

Stem cell proliferation patterns as an alternative for in vivo prediction and discrimination of carcinogenic compounds

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Contact person

Karen Smeets

Organisation

Name of the organisation University of Hasselt (UHasselt)

Department Centre for Environmental Sciences

Specific Research Group or Service Zoology: Biodiversity and Toxicology (BiTE Lab)

Country Belgium

Geographical Area Flemish Region

SCOPE OF THE METHOD

The Method relates to	Animal health, Environment, Human health
The Method is situated in	Translational - Applied Research
Type of method	In vivo
Used species	Planarians (i.e. Schmidtea mediterranea)
Targeted organ system or type of research	Full organism model (stem cell proliferation)

DESCRIPTION

Method keywords

Planarians

Stem cell proliferation patterns

in vivo

Scientific area keywords

Genotoxic carcinogen

Non-genotoxic carcinogen

genotoxicity

Method description

The method uses planarians as an alternative *in vivo* model to assess carcinogenicity. Planarians are characterized by a high regenerative capacity and a large number of pluripotent stem cells. The assay is based on the discriminative power of stem cells in an *in vivo* setting. Based on specific stem cell dynamics and proliferation patterns, this method predicts carcinogenic potential and discriminates between genotoxic and non-

genotoxic compounds. The workflow includes: (1) Exposure of planarians to the compound of interest, (2) Fixation of the animals at specific time points, (3) Immunohistochemical staining of the proliferating stem cells, (4) Quantification of the number of proliferating stem cells, (5) Determination of the resulting patterns in proliferative responses.

Lab equipment

- Facility for planarian culture
- Shaker
- Incubator or oven
- Fluorescent microscope

Method status

Internally validated
Published in peer reviewed journal

PROS, CONS & FUTURE POTENTIAL

Advantages

- Reduced use of laboratory animals, the method can be used as an initial screening
- Inexpensive and time-effective method
- Fast learning curve to apply the method successfully
- Includes biological variation
- Stem cells are studied in their natural context in a full organism model, including all communication signals

Challenges

Further validation with additional compounds is needed.

Modifications

Possibility to upscale and work in a high-throughput setting.

Future & Other applications

Inclusion of additional parameters (e.g. phenotypes, gene-expression) to increase the discriminative power and to identify the mode of action in detail.

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

Stevens AS, Willems M, Plusquin M, Ploem JP, Winckelmans E, Artois T, Smeets K. Stem cell proliferation patterns as an alternative for in vivo prediction and discrimination of carcinogenic compounds. Sci Rep. 2017 May 3;7:45616. doi: 10.1038/srep45616. PubMed PMID: 28466856; PubMed Central PMCID: PMC5413882.

Willems, M., Stevens A.S., Adriaens E., Plusquin M., Smeets K., Van Goethem F., Vanparys P., Janssen C., Remon J.P. (2015) An adult stem cell proliferation assay in the flatworm model *Macrostomum lignano* to predict the carcinogenicity of compounds. Applied in vitro toxicology 1 (3), 213-219.

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