Engineering complexity to restore musculoskeletal functionality

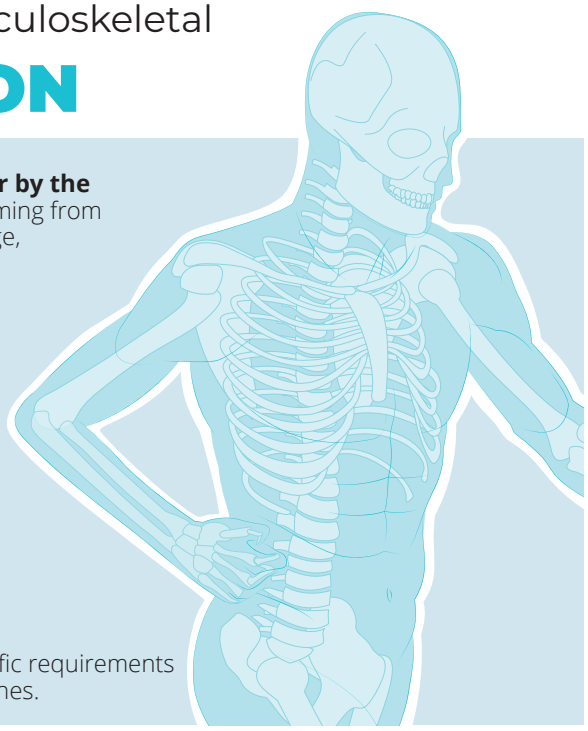
InterLynk

A scientific project supported by the European Union, uniting eight partners from four European countries.

Together they aim to pioneer cutting-edge solutions for the regeneration of damaged musculoskeletal systems,

based on tailored 3D-printed scaffolds with unparalleled biofunctionality and cell-recruiting capabilities.

The **COMPLEXITY** of musculoskeletal REGENERATION



Millions of people are affected every year by the damage of musculoskeletal tissues stemming from trauma injuries, degenerative diseases, old age, or other factors.

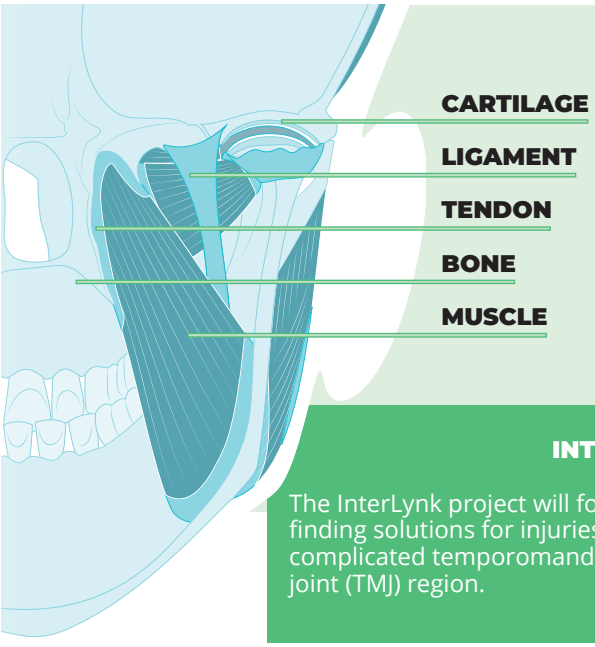
Restoring the functionality of these tissues is complex because of their **complicated biological architectures** involving hard and soft connective tissues.

Once these systems are damaged, **the ability of the body to self-repair such defects is limited.**

FACILITATING THE REPAIR OF MUSCULOSKELETAL STRUCTURES IS CHALLENGING

because of the different properties and specific requirements of interconnecting tissues and transitional zones.

The **INTRICACIES** of musculoskeletal INJURIES



Injuries that affect the musculoskeletal system are highly complex due to:

Multiple Tissue Involvement each with distinct regeneration processes;

Complex Morphology of the different tissues involved from hard bone to soft tissues;

Particularity of individual injuries requiring patient-specific treatments.

INTERLYNK CHALLENGE

The InterLynk project will focus on finding solutions for injuries of the complicated temporomandibular joint (TMJ) region.

The TMJ is a particularly complex system, integrating anterior and posterior ligaments, lateral muscle and disc, while assuring the symmetric function of the jaws.

CLINICAL STANDARDS

Current clinical standards are primarily based on grafts and implants.

These solutions present a series of shortcomings including supply limitations, high failure rates, immune rejection, disease transmission, and lack of integration into the host tissue.

GRAFTS. Biological tissue harvested from the patient, a donor or animal.

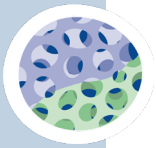
IMPLANTS. Medical constructs usually built from metal or ceramics.

NEW SOLUTIONS based on MEDICAL SCAFFOLDS

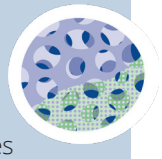
CATEGORIES

Scaffolds can be of diverse nature and made of different materials, including hydrogels, ceramics, metals, or a combination of materials; each of them affecting cell behaviour in different ways.

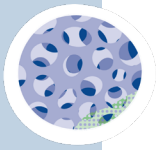
FEATURES



BIO**COMPATIBLE** to ensure harmony with surrounding tissues, without causing adverse responses in the recipient



BIO**MIMETIC** to assimilate the mechanical, structural and physical properties of the natural tissue, so as to quickly restore functionality



BIO**DEGRADABLE** to avoid a second surgery to remove the construct.

InterLynk has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 953169.

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INTERLYNK INNOVATION

A PORTFOLIO OF HUMAN BASED MATERIALS

The regenerative effect of
PLATELET LYSATE

Human derived Platelet Lysate (PL) is obtained from blood platelets after freeze/thaw cycles by disrupting cell membranes. In this process platelets release their growth factors and proteins that support cell expansion and wound healing.

In InterLynk, PL is incorporated into the material, to promote the release of growth factors essential for the regeneration of damaged tissue.

A set of
BIOFUNCTIONAL INKS

PL-based hydrogels serve as the functional matrix for all printable inks in InterLynk and are further combined with mechanically reinforcing materials, including inorganic particles and PCL-LA copolymers, as well as drug-carriers.

The different biomaterials can be combined according to the damaged tissue to be regenerated.

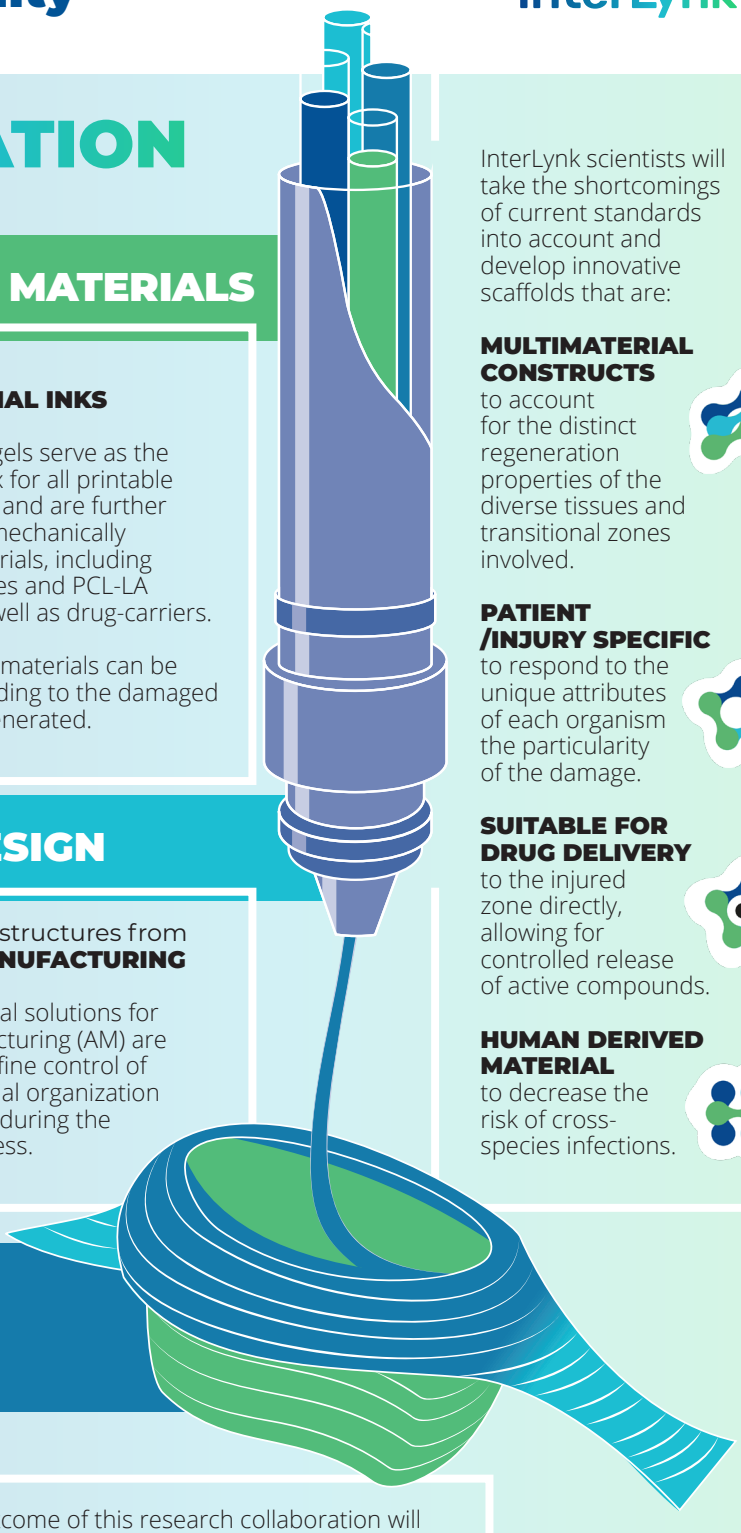
CONSTRUCTS ENGINEERED BY DESIGN

A toolbox for tailored multi-tissue
VIRTUAL MODELS

InterLynk is developing a computational toolbox to virtually design a personalized model, dosing the different bioinks depending on the diverse tissues to be regenerated and the characteristics of the particular defect.

Multi-material structures from
ADDITIVE MANUFACTURING

New technological solutions for Additive Manufacturing (AM) are developed for a fine control of biomaterial spatial organization and distribution during the fabrication process.



InterLynk scientists will take the shortcomings of current standards into account and develop innovative scaffolds that are:

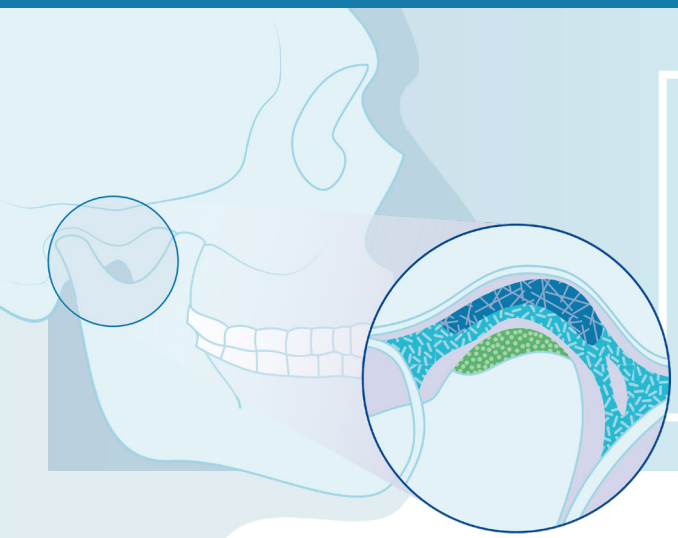
MULTIMATERIAL CONSTRUCTS
to account for the distinct regeneration properties of the diverse tissues and transitional zones involved.

PATIENT /INJURY SPECIFIC
to respond to the unique attributes of each organism the particularity of the damage.

SUITABLE FOR DRUG DELIVERY
to the injured zone directly, allowing for controlled release of active compounds.

HUMAN DERIVED MATERIAL
to decrease the risk of cross-species infections.

Personalized tissue regeneration: THE INTERLYNK SCAFFOLDS



The outcome of this research collaboration will be highly tailored multi-material scaffolds with unprecedented biofunctionality and cell-recruiting capacities. They will be able to synergistically promotethe regeneration of interfacial weight-bearing tissuesand ensure optimal integration into the natural surrounding.

Their expected clinical application will be validated on the repair of multi-tissue temporomandibular joint defects.

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