Trojan horse for tumour cells

Can phagocytes act like a Trojan horse, transporting tumour cells within themselves and thereby causing metastases in cancer patients? PD Dr. Heiko Bruns at Universitätsklinikum Erlangen, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), has been accepted to the funding programme ‘Experiment! In search of bold research ideas’ on the basis of this unusual question. He has received funding of 120,000 euros from the Volkswagen Foundation until the end of 2021. The project is due to start in spring.

The research is highly significant, as metastases are thought to pose the greatest risk to cancer patients. They are responsible for nearly 90 percent of all deaths caused by cancer. Dr. Bruns reports, however, that not enough is known at present about how metastases actually form. Until now, it has been presumed that they spread throughout the body via the lymphatic vessels and the bloodstream. ‘I am very grateful to have been granted the funding,’ Dr. Bruns continues, ‘and I am very much looking forward to starting on the project which I am truly passionate about.’

Heiko Bruns, who leads the working group ‘Immune modulation of the tumour micromilieu’ at Department of Medicine 5 – Haematology and Oncology at Universitätsklinikum Erlangen, is pursuing an innovative new hypothesis. The biologist has focused on macrophages for several years now. These are phagocytes belonging to the immune system which render bacteria, fungi and foreign pathogens harmless and repair damaged tissue. Heiko Bruns wrote his doctoral thesis on the question of how tuberculosis bacteria were able to survive in individual macrophages.

He has repeatedly observed a similar phenomenon in individual tumour cells. ‘Macrophages are essentially capable of consuming and eliminating tumour cells,’ explains Dr. Bruns, who completed his postdoctoral thesis on the significance of macrophages in the context of tumour diseases. This is the reason why phagocytes are activated within the context of antibody treatment. Paradoxically, cancer patients with a high number of macrophages have a lower life expectancy. A mouse model has demonstrated that tumour growth virtually came to a halt when macrophages were removed.

Heiko Bruns presumes that individual tumour cells are consumed by phagocytes, but are not necessarily eliminated. Instead, he suspects that they use macrophages as ‘Trojan horses.’ If this were the case, they would be able to escape detection and travel through the body to populate other locations with the cells. ‘If this is the case, this might mean that they are one of the causes of metastases,’ Dr. Brun states.

In order to test this hypothesis, macrophages will first of all be mixed with various tumour cells. They will be dyed different colours, which will allow the researchers to use a fluorescence microscope to see whether or not they have been consumed. Long-term experiments will then be set up to observe whether surviving tumour cells grow from macrophages. Experiments are planned with breast cancer tumour cells, melanoma and pancreatic carcinoma.

If the approach proves to be true, cancer researchers could focus on developing treatments targeting certain macrophages or their mechanisms. Dr. Bruns hopes that ‘this would allow a more targeted and rapid approach to be taken to avoid metastases.’
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