



神戸大学

Self-immobilizing microfiber sheets

enabling exosome production, cell sheets for regenerative therapy,
and separation of minute plasma volumes

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【Background】

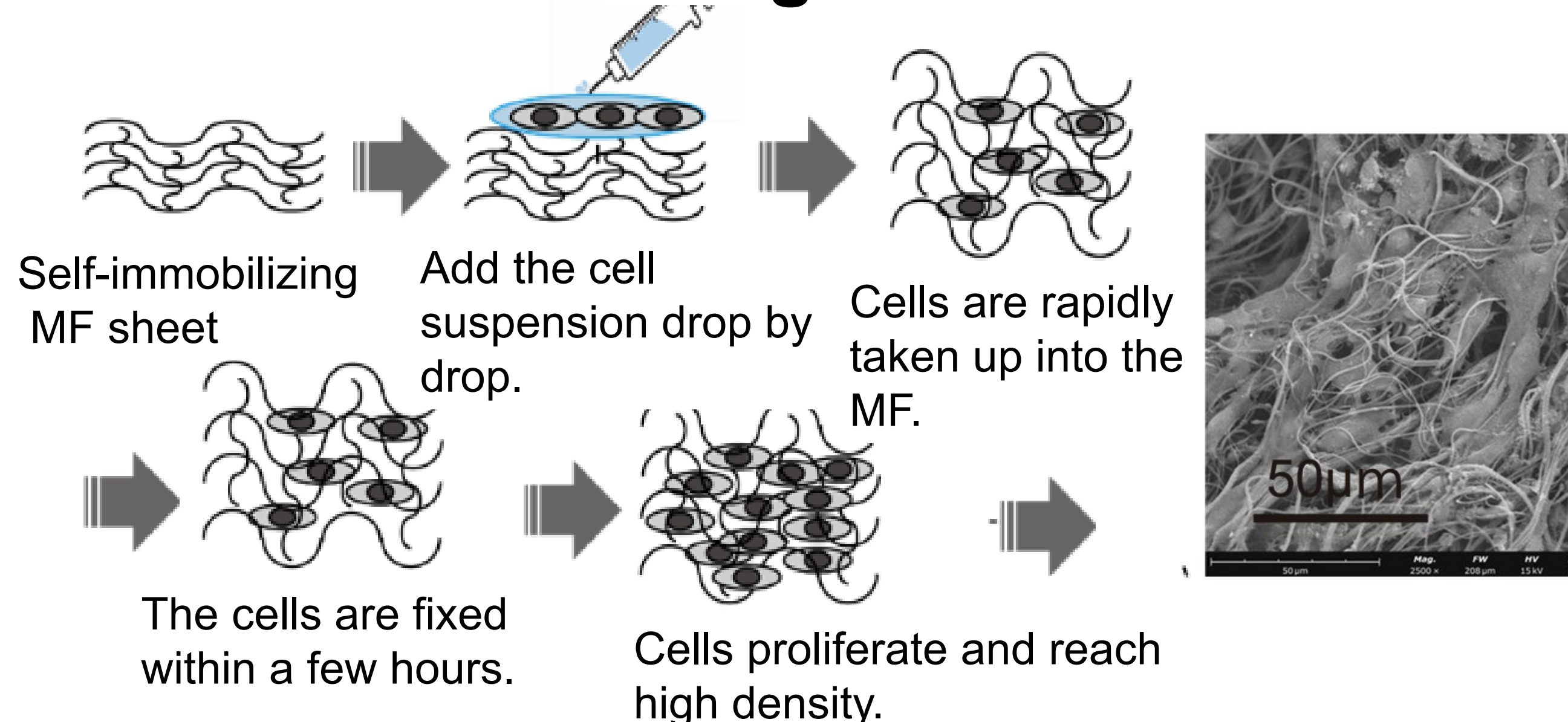
Regenerative medicine utilizing stem cells and therapies employing exosomes secreted by cells are currently attracting significant attention. "Scaffolds"—structures capable of three-dimensionally arranging and immobilizing animal cells—play a crucial role in supporting these forms of regenerative medicine. However, there is a shortage of scaffolds capable of efficiently immobilizing cells with low adhesiveness; consequently, the development of such scaffolds is an urgent priority.

【Previously Technology】

This study developed "self-immobilizing microfibers (MF)" by a reverse approach. With this microfiber, the swelling properties of the material allow cells to penetrate and become trapped within the fibers, where they are subsequently immobilized during the brief period of entrapment. This is a unique characteristic not found in conventional technologies, and it holds promise for future applications across various medical fields.

Technical Significance

Self-immobilizing microfiber sheet



Advantages of immobilization

Allows for uniform immobilization.
Immobilization is completed within a few hours.
Prevents loss of supplied cells.
Can be used with cells that have low adhesiveness.

Advantages of culture process

Allows for high-density immobilization.
Features internal voids that maintain cellular activity.
Compatible with standard dishes and flasks

Advantages of preservation

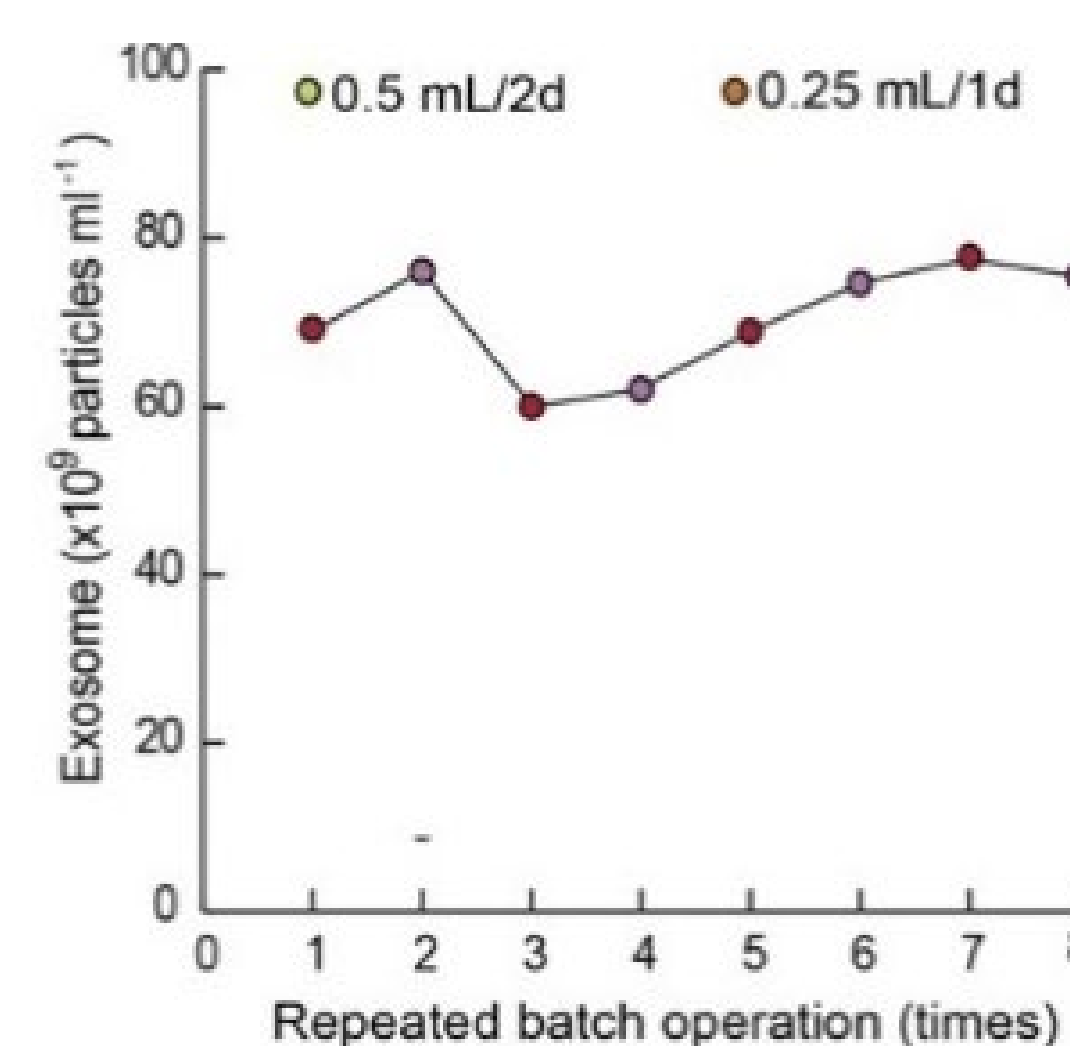
Autoclavable
MF can be stored at room temperature
Fixed cells can be cryopreserved

↑ Significant points ↑

Three advantages of use in medical applications

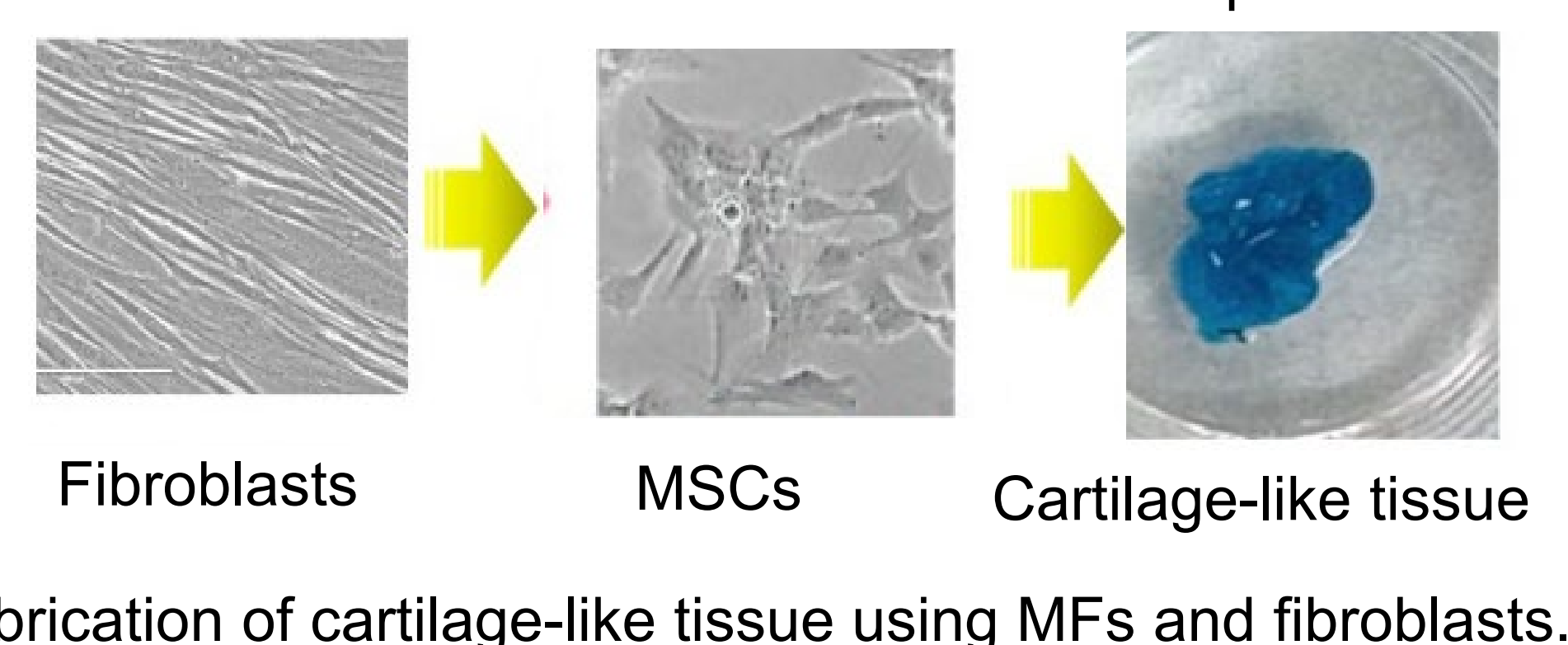
1. High-density continuous production is possible with the MF-type bioreactor.

Supplied cells can be 100% immobilized within a few hours, enabling ultra-high-density culture. This allows for the continuous, high-density production of vesicles such as exosomes.



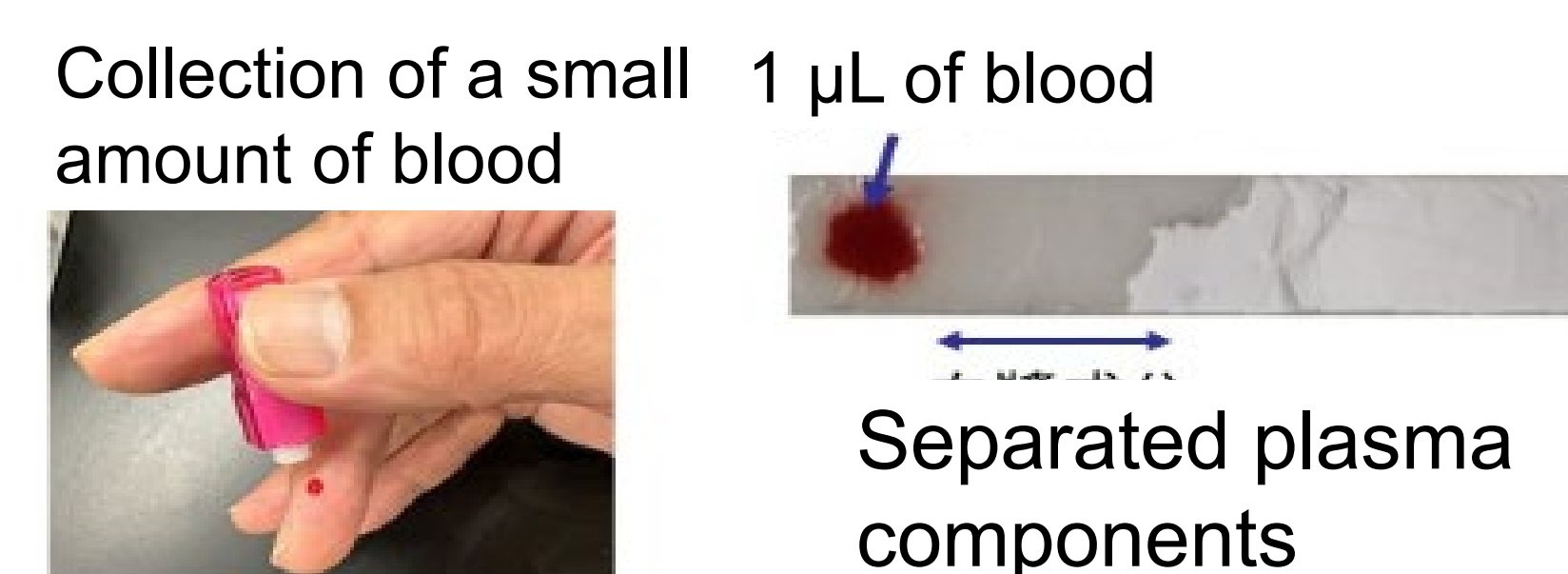
2. Enable the production of cell sheets for regenerative medicine in a short period of time.

Just by dropping cells onto this MF sheet and letting them sit for a few hours, creating a cell sheet. Moreover, immobilized stem cells can be differentiated into various cell types for use in regenerative medicine.



Enables plasma separation from minute amounts of blood.

Capable of recovering plasma components and exosomes from just 1 µL of blood! By utilizing finger-prick blood, it enables the creation of new POCT systems.



Future Prospective

【Possible Applications】

We have improved the operability, biocompatibility, and blood separation performance of self-immobilizing MF sheets and established their manufacturing process. Furthermore, we have been developing prototypes of MF-type bioreactors, cell sheets for regenerative medicine, and plasma separation sheets, and are advancing research toward their practical application.

【Possible Collaboration】

We are seeking a company interested in applying this MF sheet to the medical field and eager to actively support its implementation in society.

【Publications & IP】

- N. Shiomi *et al.* Biotechnol Lett, 47:40 (2025).
- N. Shiomi (ed) "Advances in Metabolic Syndrome and Hypoglycemia, InTech Book (2026).
- N. Shiomi et al., Microfiber material for cell immobilization, PCT/JP2025/037192 (2025)
- N. Shiomi, Method for producing pluripotent stem cells, JP Patent No. 7033318
- N. Shiomi et al, Whole blood separation method using a microfiber material to separate blood cells and plasma from a diluted solution. Patent application 2026-002900 (2026)

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