Cyfuse Biomedical

Construct 3-dimensional Tissue with the unique "Kenzan" method

Bio 3D Printer

regenova

The "Kenzan" method is a novel platform technology for high-density cell architecture

Step 3

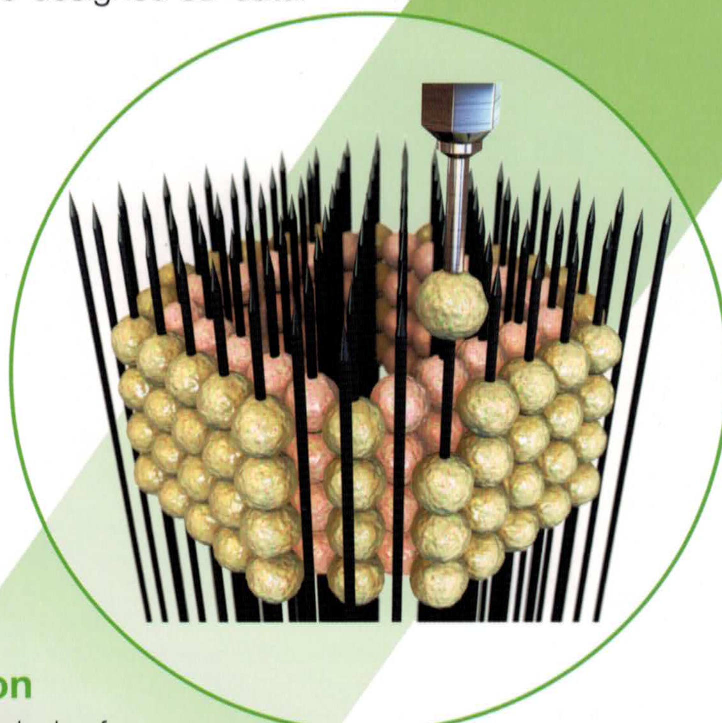
Maturation

Culture 3D-printed tissue in a bioreactor to promote self-organization of cells until the tissue presents the desired function and strength.

Step 2

3D Printing with the "Kenzan" method

Assemble cellular spheroids into a three-dimensional shape on Kenzan according to the pre-designed 3D data.



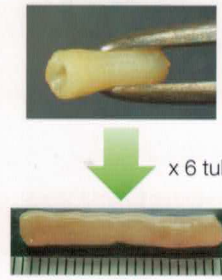
Step 1

Spheroid preparation

Form cellular aggregates with single of mixed cell types.

Blood Vessel

The Kenzan method allows tubular cellular structures suturable with host tissue in vivo. Our goal is to aid in vascular access in dialysis patients, coronary artery bypasses, and revascularization for severe limb ischemia. This innovative technology contributes to overcoming the problems of infection and stenosis associated with current polymer-based artificial blood vessels on the market.



Scaffold-free cellular tube after the maturation process

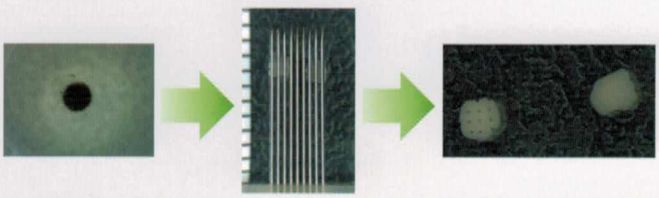
x 6 tubes

2-3 cm tube fused for 7 days

*Co-research with Dr Itoh et al, Saga University. This project is funded and supported by AMED.

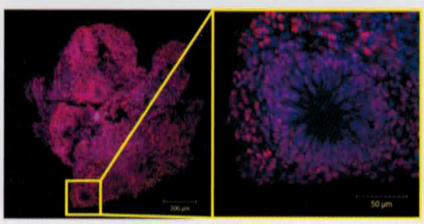
Nerve

Nerves are difficult to construct as a functional 3D structure. 3D human neural tissue printed with the Kenzan method retains the viability of neural stem cells and neuron in 3D tissue. This novel technology could be used for regenerative treatment in neurological disorders, including spinal cord injury and cerebral infarction, for which the current therapy has limitations.

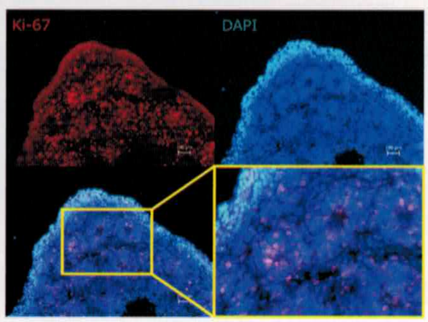


Human iPSC-derived neural progenitor cells cultured on Kenzan for 10 days.

'Rosette structure', which is the sign of neural differentiation from stem cells.



Proliferation of neural progenitor cells was seen in the Rosette structure.

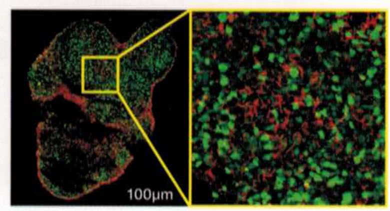


*Co-research with Dr Fujita et al, University of Tokyo, Japan

Neurosphere, 350 µm in diameter

3D printed + 4 days maturation

The viability of neural stem cells and neuron was observed.



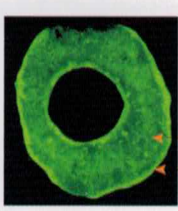
3D neural tissue

Neural stem cells (Green)
Neuron (Red)

*Collaboration with Prof Nakatsuji (Kyoto University) and Prof Okano (Keio University). This project is funded and supported by AMED.

Liver

Transplantation of miniature livers is expected to improve liver function*. Miniature livers are also expected to allow evaluation of long-term toxicity as an ex vivo model for investigating disease mechanisms and drug metabolism in the drug-discovery process.



3D liver tissue shows self-sorting and self-organization according to cell types

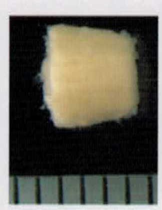
Hepatocyte

Endothelial cells

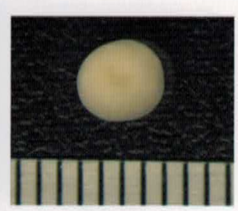
*Co-research with Dr Yanagi et al, Kyushu University, Japan

Cartilage and subchondral bone

Currently damaged articular cartilage has very limited potential for healing. Transplantation of our mesenchymal stem cell construct enables regeneration of cartilage and subchondral bone at the damaged area.



Removal from Kenzan



1 day after removal

*This project was funded and supported by NEDO.

How does the "Kenzan" method work?

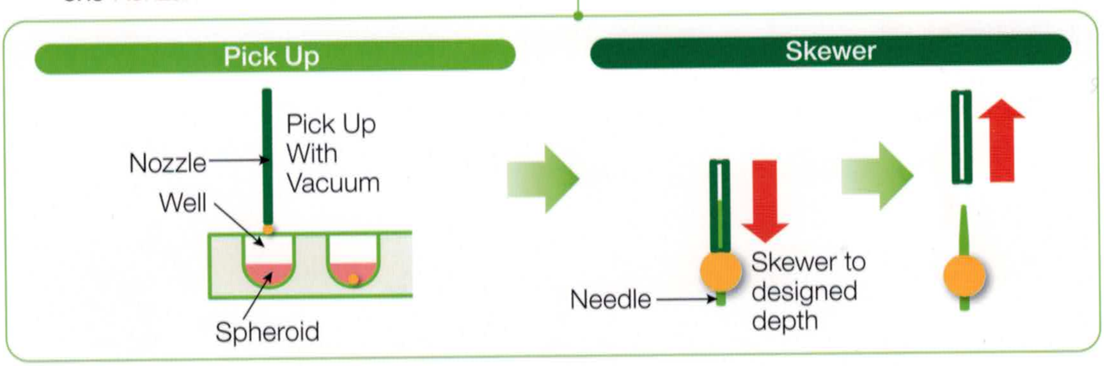
01 Prepare Spheroid

02 Design

03 3D Print on Kenzan


9x9 Kenzan

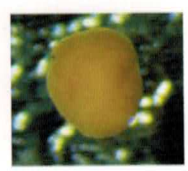

After Print



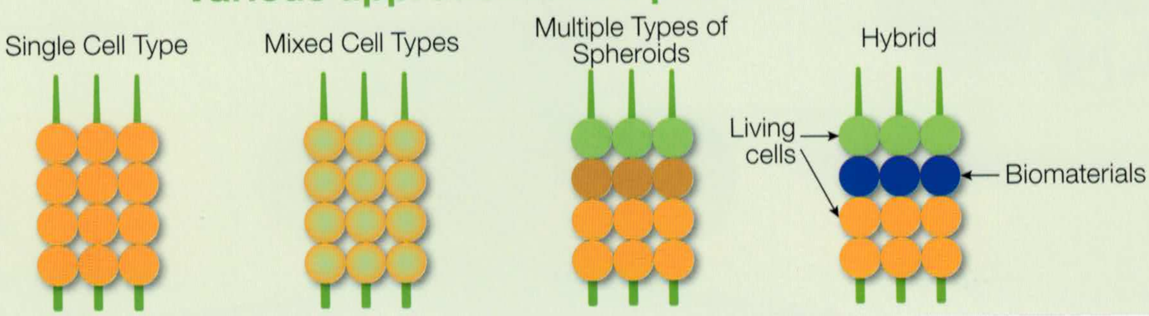
04 Maturation


Maturation on Kenzan


Immediately after removal from Kenzan


After maturation

Various approaches are possible



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Proprietary Technology

The Kenzan method was invented by prof Koichi Nakayama (Saga University) and is globally patented intellectual property.

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Weight	385 kg
Components	Main body unit
	Computer
	Air compressor
	3D design software
Size of Main Body Unit	W1340 X D825 X H1740 mm
Operating Voltage	AC 120V
Kenzan (Needle Array)	Single needle diameter: 170 µm Applicable length: 10 mm Pitch: 400 µm Type: 9X9 (Standard: 81 needles, For tubular construct: 60 needles) 26X26 (676 needles)
Spheroid specification	Size: diameter 400-600 µm Cell multiplicity: Up to two types of spheroids in one batch

Kenzan is used in Ikebana flower arrangements to hold the stalks of flowers, branches and other plant material steady. The base is as heavy as lead, and has many needle-like prongs stuck in it.

Ikebana began as flower offerings to the gods and Buddha. Around the end of the 16th century, a number of Ikebana styles and techniques developed, and before long, flower arrangements were admired as works of art.

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