SCIENCE & TECHNOLOGY PARK FOR MEDICINE
TECNOPOLO MARIO VERONESI
MIRANDOLA

CUBIBOX (Customized Biological Box): new generation platform for in vitro testing

CUBIBOX is a technological platform able to generate complex biological tissues of human origin, to be used for in vitro testing of drug screening, biocompatibility of materials, efficacy of drugs, cosmetics and molecules of interest. The models were obtained with bioprinting technology that places an ink composed of homogeneously distributed biomaterials and cells on the surface. The 3D model is produced in automated mode following a CAD design, ensuring the standardisation and reproducibility of the process, reducing variability between samples and improving the robustness of the results. Tissues were housed inside a closed bioreactor, a real 'box', making two kits: **SkinBOX** and **VesselBOX**. The platform has the potential to replace animal models in the future, allowing those without expertise in bio or cell culture tools to conduct specific tests.

Laboratory	TPM - TECNOPOLO MIRANDOLA "Mario Veronesi"
Specialization Area	Health and Wellness
Contacts	Elena Veronesi
Keyword	Bioprinting, Medical Devices , Testing

"3D Bioprinting - innovative tools for diagnostics and toxicology"

CUBIBOX

Fig. 1: Cubibox logo

RETE ALTA TECNOLOGIA
EMILIA-ROMAGNA
HIGH TECHNOLOGY NETWORK

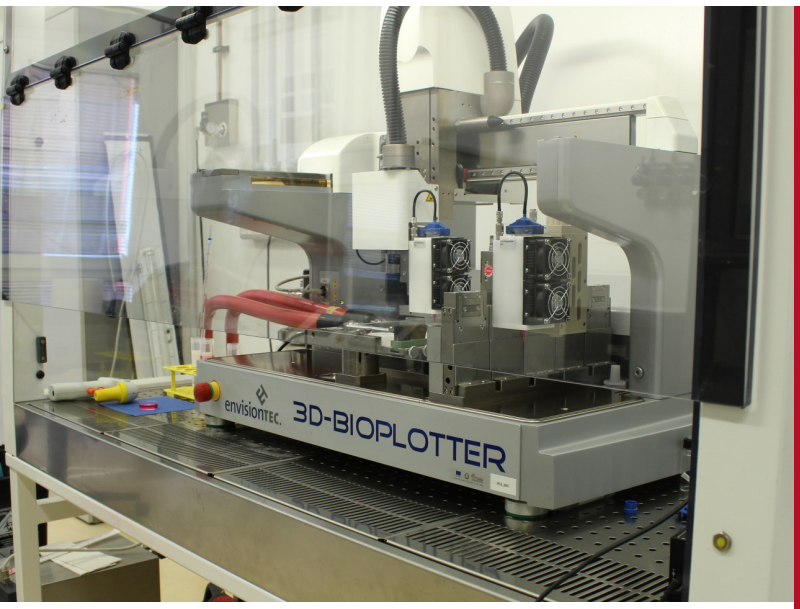


Fig. 2: EnvionTec 3D Bioplotter, an instrument used for in vivo modelling

Description

3D printing technology allows the standardised and reproducible production of biomimetic healthy and/or pathological tissues, which reproduce the architecture and physiology of human tissues. The resulting tissue is placed inside a bioreactor, which is a container with specific functions that preserve cell viability and allow tissue development and maturation. This specially designed skin and vessel device has easy access for the insertion of compounds or materials to be tested. Thanks to the collaboration with research partners LTTA and IRST, it was possible to develop specific protocols to analyse the biological effect determined on the tissues housed inside the container.
The kits obtained in this way represent an innovative tool for studying the biocompatibility of materials, starting from cytotoxic effects through to the analysis of more complex phenomena such as irritation and sensitisation. **SkinBOX** and **VesselBOX** are a promising tool to replace animal experimentation.

Innovative aspects

Through the use of the CUBIBOX platform, based on the employment of in vitro models, it is possible to:
• obtain more accurate and predictive results about the biological effect of a compound on the human organism, reducing experimental limitations due to the inter-species variability typical of animal models;
• reduce the use of animal models by satisfying the ethical principles of the **3R**s (refine, reduce, replace), and consequently also the resources and time required for in vivo experimentation.

Potential applications

Using biomimetic biological tissues/organs to test, quickly and without the use of animal models, the efficacy and safety of compounds, drugs and materials.

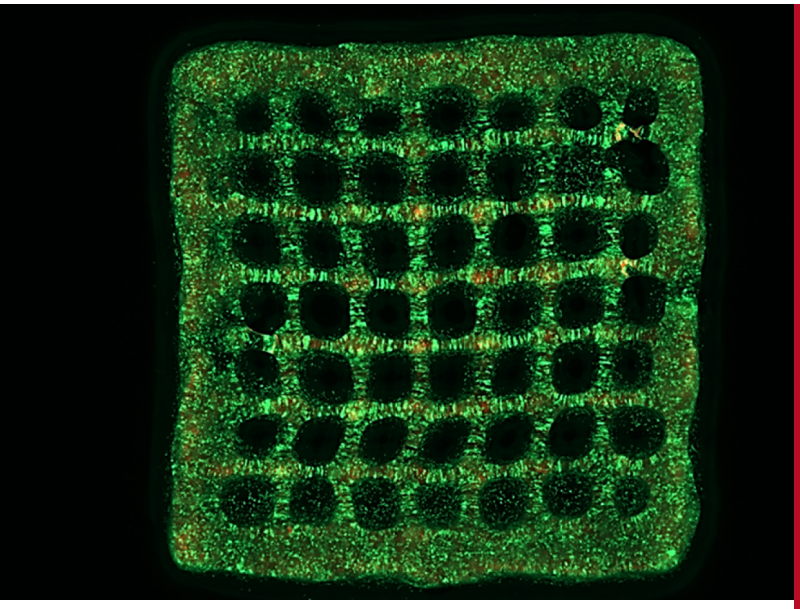


Fig. 3: Example of three-dimensional tissue obtained by bioprinting technology that imitates skin architecture

Involved partners	CUBIBOX was born from the collaboration between 3 laboratories TPM - TECNOPOLO MIRANDOLA 'Mario Veronesi', LTTA - Laboratory for Advanced Therapy Technologies, IRST-HTN LAB and the support of 5 companies Comecer, Rigenerand, Rimos, B.Braun Avitum Italy and Ophera.
Implementation Time	24 months.
Technology Readiness Level	TRL5 - Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
Exploitation	2 kits, SkinBOX and VesselBOX, were prototyped. A patent application has been submitted for the pathological phenotype of dermis generated using the SkinBOX.

Application example

SkinBox

Creation of a platform consisting of a bioreactor inside which is housed a three-dimensional tissue obtained by bioprinting technology capable of simulating skin architecture.

VesselBox

Creation of a platform consisting of a bioreactor inside which is housed a three-dimensional tissue obtained by bioprinting technology capable of simulating the architecture of a blood vessel.

The **SkinBox** and **VesselBox** platforms offer companies a prototype screening tool capable of predicting the biological effect of a compound/material. The companies most interested in these technologies belong to industries such as biomedical, cosmetic, pharmaceutical and textile.
The **SkinBox** platform, thanks to its ability to imitate the correct architecture of the skin, makes it possible to predict the skin's biological response following contact with a drug, compound or medical device. The kit allows the study of complex phenomena such as the irritative or sensitising potential of the tested element, guaranteeing its safe introduction onto the market for the end consumer.
With **VesselBox**, on the other hand, you have the advantage of analysing the biocompatibility of all blood contact devices such as catheters or stents. This platform can recreate the typical structure of arteries and veins, in which the device to be tested can be placed. It can therefore be used as a screening platform to analyse the complex biological phenomena that occur in the blood tissue following contact with the medical device. Finally, it offers the possibility to imitate the blood flow in order to predict the effect in dynamics as well.

SCIENCE & TECHNOLOGY PARK FOR MEDICINE
TECNOPOLO MARIO VERONESI
MIRANDOLA

TPM - TECNOPOLO MIRANDOLA "Mario Veronesi"

Parco Scientifico e Tecnologico Materiali Innovativi e Ricerca Applicata del Mirandolese



Website https://tpm.bio/

Published on 05/12/2024

Il laboratorio di ricerca Tecnopolo TPM "Mario Veronesi" di Mirandola mette a disposizione delle imprese principalmente del comparto biomedicale, ma anche cosmetologico e agro-alimentare, servizi di alto livello per la ricerca applicata, lo sviluppo industriale e la convalida di prodotti, oltre che consulenze per la formazione continua di tecnici e ricercatori.

È porta di accesso privilegiata alla Rete Alta Tecnologia, è certificato in accordo alle UNI EN ISO 13485 e 9001, opera in connessione con la Sanità provinciale e regionale e in collegamento con network nazionali ed internazionali. È organizzato su un modello integrato fatto di ricerca, servizi avanzati, formazione e incubazione presso il TPM Cube.

Il TPM è in grado di risolvere problematiche altamente complesse tramite analisi biologiche e di biocompatibilità, analisi di performance, test specifici e su misura del richiedente adottando protocolli che tutelano la riservatezza e la proprietà intellettuale dei progetti o ricerche affidati.

In collaborazione con l'Università di MO e RE, gestisce i laboratori:

· TOP, Tossicologia e Proteomica

· MAB, Microscopia applicata e Biologia Cellulare

· MS2, Materiali, Sensori e Sistemi

· PoS, Analisi chimico/fisiche

· Usability

Grazie alle competenze specifiche del team e all'utilizzo delle più recenti e avanzate tecnologie, è un luogo dove imprese e competenze scientifiche si incontrano per creare, risolvere ed accelerare opportunità produttive personalizzate per il richiedente.