German Federal Institute for Risk Assessment

Communication 018/2025

15 May 2025

Colourful cells show and tell

Research team improves detection methods to understand the effects of chemicals and drugs

Stained cells can be used to detect the effects of drugs and chemicals. A team of researchers from the German Centre for the Protection of Laboratory Animals (Bf3R) at the German Federal Institute for Risk Assessment (BfR) has now succeeded in further improving a method involving fluorescent dyes. The method will also help to reduce the number of animal experiments in the future. The scientists published their findings in the journal “Nature Communications”.

Link to the study: https://www.nature.com/articles/s41467-025-58765-8

To test whether a substance damages cells, cells are first exposed to the substance in the laboratory. They are then coloured with fluorescent dyes and scanned under a microscope using a laser. Depending on the dye used, certain organelles (the “organs” of the cell) light up. This method of detecting substance effects is generally referred to as *Cell Painting*.

C*ell Painting* involves microscopic recording and automated analysis of fluorescent signals. This high-throughput method can be used to determine if and how cells are altered by different substances. This affects organelles with important functions, such as the cell nucleus with the DNA, the actin cytoskeleton, the cell membrane, the mitochondria (the “powerhouse of the cell”), and the endoplasmic reticulum (the “factory of the cell”). As with a scanner at the supermarket checkout, each individual cell is automatically registered and a ”diagnosis” of changes in individual organelles is performed.

The new expansion, *Cell Painting Plus,* takes a little longer than conventional *Cell Painting*, as there are now several straining cycles instead of just one. However, this has significant advantages. A larger number of different dyes can be combined more flexibly and used in a more targeted manner. Not only does the cell become much more colourful, but the evaluation is also much more accurate and detailed. The plan now is to test *Cell Painting Plus* in various independent laboratories and to further establish the application as an internationally accepted test method that does not require animal experiments.

About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMLEH) in Germany. The BfR advises the Federal Government and the States ('Laender') on questions of food, chemicals and product safety. The BfR conducts independent research on topics that are closely linked to its assessment tasks.

About the Bf3R

The German Centre for the Protection of Laboratory Animals (Bf3R) was founded in 2015 and is an integral part of the German Federal Institute for Risk Assessment (BfR). It coordinates nationwide activities with the goals of restricting animal experiments to only those which are considered essential, and ensures the best possible protection for laboratory animals. Moreover, it intends to stimulate research activities and encourage scientific dialogue.

This text version is a translation of the original German text which is the only legally binding version.

Legal notice

Publisher:
German Federal Institute for Risk Assessment
Max-Dohrn-Straße 8-10
10589 Berlin, Germany
T +49 30 18412-0
F +49 30 18412-99099
bfr@bfr.bund.de
bfr.bund.de/en

Institution under public law
Represented by the president Professor Dr Dr Dr h. c. Andreas Hensel
Supervisory Authority: Federal Ministry of Food and Agriculture
VAT ID No. DE 165 893 448
Responsible according to the German Press Law: Dr Suzan Fiack

BfR | Identifying Risks –
Protecting Health