An experimental model to study the effects of pollutants on cardiac tissue

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People are continuously exposed to a huge amount and variety of potentially toxic chemicals present in the surrounding environment, such as pesticides or drugs traces in water, soil, air and living organisms. The combined action of pollutants can increase the risk of toxic effects. At the same time, a growing occurrence of cardiovascular diseases has been observed. These diseases have been among the top-ranked causes of death in mature and aged populations for the last 30 years. Scientists think that this increase may be related to the environmental exposure to exogenous toxic chemicals.

ALTERNATIVE (environmentAL Toxicity chEmical mixtuRes through aN innovative platform based on aged cardiac tissue model) project, coordinated by Prof. Gianluca Ciardelli with the Biomedical Lab team (Susanna Sartori, Monica Boffito) from DIMEAS-Department of Mechanical and Aerospace Engineering of Politecnico, will produce an innovative in vitro platform able to evaluate the cardiotoxicity of single chemicals or a mixture of chemical components. The platform is made by a tri-dimensional model of bioengineered human functional cardiac tissue cultured in a bioreactor, together with a system allowing "omics" analysis to understand the response of the model to different substances. Artificial intelligence algorithms are implemented to estimate the risk. Additionally, the project will develop a model of aged cardiac tissue to evaluate the impact of toxics on the fragile population.

The model will be initially validated on existing toxicity data and after it will be used to make predictions on chemical and pharmaceutical

substances.

This project aims at finding impact also at regulatory level. The European bodies responsible for regulating chemicals such as fertilizers or detergents, industrial chemicals or pharmaceutical products are seeking an exhaustive evaluation of the toxicity of single substances or mixtures. ALTERNATIVE proposes a new method to make this information available for what concerns cardiotoxicity, allowing to obtain more reliable results with a viable technology which will have a lower impact on the environment and minimize ethical concerns through the reduction of animal testing,

This project has been financed in the framework of the European Green Deal Actions and put together different expertise (in silico systems, machine learning algorithms, toxicology, epidemiology, regulatory affairs) to deliver, in the end, increased awareness of cardiovascular risks related to pollutants (a poorly investigated field so far). A significant support to the regulatory framework for the management of the production and disposal of chemicals and pharmaceuticals is also expected.

"With colleagues at Politecnico di Torino, I am thrilled to start this exciting interdisciplinary research, hoping to contribute with the development of new biomedical technologies to solve problems which are currently impacting the population significantly—says professor Gianluca Ciardelli—The project aims are challenging, but achievable, having put together, with the unvaluable help of Dr. Federico Vozzi (CNR, Pisa), a well-composed international consortium with all the required competencies. In the end, we envisage a significant contribution for making our Technosphere greener and increasingly sustainable."

Provided by Politecnico di Torino