Cooperation between B and T Cells

THE experimental evidence which underlies theories for the function of B and T cells—lymphocytes which originate from the bone marrow and thymus respectively—derives from mice and latterly rats. Some support can be gleaned from various immunodeficiency syndromes in man but the picture presented is, as always with nature's uncontrolled experiments, rather confusing. Indeed, those immunologists who work with sheep find the whole notion of B and T cells unhelpful. But from all these different opinions may arise the heat to temper something solid which can actually be used in rational manipulations of immunological processes. On page 454 of this issue of *Nature*, H. W. Kreth and A. R. Williamson present a hypothesis for the mode of interaction of B and T cells which, if it can be substantiated, will present a valuable way of thinking of one of the associations between lymphoid cells.

If small numbers of spleen cells, from mice which have been immunized with DNP–BGG (dinitrophenol coupled to bovine gamma globulin), are transferred into irradiated syngeneic recipients and the antigen is injected again, production of anti-DNP antibody can be noted. The antibody produced in the original host is heterogeneous but in the secondary host the heterogeneity is sometimes much less. Furthermore, if spleen cells from the secondary host are transplanted into a third host (along with antigen) not only can the immune response be maintained but the exact quality of the antibody is reproduced.

This type of experiment has been said to lead to the production of clones of B cells capable of producing homogeneous antibody. Some reservation should be expressed about the "clones" because their identity is said to be established by their protein products rather than by, say, a cytogenetic marker. The assumption is here made that it is unlikely that cells of two different lineages should produce the same protein molecule; in other words, specific immunity is neither infectious nor polyphyletic. But aside from these considerations the capacity to produce the homogeneous anti-DNP antibody has been shown to depend on the activity of B cells. There has also been revealed a requirement for carrier-primed T cells. For example, if the spleen cells used to transfer the capacity to produce anti-DNP antibody are incubated, on transfer, with anti-θ antiserum (to eliminate T cells) in the presence of complement the immune response fails. An anti-θ depleted spleen cell population can be restored to its usual functional capacity by the addition of carrier primed syngeneic spleen cells. This type of experiment which implicates the T cell in relation to the anti-carrier and the B cell in relation to the anti-hapten response has led to the hypothesis that interaction between T and B cells involves an antigen bridge. The T cell is imagined to be at the carrier foundations of the bridge proffering the hapten in a particular manner to the B cell on the other side.

In earlier experiments it has been shown that attempts to elicit anti-DNP antibody formation, on transfer, by the use of DNP bound to a different carrier (for example, ovalbumin, OA) are unsuccessful. This suggests that the T cell, which is responsible for the anti-carrier response, makes a specific contribution to the immune process. Kreth and Williamson reasoned that this may not be so. They offer in evidence the fact that if spleen cells from an animal producing a homogeneous anti-DNP antibody are transferred to an irradiated recipient along with DNP bound to a heterologous carrier (DNP–OA instead of DNP–BGG) a secondary anti-DNP antibody response results if unprimed AKR spleen cells are added to the inoculum. Kreth and Williamson argue that the reaction of the T cell component of the AKR spleen populations against the CBA (B) cells in the immune syngeneic spleen cell population provides the necessary bridges and non-specific stimulation which are required to promote anti-DNP antibody production in the presence of DNP bound to any carrier. With this experimental finding as the basis of their case they go on to adduce a general theory for interaction between B and T cells.

Kreth and Williamson suggest, following Burnet, that cells have a surveillance function in relation to other cells. B cells can firmly bind antigens to specific receptors on their surface but beyond that point they may need some further stimulus to react. Wandering T cells, finding the foreign material bound to the B cells, form some link with the altered B cell, and produce a mitogenic stimulus which triggers the further response of the B cell to the bound antigen. In their experimental studies Kreth and Williamson envisage that by providing an artificial difference between the interreacting B and T cell populations they exaggerated the kind of response which normally occurs between B and T cells. They cite the evidence that T cells are responsible for effector function in cell-mediated immunity and they feel that their postulated role in B–T cooperation systems is consistent with this aggressive potentiality.

Perhaps the weakest point of Kreth and Williamson's theory is the lack of any suggestions about the "appropriate receptors" which are said to enable the surveying T cells to recognize foreignness on the surfaces of other cells. This failing, however, is not unique when the discussion turns to interactions between such complex matrices as mammalian plasma membranes.

Righting the Applecart

THE discovery during the past year of pulsating X-ray sources with little or no easily detectable radio and optical emission has upset the pulsar applecart. It has become obvious that some phenomenon other than the accustomed pulsar models is active in these energetic sources. For the present the questions are what sort of phenomenon, and is one extra phenomenon sufficient to account for the observations ?

Henriksen, Feldman and Chau (Queen's University, Ontario) believe they have answered the first of these questions with their model, which they apply to Cen XR-3 on page 450 of this issue of *Nature*. The general applicability of the model has yet to be confirmed, but it could well turn out that the application of this model to other pulsed X-ray sources will answer the second question too.

Apart from the pulsations themselves, several of the newly observed sources are characterized by emission which can be interpreted in terms of black body radiation or by thermal bremsstrahlung. Henriksen, Feldman