Gluing Cells

July 21 2006

The adhesion and growth of cells on solid carriers is required for many applications. Laboratory-cultured tissues, diagnosis chips, and biosensors all have something in common: Cells need to be attached to the surface.

Suitable surfaces that induce the adhesion of cells are available, yet, there is no simple method to attach cells onto carriers at defined positions, such as in a particular pattern. The ordering of different cell types in a precise alignment was, until now, extremely complicated.

Researchers from the University of Oldenburg have now developed a simple microelectrochemical method by which cells can be "glued" to an exact position on a carrier. Chuan Zhao, Irene Witte, and Gunther Wittstock have also shown that it is possible to adhere, in the same way, a different type of cell at a different location.

The carrier or chip is covered by a continuous thin coating of a material that has ethylene glycol units as free end groups. On such a coated surface, however, it is almost impossible for cells to stick. The Oldenburg research team had found, previously, that treatment with an oxidizing substance such as bromine instantly changes the antistick surface to one that is attractive to cells. This effect can also be applied to small and specific areas if the bromine is directly aimed to come into contact with these defined surface areas. To achieve this, the help of microelectrodes and a solution that contains bromide ions is required.

The electrode is positioned close over selected positions of the carrier, and a short potential pulse is applied. As long as the microelectrode is

on, the bromide ions will be converted into bromine. The bromine acts on the local area of the surface, however, too little bromine is formed to react extensively with the whole surface. Like a pen, the microelectrode "draws" a pattern on the carrier. If the carrier is incubated with a protein solution, then all the sites that were previously treated by the microelectrode are deposited with the protein from the solution.

It is in these positions that the cells then settle. In this way, the researchers were able to cultivate human fibroblasts in a particular pattern. A second fibroblast population could be specifically adhered at further points by repeated electrochemical treatment.

Says Wittstock: "By stepwise site-directed introduction of different cell types onto the surface, our method could facilitate the formation of micropatterned co-cultures and, therefore, contribute to in vitro investigations of multicellular interactions and to tissue engineering".

Citation: Gunther Wittstock, Carl-von-Ossietzky-Universität Oldenburg, Switching On Cell Adhesion with Microelectrodes, *Angewandte Chemie International Edition* 2006, 45, No. 33, doi: 10.1002/anie.200601151

Source: Angewandte Chemie