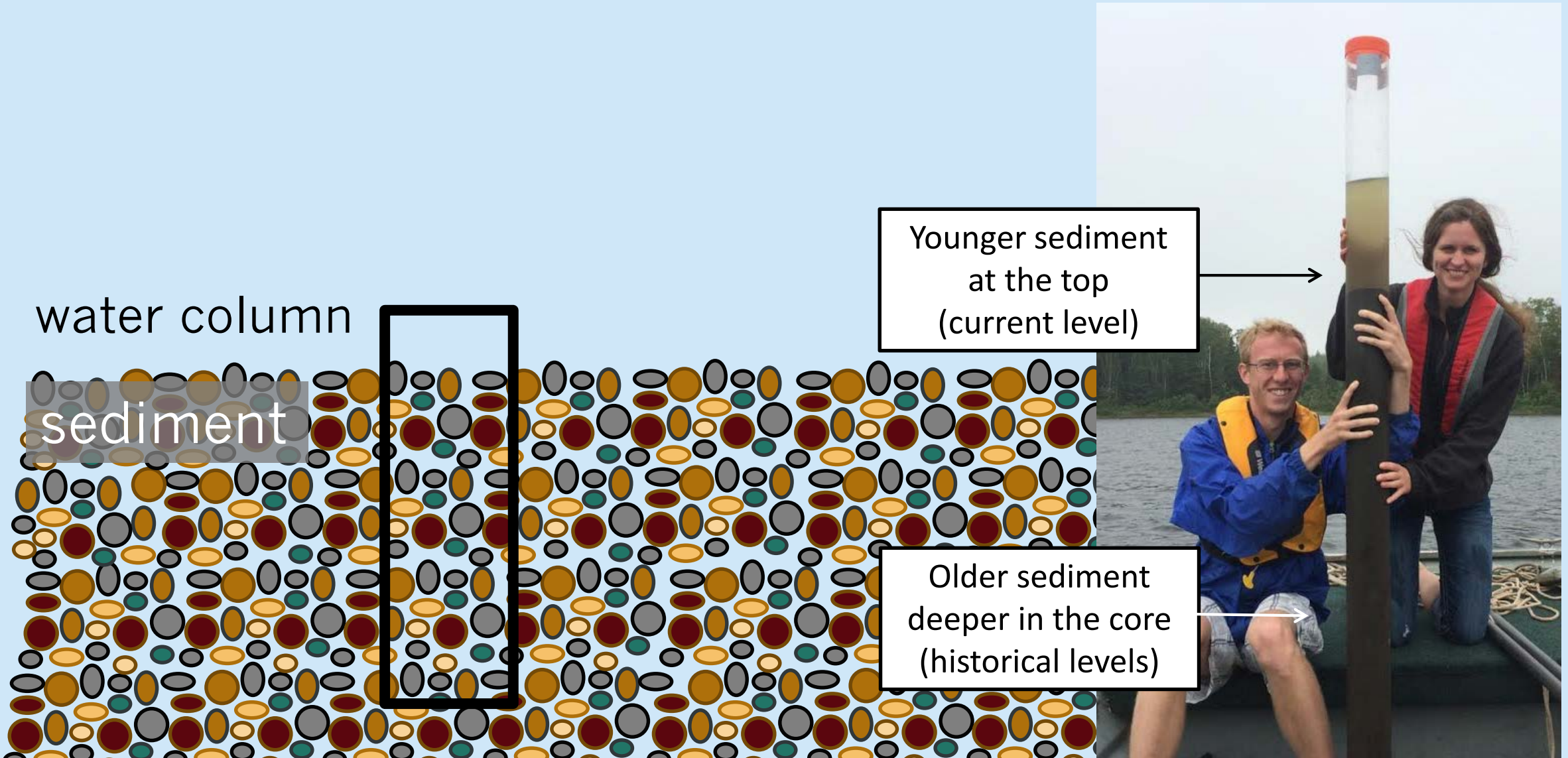
# Inputs: Wastewater



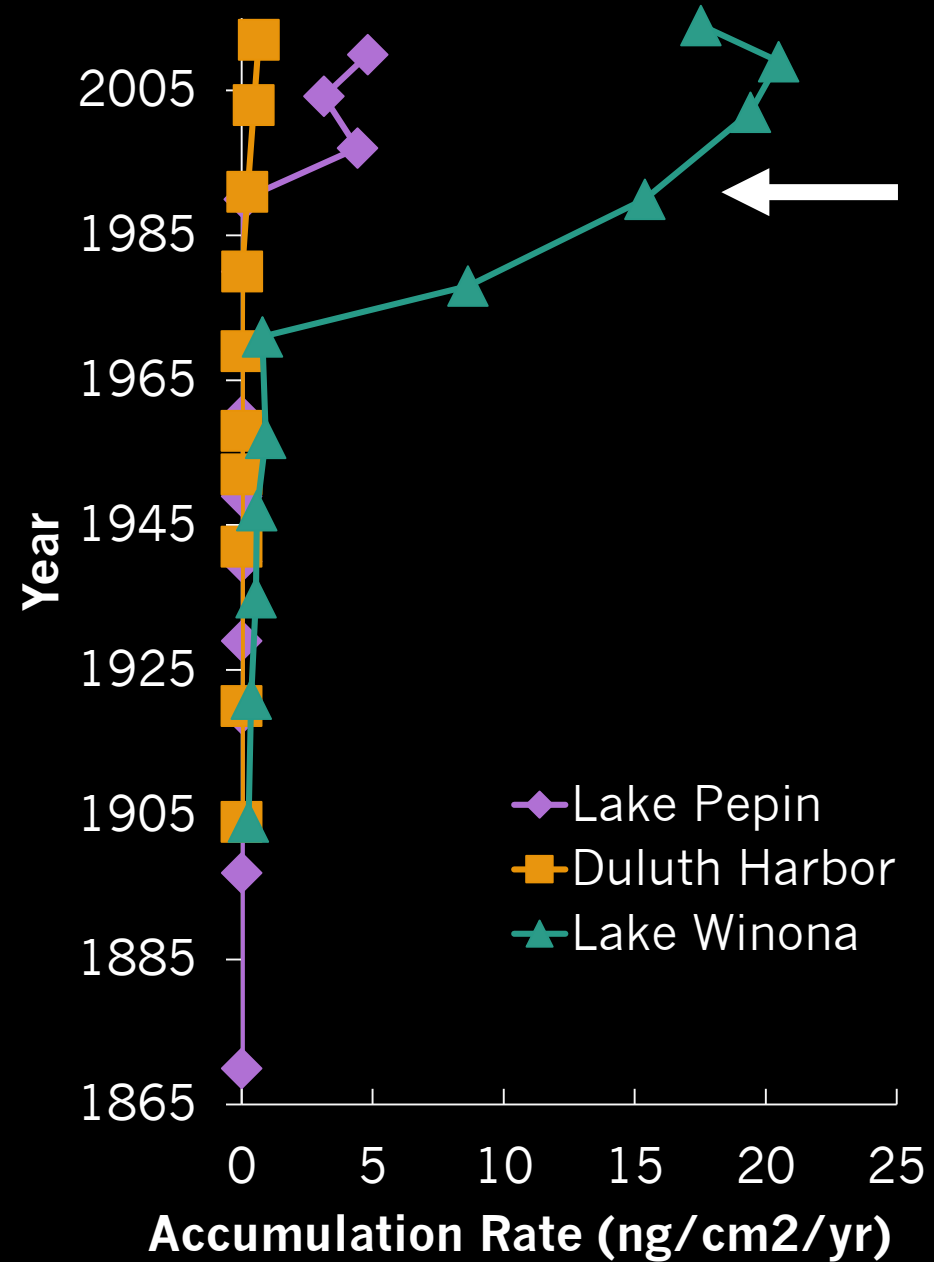
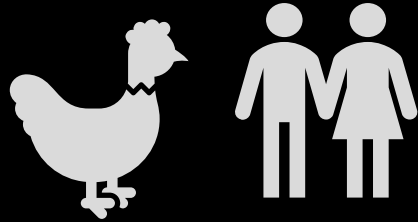
## Total Fluoroquinolones (ng/L)

<b>1:</b>	<b>744</b>
<b>2:</b>	<b>831</b>
<b>3:</b>	<b>755</b>
<b>4:</b>	<b>615</b>
<b>5:</b>	<b>80</b>
<b>8:</b>	<b>0</b>

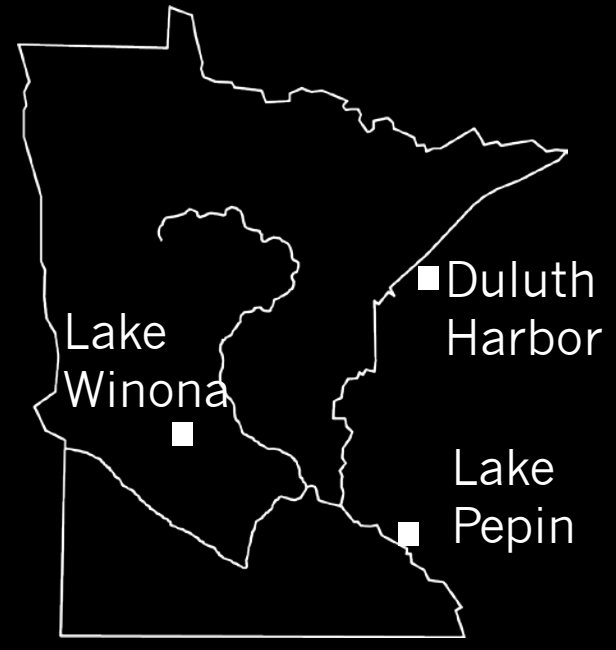
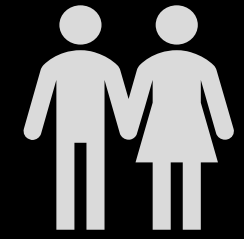
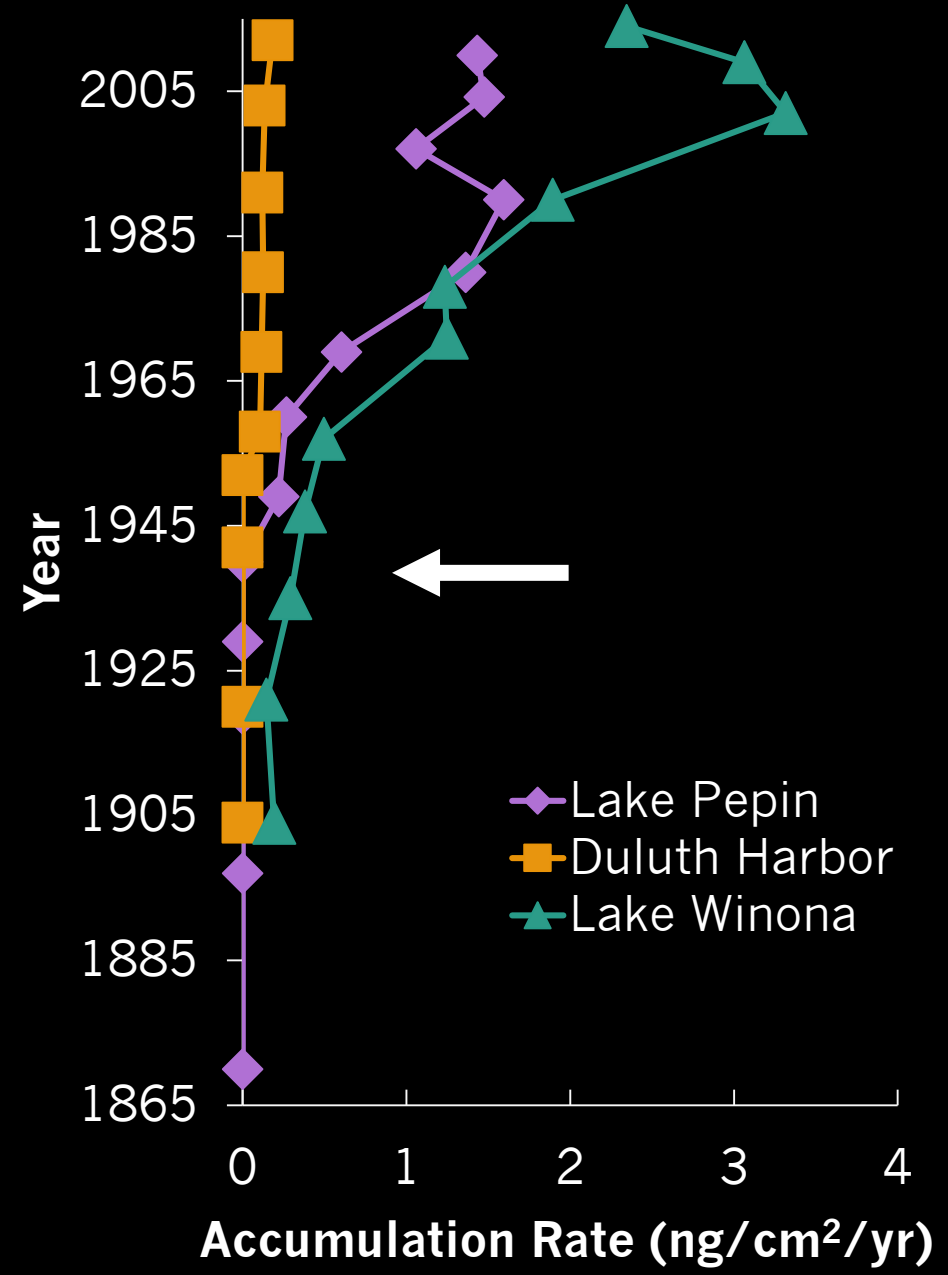
**Sediment cores** can be used to determine historical trends of antibiotics in a water body

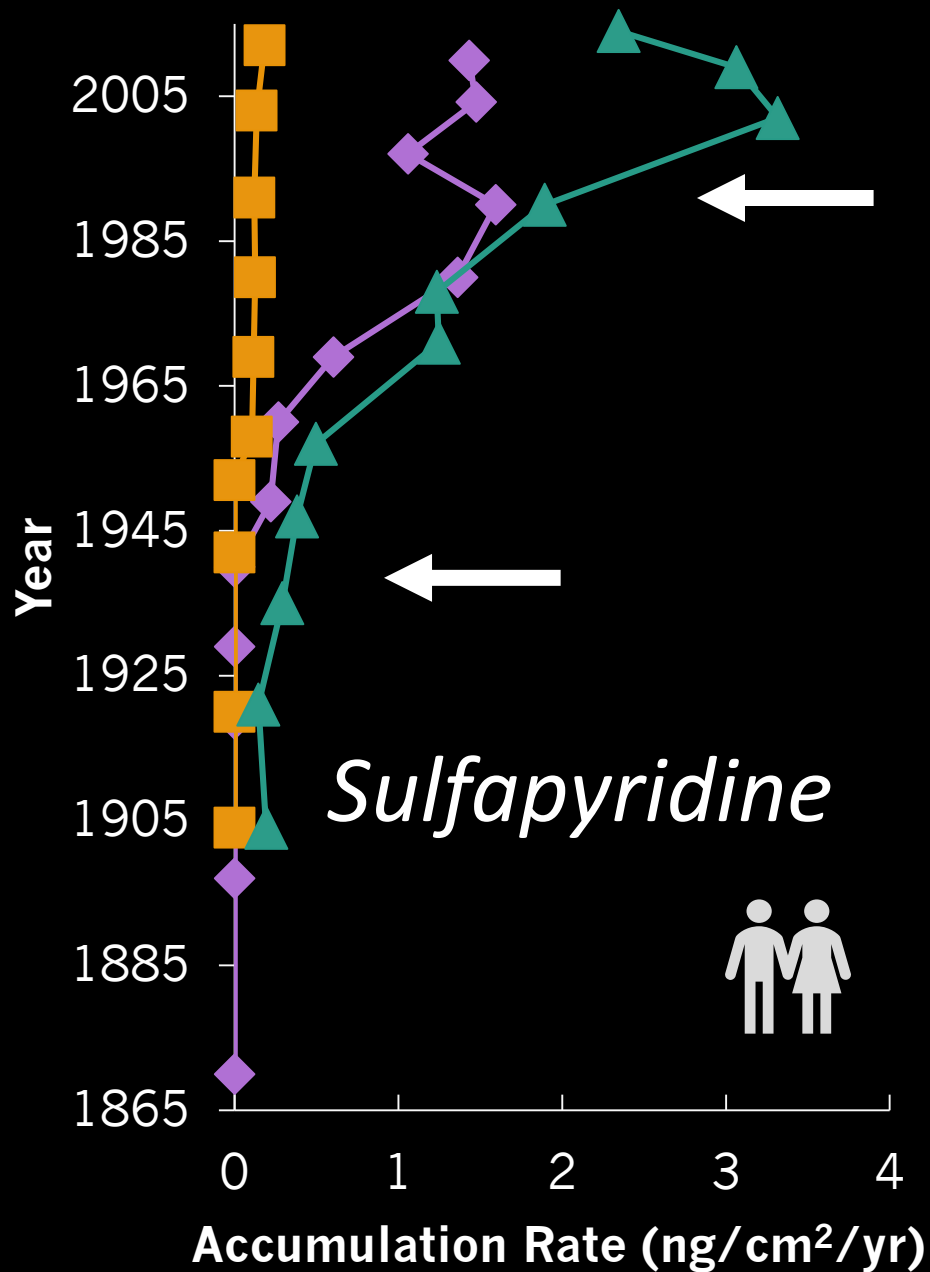


# *Ofloxacin* (new)

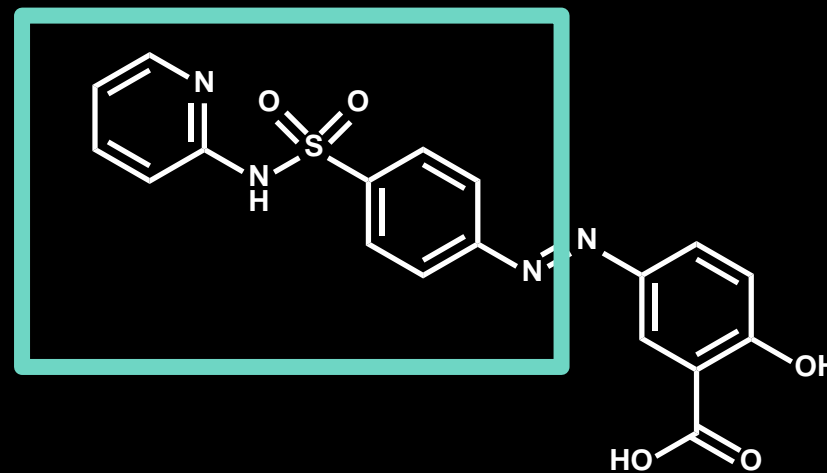


# *Sulfapyridine* (old)





# *Metabolism Matters*



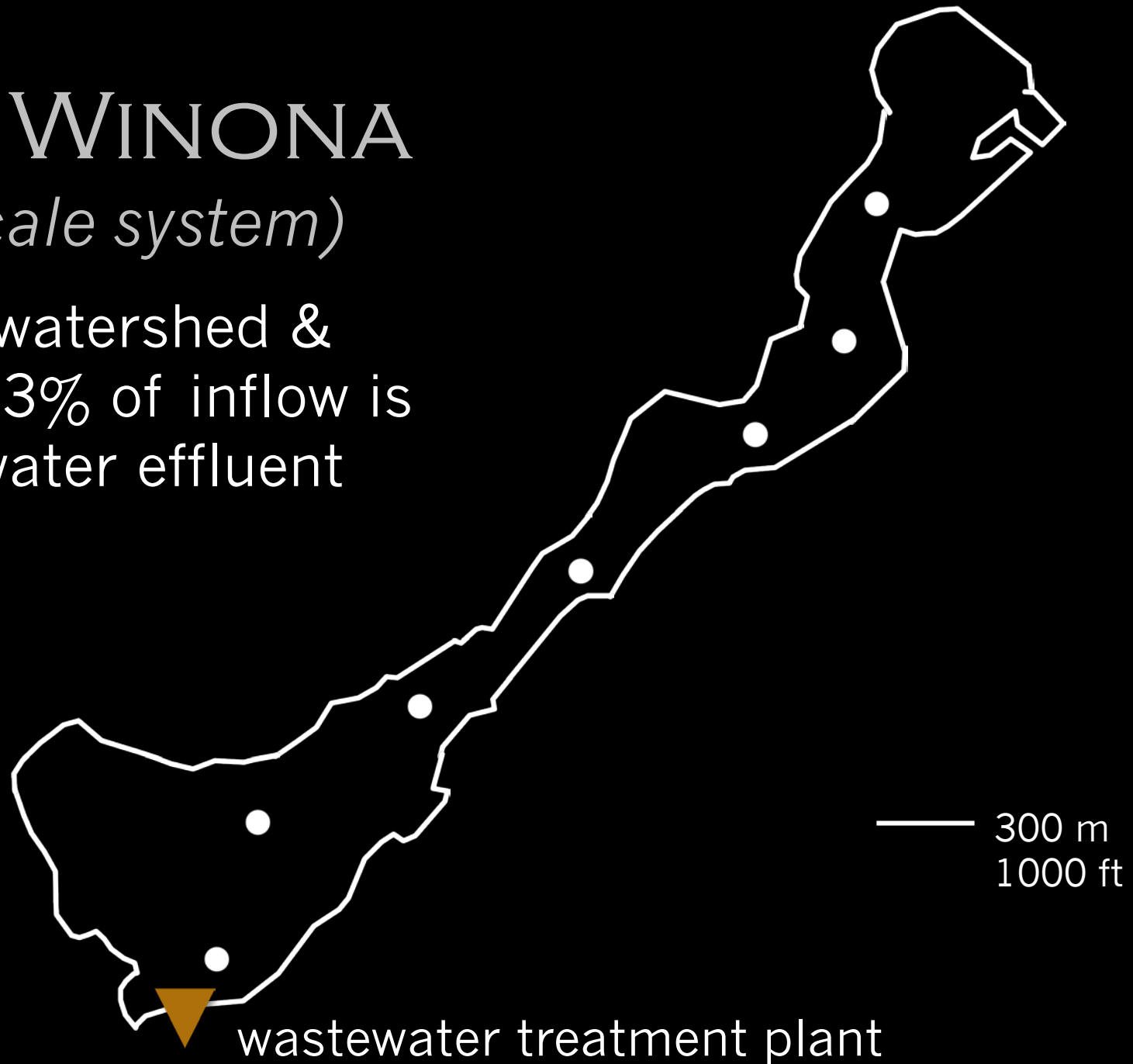
*Sulfasalazine*



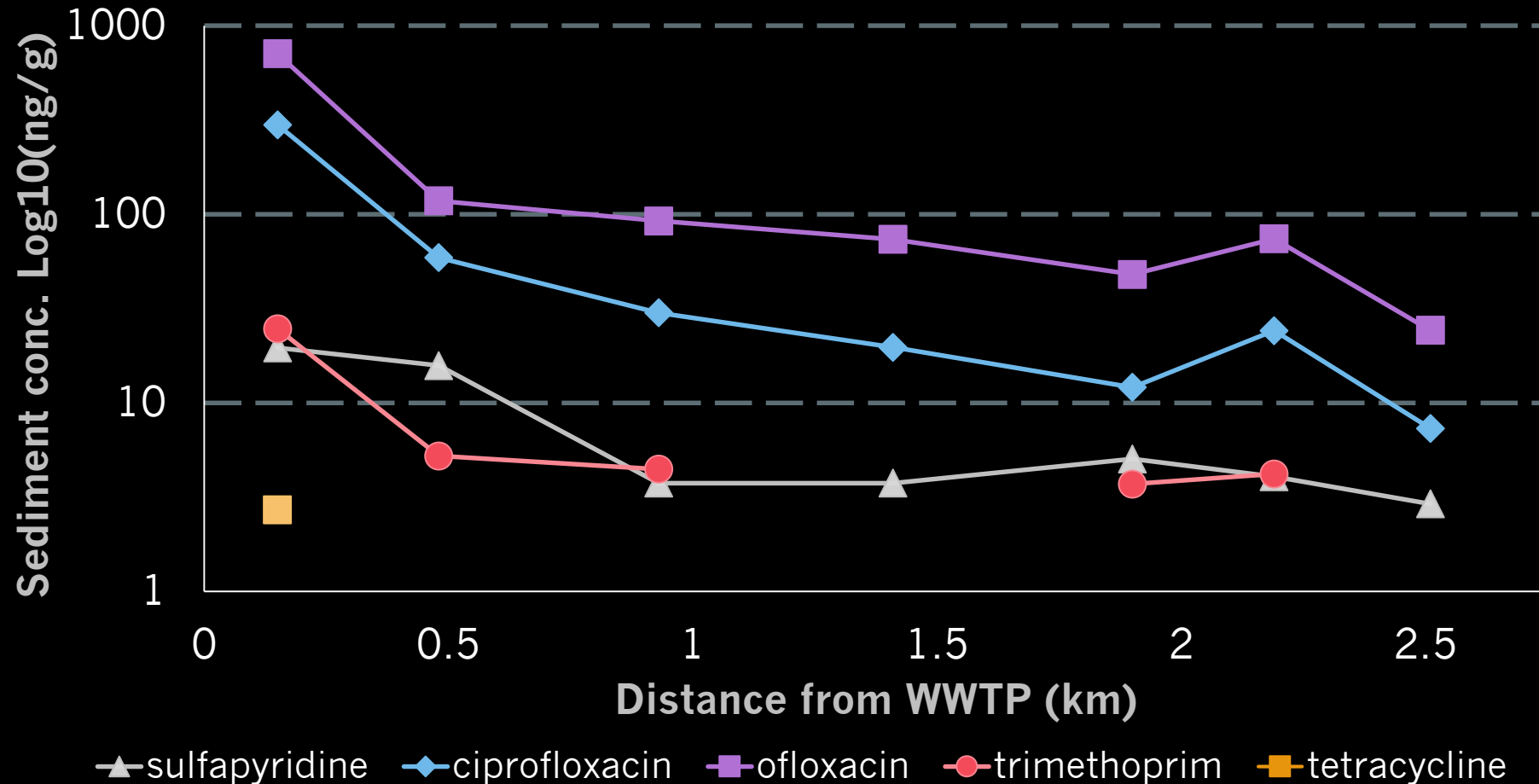
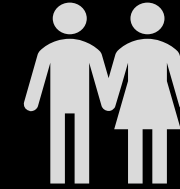
# LAKE WINONA

*(small-scale system)*

small watershed &  
approx. 63% of inflow is  
wastewater effluent

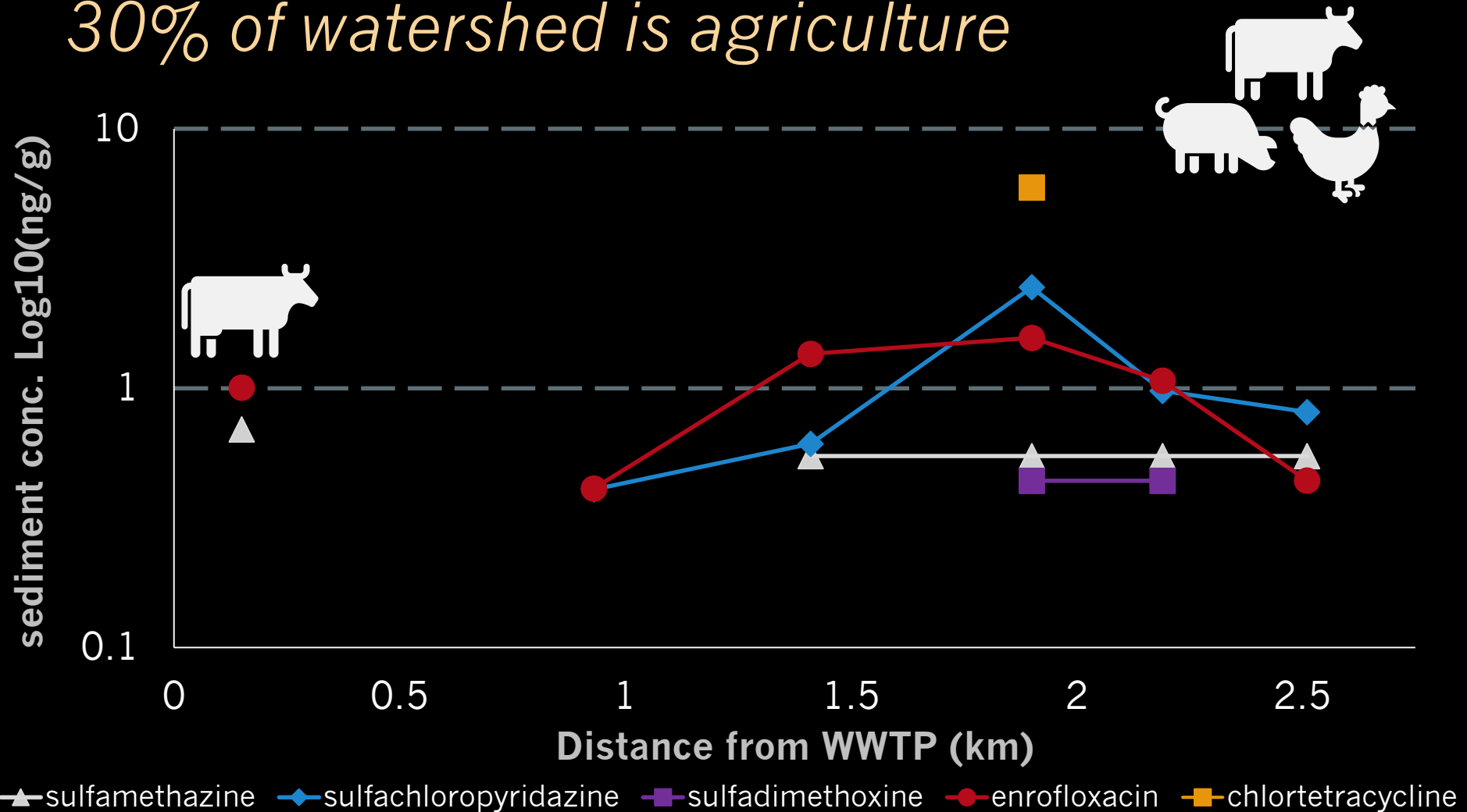


# Highest concentration of human-use antibiotic was near WWTP outfall



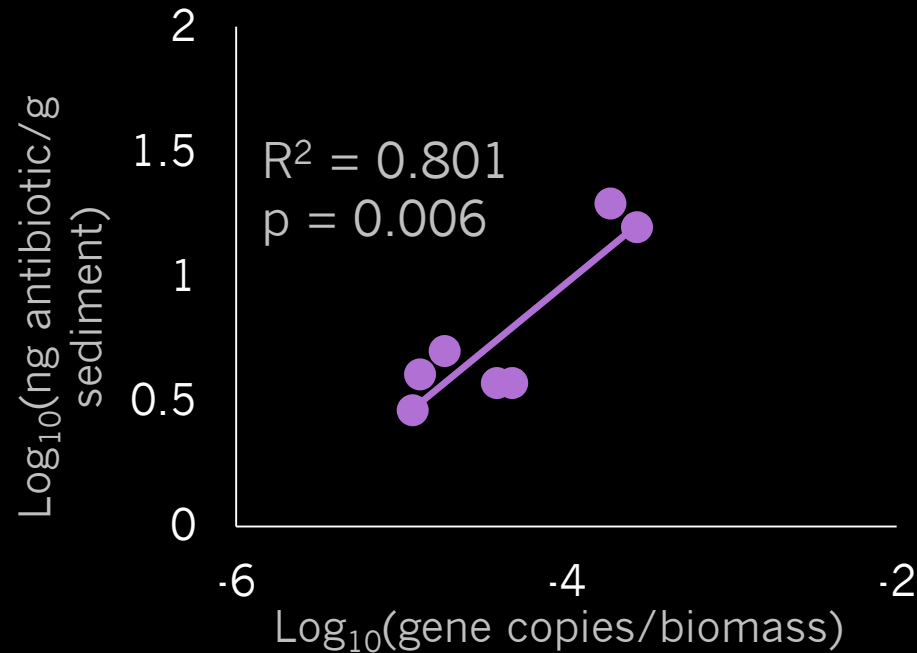
Appears to have input of agricultural antibiotics

*30% of watershed is agriculture*

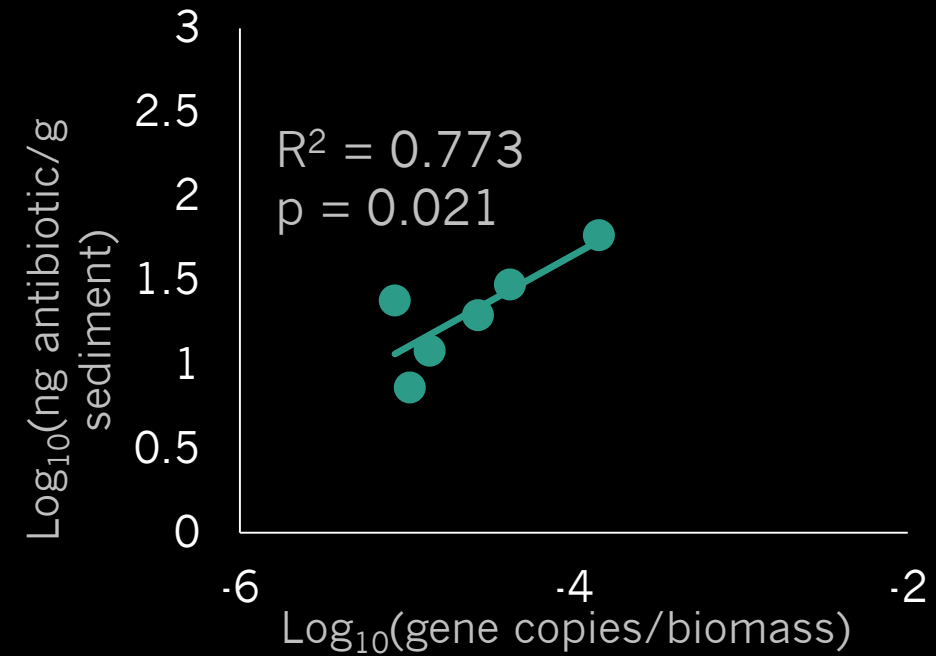


# Correlated the presence of antibiotics to ARGs...

*sulfapyridine vs sulfonamide resistance (sul1)*



*ciprofloxacin vs mercury resistance (merA)*



some antibiotic resistance genes may have been discharged with **treated wastewater**

# What did we learn?

- Wastewater treatment removal varies
- Sediments capture antibiotics
- Anthropogenic impact matters
  - Wastewater
  - Land use
  - ARGs
- Implications for
  - Engineering interventions
  - Policy decisions