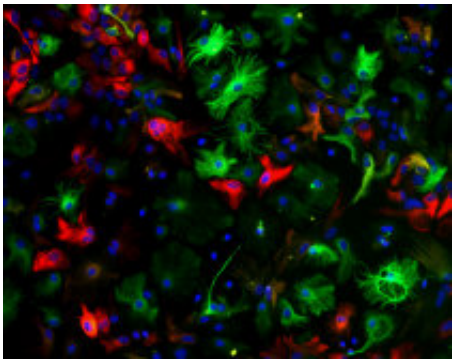
Control by the matrix: Researchers decipher the role of proteins in the cell environment

December 12 2011



Under suitable conditions, precursor cells in the nervous system (red) transform into other cell types, e.g. astrocytes (green). A fluorescence microscope image of a precursor cell culture is shown in which all cell nuclei are stained blue. © Dr. Michael Karus

How astrocytes, certain cells of the nervous system, are generated was largely unknown up to now. Bochum's researchers have now investigated what influence the cell environment, known as the extracellular matrix, has on this process. They found out that the matrix protein tenascin C has to be present in order for astrocytes to multiply and distribute in a controlled fashion in the spinal cord of mice. Together with colleagues from the RWTH Aachen, the scientists from RUB Department of Cell Morphology and Molecular Neurobiology report their findings in the journal *Development*.

Immature astrocytes produce tenascin C and secrete it into the extracellular matrix. From there, it controls the development of the cells. To characterise the role of the protein more precisely, the Bochum team lead by Prof. Dr. Andreas Faissner, Prof. Dr. Stefan Wiese and Dr. Michael Karus analysed astrocytes that were genetically manipulated so that they did not produce tenascin C. The scientists observed that the astrocytes without the protein divided for a longer period of time, and migrated later to their destination in the spinal cord. "As a consequence of the longer cell division phase, we found an increased number of mature astrocytes" explained Karus.

Also at the molecular level, the tenascin C manipulation leaves its mark. With colleagues at the RWTH Aachen, Bochum's researchers compared the gene activity in the spinal cord with and without tenascin C production. The absence of the protein not only affected genes that are typical of astrocytes. The scientists also documented expression level changes of genes that play a role for specific growth factors. These have an influence, for example, on the survival and division activity of different cell types.

Astrocytes take on a variety of tasks in the nervous system. They regulate the ion balance and the concentration of neurotransmitters, are part of the blood-brain barrier, and influence the activity of the nerve cells. In case of injuries to the central nervous system, or brain tumours, they form what are known as reactive astrocytes, which behave similarly to immature astrocytes. "So far, the function of tenascin C under such pathological conditions is largely unknown" said Karus. "However, if we find out more about the role of tenascin C during development, we will probably be able to better understand what affect it has, for example in spinal cord injuries."

More information: M. Karus, B. Denecke, C. ffrench-Constant, S. Wiese, A. Faissner (2011): The extracellular matrix molecule tenascin C

modulates expression levels and territories of key patterning genes during spinal cord astrocyte specification, *Development*, doi: 10.1242/dev.067413