Biotechnology | Medicine | Smart materials | Technology Offer

Biocompatible 3D cell culture system with shape memory effect for gentle and efficient cell cultivation & release

Field of application

An increasing number of scientists are working on three-dimensional (3D) cell culture systems, which have become essential for research, regenerative medicine and drug testing.
The macroporous 3D cell culture system presented here is based on cationized proteins. It allows users to cultivate cells under in-vivo-like conditions and to gently include them in and release them from the scaffold using mechanical forces only.

State of the art

Two-dimensional (2D) cell carriers such as standard cell culture plastics are often used for the cultivation of eukaryotic cells. Their architecture and composition hardly resemble the in-vivo situation in tissues, which can influence both the natural development of the cells and their function. Well-known 3D scaffolds often consist of natural or synthetic polymers that mimic the natural environment of cells in tissue. The imperfect colonization of the 3D structures with cells is often unsatisfactory, so that relatively complex methods such as centrifugation or pumping systems must be used to introduce the cells into the structures. Furthermore, the shear stress that occurs during such treatments can affect the behaviour of cells. At worst, it can even impair the viability of the cells. Therefore, especially sensitive cells cannot survive this kind of colonization of 3D cell culture systems undamaged.

Innovation

As part of a project funded by the Baden-Württemberg Stiftung gGmbH, scientists of the Karlsruhe Institute of Technology (KIT) and Ulm University succeeded in developing an easily reproducible and low-cost 3D cell model whose macroporous scaffold is based on cationised bovine serum albumin (cBSA). This elastic scaffold structure, which is variable in its pore size and water content, has sufficient stiffness to be free standing and at the same time it is so flexible that it can regain its original shape like a sponge after deformation (shape memory effect). This effect allows gentle cell uptake by compressing (squeezing) and simply absorbing the cells from a liquid medium (by passive decompression of the scaffold). After cultivation, the cells can be isolated from the structure just as easily by squeezing and/or rinsing the scaffold with a suitable solution.

Your benefits at a glance shape memory effect

- ✓ Efficient, gentle colonization and isolation of cells or cell components
- ✓ Simple, cost-effective fabrication of the protein-based 3D scaffold
- ✓ Biomimetic imitation of the extracellular matrix
- ✓ Cell-cell interaction in confined spaces
- ✓ High stability during incubation
- ✓ Adaptable architecture and material properties

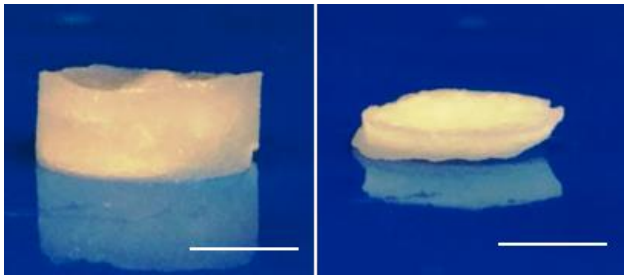

Figure: Photographs of the cBSA structure (5 % (w/v)): completely filled with water (left) and after emptying by mechanical squeezing (right), Scale: 0,5cm [Source: KIT].

Technology transfer

Technologie-Lizenz-Büro GmbH is responsible for the exploitation of this technology and assists companies in obtaining licenses.

Patent portfolio

A DE application is pending.

Contact

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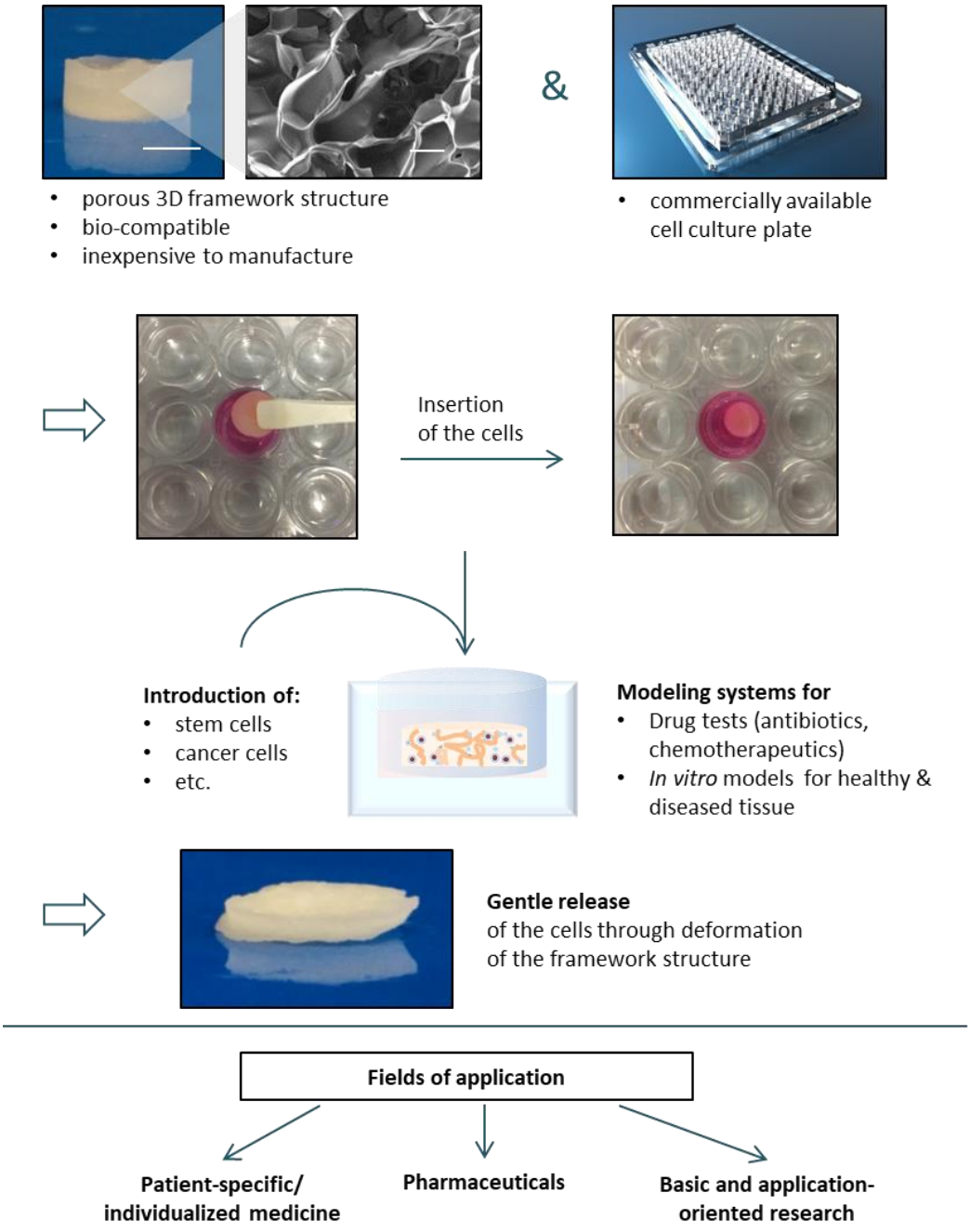

Figure 2: Use of the ingenious 3D cell culture system (top) and possible applications (below) [Sources: KIT, fotolia.de].

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