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Advanced 3D cell models and zebrafish embryos: A bridge between in vitro and in vivo

B. Žegura*, T. Eleršek, M. Štampar

*Department of Genetic Toxicology and Cancer Biology,
National Institute of Biology, 1000 Ljubljana, Slovenia
bojana.zegura@nib.si

The number of animals used in research has increased tremendously with the advancement of research and the development of pharmaceutical, medical and industrial fields. Under current EU legislation, toxicity testing is mandatory for all new chemicals and products before they are placed on the market. International regulations and guidelines for safety testing require animal testing as a follow-up when positive results are obtained in bacterial and mammalian in vitro models. Because currently used in vitro test systems are highly inaccurate and not sufficiently reliable, as indicator cells do not reflect the metabolism of chemicals in the human body, many chemicals are prematurely and often unnecessarily tested in vivo, which is ethically questionable and not in line with EU legislation on the welfare and protection of laboratory animals (3R strategy: reduce, refine, replace). Therefore, researchers are developing alternative approaches that are more reliable and relevant for human exposure to replace or at least reduce the number of animal experiments. One of the alternative approaches in toxicology research is advanced three-dimensional (3D) cell models, which more closely resemble the in vivo microenvironment than the traditional two-dimensional (2D) in vitro cell models currently used. Another model that is gaining popularity in toxicology research and is considered as a replacement for animal testing, is the zebrafish (*Danio rerio*) embryo model. The European Commission Directive 2010/63/EU currently allows experiments on fish embryos at the earliest life stages without regulating them as animal experiments. The presentation will discuss advanced 3D cell models in vitro developed from a human hepatocellular carcinoma (HepG2) cell line and zebrafish embryos as alternatives to animal testing in toxicology research.

Keywords:

Alternative to animal testing, 3D cell model, zebrafish embryo model.