T&R Biofab

Tissue engineering & Regenerative Medicine, Bio-Fabrication

Company profile

April. 2024

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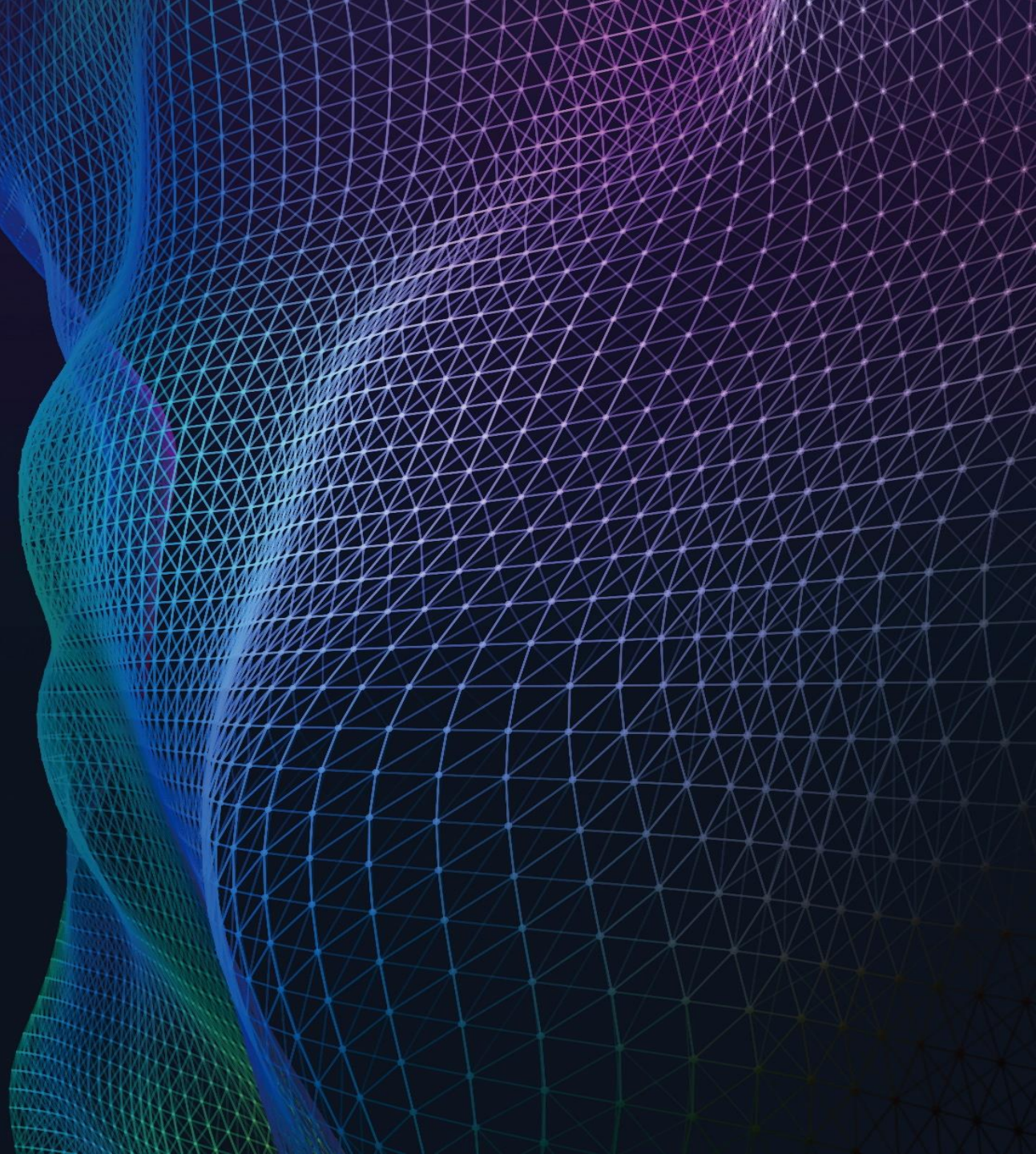
Part 00. Introduction

01. Introduction
02. Business Domain



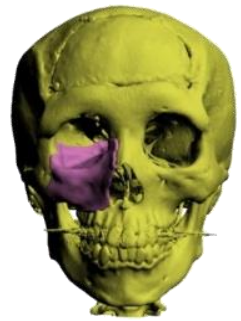
Company Intro

T&R Biofab Co. Ltd. Tissue engineering & Regenerative Medicine, **Bio-Fab**rication

2000 ~ UNIVERSITY

2013 T&R Biofab

2014



First clinical application

2018 KOSDAQ

2023 THE 10th YEAR

171 Patents

20M $ Grants

200 Papers

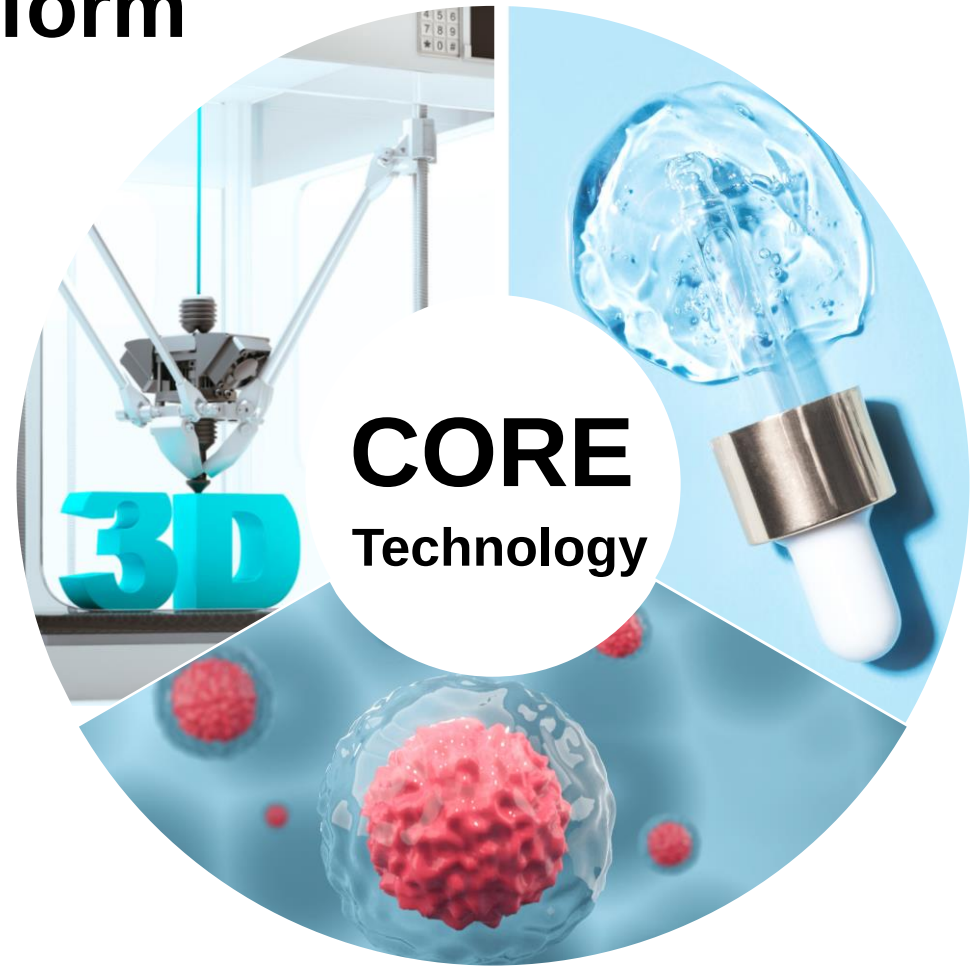
100 Employees

80,000 patients

T&R Biofab

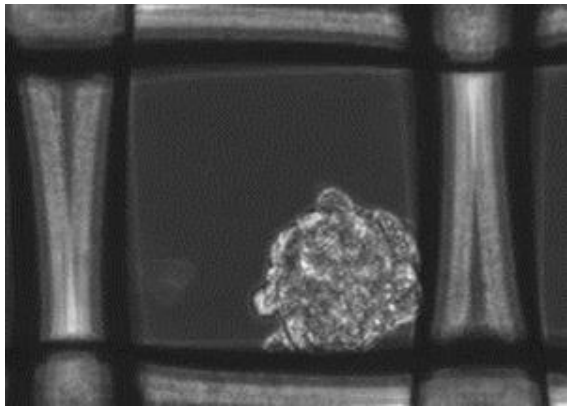
3D Bioprinting Platform

- Original technology
- 15+ years of 3D printing know-how
- Customized 3D bioprinting system
  - Hardware
  - Software



Biomaterials

- Bio-polymers
  - Absorbable
  - Non-absorbable
- Bioink
- Extracellular matrix (ECM



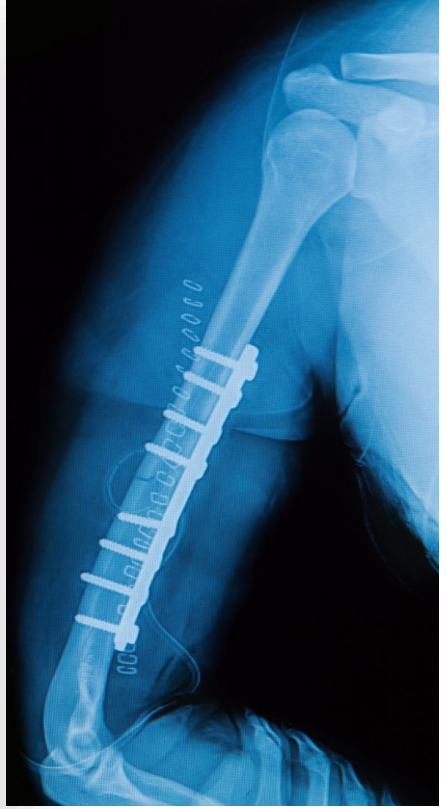
Stem Cells

- Induced pluripotent stem cells
- Autologous cells

BUSINESS DOMAINS for *Regenerative Medicine*

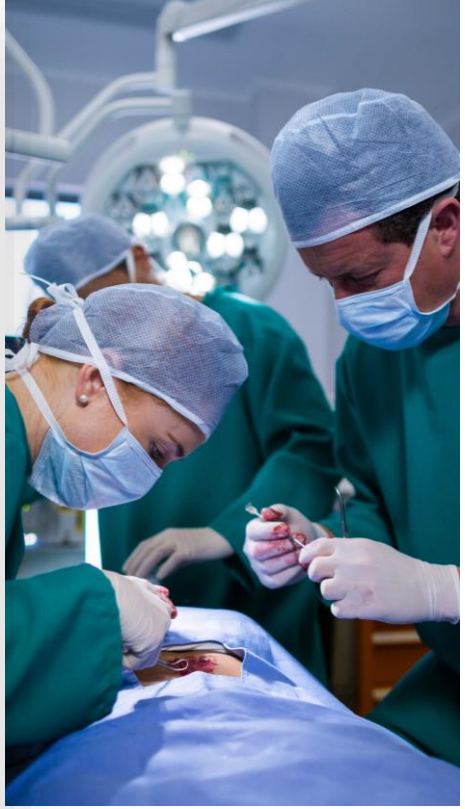
Lifecare Medical Devices

PU wound dressing
Hydrocolloid spot patch
HA solidified cosmetics



Printed Medical Devices

Bone Support Scaffolds
Patient-specific
Off-the-shelf

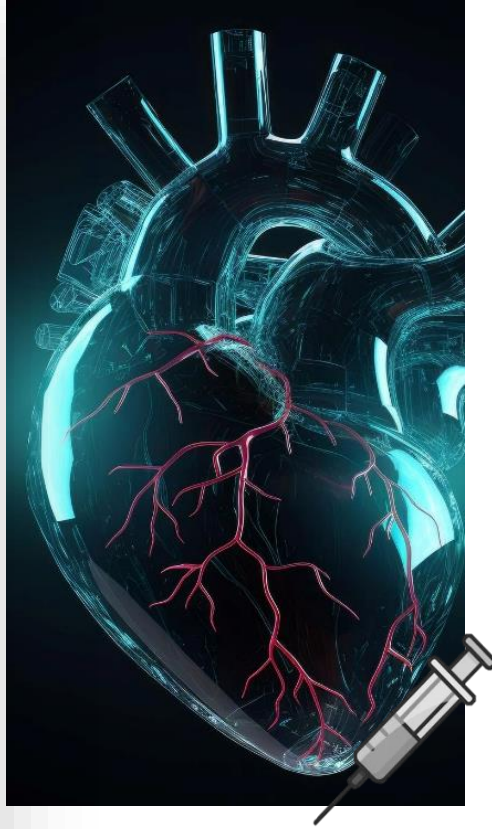


Biosurgical Solutions

Wound healing products
ADM, Hemostatic agents,
Adhesion barrier
Biomaterial-based products

Mini-tissues & Organoids

In-vitro skin modelling
Drug screening
Skin & Liver tissues



Transplantable organ & Cell Therapy

World first organ transplantation
Heart failure therapy

Part 01. Polymer Products

1. Lifecare products
2. 3D printed medical device

1. Lifecare products (Skincare)

T&R Biofab

Advanced skincare products

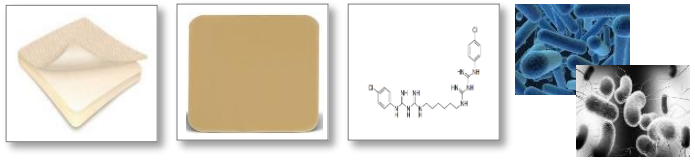
Korea's largest wound dressing production line

- KGMP CLEAN ROOM
- All-in-one process (Coating & Gas foaming & Processing)
- KGMP certified for medical device and cosmetics (March in 24)

- **Site area : 3,300 m^2**
- **Gross floor area : 5,940 m^2**
- **Revenue capacity : 200 USD**

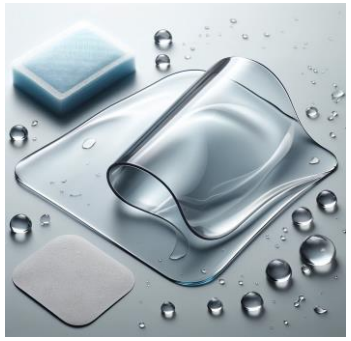
PU foam & Hydrocolloid for wound dressing (Medical device)

- Able to develop highly functional wound dressing products containing various active agents (antibiotics, local anesthetics, ets.)
- Anti-infectious type: FU + Drug (Chlorhexidine)



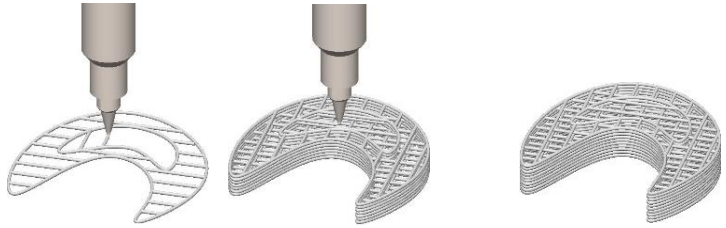
Solidified cosmetics with hyaluronic acid (HA)

- Able to develop film and dried ball typed cosmetics using proprietary HA and ECM technology
- Thin film form with 20~30㎛ thickness
- Freezing dried form
- Will be launched in QVC Home Shopping (3Q, 24)



2. 3D Printed medical devices (Bioabsorbable scaffold)

T&R Biofab



Printing FDA-approved biomaterials

Scaffold for tissue regeneration

Biocompatible materials (PCL, TCP, etc)

World's largest approved 3D printed medical devices provider

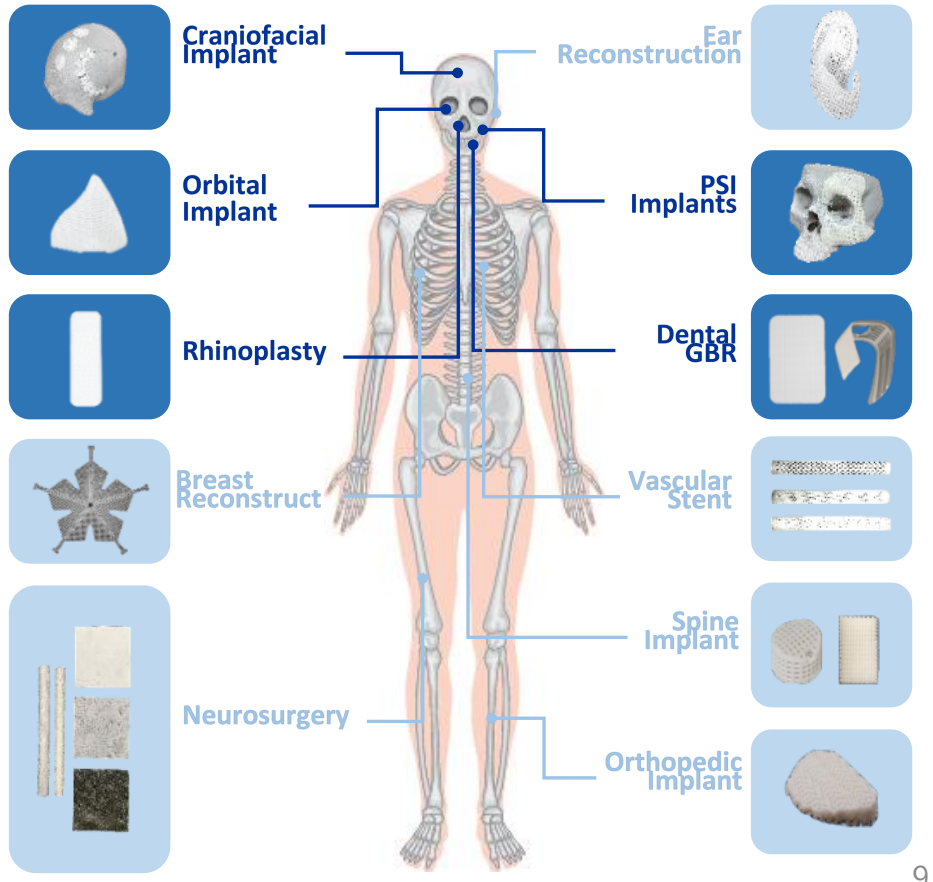
- **13 products** of class 4 medical devices (**over 13,000 specifications**)
- The largest clinical cases in the world (as of 2023 - **80,000+ cases**)
- Verified long-term follow up outcomes by **16 SCI clinical publications**

Infrastructure in development/licensing/production/medical verification

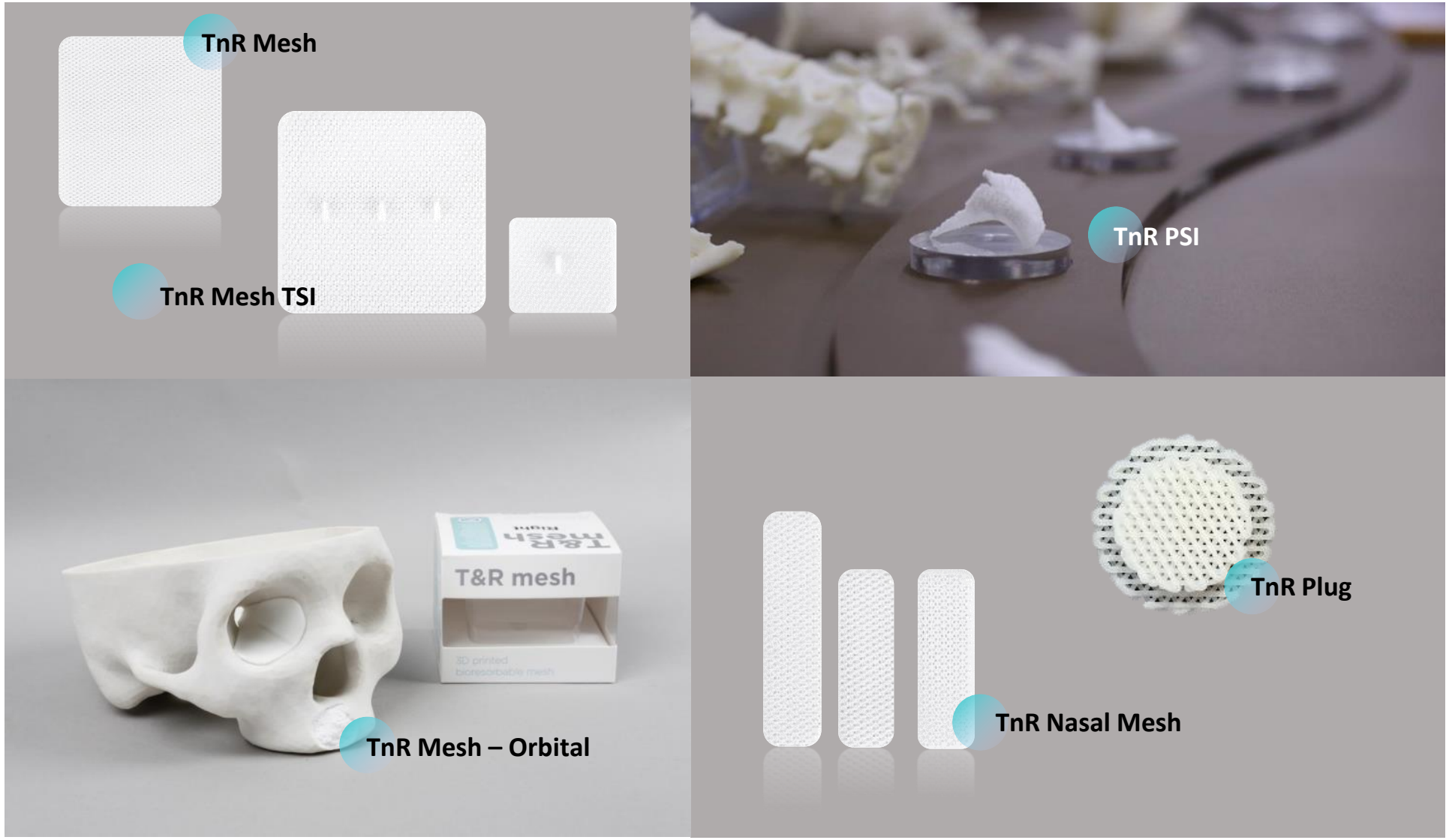
- In the phase of **expanding indications** and **market penetration**
- **US FDA Approval will be done in 2025 1Q**

Scaffolds for Tissue Regeneration

Applications

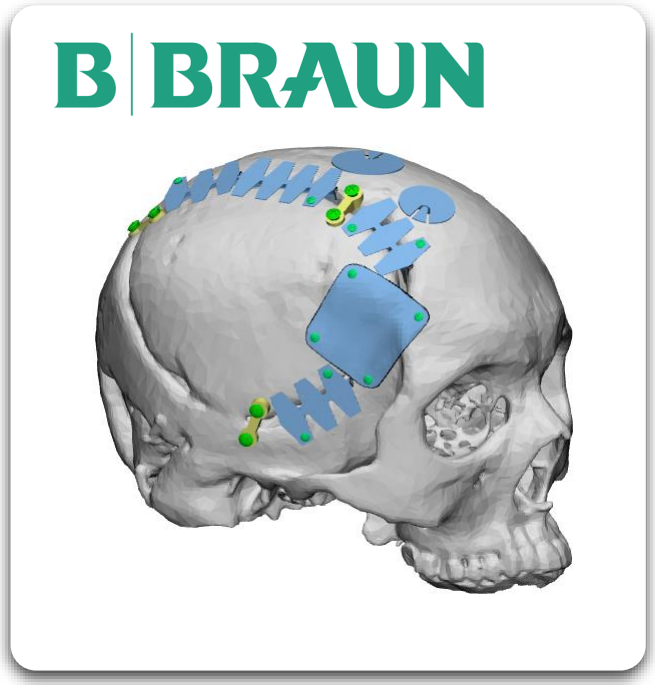


2. 3D Printed medical devices (Bioabsorbable scaffold)



2. 3D Printed medical devices – Global Partners

Partnering with global companies



CranioFacial Implants (CFI)

- Distributed by **B.Braun**
- Launched in April 2021.
- Used in over 100 hospitals (as of 24.03).
- **FDA approval submitted (expected 2Q, 2025)**

Patient Specific Implants (PSI)

- Contract with **Johnson and Johnson Medical Korea** in March 2023.
- Expanding in Asia - Oceania (2023 – 2024)

Joaquin Duato (CEO of J&J) Visit (2022)

Bbraun VP of AP Visit (2023)

Part 02. ECM Products

1. ECM Based Bio-surgical Solutions

1. ECM based Bio-surgical solution

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"Applications of unique natural bio-material(ECM, ADM) technologies "

Development of products through platform technologies in ADM, ECM-based medical devices and therapy
Patent in mass production of natural bio-materials (ADM, ECM).

ADM (Acellular Dermal Matrix)

- Source from Xenograft
- Non-cross linking,
- E-beam sterilization
- Controllable degradation up to 6M
- Implantable scaffold for tissue regeneration

ECM (Extracellular Matrix)

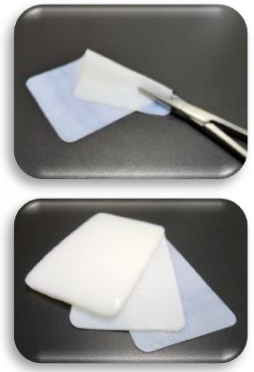
- Source from porcine tissues like skin, cartilage etc
- Contains tissue regeneration substances
- Proprietary technology secured by IP
- VdECM(elastic), LdECM(laminine) enhances tissue regeneration

1. ECM based Bio-surgical solutions - ADM

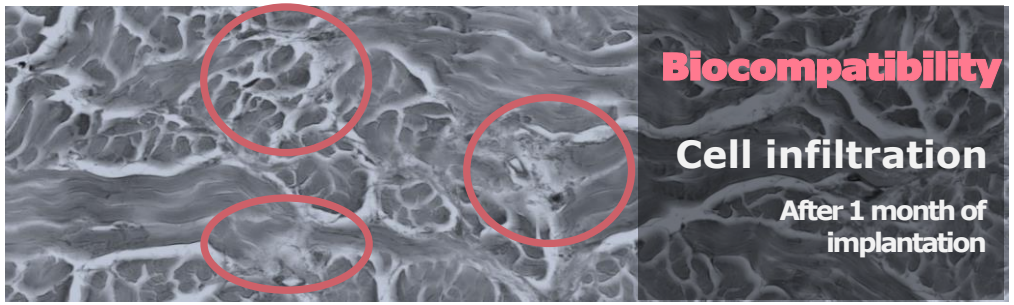
T&R Biofab

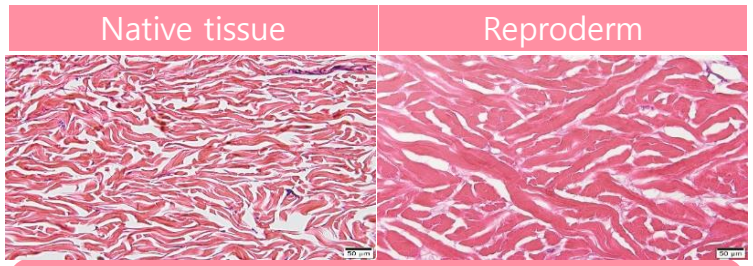
1. ADM (Acellular Dermal Matrix)

"IP secured technology for biomaterial processing (Opti-SdECM)"



- Similar property to **human ADM** by the IP secured processing technology.
- **Able to control degradation period 5 times longer up to 6 M** (Non-chemical crosslinking)
- Specific property depending on target indication
- Hydrolyzed state with antibiotic included solution
- **MFDS approved in April 23**. Distributed by multiple distributors depending on each indication



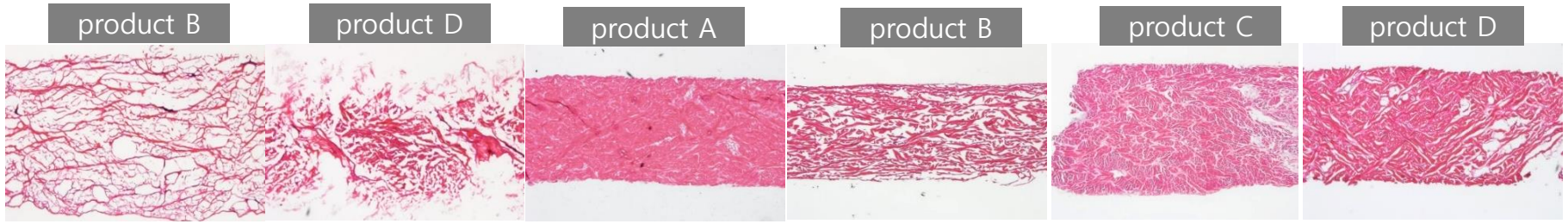


Almost identical structure with human dermis

Global	Domestic
Xeno $3.4 B Human $4.4 B	$120 M (CAGR 20%)

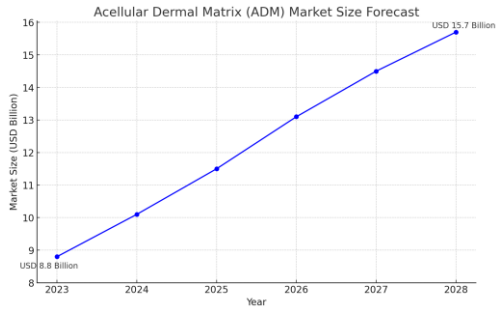
- 2024 Estimates -

Dissimilar structure



Allograft | Xenograft

Relatively loose structure | **Relatively denser structure**



**Global market source: Coherent MARKET INSHIGHTS, Primary and Secondary Analysis *Domestic market source: market research report*

1. ECM based Bio-surgical solutions – Wound healing gel

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2. Wound Healing Ointment

- Wound-dressing ointment containing proprietary ECM (VdECM)
- Perform dual functions of **'Enhancing wound-healing & Scar tissue reduction'**
- **22. 03** Approved by MFDS(non-antibiotics). **22. 07** Launch. **22. 09** FDA Class I listing
- **Distributorship agreement** with **'Gems Korea' (general hospital)** and **'NeoPharm' (private clinics)**

"Non-antibiotic formulation, targeting antibiotic-containing type to be released in the second half of 2024"

Global	Domestic
$11 B (CAGR 5.2%)	**$120 M** (CAGR 6%)

- 2020 Market Size -

"Contain VdECM, component specializing in Tissue Regeneration"

"Wound healing + Scar tissue reduction"

- **VdECM (patent pending)**
  - VdECM is obtained by eliminating cellular components of specific porcine tissue (cell, DNA, virus, etc) that can trigger immune response to extract and generate ECM components consisting of 40% collagen and **60% elastin.**

**Global market source: Medical equipment market size & growth-wound care management market, global 2013~2020*

**Domestic market source: Production, Export, Import report on Medical Devices (2009~2013, Ministry of Food and Drug Safety)*

1. ECM based Bio-surgical solutions – Hemostatics

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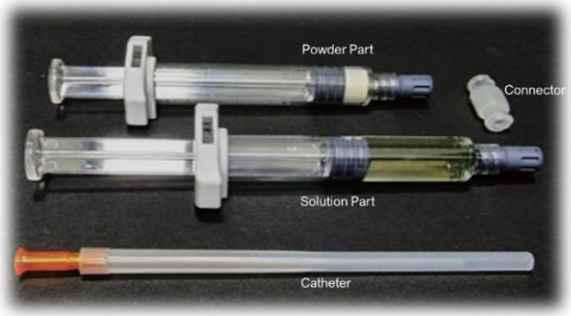
3. Hemostatic – Matrix & Powder Type

"Absorbable biomaterial products used for hemostasis in bloody site to stop it during surgical operations."

1. Matrix Type

1. **Protective layer** – non-porous structure acts as a barrier to seal out contamination and prevent blood from leaking and to prevent tissue adhesion during healing.
2. **Absorbent layer** – proprietary formulation that absorbs blood and wound exudate and enacts the blood clotting process. Contains thrombin, VdECM, and in-house low-endotoxin gelatin.

2. Powder type



Product Features

1. VdECM facilitates rapid tissue healing
2. Essential raw materials like gelatin and vdECM are prepared by proprietary processing technology
3. Excellent hemostatic performance compared to existing hemostatic agents in the market

"Scheduled to be released in the first half of 2025"

FORTUNE BUSINESS INSIGHTS

Hemostatic Agents Market to reach US$ 5,441.5 Mn by 2025, at a CAGR of 6.4% | Exclusive Report by Fortune Business Insights

Key companies covered in the Hemostatic Agents Market report include Baxter, Stryker, CryoLife Inc., Integra Life Sciences, BD, Ethicon LLC., Pfizer Inc., Medtronic, Biom'up, and others

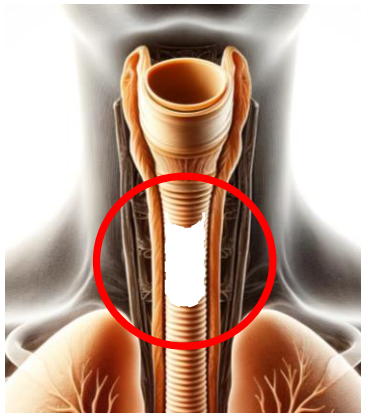
Part 04. Transplantable organ & Cell Therapy

1. World first transplantation of 3D organ
2. iPSC Technology & Cell Therapy

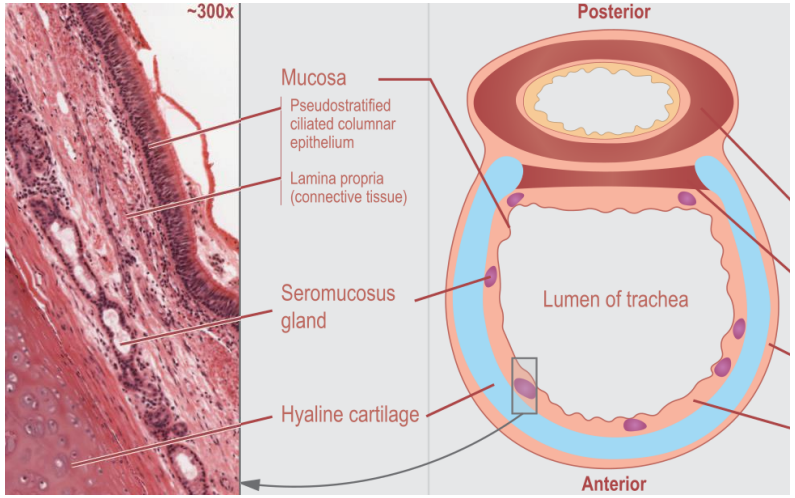
1. World First Transplantable 3D Organ -Trachea

T&R Biofab

The World First 3D Bioprinted Trachea Organ Transplantation in Human (2023. Aug)



3D Bioprinted trachea tissue for reconstruction of tracheotomy



Nature of trachea

Clinical application in 2023

BBC Science Focus

Woman given a new 3D-printed windpipe in a world-first

A cutting-edge procedure in Korea has used other peoples' stem cells to design a tailor-made artificial windpipe.

Photo credit: T&R Biofab

2. iPSC derived Cell Therapy – Heart failure

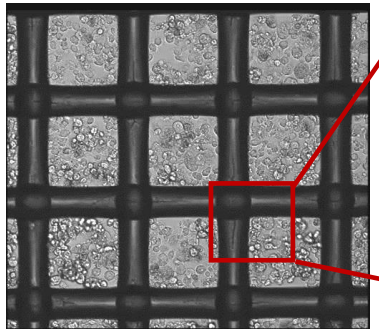
T&R Biofab

"Development of clinically applicable FROZEN cardiomyocyte aggregates"

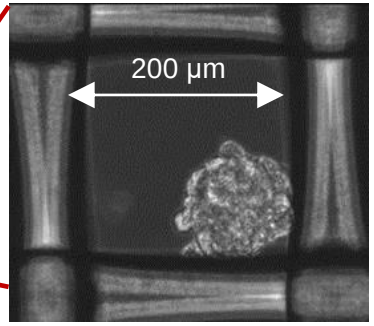
Completed patent registration in Korea/Japan. PCT application (on-going patent examination in USA, Europe, China)

➢ **Cell aggregation technology appliable to clinically approved catheters**

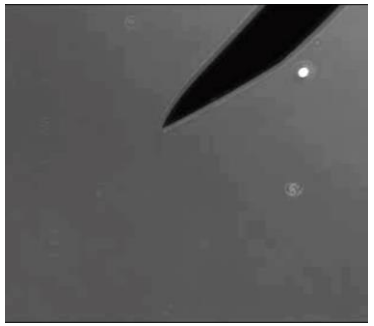
1 aggregate ≒ 41±3 cells



Heart buds ≒ 105±5 μm

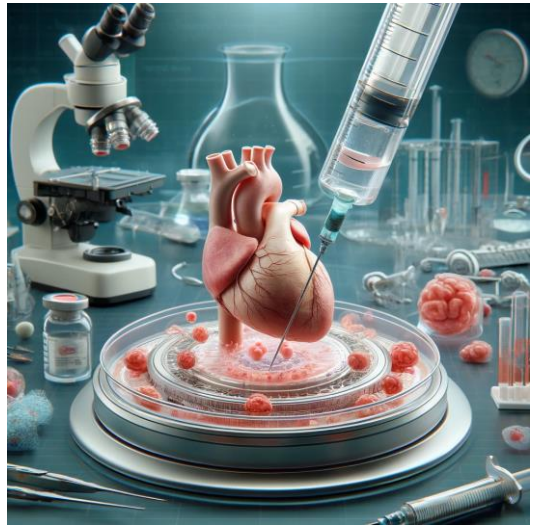


Catheter applicability test

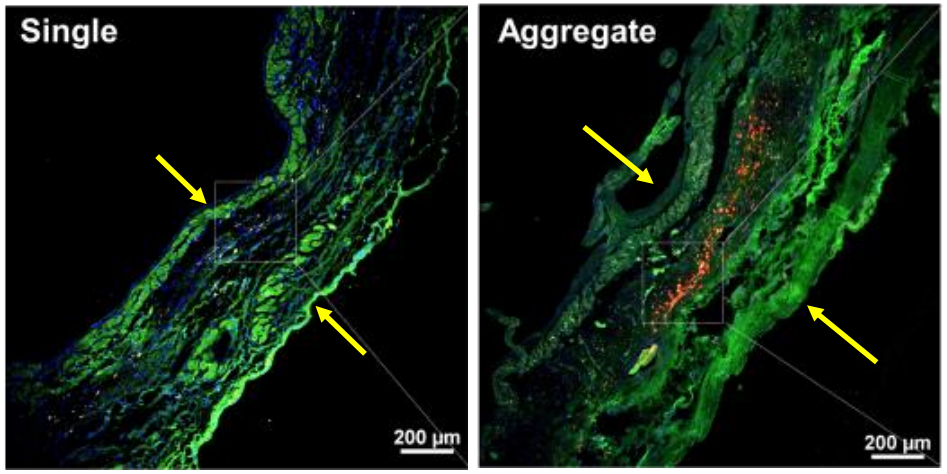


Cardiomyocyte aggregates [~100 μm]

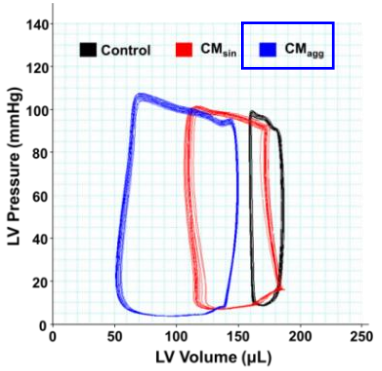
1. **Improved survival rate** in hypoxic environment immediately after transplantation
2. **Long-term cryopreservation** (off the shelf therapy)
3. Appliable to clinical catheters (**FDA friendly**)



➢ **Pre-clinical trials – Confirmed regenerative effects of damaged cardiac tissue after transplantation**



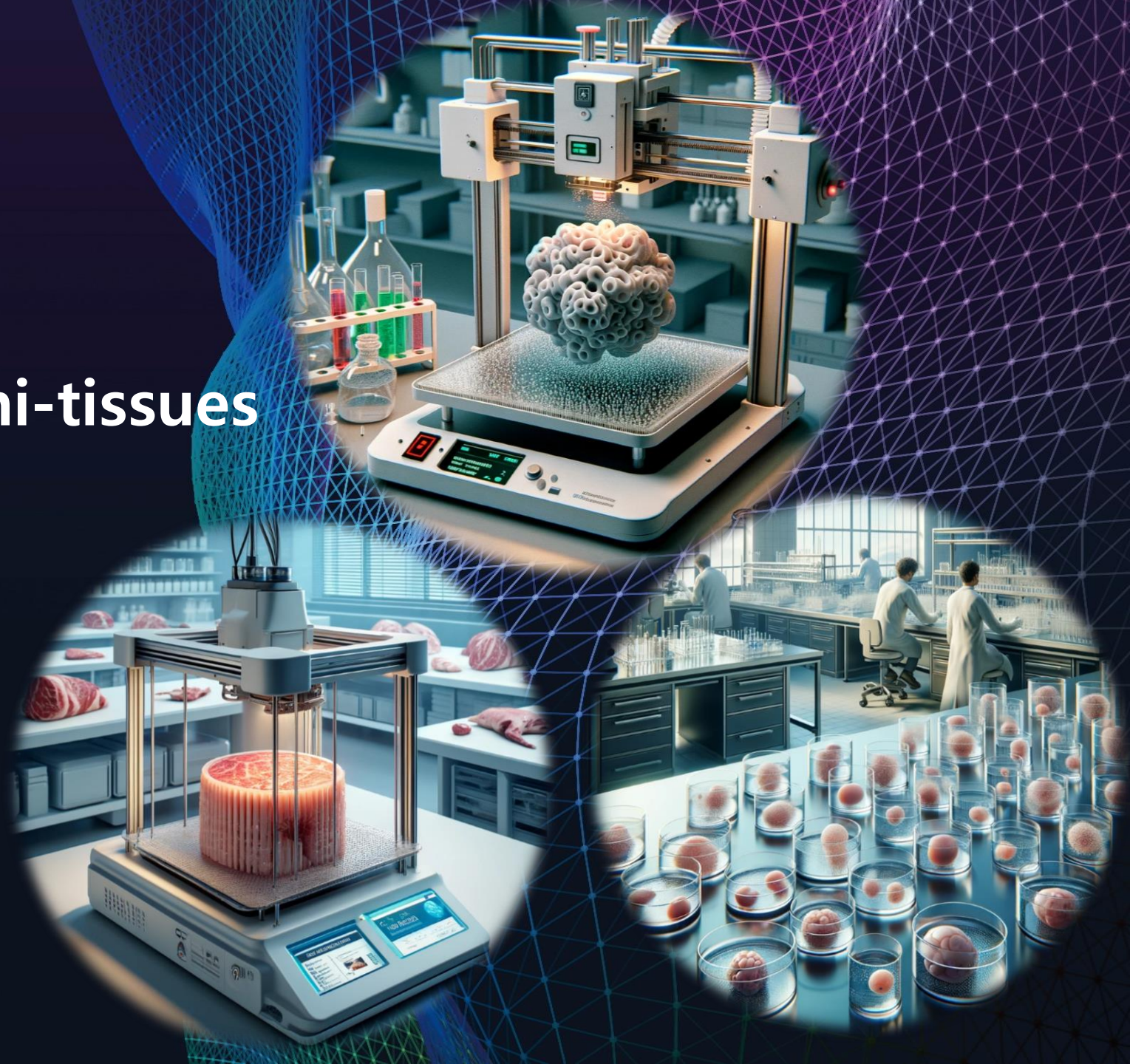
"Improved cardiac function"
(increased blood flow rate)



[SCI] Effect and application of **"cryopreserved cardiac spheroids"** for myocardial infarction therapy. 2022; ***Clinical Translational Medicine*** *(IF 11.492).*

Part 03. Organoids/Mini-tissues

1. Artificial Skin
2. Artificial Liver
3. Artificial Meat



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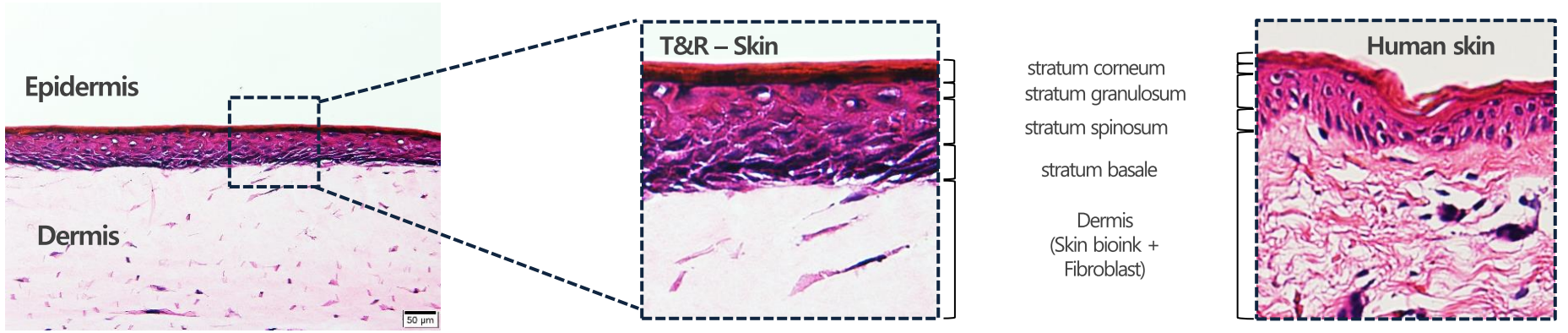
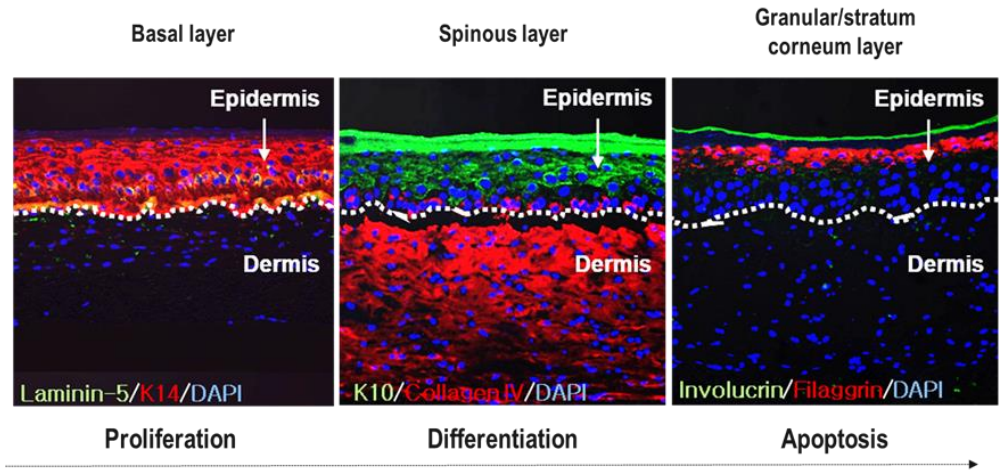
"Full thickness skin model based on 3D hybrid bioprinting technology"

Development of human skin and skin disease models by combining cells, ECM, and various printing technologies





- 3D printed full-thickness skin model
- In-vivo like skin consisting of both epidermis and dermis
- Cultivation after printing dermal fibroblasts and epidermal keratinocytes

· Expression of early and late differentiation markers (day 11)
· Very similar to native full-thickness skin

01 | 3D Bio-printed Mini Tissues - Skin

T&R Biofab

"Advance in development through extensive collaboration"

Validation of novel materials – Model applications – Advanced new model development

SdECM for skin model

- Self-developed SdECM used to create skin model
- Superior performance verses natural collagen
- **Published in Acta Biomaterialia 2022 (with L'Oreal)**

Applications of skin model

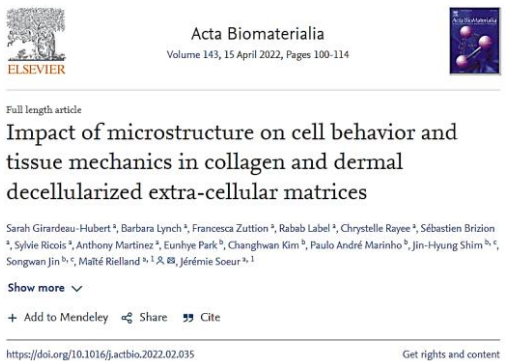
- New material evaluation using T&R skin model with HK inno.N, C company

Advanced skin model

- Development of a functional skin model with COSMAX

BASF
We create chemistry

L'ORÉAL


Acta Biomaterialia
Volume 143, 15 April 2022, Pages 100-114

Full length article

Impact of microstructure on cell behavior and tissue mechanics in collagen and dermal decellularized extra-cellular matrices

Sarah Girardeau-Hubert [a], Barbara Lynch [a], Francesca Zuttion [a], Rabab Label [a], Chrystelle Rayee [a], Sébastien Brizion [a], Sylvie Ricois [a], Anthony Martinez [a], Eunhye Park [b], Changhwan Kim [b], Paulo André Marinho [b], Jin-Hyung Shim [b, c], Songwan Jin [b, c], Maïté Rielland [a, 1], Jérémie Soeur [a, 1]

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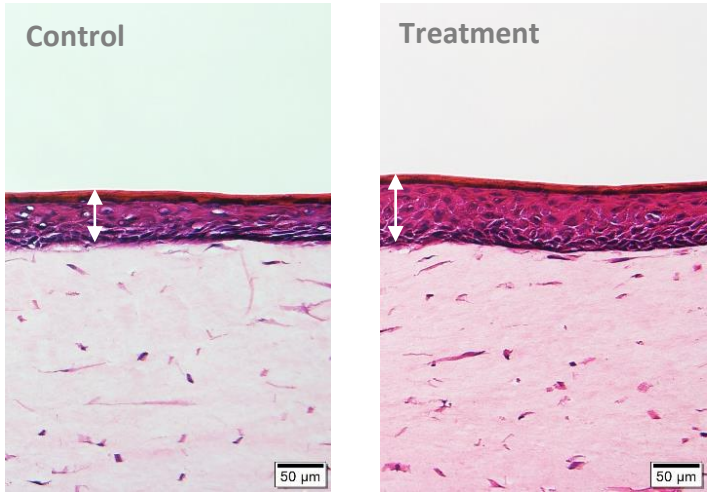
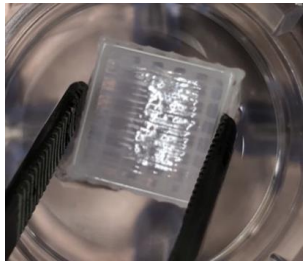




ADM
ECM
iPSC

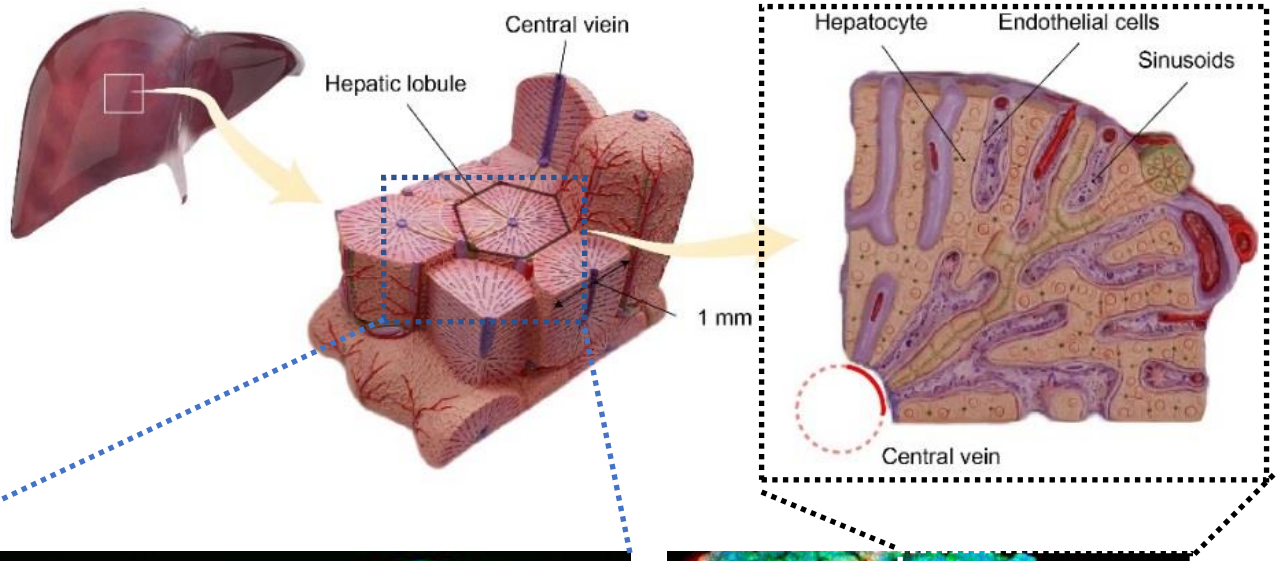
"Therapeutic bio-artificial skin"

02 | 3D Bio-printed Mini Tissues - Liver

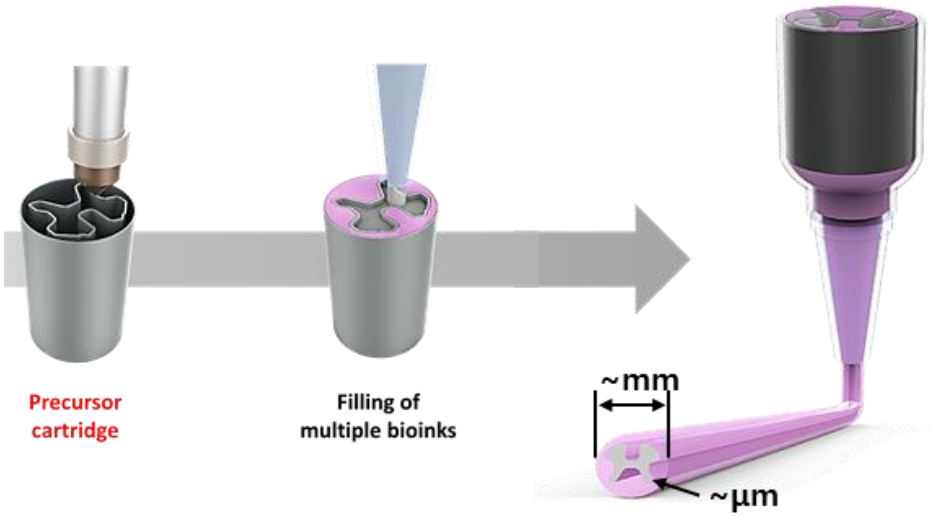
T&R Biofab

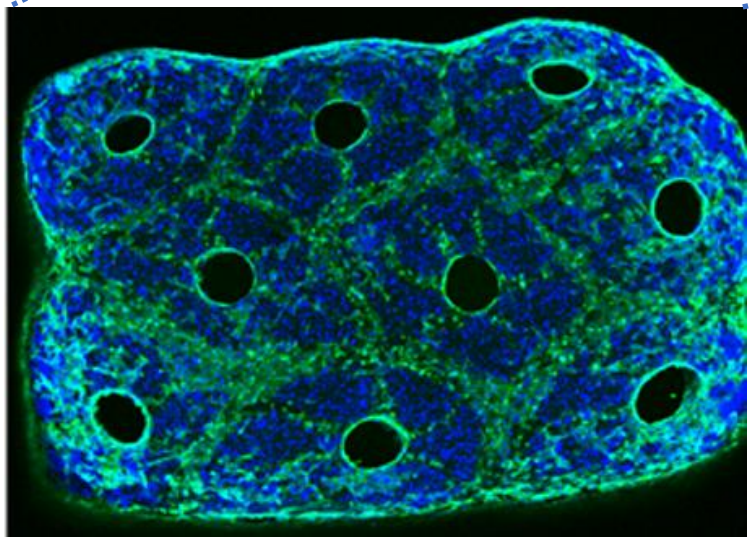
3D Printed mini-liver tissue (hepatic lobule)

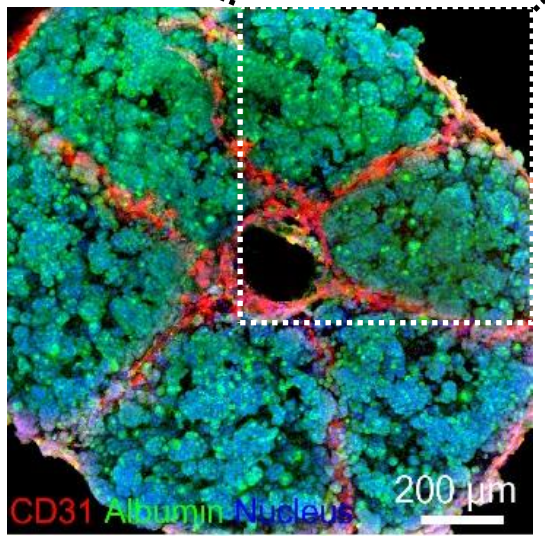
- Unprecedented precision of bio-printing of the globally patented **'Pre-set extrusion'** method
- Simultaneous printing of multiple materials or cells
- Printing resolution in the order of tens of micrometers
- **Published in Biofabrication (IF 10.2), Small (IF 13.2), Advanced Materials (IF 30.8)**



World-wide patented 'Pre-set extrusion' method





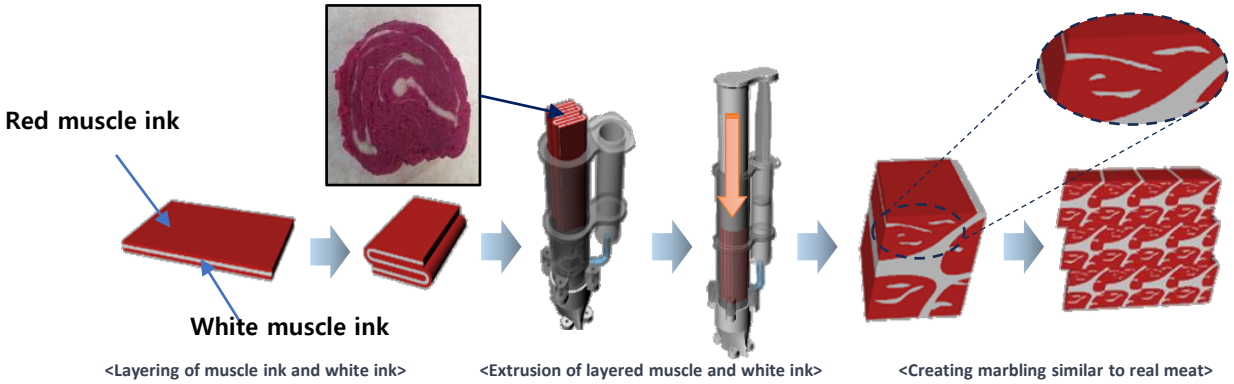


03 3D Bio-printed Artificial Meat

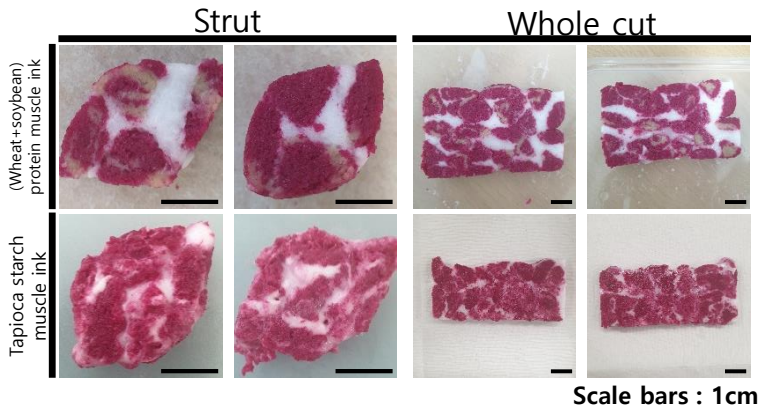
T&R Biofab

3D Printed Artificial Meat Project with CJ Food

- Development of artificial meat using edible ingredients



<Layering of muscle ink and white ink> <Extrusion of layered muscle and white ink> <Creating marbling similar to real meat>



Scale bars : 1cm

<Marbling in real meat (Wagyu)>

PR Newswire

CJ Foods Partners with T&R Biofab to Shape the Future of Food

CJ FOODS

NEWS PROVIDED BY
CJ CheilJedang →
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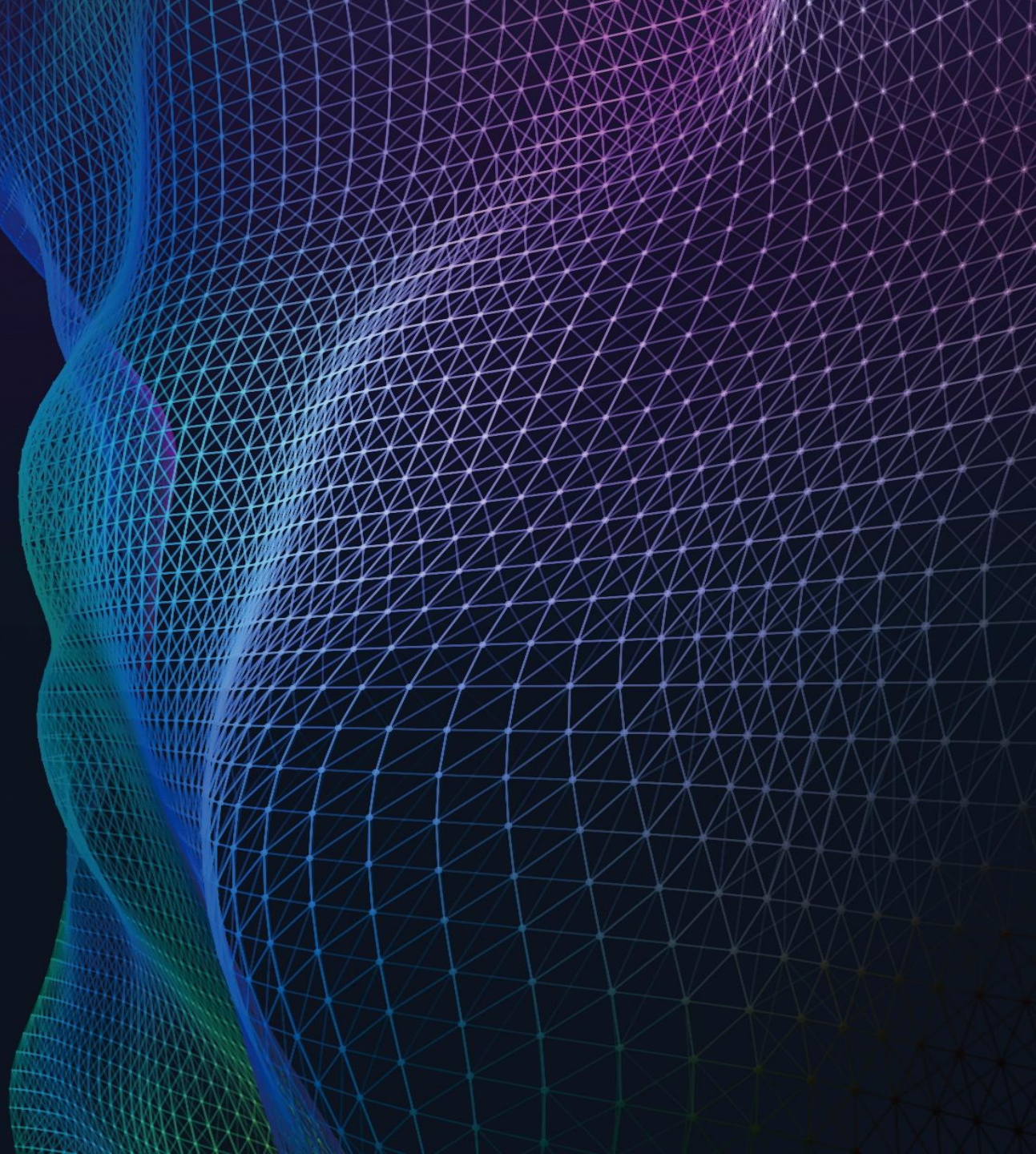
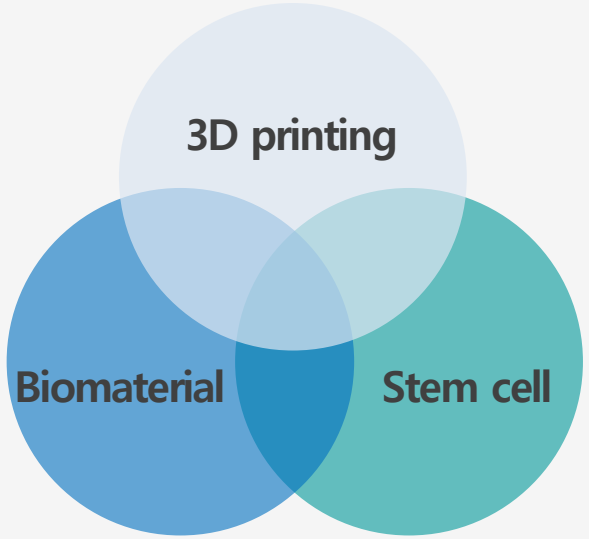


"Key Competitiveness of T&R Biofab"

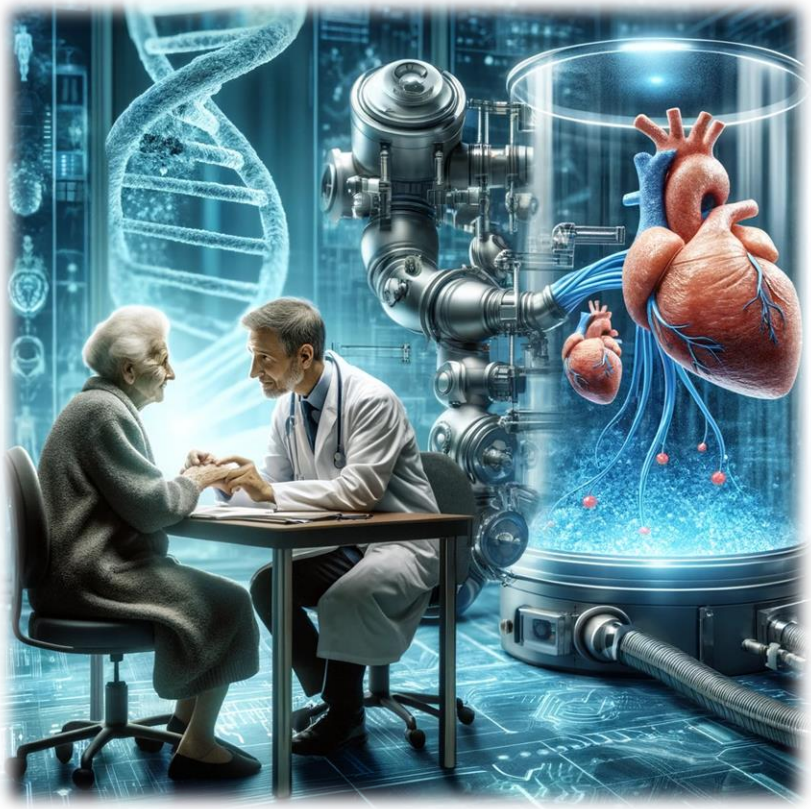
T&R Biofab

"Innovative company to be a leader in regenerative medicine"

"Integrative core technology"



- Translational experience from Technology to Product
- Mass producible manufacturing facility for RM field
- Achievement of world's first clinical application
- Reliable clinical data



"Era where human tissues and organs can be artificially produced has come!!"
Don't miss the opportunity to be on board"

㈜티앤알바이오팹

T&R Biofab

www.tnrbiofab.com ir@tnrbiofab.com

- Headquarter #542 Smart-Hub Industry-University Convergence Center, 237, Sangidaehak-ro, Siheung-si, Gyenoggi-do
- R&D Center 8F PDC Building C, 242, Pangyo-ro, Bundang-gu, Seongnam-si, Gyeonggi-do
- Seoul Branch 16F SYH Tower, 107, Dosan-daero, Gangnam-gu, Seoul