and much less diverse than, those recognized by γ/δ receptors found in somatic lymphoid tissues. In considering potential ligands for those less diverse γ/δ receptors found on DEC and IEL, anatomy may again stimulate our understanding.

The α/β T cells that are the dominant effector cells in the body are characterized by their remarkable recirculation. These cells traverse from blood to lymphoid tissues to blood, contacting the surface of many antigen presenting cells (APC) in the lymph nodes and spleen. A pertinent question is how many T cells contact a given APC per unit time, as immune responses can occur only when a T cell encounters an APC bearing the antigen for which its receptor is specific. This number would have to be large to accommodate the low frequency of specific T cells in this recirculating pool; this is supported by the observation that all antigen-specific T cells cease recirculation within 48 hours of antigen injection. In epithelia, by contrast, the number of IEL an average epithelial cell encounters per day is probably one. If the function of IEL is to recognize alterations in epithelial cell surfaces that result from infection or transformation, then it is unlikely that IEL will be effective in this task if they recognize a set of ligands as diverse as that recognized by α/β T cells, as the limited number of cell interactions possible in this setting would preclude recognition in all but the rarest cases.

As noted previously, the α/β receptors are specialized for MHC recognition, so it seems likely that the γ/δ receptor will be as well. However, there is no obvious reason to suppose that γ/δ receptors will recognize products of the same MHC genes as do α/β receptors. The expression of CD8 on γ/δ IEL[1] further strongly suggests that these cells will be specific for class I MHC molecules, as CD8 expression is associated with class I MHC recognition (table 1; ref. 21), and isolated CD8 binds class I MHC molecules. The bulk of α/β T cells so far characterized recognize class I and class II MHC molecules. It seems possible that γ/δ T-cell receptors will be specific for the many uncharacterized class I-like genes that map distal to *H–2D* in the mouse, called class IB by Klein[22]. This supposition is supported by results obtained using two different cloned γ/δ T cells that recognize class IB MHC molecules (ref. 18; S. Tonegawa); however, it should be pointed out that J. Bluestone, L. Matis and colleagues have also cloned γ/δ T cell lines that are specific for class I and class II MHC molecules when allogeneic spleen cells are used as stimulators. I contend that this stimulus, although effective, is eliciting rare cross-reactions that may not be representative of the self molecules that are likely to be a critical part of the ligand for γ/δ T cell receptors.

The γ/δ T-cell recognition of autologous class IB MHC molecules expressed by epithelial cells under conditions of stress might be an effective if seemingly primitive means of epithelial defence. These genes, unlike class I MHC genes, are expressed in a tissue- and activation-specific fashion in those cases in which this has been examined. As shown by Goodman and Lefrançois[1], this recognition event should lead to killing of the epithelial cell. This form of defence at the immunological frontiers, outside the epithelial basement membranes, could be highly effective. Epithelia that lose a cell or two rapidly cover such lesions by lateral migration of healthy cells into the open area. As long as an infected or a transformed cell is killed before spread across the basement membrane can occur, neither infection nor malignancy can ensue. This system may lack the sophistication of antigen specificity and immunological memory, but it may also not need them to perform its function. It is tempting to speculate that this present-day frontier is also the site in which cell-mediated immunity originated, and that this 'new' component of the immune system is actually one of its oldest. The immune system has engrafted antigen specificity onto several existing non-specific effector mechanisms, and the γ-δ T-cell system may exemplify this principle again.

It will be interesting to learn more about epithelial lymphocytes, the heterogeneity of their receptors, their functions and their ligands. From this, we may be able to deduce their overall biological role. Deficiencies in these cells, if discovered, could also be enlightening as to the importance of this outermost barrier of cell-mediated immunity. It seems likely that it will be the γ/δ T cell that will stand and be counted when it comes to the defence of our epithelial frontiers. □

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Daedalus

Dreams for sale

THE brain differs from a computer in at least two important ways. It seems not to store data in fixed locations; and it hangs onto that data tenaciously (whereas we all know how disastrously easy it is to erase computer-stored data by overwriting it). Daedalus muses that the brain must store its data dynamically, like a magnetic-bubble memory or a charge-coupled device. Entering new data does not overwrite the old stuff, but pushes it along a bit to make room.

This notion ties in neatly with the claim that a dream is the repacking of the day's experiences: the updating of the current world-picture. The discarded data are not overwritten, but pushed out of the way. In fact they are pushed right back into the sensory region of the brain, to be sensed as a dream.

And this, says Daedalus, is why dreams (to the dismay of psychiatrists) are usually such nonsense. They are the rejects on the brain's cutting-room floor, the discards of the night's editing. Furthermore, they are in the brain's internal machine-code, and like all machine-codes can be interpreted as high-level language only with the aid of many arbitrary symbols.

But Daedalus takes his theory further. He recalls the characteristic rapid eye movements of dreaming, as if behind closed eyelids the dreamer were scanning a visual image. Maybe the rejected dream images are pushed, not just back into the sensory processing area, but right down the optic nerves to the retinas, where the eyes' reflex motor responses try to follow them.

To test this appealing notion, Daedalus is devising special telemetric retinal-imaging goggles for DREADCO volunteers to wear in bed. The goggles can be filled with simulated tear fluid. With good fortune this should not prevent the bathed eyes from closing in sleep, but will complete an ultrasonically clear path from each retina out through eye, eyelid and fluid to a focusing lens and piezoelectric detector array in the goggles. The idea is that, because a nerve expands slightly on transmitting an impulse, the dreaming retina should radiate an ultrasonic pattern corresponding to the image it is 'seeing'. The piezoelectric goggles will intercept that dream image, and transmit it for display on a television monitor.

Thus the poignant terrors, charms and crazinesses of our nocturnal fantasies will be captured for objective study. Brain theorists, psychiatrists and dreamers themselves will be fascinated. Film and television companies will rush to screen the wilder dreams: their surrealistic visual vocabulary will speak compellingly to our subconscious minds. David Jones