
CLECELL

**Bioplatform company**
creating a new future of
life sciences

# U-FAB ACTIVO

The Most Innovative Solution for Tissue Engineering and Beyond
U-FAB ACTIVO, created with cutting-edge technology from various engineering experts and
a vast body of research experience in the field of tissue engineering


www.clecell.co.kr

In 2018, CleCell successfully commercialized the groundbreaking technology underlying 3D bioprinting, which was researched for over a decade at Harvard University in the United States. Through this advancement, CleCell specializes in producing three-dimensional artificial tissues essential for regenerative medicine and precision medicine, and strives further by pioneering a clinical simulation platform utilizing these tissues.

Incorporating insights from over 100 researchers globally in the life sciences and tissue engineering field, CleCell provides tailored solutions prioritizing the convenience and efficiency of researchers in their scientific endeavors.

Supported by extensive global patents and research publications, CleCell's products are validated for quality, precision, and efficiency through significant research outcomes.

CleCell is dedicated to enhancing the quality of life and advancing disease treatment through innovative biotechnology, all with a focus on a sustainable future.

CLECELL

# What is 3D Bioprinting?

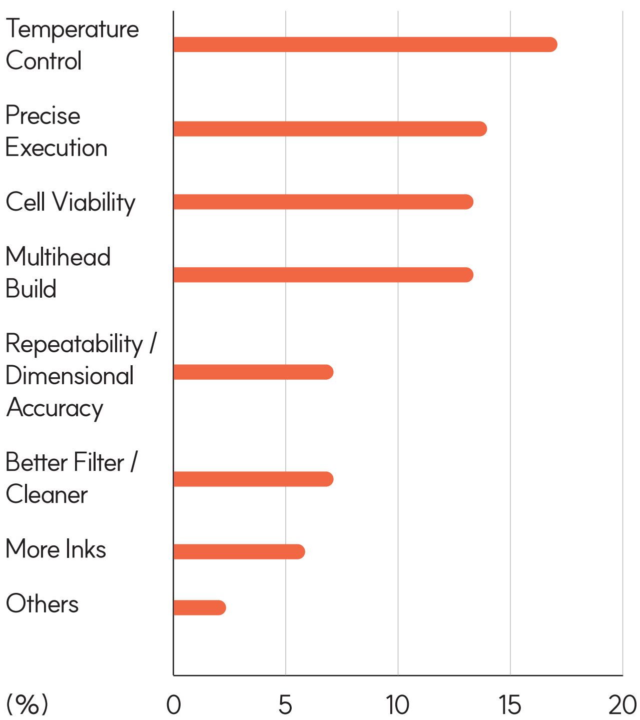
3D Bioprinting is a technology that allows for the precise fabrication of biomaterials to biomimic complex structures found in the human body through computer-aided design.

Using biocompatible polymers, bio-inks, and biomaterials, various scaffolds and structures can be produced based on the 3D models generated on a computer.

CleCell's U-FAB MASTER and U-FAB ACTIVO incorporate advanced printing technology capable of accommodating low viscosity to high viscosity, facilitating the fabrication of organoids to biomimetic structures.

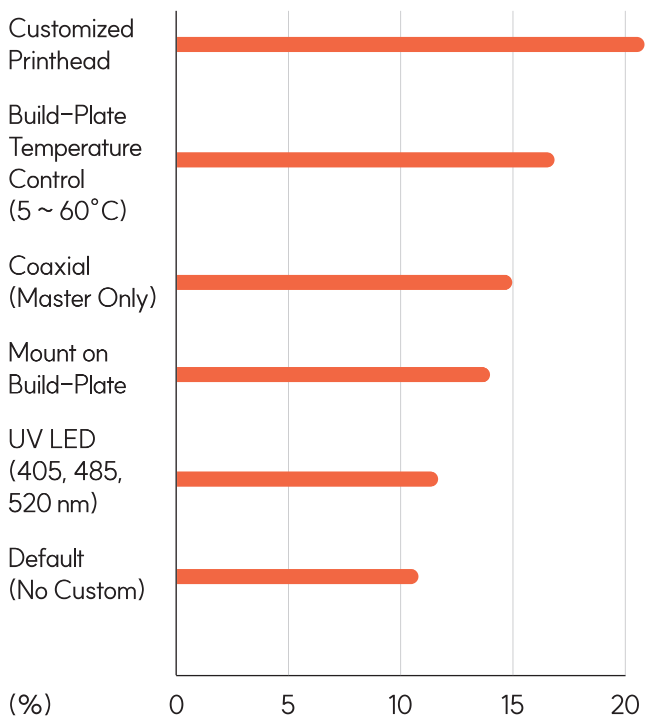
CleCell's U-FAB MASTER and U-FAB ACTIVO have been meticulously designed to maximize product differentiation and provide customizable solutions to cater to the specific needs of researchers.

### Functions Requested by Researchers




Source : 2022.10~2022.12 (Survey Conducted by CleCell)

### Functions Provided by Clecell




Source : 2023.01~2023.10 (Survey of CleCell's Clientele)

# Applications

## 3D Bioprinting for the Development of Innovative Medical Solutions

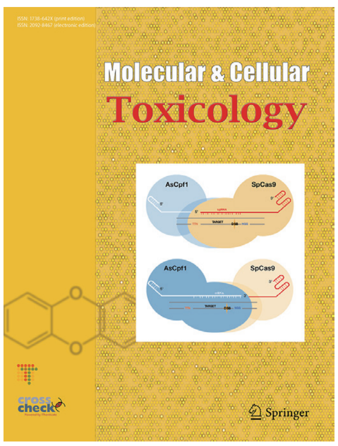
At Seoul National University's Dental Research Institute, a customized U-FAB ACTIVO is utilized for the culture of hard tissues (bone, cartilage) and soft tissues (periodontal membrane) by precisely placing cells, with a low viscosity, at desired locations to construct three-dimensional structures.

(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.

서울대학교 치의학대학원
SEOUL NATIONAL UNIVERSITY SCHOOL OF DENTISTRY

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




건국대학교

## 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

## 3D Bioprinting for Animal Welfare

For the research on artificial skin at a veterinary hospital (STEMPOINT), CleCell provided customized optimization by adding one additional droplet nozzle to the existing U-FAB ACTIVO system. With unique low-viscosity layering technology, which utilizes 2 droplet nozzles, CleCell hopes to support the technological development for the mission of STEMPOINT, which is to find alternatives to animal experimentation.

U-FAB ACTIVO's droplet printing method allows for meticulous fabrication control of cell or tissue density and composition, which enables precise printing of artificial tissues.

- Dr. Sin Him-cha, Researcher at STEMPOINT -

Focus on the point
STEMPOINT

# 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 leveling

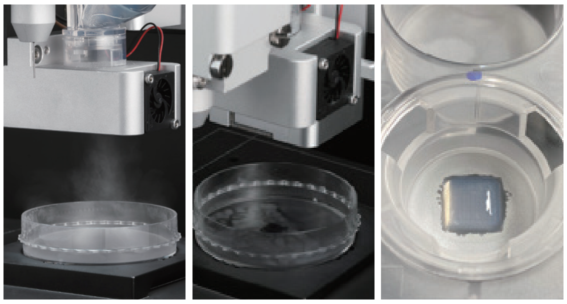

## Functions

| Functions | Droplet Dispenser | Micro-valve Extruder | HV Extruder (LT) | HV Extruder (HT) | Nebulizer | Probe |
|---|---|---|---|---|---|---|
| **Cooling**<br>with a single nozzle, lowest temp 4°C | ✓ | ✓ | ✓ | | | |
| **Heating**<br>with a single nozzle, highest temp 60°C | ✓ | ✓ | ✓ | ✓<br>highest temp 250°C | | |
| **Droplet**<br>Optimized to print low-viscosity | ✓ | | | | | |
| **UV-LED**<br>Photopolymerization | ✓ | | | | | |
| **Nebulizing**<br>pH, enzymes, chemical (ion) crosslinking | | | | | ✓ | |
| **Cell Homogenization** | ✓ | | | | | |
| **Auto Calibration** | | | | | | ✓ |

# Key Features

## Low-viscosity Stacking (Droplet Dispenser + Nebulizer)

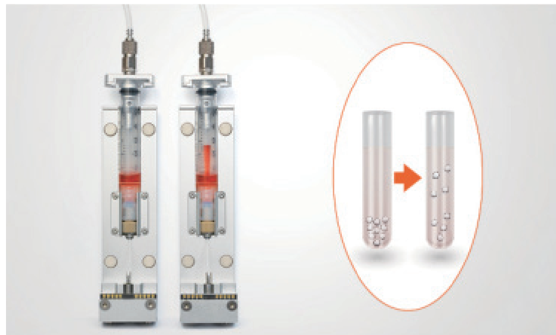
3D stacking of low-viscosity biomaterials
(Droplet Dispenser + Nebulizer)



The Droplet Dispenser can dispense low-viscosity biomaterials in droplet form, and with the use of a nebulizer, it can form polymer micro-particles (size: 4μm) through neutralization/chemical/enzymatic cross-linking. Additionally, layer-by-layer crosslinking enables easy 3D stacking of low-viscosity materials through gradual curing.

## Cell Homogenization

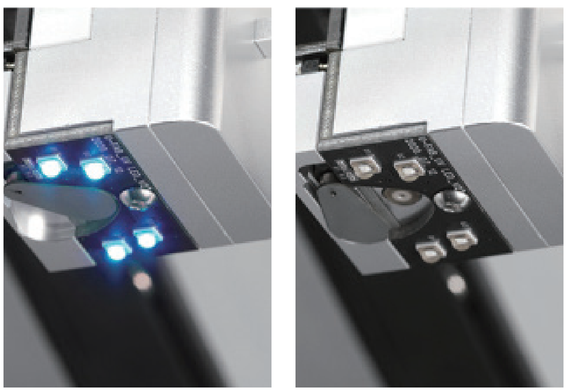
Cell printing and cell homogenization solution



By circulating the fluid mixture, density differences within the solution are prevented, ensuring a uniformity during 3D printing and enabling consistent and high-quality output.

## UV-LED Shutter

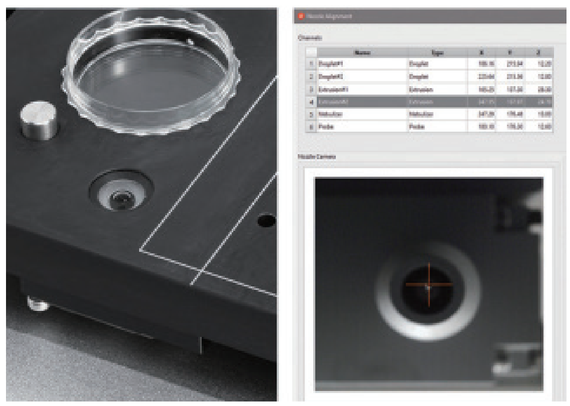
UV-LED shutter for efficient photopolymerization



Unnecessary curing of materials at the end of the nozzle caused by UV-LED exposure is mitigated by the UV-LED shutter, enabling efficient photopolymerization in 3D printing.

## Automatic Calibration

Automated nozzle-end alignment system & build-plate leveling



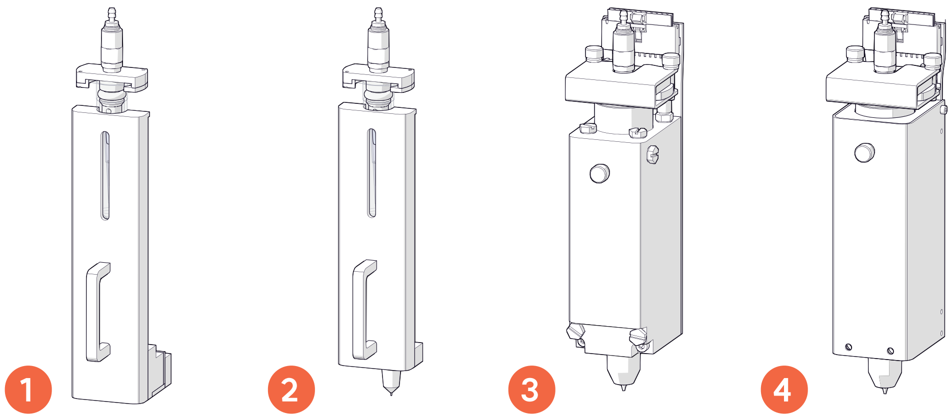
Surface height of the bioware is automatically measured and calculated, which enables it to fine-tune the X/Y coordinates of the nozzles used in printing for stable extrusion 3D printing.

# Product Specifications

| | |
|---|---|
| 3D Modeling / Editing Type | 3D data(STL file format) / Layer-based 2D Editing |
| Interface | PC (Windows 10/11) |
| Camera | Full HD (1920x1080) |
| Linear Actuation | High Precision Linear Robot |
| Bulid Volume | 150(W) x 150(D) x 50(H) mm |
| Weight | 100~110kg |
| Size | 662(W) x 637(D) x 730(H) mm |
| Print Speed | Up to 50mm/s |
| Max.Pneumatic Pressure | 8bar |

# Printhead Types

Discover CleCell's four unique printheads known for its exceptional precision.




## 1 Droplet Dispenser

Low-viscosity material dispensing channel (nm)

| | |
|---|---|
| Range | 0~14 psi (Max 96.5 kPa ) |
| Resolution | Minimum size of 1 droplet 10 nL (when using distilled water) |
| Temperature | 10 ~ 50°C (Single Printhead Operation: 4 ~ 60°C) |
| Material Type | Sol |
| Viscosity | 0~ 100 cPs(Viscosity similar to maple syrup) |
| Applicable biomaterials | Collagen, Alginate, Gelatin, Fibrin, Agarose, Hyaluronic acid(HA), Decellularized extracellular matrix, Matrigel TM |

## 2 Micro-valve Extruder

Low/mid-viscosity material extrusion channel

| | |
|---|---|
| Range | 0~14 psi (Max 96.5 kPa) |
| Resolution | Max resolution 0.127mm |
| Temperature | 10 ~ 50°C (Single Printhead Operation: 4 ~ 60°C) |
| Material Type | Sol/Gel |
| Viscosity | 0~ 1000 cPs(Viscosity similar to Glycerin) |
| Applicable biomaterials | Collagen, Alginate, Gelatin, Fibrin, Agarose, Hyaluronic acid(HA), Decellularized extracellular matrix, Matrigel TM |

## 3 HV Extruder (Low Temperature)

High-viscosity material extrusion channel

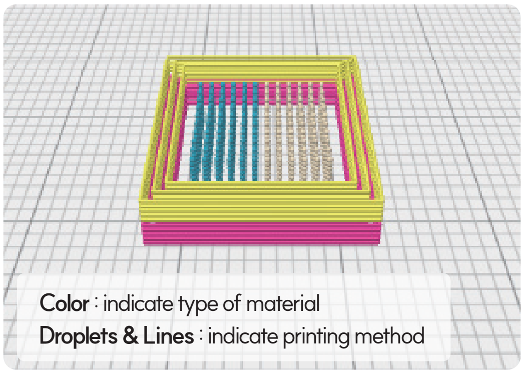
| | |
|---|---|
| Range | 0~114 psi (Max 786 kPa) |
| Resolution | Max resolution 0.05mm |
| Temperature | 10 ~ 50°C (Single Printhead Operation: 4 ~ 60°C) |
| Material Type | Gel |
| Viscosity | 1000 cPs < (Viscosity similar to Vaseline) |
| Applicable biomaterials | Hydrogel with Cell Mixtures, Hydroxyapatite, Chitosan, Collagen, Gelatin, Fibrin, Hyaluronic Acid, Alginate, etc. |

## 4 HV Extruder (High Temperature)

High-viscosity material extrusion channel

| | |
|---|---|
| Range | 0~114 psi (Max 786 kPa) |
| Resolution | Max resolution 0.05mm |
| Temperature | Room Temperature RT ~ 180 °C (Single Printhead Operation: RT ~ 250°C) |
| Material Type | Gel/Pellet |
| Viscosity | 0~ 100 cPs (Viscosity similar to Vaseline) |
| Applicable biomaterials | Hydrogel with Cell Mixtures, Hydroxyapatite, Chitosan, Collagen, Gelatin, Fibrin, Hyaluronic Acid, Alginate, etc. |

# Easy-to-use U-STUDIO




Customized modeling is possible, allowing researchers to create the desired model by specifying parameters such as shape, size, number of layers, and layer thickness.

U-Studio facilitates simultaneous design of 3D models using various materials, enabling researchers to tailor printing outcomes to their specific research requirements.

## Compatible with External STL Files

U-Studio is compatible with external STL files, allowing users to design shapes freely.

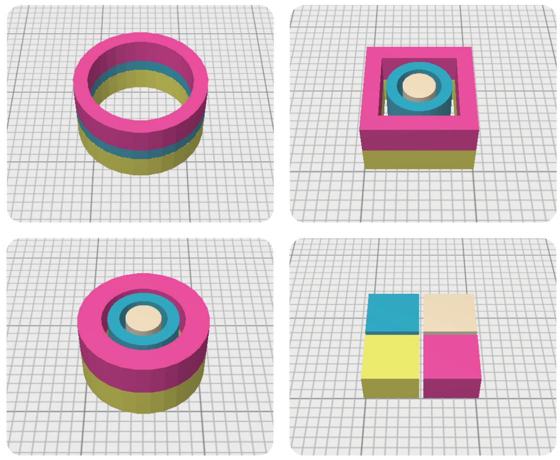
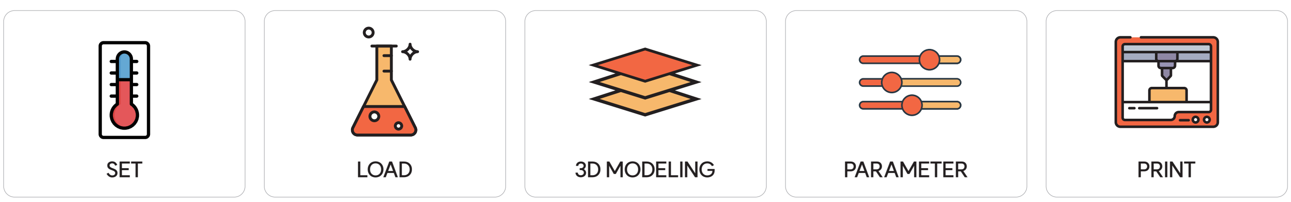


*Image of U-Studio interface

# How to Print




| | |
|---|---|
| 1. SET | Run U-Studio to set the temperature of the printhead.<br>(Set the appropriate temperature according to the type of printed material.) |
| 2. LOAD | After loading the printing material, use the "Flush" operation to set the basic parameters, and prepare it for printing. |
| 3. 3D MODELING | Set the desired shape, size, and printing resolution of the model to complete the 3D modeling process. |
| 4. PARAMETER | Set the pressure, cross-linking, and layering method to configure the printing parameters. |
| 5. PRINT | Print.<br>(To halt the printing process, simply press the "Abort" button.) |

# CleCell's Bioink, Celluid

## Advantages of Celluid Bioink

**CleCell Bioink Celluid**

### 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 bio-ink 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 photocrosslinking 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 Product

### Celluid GM

CleCell's Celluid GM is produced by synthesizing Gelatin, a natural polymer, with Methacrylate, and is available in a freeze-dried sponge form.

Celluid GM is available in two types, providing users with the flexibility to choose based on the viscosity requirements of the intended biological material or tissue for printing.

**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

### Celluid AM

Celluid AM contains ALMA (Alginate Methacryloyl) and a photoinitiator, allowing the formation of 3D structures upon UV exposure. Users can adjust the concentration for various applications.

Celluid AM is widely used in the research of artificial tissue fabrication and can enhance cell adhesion and cell viability when mixed with GelMA.

**AM**

### Celluid GM+AM

The mixture of GelMA and ALMA allows for higher viscosity output, compared to GelMA bioink alone, due to the high viscosity characteristics of ALMA.

Furthermore, with high cell viability, the GelMA and ALMA combination facilitates the output of optimized structure for human tissue mimicry and cell culture.

**GM+AM**

※ For detailed product information and purchase guide, please visit our website (www.clecell.co.kr).

# Application

| | | |
|---|---|---|
| Cartilage Structure | **Hardened Soft Tissue Structure Printing Using Bioink** | Cartilage tissue, which serves as a cushioning component in the human body, can be printed and cured using low-viscosity substances and a droplet-based 3D printing approach. By incorporating chondrocytes, specialized cells responsible for cartilage production, into the bioink, it becomes possible to create three-dimensional structures for tissue regeneration research. |
| Artificial Ear | **Microtia Patient Model Printing Using PCL** | With 3D composite printing technology, an artificial ear model was created using Polycaprolactone (PCL), a FDA approved synthetic polymer material, for a patient with microtia. |
| Artificial Skin | **Artificial Skin Model Printing Using Bioink** | With the use of various bioinks (collagen & sodium bicarbonate) and CleCell's unique nebulizing technology, a FT model was printed through the repetition of culture/differentiation processes. |
| Cardiac Organoids | **Artificial Heart Replica Printing Using Cardiomyocytes** | Professor Si-Yoon Kim, at Konkuk University, conducts research and development on artificial cardiac organoids using a bioprinter and incorporating a vascular model during the differentiation of myocardial cells. |
| Animal Replacement | **Alternatives to Animal Testing Through Printing Artificial Organ Replicas** | Using Gelatin Methacrylate (GelMA) bioink, artificial skin of pets are printed for use in evaluating toxicity and efficacy of pet skin treatments. |
| Dental Structure | **Printing of Tooth Structures Using Biocompatible Materials** | To establish tissue patterning in a three-dimensional structure, low-viscosity cells are placed at desired locations using droplet or extrusion methods for the culture of hard tissues (bone, cartilage) and soft tissues (periodontal membrane). |

# Affiliated with

ALTECH · AS ONE · azcuris · KNUH 경북대학교병원 · SNUH 분당서울대학교병원 · OkaSciences
서울대학교 치의학대학원 SEOUL NATIONAL UNIVERSITY SCHOOL OF DENTISTRY · 건국대학교 · KNU 강원대학교 KANGWON NATIONAL UNIVERSITY · TPC · (주) TPC 메카트로닉스
고려대학교 KOREA UNIVERSITY · Brigham and Women's Hospital Founding Member, Mass General Brigham · innoregen · HARVARD UNIVERSITY · Focus on the point STEMPOINT
CancerFree Biotech · Alliswell · PRECISION TECHNOLOGIES · PURE DYNE by ViscoTec · 3idea Imagine Create Print · China Scientific (HK) Limited 華儀 (香港) 有限公司

**Headquarter**
H6107, Healthcare innovation park, 172, Dolma-ro, Bundang-gu,
Seongnam-si, Gyeonggi-do, Republic of Korea

**R&D Center**
201-204 of Munjeong Daemyung Bellion, 127 Beopwon-ro, Songpa-gu, Seoul, KR

**Tel.** : +82 2-6951-3100
**Fax.** : +82 2-6951-3150
**E-mail.** : clecell@clecell.co.kr
www.clecell.co.kr