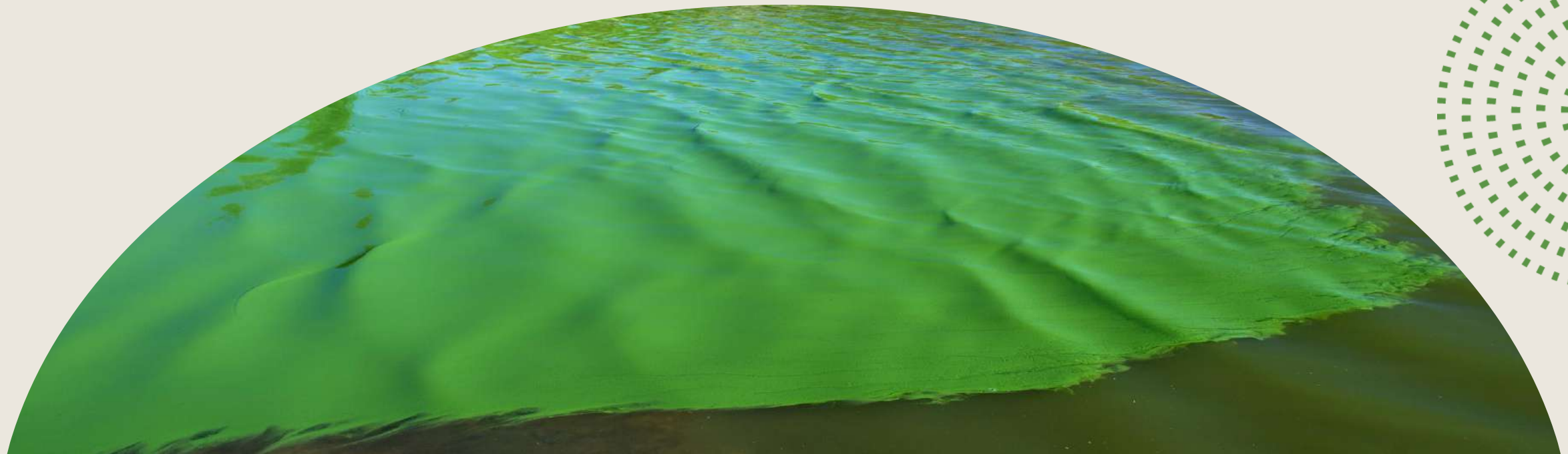
ONE HEALTH PhD FORUM 2ND EDITION

Freshwater Under Pressure:

Daphnia spp. as Sentinels of Cyanobacterial Stress

Ivo Pinto, Luísa Azevedo, Sara C. Antunes



Introduction

Contributing Factors

Stagnant water

Fertilizer and sewage runoff

Animal waste

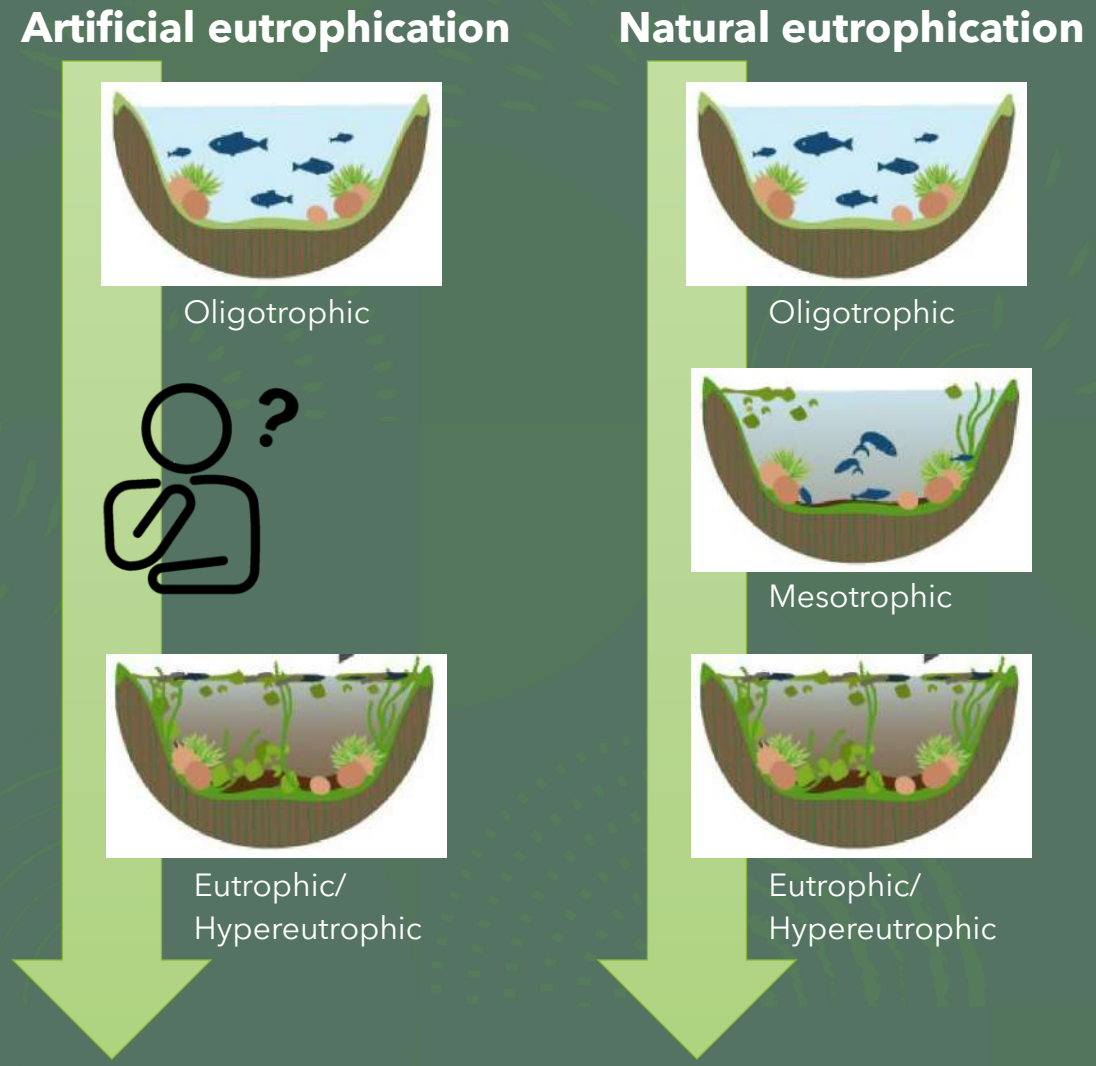
Chemical discharge

Climate change

Water and air temperature increases

Droughts and flooding increases

Amount of CO_2 increases



Cyanobacteria Blooms

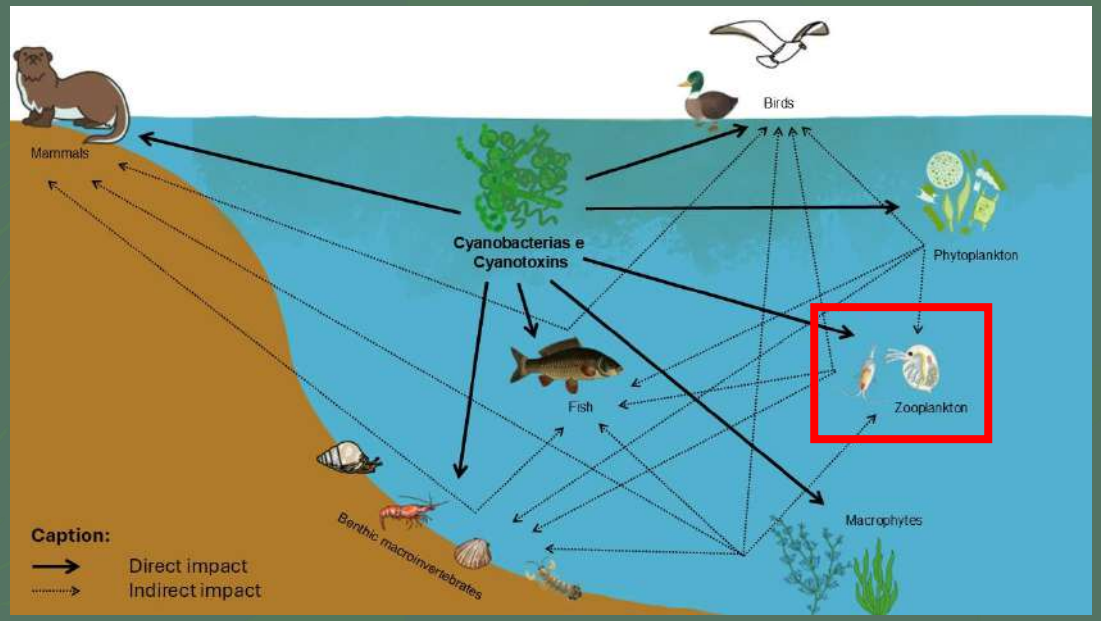
- Prokaryotes, blue-green color, able to perform photosynthesis;
- *Microcystis*, *Planktothrix*, *Synechococcus*, *Anabaena*, *Aphanizomenon*;

- Oxygen depletion, toxin production, alteration of the food web
- Biochemical changes, growth and fertility disorders and mortality;

- Zooplanktonic organisms are the main target – Primary consumer







Aim

How do *Daphnia* spp. react when cyanobacteria are used as their primary food source?

- H0 – No significant effects are observed.
- H1- *Daphnia* spp. showed significant effects.
- H2 - *Daphnia* spp. from different locations exhibited different effects to cyanobacteria.







Methods

Organisms

- 3 *Daphnia* species
- *Aphanizomenum flos-aquae* (LEGE 231513)

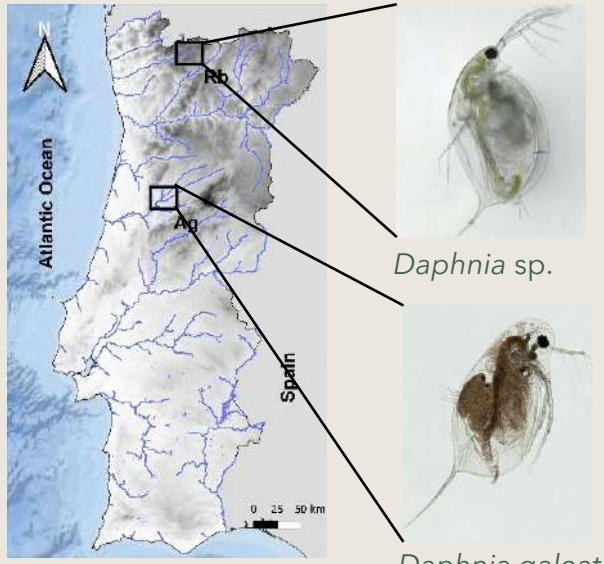
Daphnia feeding rate assays
(McWilliam and Baird, 2002)

- T1 - 7.5×10^4 cells/mL — **Medium risk**
- T2 - 1.5×10^5 cells/mL — **High risk**
- T3 - 3.0×10^5 cells/mL — **High risk**
- T4 - 1.2×10^6 cells/mL — **Very high risk**

Public health risk
(World Health Organization, 2023)

Feeding rate

Oxidative stress, neurotoxicity and reserves

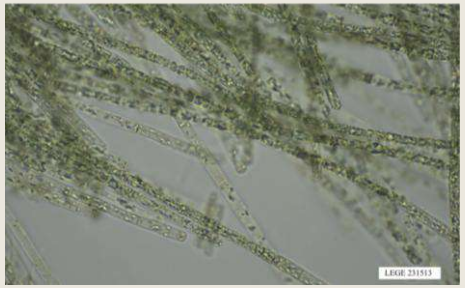


Daphnia sp.

Daphnia galeata



Daphnia magna
(model species)



Aphanizomenum flos-aquae (LEGE 231513)



Results

Daphnia feeding rate

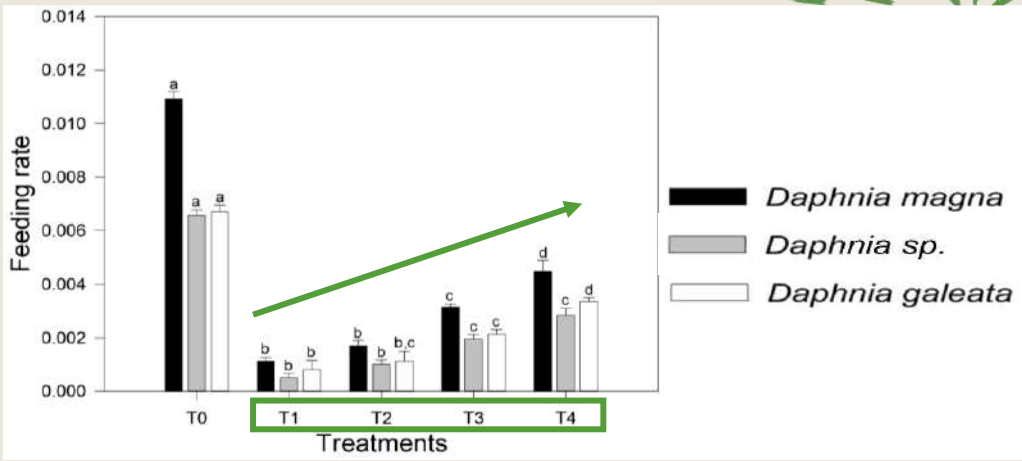
- Validation of assay at T0 – Control group
- Significant inhibition in all food treatments
- Increasing trend over the treatments

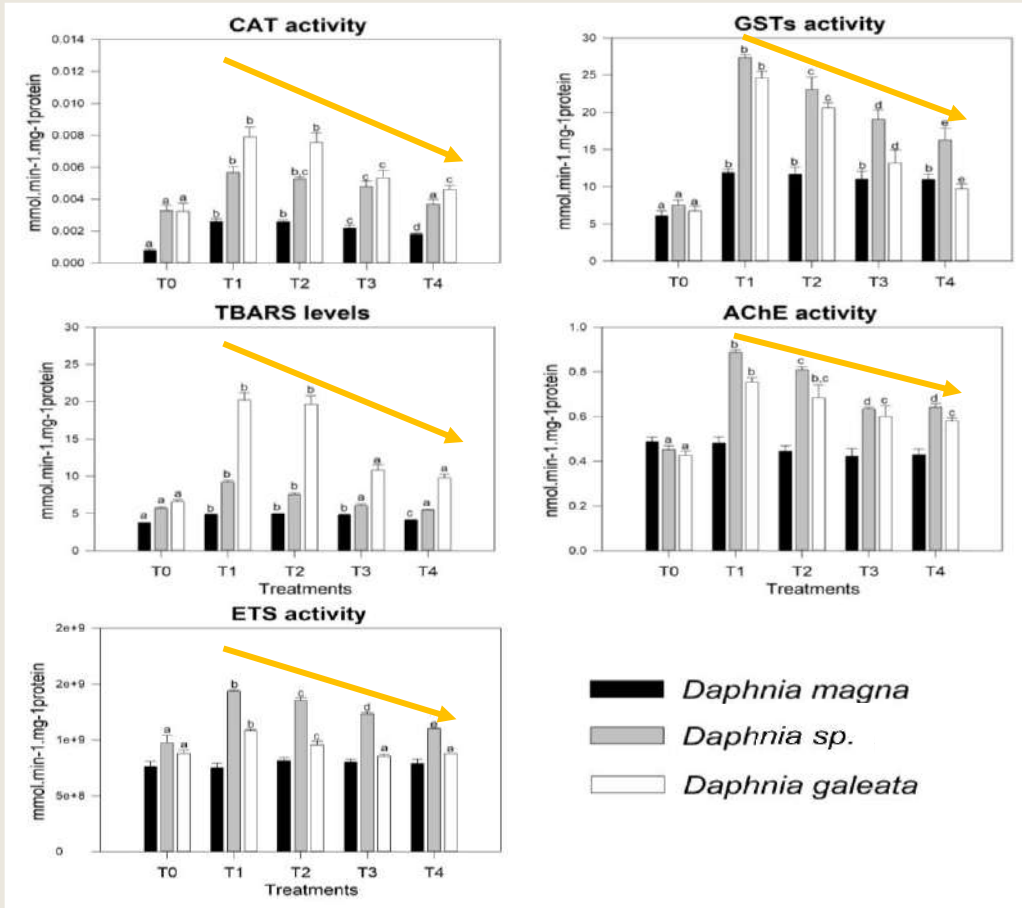
- No significant differences between the two field species

Daphnia biomarker response

- *D. magna* affected regardless the concentration (CAT, GSTs, and TBARS)
- *Daphnia* from field affected depending on the concentration (All biomarkers)

- *Daphnia* sp. and *D. galeata* show different responses





Results

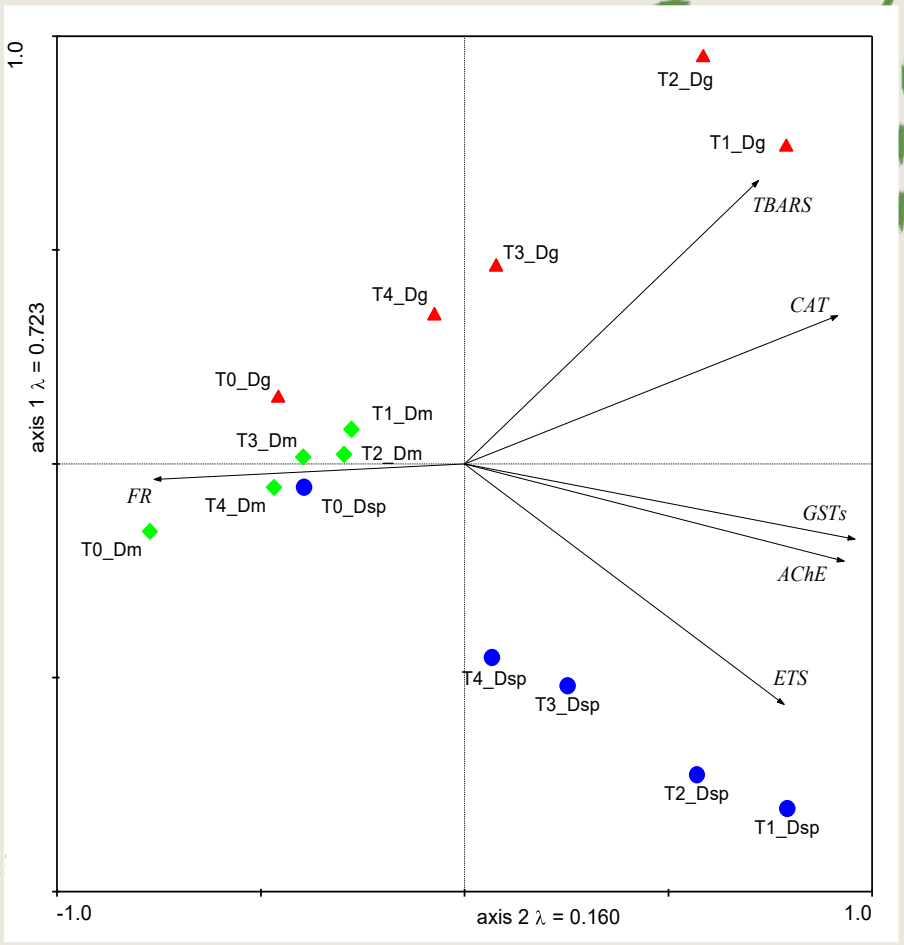
Daphnia spp. performance

- Distinct responses of the 3 species:

◆ *Daphnia magna*

▲ *Daphnia galeata* (Aguieira reservoir)

● *Daphnia* sp. (Rabagão reservoir)



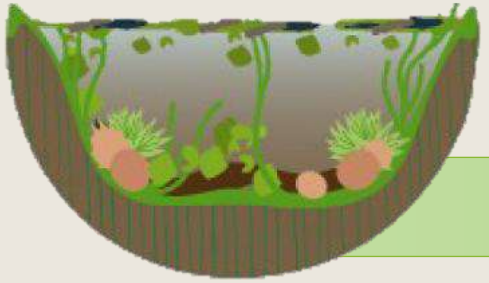
As cyanobacteria concentration increases *Daphnia* spp. response improves – Lower than the control

⚠ T4 - 1.2×10^6 cells/mL (Very high risk)

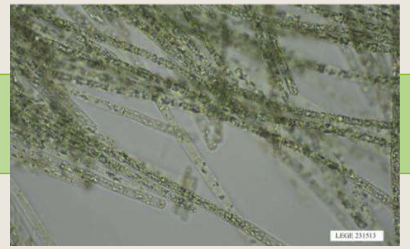
Conclusion

- H1- *Daphnia* spp. showed significant effects. **YES**
- H2 - *Daphnia* spp. from different locations exhibited different tolerance to cyanobacteria **INCONCLUSIVE**

A One Health Perspective



Eutrophic
Cyanobacteria blooms



Humans
(Shortage of drinking water)

Imbalance

Animals
(Species collapse)

Environment
(Loss of biodiversity)

This work provides us:

Education	Prediction	Detection	Control	Improve
Participatory science	Warning systems	Environmental changes	Mitigate risks	Management plans

ONE HEALTH CYCLE

Thank you

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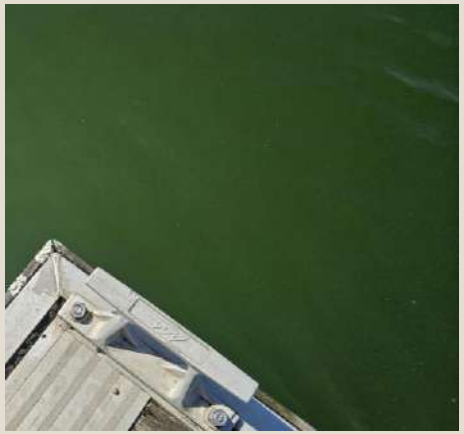
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3 UMIB, Unit for Multidisciplinary Research in Biomedicine, University of Porto

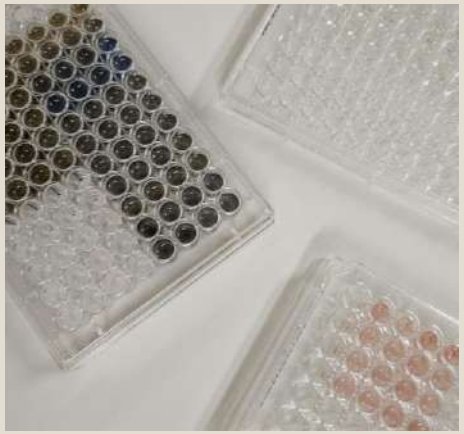
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5 ITR - Laboratory for Integrative and Translational Research in Population Health









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