

Tumor stem cells in the focus of cancer research

Cancer researchers, stem cell researchers and tumor stem cell researchers will convene for the fourth time at the German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) in Heidelberg on October 14th to 16th, 2012. About 400 experts from around the globe will discuss the role of tumor stem cells in the development of cancer and how they sustain tumors and cause metastasis. Of particular relevance is the question of how these findings may be utilized for potential new therapies. The symposium is generously supported by the Heinrich F. C. Behr Foundation, which has provided funding for six other international meetings at DKFZ before.

At the first conference on the topic of “Stem cells and cancer”, the existence of tumor stem cells was still considered to be more of a hypothesis than a fact. However, by now these particularly dangerous and, at the same time, resistant cells have been detected in a growing number of tumor types, and what started out as a theory of a handful of experts has evolved into a rapidly growing research field.

“The award of this year’s Nobel Prize in Medicine to stem cell researcher Shinya Yamanaka clearly indicates that this research field has moved into the focus of biomedical research,” says Professor Otmar D. Wiestler, Chairman of the Management Board of DKFZ, who launched the symposium. “Back in 2007, we already awarded the Meyenburg Prize to Yamanaka at the German Cancer Research Center. This shows that we were already aware of how closely linked stem cell research is with cancer research.” Thus, when Yamanaka reprogrammed body cells into stem cells, for which he was awarded the Nobel Prize, he used the same genes that also play a role in the development of cancer.

Tumor stem cells are the most dangerous cells in a tumor. Not only does the tumor originate from them, they also continuously supply new cancer cells and, thus, sustain the tumor. Their direct offspring is also supposed to be the very cells that leave the tumor and form dreaded metastases in other parts of the body. Unfortunately, it is precisely these cells which are not very sensitive to conventional chemotherapy and radiotherapy. Therefore, they are also suspected to be responsible for the recurrence of tumors after seemingly successful treatment. Professor Andreas Trumpp, co-organizer of the symposium, who leads the Division of Stem Cells and Cancer at DKFZ and is Managing Director of HI-STEM, the Heidelberg Institute for Stem Cell Technology and Experimental Medicine at DKFZ, is therefore convinced that cancer treatment can only be successful if this “root of all evil” is selectively eradicated. “We are searching for techniques to find the relatively rare tumor stem cells with sensitive methods and then to eliminate them in a targeted approach,” said Trumpp describing the goal of his research work.

“Cancer” is a collective term for multiple diseases. Cancer medicine distinguishes at least 200 different types of tumor – just as many as cell types in the human body. “It is becoming more and more apparent that this heterogeneity also applies to tumor stem cells,” says Andreas Trumpp. Just recently his group has discovered in dangerous pancreatic cancer that there are different types of this disease which differ in the severity of their progression. “We suppose that the reason for this lies in the different tumor stem cells that cause the tumors. Our goal is now to use this knowledge for therapy by selecting drugs that are specifically effective against the respective tumor stem cells.

Numerous cancer researchers today are concentrating on identifying the molecular characteristics of tumor stem cells in various cancers with the aim of developing specific therapies against them. Among those researchers is Professor Ana Martin-Villalba, who leads the Division of Molecular Neurobiology at DKFZ. Martin-Villalba discovered the cell surface protein CD95 on the tumor stem cells of glioblastoma, an extremely aggressive type of brain tumor. The cells receive growth signals via this receptor molecule. Based on her results it was possible to develop a substance which blocks this receptor and thus inhibits the growth of the tumor stem cells.

The organizers of the German Cancer Research Center, the U.S. National Cancer Institute and the Leopoldina have invited stem cell researchers from different areas to the conference. Thus, for example, Catriona Jamieson, a doctor and scientist working at the University of California in San Diego., is searching for ways to track down and destroy blood cancer stem cells in their hiding place called “niche” in the bone marrow. She will present results from first clinical trials at the symposium. Luis Parada from the University of Texas in Dallas will report on his latest findings on brain tumor stem cells. Owen Witte from the Broad Stem Cell Center of the University of California in Los Angeles, who is a member of President Obama’s Cancer Panel, will explain in his lecture how prostate cancer also originates from tumor stem cells. Finally, the last session on Tuesday afternoon will be dedicated to the Nobel Prize winning reprogramming of cells. Markus Wernig of Stanford University in California will report on how his group succeeded, based on the work of Shinya Yamanaka, in directly reprogramming skin cells into nerve cells without the detour via stem cells.

“We are proud to bring together the international elite of cancer researchers, stem cell researchers and tumor stem cell researchers in Heidelberg on a regular basis”, said Otmar Wiestler. “And we are convinced that this growing research area will critically impact and improve the treatment of cancer patients in the future.”

The German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) with its more than 2,500 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. 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. The staff of the Cancer Information Service (KID) offers information about the widespread disease of cancer for patients, their families, and the general public. The center is a member of the Helmholtz Association of National Research Centers. Ninety percent of its funding comes from the German Federal Ministry of Education and Research and the remaining ten percent from the State of Baden-Württemberg.

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