

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

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## 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

<b>The Method relates to</b>	Animal health, Environment, Human health
<b>The Method is situated in</b>	Translational - Applied Research
<b>Type of method</b>	In vivo
<b>Used species</b>	Planarians (i.e. Schmidtea mediterranea)

<b>Targeted organ system or type of research</b>	Full organism model (stem cell proliferation)
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## 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.

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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.

Patent granted: Methods to detect carcinogens using flatworms WO 2016/146620 /EP15159158.3 A1 – Karen Smeets, An-Sofie Stevens, Michelle Plusquin, Tom Artois, Maxime Willems, Jean Paul Remon- filing date 15/03/2016

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