Press release

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International Workshop: Stem cells and Medical Materials

All-rounder helps to heal damages bones

For the first time ever, Europe's leading researchers in the field of mesenchymal stem cells met at the Empa in St. Gall from the 7th to 9th November. These hitherto neglected cells could soon lead to decisive changes in the treatment of arthritic hip-joints and complicated breaks in bones.

The situation is paradoxical. There exists an interesting family of cells which demonstrate more than a hint of interesting medical applications, but which enjoy at best a step-motherly status amongst stem cell researchers. An additional disadvantage is that the few groups that do research on these so-called mesenchymal stem cells have till now had very little interaction with each other. "There is a lot of contradictory data about bone precursor cells," the Empa's Dr. Katharina Maniura, a cell biologist complained, referring to the current unsatisfactory situation. She decided to improve things by organizing a stem cell workshop together with Dr. Arie Bruinink, the Head of the Empa MaTisMed Team (MaTisMed being the acronym for «Materials and Tissues for Medicine»). The leading research teams in Europe were invited to the Empa from the 7th to the 9th of November.

Commercially interesting bone replacement material

Mesenchymal stem cells are one of the adult stem cell types which, in contrast to the all-singing, all-dancing embryonic stem cells, to date have only been made to develop a limited number of different kinds of tissues, with bone, cartilage, muscle and skin being the most important types. They are found primarily in bone marrow, but also elsewhere in the body such as in umbilical blood or fatty tissue.

One possible application for these versatile cells is to aid in the production of optimized materials for bone implants, such as, for example, those used in artificial hip joints. Beyond this, it might one day be possible to grow bone replacement material using a patient's own bone marrow. Given the huge number of hip replacement operations and the currently unsatisfactory healing rate for bone disorders, it is clear that mesenchymal stem cells show great promise – not least for commercial reasons.

But stem cell research is not yet quite that advanced. The precursor cells do not always behave as the researchers would like. “Our fundamental knowledge about these cells is still to a large extent incomplete. One reason for this is that the various studies which have been made are difficult to compare, since each research group uses a different method. And on top of this, the data has been interpreted in part based on different philosophies,” explained Arie Bruinink.

Stem cell researchers harmonize their methods

The three day stem cell workshop brought to light a range of problem areas involving mesenchymal stem cell research. On the first afternoon of the presentations, the topic was quite simple: how in a soup of bone marrow cells does one find the stem cells which are capable of transforming themselves into bone cells? “Every laboratory has its own favorite cell surface protein which it uses to sort the cells,” explained Manuira. However, with these surface proteins it is usually neither clear what their actual functions are nor how specific they are for mesenchymal stem cells. And as a consequence of this uncertainty, the results of the various research teams contradict one another. The workshop has now brought a little more clarity to the situation. “It was very helpful to be able, once and for all, to compare the various methods we have been using,” said Bruinink.

On the second day of the workshop, the scientists discussed the optimal conditions for cells to differentiate in the required direction. After this the subject was phenotyping, the search for molecules which show in which direction a cell is currently developing. “We save a great deal of time and money if we can determine early on whether a cell will develop into fat, cartilage or other tissue,” said Maniura.

At the end of the last day, an open discussion was held on the course the workshop had taken. Contradictions which had arisen during the conference were analyzed, ways forward were identified and ideas for new projects took shape. “It was a very fruitful discussion,” said Bruinink happily.

Unwanted fat cells

At the Empa, Arie Bruinink’s MaTisMed team has been working in the field of mesenchymal stem cells, among others. In the foreground of this research is the interface between the living cells and the implant material, as well as tackling the problem of growing the necessary tissue. The group has been attempting to make the stem cells in cultures differentiate into the required tissue types. With the correct concentration of vitamins C and D, together with a source of phosphates, it sometimes works. Often, however, the stem cells develop into fat cells – “Not, of course, what we are looking for,” said Bruinink.

The reason for this unwanted differentiation probably lies in the origin of the cells. The MaTisMed team obtains them from the Cantonal Hospital in St. Gall, where they are extracted during hip operations. Since the donors are mostly elderly and not physically very active as a result of their hip problems, their mesenchymal stem cells are in the genetic program mode which produces fat instead of bone cells. The Empa group is searching for a solution to this particular problem, and the stem cell workshop has given it a significant boost. The two initiators of the conference are hoping that this European meeting will take place regularly in the future. One thing is certain though: the three day workshop at the Empa has taken research into mesenchymal stem cells a giant step forward. Cooperation between the various laboratories working in the field will also be much closer in future.

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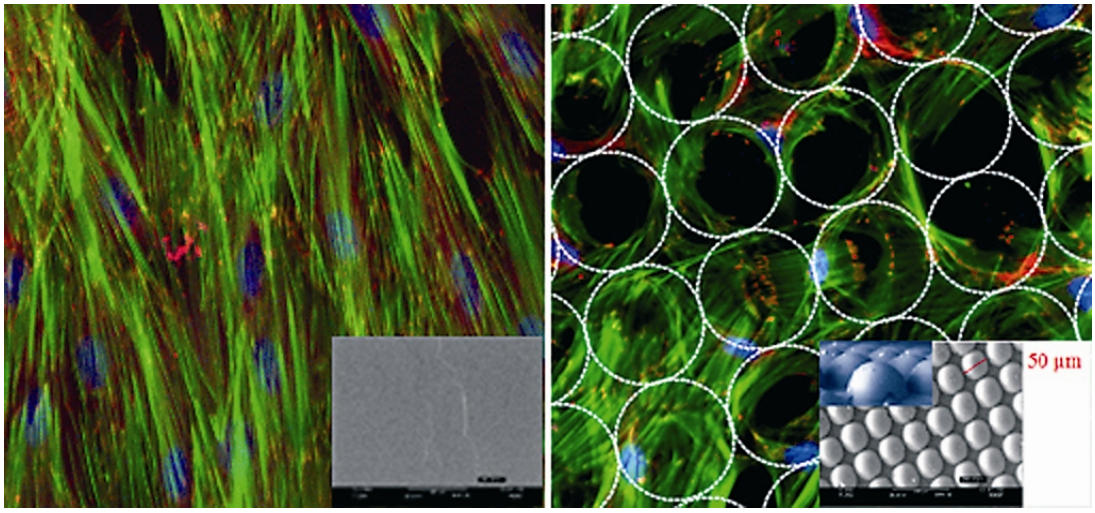

Human mesenchymal cells on structured surfaces: left, unstructured; right, hemispheres.
To improve visibility, the three cellular proteins have been stained: blue, core; green, F-Actin; red, Vinculin.

Intensive discussions: (l-to-r) Prof. Moustapha Kassem, University Hospital of Odense (DK), Dr. Heide Siggelkow, Medical Faculty, Göttingen University (DE), Dr. Arie Bruinink, Head, MaTisMed, Empa St. Gall.