Scintica

NGB-R™

Next-Generation Bioprinting




MAKE TISSUES REAL

Poietis at a glance

Founded in 2014 as a spin-off from INSERM and the University of Bordeaux, Poietis' mission is to provide solutions leveraging its proprietary next-generation bioprinting (NGB) platform and bring tissue engineering therapies to patients.

Poietis gathers a strong and interdisciplinary team of biologists, physicists, AI specialists, developers and pharmacists with extremely rich and diverse expertise. Together, we thrive to develop what is the most advanced bioprinting platform to date and use it to create tissues for key applications such as regenerative medicine and *in-vitro* testing.

For the past 5 years, we filed over 52 exclusive patents, developed a 4th bioprinter generation, devised our very own bioprinted human skin model Poieskin® and partnered up with some of the world's leading cosmetics and pharmaceutical groups such as L'Oréal, Servier, BASF...

NGB™ platform, bioprinting perfected *with* and *for* biologists

Based on 10+ years' thorough experience and innovation research, we developed NGB-R™, a 4th generation multi-modal biofabrication instrument based on unique laser-assisted bioprinting technology. The instrument gives tissue engineers and researchers superior resolution and precision, as well as viability, repeatability and reproducibility.

Besides the NGB-R™ commercial bioprinter, we are also developing NGB-C™, a second biofabrication instrument dedicated to further therapeutic applications. Based on the same core technology, NGB-C™ will meet the requirements of translational research and provide an answer to the challenges of industrial manufacturing of implantable tissues.

52 technology patents

15-year bioprinting experience

35-people team
25% PhDs

Bordeaux, France

Inserm

L'ORÉAL

BASF
We create chemistry

SERVIER

A NEW, DISRUPTIVE 4D BIOPRINTING APPROACH
TO MAKE COMPLEX, FUNCTIONAL LIVING TISSUES

Single-cell resolution

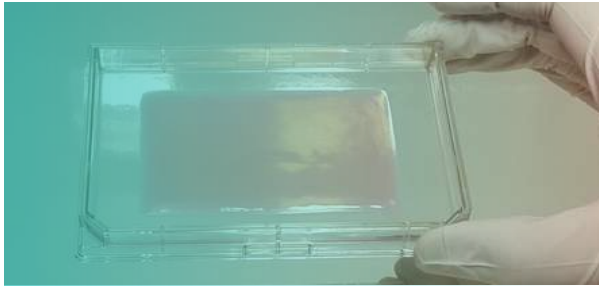
While tissues and organs are organized at a micron scale, conventional tissue engineering and 3D bioprinting techniques are limited to coarse resolution of 300-500µm. NGB-R™ solves such critical limitations by introducing unique single-cell resolution technologies, allowing to precisely control cellular interactions and guide biological processes of organogenesis (more on page 6).

We believe that single cell resolution should be considered as a paradigm shift, a new standard in tissue manufacturing, no longer conditioned by the printing device but driven by biology and the need to control cellular environment at cellular level.

>95% cell viability

Today, most bioprinting instruments rely on extrusion-based technology with process-induced forces which cause cells damage and injury and an average 50% cell viability ratio only.

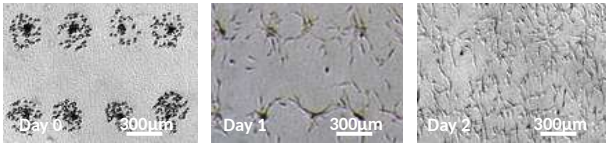
We chose another way. NGB-R™ instrument boasts laser-assisted bio-fabrication technology, a nozzle-free technique with no damage-causing forces occurring in the process. As a result, cell viability reaches >95% and printed tissues become *truly* functional.



Unrivaled 10µm precision

Boasting single-cell resolution capabilities and based on state-of-the-art robotics, automation, control and calibration technologies, NGB-R™ reaches a peak in bioprinting precision.

In tissue biofabrication, the initial positioning of cells has a huge impact on the evolution of future tissues. While ordinary extrusion-based bioprinting technique does not allow for precise positioning of printed cells within the hydrogel, NGB-R™ offers the unique possibility to accurately arrange cells exactly where and as desired.



A specific pattern of Fibroblasts printed over Collagen-I tracked over time.

Based on our own tissue-engineering experience, we indeed developed tools to predict which, how and when tissue functions and biological processes will emerge.

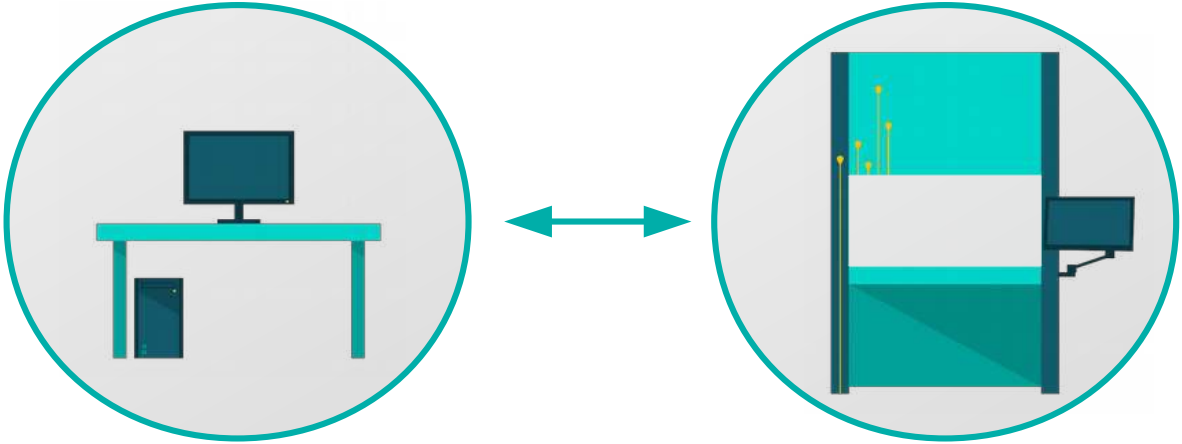
When 3D turns 4D

We understand that specific tissue functions need time in order to emerge and consequently, taking time dimension into account is key when it comes to designing appropriate 3D micro-patterns of tissue components.

We believe time plays an entire part in tissue engineering and should legitimately be considered a 4th dimension to bioprinting in its own.

As a result, our instrument and software were designed according to and with a strong focus on key biological processes such as cell proliferation, migration and differentiation.

NGB-R™ INSTRUMENT,
FULLY-INTEGRATED BIOPRINTING PLATFORM



Smart software suite

Before being an actual instrument, NGB-R™ first consists of a well-devised software suite designed to allow for seamless workflow and user-friendly operation, both on your computer and the unit itself.

Design your tissues with a large collection of pre-defined yet editable tools, anywhere you are. Customize, sequence, save your printing jobs, then export to the platform's embedded interface which will automatically translate those into processes.

Last but not least, easily monitor and control your printed tissues with accurate image analysis tools (find out more on pages 8-9).

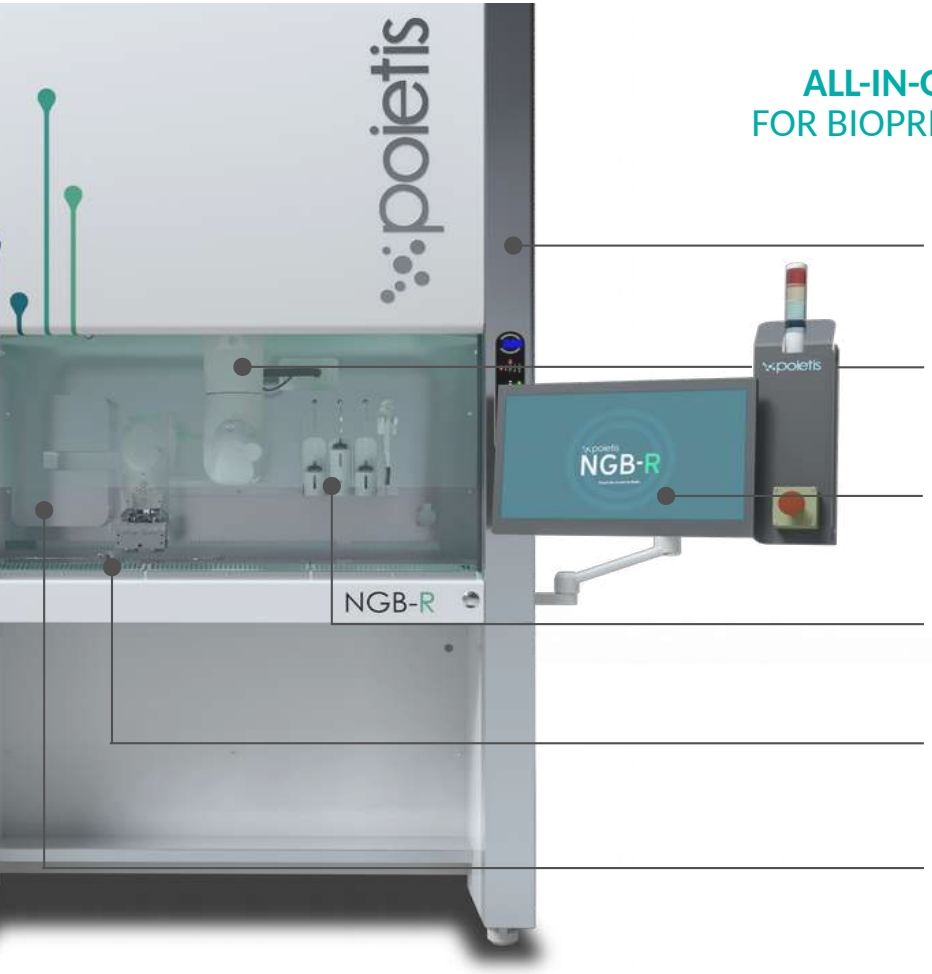
State-of-the-art hardware

The NGB-R™ instrument itself was conceived as an all-in-one, stand-alone bioprinting platform, fully-integrated into a tailored, stainless-steel made biosafety cabinet (BSC).

It features high-end robotics and automation tools for unrivaled precision and reproducibility, including a 6-axis robotic arm ensuring printing job sequences are carried out effectively and accurately.

Combined to the system is a powerful on-board computer and large 21" HD touch-screen interface providing for memorable yet effortless system operation.

ALL-IN-ONE BIOFABRICATION CABINET
FOR BIOPRINTING & CELL-CULTURE WORK



Fully integrated biosafety cabinet

Save space & money with an all-in-one cabinet for all your cell & bioprinting work

High-end 6-axis robotic arm

Enjoy unrivaled precision & automation with fully-motorized robotics

Large 21” touch-screen interface

Operate your bioprinter in optimal conditions with stunning visualization

Bio-extrusion & micro-valve heads

Continue your current bioprinting work & transfer your protocols to NGB-R™

Exclusive laser bioprinting head

Discover single-cell resolution and keep total control over cell distribution patterns

Built-in cellular-level microscope

Get stunning images and monitor your tissues without taking them out of the BSC

HIGH-RESOLUTION LASER-ASSISTED BIOPRINTING, **POIETIS' WORLDWIDE EXCLUSIVE PATENTS**

A decade of research

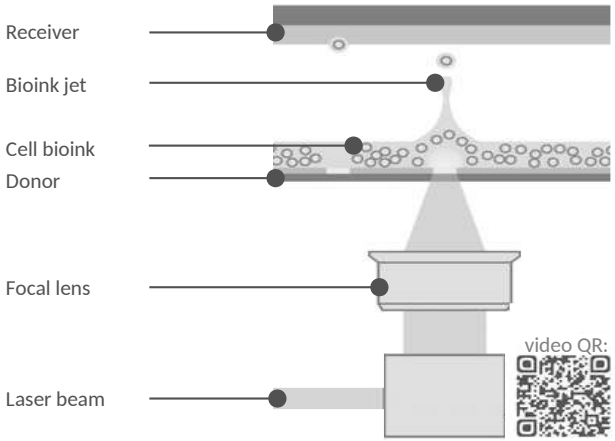
As a result of 10+ years' thorough research at INSERM and the University of Bordeaux, we eventually developed the first and only laser-assisted bioprinting (LAB) platform dedicated to research in tissue engineering and biology.

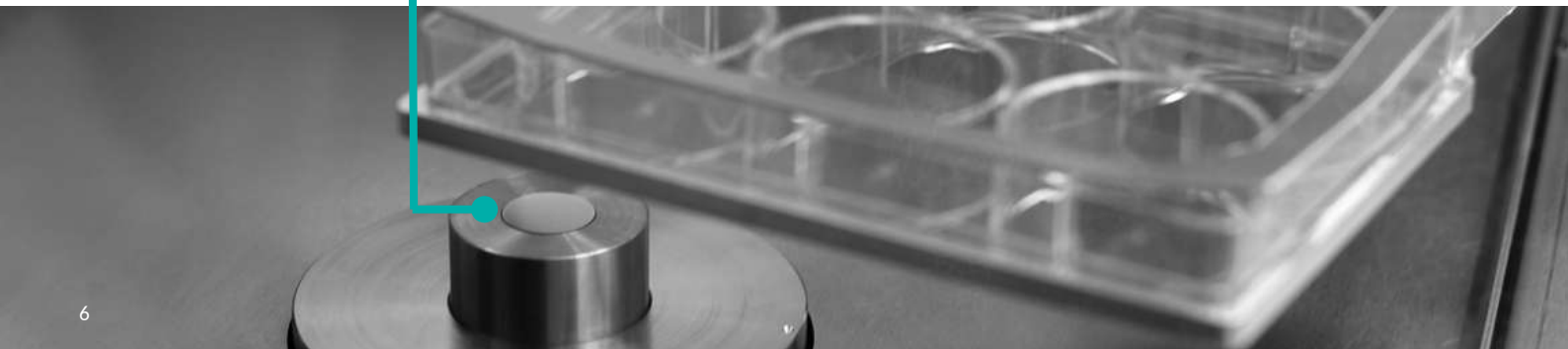
Game-changing technology

Ideal for countless regenerative medicine applications, our laser-assisted bioprinting technology makes it possible to print living cells and biomaterials with a cell-level resolution, giving tissue engineers total control over cells density, distribution and patterns within the printed tissues.

Cell resolution	1 to 100 cells per droplet
Printing speed	10,000 droplets per sec
Precision	10 µm
Droplet volume	from pL to nL
Viscosity	20 to 300 mPa.s min.
Cell concentration	up to 100 millions per ml
Min. bioink volume	from 4µL

How does LAB work?



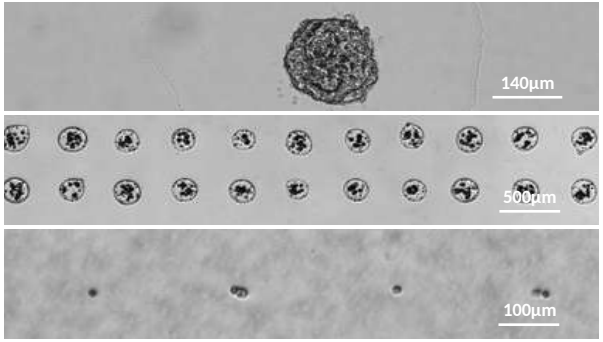


WHY ADD LASER BIOPRINTING
TO YOUR CURRENT EXTRUSION WORK?

All resolution and precision levels available

NGB-R™ is the first commercially-available instrument to boast laser-assisted bioprinting, allowing to deposit micro droplets (with size from 300 to 50µm) of cell bioink with a precision of a few microns only.

With outstanding printing capabilities, all levels of resolution are possible, from aggregates to cellular spots and single cells:



>95% cell viability

With traditional bio-extrusion printing, living cells are subject to significant process-induced forces (pressure, rough shear stress, compressive forces) which cause cell injury or damage.

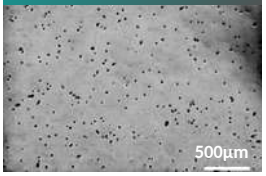
As a nozzle-free printing technique, laser-assisted bioprinting helps overcome this critical issue. Cells are transferred with laser pulse energy, hence do not endure any force whatsoever. So in addition to a high speed of printing, LAB provides much greater cell survival rate and leads to truly functional tissues.

Ideal for cell-loaded bioinks

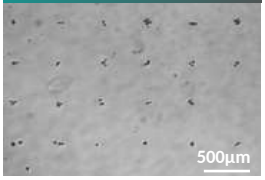
LAB also offers unrivaled precision compared to other printing techniques and thus provides total control over cell distribution and thus cell patterns within bioprinted tissues.

Indeed, all critical parameters (i.e. cell concentration, droplet size, exact printing location) may be optimally adjusted, leading to superior and truly functional tissues.

Bio-extrusion
random cell distribution



LAB
precise cell distribution



Precise and proper cell patterns are key so that cell proliferation and migration occur and specific tissue functions emerge. This could only be achieved with superior resolution and precision.

Publications

Laser-assisted cell printing: principle, physical parameters versus cell fate and perspectives in Tissue Engineering
F. Guillemot et al., Nanomedicine (2010)

Laser assisted bioprinting of engineered tissue with high cell density and microscale organization
B. Guillotin et al., Biomaterials (2010)

Cell patterning technologies for organotypic tissue fabrication
B. Guillotin et al., Trends in Biotechnology (2011)

COMPLEMENTARY PRINTING HEADS,
FOR AN ALL-IN-ONE BIOPRINTING PLATFORM

Up to 3 nozzle-based printing heads

NGB-R™ comes with a bio-extrusion and a micro-valve printing head by default, and a 3rd additional printing head as an option.

These may be used for simultaneous dispensing of cells and biomaterial or an hydrogel without any living cell. Micro-valve (MV) is often used for stable liquid-type biomaterials while bio-extrusion (BE) can work with viscous, gel-type ones.

Transfer your printing work to NGB-R™

You may already be using nozzle-based bioprinting. That is why NGB-R™ allows you to keep working with the techniques you are familiar with, yet add LAB to your current extrusion work and take your tissue engineering further.

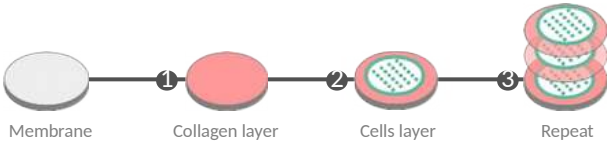
Resolution (BE)	100µm (filament)
Resolution (MV)	100nL (droplet)
Printing speed (BE)	from 1 to 20mm per sec
Pressure (BE & MV)	from 0 to 3 Bar

Complementary techniques, not opposed

We certainly promote laser-assisted bioprinting as a fantastic and better way to bioprint living cells. However, bio-extrusion and micro-valve techniques are far from irrelevant. As a matter of a fact, NGB-R™ is equipped with these printing heads too.

As such, layers of extra-cellular matrix (ECM) or hydrogel (such as Collagen I) may perfectly be printed with bio-extrusion before actual cells are incorporated with laser, layer by layer.

This actually is how our own bioprinted human skin model Poieskin® is fabricated, for both fibroblasts and keratinocytes:



NGB-R™ offers superior versatility, letting you take advantage of every technology available according to your very applications as well as any biomaterials you wish to work with.

PRINTING HEAD ACCESSORIES

Fully customizable printing heads

Configure NGB-R™'s complementary printing slots as you please with up to 3 additional printing heads and plenty of options tailored to your applications.

Bio-extrusion and/or micro-valve, *Peltier* thermoregulated (4 to 60°C) or not, 1, 2 or 3 heads. It's entirely up to you.

UV crosslinking and photopolymerization options

Photocuring is often necessary with several polymer in the gelification process.

365 nm 405 nm

NGB-R™ may therefore be equipped with an optional dual-wavelength 365 and 405nm multichromatic UV lamp.

Tell us what your biomaterials and requirements are and we will provide a tailor-made system configuration for you.

BIOINK & CELL COMPATIBILITY

Versatile, multi-modal solutions

NGB-R™ 4D bioprinting platform was designed as an extremely versatile instrument capable to work with any kind of polymer-based biomaterials. With laser (LAB), bio-extrusion and micro-valve complementary printing heads, NGB-R™ offers a suitable option for any bioink/biomaterial such as:

Biomaterial	NGB-R™
Pluronic F127	●
Collagen I	●
Cellulose nanofiber	●
Hyaluronic acid	●
Matrigel	●
Glycerol	●

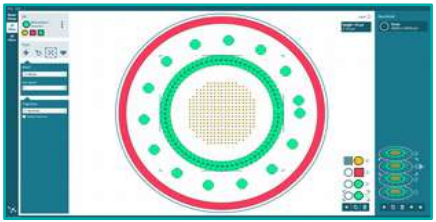
Countless cell types

There are about 200 different types of cells in the human body alone, and with these about 20 different types of structures.

We have successfully experimented with over 40 different cell types as part of extensive research conducted internally in our own labs as well as with academical and industrial partners.

As a result, here is a non-exhaustive list of cells which may perfectly be bioprinted with the NGB-R™ platform: HADSCs, hMSC, HUVEC, EaHY926, Human Osteoprogenitors (HOPs), Fibroblasts, Keratinocytes, Melanocytes, HUT68, HepaRG...

WHAT YOU DESIGN...



CAD > HMI

Save your designs and edit them at any time. When complete, transfer your .bio files over to the NGB-R™ platform in no time. Don't worry, all your parameters may still be edited afterwards.

1

DESIGN

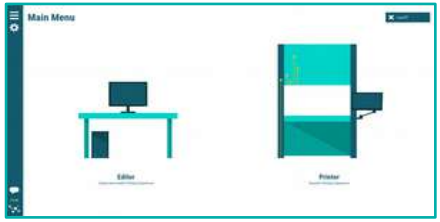
CAD*

Create or import your tissue designs layer by layer, every step of the way. For any cell type, select a printing method, design specific patterns and adjust cell distribution just as you need it.

*CAD = Computer Assisted Design

2

EXPORT



3

ARRANGE

HMI*

The instrument's user interface allows for innumerable options among which is the possibility to organize, sequence and even add printing jobs in a desired order, as well as edit any existing settings.

*HMI = Human-Machine Interface

Design your own tissue constructs...

3 simultaneous printing ways.
Laser, extrusion & micro-valve.

Any resolution.
From tiny to large. Droplets, spots or filaments.

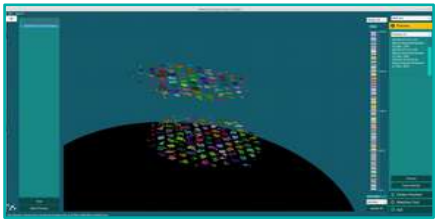
Juxtaposed or overlapped.
Grid or free form. Any way you want.

As many layers as you need.
Copy layers or customize any.

... IS WHAT YOU PRINT

HMI

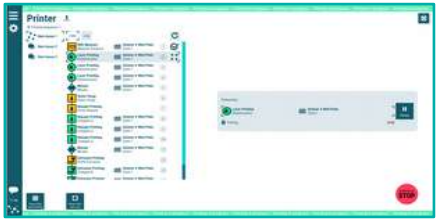
Initiating printing is as simple as a 1-touch process. The rest is a hands-off, automated operation. The NGB-R™ platform follows the exact sequence defined and displays progress on screen.



PIA™

Along with striking visualization tools, PIA™ may also perform image analysis such as measuring patterns diameters, counting cells in every well and much more. All this, fully automatically of course.

PRINT 4



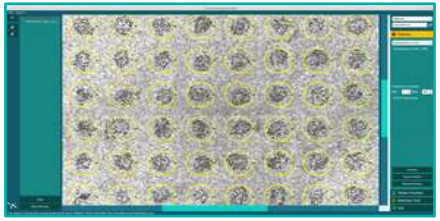
VISUALIZE 5

PIA*

Use the NGB-R™'s cutting-edge imaging devices profitably to monitor printing outcome. PIA™ software allows to recapitulate every single layer as well as view all cells in a stunning 3D mode.

*PIA = Poietis Image Analysis

CONTROL 6



... Or import existing designs

Import your 3D file to NGB-R™. CAD software reads .stl files too.

Integrated slicer. your file is broken down into slices & printable layers.

Converted into NGB-R™ format. CAD turns your file into .bio & exports it.

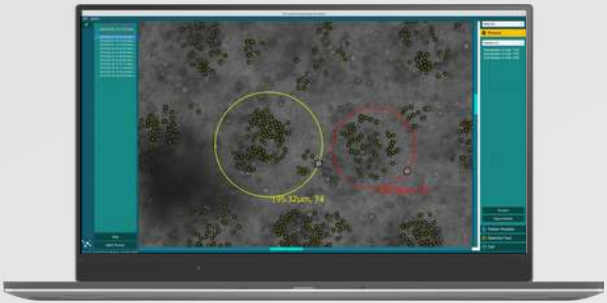
Printed out, layer by layer. Your 3D object is reconstructed.

PIA™, POIETIS IMAGE ANALYSIS

Stunning 3D image visualization

How would you like to automatically get cellular-level images of your printed tissues and cells straight after printing? Ask PIA™. Our software works hand-in-hand with NGB-R™'s integrated microscope to deliver sharp images of every single tissue layer.

PIA™ then reconstitutes an impressive 3D representation of the entire tissue, layer after layer.



In-line 2D & 3D cell patterns analysis

And there is more. On each and every layer of your tissues, the software performs cell patterns analysis which includes automatic and accurate cells counting based on advanced machine learning algorithms. PIA™ then ensures all wells have received an equal number of cells.

PIA™ also calculates valid droplets percentage according to your preferences, parameters and desired number of cells per drop.

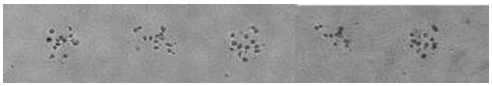
MEET VIEWPRINT™

Print onto precise, selected areas

Some specific receivers such as organ-on-chip devices or in-vivo applications require to print living cells into confined, microscopic areas. That's when ViewPrint™ takes over – yet another Poietis' patented technology for unparalleled precision where it matters the most.

1

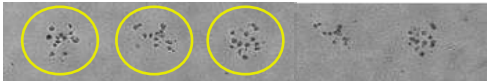
VIEW



Visualize your printed cells just after printing with a built-in cellular-level microscope inside NGB-R™.

2

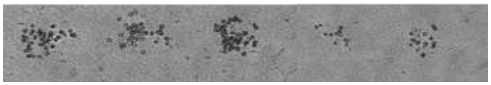
SELECT



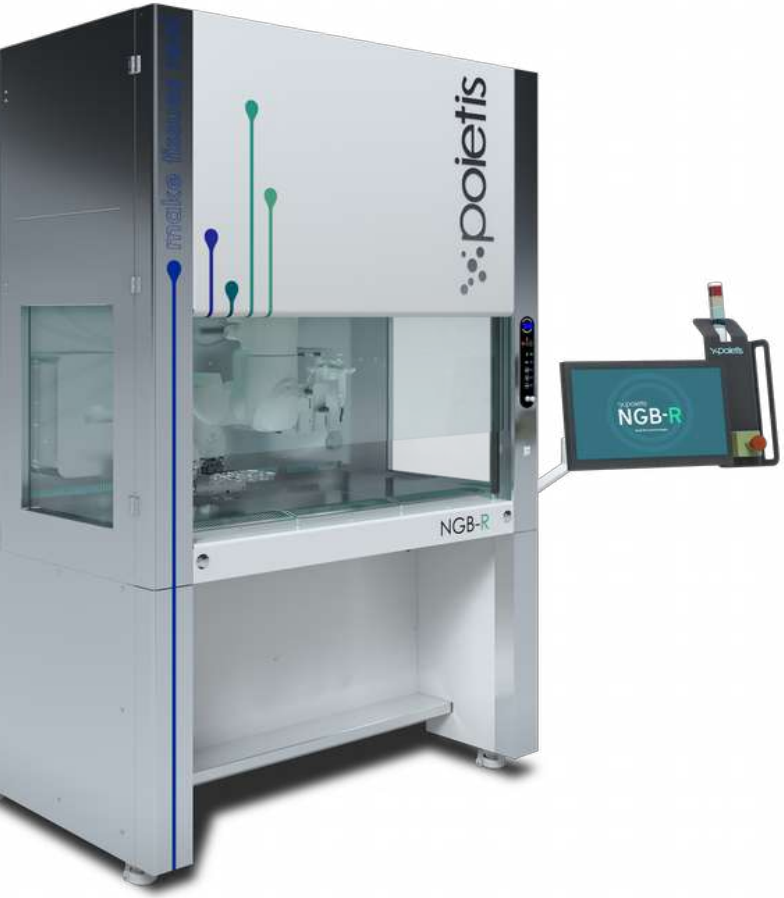
Touch the screen to easily select the exact area(s) onto which you wish print cells.

3

PRINT



Cells get printed onto defined area(s) with laser-assisted bioprinting technology and precision.



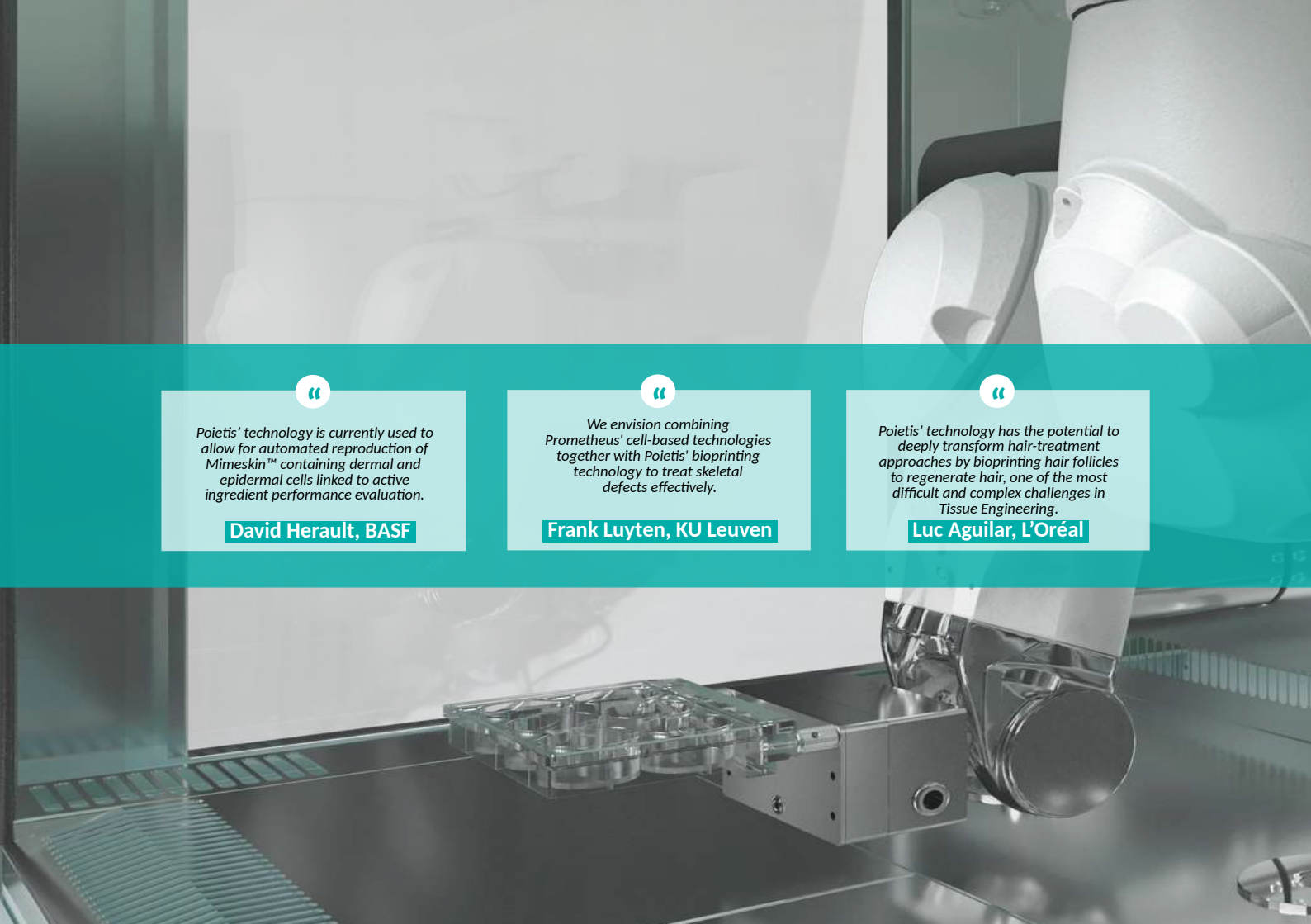
NGB-R™ SPECIFICATIONS

● = included ○ = optional

Printing heads included	Laser, as well as bio-extrusion & micro-valve
Printing process	Automated, hands-off
Printing capability	Standard 6-well & 12-well plates
Biosafety cabinet	●
6-axis robotic arm	●
Computer	●
Interface	21” HD touch-screen
CAD & HMI soft	●
Wide-field camera	○
Built-in microscope	○
UV 365/405nm	○
PIA™	○
ViewPrint™	○
Power	220V or 110V
Warranty	1 year
Warranty extension	○

Full service on LAB consumables

We do also provide ready-to-use metalized glass substrates (15mm or 30mm) required for laser-assisted bioprinting.
How to get yours? Subscribe to a monthly automatic service or purchase packs as you go, whenever needed.



Poietis' technology is currently used to allow for automated reproduction of Mimeskin™ containing dermal and epidermal cells linked to active ingredient performance evaluation.

David Herault, BASF

We envision combining Prometheus' cell-based technologies together with Poietis' bioprinting technology to treat skeletal defects effectively.

Frank Luyten, KU Leuven

Poietis' technology has the potential to deeply transform hair-treatment approaches by bioprinting hair follicles to regenerate hair, one of the most difficult and complex challenges in Tissue Engineering.

Luc Aguilar, L'Oréal

Get a quote or more information
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