

## Cancer stem cells – The long road to targeted therapies

**Researchers working on cancer, stem cells and cancer stem cells convened for the fifth time at the German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) in Heidelberg on September 28<sup>th</sup> to 30<sup>th</sup>, 2014. About 400 experts from around the world discussed the role of cancer stem cells in various forms of the disease, considering questions such as how they sustain tumors and cause metastases and how they interact with their immediate environments, known as “stem cell niches.” Researchers have gained an ever better understanding of the fatal tricks that cancer stem cells play to survive, and the first attempts to target these cells through therapies have delivered positive results. The next major milestone will be to translate discoveries about the cells into novel treatments. The symposium was funded generously by the German National Academy of Sciences Leopoldina and by the Heidelberg-based Heinrich F.C. Behr Foundation, which has supported seven other international meetings at the DKFZ in the past.**

Cancer stem cells are considered to be the most dangerous types of cells in a tumor: Not only do they give rise to a tumor, they provide a constant supply of new cancer cells to help the tumor survive. Scientists suspect that the direct offspring of these cells have a unique capacity to break away from a solid tumor in one tissue and spread to form dreaded metastases in other parts of the body. Unfortunately, these cells are not very sensitive to conventional forms of chemotherapy or radiotherapy. They are therefore regarded as the main culprits that cause cancer to recur after treatments that initially appear to be successful.

“We are convinced that we can only overcome cancer if we manage to track it to its roots and eradicate cancer stem cells,” says Prof. Dr. Dr. h.c. Otmar Wiestler, Chairman of the Management Board and Scientific Director of the DKFZ, and initiator of the stem cell conferences at the Center. “We are very pleased about the extraordinary resonance to our conference, which has already been ‘fully booked’ for several weeks.”

Another researcher whose work has begun to focus on the stem cell niche is conference co-organizer Professor Andreas Trumpp, head of DKFZ’s Division of Stem Cells and Cancer and Managing Director of the Heidelberg Institute for Stem Cell Technology and Experimental Medicine (HI-STEM) of the DKFZ and the Dietmar Hopp Foundation. “Niche cells surround cancer stem cells and support them as they trigger processes that are ultimately fatal. It is therefore vital to keep an eye on niche cells in our efforts to find new approaches in cancer treatment.”

A team led by Dr. Haikun Liu of the DKFZ has recently achieved the first positive results on the road toward specifically blocking stem cells responsible for brain cancer. A key step was the group’s identification of a protein called Tlx that seemed to be uniquely active in the cancer stem cells of brain tumors. Switching off Tlx in mice with tumors led to cancer stem cells which lost their ability to renew themselves and a longer survival time for animals with the disease. “Highly humans have properties resembling those of the brain tumors we studied in mice. Human tumor stem cells also produce Tlx, making the protein a new target in combatting these highly aggressive cells. We hope that interfering with its functions will help us check the growth of aggressive brain tumors in humans.”

The organizers from the German Cancer Research Center and the German Consortium for Translational Cancer Research (DKTK), the U.S. National Cancer Institute and the National Academy of Sciences Leopoldina invited an elite cast of prominent international stem cell researchers to the conference. John Dick of the University of Toronto is credited with the first identification of cancer stem cells. He reported on the discomfoting finding that nearly everyone hosts the precursors of cancer stem cells in their bodies. His Canadian team discovered such “pre-leukemic” stem cells in the bone marrow of healthy study subjects. Elaine Fuchs of Rockefeller University in New York City investigates when and how skin stem cells leave their normal path of development to become cancer stem cells. Frederic de Sauvage, of Genentech Incorporated in San Francisco, California, showed spectacular results from trials of a first drug that specifically targets skin cancer cells. Mina Bissell of the University of California in Berkeley is studying the micro-environment of breast cancer cells, which she is convinced plays an important role in the development of metastases.

“We are also particularly pleased that the conference gives our young researchers an opportunity to talk to stars of stem cell research during the ‘Speakers’ Lunch,’” says Wiestler. “We are convinced that this field of research will play an ever more important role in cancer research in the future.”

The German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) with its more than 3,000 employees is the largest biomedical research institute in Germany. At DKFZ, more than 1,000 scientists investigate how cancer develops, identify cancer risk factors and endeavor to find new strategies to prevent people from getting cancer. They develop novel approaches to make tumor diagnosis more precise and treatment of cancer patients more successful. The staff of the Cancer Information Service (KID) offers information about the widespread disease of cancer for patients, their families, and the general public. Jointly with Heidelberg University Hospital, DKFZ has established the National Center for Tumor Diseases (NCT) Heidelberg, where promising approaches from cancer research are translated into the clinic. In the German Consortium for Translational Cancer Research (DKTK), one of six German Centers for Health Research, DKFZ maintains translational centers at seven university partnering sites. Combining excellent university hospitals with high-profile research at a Helmholtz Center is an important contribution to improving the chances of cancer patients. DKFZ is a member of the Helmholtz Association of National Research Centers, with ninety percent of its funding coming from the German Federal Ministry of Education and Research and the remaining ten percent from the State of Baden-Württemberg.

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