

Readily3D

# Tomolite

For rapid, contactless, high-viability  
tomographic bioprinting





## What is volumetric bioprinting?

Volumetric tomographic 3D printing rapidly solidifies photosensitive inks in three dimensions, using shaped light beams from multiple angles. As the entire build volume is illuminated simultaneously, centimeter-scale biological systems are produced in just tens of seconds. After printing, the object is simply separated from the uncured ink and collected.

Our printing method is light-based, so it does not induce any shear stress on the printed cells. The remarkably low photoinitiator content (eg 1mg/mL LAP) and low light dose ( $<600 \text{ mJ/cm}^2$ ) make tomographic bioprinting a cell-friendly technique.

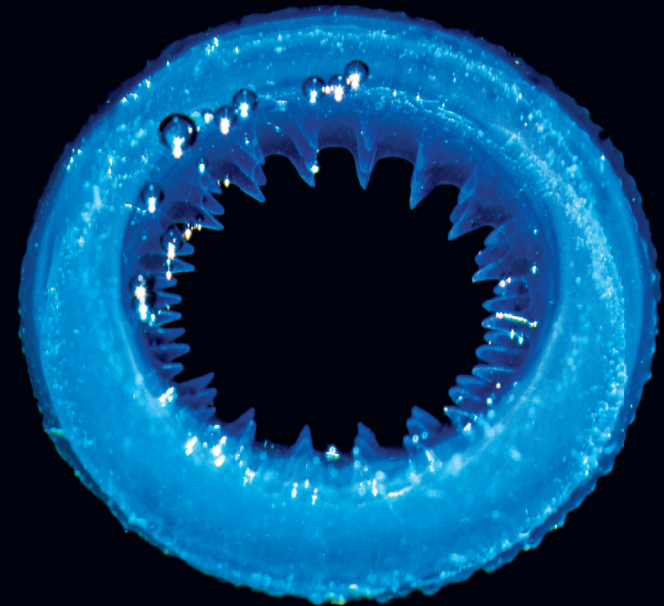
## Swiss-made bioprinters

We are Readily3D, we developed Tomolite and Apparite to make research in biosciences quicker and more efficient. Founded in 2020, Readily3D originates from a research work started in 2017 at EPFL in Lausanne, Switzerland.

The first generation of our 3D bioprinter, the Tomolite v1, was certified and commercialized in May 2021. The second generation, a modular volumetric bioprinter, the Tomolite v2 is certified and commercialized since September 2022.

Currently in use in dozens of laboratories around the world, our volumetric bioprinters led to ground-breaking research and publications in the Life Science community.

# Tomolite Complex living constructs shaped by light



## Tomolite 2.0



### Readily bioprinted

Tomolite leverages our contactless tomographic illumination technology to shape sensitive cells and biomaterials into biological systems, without impairing their viability. Volumetric printing not only preserves cells but also makes research more efficient by simplifying design iterations and statistical studies.

### Modularity and continuous upgrades

The Tomolite v2.0 can be readily used in any work environment since it is a class 1 laser product, accessible radiation is safe under all conditions of normal use. It accommodates different modules such as various laser sources and build volumes. Upgrades and new modules also fit onto this modular platform.

## Benefits



### Fast

Shape hydrogels in 30 seconds



### Cell and organoid-friendly

Low light dose, high viability (>90%)



### Optical resolution

Pixel size of 28 microns



### Modular

Choose between a range of build volumes and wavelengths



### Contamination-free

Print through sealed, autoclavable containers



### Design freedom

Easily print hollow, embedded or overhanging structures

## Extrusion, DLP and Two-photon v.s. volumetric bioprinting



### Extrusion

Shear stress  
< 60% Viability

Limited design freedom

Low-throughput  
< 0,1cm<sup>3</sup>/min



### Volumetric bioprinting

No shear stress  
Increased viability > 90%

Freeform, no support struts

High-throughput  
> 10cm<sup>3</sup>/min



### DLP

Slow (< 0,5cm<sup>3</sup>/min), large dose light  
Low viability

Limited design freedom, supports struts

Limited viscosity



### Volumetric bioprinting

30s to 60s to print  
High viability > 90%

Organic shapes with tunable porosity and vasculatures

Can process gels



### Two-photon

Limited depth (500µm), 2.5D

Low-throughput  
< 10<sup>-7</sup>cm<sup>3</sup>/min

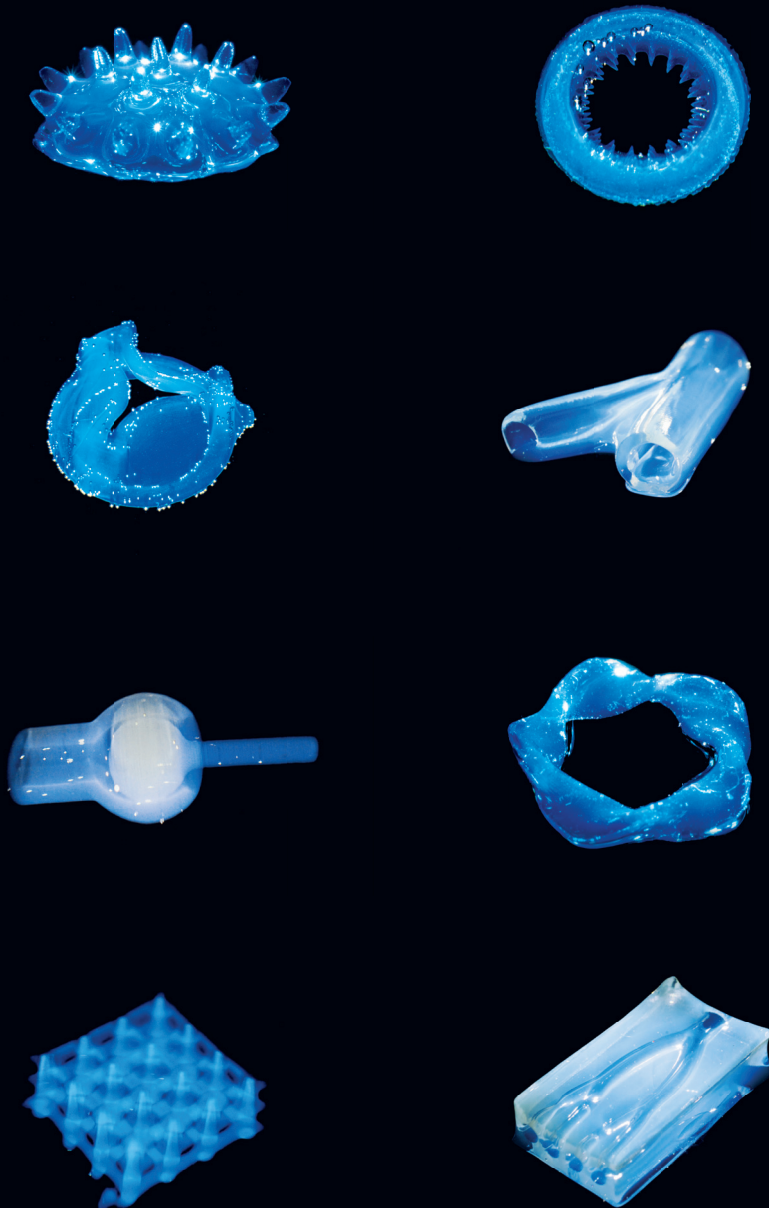


### Volumetric bioprinting

True 3D

High-throughput  
> 10cm<sup>3</sup>/min

## Tomolite v2.0



Specifications & models	Standard	Performance
Pixel size	14µm	28µm
Build diameter	up to 6.3mm	up to 12.5mm
Build height	≥ 12.5mm	≥ 25mm
Container diameter range	5mm -10mm	5mm -20mm
Wavelength*	405nm ± 5 nm	400nm ± 1 nm
Light intensity	1 to 60mW/cm <sup>2</sup> (average at container) ≥ 100mW/cm <sup>2</sup> (maximum peak intensity)	1 to 20mW/cm <sup>2</sup> (average at container) ≥ 45mW/cm <sup>2</sup> (maximum peak intensity)
Indicative print time	20s–120s (depends on material)	
Container materials	Autoclavable and reusable glass vials	
Max. rotation speed	≥ 60°/s	
Compatible materials	hydrogels, acrylics and silicones	
External footprint	27cm x 30cm x 67cm	
Initial accessories kit	Precision chuck adaptor for vials Vial extraction tool	
Laser class	Class 1 laser product: accessible laser radiation is safe under all conditions of normal use. (IEC/EN 60825:1-2014 certified)	

\* other wavelengths available upon request

# An organoid and cell-friendly bioprinter

Examples of organoid and cell types printed to date

Type	Concentration
1 Human hepatic organoids	5.10 <sup>6</sup> cells/ml
2 Human embryonic kidney cells (HEK 293)	4.10 <sup>6</sup> cells/ml
3 Mouse myoblasts (C2C12)	10 <sup>6</sup> cells/ml
4 Normal human dermal fibroblasts (NHDF)	10 <sup>6</sup> cells/ml
5 Equine mesenchymal stromal cells (MSCs)	10 <sup>6</sup> cells/ml
6 Equine articular chondroprogenitor cells (ACPCs)	10 <sup>7</sup> cells/ml

Viability	Construct size	Print time
> 95% after 10 days	Ø 6 mm × h 17 mm	15.5s
—	Ø 8.1 mm × h 9 mm	36s
> 90% after 7 days	Ø 7 mm × h 15 mm	10–11s
> 90% after 7 days	13 mm × 6.0 mm × 2.6 mm	11.4s
—	Ø 8.5 mm × h 9.3 mm	12.5s
> 85% after 7 days	Ø 5.0 mm × h 1.0 mm	—

## Publications

1 Bernal et al., “Volumetric Bioprinting of Organoids and Optically Tuned Hydrogels to Build Liver-Like Metabolic Biofactories”, Advanced Materials (2022)

2 Madrid-Wolff et al., “Controlling Light in Scattering Materials for Volumetric Additive Manufacturing”, Advanced Science (2022)

3,4 Rizzo et al., “Optimized Photoclick (Bio)Resins for Fast Volumetric Bioprinting”, Advanced Materials (2021)

5,6 Bernal et al., “Volumetric Bioprinting of Complex Living-Tissue Constructs within Seconds”, Advanced Materials (2019)



## Publications

### Volumetric Bioprinting of Organoids and Optically Tuned Hydrogels to Build Liver-Like Metabolic Biofactories

Bernal, P. et al., 2022

DOI: 10.1002/adma.202110054

### Tomographic volumetric bioprinting of heterocellular bone-like tissues in seconds

Gehlen, J. et al., 2022

DOI: 10.1016/j.actbio.2022.06.020

### Optimized Photoclick (Bio)Resins for Fast Volumetric Bioprinting

Rizzo, R. et al., 2021

DOI: 10.1002/adma.202102900

### Filamented Light (FLight) biofabrication of highly aligned tissue-engineered constructs

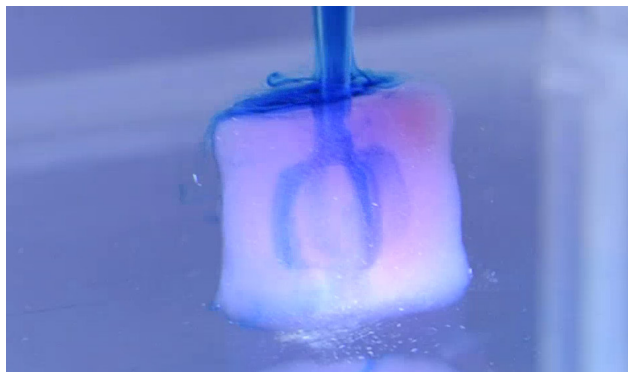
Liu, H. et al., 2022

DOI: 10.1002/adma.202204301

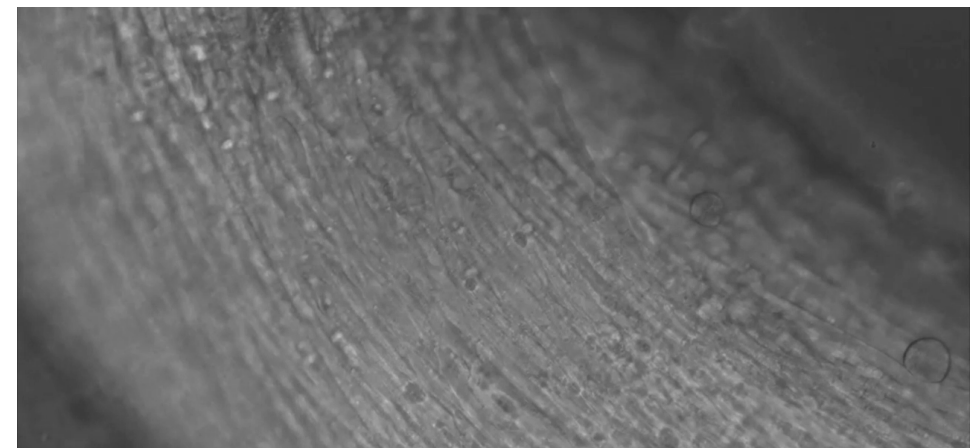
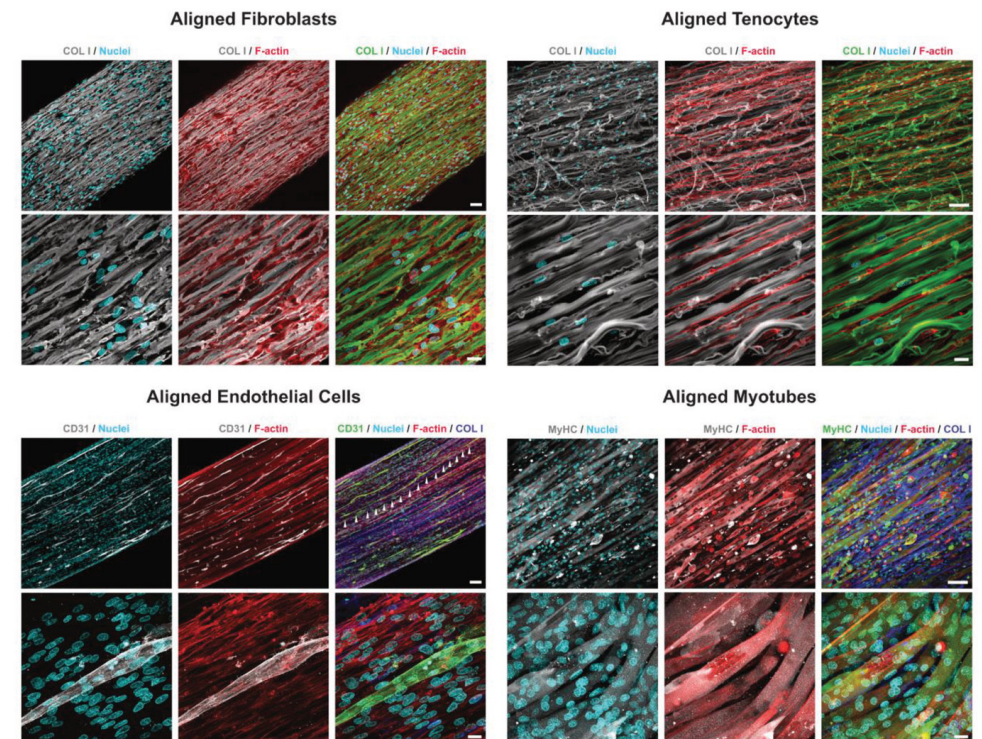
### Volumetric Bioprinting of Complex Living-Tissue Constructs within Seconds

Bernal, P. et al., 2019

DOI: 10.1002/adma.201904209



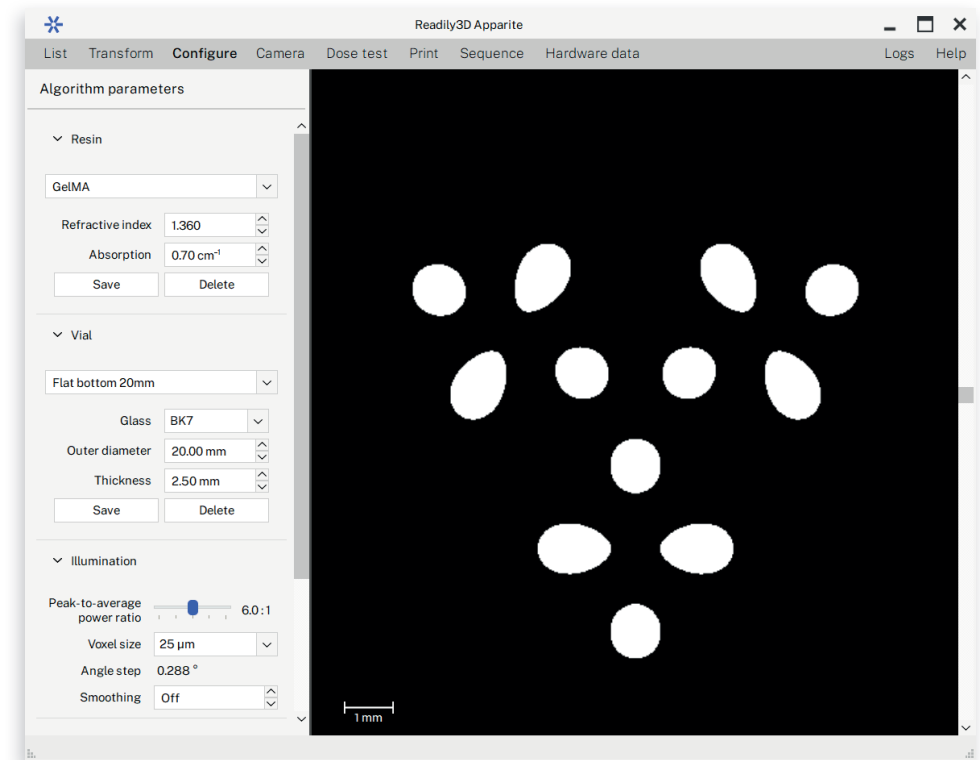
Adapted from Madrid-Wolff et al., Controlling Light in Scattering Materials for Volumetric Additive Manufacturing, Adv. Sci., 2022, License: CC BY 4.0 DEED - <https://creativecommons.org/licenses/by/4.0>



Adapted from Liu et al., Filamented Light (FLight) Biofabrication of Highly Aligned Tissue-Engineered Constructs, Adv. Mat., 2022, License: CC BY 4.0 DEED - <https://creativecommons.org/licenses/by/4.0>

# Apparite

## Rapidly configure and launch your 3D bioprint



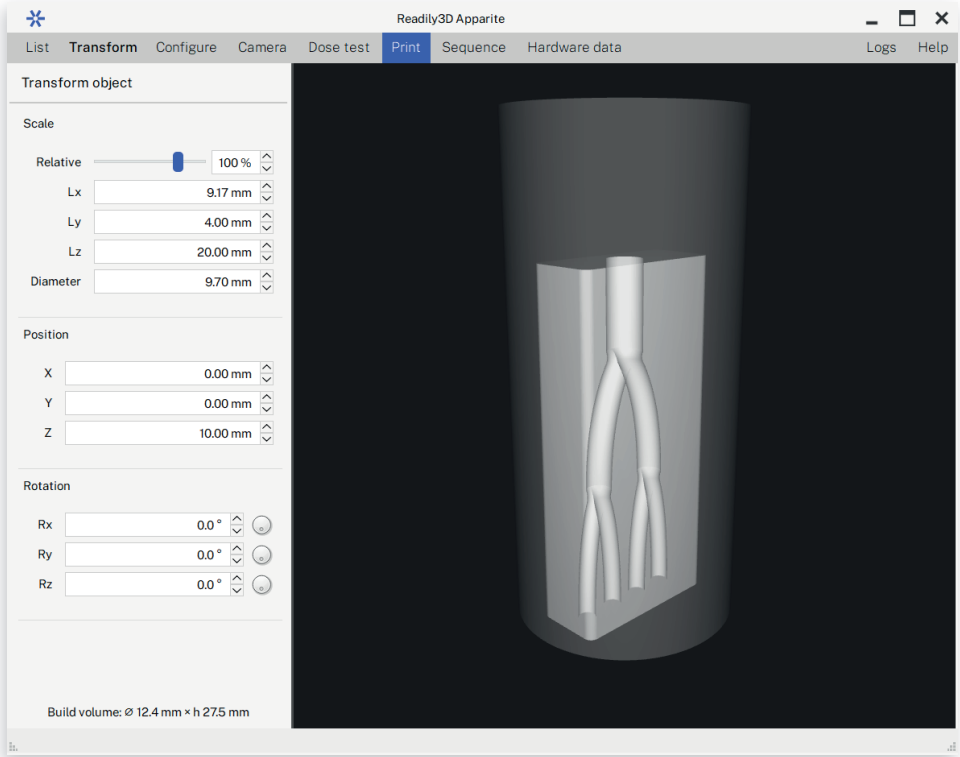
Load,  
Preview,  
Print.

Apparite facilitates the preparation of a print while giving users full control over the process parameters. In a few clicks, import the STL geometry of your constructs, configure the material properties and preview the computed light dose distribution.



# Specifications

3D object format	STL
Multi-object printing	Supported
Transformations	Position Rotation Scaling
Beam computation time	Approximately 30s-90s (cloud-accelerated)
Print parameters	Dose Intensity Exposure time Print speed Number of rotations Projection rate
Computation parameters	Voxel size Angular step Dose contrast Resin compensation
Build volume monitoring	Live camera feed
Print log	Automatic
Dose estimation	Preview of dose distribution before printing Dose test procedure (with small volume of ink)
Supported operating system	Windows 10 and 11



# Contact us

## Let's work together

**Learn more**

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