MISSIONE 4
ISTRUZIONE
RICERCA

Finanziato dall'Unione europea
NextGenerationEU

Ministero dell'Università e della Ricerca

Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA

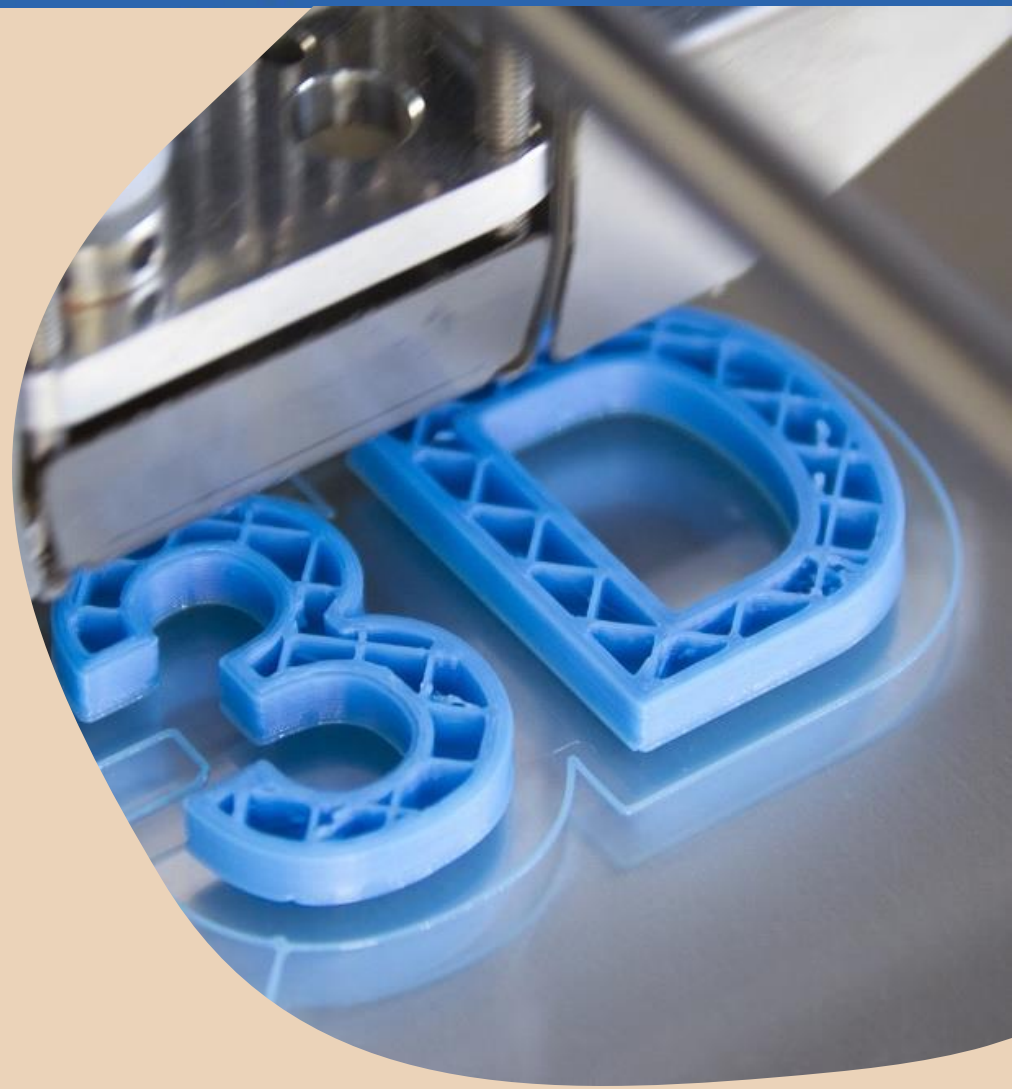
3D printing: What is achievable in the pharmaceutical field?

Mattia Tiboni, PhD
Università degli Studi di Urbino Carlo Bo
23 maggio 2024

mattia.tiboni@uniurb.it

VITALITY

How many of you know what 3D printing is?



Finanziato dall'Unione europea
NextGenerationEU

Ministero dell'Università e della Ricerca

Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA

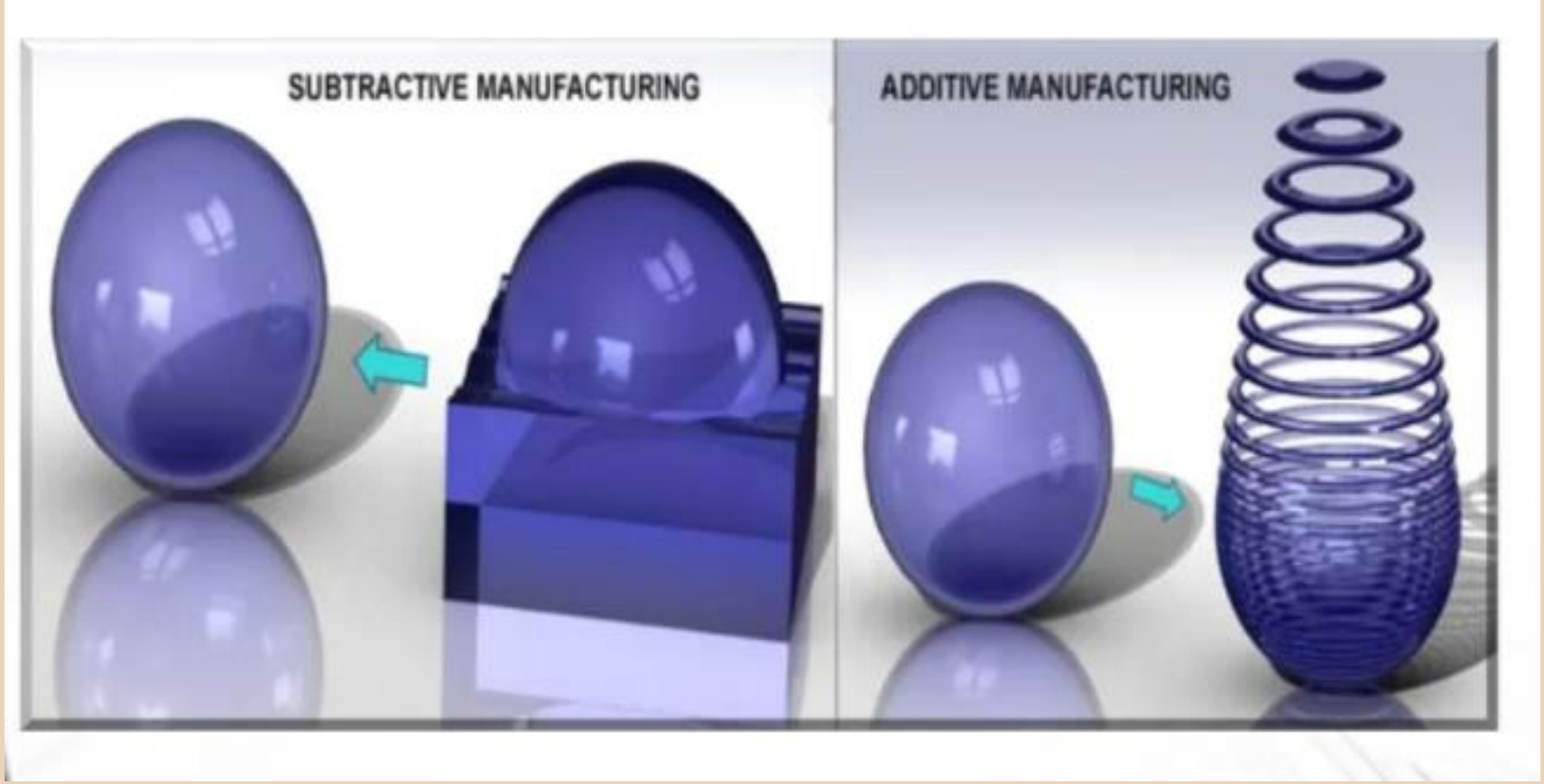
Keywords

ADDITIVE MANUFACTURING

RAPID PROTOTYPING

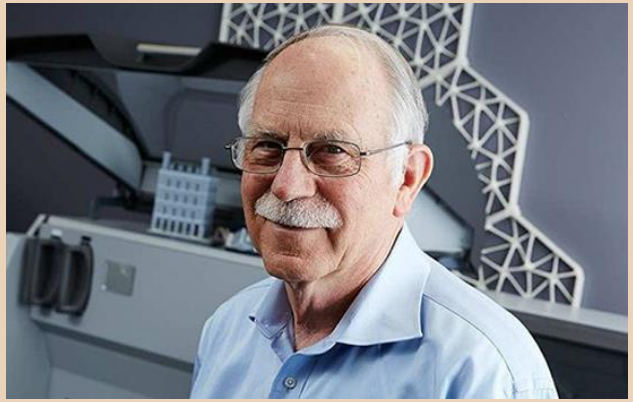
PERSONALIZATION

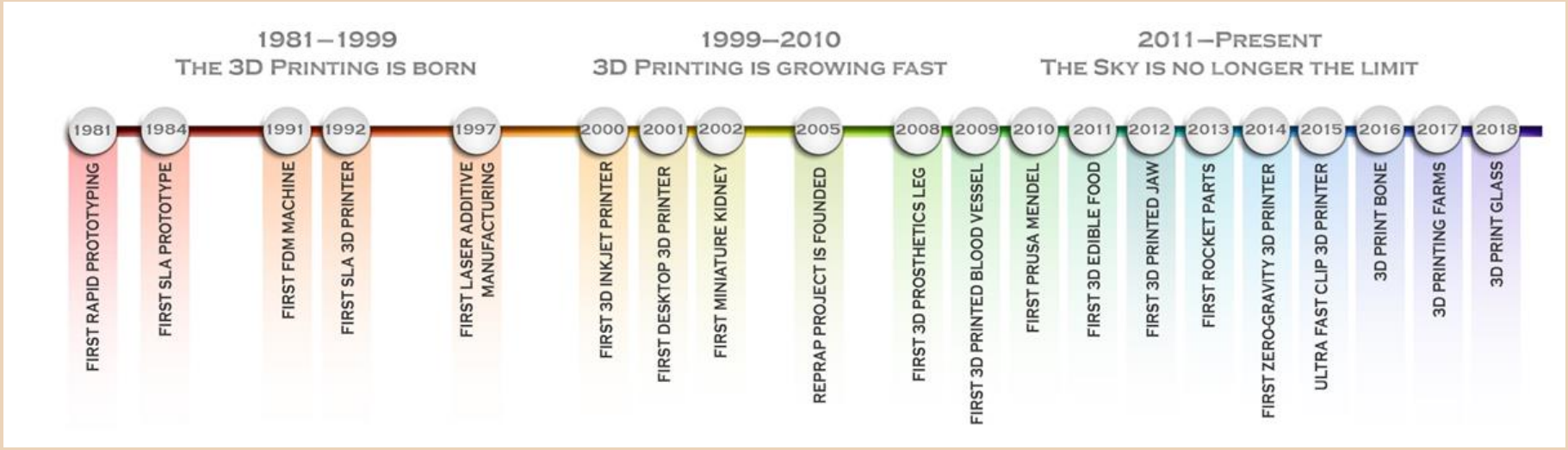
Additive manufacturing technologies

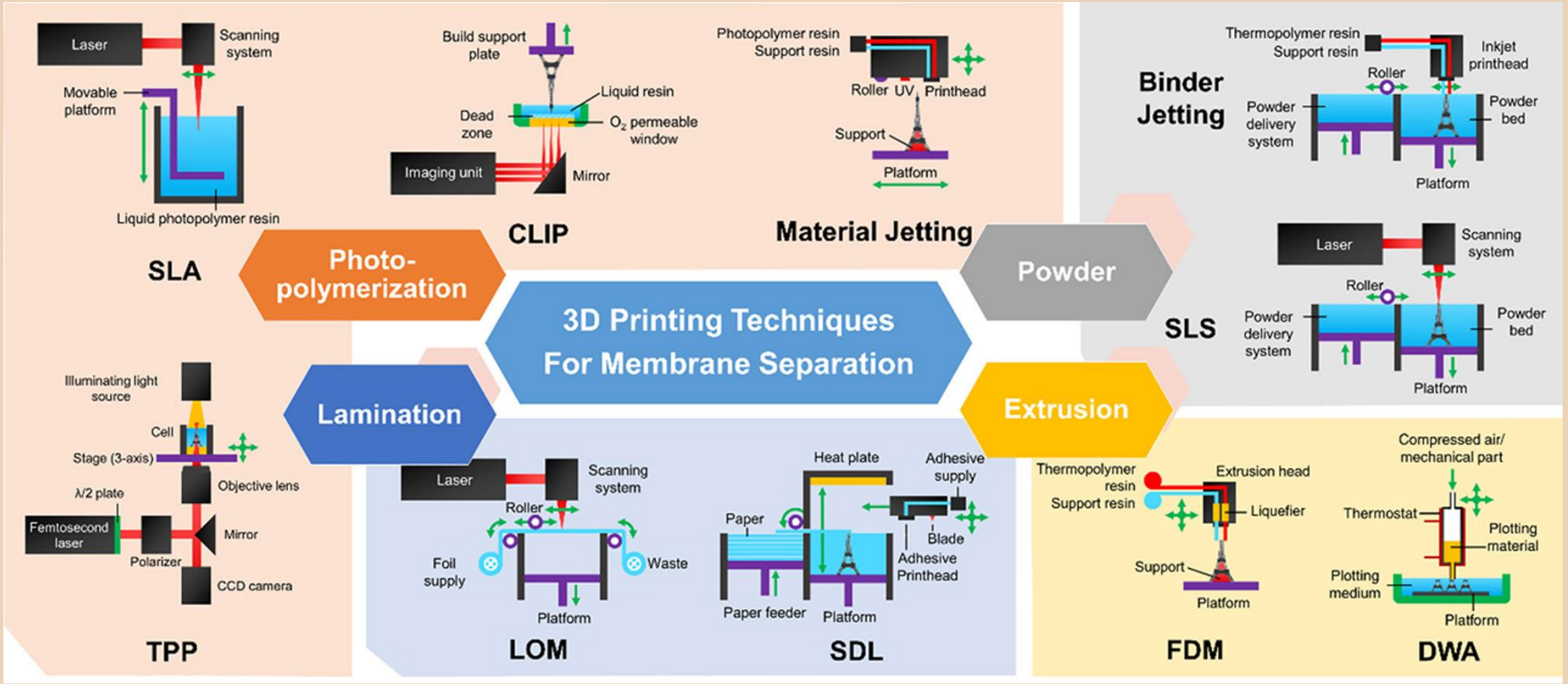


A bit of history

Charles Hull in 1984 patenteted this technique as StereoLithography Apparatus(SLA)
Then similar technologies were developed such as selective lased sintering (SLS), fusion deposition modeling (FDM), inkjet printing, etc.






3D Printing Techniques For Membrane Separation
Photo-polymerization
Powder
Lamination
Extrusion
Laser
Scanning system
Movable platform
Liquid photopolymer resin
SLA
Build support plate
Liquid resin
Dead zone
O_2 permeable window
Imaging unit
Mirror
CLIP
Photopolymer resin
Support resin
Roller
UV
Printhead
Support
Platform
Material Jetting
Binder Jetting
Thermopolymer resin
Support resin
Inkjet printhead
Roller
Powder delivery system
Powder bed
Platform
Laser
Scanning system
Roller
Powder delivery system
Powder bed
Platform
SLS
Illuminating light source
Cell
Stage (3-axis)
Objective lens
λ/2 plate
Femtosecond laser
Mirror
Polarizer
CCD camera
TPP
Laser
Scanning system
Roller
Foil supply
Waste
Platform
LOM
Heat plate
Adhesive supply
Paper
Blade
Adhesive Printhead
Paper feeder
Platform
SDL
Thermopolymer resin
Support resin
Extrusion head
Liquefier
Support
Platform
FDM
Compressed air/ mechanical part
Thermostat
Plotting material
Plotting medium
Platform
DWA

Where can it be applied?

- Production of medical devices: patches, microneedles, films, catheters, rings
- Production of solid dosage forms: Tablets, suppositories
- Personalized medicine: Dosage, shape, multidrugs
- Production of manufacturing and analytical systems

Science fiction or reality?


Forbes / Tech

AUG 4, 2015 @ 08:24 AM 21,834 VIEWS

FDA Approves First 3-D Printed Drug

2015

2020
Image via FabRx

FabRx

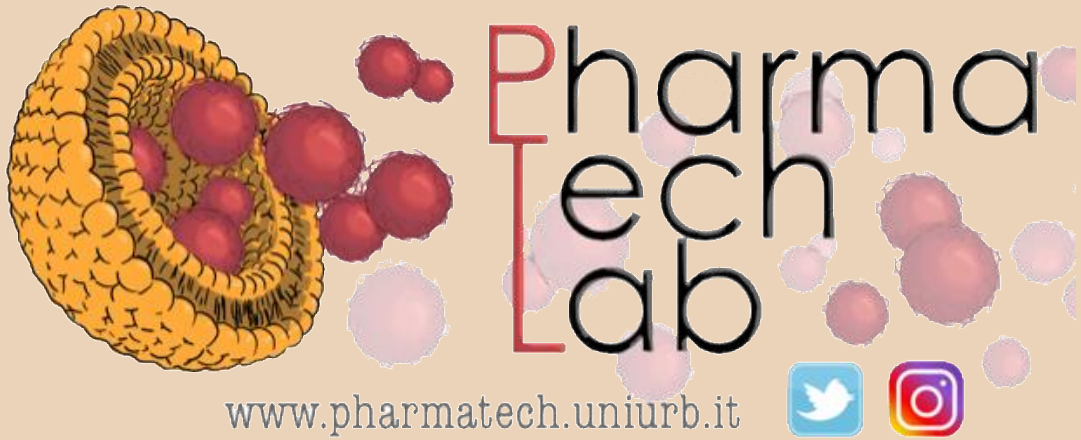
M3DIMAKER

2021 Triastek has gained Investigational New Drug (IND) clearance from the FDA for its T19 drug for rheumatoid arthritis.

2022 IND clearance for T21 for ulcerative colitis.

Image via Triastek.

What are we doing with 3D printing?



1506
UNIVERSITÀ
DEGLI STUDI
DI URBINO
CARLO BO

Finanziato dall'Unione europea
NextGenerationEU

Ministero dell'Università e della Ricerca

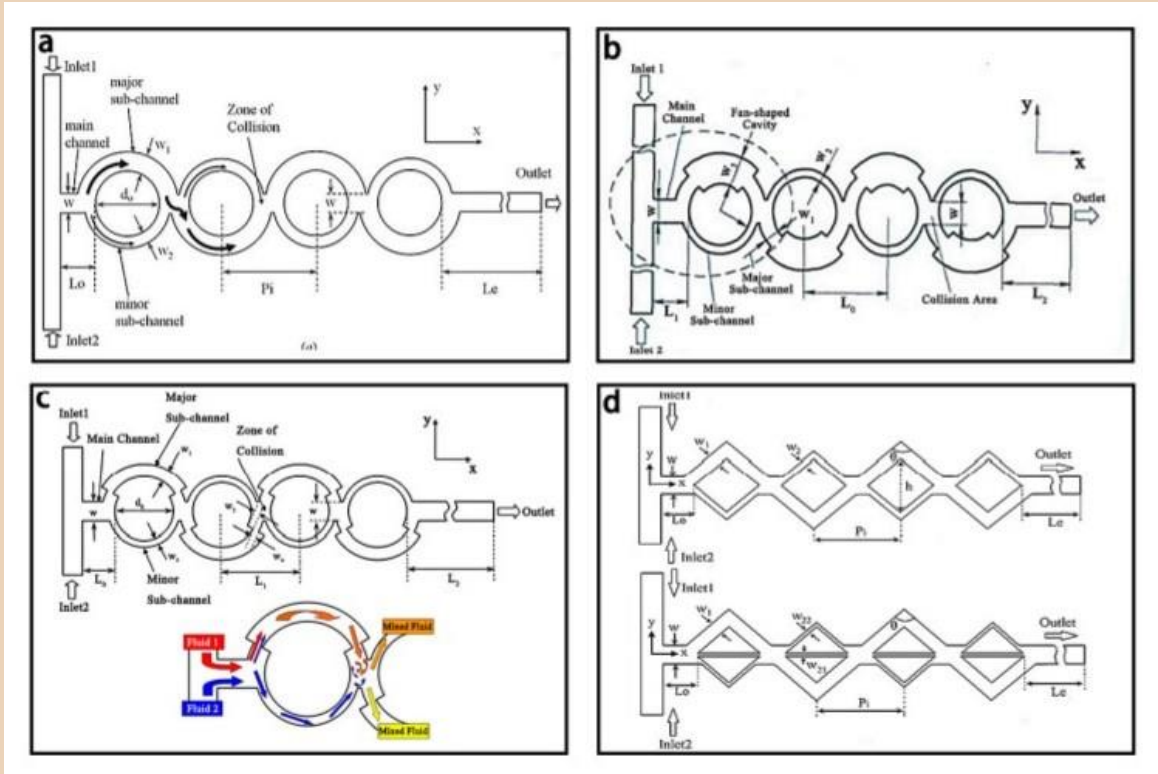
Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA

MANUFACTURING DEVICES

Let me briefly introduce microfluidics!

Pharma Tech Lab
www.pharmatech.uniurb.it

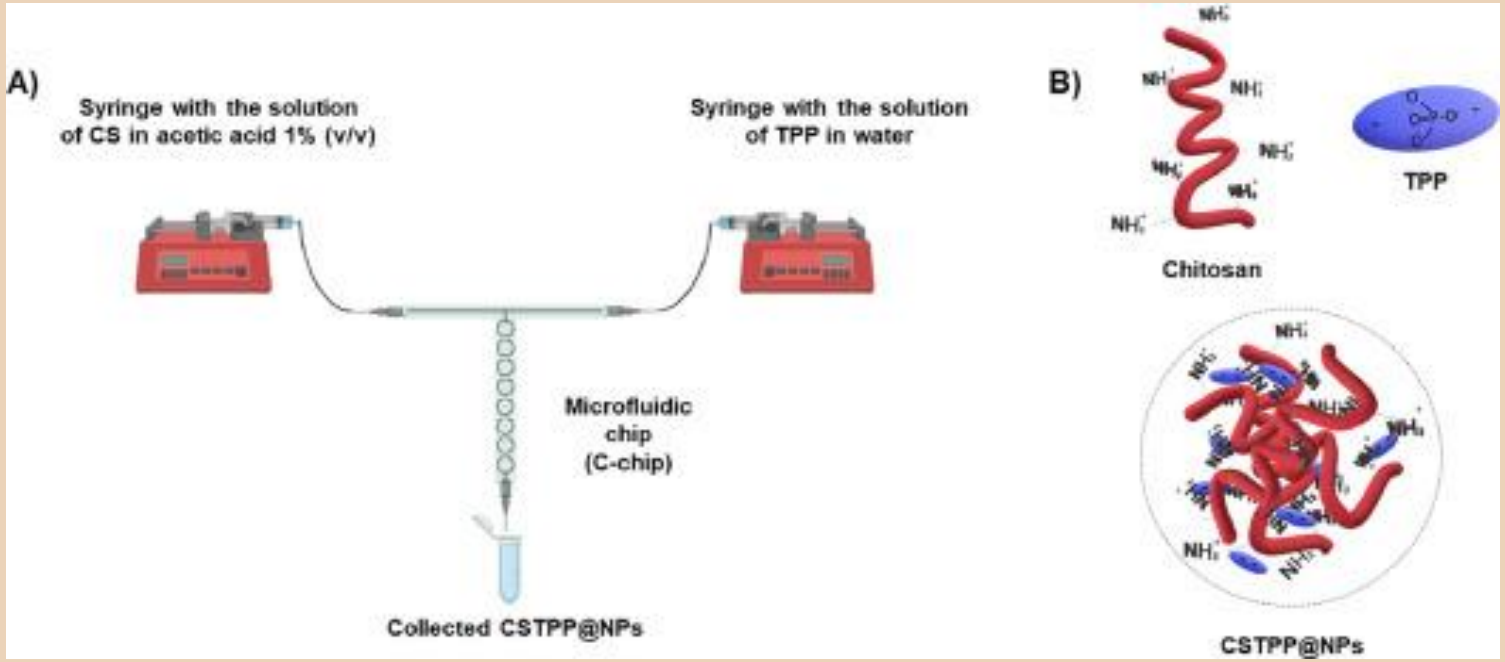
- Innovative manufacturing approach
- Precise control of micromixing in sub-millimiter channels
- High production rates
- Easily scalable
- mRNA vaccine production

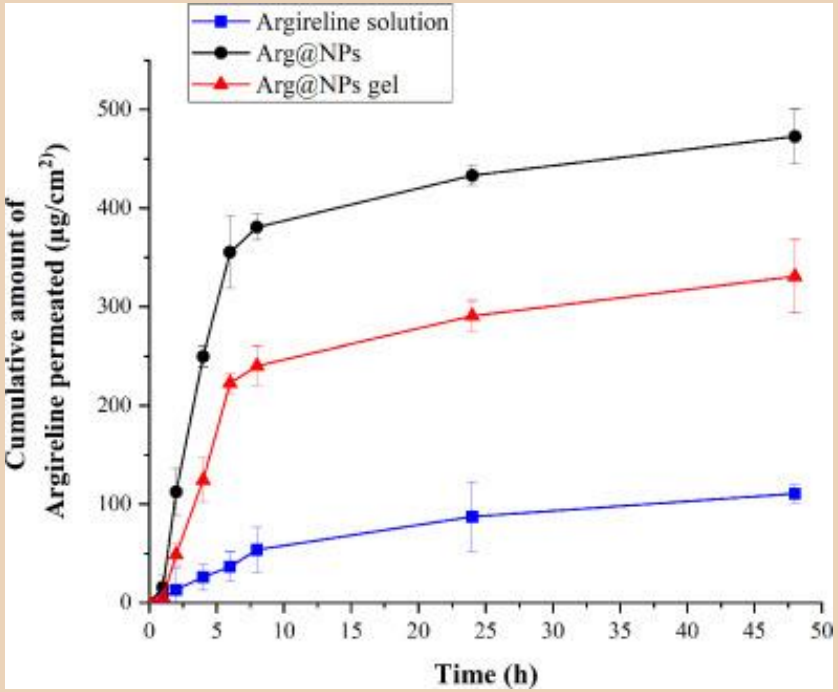


MECCANO
human technology for innovation

COSMOB
TECHNOLOGICAL CENTER

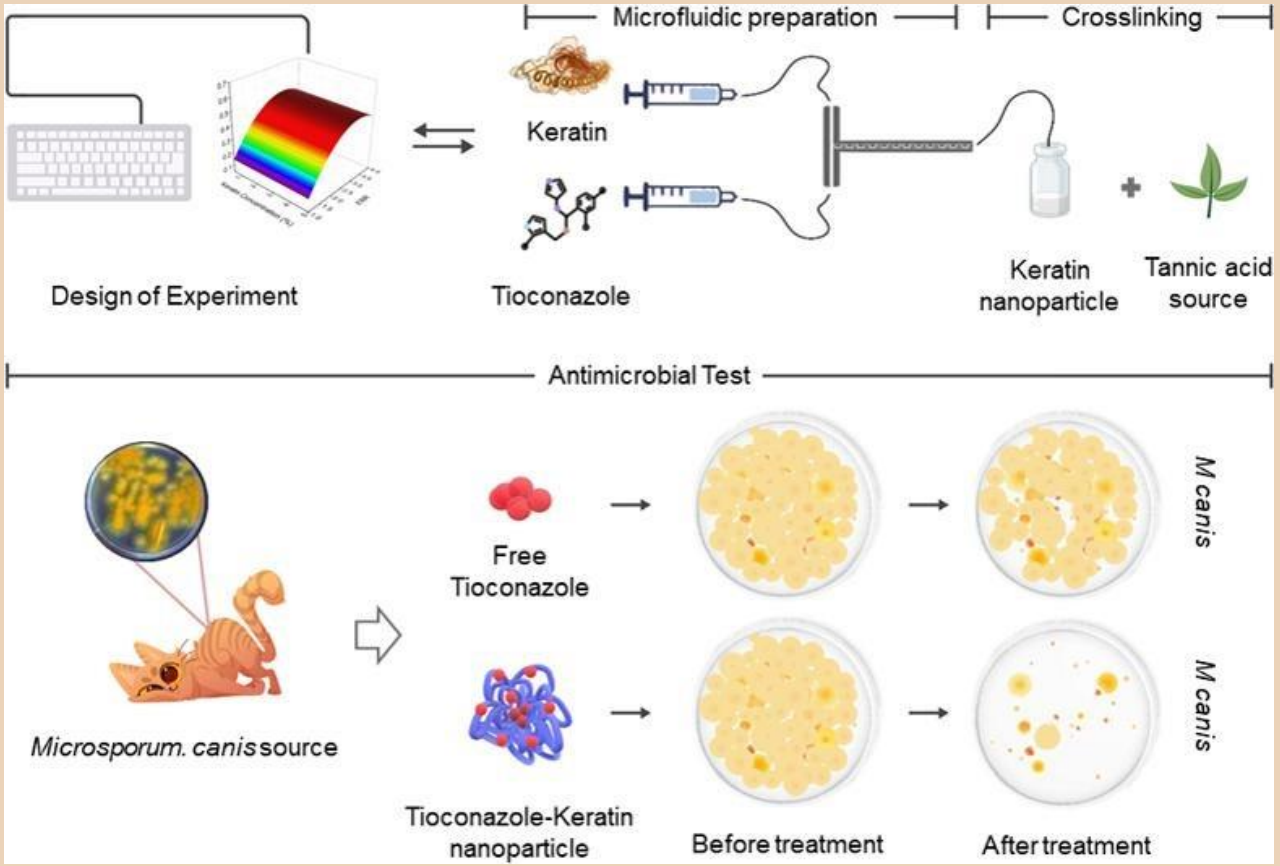
Non-invasive peptides delivery using chitosan nanoparticles assembled via scalable microfluidic technology





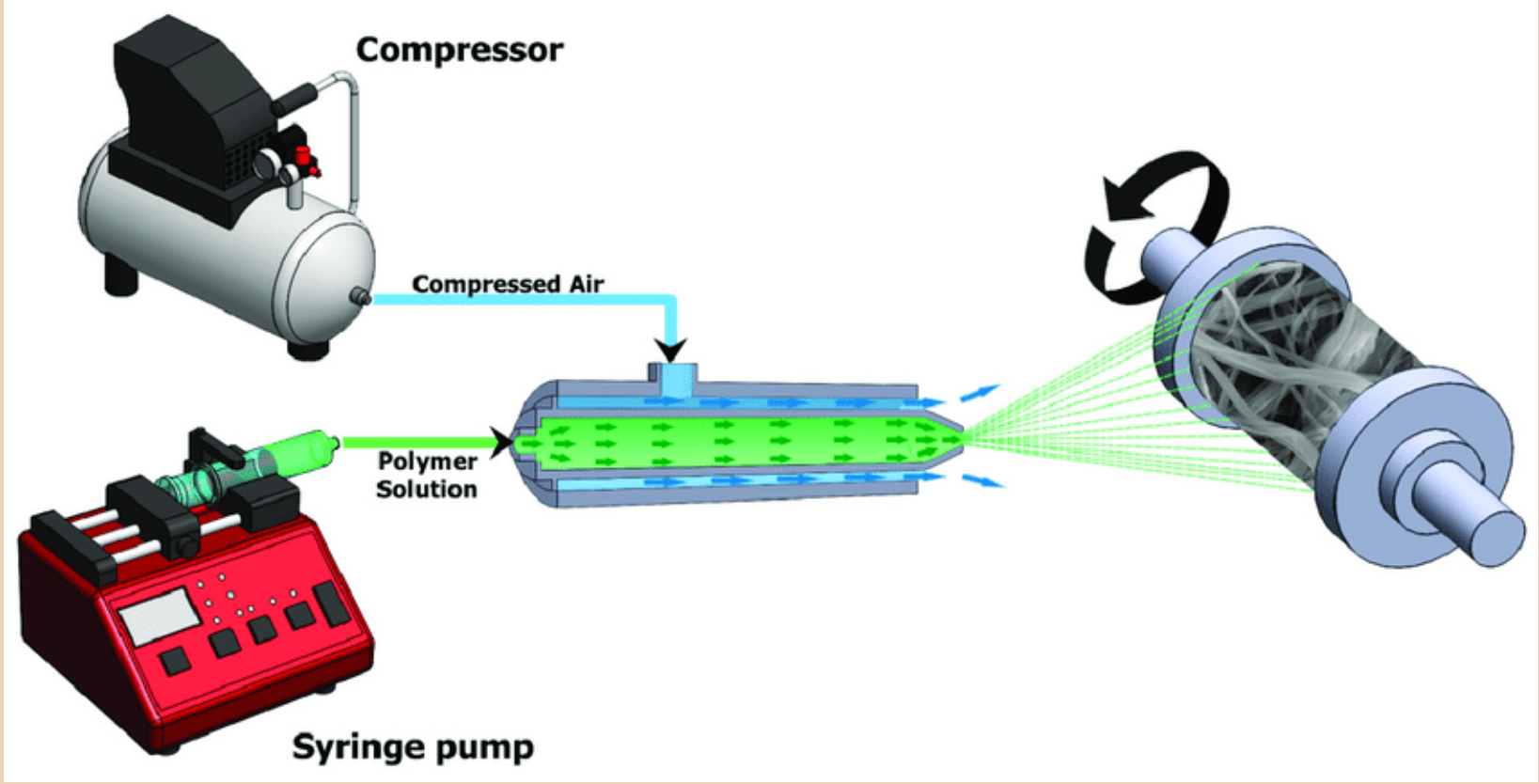
Giorgia Maurizii, Sofia Moroni, Javier Vicente Jimènez Núnez, Giulia Curzi, Mattia Tiboni, Annalisa Aluigi, Luca Casettari, Non-invasive peptides delivery using chitosan nanoparticles assembled via scalable microfluidic technology, Carbohydrate Polymer Technologies and Applications, Volume 7, 2024, 100424,

Microfluidic manufacturing of tioconazole loaded keratin nanocarriers: Development and optimization by design of experiments

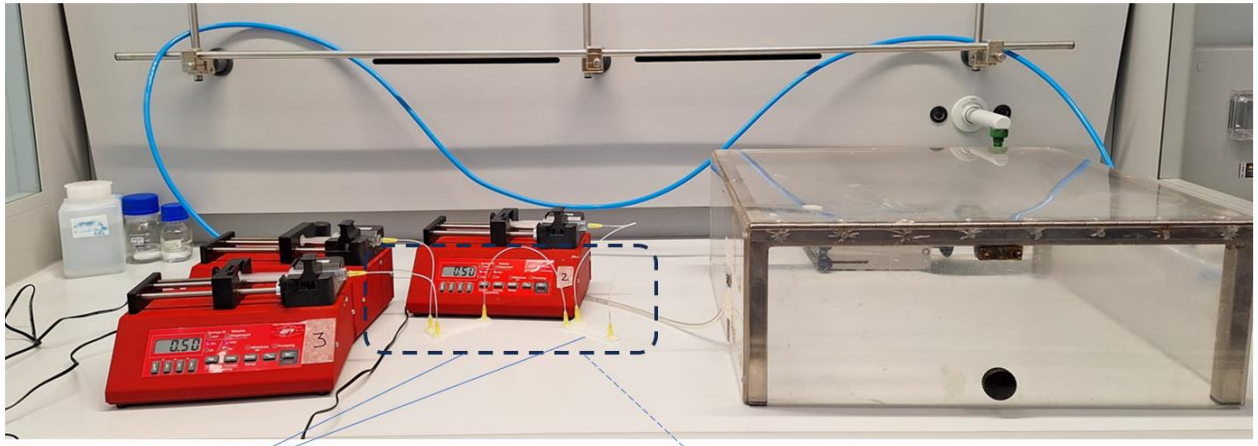


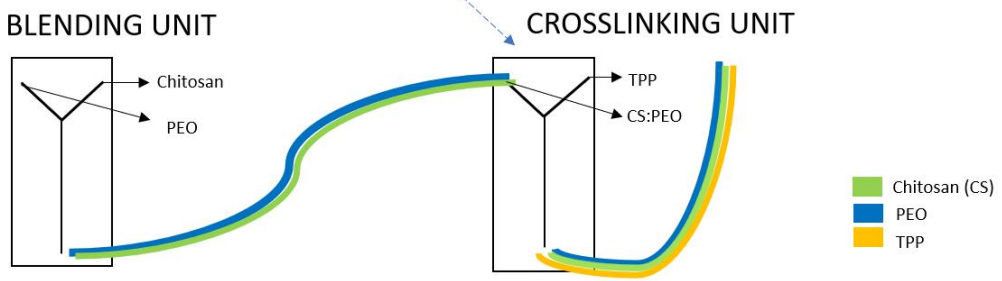
Shiva Khorshid, Rosita Goffi, Giorgia Maurizii, Serena Benedetti, Giovanna Sotgiu, Roberto Zamboni, Sara Buoso, Roberta Galuppi, Talita Bordoni, Mattia Tiboni, Annalisa Aluigi, Luca Casettari, Microfluidic manufacturing of tioconazole loaded keratin nanocarriers: Development and optimization by design of experiments, International Journal of Pharmaceutics Volume 647 2023, 123489,

SOLUTION BLOW SPINNING

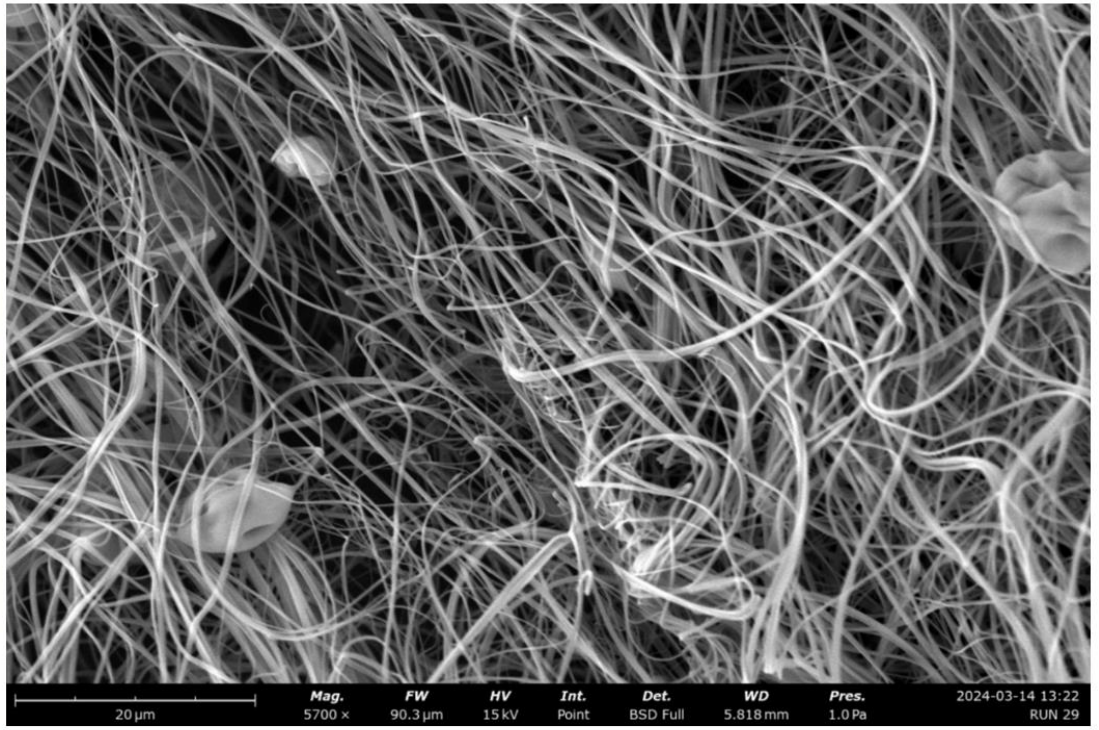


SOLUTION BLOW SPINNING





SOLUTION BLOW SPINNING

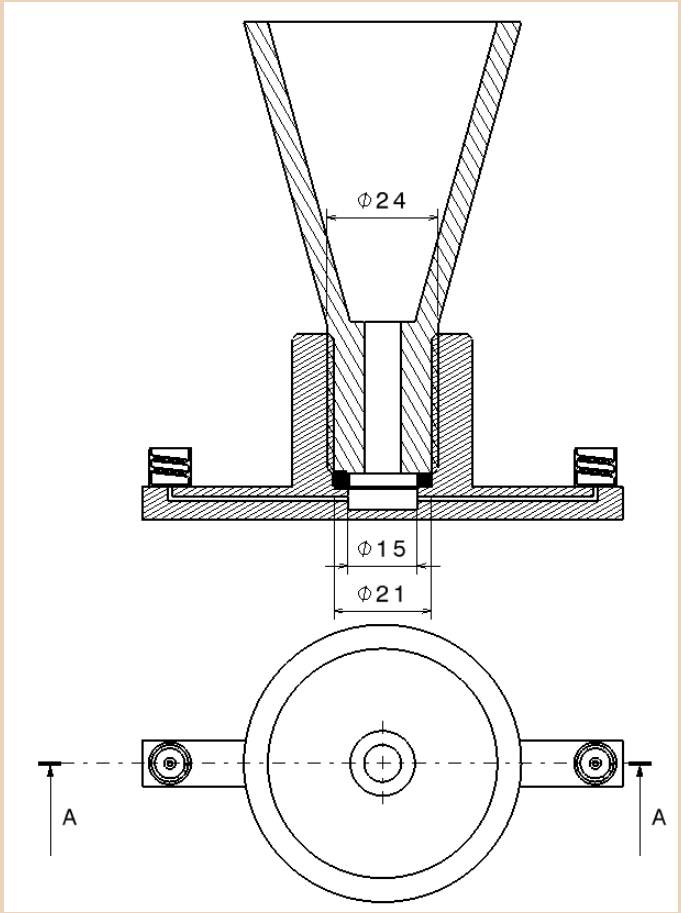


Finanziato dall'Unione europea
NextGenerationEU

Ministero dell'Università e della Ricerca

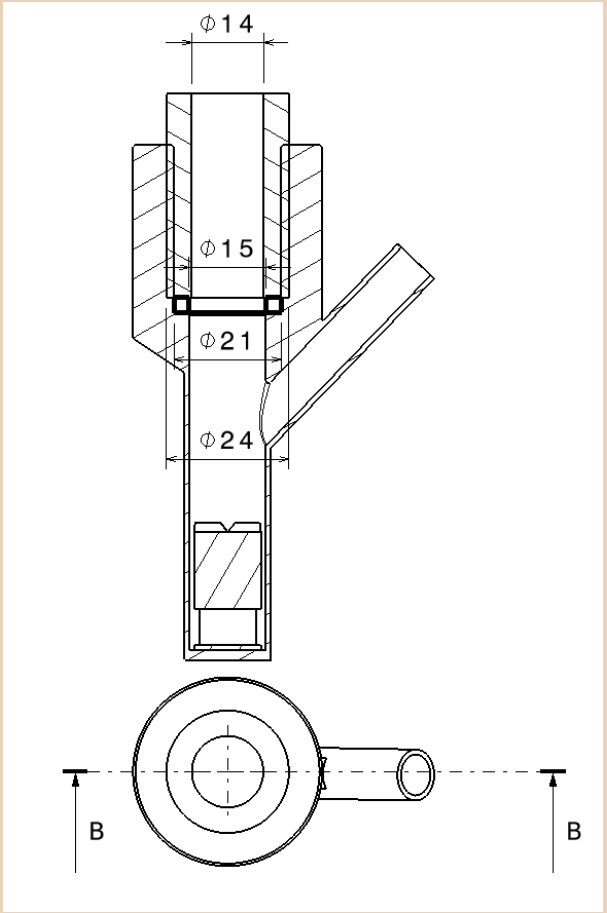
Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA

ANALYTICAL DEVICES



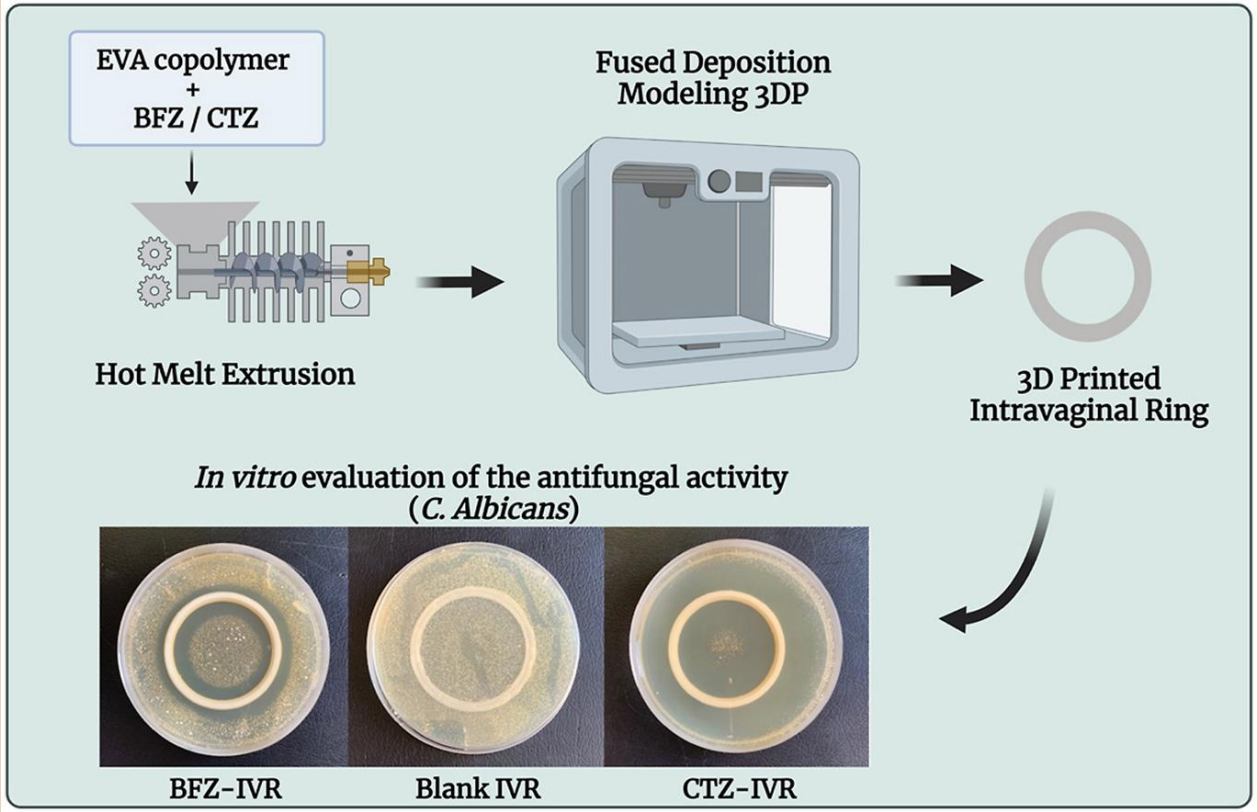
MECCANO
human technology for innovation

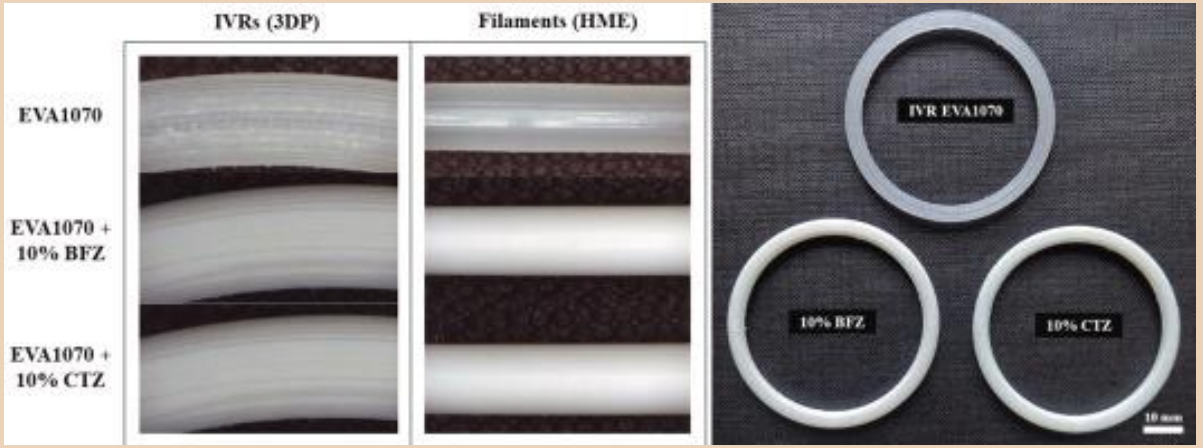
Pharma Tech Lab
www.pharmatech.uniurb.it



PHARMACEUTICALS AND MEDICAL DEVICES

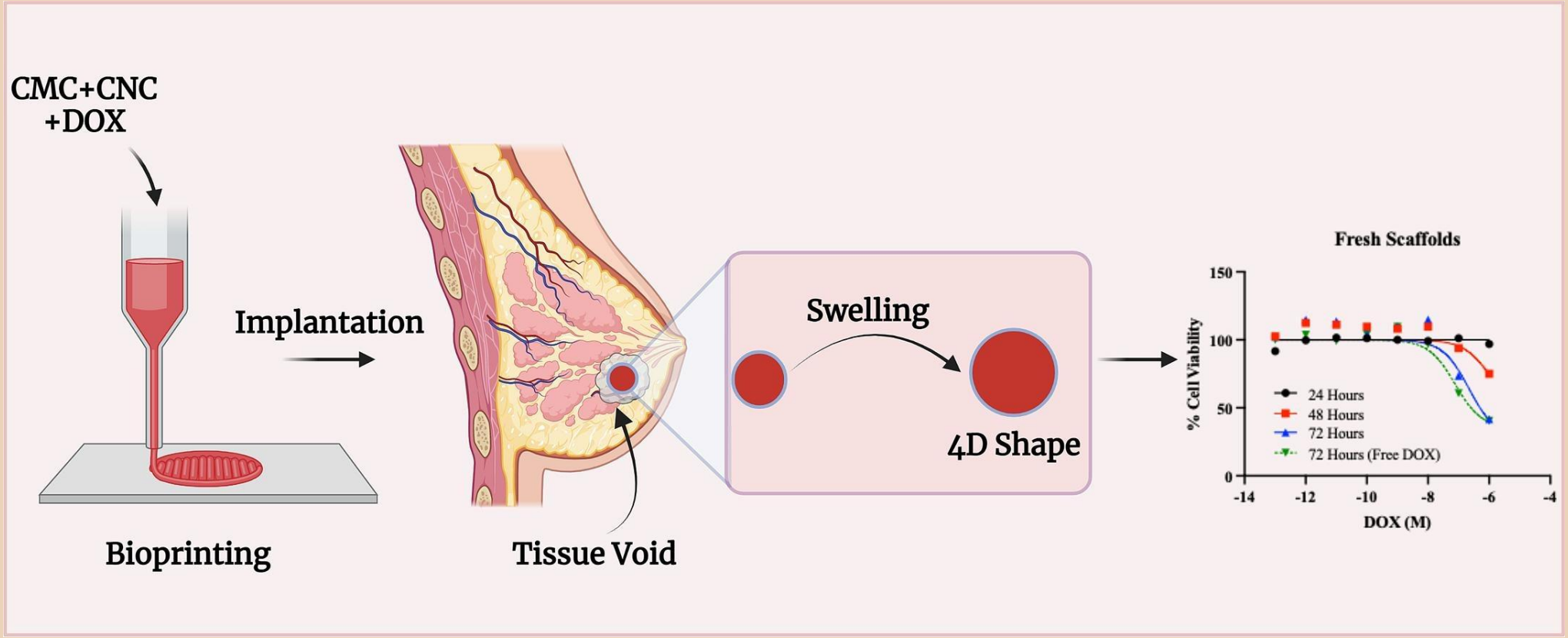
3D printing fabrication of Ethylene-Vinyl Acetate (EVA) based intravaginal rings for antifungal therapy





Sofia Moroni, Francesca Bischi, Annalisa Aluigi, Raffaella Campana, Mattia Tiboni, Luca Casettari, 3D printing fabrication of Ethylene-Vinyl Acetate (EVA) based intravaginal rings for antifungal therapy, Journal of Drug Delivery Science and Technology, Volume 84, 2023, 104469,

4D printed multipurpose smart implants for breast cancer management



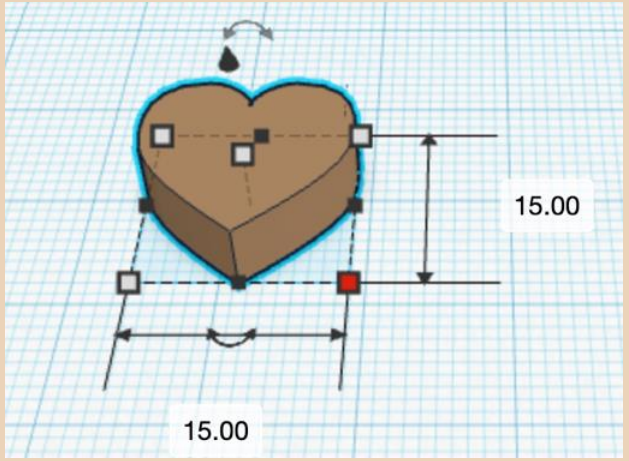
Sofia Moroni, Rachel Bingham, Niamh Buckley, Luca Casettari, Dimitrios A. Lamprou, 4D printed multipurpose smart implants for breast cancer management, International Journal of Pharmaceutics, Volume 642, 2023, 123154

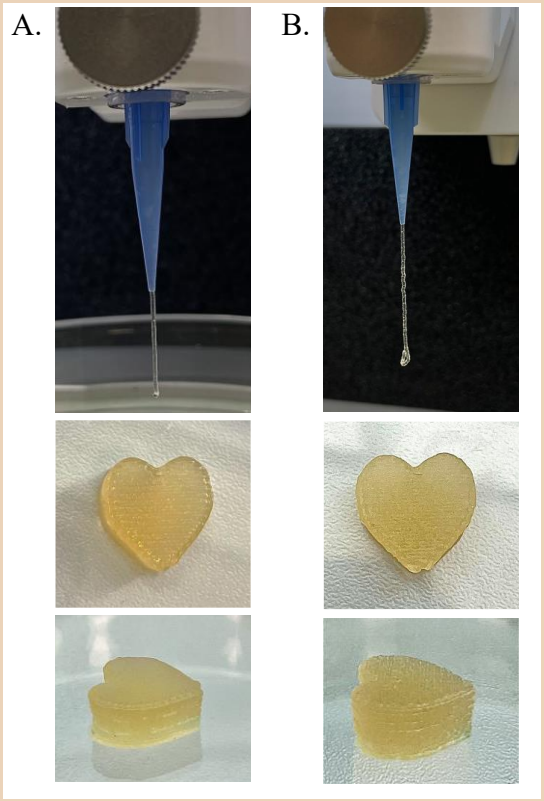
Finanziato dall'Unione europea
NextGenerationEU

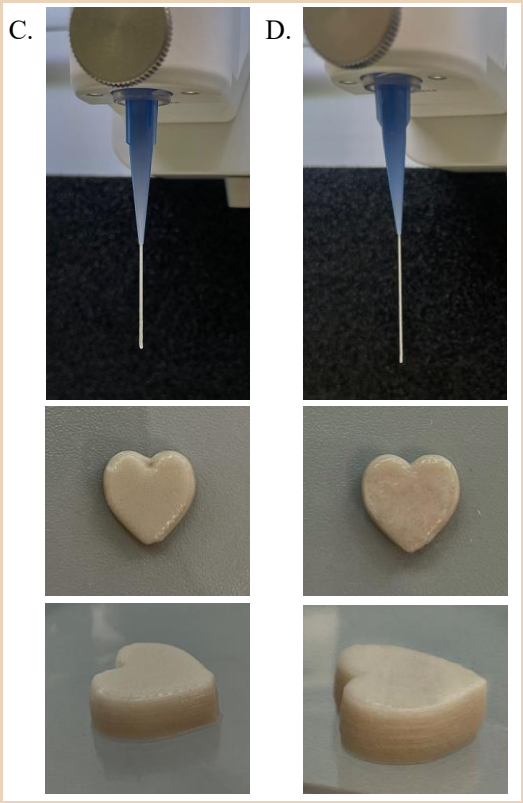
Ministero dell'Università e della Ricerca

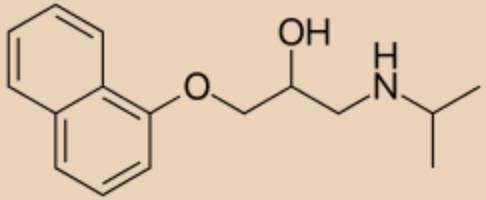
Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA

3D printed gummy-like oral dosage forms for the treatment of pediatric cardiac diseases










URBINO
Unesco Heritage
UNESCO
PATRIMONIO MUNDIAL
WORLD HERITAGE
PATRIMOINE MONDIAL
Thank you for your attention
For any questions:
mattia.tiboni@uniurb.it