



THE COLLEGE OF  
**WOOSTER**

***Assessing *Batrachochytrium dendrobatidis* infections in  
Invasive and Native frog species in Jamaica and  
antifungal properties of *Pseudomonas* Bacteria***

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Advised by: Dr. Stephanie Strand, Dr. Rick Lehtinen

I.S. Symposium 2026

# Why are frogs some of the coolest animals on this planet



Bioindicator species



Balance food chain



Natural pest control



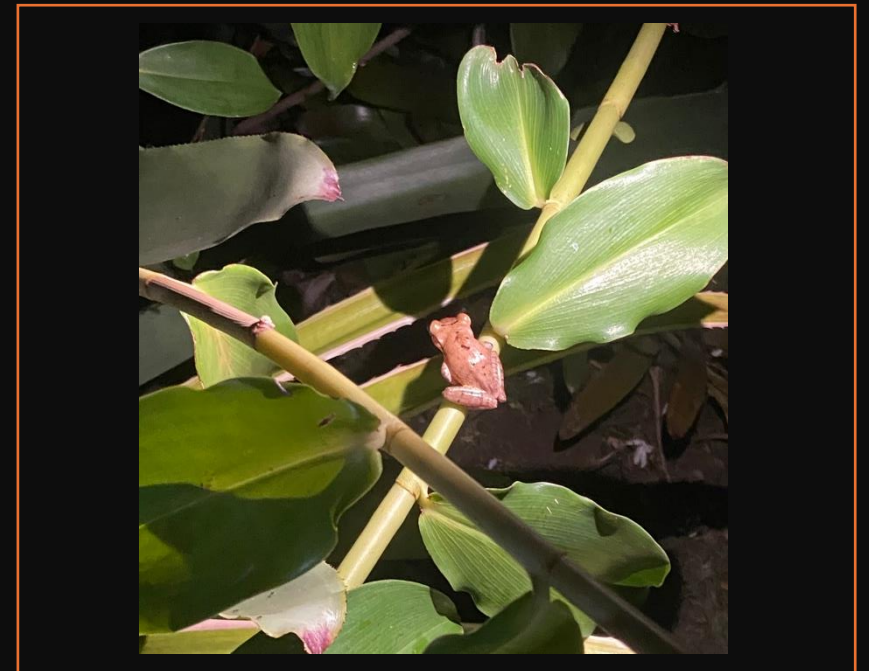
Soil enrichment



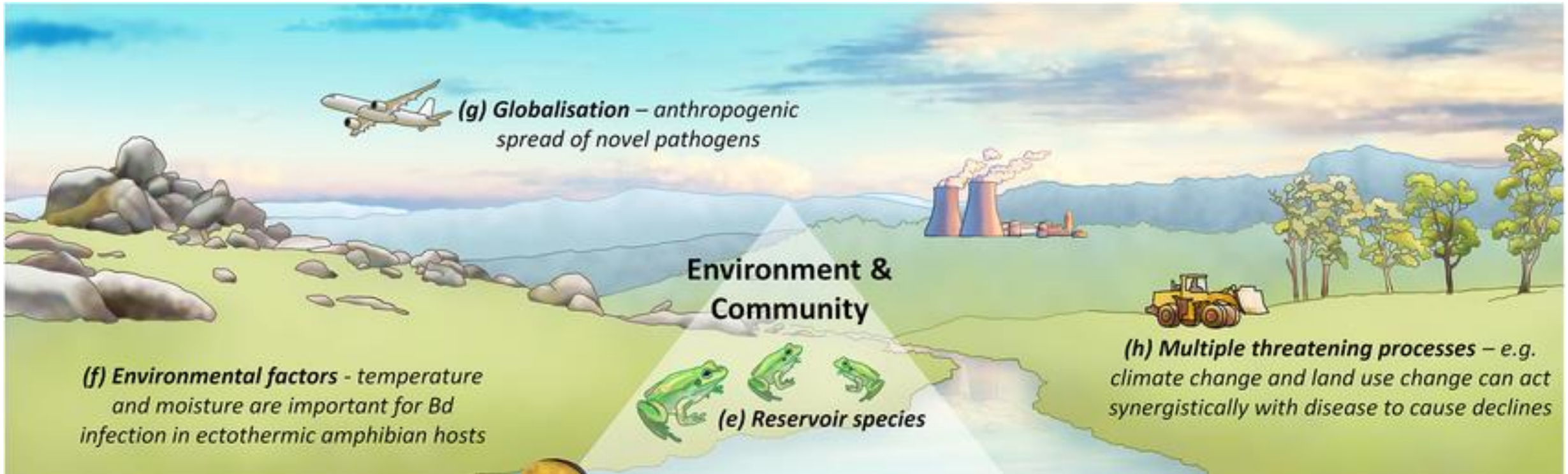
Skin microbiome secretes compounds of medical research interest



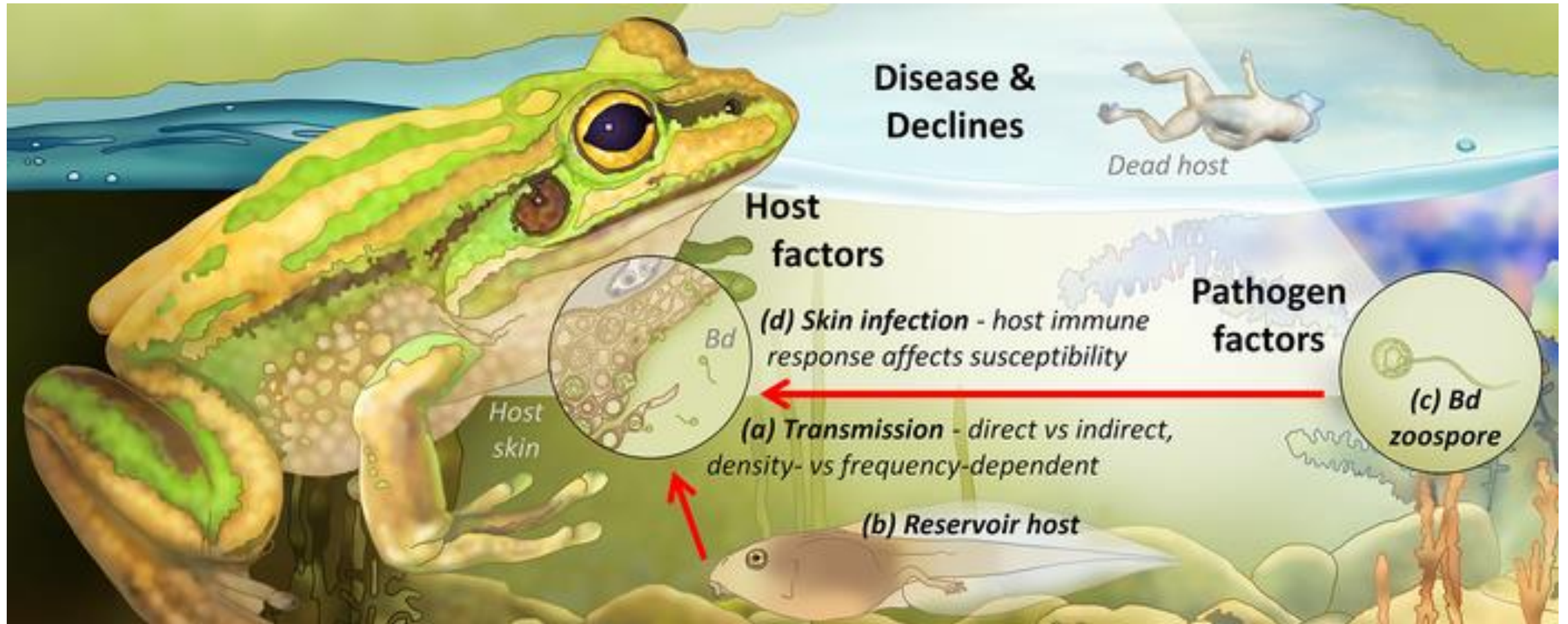
*Osteopilus ocellatus*



# Many factors affect frog populations



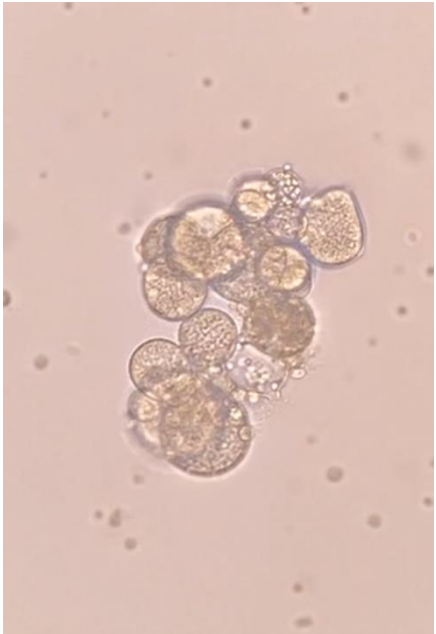
*Batrachochytrium dendrobatidis* (*Bd*) is a panzootic wildlife disease.



- Fungal pathogen that causes Chytridiomycosis, the **leading cause** of amphibian death worldwide.

# *Bd* burrows into skin and inhibits vital bodily functions

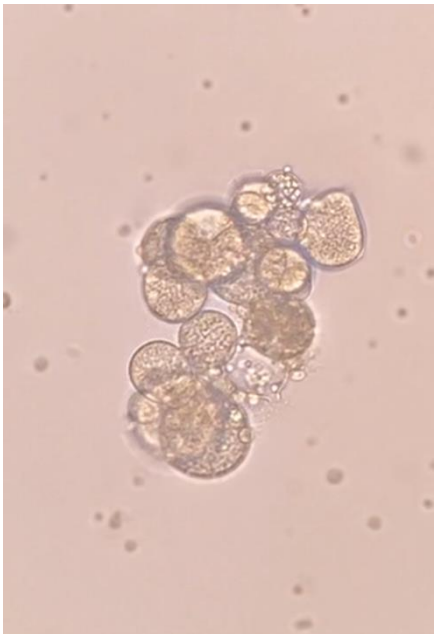
- Amphibian skin is responsible for respiration, thermal regulation, and electrolyte balance.
- *Bd* invasion induces thickening of keratin layers leading to muscle loss and cardiac arrest.
- Increasing global temperatures are providing optimal factors for *Bd* growth



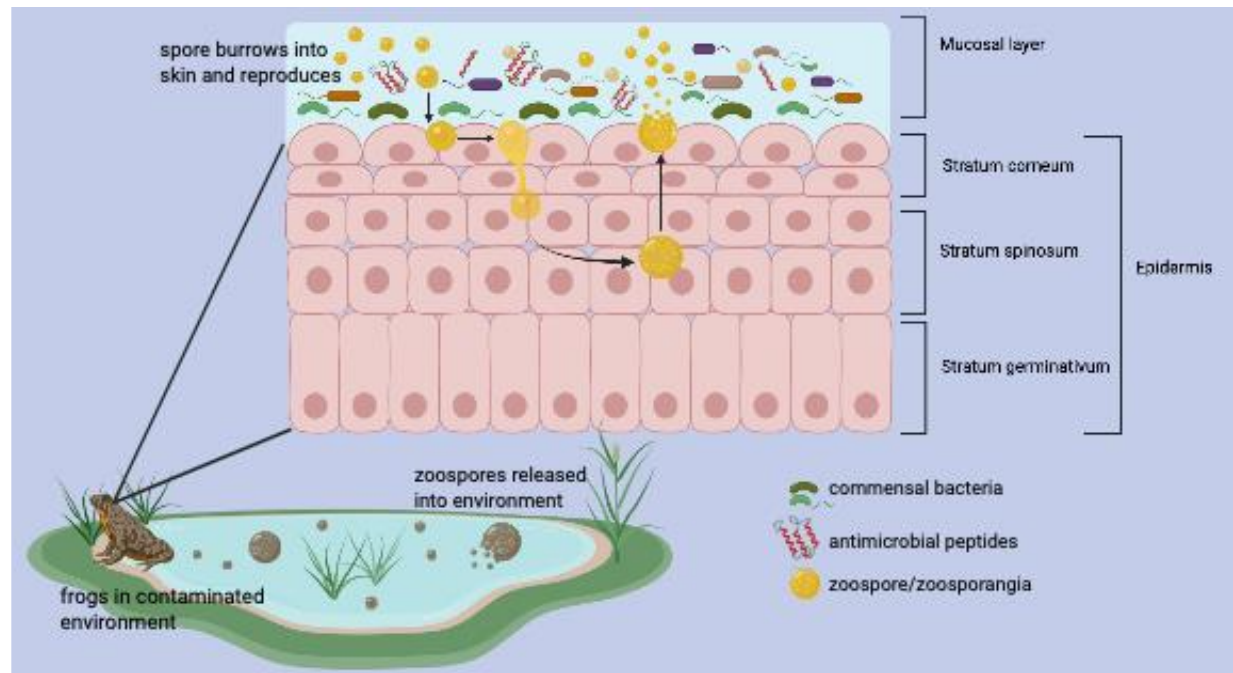
*Bd* under the microscope

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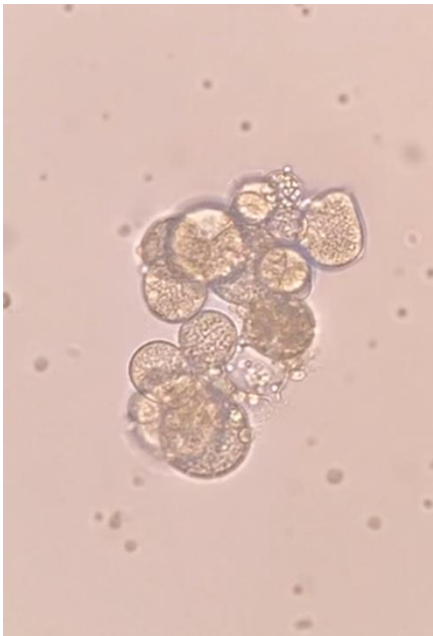


*Bd* under the microscope

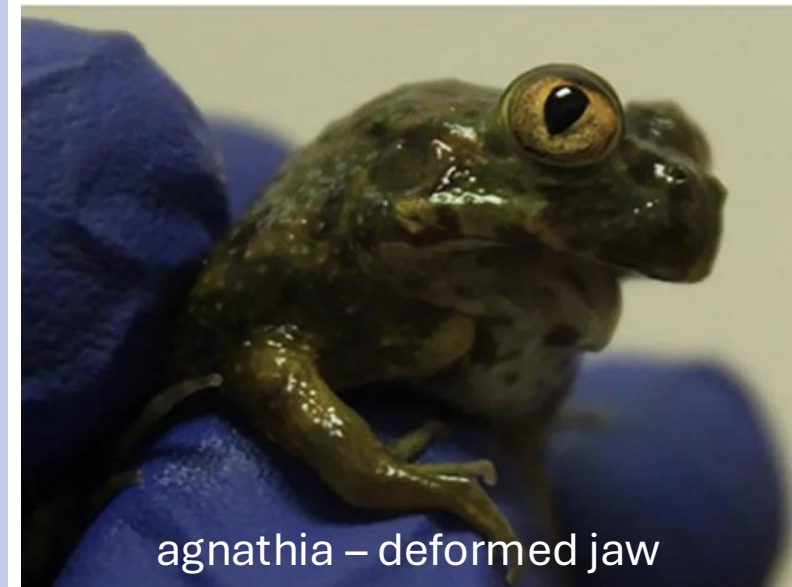
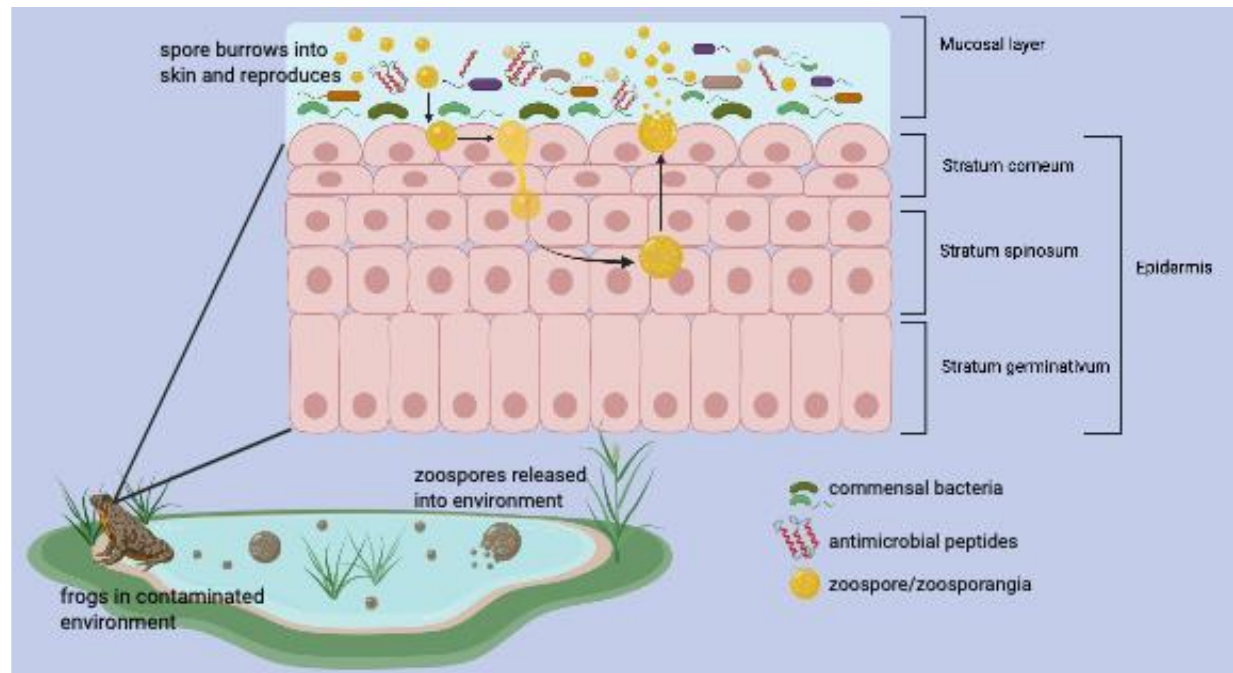


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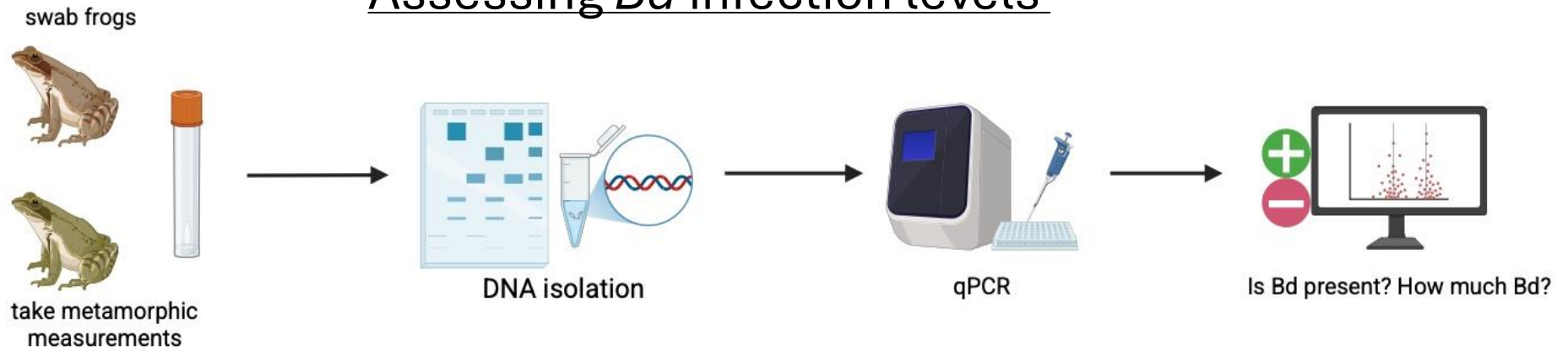
Are *Bd* infections affecting native species more than invasive species?

-  Native endangered species
-  Invasive species

Scientific Name	Photo	Sound	IUCN Red List Status	Vernacular Name	Family	Order
<a href="#">Rhinella marina</a>	<a href="#">photos</a>	<a href="#">sounds</a>	Least Concern (LC)	Marine Toad	Bufoidea	Anura
<a href="#">Eleutherodactylus alticola</a>	no photos		Data Deficient (DD)	Jamaican Peak Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus andrewsi</a>	no photos		Endangered (EN)	Jamaican Rump-spotted Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus cavernicola</a>	no photos		Critically Endangered (CR)	Portland Ridge Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus cundalli</a>	<a href="#">photos</a>		Near Threatened (NT)	Jamaican Rockfrog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus fuscus</a>	no photos		Critically Endangered (CR)	Jamaican Ear-spotted Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus glaucoreius</a>	no photos		Near Threatened (NT)	Blue Mountain Rockfrog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus gossei</a>	<a href="#">photos</a>		Least Concern (LC)	Jamaican Forest Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus grabhami</a>	no photos		Endangered (EN)	Jamaican Pallid Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus griphus</a>	no photos		Critically Endangered (CR)	Cockpit Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus jamaicensis</a>	no photos		Endangered (EN)	Jamaican Bromeliad Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus johnstonei</a>	<a href="#">photos</a>		Least Concern (LC)	Lesser Antillean Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus junori</a>	no photos		Critically Endangered (CR)	Rock Pocket Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus luteolus</a>	no photos		Endangered (EN)	Jamaican Masked Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus nubicola</a>	no photos		Endangered (EN)	Jamaican Red-eyed Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus orcutti</a>	no photos		Critically Endangered (CR)	Jamaican Streamfrog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus pantoni</a>	no photos		Near Threatened (NT)	Jamaican Yellow-bellied Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus pentasyringos</a>	no photos		Vulnerable (VU)	John Crow Yellow-bellied Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus planirostris</a>	<a href="#">photos</a>	<a href="#">sounds</a>	Least Concern (LC)	Cuban Flat-headed Frog	Eleutherodactylidae	Anura
<a href="#">Eleutherodactylus sisypodemus</a>	no photos		Critically Endangered (CR)	Leaf Mimic Frog	Eleutherodactylidae	Anura
<a href="#">Osteopilus crucialis</a>	<a href="#">photos</a>		Endangered (EN)	Jamaican Snoring Treefrog	Hylidae	Anura
<a href="#">Osteopilus marianae</a>	no photos		Endangered (EN)	Jamaican Yellow Treefrog	Hylidae	Anura
<a href="#">Osteopilus ocellatus</a>	no photos		Least Concern (LC)	Jamaican Laughing Treefrog	Hylidae	Anura
<a href="#">Osteopilus wilderi</a>	no photos		Endangered (EN)	Jamaican Green Treefrog	Hylidae	Anura
<a href="#">Rana catesbeiana</a>	<a href="#">photos</a>	<a href="#">sounds</a>	Least Concern (LC)	American Bullfrog	Ranidae	Anura

# Are there differences in infection rates between native and invasive frogs?

## Assessing *Bd* infection levels



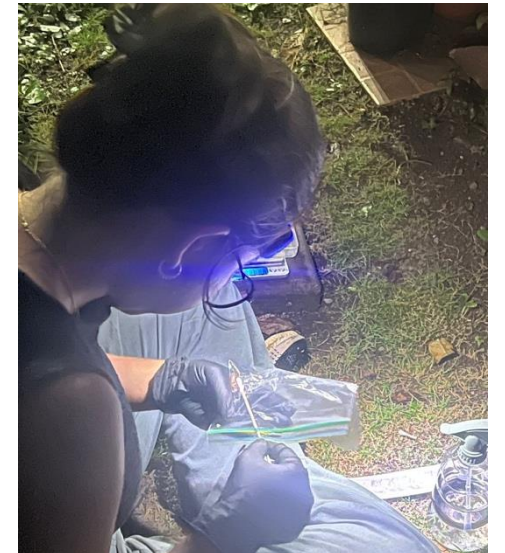
*Eleutherodactylus johnstonei*



*Eleutherodactylus glaucoreious*



*Eleutherodactylus gossei*



# 3 of 33 samples were positive for *Bd*



This woman just swabbed me for nothing.....

Frog Species	n	no. <i>Bd</i> +	% <i>Bd</i> +	<i>Bd</i> load
<b>Native</b>				
<i>Eleutherodactylus gossei</i>	13	1	7.79	970
<i>E. cundalli</i>	1	0	0	-
<i>E. andrewsi</i>	2	0	0	-
<i>E. alticola</i>	1	1	100	386
<i>Osteopilus ocellatus</i>	1	0	0	-
<b>Invasive</b>				
<i>E. planirostris</i>	6	1	33.3	53
<i>E. johnstonei</i>	10	0	0	-

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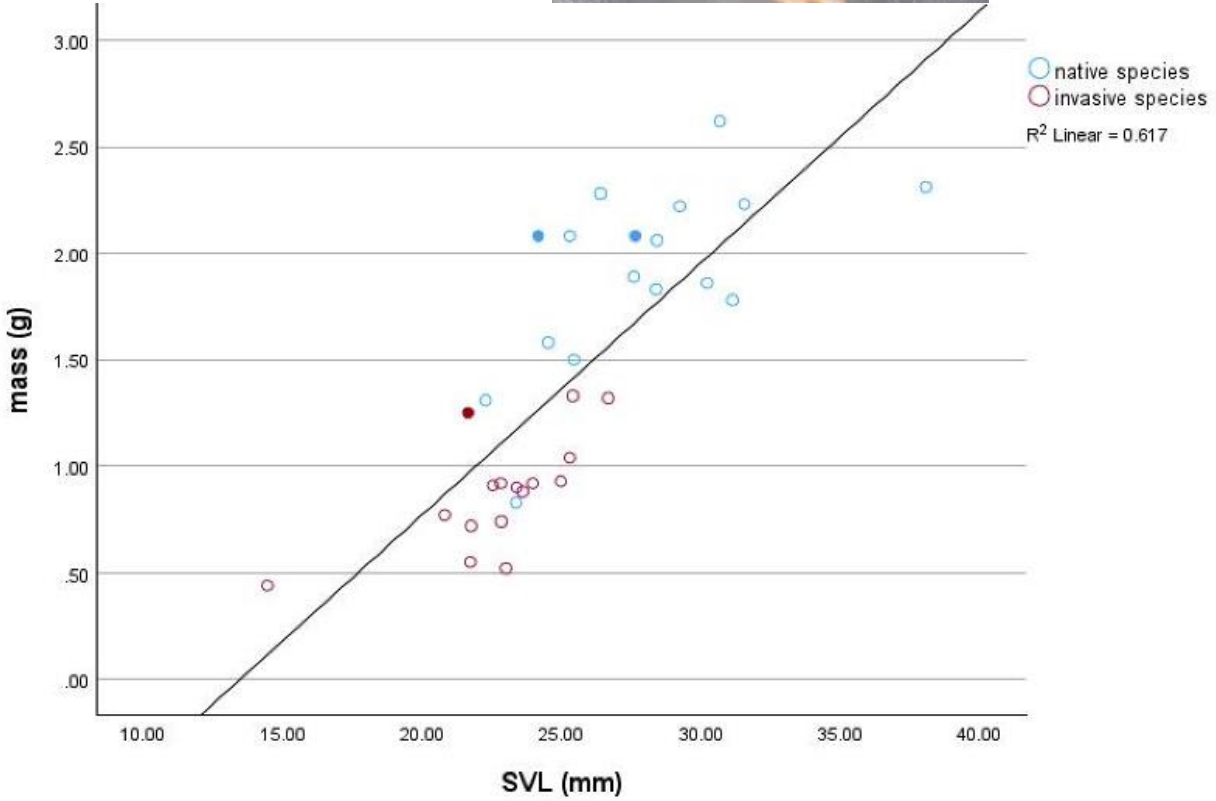
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- 2 of 3 positive samples are native species
- Relatively low *Bd* concentrations

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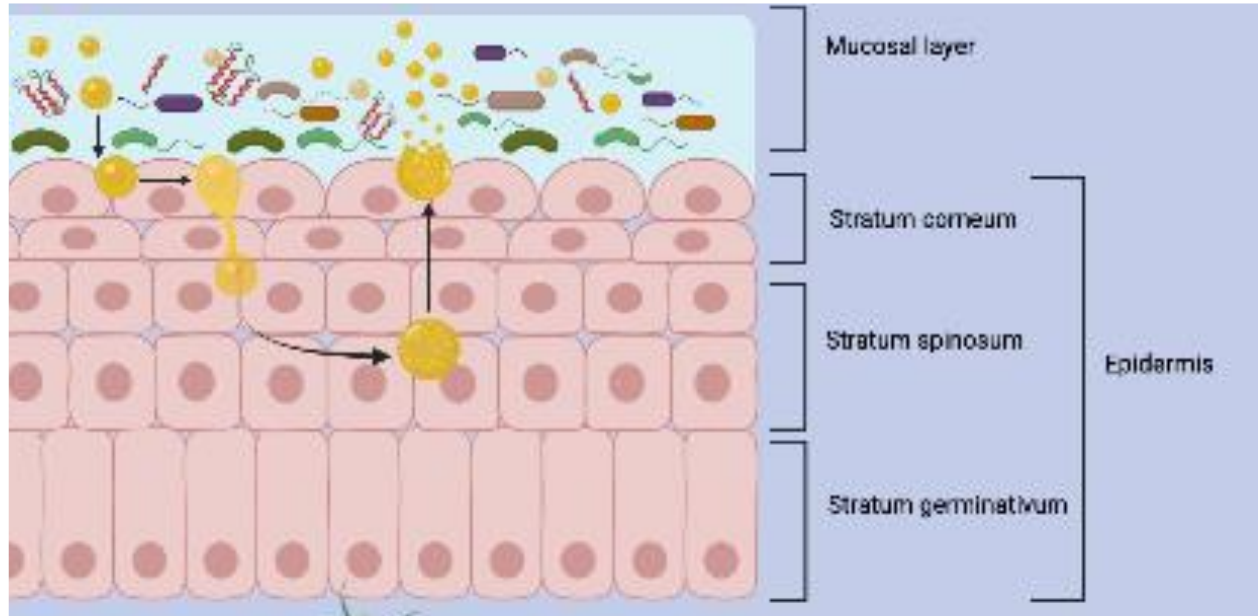
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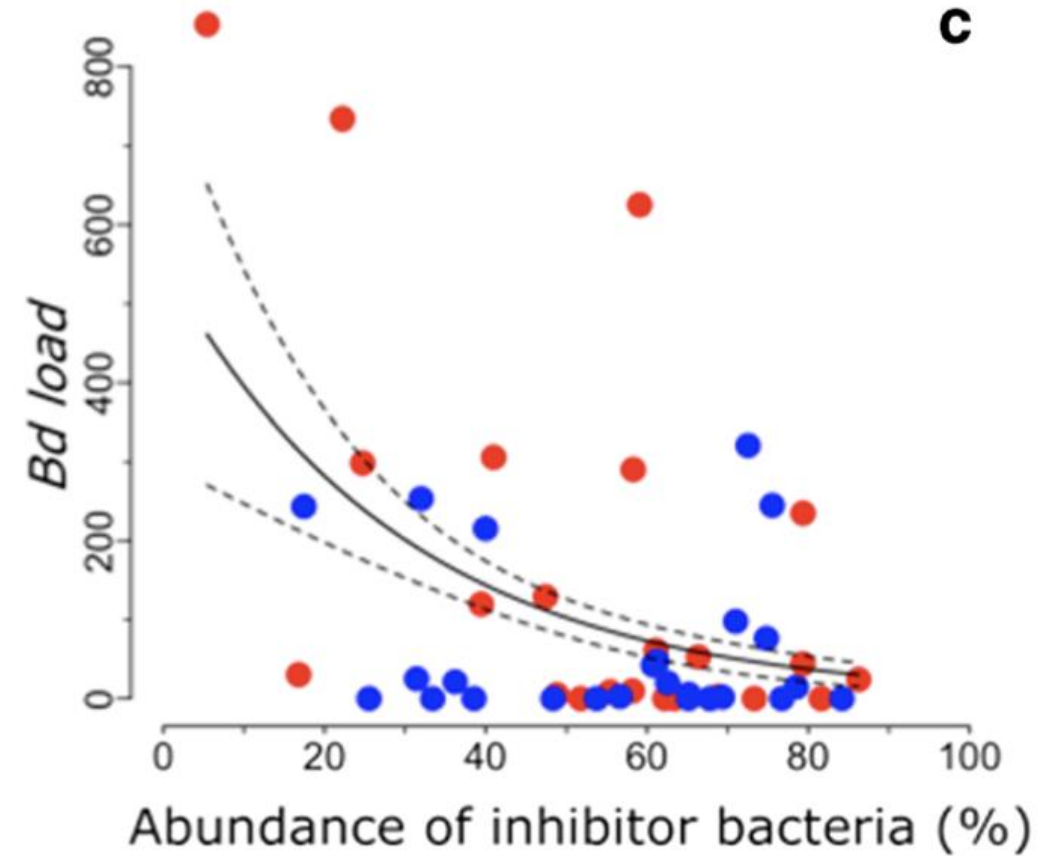
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- Relatively low *Bd* concentrations

- *Bd* does not seem to be affecting body condition scores

# High abundance of inhibitor bacteria within the microbiome correlates to lower levels of *Bd*



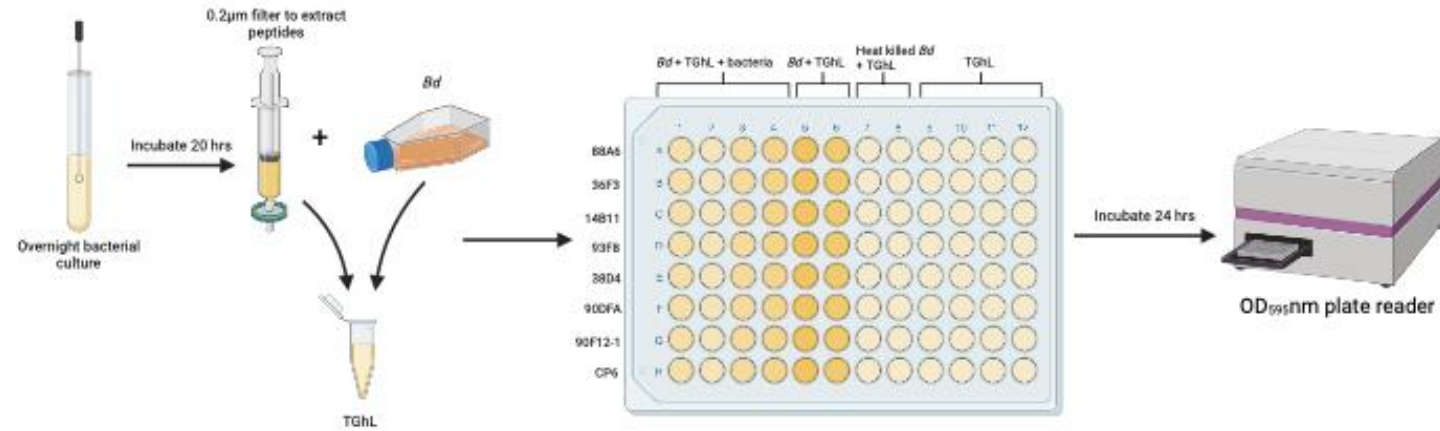
Bacteria produce anti-fungal metabolites that inhibit *Bd* replication



Nava-González, B., Suazo-Ortuño, I., López, P.B. *et al.* Inhibition of *Batrachochytrium dendrobatidis* Infection by Skin Bacterial Communities in Wild Amphibian Populations. *Microb Ecol* **82**, 666–676 (2021).

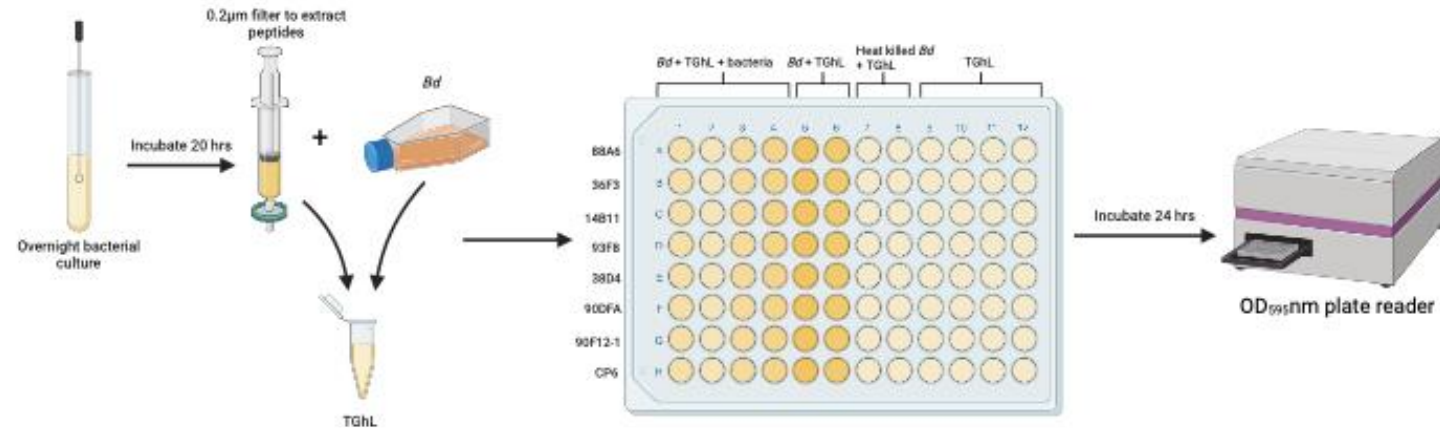
# Can we identify which *Pseudomonas* species that display *Bd* inhibitory effects?

## Bacterial metabolite inhibition assay

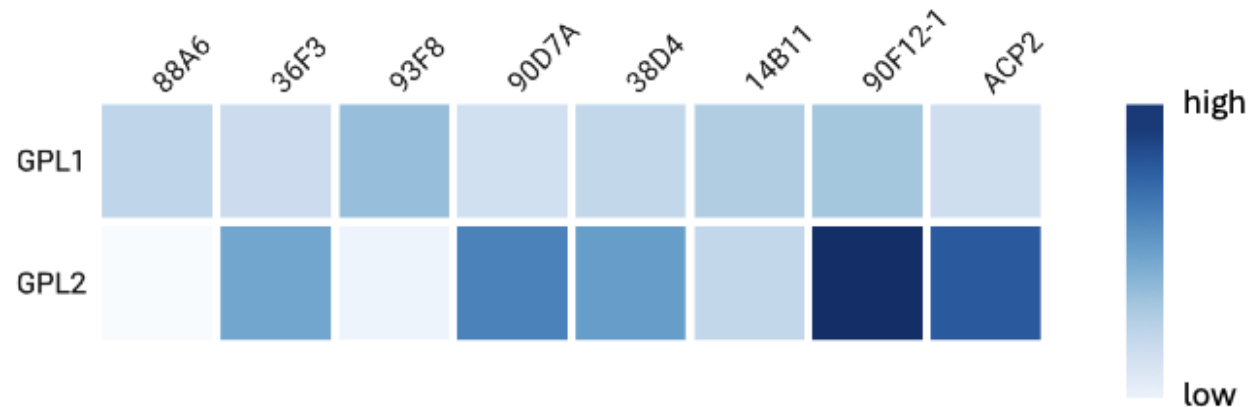


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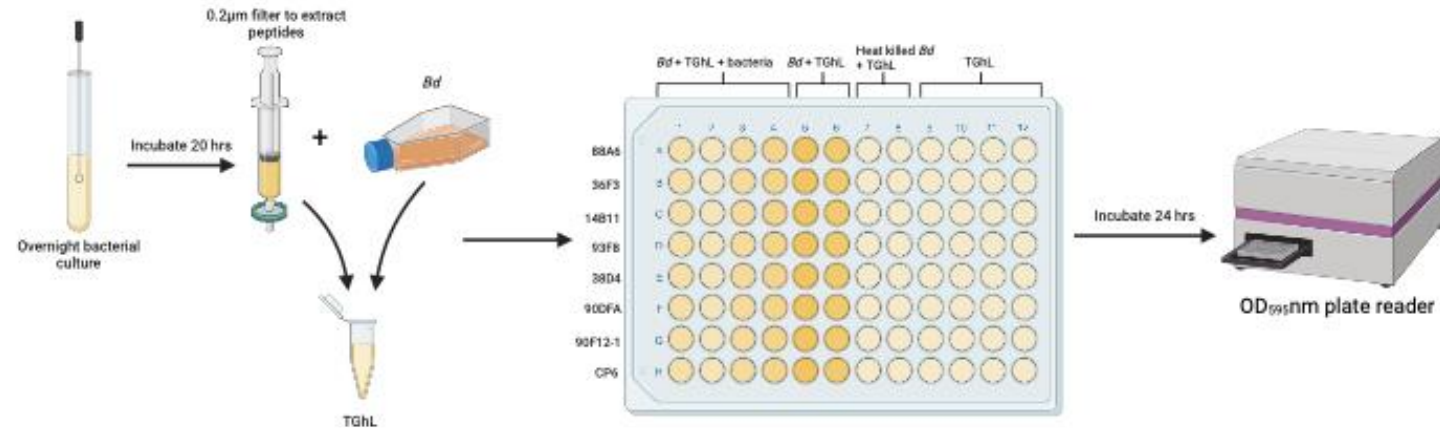


## ***Bd* Inhibition Assay**



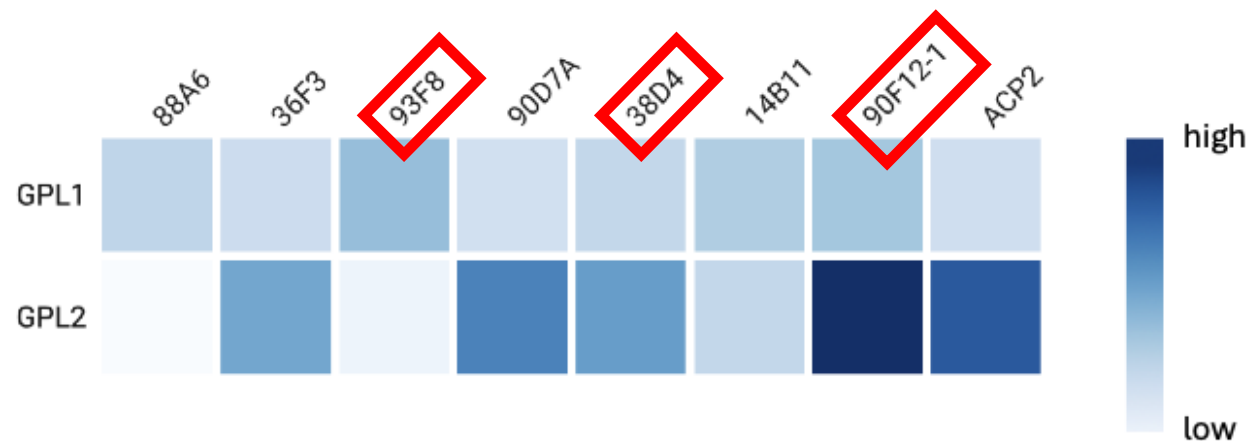
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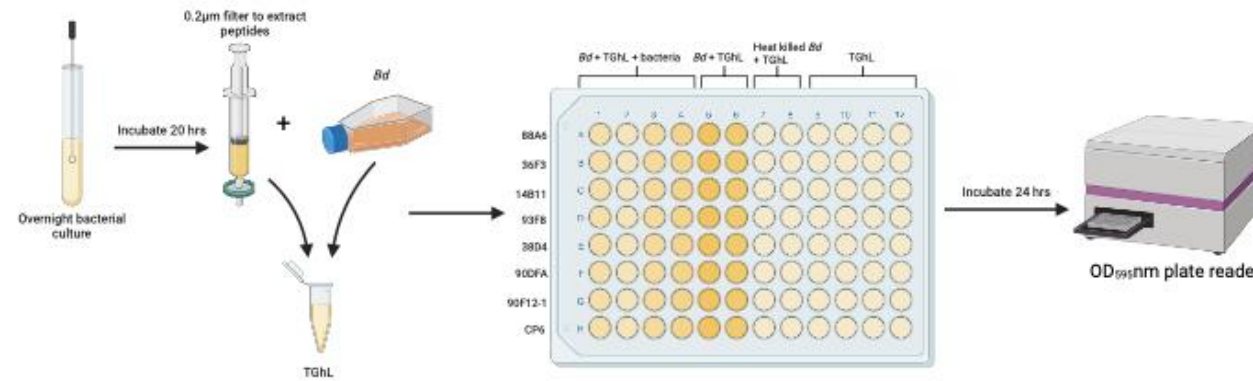


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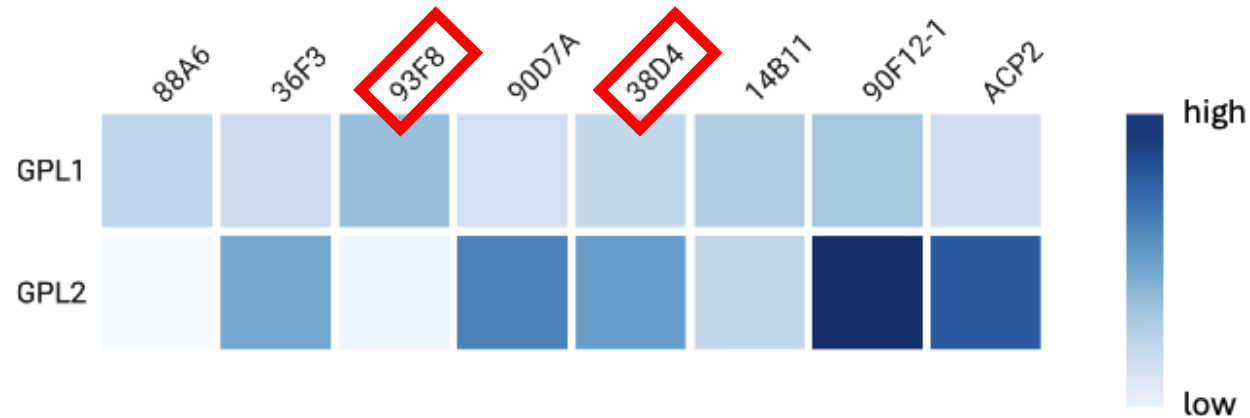
- *P. rhodesia* 90F12-1 displays the most inhibition
- *P. brassicacearum* 93F8 and 38D4 displayed moderate inhibition



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## *Bd* Inhibition Assay



# Discussion

- Differences in infection rates between invasive and native species could be due to interspecific interactions
- *P. rhodesia* and *P. brassicacearum* present as new potential inhibitor bacteria
- Inoculating bacteria is not as simple as it sounds

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## Future Works

- Shotgun metagenomic sequencing to compare microbiome compositions between native species that are critically endangered and those that are thriving amongst *Bd*.
- Mass spectrometry to analyze which specific metabolites are responsible for these inhibitory effects
- Potentially inoculate specific inhibiting metabolites instead of whole bacterium

# Acknowledgements

- Dr. Strand and Dr. Lehtinen
- Copeland Funding
- Damion Whyte and Sloane Jackson
- Richards-Zawaski Lab at University of Pittsburgh
- Strand and Williams Lab



**Thank you for listening!**