to the north by $285 \pm 74$ km. Later, however, Watkins (*Geophys. J.*, **28**, 193; 1972) pointed out that, although the northern hemisphere palaeomagnetic results for the Brunhes alone are consistent with a dipole offset to the north by 300–400 km, the southern hemisphere data require no such offset. He therefore suggested that the simplest model consistent with data from both hemispheres would have a main centred dipole with a weaker axial dipole some distance to the north.

In a more thorough analysis, Watkins and Richardson now show that the Brunhes palaeomagnetic data are best satisfied by a major dipole offset to the north together with two minor axial dipoles offset arbitrarily to the core-mantle interface (one in each hemisphere). These minor dipoles have moments of 1–4% of that of the main dipole, the one in the southern hemisphere having the same polarity as the main dipole and the one in the northern hemisphere opposing the main dipole. This is apparently the simplest model consistent with all current Brunhes palaeomagnetic results although more complex models could be devised (and may be necessary later to explain better data).

Finally, Bhattacharyya and Leu (*J. Geophys. Res.*, **80**, 4461; 1975) have used the magnetism of rocks indirectly to investigate a much more local effect. From an analysis of magnetic anomalies over Yellowstone National Park, they show that the Curie point isotherm below this geothermal area is particularly shallow. This is only to be expected and in any case has been proved before using other methods. The point of this confirmation, however, is its suggestion that aeromagnetic data may prove useful in regional reconnaissance for potential geothermal energy resources. □

# Tail-wagging antibodies?

*from C. C. F. Blake*

Now that X-ray studies have established a broad understanding of the antigen binding function of immunoglobulins, attention is being turned to the Fc region and how its complement fixation and B-cell activation functions are influenced by binding of antigen.

The first successful structural study of a whole myeloma protein, the IgG1 Dob, by both low resolution X-ray analysis and electron microscopy (Sarma *et al.*, *J. biol. Chem.*, **246**, 3753; 1971; Lebaw and Davies, *J. ultrastr. Res.*, **40**, 349; 1972) revealed that the molecule was T-shaped, but little else. Recently Huber and his colleagues (Colman *et al.*, *J. molec. Biol.*, **100**, 257; 1976) reported a second low resolution study, of the IgG1 Kol, which has produced much more information. There are two reasons for this: first, high-resolution structural information on the Fab region is now available and second, the Kol protein does not have the deletion in the Fab–Fc hinge region that the Dob protein has. Since the resolution of Huber's map is only 5 Å, only the quaternary structure of the molecule—the arrangement of the various domains—can be analysed in any detail. Changes at this level of structure, however, could be highly significant, and some very intriguing results have been obtained, even though, or rather because, there is no electron density for the Fc region of the molecule.

One of the characteristics of X-ray analysis of crystal structures is that it is only possible to see side-chains or parts of molecules that are positionally stable in the crystal. Thus the lack of electron density in that part of the crystal that should contain the Fc of Kol, must indicate that the whole region can, and does, take up at least two orientations relative to the well-defined Fab regions. Huber has interpreted this as indicating the presence of a hinge in the molecule at the point at which the electron density fades out—immediately C-terminal of the inter-heavy chain disulphide bridges. If this is so the hinge is different from the classical one proposed to account for the Y→T transformation which must be N-terminal of these bridges. It should be noted that the angle between the two Fab arms is 125° in Kol, in contrast to the 180° found in Dob.

Yet a third hinge region may be present in the molecule, coincident with the switch regions between the V and C domains of the Fab arms. Interpretation of the Fab region of the Kol protein in terms of the known structures of the human $V_k$ dimer fragment Rei, and the mouse McPC 603 Fab fragment, has shown that the V and C domains are not in the same relative orientation as that found in the Fab fragments so far analysed. The difference can be judged by the angle of intersection of the pseudo-dyads that relate the light and heavy chains in the two domains, which changes from 120° in the Fab fragments to 170° in the Kol protein. Colman *et al.* refer to this change as "bending the elbow" of the Fab arms—in the Kol protein therefore the arms are almost straight.

Huber and his colleagues speculate that these two new hinge regions may permit antibodies to act as allosteric proteins, in which the allosteric effect is transmitted through the polypeptide chain from one domain to another. They suggest the possibility that hapten binding is accompanied by a "bending of the elbow" and that the elbow movement is sensed by the hinge causing a change in the Fc region that by implication influences complement fixation. Although there is little other evidence that complement fixation is accompanied by conformational changes, the present hypothesis is certainly plausible in view of the extraordinary domain structure of the immunoglobulins, and we now await the results of hapten binding to the Kol protein with considerable interest. □

# Tunguska revisited

*from David W. Hughes*

AT about 7.17 a.m. local time on June 30, 1908 in the basin of the River Podkamennaya Tunguska, Central Siberia (latitude 60° 55′N, longitude 101° 57′E) a gigantic explosion occurred. The ancient trees of the mighty Yenissi taiga were torn up by their roots and in places piled up in thick layers by the explosion wave, their trunks pointing radially away from the centre of the explosion. The devastation extended over an area of radius 30–40 km, the centre of the area having been ravaged by fire, searing being traceable for 18 km. A farmer 60 km away told how his shirt was almost burnt off his back, the explosion throwing him off the steps of his house and several feet across the ground. Eye witnesses up to 500 km away saw, in a cloudless sky, the flight and explosion of a blindingly bright, pale blue bolide, "which made even the light of the Sun appear dark". This left in its wake a thick dust trail. The explosion took the form of a vertical column of fire and threw incandescent matter up to a height of 20 km. The sound of the explosion, like gun fire, reverberated thousands of kilometres away, seismographs registered an earthquake; the explosion air wave, recorded on microbaragraphs in many meteorological stations, went twice round the world. Magnetic disturbances similar to those subsequently recorded after atmospheric nuclear explosions were recorded at the Irkutsk Observatory.

After the explosion the nights were expectionally bright over Western Asia and Europe, the enhanced night brightness slowly diminishing and disappearing after two months. In mid-July, two weeks after the explosion, the coefficient of transparency of the atmosphere was found to be noticeably depressed over California. This, it was suggested, was due to the loss of vast amounts of material from the incident body as it