Jaw fragments from the Upper Devonian of Scotland, under study by Ahlberg and presented at the meeting, may be those of a tetrapod. If so, they would antedate the earliest-known tetrapod body fossils (*Ichthyostega* and *Acanthostega* from Greenland, and *Tulerpeton* from the Soviet Union) by about ten million years. But some of the jaw's features resemble those of panderichthyids. The truth may lie somewhere in between. And three new genera of porolepiform fishes from the Lower Devonian of China currently under study[9] promise to add crucial information to our picture of sarcopterygian evolution. □

Henry Gee is an assistant editor of Nature.

ANTIGEN PRESENTATION

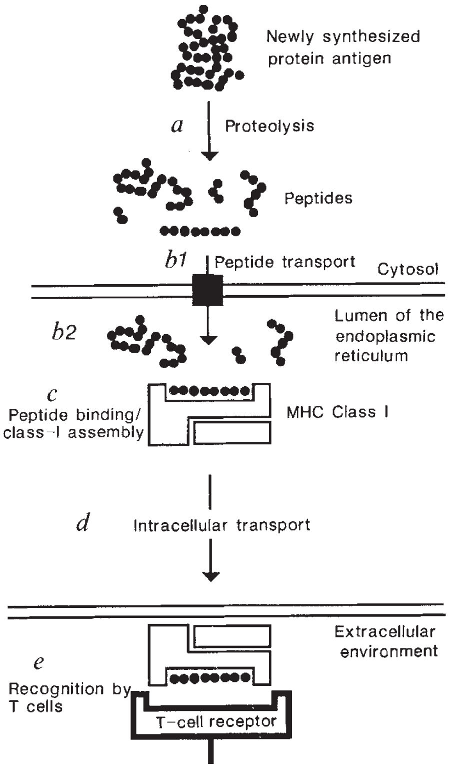
Naturally processed peptides

Tim Elliott, Alain Townsend and Vincenzo Cerundolo

THE form in which protein antigens are recognized by class I-restricted cytotoxic T lymphocytes (CTL) has, until recently, been ill defined. There is good evidence that CTL recognize proteolytic fragments of intracellular protein antigens. Most of it has depended on mimicking the naturally processed antigen with synthetic peptides *in vitro*. Now, the ingenious application of high-performance liquid chromatography by two groups has resulted in the identification of the natural fragments of both viral and host antigens presented to CTL[1-5]. Three of the reports[3-5] appear in this issue.

Cytotoxic T lymphocytes recognize peptides derived from intracellular antigens presented at the cell surface in association with class I glycoproteins encoded within the major histocompatibility complex. Various lines of evidence suggest the following events in the presentation of antigens with class I molecules (see figure; for reviews, see refs 6–8). Antigenic proteins are degraded in the cytosol (*a* in the figure), and peptides derived from them are transported into the endoplasmic reticulum (*b1*); it is also possible that proteolysis of proteins in the endoplasmic reticulum might provide additional peptides for binding to class I (*b2*), but as yet there is no evidence for this. In the endoplasmic reticulum, peptides bind to, and take part in, the assembly of class I molecules[9] (*c*). Unbound peptides may have an extremely short half-life. Finally, the class I/peptide complex is transported to the cell surface (*d*), where it can be recognized by CTL (*e*). Synthetic peptides composed of between 8 and 25 residues can mimic the epitopes recognized by CTL *in vitro* when exposed to the cell surface. But, until now, it was not known whether cells actually produced peptides of this length from intracellular protein antigens.

Peptides have been isolated from whole cells by acid extraction and fractionation of cell extracts either directly[1], or after digestion with a specific endopeptidase[2]. The first experiments showed that minor histocompatibility antigens can, like intracellular viral proteins[10], be identified as peptides; previously they could be defined only by genetic analysis and tissue graft rejection. An intriguing aspect of the results was that each of the active peptides defined as an intracellular antigen eluted as a single peak (or in one case with a small additional peak) from undigested cell extracts[1]. Each of the peptides naturally



Events leading to the presentation of intracellular antigens to major histocompatibility complex class-I restricted T cells. See paragraph 2 of the text for explanation.

produced by the cell was therefore surprisingly homogenous in length.

On page 252, Rötzschke *et al.*[3] now extend these results to the presentation of influenza virus proteins to class I-restricted CTL. Peptides were isolated from infected cells. The extracts were not treated with a protease, thus allowing identification of only those peptides that arose through the action of the cells' own proteolytic enzymes. Again, the naturally processed peptides eluted as single sharp peaks. This was in stark contrast to the products obtained from a standard peptide synthesis *in vitro*, when minor contaminants of various lengths gave rise to a series

RÉSUMÉ

Timeless gravity

THE strength of gravity has changed by less than one part in a million million each year since the beginning of the Universe, according to new calculations by F. S. Accetta, L. M. Krauss and P. Romanelli (*Phys. Lett.* B**248**, 146–150; 1990). The key to the calculation is, curiously, the nucleosynthesis that occurred in the first four minutes after the Big Bang. Estimates of the cosmic abundances of light isotopes, together with new measurements at CERN of the number of types of neutrinos and improved measurements of the radioactive half-life of the neutron, are used to constrain calculations of the rate at which the Universe expanded in these first few moments — in turn determining the strength of gravity at the time. Although the new result still allows for a 40 per cent variation in Newton's gravitational 'constant' ('big G') since the Big Bang, this hardly reflects the scale of change envisaged by P. A. M. Dirac 50 years ago (*Nature* **139**, 323; 1937).

Staying cool

ELEPHANTS have a problem: disposing of the heat from their imposing bodies. Using infrared thermography, T. M. Williams has mapped the skin temperature for an adult African elephant and an immature Indian elephant, thus determining the main routes by which they lose heat (*J. Zool. Lond.* **222**, 235–245; 1990). At an ambient temperature of 12.6 °C, 86 per cent of total heat loss is accounted for by free convection and radiation. Surprisingly, only 8 per cent of the total heat transfer occurred across the African elephant's ears, traditionally taken to be the main route for heat dissipation. However the thermal conductance of both species of elephant is 3–5 times higher than that predicted from allometry, which Williams attributes to the absence of fur, an adaptation which clearly helps them to stay cool.

Bye cycles

DON'T do it, is the advice of A. K. Baksi to those who would seek evidence of cyclical events in Earth history. Writing in *Geology* (**18**, 983–986; 1990), Baksi discusses various hypotheses proposing that events have recurred with periodicities of around 30 million years (flood-basalt volcanic episodes, cometary impacts and faunal extinctions) and finds all to be flawed. The radiometric dates used, he says, are quite simply too unreliable and were questionably selected. "Further search for periodicity in global events," he adds, "should be postponed until an adequate data base of high-quality radiometric ages becomes available." But recent advances in analytical techniques should allow quick progress on this front.