What is the function of lymph nodes?

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If we imagine our immune system to be a police force for our bodies, then previous work has suggested that the Lymph nodes would be the best candidate structures within the body to act as police stations - the regions in which the immune response is organised.

However, Prof. Burkhard Becher, University of Zurich, suggests in a new paper - published in this week's issue of PLoS Biology - that lymph nodes are not essential in the mouse in marshalling T-cells (a main immune foot soldier) to respond to a breach of the skin barrier. This result is both surprising in itself, and suggests a novel function for the liver as an alternate site for T-cell activation.

When a child falls off its bike and scratches its skin, the body responds via the immune system. Scavenger cells at the site of the wound pick up antigens -tiny particles derived from invading microorganisms and dirt that the body will recognize as foreign. These antigens are delivered to the nearest lymph node. T and B cells (immune cells) carrying the matching antigen-receptors on their surface will be stimulated by the concentrated antigen now present in these lymph nodes. T cells will then go on and orchestrate the defensive response against the invaders, whereas B cells will transform into antibody-producing cells flooding the body with antibodies which act against the hostile microorganisms.

Mice that lack lymph nodes due to a genetic mutation (alymphoplasia) are severely immuno-compromised and struggle in fighting infections and tumors. New work by Melanie Greter, Janin Hofmann and Burkhard Becher from the Institute of experimental Immunology at the University

of Zurich reports that the immunodeficiency associated with alymphoplasia is not due to the lack of lymph nodes, but caused by the genetic lesion on immune cells themselves. The new paper shows that in the mouse T cell function is unperturbed in the absence of lymph nodes, whereas B cell activation and antibody secretion is strongly affected. That T cell responses can be launched outside of lymph nodes is highly surprising, because this means that T cells can encounter antigens elsewhere in order to become activated.

By tracing the migration of fluorescent particles from the site of antigen invasion (i.e. the wound) the scientists discovered that the liver could serve as a surrogate structure for T cell activation. During embryonic development, the liver is the first organ to provide us with blood and immune cells. Apparently, at least in the mouse the liver continues to serve as an "immune organ" even during adulthood.

This work suggests an explanation for the curious fact that patients receiving a liver transplant sometimes inherit the donor's allergies and immune repertoire, so in keeping with the idea that donor immune information is being transplanted. It also suggests that the liver as an immune organ is an evolutionary remnant from the time before lymph nodes developed in higher birds and mammals.

Cold-blooded vertebrates have functioning T and B cells but no lymph nodes. The main achievement of the development of lymph nodes in mammals is a drastic improvement for the production of better antibodies. T cells on the other hand have not changed their function much during evolution and the work by the Zurich group finally provides solid evidence for the versatility and promiscuity of this cell type.

Source: University of Zurich