CLECELL Bioink
Celluid

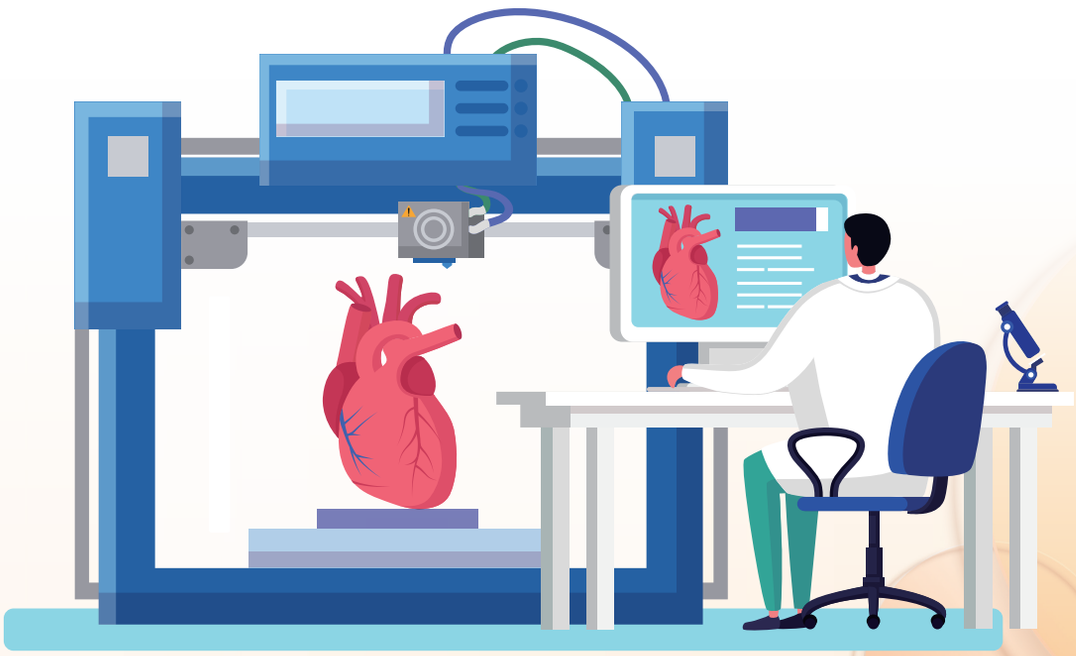
CLECELL

WHAT IS 3D BIOPRITING?

3D bioprinting is a technology that utilizes biocompatible materials to print biomimetic organisms and structures. It applies 3D printing technology to the field of biomedicine, combining disciplines such as life sciences, mechanical engineering, and biomedical engineering. This technology uses computer software to design digital models, and by depositing biocompatible materials layer by layer, it creates three-dimensional structures, including biomimetic organisms and structures.

CLECELL's U-FAB 3D bioprinters feature a high-performance printing technology that can operate in a wide range of viscosities. This technology enables printing from low-viscosity to high-viscosity materials, and utilizes various printing methods and unique cross-linking methods exclusive to U-FAB, allowing the fabrication of biomimetic structures, including organoids.

Likewise, this groundbreaking 3D bioprinting technology has opened up innovative applications in diverse fields such as tissue engineering, regenerative medicine, and drug testing. Extensive research is currently underway in these areas, harnessing the full potential of this technology.



WHAT IS BIOINK?

Bioink is a biomaterial based on biocompatible polymers that is known for its suitability as a biomaterial when used in conjunction with cells. It is primarily used for printing alongside cells, as it provides a compatible environment for their growth and function.

Bioink can be made from a variety of biomaterials and is used for bioprinting. It has the ability to interact with cells, promoting cell culture, differentiation, and tissue formation. By combining the safety and functionality of biomaterials, bioink plays a crucial role in the development of innovative tissue engineering and biomedical technologies.

This enables the development of artificial organs using biofabrication techniques and enhances treatment methods by creating disease models with bioink-based constructs. Such progress in the field of medicine opens doors to significant advancements and breakthroughs.

CLECELL has developed a biocompatible sponge-type bioink alongside its advanced 3D bioprinting technology, enhancing convenience for researchers and enabling easy storage of bioinks. CLECELL's bioink contributes to innovative advancements in the field of life sciences through various research possibilities.

We are CLECELL

Technology

CLECELL successfully commercialized the foundational technology of 3D bioprinting, which had been researched for over 10 years at Harvard University in the United States. The company aims to create bio-mimetic and structural constructs, essential for the fields of regenerative medicine and precision medicine, and develop clinical simulation platforms. CLECELL continuously leverages its technical expertise to actively pursue product development and expand its product portfolio.

Collaboration

CLECELL provides customized solutions for researchers, prioritizing the convenience and efficiency of research, by engaging with over 100 life science and tissue engineering researchers domestically and internationally. The company actively seeks and incorporates their opinions to meet the specific needs of researchers.

Achievement

CLECELL has achieved numerous research accomplishments with its validated products in terms of quality, precision, and efficiency, supported by a multitude of domestic and international patents and research publications.

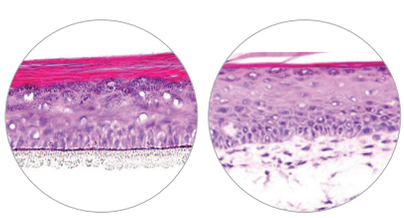
Development & Keep Evolving

CLECELL is dedicated to improving the quality of life and advancing disease treatment through innovative biotechnology, all with a focus on continuous research and innovation for a sustainable future.

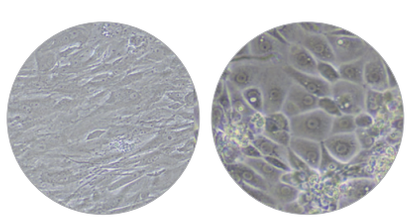
CLECELL's Products

3D Bioprinter U-FAB & NOVO/CLIBOT

Bioink Celluid



Artificial Skin CleKIN



Skin Cell CleDC

U-FAB ACTIVO

The Most Versatile and Scalable 3D Bioprinting Solution for Tissue Engineering and Beyond

U-FAB ACTIVO, from the vast research experience of tissue engineers and CLECELL's cutting-edge 3D printing technology, provides a fundamental solution for research and development in tissue engineering.

- 3D stacking of low-viscosity biomaterials
- Independent 3D modeling for each layer
- Ability to use composite materials
- Nebulizing System – provide pH, enzyme, chemical (ion) crosslinking methods
- UV-LED shutter for efficient 3D printing photocuring
- Solution for cell printing and cell homogenization process
- Automatic nozzle-end alignment system & build-plate levelings

"CLECELL's U-FAB 3D Bioprinters have been meticulously designed to maximize product differentiation and provide customizable solutions to cater to the specific needs of researchers."

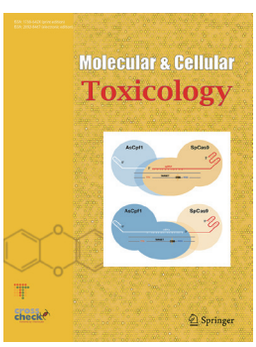
3D Bioprinting for the Development of Innovative Medical Solutions

서울대학교 치의학대학원
SEOUL NATIONAL UNIVERSITY SCHOOL OF DENTISTRY

At Seoul National University's Dental Research Institute, a customized U-FAB ACTIVO is utilized for the culture of hard tissues (bone, cartilage) and soft tissues (periodontal membrane) by precisely placing cells, with a low viscosity, at desired locations to construct three-dimensional structures. (Three low-viscosity droplet nozzles + temperature control feature of the build plate)

The use of low-viscosity ink enables more accurate 3D printing, allowing for the creation of biomimetics with precise oral structures, such as teeth. We anticipate that this will establish conducive conditions for facilitating research outcomes. Additionally, the system is effective in constructing evaluation models for assessing tissue and cell interactions through the development of artificial tissues.

– Professor Yang Hyeong-Cheol, Department of Dentistry, Seoul National University –



Building an Artificial Skin Model Based on Primary Cells Using 3D Bioprinting

At Konkuk University's Stem Cell Center, CLECELL's U-FAB MASTER is utilized to produce artificial skin using biocompatible materials, enabling research in the field of regenerative medicine through toxicity and safety testing.

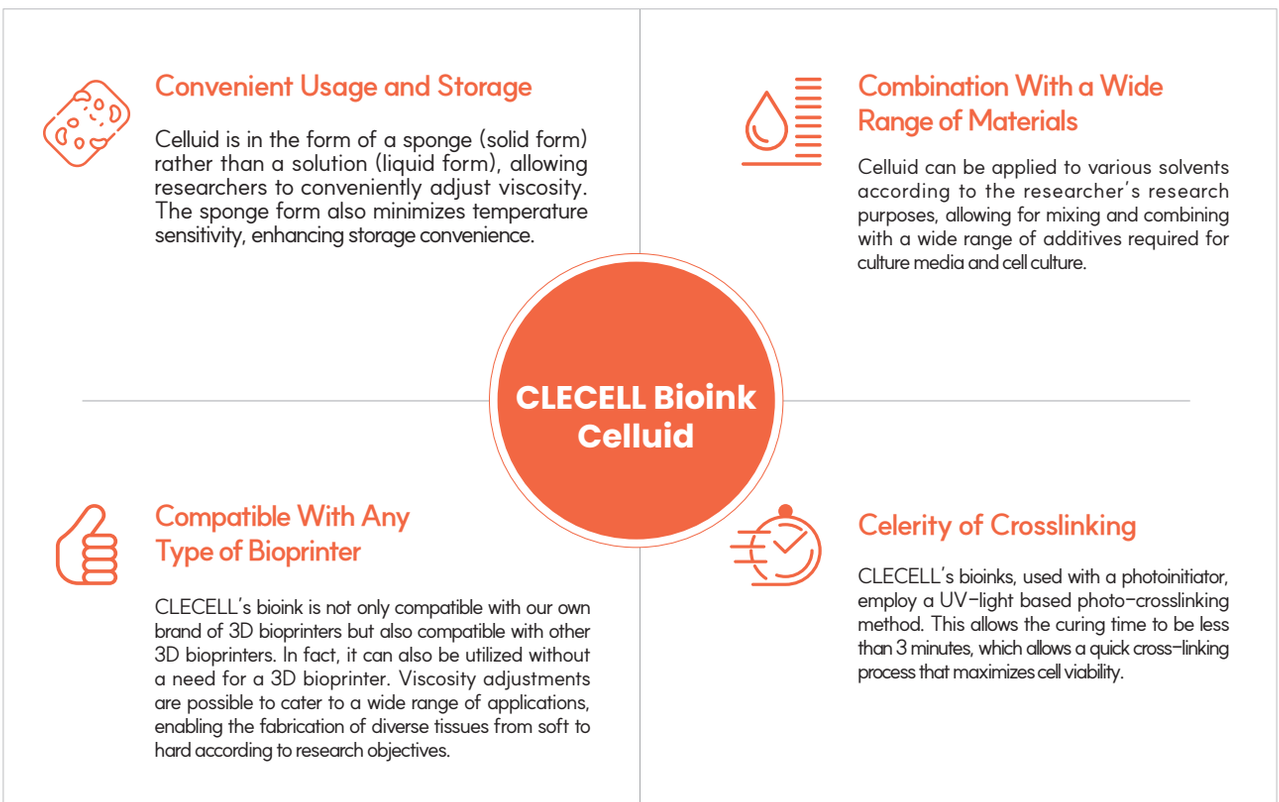
Compared to manual methods of artificial skin fabrication, the use of 3D bioprinting greatly enhances reproducibility, optimizing standardization of evaluation methods using artificial skin. Additionally, its scalability for application to various cell types makes it highly promising for research in the field of biology.
– Professor Kim C-Yoon, College of Veterinary Medicine, Konkuk University –

Lee, Seul-Gi, et al. "Evaluation of the therapeutic efficacy of human skin equivalents manufactured through droplet-based bioprinting/nebulization technology."
Molecular & Cellular Toxicology, 2023, https://doi.org/10.1007/s13273-023-00330-9

건국대학교

CLECELL's Bioink, Celluid

Advantages of Celluid Bioink



Convenient Usage and Storage

Celluid is in the form of a sponge (solid form) rather than a solution (liquid form), allowing researchers to conveniently adjust viscosity. The sponge form also minimizes temperature sensitivity, enhancing storage convenience.

Combination With a Wide Range of Materials

Celluid can be applied to various solvents according to the researcher's research purposes, allowing for mixing and combining with a wide range of additives required for culture media and cell culture.

Compatible With Any Type of Bioprinter

CLECELL's bioink is not only compatible with our own brand of 3D bioprinters but also compatible with other 3D bioprinters. In fact, it can also be utilized without a need for a 3D bioprinter. Viscosity adjustments are possible to cater to a wide range of applications, enabling the fabrication of diverse tissues from soft to hard according to research objectives.

Celerity of Crosslinking

CLECELL's bioinks, used with a photoinitiator, employ a UV-light based photo-crosslinking method. This allows the curing time to be less than 3 minutes, which allows a quick cross-linking process that maximizes cell viability.

Celluid Bioink

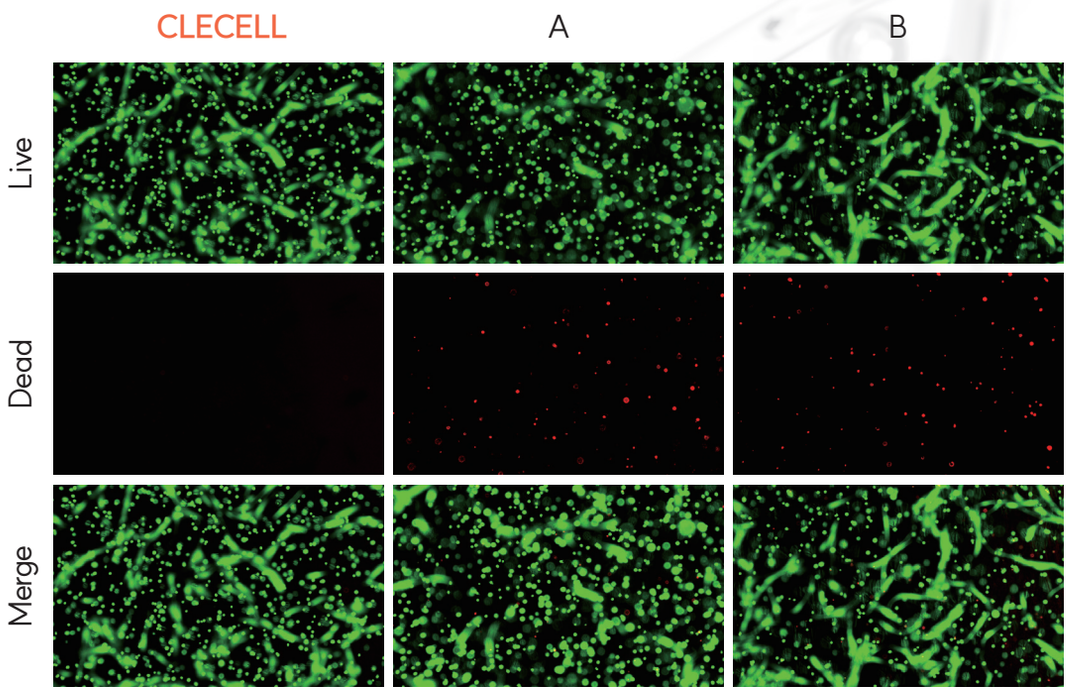
Celluid bioink ensures high quality biocompatibility and safety. This is essential for applications in tissue engineering, guaranteeing stable cell growth and biocompatibility with biological materials.

	Celluid GM (Porcine)	A (Porcine)	B (Porcine)
Self imbedded Drug Delivery	Attainable	Attainable	Attainable
Encapsulated Cell before printing	Attainable	Attainable	Attainable
Cell viability	≥95%	≥90%	≥90%
Curing Time	3 min	3 min	3 min
pH	6.0~7.0	7.2	7.2
Viscosity	15 ~ 50 Pa·s	N/A	N/A

CLECELL's Bioink, Celluid

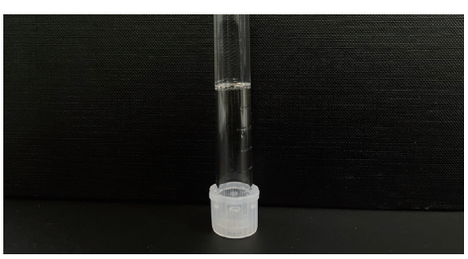
Cell Viability

Cell viability assays are used to evaluate the survival rate of cells. Typically, fluorescent dyes are used to distinguish between living and dead cells. Green indicates living cells, while red indicates dead cells. Celluid GM shows minimal presence of dead cells and demonstrates a cell survival rate of over 95%.

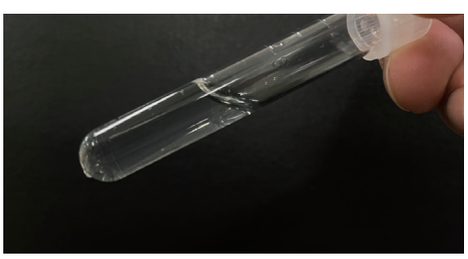


Variations in Form with Temperature and Post-UV Crosslinking (Celluid GM)

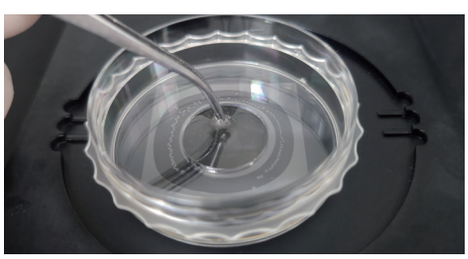
GelMA maintains a solid jelly-like form at 15~20°C but transitions into a flowable form similar to detergent at 37°C. After UV crosslinking, Celluid GM maintains a solid jelly-like form at any temperature.



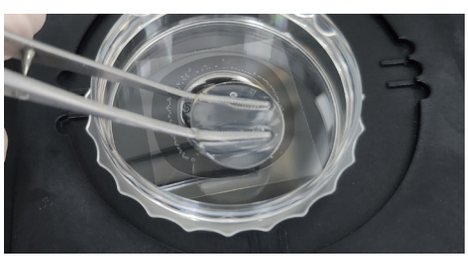
15~20°C



37°C



Before UV Crosslinking



After UV Crosslinking

Celluid Bioink Product and Kit Overview

Celluid GM

Celluid GM is a bioink made by synthesizing Gelatin, a natural polymer, with Methacrylate and it is in the form of a freeze-dried sponge.

1. **Adjustable Concentration**
   The concentration of Celluid GM can be lowered to promote improved cell mobility, or conversely, increased to enhance structure formation. Users can adjust Celluid GM concentration to their desired purpose.

2. **3D Structure Formation**
   Celluid GM is a bioink that uses photoinitiator to form 3D structures through UV exposure by photo-crosslinking.

3. **Various Application Fields**
   Research on the production of various micro artificial tissues such as bone, cartilage, skin, and blood vessels is being conducted using Celluid GM. This product has various possibilities for application in research and medical fields.

CLECELL offers two types of Celluid GM, allowing users to select the product based on viscosity preferences that best suit the intended application, whether it would be biomaterials or tissues.

GM225

- 225g bloom based Gelatin (Bovine)
- Optimal for achieving outcomes with low elasticity

GM300

- 300g bloom based Gelatin (Porcine)
- Optimal for achieving outcomes with high elasticity

Product Description

Synonyms	Gelatin methacrylate
Form	Lyophilized Sponge
Gelatin Source	Type B, 225 Bloom, Bovine 300 Bloom, Porcine
pH	7.5~
Degree of methacrylation	95%
Storage Temperature	Solid −20°C Liquid 4°C (Photoinitiator 4°C)

Product Kit 1 – GM only

Item	Volume
Celluid GM 225	1g

Item	Volume
Celluid GM 300	1g

Product Kit 2 – GM + IRG

Item	Volume
Celluid GM 225	1g
Photoinitiator – IRGACURE 2959	10ml

Item	Volume
Celluid GM 300	1g
Photoinitiator – IRGACURE 2959	10ml

Product Kit 3 – GM + LAP

Item	Volume
Celluid GM 225	1g
Photoinitiator – LAP	10ml

Item	Volume
Celluid GM 300	1g
Photoinitiator – LAP	10ml

Celluid AM

Celluid AM is a bioink made by synthesizing Alginate, a natural polymer, with Methacrylate and it utilizes a photoinitiator.

1. **ALMA and Photoinitiator**
   Celluid AM is an ALMA (Alginate Methacrylate) bioink paired with a separate photoinitiator. It can create three-dimensional structures upon UV exposure through photopolymerization.
2. **Adjustable Concentration**
   Celluid AM is in the form of freeze-dried sponges and includes separately packaged photoinitiators, allowing users to adjust the concentration according to their convenience.
3. **Diverse Research on Artificial Tissue Production**
   Various research is being conducted using Celluid AM for the production of artificial tissues such as bone, cartilage, skin, blood vessels, and nerves. Additionally, when mixed with GelMA, it can enhance cell adhesion and cell attachment.

Product Description

Synonyms	Alginate methacrylate
Form	Lyophilized Sponge
pH	7.4
Degree of methacrylation	> 30%
Viscosity	0.8 ~ 1 Pa·s
Storage Temperature	Solid −20°C Liquid 4°C (Photoinitiator 4°C)

Product Kit 1 - AM only

Item	Volume
Celluid AM	200mg

Product Kit 2 - AM + IRG

Item	Volume
Celluid AM	200mg
Photoinitiator - IRGACURE 2959	10ml

Product Kit 3 - AM + LAP

Item	Volume
Celluid AM	200mg
Photoinitiator - LAP	10ml

Celluid GM+AM

Celluid GM+AM is a bioink that combines GelMA and ALMA using CLECELL's distinctive blending technology.

1. **High-viscosity output**
   Due to the physical properties of ALMA, the mixture of GelMA and ALMA allows for higher-viscosity output compared to GelMA bioink.
2. **3D Structure Formation**
   This mixture maintains a balanced combination of GelMA and ALMA properties, enabling the application of photopolymerization or ion crosslinking methods, thus forming solid 3D structures through 3D bioprinting.
3. **Stable fabrication**
   GM+AM products, with their capability of high-viscosity output, maintain a higher degree of durability without compromising cell viability. This makes them ideal for fabricating tissue mimics with stability and supporting cell culture when utilized in 3D bioprinting applications.

Product Description

Synonyms	Gelatin methacrylate + Alginate methacrylate
Form	Liquid
pH	7.4
Viscosity	3 ~ 7 Pa·s
Storage Temperature	Liquid 4°C
Volume	10ml

AM

GM+AM

3D Bioprinting with Celluid Bioink

1 Bioink Solution

Prepare the bioink by dissolving the freeze-dried sponge in the photoinitiator and handle with caution to avoid exposure to light.

2 Cell Mixing

Use a pipette to gently place the cell pellets into the bioink and ensure even distribution of cells.

3 Bioprinting

Follow the instructions of the 3D printer manufacturer to adjust nozzle diameter, printing speed, printing pressure, and temperature, and directly print the output onto a Petri dish or a Multi-well plate.

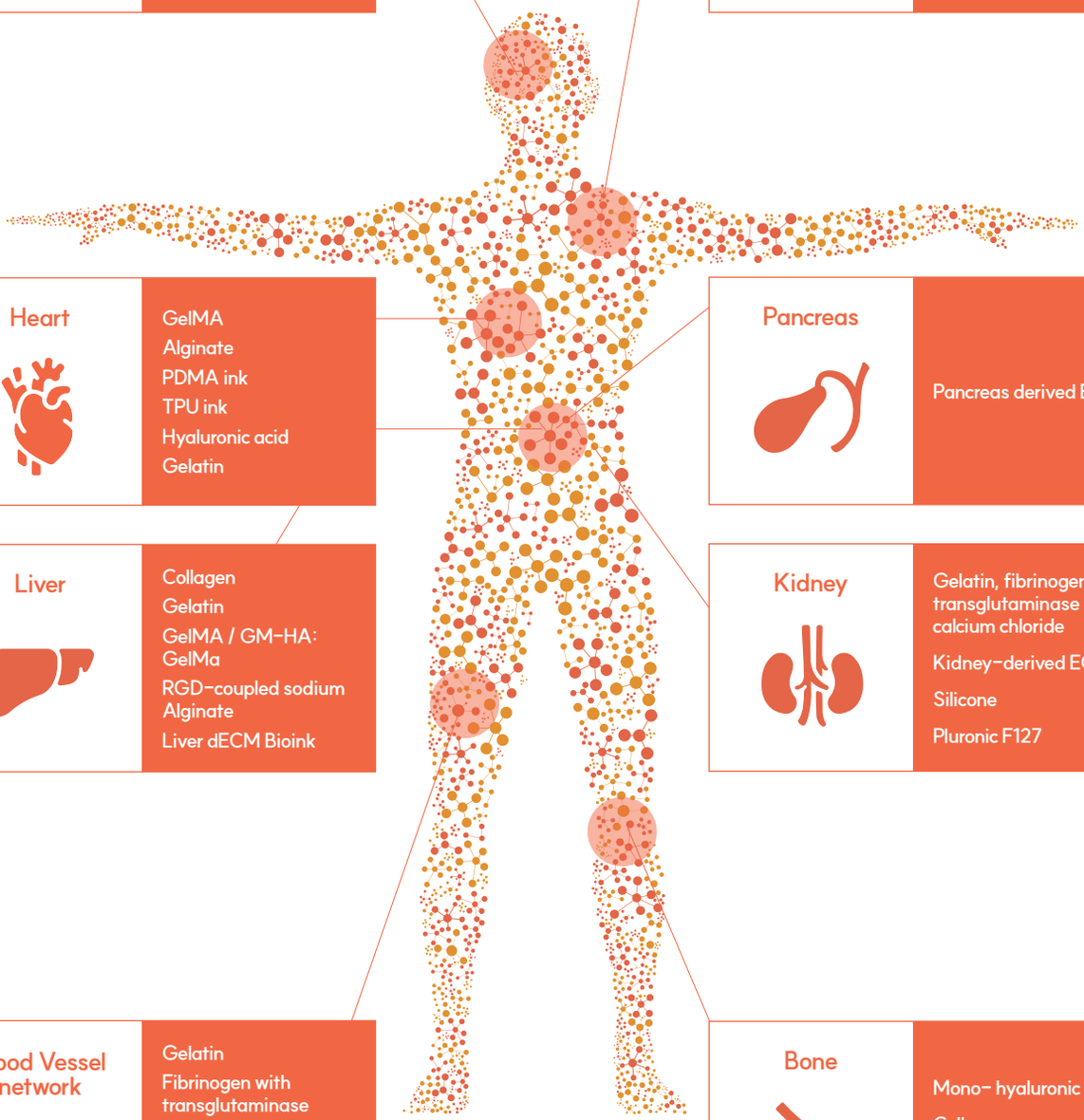
4 Crosslinking

Place the printed structure under a UV light source and expose it at an appropriate distance and exposure time. Adjust the distance and exposure time based on the light source used.

5 Cell Culture

Culture the printed tissues in an appropriate cell culture medium following standard tissue culture procedures.

Bioink for 3D Bioprinting



Cornea
- Gelatin
- Alginate
- Collagen

Skin/Skin tissue
- ECM with fibrinogen
- Thrombin
- Gelatin PEG
- Collagen
- Agarose
- Alginate

Heart
- GelMA
- Alginate
- PDMA ink
- TPU ink
- Hyaluronic acid
- Gelatin

Pancreas
- Pancreas derived ECM

Liver
- Collagen
- Gelatin
- GelMA / GM-HA: GelMa
- RGD-coupled sodium Alginate
- Liver dECM Bioink

Kidney
- Gelatin, fibrinogen with transglutaminase and calcium chloride
- Kidney-derived ECM
- Silicone
- Pluronic F127

Blood Vessel network
- Gelatin
- Fibrinogen with transglutaminase
- Agarose
- Vascular-derived ECM with Alginate
- GelMA

Bone
- Mono- hyaluronic acid
- Collagen
- PCL/PLGA/B-tcp, Fibroblast

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