The Worm-On-Chip platform: a whole-organism screening technologies for next-generation drug discovery

Today, a novel chemical substance is registered every 2.3 seconds in average. To protect people and environment from harm, potential toxic effects of this massive amount of substances must be thoroughly evaluated. Pharmaceutical compounds, moreover, require years of additional tests to assess their efficacy as candidate drugs, and this significantly contributes to a relentless decline of the drug discovery industry efficiency. Overall, this enormous need for substance testing cannot be satisfied today because: (i) the use of *in vivo* biological models (e.g. mice) is spreadingly under scrutiny, due to its increasing associated costs and growing legal pressure against animal testing worldwide; (ii) current *in vitro* alternatives rely on simplified cellular models, still unable to assess complex responses at organismal level.

We introduce the first "Organism-on-Chip" technology, allowing "i*n vivo* testing at the *in vitro* scale". Our solution combines the use of a simple yet complete organism for *in vivo* testing – a microscopic worm, named "*Caenorhabditis elegans*" – with the first technological platform for its fully automated *in vitro* handling and use (1-3). *C. elegans* is widely reputed as relevant model in biomedical research, but current protocols for its culture and analysis are still based on manual operations, totally lacking the reproducibility and throughput standards needed for its use in large scale applications. Our technology replaces all these protocols by automated standardized operations within small disposable cartridges, where thousands of chemical/drug tests can be now performed in parallel, at unprecedented accuracy.

Our "organism-on-chip" platform is meant to provide one of the first examples of next-generation technologies for whole-organism drug screening. We expect this not only to represent a breakthrough in the biomedical research community but also pave the way for the widespread use of worm models – and, possibly, of other alternative model organisms – to contribute to the replacement, reduction and refinement of animal testing within the drug discovery industry.

References

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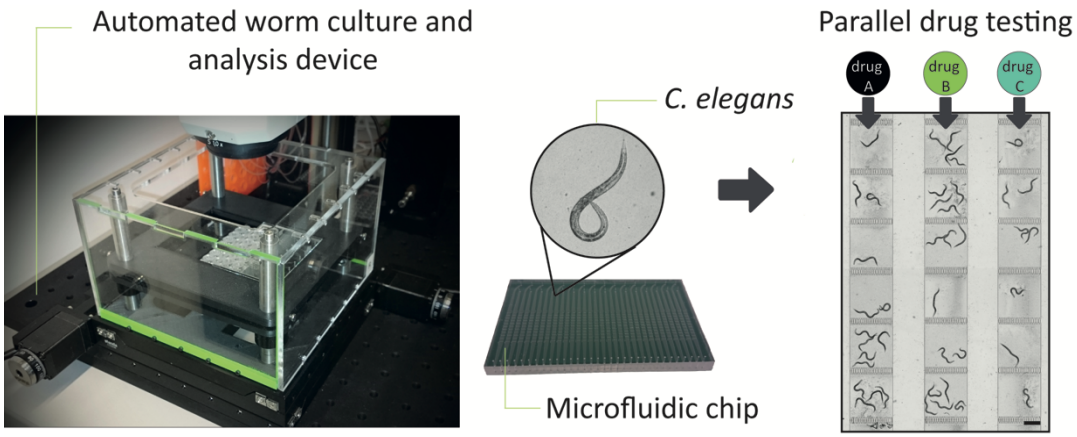
Figures



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