

Possible origin of neuroblastoma in the adrenal glands discovered

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Possible origin of neuroblastoma in the adrenal glands discovered. Credit: Medical University of Vienna

Neuroblastoma is a childhood cancer, most commonly affecting children aged between two to three and can be fatal. Since the tumor cells resemble certain cells in the adrenal glands, a joint research group from MedUni Vienna's Center for Brain Research and the Swedish Karolinska Institute investigated the cellular origin of these cells and sympathetic neurons during the embryonic development of human adrenal glands. During the course of their investigations, they discovered a previously unknown cell type that might potentially be the origin of the tumor cells.

Treatments for this disease are extremely aggressive and challenging and relapses are not uncommon. So far, little is known about the origins of this cancer or the causes of relapse. However, it is assumed that neuroblastomas are due to

abnormalities in the [neural crest cells](#), which form the peripheral nervous system during embryogenesis.

The [cells](#) of [neuroblastoma](#) resemble sympathetic neurons. Although these neurons occur in sympathetic ganglia and are therefore found in many different sites in the [human body](#), neuroblastomas often occur in the adrenal medulla. The reason for this is not yet clear. However, recent studies found that the chromaffin cells of the adrenal medulla, which have long been thought to be related to sympathetic neurons and to derive from neural crest cells, are derived from a completely new cell type, namely from nerve-associated Schwann cell precursors. Based on these observations, the researchers led by Igor Adameyko from MedUni Vienna's Center for Brain Research and the Swedish Karolinska Institute looked for another new cell type in the human [adrenal glands](#) that might play a major role in the development of neuroblastoma.

Cells develop in different directions

In order to investigate the cellular origin of chromaffin cells and sympathetic neurons during embryonic development of the human adrenal glands, they analyzed the RNA expression profiles of individual cells and found a population of intra-medullary sympathoblasts that derive from Schwann cell precursors. These cells divide and, in humans, organize themselves into large ganglia-like structures in the medulla of the developing adrenals. Such structures are primarily found during embryogenesis. After birth, only isolated cells or small groups of sympathetic nerves are observed. Based on these bioinformatic investigations, the researchers are now able to predict that these intra-adrenal sympathoblasts can develop into chromaffin cells under certain conditions.

Further investigations will now be conducted to find

out what happens if the cells are unable to turn into chromaffin cells. It is assumed that the nerve-associated Schwann cell precursors, which continue to divide for a long time and can differentiate to form various cell types, lead to the formation of neuroblastoma. The researchers therefore want to conduct a detailed study into the role of these cells in the development of neuroblastoma, in the hope that this will provide a basis for effective treatments.

Important findings about adrenal gland development

During the course of the investigations conducted so far, an atlas has been produced of the transcription profiles of individual cells in early stages of human adrenal development and this is a valuable and freely available resource for the [scientific community](#) and might be of particular interest to developmental biologists and endocrinologists studying congenital diseases of the adrenal glands.

More information: Polina Kameneva et al. Single-cell transcriptomics of human embryos identifies multiple sympathoblast lineages with potential implications for neuroblastoma origin, *Nature Genetics* (2021). DOI: [10.1038/s41588-021-00818-x](https://doi.org/10.1038/s41588-021-00818-x)

Provided by Medical University of Vienna

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