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Beyond Lab to Life

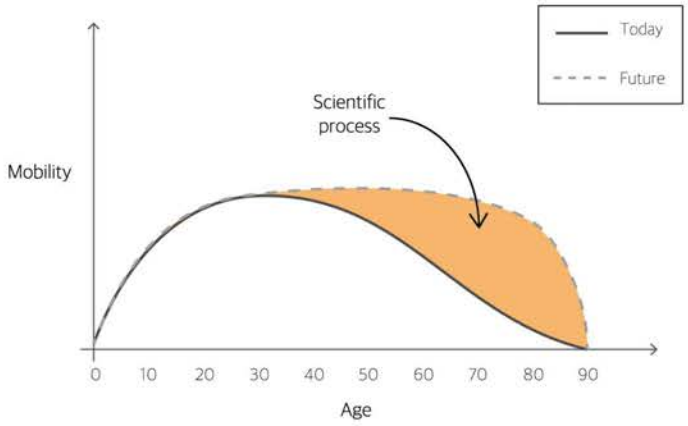
Organ Regenerator

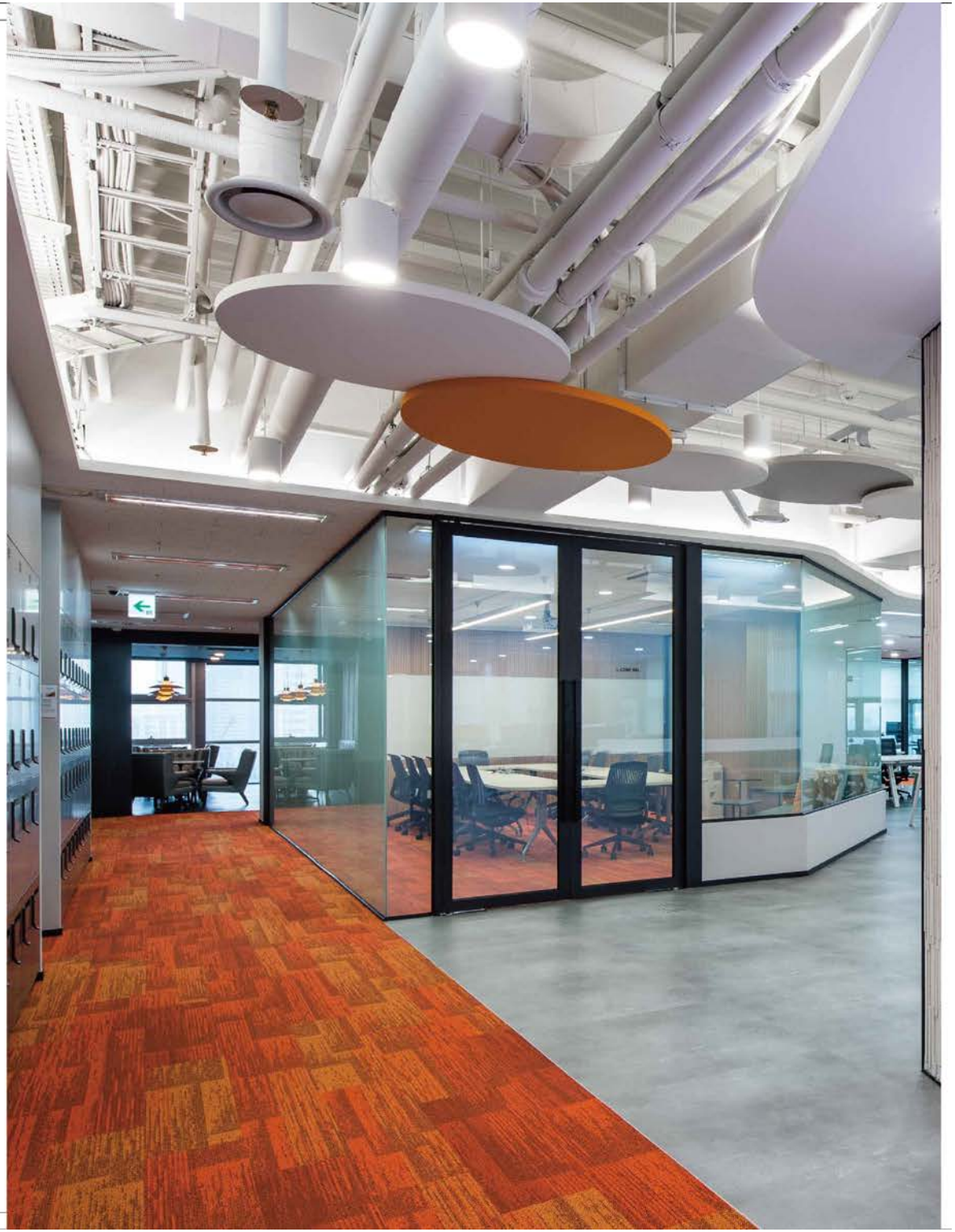
Dr. INVIVO 406

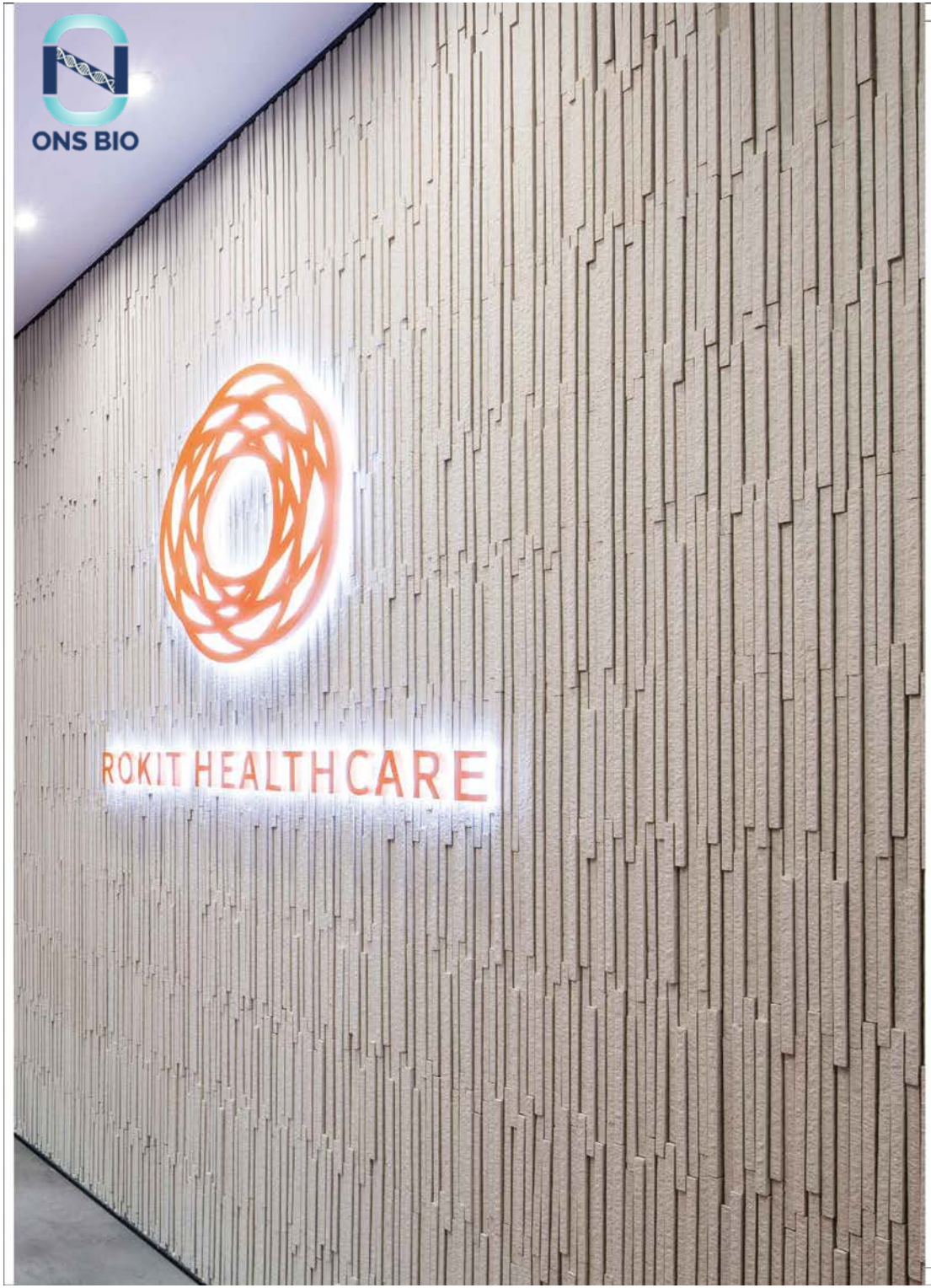
"INEVITABLE AGING IS OVER."

Some might consider aging as a natural and unstoppable way of life. But, over the last few decades we have started to view aging as a scientific process. Cancer, dementia, organ failure which are often associated with aging have a clearly scientific basis of understanding and response. That's why ROKIT Healthcare is dedicated to developing and providing a total healthcare solution to address the problem of aging. The hope is to "age well", in a world where people are living longer and longer.

PICTURE OF AGING







ROKIT HEALTHCARE HERE FOR YOU

ROKIT Healthcare takes a holistic approach to human body regeneration - from prevention to therapy to daily management through the work of our three business units:

ORGAN REGENERATION

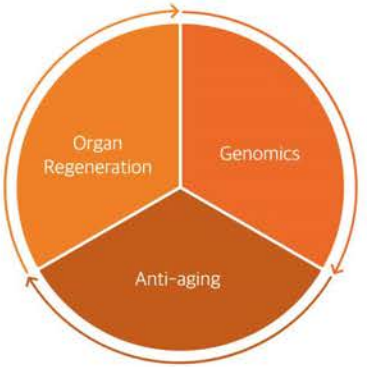
The Organ Regeneration division applies the latest science in 4D bioprinting and human biomaterials to advance research and therapy in regenerative medicine.

GENOMICS

The Genomics division translates single-cell RNA sequencing to offer disease prevention informed by the patient's genetic data.

ANTI-AGING PLATFORM

The Anti-Aging Platform division focuses on the day-to-day care of the body through diet supplements and AI-based cosmeceutical products.



ROKIT Healthcare considers "4D bioprinting" as the most promising way to advance progress in organ regeneration.
We provide bioprinters that realize researchers' and healthcare professionals' vision, which is ultimately the customized, in-hospital biofabrication of human tissues.

FACE THE NEW
Dr. INVIVO 406

"As you know there is a critical need to bring new breakthrough technologies and therapies to the market for patients. In that regard, ROKIT Healthcare's innovative products are developed to support this very endeavor. Specifically, the bioprinter and biomaterials are essential tools and products that will help us reach our goal faster and better."
– James J. Yoo, M.D., Ph.D., Professor, Institute for Regenerative Medicine, Wake Forest School of Medicine

"As the medical world has increasingly better understood the molecular mechanisms of aging, it has reached a consensus that aging is disease and that we have to take a progressive action. In the near future, the medical community should provide innovative solutions to stop and even reverse aging itself, which is the root cause of diseases. ROKIT Healthcare will be at the frontier to do these."
– Jae-Ho Lee, M.D., Ph.D., Professor, Samsung Medical Center

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HOME FOR CELLS

BUILT-IN CELL INCUBATOR

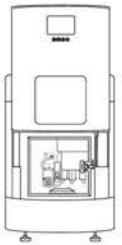
Long printing time could affect cell viability during or after the process. So, we thought the ideal bioprinter should provide a comfortable environment for your cells. What is the home for cells? The incubator! Meet Dr. INVIVO 4D6, the world's first bioprinter with a built-in double door incubator with controlled chamber temperature, CO_2 levels as well as humidity.

CLEAN CHAMBER

Dr. INVIVO 4D6 keeps your cells safe from any contamination through the finest particle control via H14 HEPA filter and circular flow system. There are also UV-C germicidal lights to keep your cells' home clean. But we thought this is not enough. So, we have added low temperature plasma systems to satisfy the requirements of medical settings.

AUTO BED LEVELING & NOZZLE END ALIGNMENT

From time to time, you may have found that opening the door to adjust the printer's calibration settings is not ideal for cells. Using ultrasonic sensor technologies, Dr. INVIVO 4D6 is on auto-pilot mode. You don't need to worry - Dr. INVIVO 4D6 sets itself up by automatic bed leveling and alignment of its nozzles. It knows where to print, and you keep hands away from cells.



BUILT-IN CELL INCUBATOR
CO_2 level control

CLEAN CHAMBER
Sterilization
Particle control system

AUTO BED LEVELING
& NOZZLE END ALIGNMENT
Ultrasonic sensor

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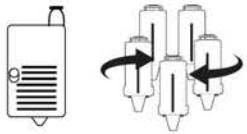
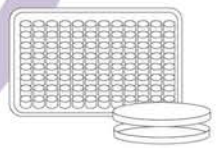


MODULAR PRINTHEADS
1 interchangeable dispenser
+ 5 rotary biodispersers

VISUALIZATION
Optical microscope



MULTI PLATFORM PRINTING BED
Well plates, culture dish

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COMPLEX TISSUES BUT EASY FABRICATION

6 MODULAR PRINTHEADS WITH INDIVIDUAL CONTROL

Human tissues are not made up of one type of cells. To mimic complex structures closer to nature, it is necessary to use various cell types and biomaterials. We respect every cell type needs its own dispenser with unique pressure and temperature control.

MACRO BUILD VOLUME WITH FINE-SCALE VISUALIZATION

Wasn't it a hassle to move back and forth between the bioprinter and the microscope to check if your printed tissue is okay? Using the built-in optical microscope, monitor the print in the palm of your hands with a smartphone, up to 20X resolution.

HIGH-THROUGHPUT WITH LOW ERRORS

Capable of dispensing in up to 384 well plate assays, Dr. INVIVO 4D6 combines the best of both worlds - the high-throughput liquid handler and high-precision linear robot. Dramatically reduce human errors and eliminate the time-consuming process of manual pipetting.

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NEXT-GENERATION BIOPRINTING

A next-generation bioprinting technology should be ready for the most complex challenges in human tissue fabrication and applications. Stepping up from simply laying cells out in a 3-dimensional space, Dr. INVIVO 4D6, with the built-in cell incubator and liquid handling functions, allows the researcher to meet the real needs of keeping cells functional while upgrading researchers' work to high-throughput usage.

LIQUID HANDLER

INCUBATOR

STERILIZER

BIOFABRICATOR

SMART UI

EFFECTS OF VARIOUS PRINTING PARAMETERS ON CELL VIABILITY

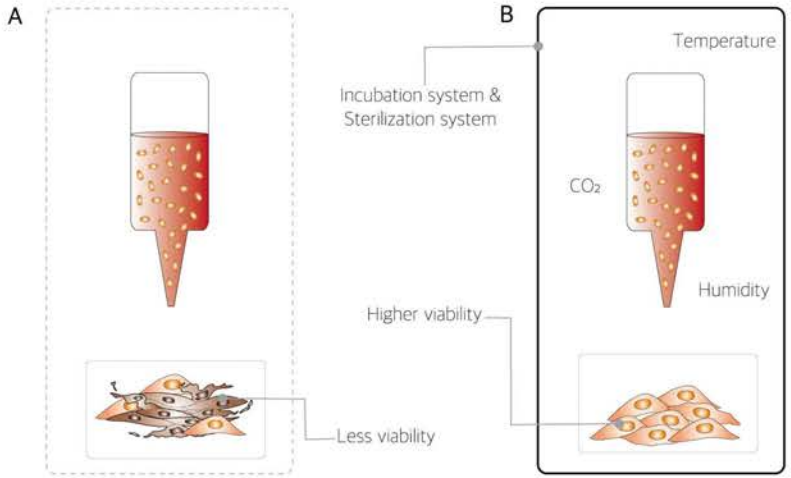

FIG.1. Effects of various printing parameters on cell viability. (A) Open Bio 3D printer. (B) Closed Dr.INVIVO 4D6.
Cell viability is affected by both mechanical and biological parameters of the printing process. While smaller nozzle diameters, higher dispensing pressure and higher bioink concentrations may lower cell viability, simulating the appropriate cellular environments inside the chamber can boost the result, i.e. temperature up to threshold 37°C, carbon dioxide level of 5% concentration similar to the environment in mammalian blood and tissues; 75-80% humidity level similar to the internal organs in the human body.

Reference:
[1] Panwar, A., & Tan, L. (2016). Current Status of Bioinks for Micro-Extrusion-Based 3D Bioprinting. Molecules, 21(6), 685.

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IMPORTANT BIOLOGICAL PRINTING PARAMETERS

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TEMPERATURE

Cellular functions are highly responsive to temperature which can also affect cell viability.

CO_2

CO_2 gas changes pH in the medium. In the improper pH conditions, cells stop growing and lose viability and it may produce morphological changes of cells.

HUMIDITY

Low humidity causes evaporation of water from the media. Evaporation leaves too-high concentrations of salts, minerals, etc., resulting in toxicity and cell death. [2]

STERILIZATION

Preventing contamination is the key to apply the printed tissue in vivo.

Replicating the temperature, CO_2 and humidity with in vivo conditions is important to replicate tissues and organs.

AVERAGE VIABILITY WITH AND WITHOUT ADDED HUMIDITY

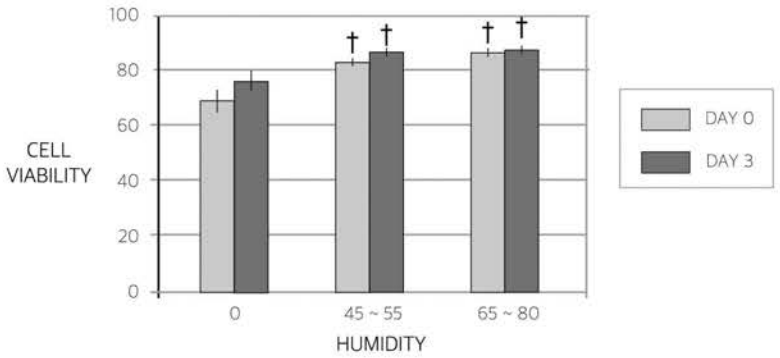
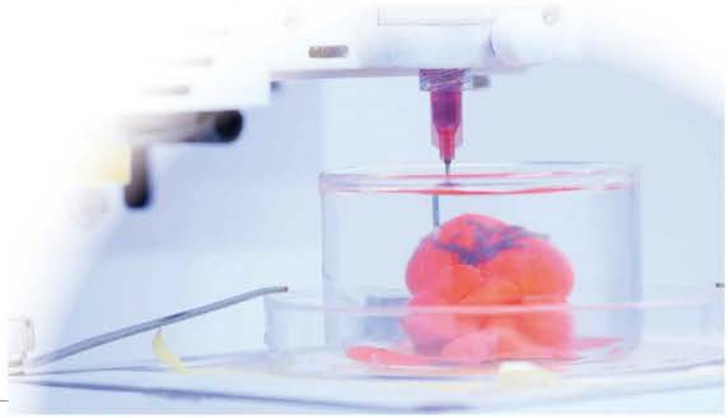


FIG.2. Average viability with and without added humidity. At day 0 and 3, the average viability of constructs generated with and without added humidity (45-55% using an evaporative humidifier or at 65-80% using an ultrasonic humidifier) is greater and the difference is sustained over the three days of time period.

Reference:
[2] Smith, C. M., Christian, J. J., Warren, W. L., & Williams, S. K. (2007). Characterizing Environmental Factors that Impact the Viability of Tissue-Engineered Constructs Fabricated by a Direct-Write Bioassembly Tool. Tissue Engineering, 13(2), 373-383.



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REVOLUTIONARY APPLICATIONS

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Key Function	Capability	Applications
Chamber Temperature Control (4~ 40 ℃)	Fabricates with diverse types of hydrogels	* Below 10 ℃ : Collagen, Gelatin, Matrigel, Hyaluronic acid, Alginate, Silk * Between 10 ℃ - 30 ℃: Pluronic, Fibrin, Chitosan, Cellulose, PEG * Above 30 ℃: Poly-phosphazen, Agarose
Max 6 Modular Printheads	Fabricates complex tissue structures with six different cell types and/or materials	* Cardiac patch with vasculature (3 types of vascular cells, cardiac outer and inner wall muscles) * Lung tissue with air sacs (multi-level porous scaffold seeded with cells) * Organ-on-a-chip (3-D cell culture chip that simulates the activities, mechanics and physiological response of mini-organs) * Food printing (production of "future food" containing complex and customized formulations of nutrients, i.e. artificial meat, complex vitamins) * Pharmaceutical tablet printing (1 excipient material combined with 5 different types of drug formulations)
Sterile Chamber	Creates implantable devices in an environment compliant with medical device standards	In-hospital manufacturing of patient-customized tissues and regenerative patches with autologous solutions (i. e. skin regeneration for diabetic foot ulcer patients, cartilage regeneration, heart patch development, retina patch development)
Cell Incubator (Temperature/Humidity/CO_2)	* Supports higher cell viability both during and after the printing process * Supports proper cell proliferation and differentiation in the printed tissue	* Study of stemness maintenance and stem cell differentiation in a controlled 3-D culture environment * Incubator for genetically modified plant organisms (protoplast development into plants using various seeds in a 3-D agarose matrix)
Well-Plate Printing (up to 384 wells)	* Creates an assay composed of organoids that can be used for drug efficacy and toxicity testing * Allows for high-throughput media exchange using suction features	* Safer development of vaccine assays using highly contagious and harmful forms of pathogens (i. e. HIV, Coronavirus) * Controlled dispensing of small volumes of mixed materials, i. e. PCR genotyping, drug formulation development, etc. in a CO_2 chamber
20X Built-In Scope	Allows for quality evaluation of scaffolds (i. e. pore size, morphology, surface)	* Creation of complex biological systems with surface modifications and pore sizes that mimic native tissues * Development of personalized medicines with precisely controlled pore sizes and different dissolution rates

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DR. INVIVO PUBLICATIONS

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Skin Tissue	Adipose Tissue	Cartilage Tissue	Salivary Gland Tissue
Cancer Modeling	Wound Healing	Medical Devices	Stem Cell Spheroids
Drug Testing	4D Printing (Polyurethane)	Nuclear Waste Management	Bioink Development

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DR. INVIVO 4D6 AT A GLANCE

Category	Description	Standard	Upgrade	Premium
Dimension	Φ683 x 965 (H)			
Weight	~95 kg			
Print Speed	Max 50 mm/s			
Max Build Area	80 x 80 x 80 mm			
Auto-Bed Leveling and Nozzle End- Alignment	Ultrasonic sensor, nozzle-end align sensor	✔	✔	✔
XYZ Motor Resolution	10 ㎛	✔	✔	✔
Monitoring Camera	Built-in monitoring camera (720p)	✔	✔	✔
Embedded Air Compressor	5 bar 3-layer filtering (5 ㎛, 0.5 ㎛, 0.01 ㎛), water separator	✔	✔	✔
Particle Control	Circular flow and HEPA filter (0.5 ㎛, 99.998%)	✔	✔	✔
Printhead Set 1	5-axis rotary syringe dispensers (R)	✔	✔	✔
Printhead Set 2	1-axis interchangeable printhead (L)	2 Types Filament Extruder Syringe Dispenser	2 Types Filament Extruder Syringe Dispenser	3 Types Hot-Melt Pneumatic Dispenser Filament Extruder Syringe Dispenser
Embedded Cooling	Coolant tank, Circulation pump, Manifold		✔	✔
Bed Temperature	Heating and cooling functions	Heating Only RT ~ 60 ℃	Cooling and Heating -4 ~ 60 ℃	Cooling and Heating -4 ~ 60 ℃
Linear Robot	Medical-grade linear motion system		✔	✔
Incubator	Chamber CO_2 level, temperature & humidity control			✔
External Air Compressor	Max 20 bar via HPA system (CO_2) (Option)			✔

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EMPOWERING RESEARCH WITH VERSATILE PRINTHEADS AND CUSTOMIZABLE OPTIONS

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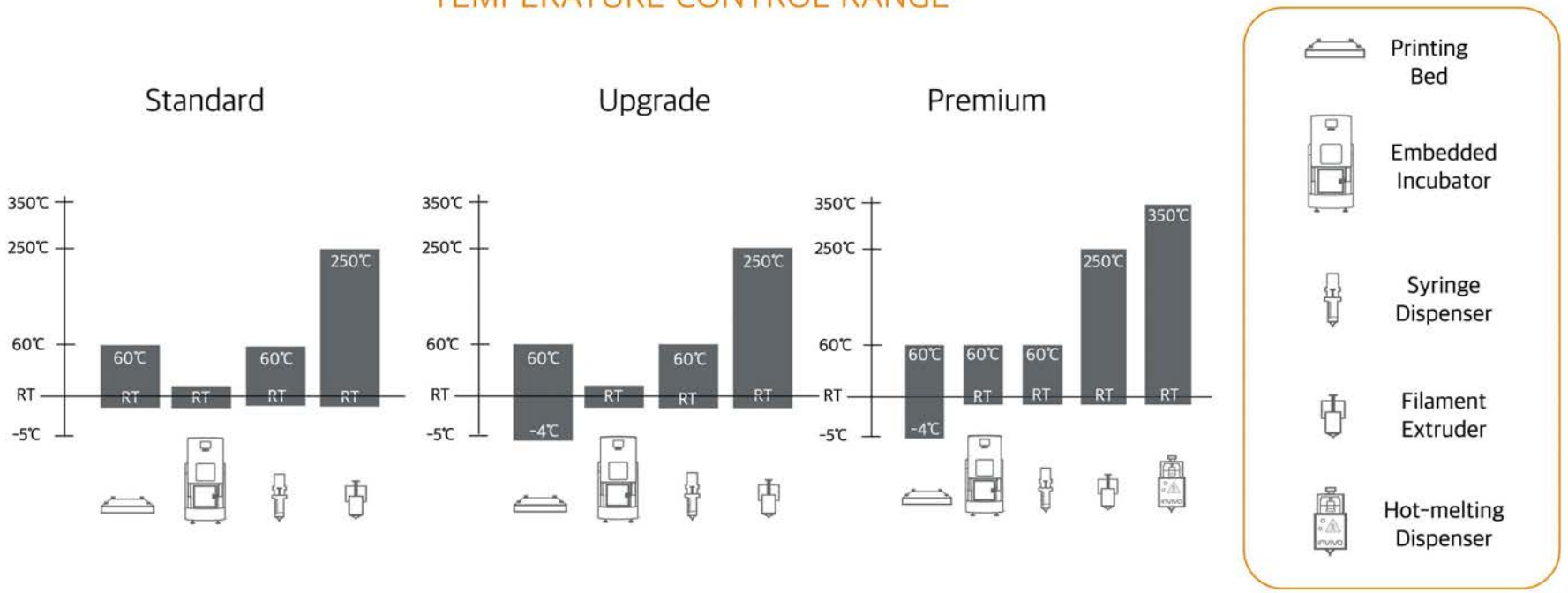
TEMPERATURE CONTROL RANGE



OPTIONAL

Co-Axial Dispensing Syringe

Frozen Bed (-30℃)

Air Compressor (MAX 20 bar)

Optical Microscope (20X)

Low-Temperature Plasma Sterilizer

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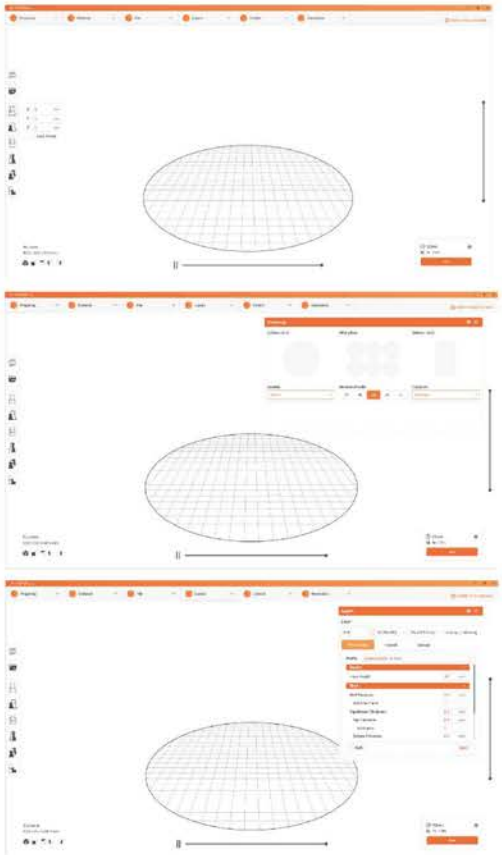
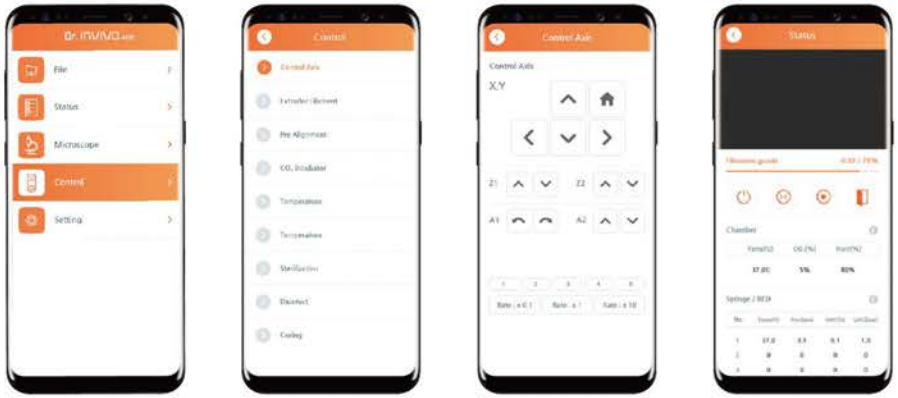
INTUITIVE, HUMAN-CENTERED SOFTWARE

Dr. INVIVO 4D6 is equipped with a state-of-the-art, user-centered operating system, designed to simplify the bioprinting workflow while maximizing the diversity of outputs from the printer. It can be controlled by both the built-in LCD touchscreen as well as the PC software, accessible by Wi-Fi, Ethernet, and USB cable connections. For the ease of mobility, the software is also provided as a first-of-its-kind mobile app, allowing you to operate Dr. INVIVO 4D6 in the palm of your hands.

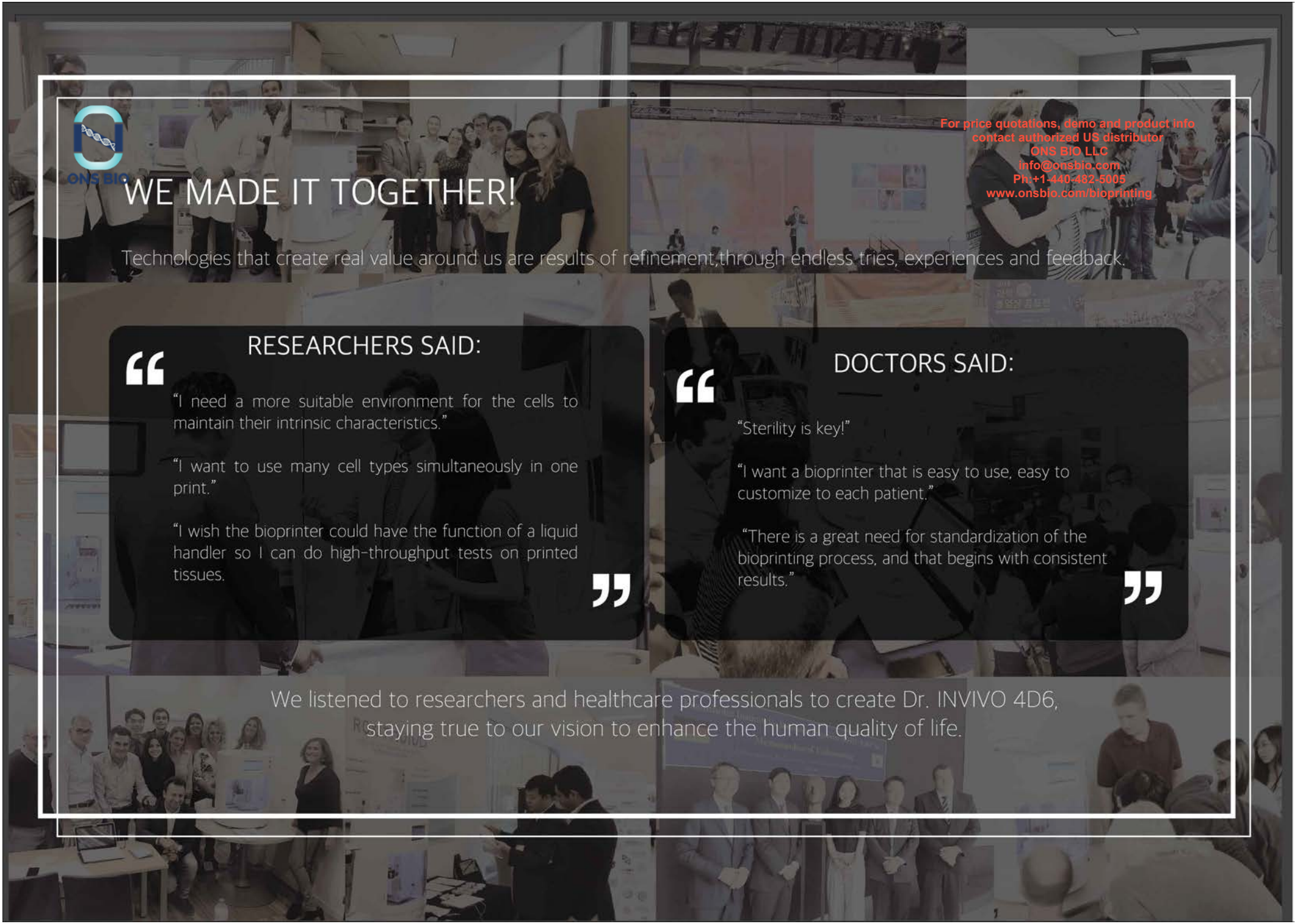
PC SOFTWARE



MOBILE APPLICATION (ANDROID)



CONNECTIONS



WE MADE IT TOGETHER!

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Technologies that create real value around us are results of refinement,through endless tries, experiences and feedback.

RESEARCHERS SAID:

"I need a more suitable environment for the cells to maintain their intrinsic characteristics."

"I want to use many cell types simultaneously in one print."

"I wish the bioprinter could have the function of a liquid handler so I can do high-throughput tests on printed tissues.

DOCTORS SAID:

"Sterility is key!"

"I want a bioprinter that is easy to use, easy to customize to each patient."

"There is a great need for standardization of the bioprinting process, and that begins with consistent results."

We listened to researchers and healthcare professionals to create Dr. INVIVO 4D6, staying true to our vision to enhance the human quality of life.

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ROKIT HEALTHCARE, Inc.
12F, Gasan High-heal bldg, 9, Digital-ro, 10-gil
Geumcheon-gu, Seoul, Republic of Korea
Web : rokithealthcare.com