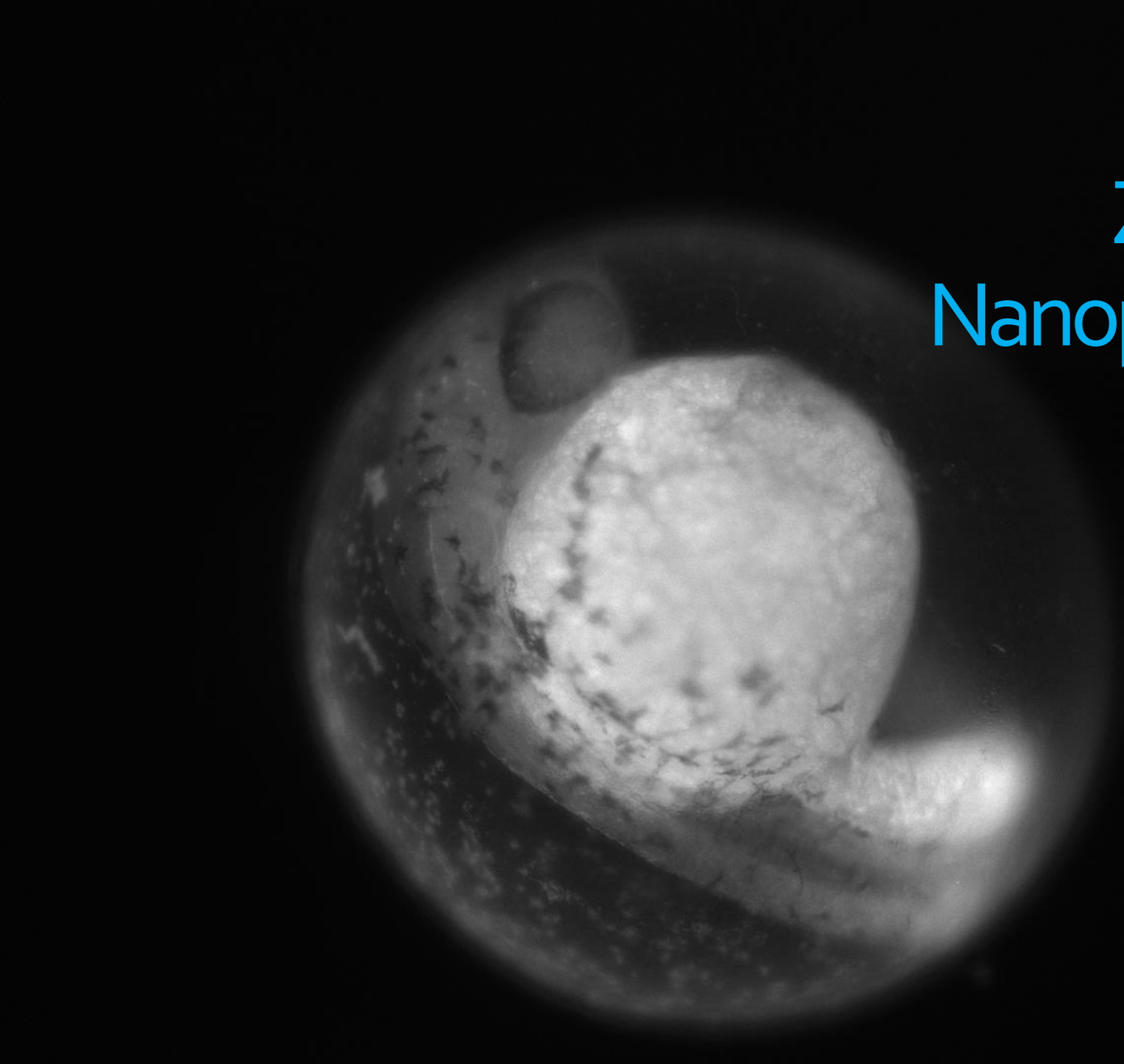


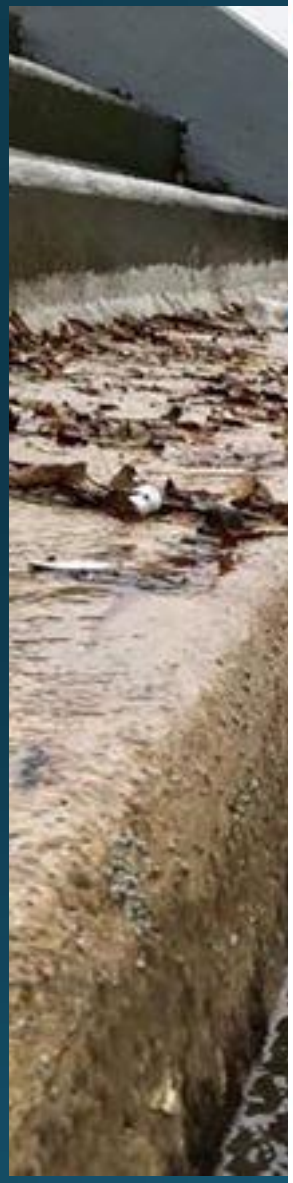
Host Response of Zebrafish Embryos to Nanoplastic Contamination

Sandra Marbach

Texas A&M Corpus Christi
Laboratory of Environmental Health

TEXAS A&M UNIVERSITY CORPUS CHRISTI | COLLEGE OF SCIENCE AND ENGINEERING

Image Credit: Corpus Christi Coastal Issues Forum



Millions of Plastic Pellets in Lavaca Bay? Formosa Says it's Just 'Trace Amounts'

After decades of polluting the air and water in Point Comfort, Formosa is now being confronted about its release of millions of plastic pellets.

Erin Gaines, a Texas RioGrande Legal Aid attorney, said the bays near Formosa's plant contain "a massive amount" of pellets. *AP PHOTO/THE VIRGINIAN-PILOT, PAUL L. NETTLES*

Naveena Sadasivam
Feb 4, 2019, 1:44 pm CST

OBSERVER

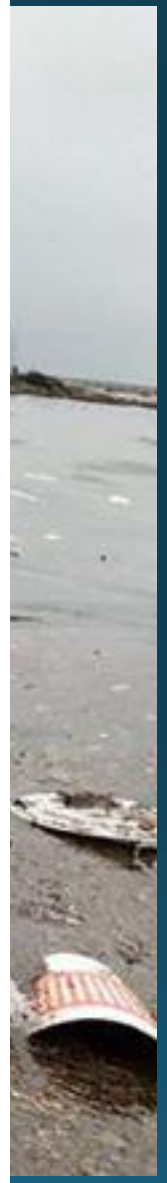


Image Credit:

ENVIRONMENT | PLANET OR PLASTIC?

Microplastics found in 90 perce table salt

A new study looked at sea, rock, and lake salt sold around the worl what you need to know.

3 M

BY LAURA PARKER

PUBLISHED OCTOBER 17, 2018

New study finds microplastic American beer

A study in the US has been eye-opening

BY KATIE AVIS-RIORDAN MAY 5, 2018

THE DAILY NEWSLETTER
Sign up to our daily email newsletter

NewScientist

News Technology Space Physics Health Environment Mind Video | Tours Events Job

Plastic tea bags shed billions of microplastic particles into the cup

HEALTH 25 September 2019

By Ad

Health

You're literally eating microplastics. How you can cut down exposure to them.

A cluster of plastic pieces on a finger. When you eat, drink or even breath, you're almost certainly taking in tiny particles along with it. These ubiquitous fragments are known as microplastics. (iStock)

By Consumer Reports

Nanoplastics: What are they? Why do they matter?

- Particles smaller than 1 µm (1000 nm)
- High chemical stability = high environmental accumulation rates
- Sources:
  - UV degradation
  - Mechanical shearing
  - Laundry
  - Cosmetics
  - Industrial use of plastics/ Plastic production

- Wide range of shapes, chemical compositions, and sizes
- Nanoplastic surface charge affects hydrophilicity/ hydrophobicity
  - Chemical pollutants adsorb to particles (Almi, Olubukola, S., et al., 2018)
- Accumulate in lipid rich areas of several shellfish (Al-Sid-Cheikh et al., 2018)
- **Exposure routes:** Ingestion, Inhalation, Dermal Exposure

The Zebrafish Model

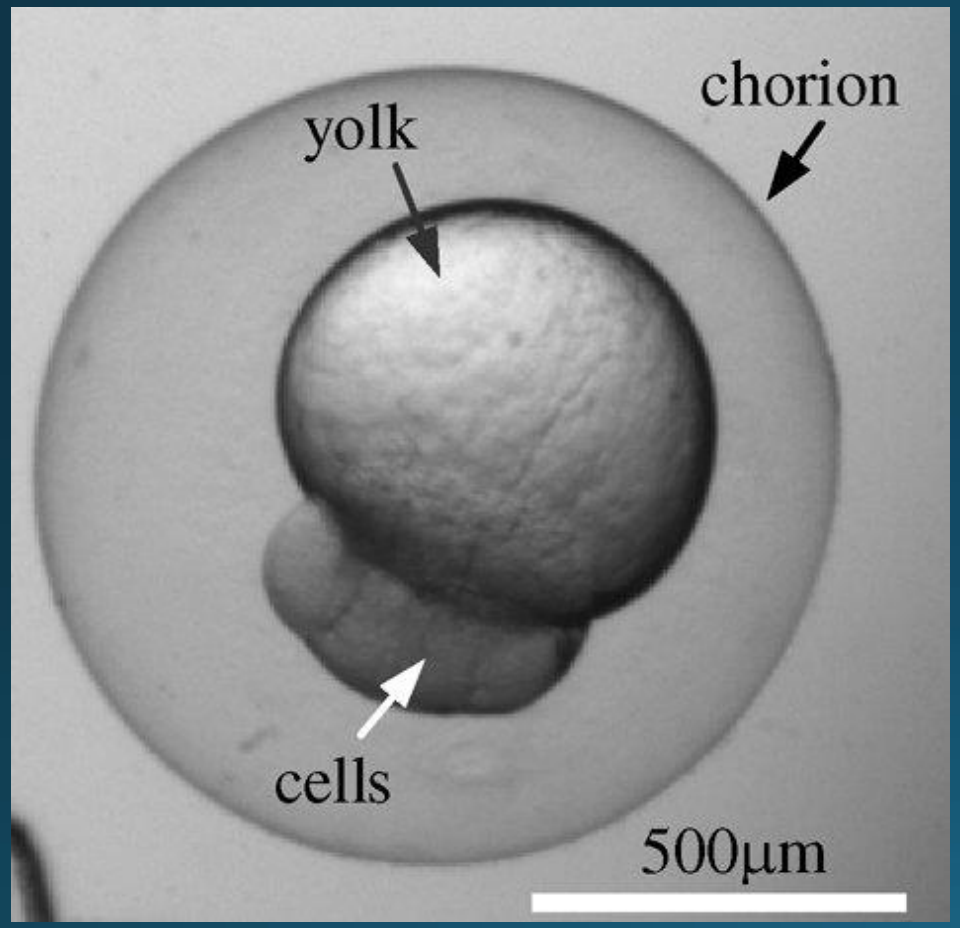


Image: W.H. Wang et al

- Transparent
- Sensitive to environmental pollution during embryonic development
- Chorion is the 1st barrier with pores of **0.5 – 0.7 µm diameter**
- Homology with human genome

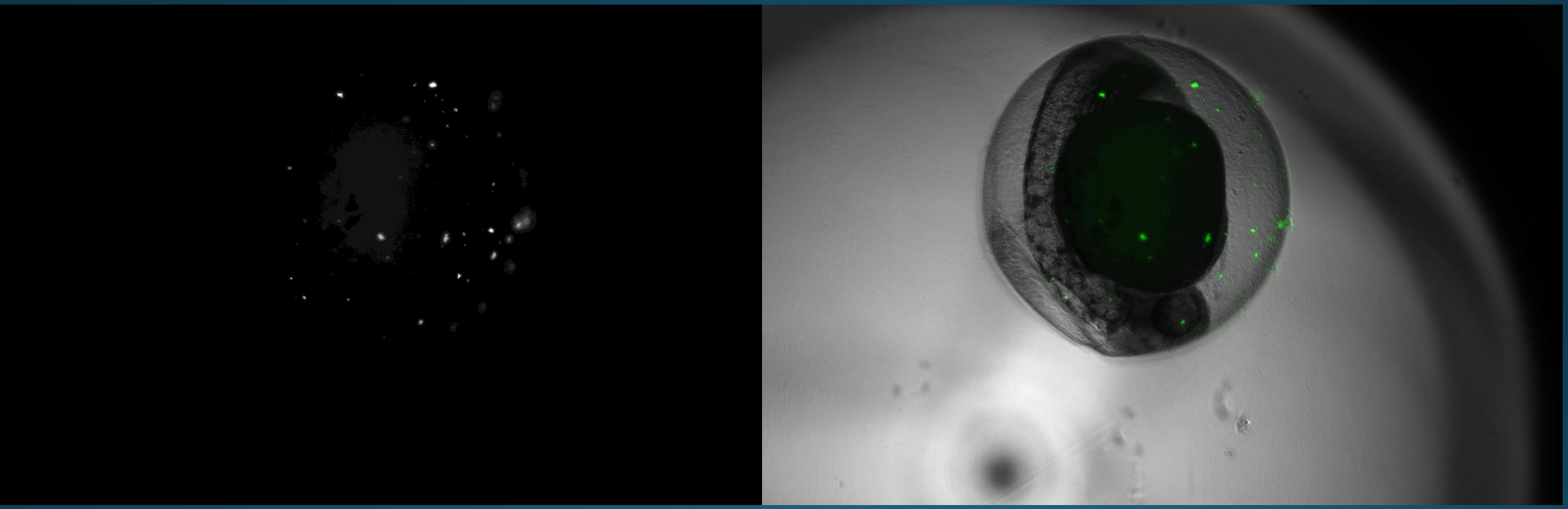
Environmentally relevant concentrations of NPs will affect the **gene expression, mortality rate, and development of embryonic Zebrafish**.

Experimental Design

0hpt
- Nanoplastic exposure
  - 3nm, 5nm, 30nm, 50nm, 100nm diameter
  - 0.1ppm, 1.0ppm, 10ppm

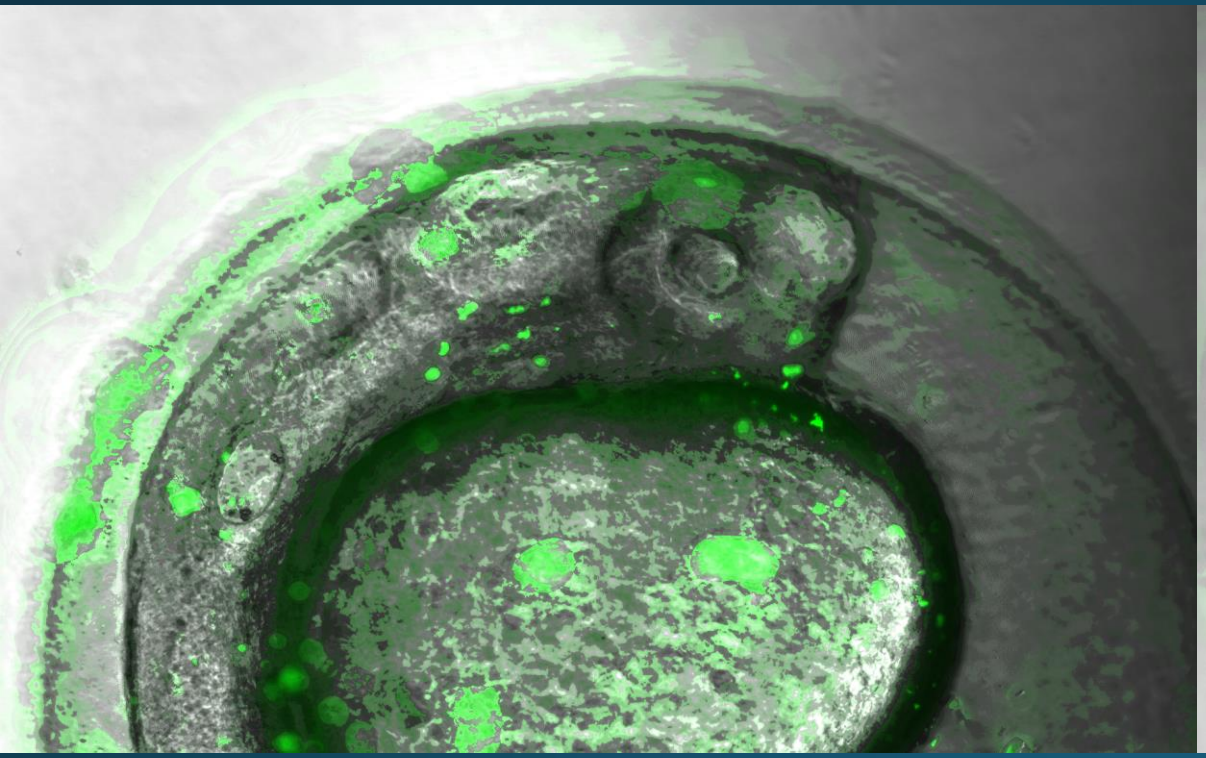
24, 48, 96hpt
- Mortality counts
- Embryo collection
- Microscopy
- Treatment collection

Analysis
- qPCR: gene expression
- Fluorescence microscopy
- Histology slide preparation
- Fluorescence quantification

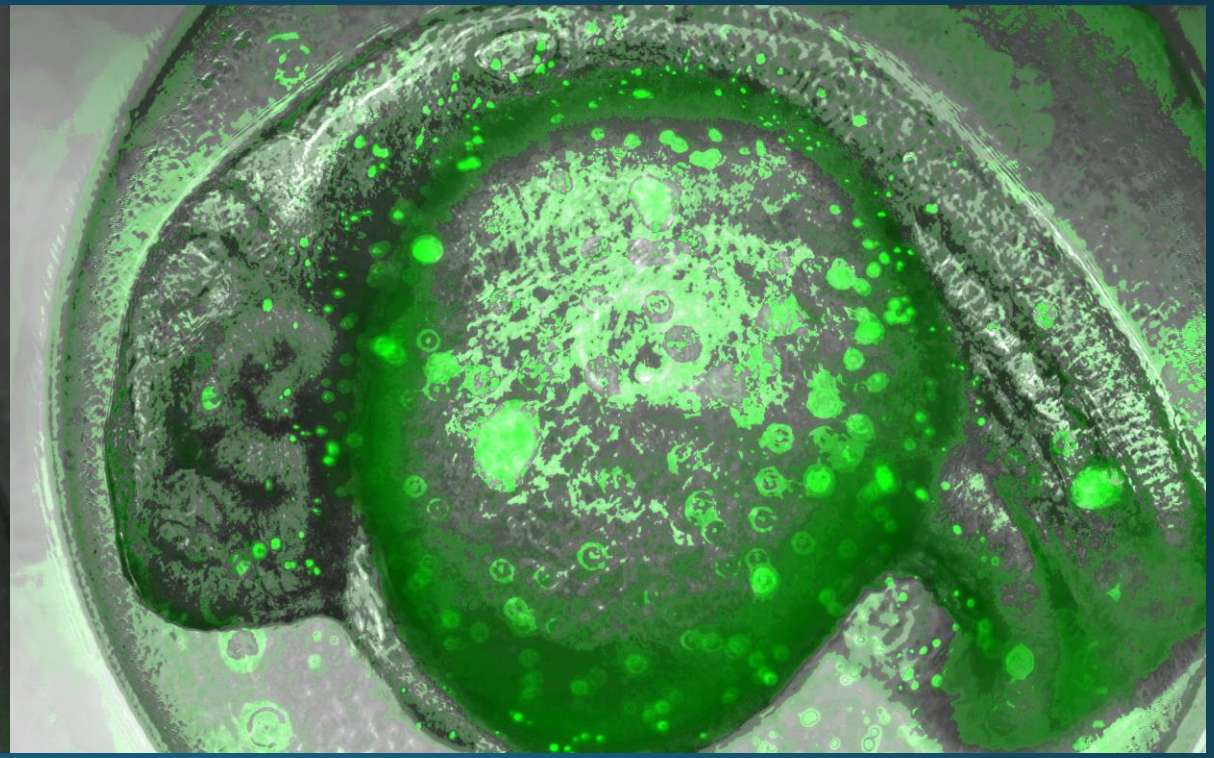


100nm, orange Polystyrene

100nm Nanoplastic Adsorption 24hpt

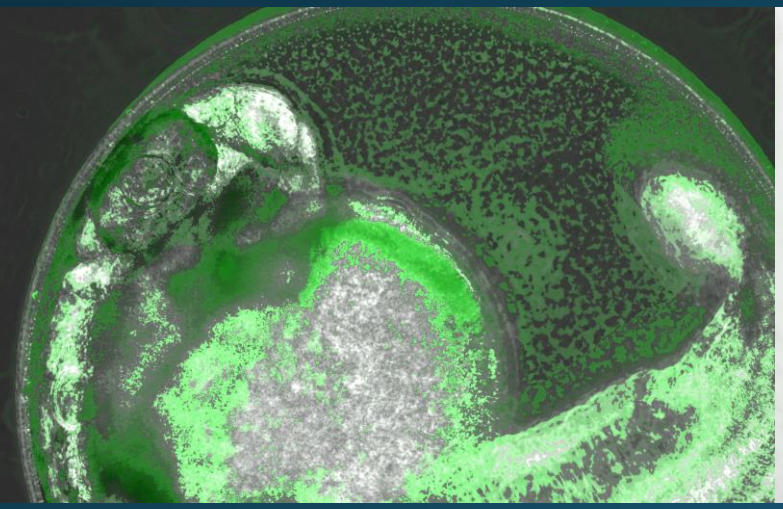


1ppm

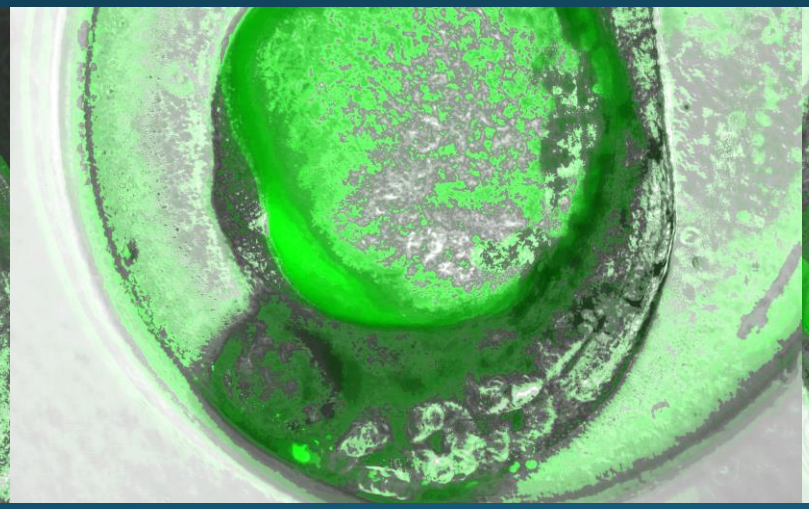


10ppm

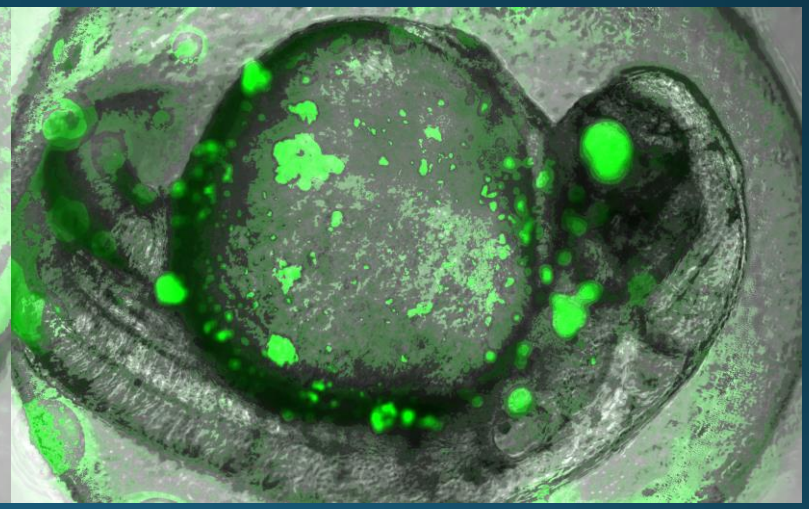
100nm Nanoplastic Adsorption 48hpt



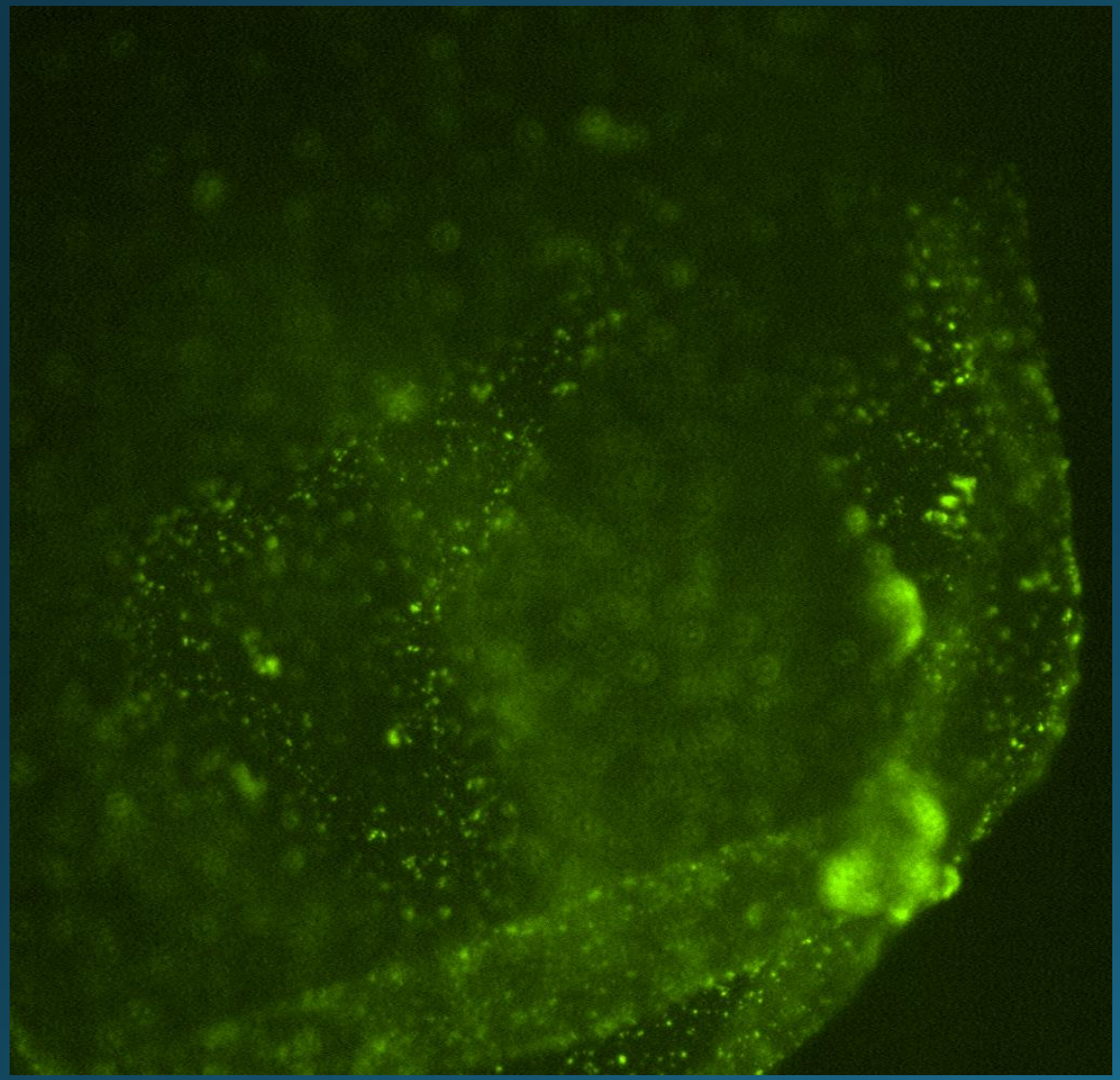
0.1ppm

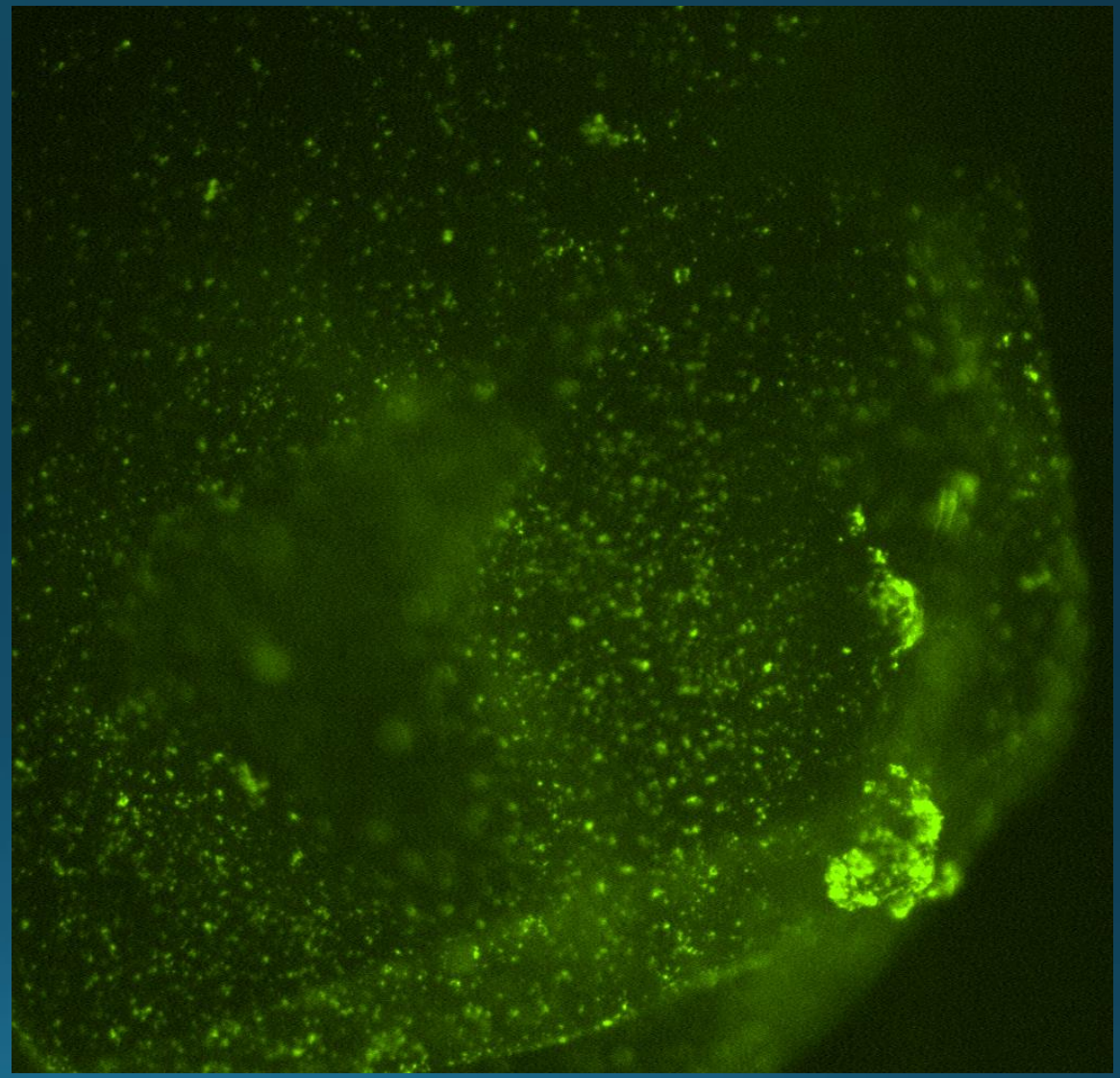


1.0ppm

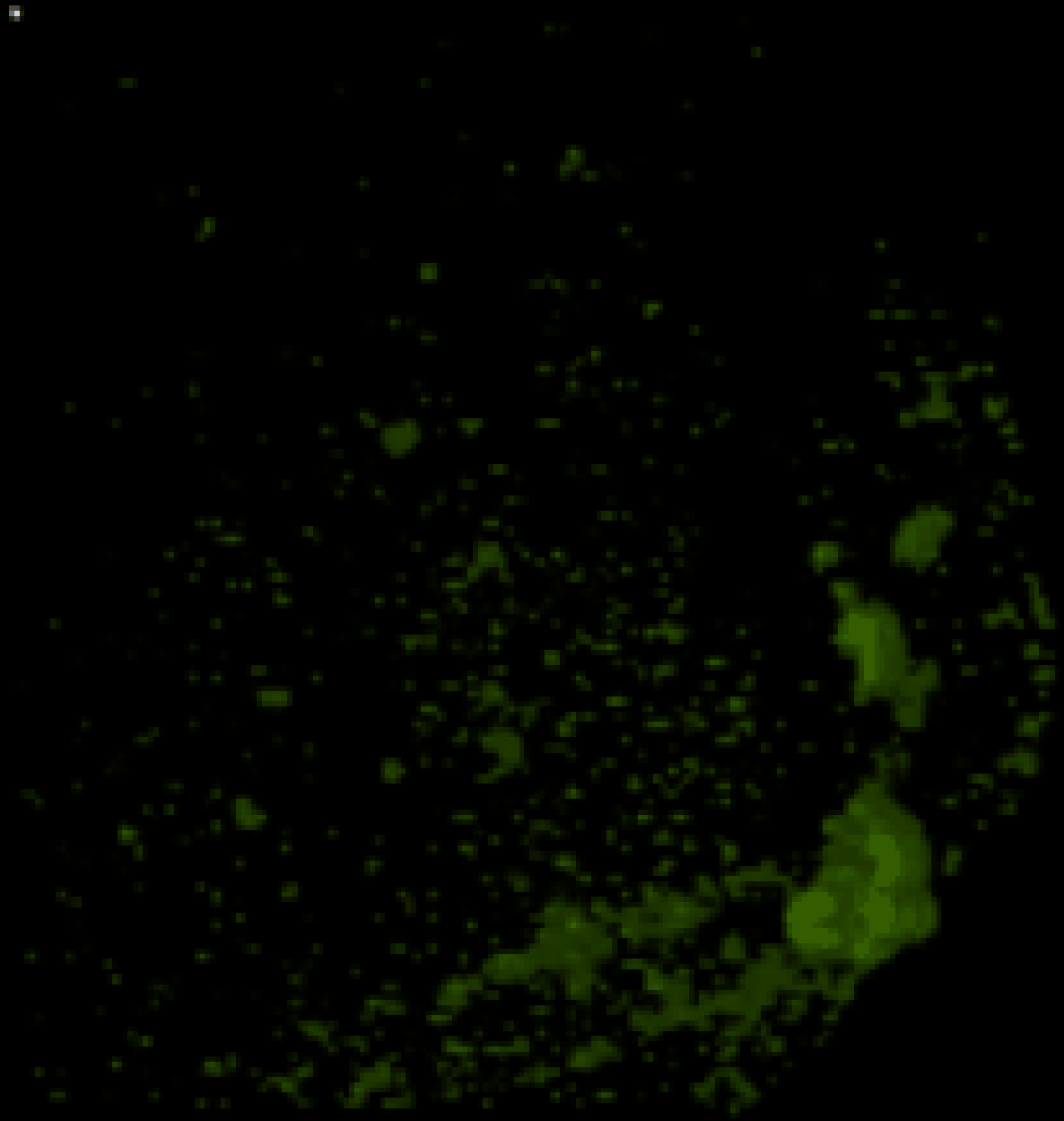


10ppm





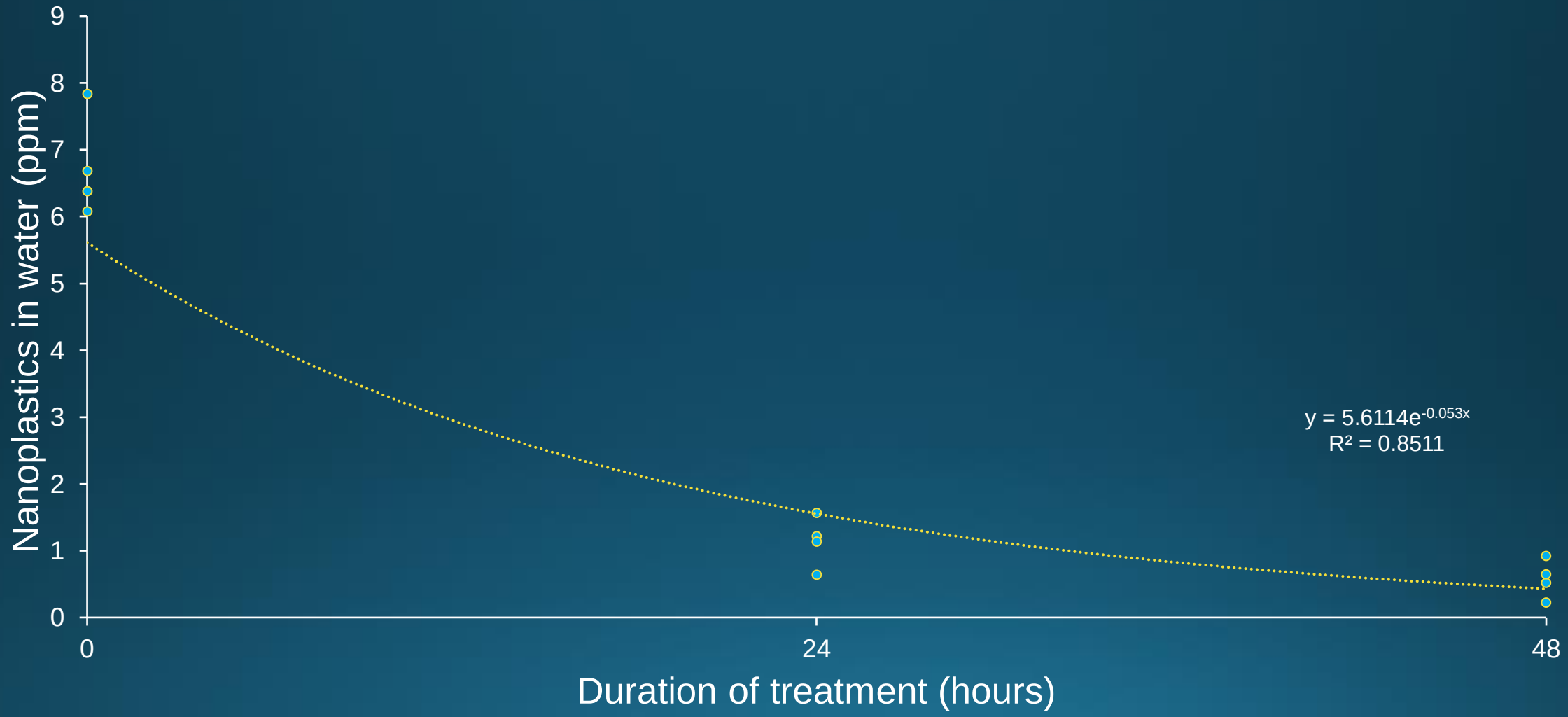
1 ppm 24hpt



Chorion

1.0ppm
24hpt

Absorption of NP by zebrafish embryos

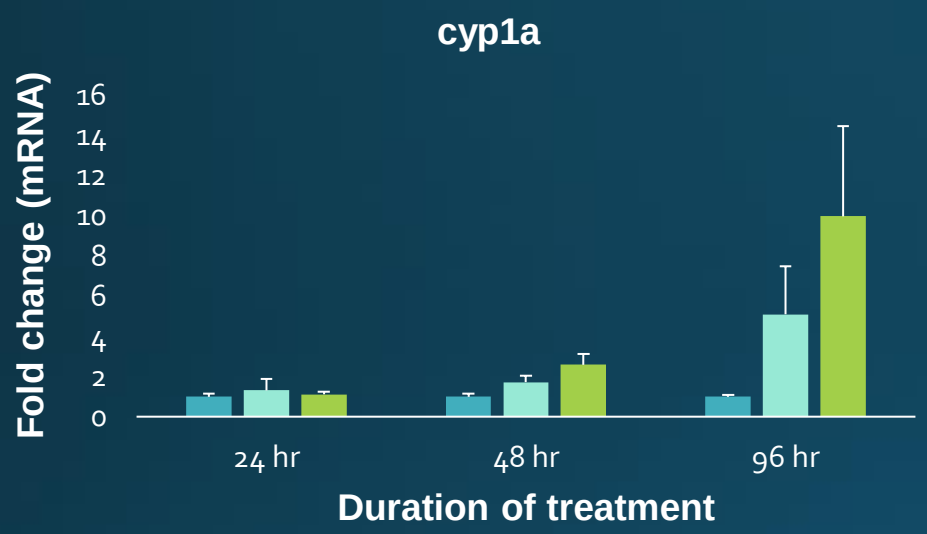


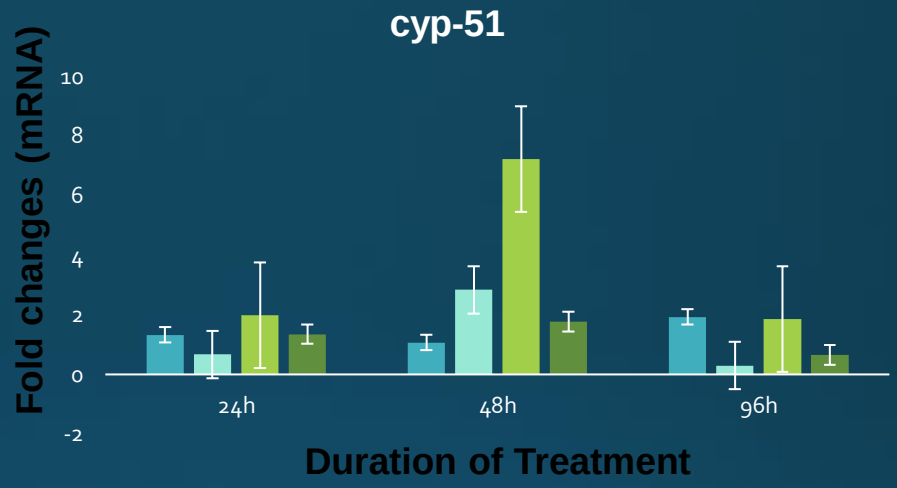
qPCR and Gene Expression

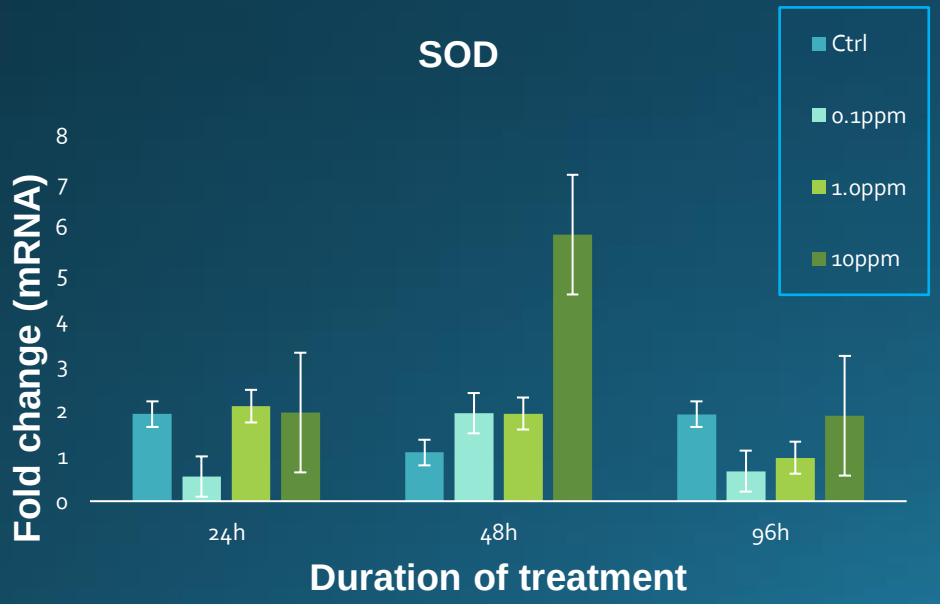
- cyp1a
- Catalase
- SOD
- il-6
- il-1a
- il-1b
- cyp51

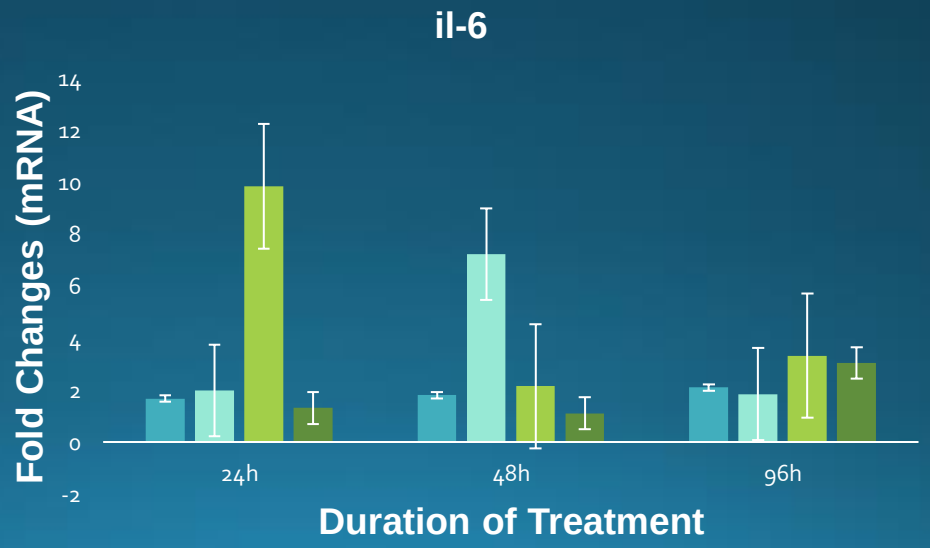
Genes known to be associated with environmental stress response

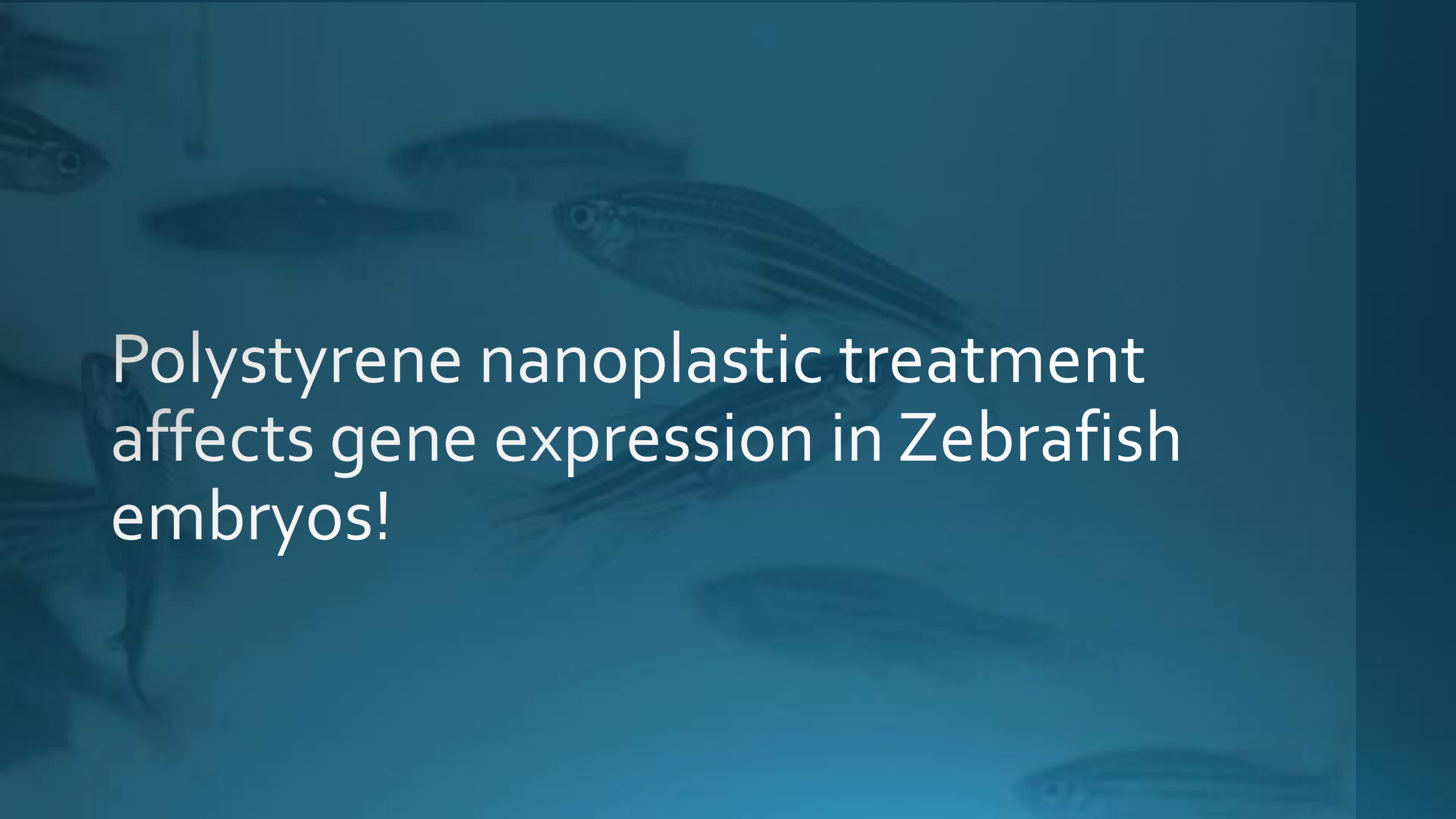
Gene expression changes










Polystyrene nanoplastic treatment affects gene expression in Zebrafish embryos!

Future Directions…

- Histology slide preparation and analysis of Zebrafish embryos, larvae, and human skin cell cultures
- More in-depth study of nanoplastics smaller than 50nm
  - Where to they go?
  - Do they accumulate in the lipid rich egg yolk/ are they metabolized in human cells?
- Downstream effects of the treatment on growing larvae/ juvenile Zebrafish

To summarize:

- Aquatic and human health effects of nanoplastic particles not well studied
- Zebrafish serve as models to study effects of nanoplastics on embryo development
- Fluorescently labeled polystyrene naoplastics adsorb to the outside of the chorion just hours after exposure, smaller particles migrate into organism
- Expression of several environmental stress response genes is affected by concentration and exposure time of nanoplastic treatment

Acknowledgements

Department of Life Sciences,

Texas A&M Corpus Christi

Environmental Health Lab:

Dr. Wei Xu

Kenzie Merrill

Landrue Richards

Dr. Leisha Martin

Nezar Jifi

Kenneth McGraw

Dr. Jian Sheng,

Department of Engineering

Texas A&M Corpus Christi