Bioengineering Day
6th November 2026

FORCE-REPAIR: SMART AND MULTIFUNCTIONAL 4D PRINTABLE PRO-REGENERATIVE BIOLOGICAL MATRIX MODULATING MECHANOTRANSDUCTION AS ADVANCED THERAPY TO TREAT SKIN CHRONIC WOUNDS

Project: 101092243 — FORCE REPAIR — HORIZON-CL4-2022-RESILIENCE-01

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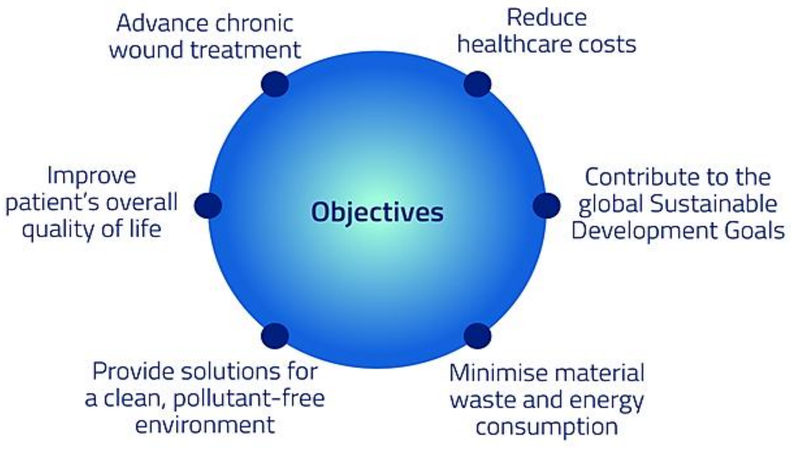
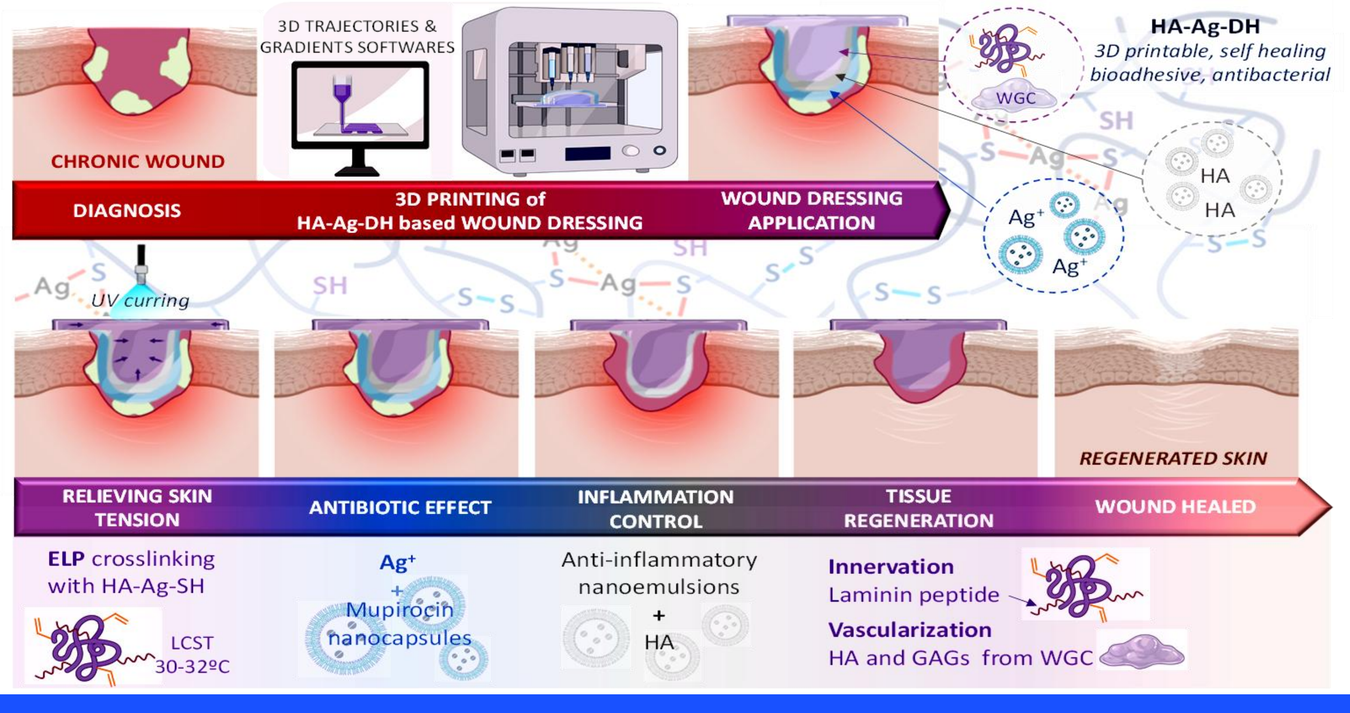
Introduction & Objectives

To develop a **smart, cost-effective, 3D-printed wound dressing** that **controls infection and inflammation, relieves skin tension, and promotes chronic wound healing**

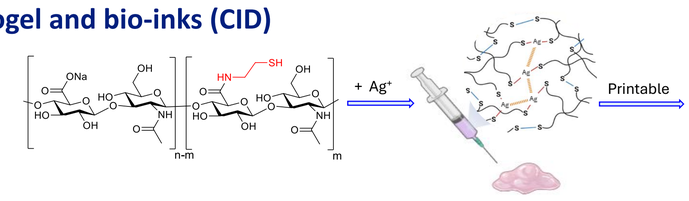


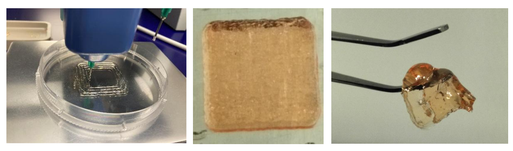


Results & Discussion

1) Bio-inks formulation, characterisation, and testing / 2) Design and development of 3D bioprinting protocol

Ag-HA-SH based hydrogel and bio-inks (CID)





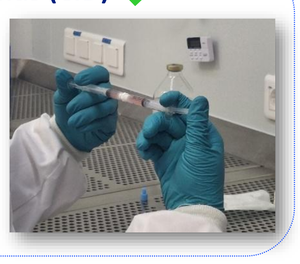
- ✓Sterilise hydrogel (autoclave)
- ✓Hydrogel with customisable modulus
- ✓Self-healing in 10 minutes (recovery > 70%)
- ✓Injectable / Printable

Hydrogel mixing with bioactive compounds (CID) ✓

Antibacterial ink
Mupirocin+Tobramycin Nanoemulsions

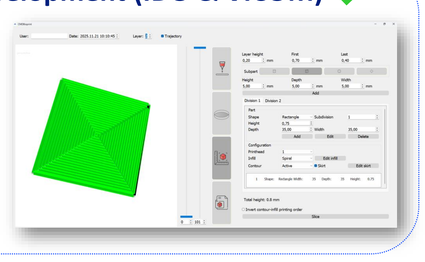
Anti-inflammatory ink
Diclofenac Nanoemulsions

Pro-regenerative bio-ink
IKVAV peptide (innervation)
WGC (vascularization)
ELP (contraction)



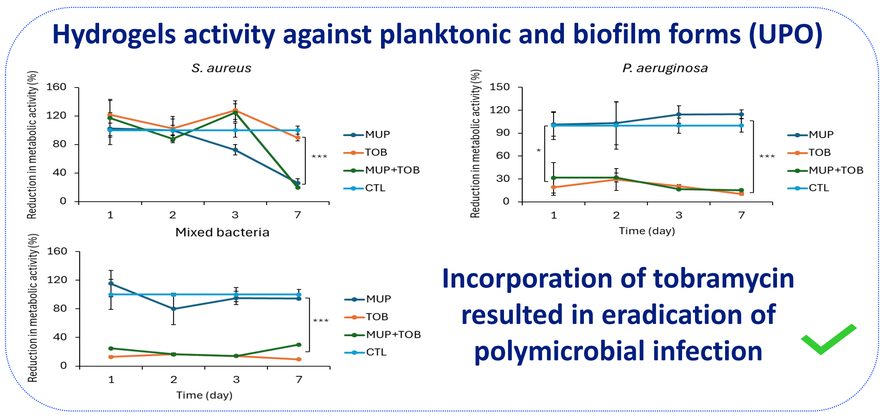
Printer & Software development (IDO & VICOM) ✓





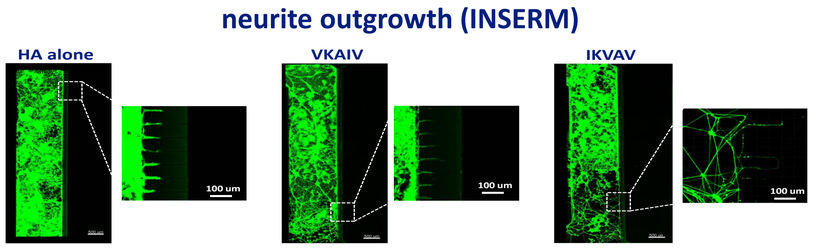
2) Selection via in vitro testing

Hydrogels activity against planktonic and biofilm forms (UPO)



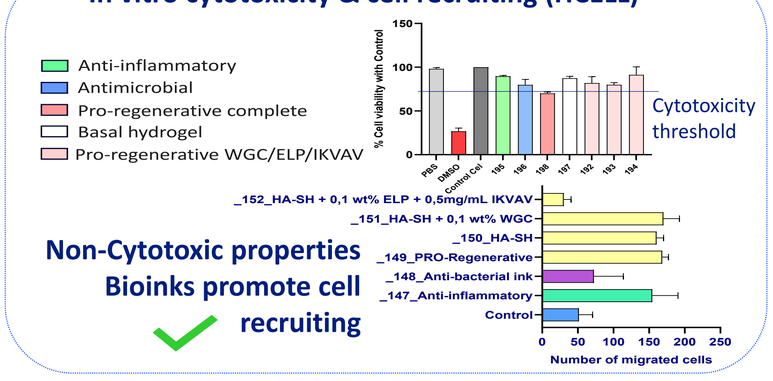
Incorporation of tobramycin resulted in eradication of polymicrobial infection ✓

Neurogenic potential of HA-based bioinks (± IKVAV) on neurite outgrowth (INSERM)



IKVAV and VKAIV (laminin-derived peptides) hydrogels significantly increase neurite extension vs HA alone ✓

In vitro cytotoxicity & cell recruiting (HCELL)

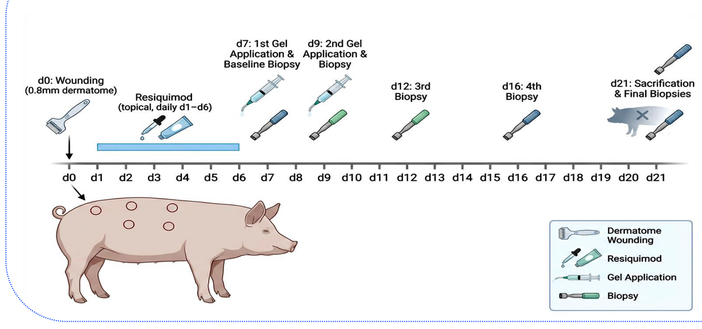


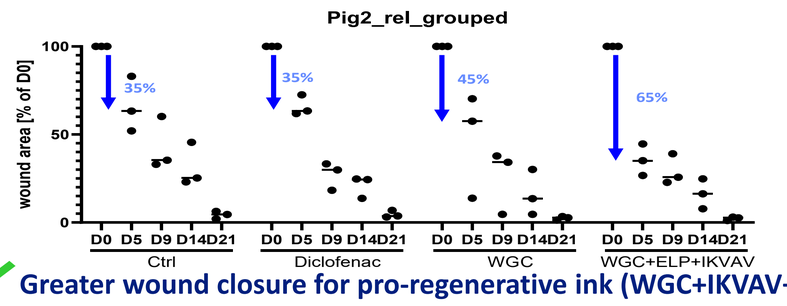
Non-Cytotoxic properties
Bioinks promote cell recruiting ✓

3) In vivo biocompatibility and validation

- All bioactive inks performed well *in vivo* on wound healing
- All components showed a good wound healing tendency and were well tolerable
- Validation of bio-ink on chronic wound pig model (on going)

In vivo evaluation in acute wounds (JOANNEUM)





✓ **Greater wound closure for pro-regenerative ink (WGC+IKVAV+ELP)**

Consortium

Website

LinkedIn

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