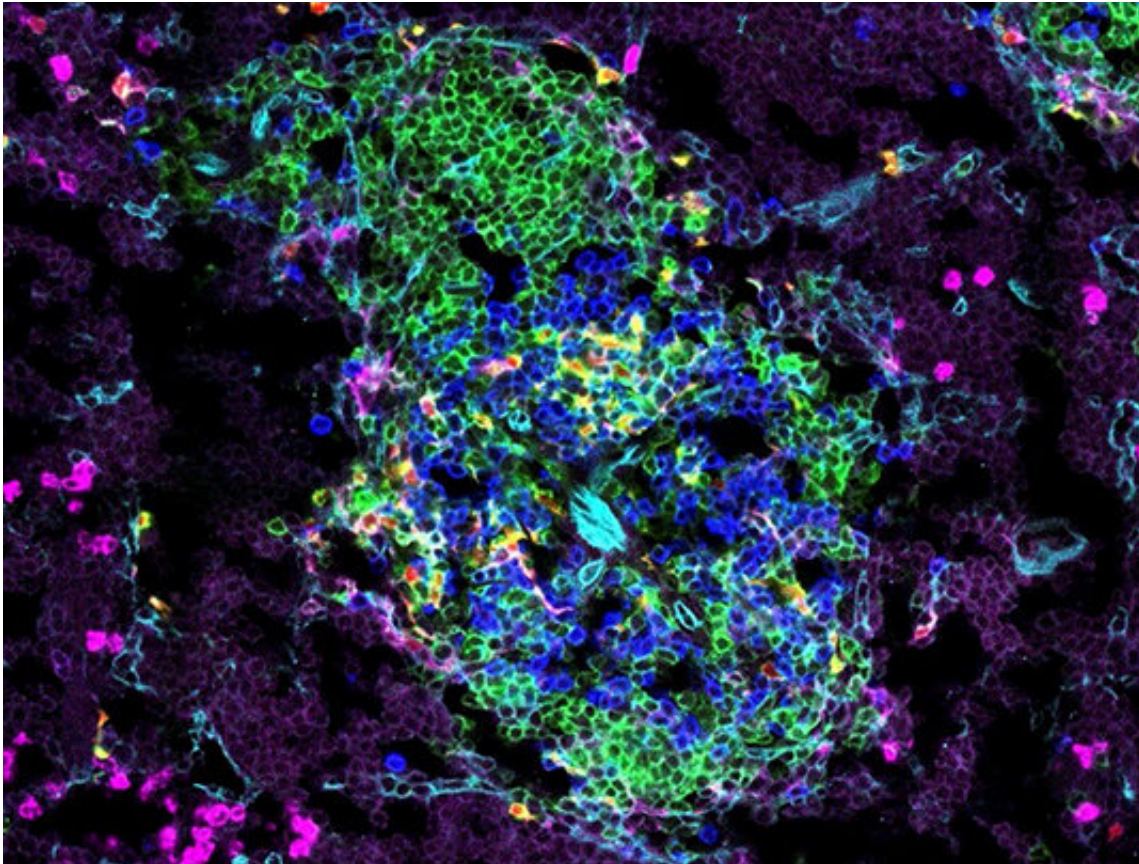


Functionality of immune cells in early life

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Dendritic cells (red/yellow) and T cells (blue) in the spleen of newborn, 8-day-old mice. Credit: Stephan Rambichler

A study by LMU researchers shows that putatively immature dendritic cells found in young children are able to induce robust immune responses. The results could lead to improved vaccination protocols.

Dendritic [cells](#) are a vital component of the innate immune system, which constitutes the body's first line of defense against infectious agents and [tumor cells](#). Their job is to activate the T-cell arm of the adaptive immune system, which confers specific and long-lasting protection against bacterial and viral infections. Dendritic cells engulf and degrade proteins that signal the presence of invasive pathogens. The resulting fragments (antigens) are displayed on their surfaces. T cells bearing the appropriate receptors are then activated to seek out and eliminate the pathogen. Newborns and young children have fewer dendritic cells than adults, and these juvenile cells also carry fewer antigen-presenting complexes on their surfaces.

Based on these observations, immunologists have generally assumed that these cells are functionally immature. However, new work published by a research team led by Professor Barbara Schraml at LMU's Biomedical Center has shown—using the mouse as a model system—that this assumption is in fact erroneous. Although early dendritic cells differ in their characteristics from those of mature [mice](#), they are nevertheless quite capable of triggering effective immune reactions. The new findings suggest ways of boosting the efficacy of vaccines for young children.

With the help of fluorescent tags attached to specific proteins of interest, Schraml and her colleagues traced the origins and biological properties of dendritic cells in newborn and juvenile mice, and compared them with those of mature animals. These studies revealed that dendritic cells are derived from different source populations, depending on the age of the animal considered. Those found in neonatal animals develop from precursor cells produced in the fetal liver. As the mice get older, these cells are progressively replaced by cells arising from myeloid precursors, a class of white blood cells that originates from the bone marrow.

"However, our experiments demonstrate that—in contrast to the conventional view—a particular subtype of dendritic cells named cDC2 cells is able to activate T-cells and express pro-inflammatory cytokines

in young animals," Schraml explains. "In other words, very young mice can indeed trigger immune reactions."

Nevertheless, early cDC2 cells differ in some respects from those found in adult mice. For example, they show age-dependent differences in the sets of genes they express. It turns out that these differences reflect the fact that the signaling molecules (cytokines) to which dendritic cells respond change as the mice get older. "Among other things, the array of receptors that recognize substances which are specific to pathogens changes with age," says Schraml. "Another surprise for us was that early dendritic cells activate one specific subtype of T-cells more effectively than others. Interestingly, this subtype has been implicated in the development of inflammatory reactions."

The results of the study represent a substantial contribution to our understanding of the functions of dendritic cells, and they could have implications for medical immunology. The immune system of newborns differs from that of more mature individuals insofar as immune responses in early life tend to be weaker than those invoked later in life. "Our data suggest that it might be possible to enhance the efficacy of vaccinations in childhood by, for example, adapting the properties of the immunizing antigen to the specific capabilities of the juvenile [dendritic cells](#)," says Schraml.

More information: Nikos E. Papaioannou et al. Environmental signals rather than layered ontogeny imprint the function of type 2 conventional dendritic cells in young and adult mice, *Nature Communications* (2021). [DOI: 10.1038/s41467-020-20659-2](https://doi.org/10.1038/s41467-020-20659-2)

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