ADVANCED NON-ANIMAL MODELS IN BIOMEDICAL RESEARCH:

Cardiovascular diseases

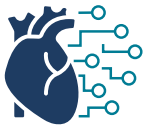
EUROGROUP FOR ANIMALS

Animal models of cardiovascular disease often bear little resemblance to human pathology, but they still are commonly and intensely used.

Only 25% of new drug programmes in the cardiovascular domain successfully reach market authorisation, largely because of poor predictivity of animal models.

In vitro and *in silico* models can replicate patient-specific conditions enabling personalised medicine approaches.

Computational models can be used to reproduce more complex systems, simulate the function of organs or even the entire human body, and to explore how diseases develop and cause adverse effects.

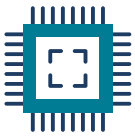


New medical drugs or devices can be entirely developed and tested for safety and efficacy *in silico*.

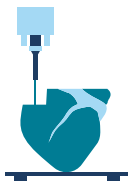
Human *ex vivo* specimen testing opens pathways for the biomechanical investigation of cardiovascular pathologies linked to biological degradation.

In vitro cell-free models have the potential to validate the devices to be implanted, study patient-specific pathologic conditions, and develop clinical training setups for surgeons.

2D *in vitro* cell cultures are being used very effectively for understanding and diagnosing cardiovascular disease and developing new therapies.

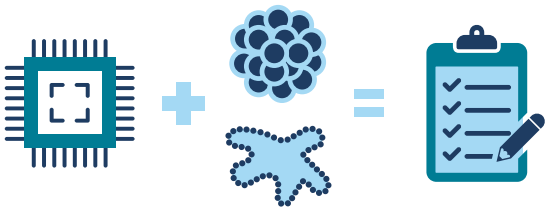


Heart- and vasculature-on-a-chip models can simulate the functioning of the whole heart or vasculature, recapitulate important organ-level functions, and recreate environment dynamics, thus providing a technological platform capable of accelerating cardiovascular drug development.



3D-printed models have been proven to be useful for training and surgical planning, since they allow for a better visualisation of complex spatial relationships that characterise cardiovascular diseases.

FUTURE NEED



Although the use of innovative *in silico* and *in vitro* human-relevant models in cardiovascular research is extensive, there is still a clear need for the development of advanced models such as organoids and organ-on-chip devices that can capture more complex human biology.

Source: Celi, S., Cioffi, M., Capellini, K., Fanni, B.M., Gasparotti, E., Vignali, E., Positano, V., Haxhiademi, D., Costa, E., Landini, L., Daskalopoulos, E., Piergiovanni, M., Dura, A., Gribaldo, L. and Whelan, M., Advanced Non-animal Models in Biomedical Research, EUR 30334/5 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-56984-8, doi:10.2760/276664, JRC130702