



Planarians as an *in vivo* model for a high-throughput assessment of developmental, neuro- and genotoxicity

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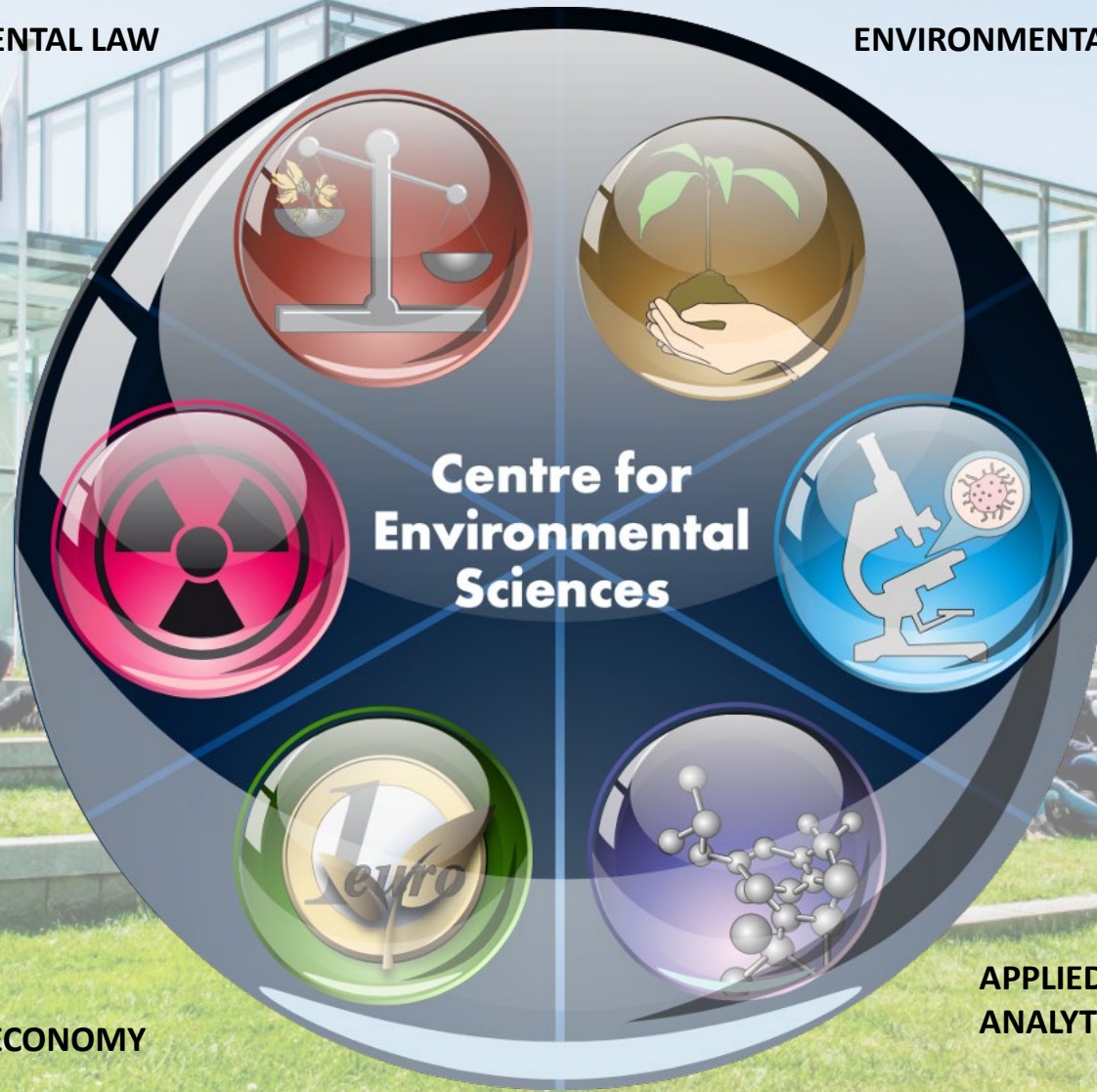




UHASSELT

ENVIRONMENTAL LAW

ENVIRONMENTAL BIOLOGY



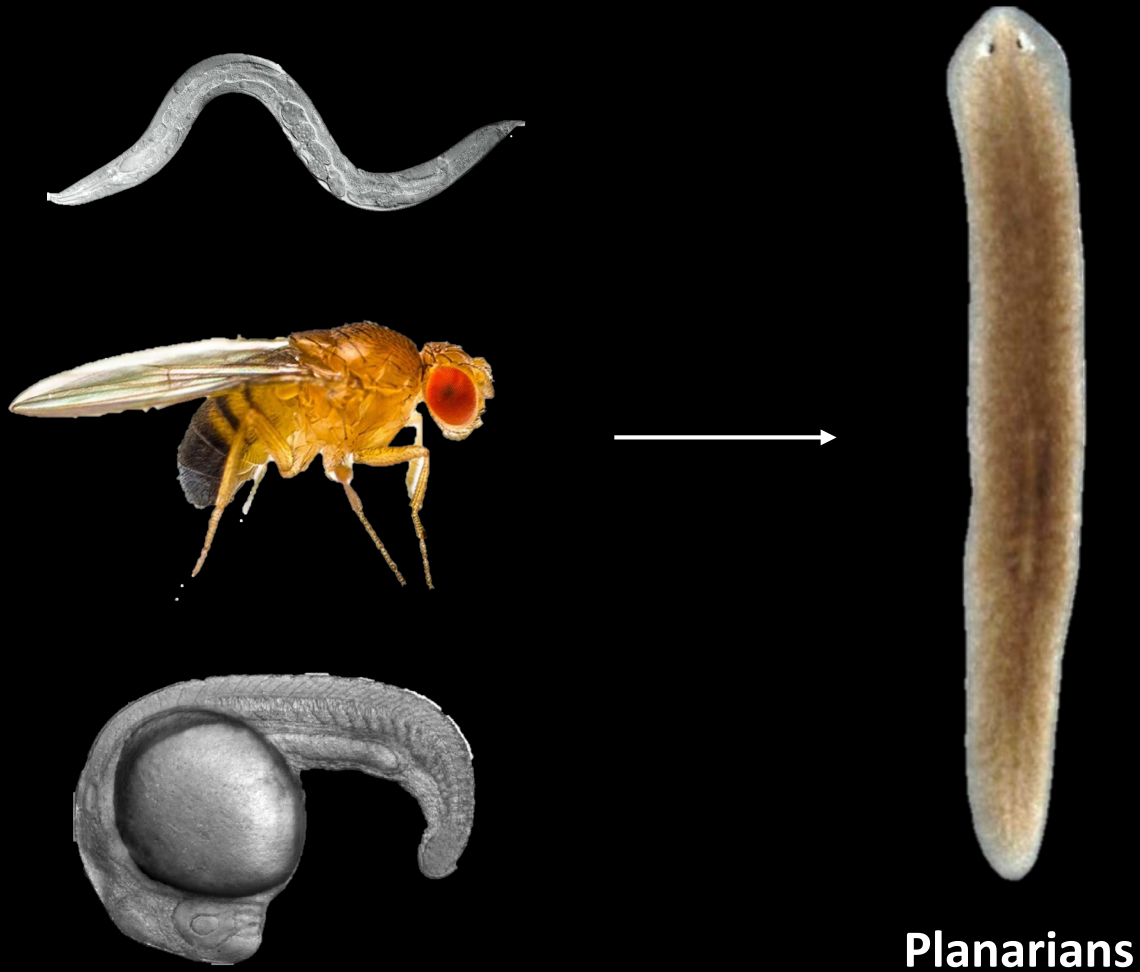
**NUCLEAR
TECHNOLOGY**

**ZOOLOGY:
BIODIVERSITY AND TOXICOLOGY**

ENVIRONMENTAL ECONOMY

**APPLIED AND
ANALYTICAL CHEMISTRY**

3R principle – Replacement | Need for full organism models



Full organism model

Regeneration & development
Different types of toxicity

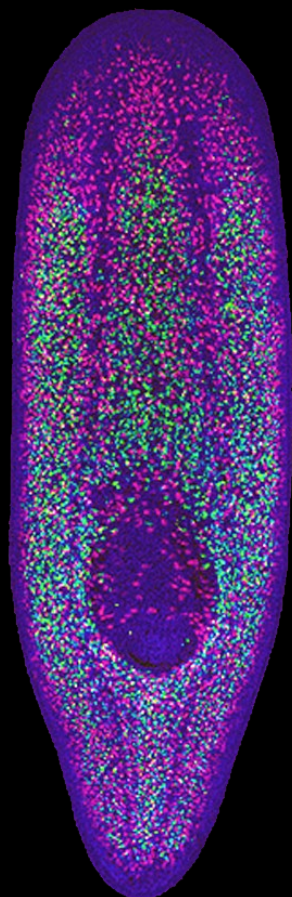
➔ All-round toxicological model

Planarians

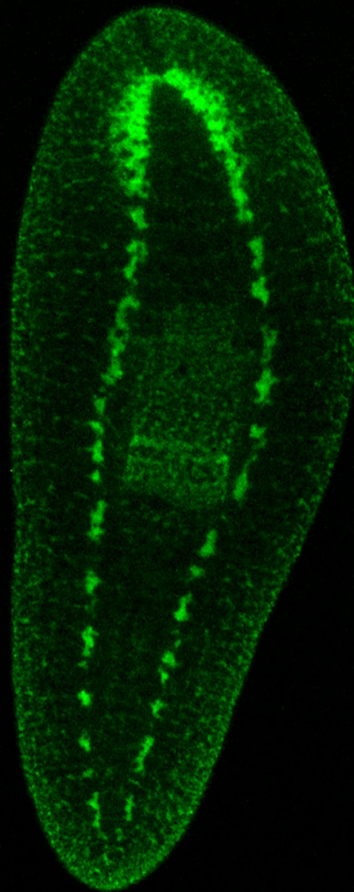
Planarians | High regenerative capacity



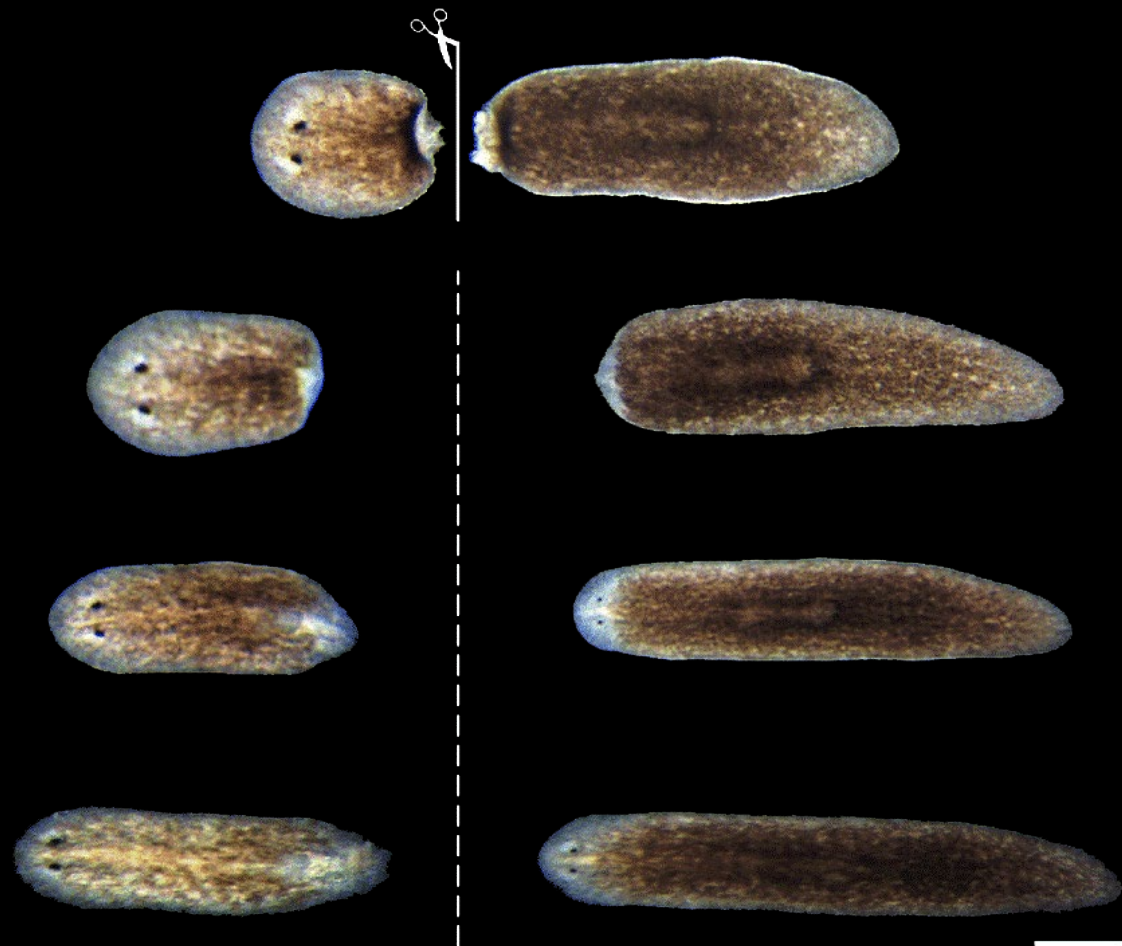
Schmidtea mediterranea



Pluripotent SC
30 %

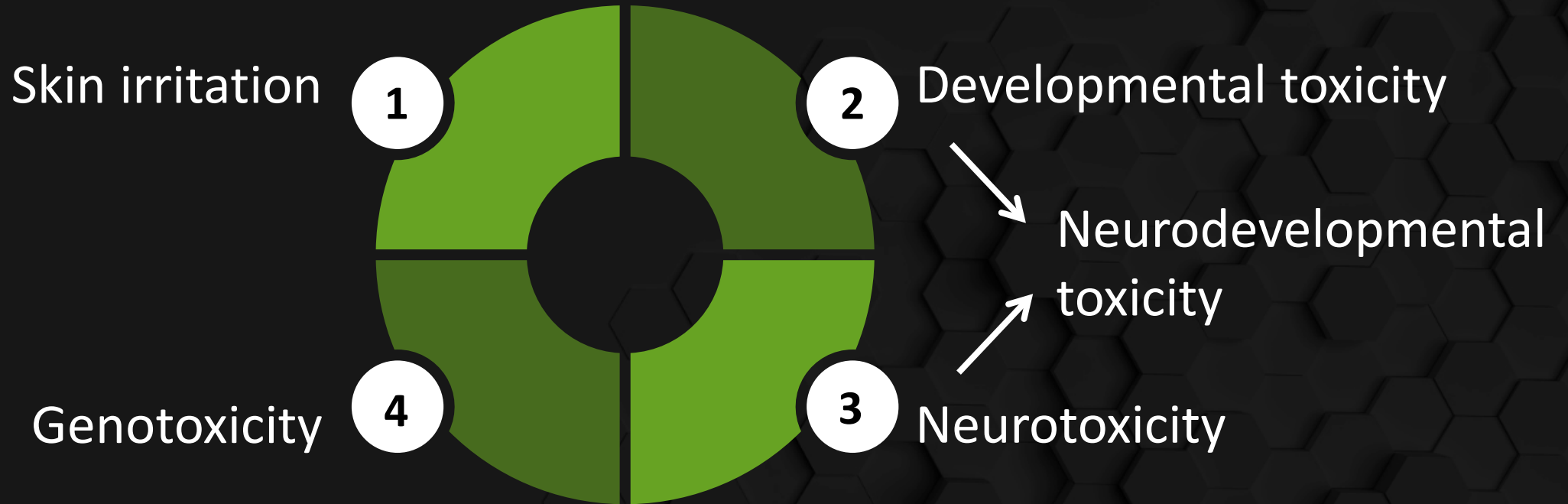


Nervous
system

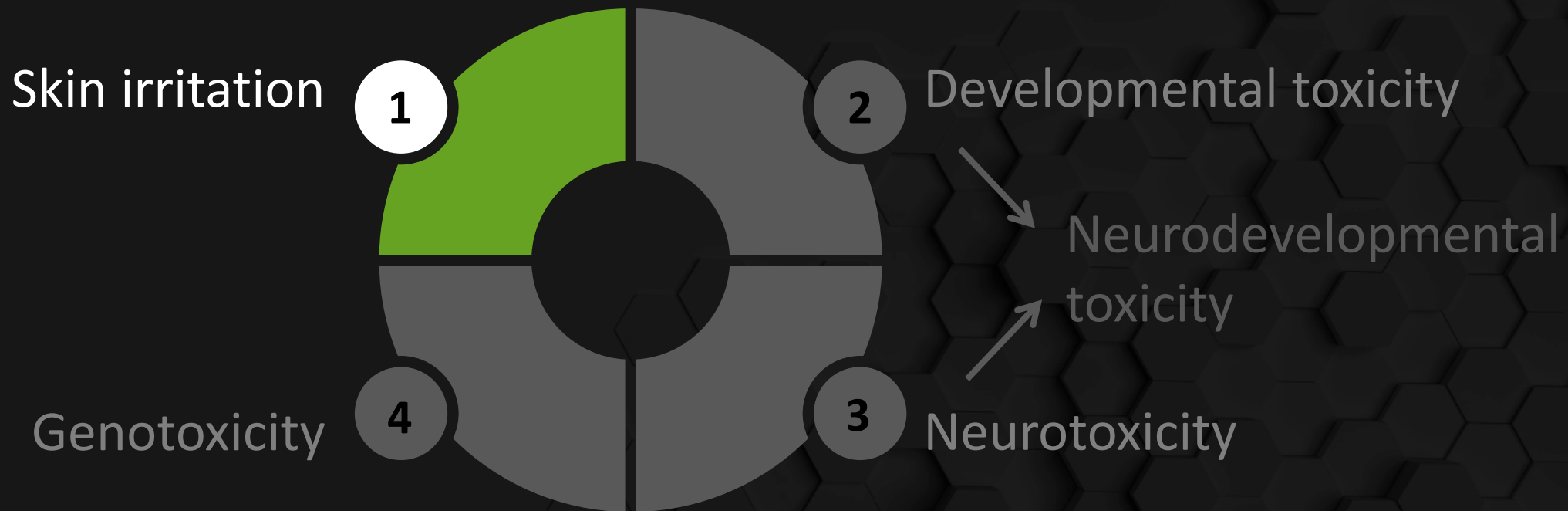


Extremely high
regenerative capacity

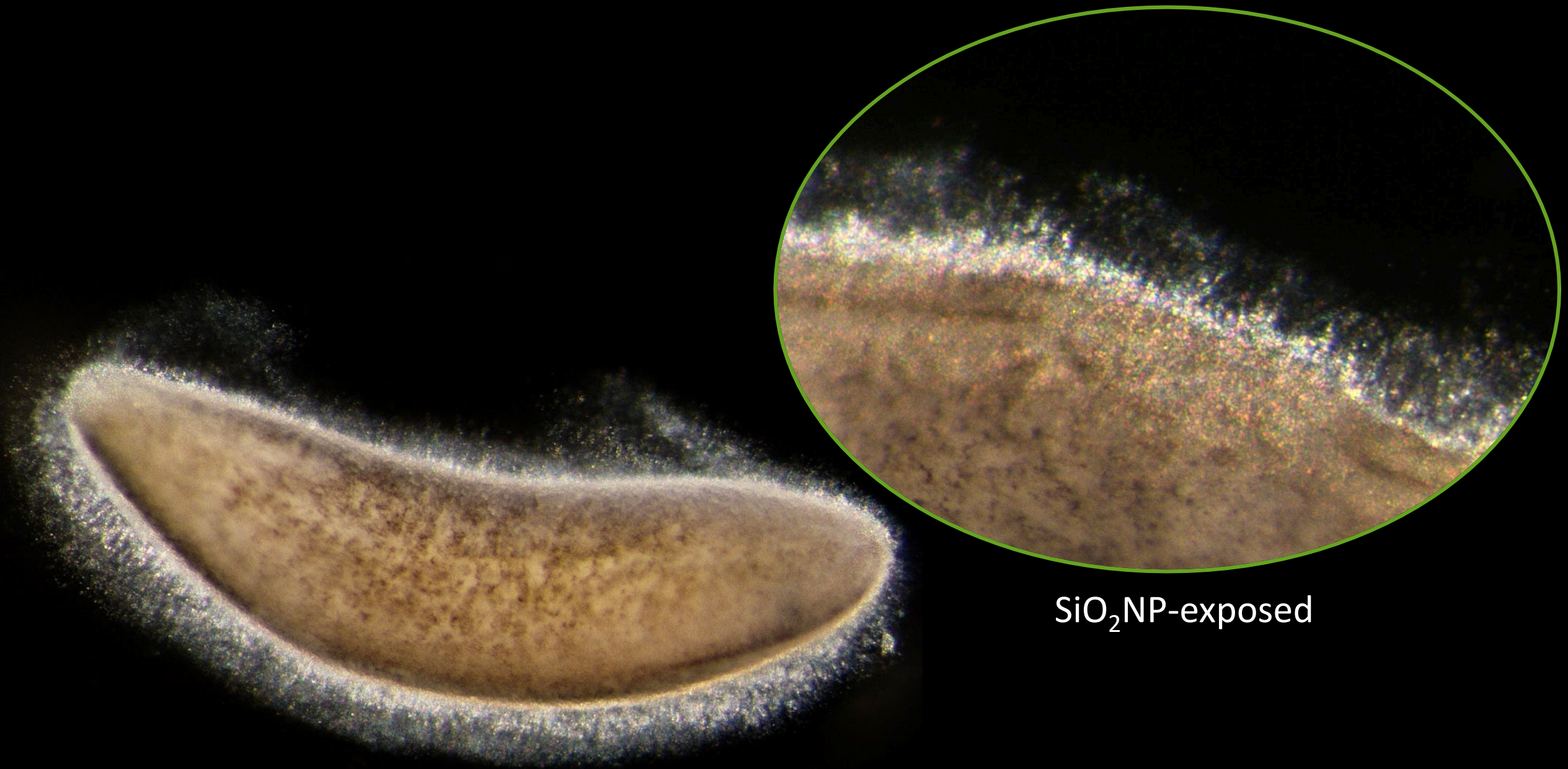
Toxicity assays



Toxicological assays

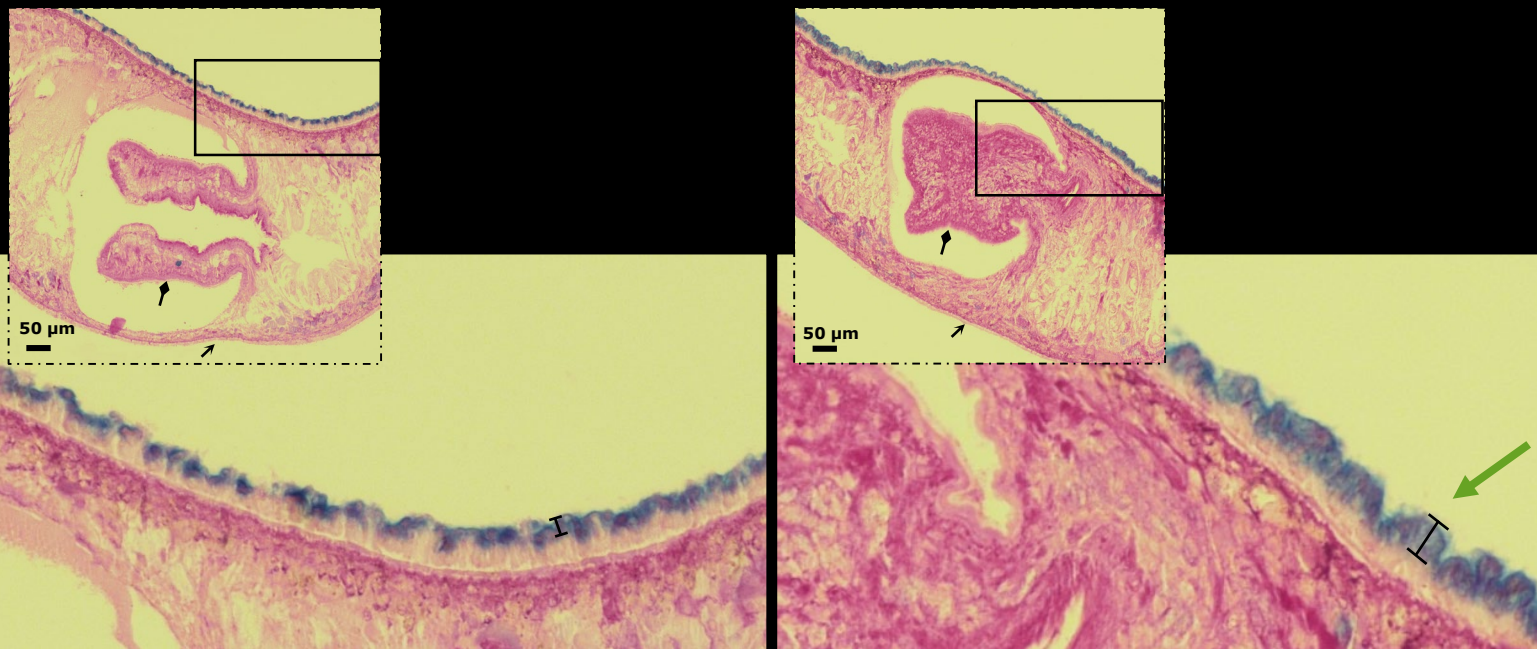
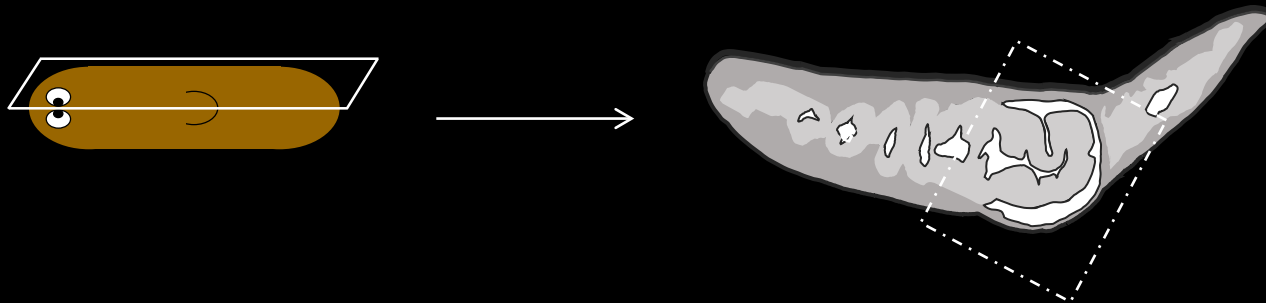


Skin irritation | Mucus production



SiO₂NP-exposed

Skin irritation | Mucus production

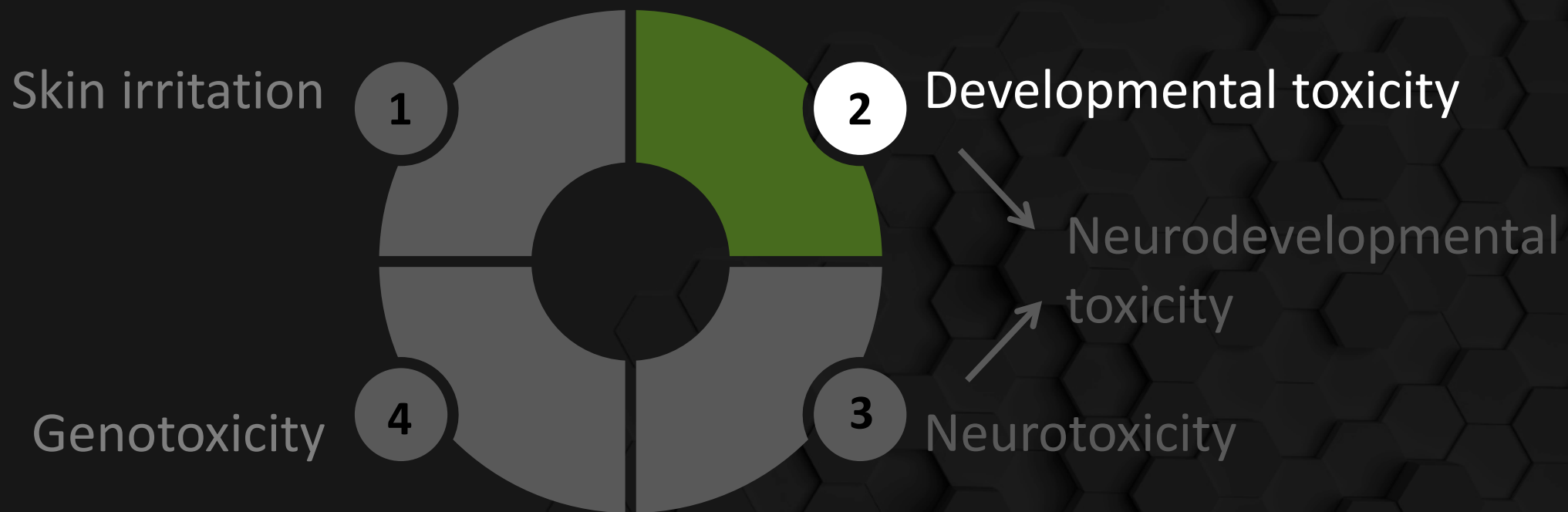


Control

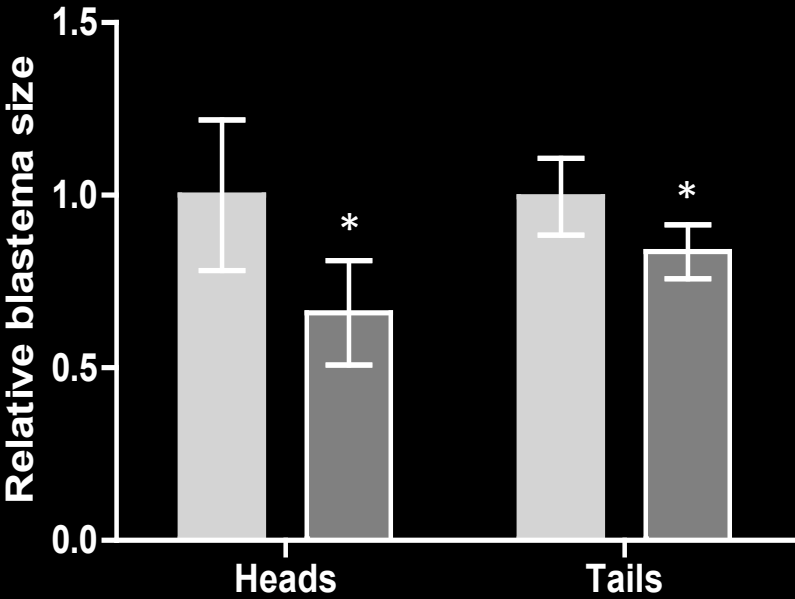
TiO₂-NP



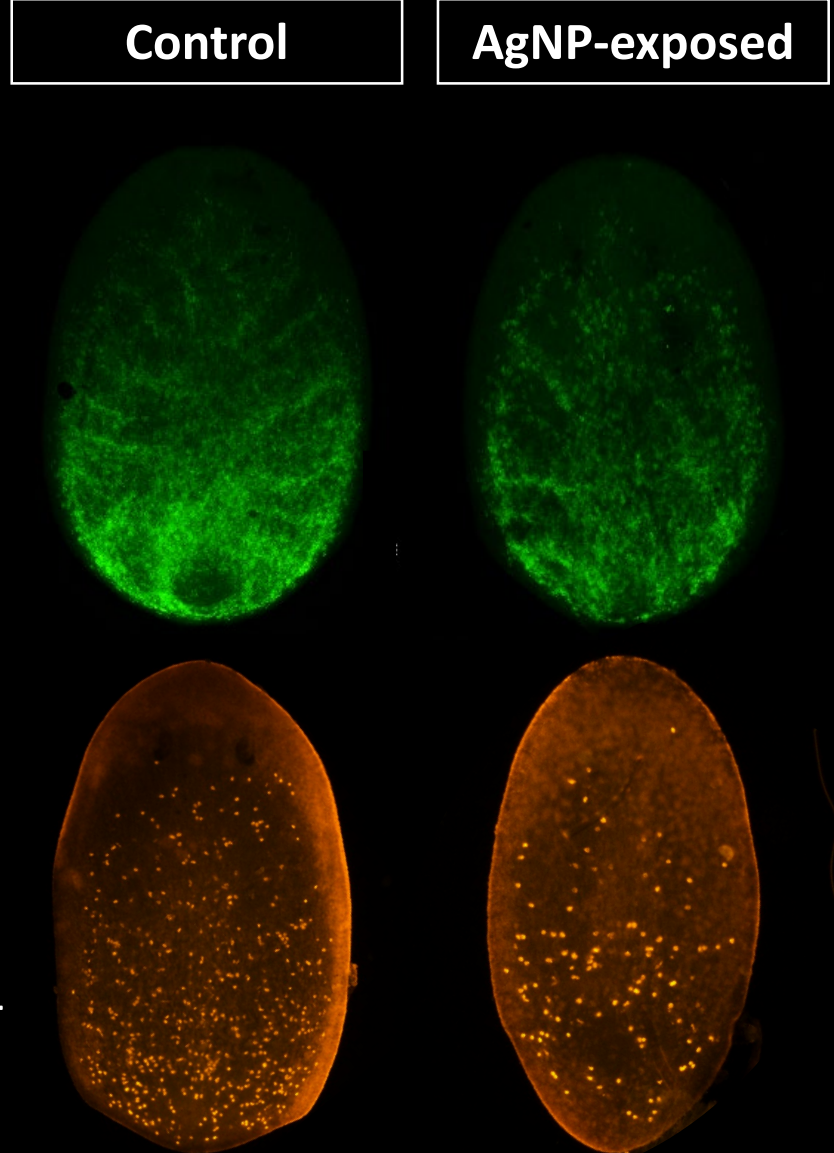
Toxicological assays



Developmental toxicity | Tissue growth & SC dynamics

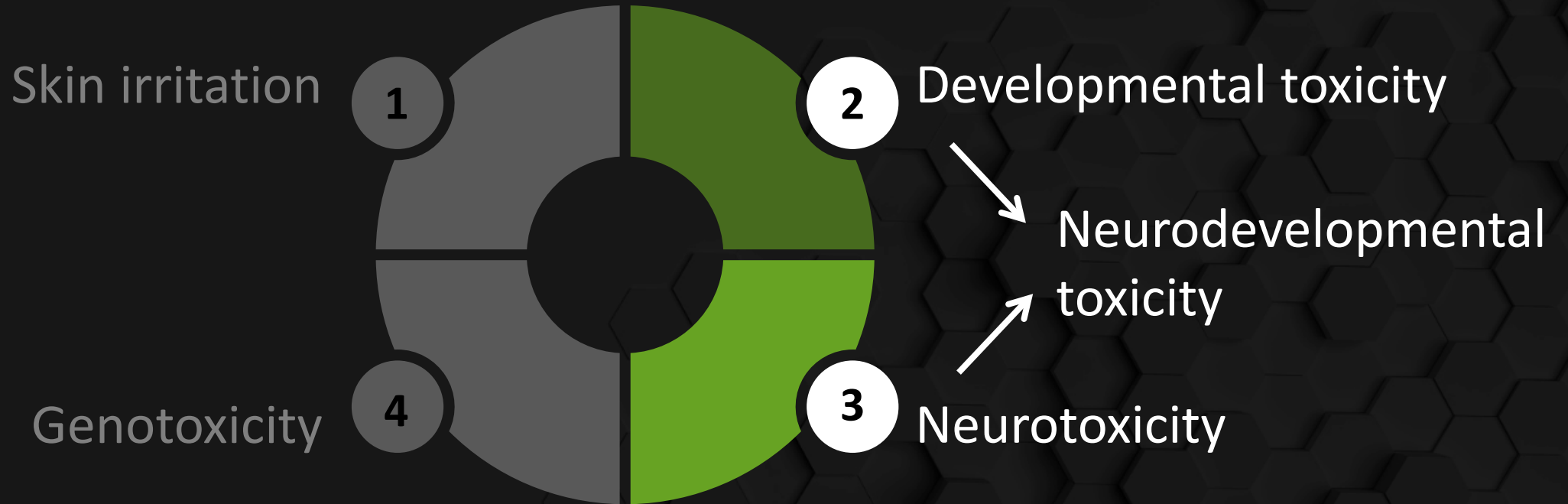


In-depth mechanism of action
→
SC dynamics



Leynen et al. 2019 (Nanotoxicology)

Toxicological assays

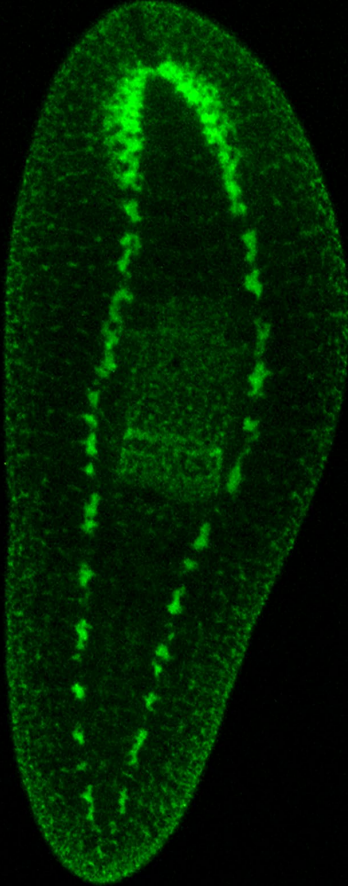


Neuro(developmental) toxicity | Behaviour & CNS



Quantification
-Motility
-Light avoidance

Hagström et al. 2016 (*Regeneration*)



Nervous system

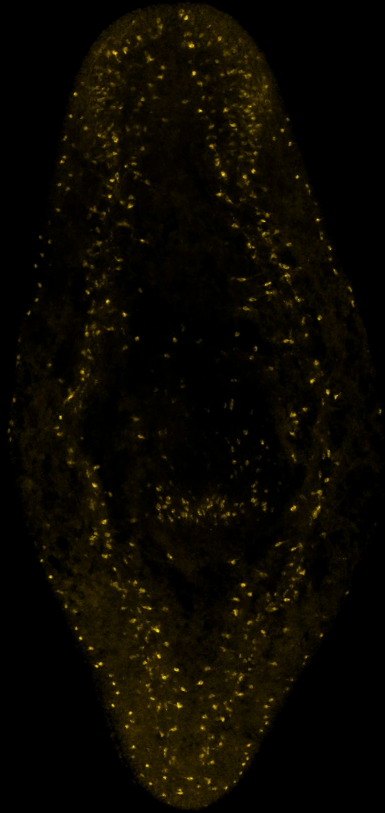


Disturbed neuroregeneration after AgNP-exposure

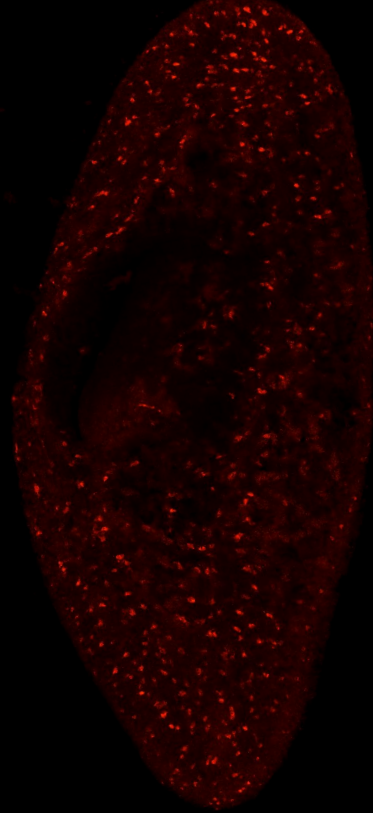


In-depth mechanism of action:
- Specific nerve structures
- Underlying SC dynamics
- Underlying redox dynamics

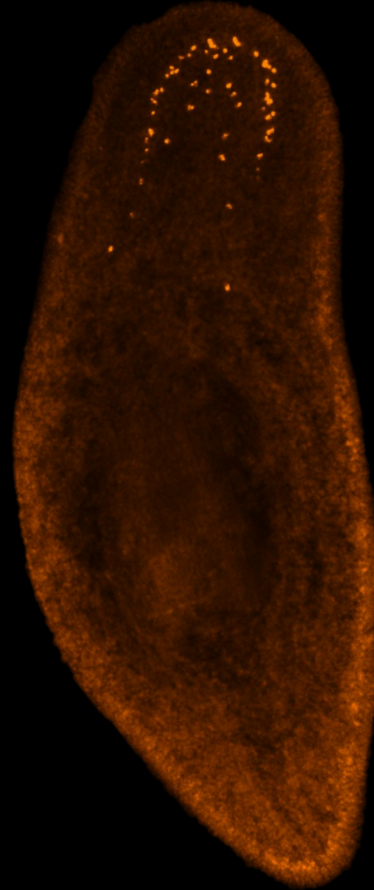
Neuro(developmental) toxicity | **Specific neur(on)al cells**



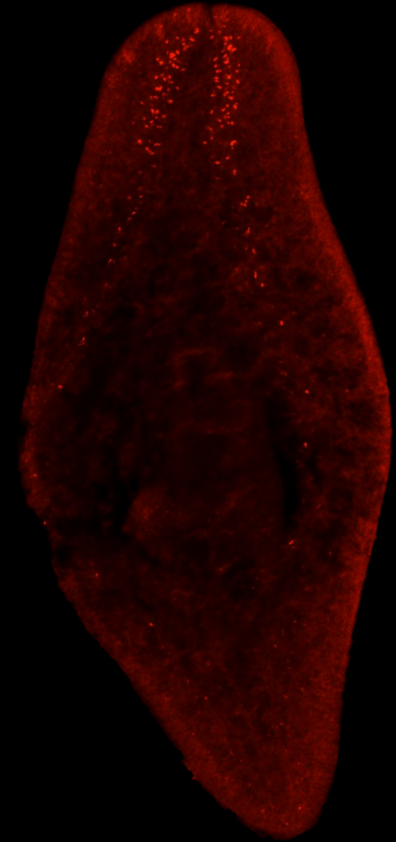
Glial
cells



Serotonergic
neurons

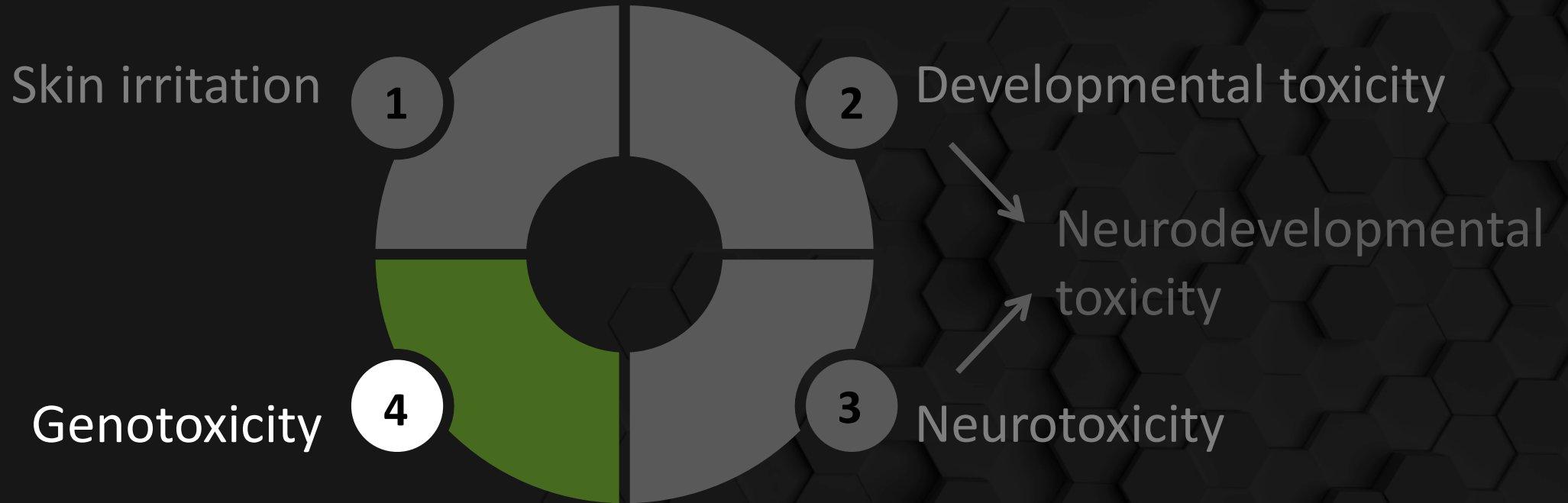


GABA-ergic
neurons

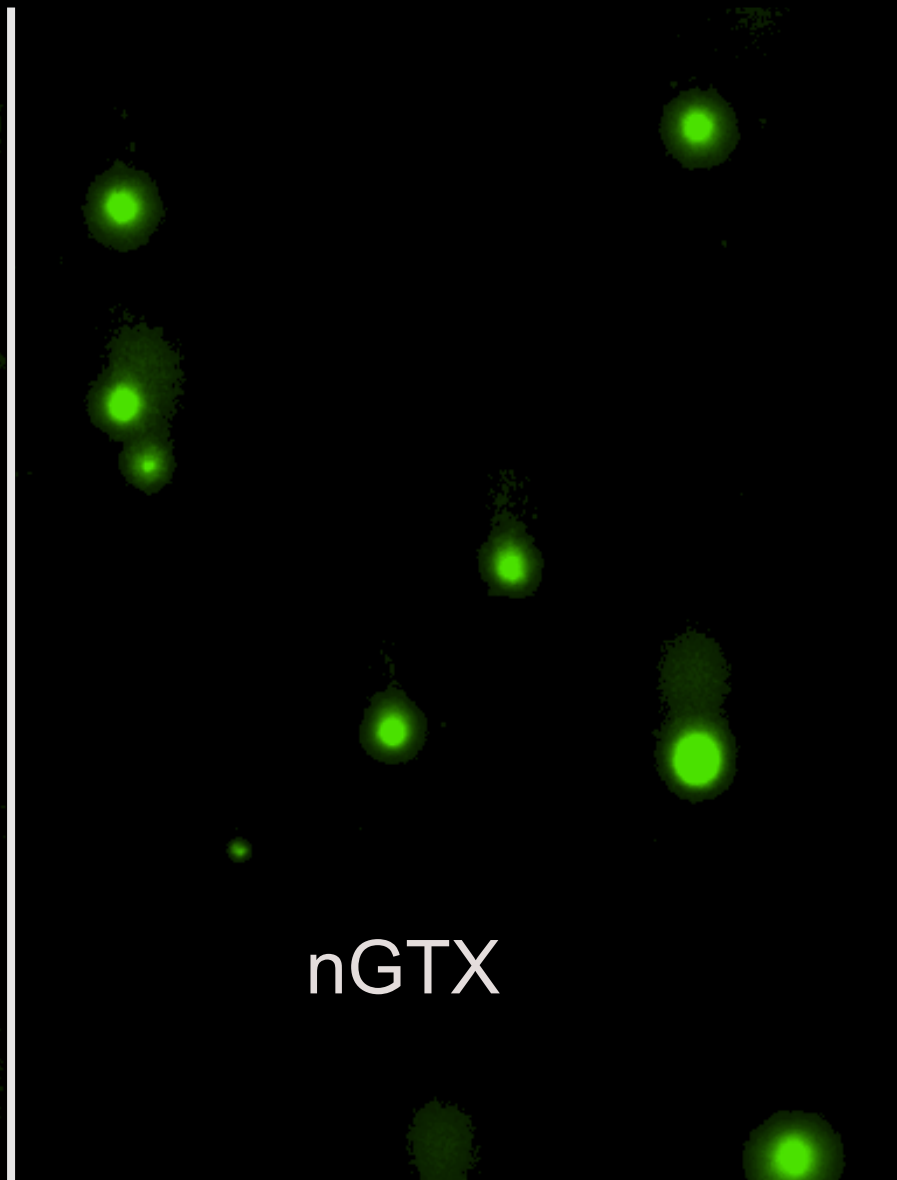
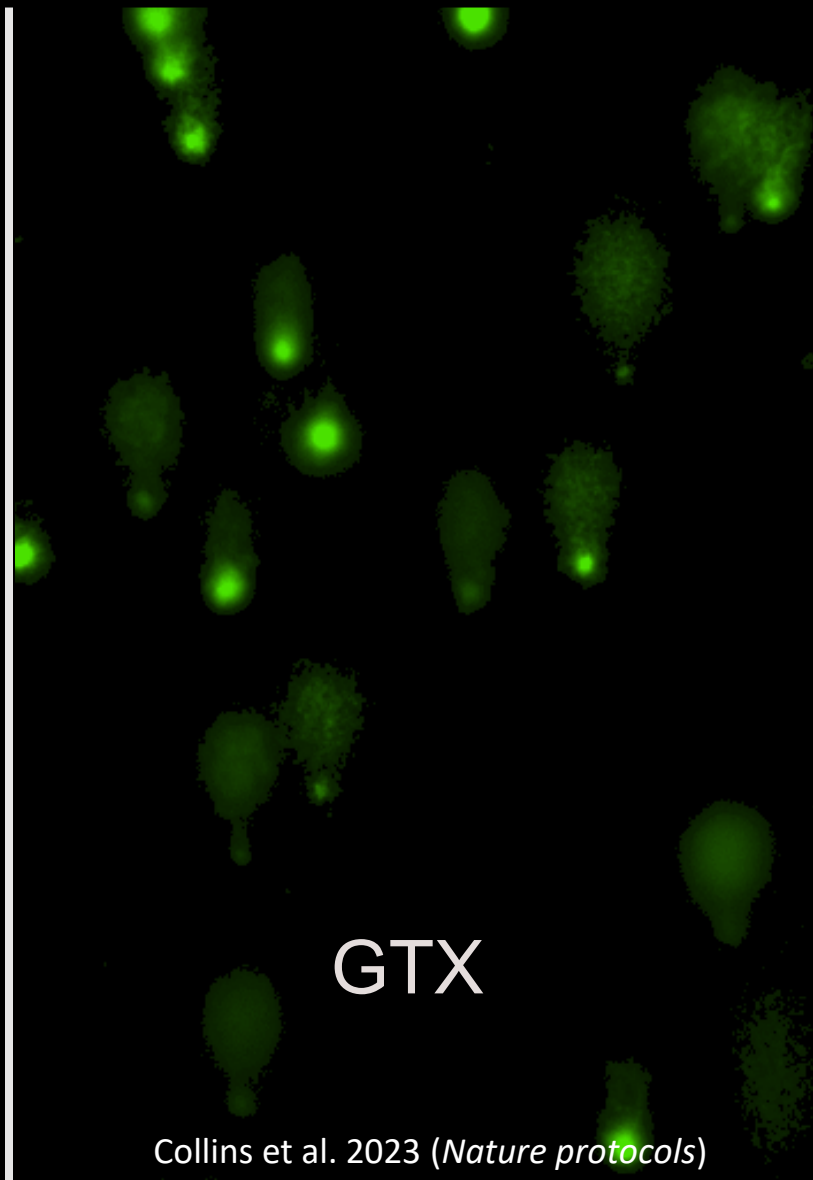
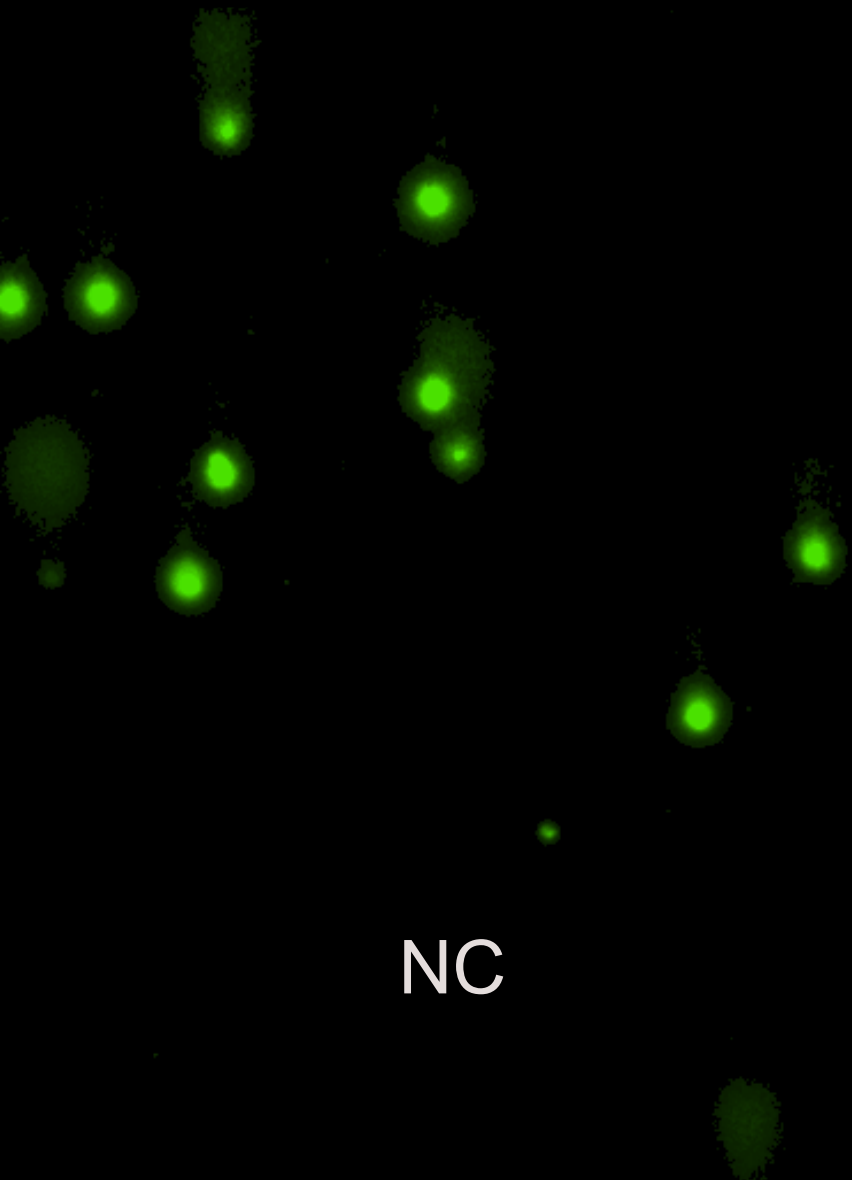


Octopaminergic
neurons

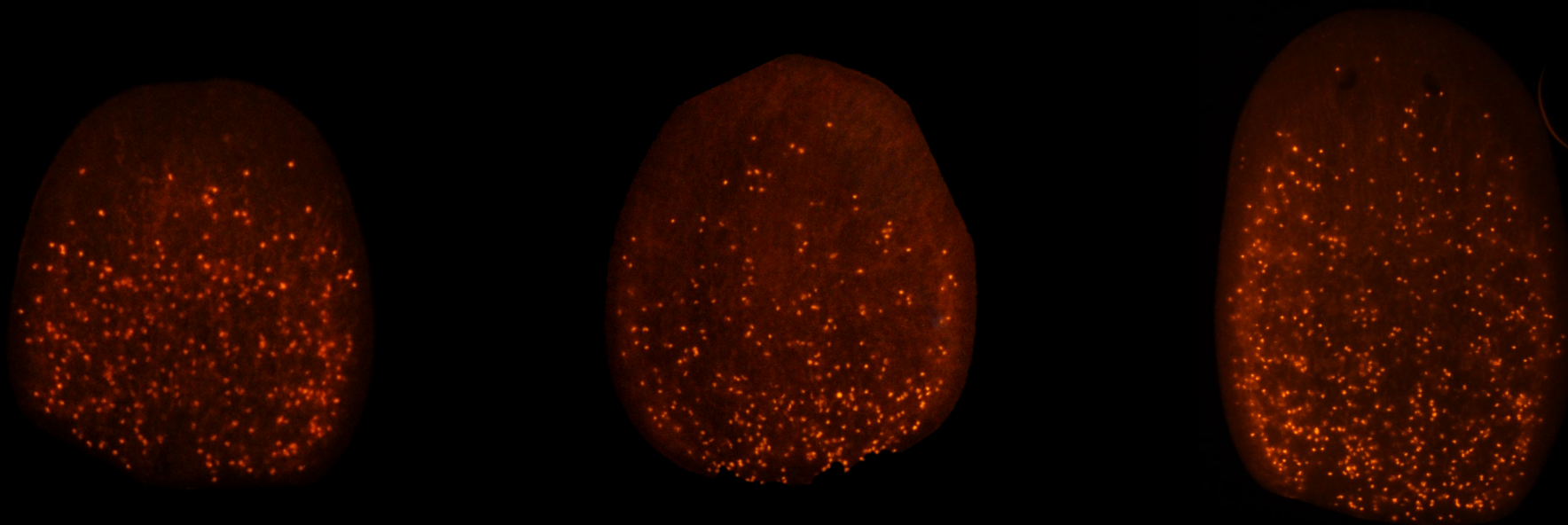
Toxicological assays



Genotoxicity | DNA damage



Genotoxicity | Stem cell proliferation patterns



NC

GTX

nGTX

SC proliferation
pattern: 1d vs 3d

=



Conclusion



Planarians

- allow full organism in vivo toxicological studies
- for the assessment of developmental, neuro- and genotoxicity
- in a high-throughput setting

→ Planarians are an all-round toxicological model

Acknowledgements



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Genotoxicity | Workflow assay

