Antiviral CD8+ cytotoxic T cell and CD4+ helper T cell responses develop following parvovirus B19 infection. Naive CD8+ cytotoxic T cells require help from CD4+ helper T cells before they can proliferate and differentiate into effectors. Similarly, for antibody production, CD4+ helper T cells are needed to activate B cells. In untreated HIV-infected people, activated CD4+ helper T cells are highly susceptible to infection by HIV due to upregulation of CCR5 co-receptors. HIV infection therefore impacts on both naive CD8+ cytotoxic T cell activation and B cell activation which allows opportunistic infections, such as parvovirus B19, to escape immune surveillance.
B cells primed in the germinal centre require activation signals from CD4+ helper T cells before they can proliferate and differentiate into plasma cells. This interaction takes place in the T cell zone of the secondary lymphoid organs where activated CD4+ helper T cells are present. A failure in providing CD4+ T cell help to B cells, such as in HIV infection, leads to a lack of antibody production that may be important for clearance of an opportunistic organism such as parvovirus B19.
Treatment of parvovirus B19 infection with IVIG provides a passive source of antiviral IgG which can neutralise virus infectivity and generate immune complexes and allow virus to be cleared by the immune system. Opsonised viral particles and immune complexes are more easily detected by phagocytes expressing Fc receptors.
In HIV-infected individuals, treatment with ARV’s can restore the immune function of CD4+ helper T cells which are necessary to promote B cell activation and hence antibody production. Naive CD8+ cytotoxic T cell activation is also dependent on CD4+ T cell help.
Antibody-mediated clearance of parvovirus B19 protects erythroid precursor cells in the bone marrow from viral infection and virus-mediated apoptosis. New erythrocytes can then be produced which reverses anaemia. Antibodies against parvovirus B19 can be provided passively by IVIG, however, ARV therapy in HIV-infected people can promote immune reconstitution and restore CD4+ helper T cell function which is necessary to activate B cells and promote antibody production. Long-lasting immunity to parvovirus B19 via memory T and B cells can be achieved in this way.