greater than in the case of immunoglobulin V domains which show highly conserved sequences outside the hypervariable regions that make up the antigen-combining site (Fig.2)[11]. Moreover, only clone 86T1 has a domain resembling an immunoglobulin V domain. For example, clone 86T5 has no cysteine residue which could be a candidate for homology with Cys 109 in 86T1, around which is seen the greatest identity of sequence with immunoglobulin V domains. Thus it is not at all clear that a structure like that shown in Fig.1 will be typical for all T-receptor polypeptide chains.

From now on things will move fast. All the questions that have been answered for immunoglobulin genes and sequences will be asked of the T-receptor molecules and their expression in T-cell subsets will be eagerly investigated. With luck, cDNA clones coding for the other polypeptides of the T-cell receptor will soon be obtained. It will be vital to close the circle between structures predicted from the cDNA clones and the glycoproteins discovered with monoclonal antibodies on T-cell clones and hybridomas. This can be achieved either by sequencing the proteins or by

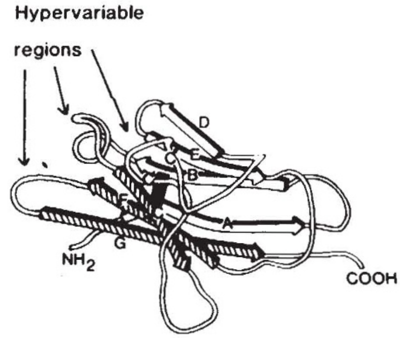

Fig. 2 Folding pattern for an immunoglobulin V domain. Antiparallel β-strands labelled A–G along the sequence fold to form two β-sheets that are held together by hydrophobic interactions and the disulphide bond indicated by the bar. The loops of sequence that form half of the combining site for antigen are labelled hypervariable regions. They show extensive sequence variation between different V domains while much of the rest of the sequence is highly conserved (adapted from ref. 14).

showing that antibodies raised against peptides predicted from the cDNA clones will react with the same structures as the monoclonal antibodies. Hedrick *et al.* already mention that anti-peptide antibodies against their structure block T-cell responses[3].

Does the structure illustrated in Fig. 1 help explain how the T-cell receptor recognizes a foreign antigen in association with a MHC antigen? Not much because the V domains presumably form a structure like the antigen-combining site of immunoglobulin which recognizes only a small area of protein or carbohydrate antigen[12]. A vital point here is whether the T-cell receptor V domains will show hypervariable regions as do immunoglobulin V domains or whether, as the data of Hedrick *et al.* already suggest, they will show extensive variation throughout much of their sequence. If this is so, then the combining site of the T-cell receptor may be considerably larger than that of antibody, and this might allow a single T-cell receptor to recognize both foreign antigen and MHC antigen. □

Alan F. Williams is Director of the MRC Cellular Immunology Unit, Sir William Dunn School of Pathology, University of Oxford, South Parks Road, Oxford OX1 3RE.

The tale of a falling cat

THE feline somersault shown below may not at first sight look a candidate for an historic scientific photograph, but in fact it occupies a special place both scientifically and photographically. It was recorded in 1894 on a continuous filmstrip by one of the most ingenious and productive scientific photographers of the last century, Etienne-Jules Marey, using an advanced form of his 'chronophotographic' apparatus with a rotating shutter.

On 29 October of the same year, the filmstrip was run through a zoetrope (a Victorian antecedent of the cineprojector) at a meeting of the Académie des Sciences in Paris. The falling cat sparked lively controversy among the academicians. Dropped upside down, cats virtually always manage to land feet-first, in apparent contradiction of the principle of conservation of angular momentum. The sequence of frozen images, shown below, far from resolving the question, incited Messieurs Appell, Deprez, Fouché, Guyou, Lecornu, Lévy, Picard, West and others to debate whether the 'theorem of areas' (as the conservation law was described, following Laplace) had been photographically confounded. Indeed, Guyou — the speaker after Marey at the 29 October *séance* — started by saying that "this spontaneous turning of the animal appears impossible".

The controversy came within a whisker of becoming another case where theoreticians prove that, aerodynamically, bees cannot fly. Marey pointed out that the cat first flings its hind paws out with its forepaws retracted to rotate its head and shoulders and then reverses the procedure, extending its forepaws whilst tucking in its hind ones. On the basis of the photographic evidence, he gave short shrift to prior notions that the cat shoves itself in the right direction at the moment of falling, in this instance pushing against the experimenter's hands; or that it somehow utilizes air resistance.

The Italian mathematician Giuseppe Peano, writing in 1895, dealt wittily with what he considered the quite irrelevant paw movements and asserted stoutly that the whole manoeuvre depended on the twisting of the cat's tail in the opposite direction to its bodily rotation. In 1969, T.A. Kane and M. P. Scher of Stanford University re-opened the question with a dynamical study of the cat's fall. "The torso of the cat bends", they contend, "but does not twist". Perhaps an experiment with a tailless Manx cat would settle the issue.

Jon Darius

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