sition in the Deep. For the time being the detailed picture remains unclear. What is certain, however, is that the rate of accumulation of metals in the Bauer Deep is an order of magnitude lower than that on the East Pacific Rise. □

"Turn-coat" trypanosomes undressed

from J. R. Baker

IT has been known for some time that the tsetse-transmitted trypanosomes of Africa (including *Trypanosoma brucei*, which causes human sleeping sickness) have, at certain times in their life cycle, a 12–15 nm thick "coat" outside their unit plasma membrane. Mainly circumstantial evidence strongly suggested that this coat contained antigens presented to the vertebrate host which, by being structurally changed every time the host produced a specific antibody, contributed to the parasites' survival and, hence, the eventual death of the host (Vickerman, *Ciba Symposium*, **25**, 53; 1974) and also to our inability to produce an effective anti-trypanosomiasis vaccine.

A few years ago, Wright and Hales in Toronto (*J. Parasit.*, **56**, 671; 1970) suggested that the coat consisted of carbohydrate and protein, and work by them and Lumsden (*J. Cell Sci.*, **6**, 285; 1970) led to the idea that the trypanosomes may cast off old antigen by releasing long tubular threads of encoated plasma membrane (though the natural production of these threads *in vivo* has never been conclusively demonstrated). In Basel, Steiger produced evidence that new coat was produced by the trypanosomes' Golgi-derived reticulum (*Acta trop.*, **28**, 341; 1971 and **30**, 64; 1973). This study took an exciting step forward three years ago when Cross reported to the 13th Trypanosomiasis Seminar in London the isolation of a single glycoprotein apparently representing dissociated coat (*Trans. R. Soc. trop. Med. Hyg.*, **67**, 261; 1973). Significantly, the putative coat proteins prepared from different clones of one strain of *T. brucei* differed in composition. This supported the view that coat protein is the variant antigen, an idea now further strengthened by Cross's latest discovery that mice immunised with purified coat glycoprotein (molecular weight 65,000 ± 3,000) are protected against subsequent infection with living trypanosomes of the same, but not of other, clones (*Parasitology*, **71**, 393; 1975). One of the major remaining problems concerns the cellular control of this antigen switch: it is insufficiently random to be explained easily by mutation and its occurrence within a clone appears to preclude its resulting by selection from a pre-existent mixed population. Current thinking—stemming, incidentally, from work by Ehrlich and others in 1909 (*Z. Immunitaetsforsch.*, **3**, 296; 1909)—favours a rather vague concept of induction by antibody. Cross's work may well prove to be an important key in the eventual unlocking of this mystery which, in turn, could conceivably lead to successful vaccination against sleeping sickness. □

A hundred years ago

A REMARKABLY valuable discussion by M. Belgrand, of the inundations of the Garonne, viewed specially in connection with the heavy rains which fell over France from the 21st to the 24th of June last, has been appearing at intervals for the past fortnight in the *Bulletin International* of the Paris Observatory. It is pointed out, from the dates of their occurrence, that the inundations of the southern portion of the basin of the Garonne which slants from the Pyrénées, have nearly always occurred in spring or early summer, and at the same dates either no floods at all, or comparatively unimportant floods, were experienced in the northern portion of the basin which slopes down from the Cevennes and central plateaux of France. It is to be noted that it is just at this season that the rainfall of the southern portion of France attains its annual maximum, and the nearer to the Pyrénées the more decidedly is the May–June maximum marked, and that the melting of the snows which have accumulated on the Pyrénées during the winter months proceeds most rapidly. On the other hand, it is shown that the great inundations of the northern portion of the basin occur generally during the cold months of the year, and that at the time of their occurrence there have been no corresponding great floods at Toulose, in the southern portion of the basin. It is during the cold season that the rainfall reaches its annual maximum on leaving the slopes of the Pyrénées and advancing northwards over the basins of the Tarn, Lot, and Dordogne. The disastrous inundation of June, 1875, was in accordance with the experience of previous floods in the south of France. As a great flood it was limited to the river courses sloping down from the Pyrénées; and the nearest approach to a great flood elsewhere was in the basin of the Argout, the most southern tributary of the Tarn, and it was the flood of this tributary which occasioned almost the whole of the flood of the Tarn. At such places as Auch, situated in a narrow valley, and where, consequently, the drainage area is small, the inundation was much less disastrous than at Toulouse and places similarly situated near the confluence of large affluents draining a wide extent of the country.

from *Nature*, **13**, January 6, 197, 1876

Oscillating universe bounces back

from John Gribbin

THE biggest problem with the Big Bang theory of the origin of the Universe is philosophical—perhaps even theological—what was there before the bang? This problem alone was sufficient to give a great initial impetus to the Steady State theory; but with that theory now sadly in conflict with the observations, the best way round this initial difficulty is provided by a model in which the Universe expands from a singularity, collapses back again, and repeats the cycle indefinitely. Such models have been known since the earliest development of relativistic cosmologies in this century, but have been favoured with a revival of interest in recent years. The latest study provides some intriguing agreements with observation of the real Universe, but also poses some new puzzles (Landsberg and Park, *Proc. R. Soc. Lond.*, **A346**, 485–495; 1975).

Landsberg and Park consider a model universe composed of gas and radiation which are 'lowed to interact; this incorporates features of standard cosmology (taking account of gravitation) and of statistical mechanics (which does not take account of gravitation). The resulting hybrid is, they suggest "too simple to be realistic", but does go a step further than the standard dynamic models of traditional cosmology. Both the gas and the radiation (assumed black body) are uniform, which is as good an approximation as in any other cosmology, where such incidentals as galaxies are generally taken as 'test particles' of no great account.

The first important result which emerges from this incorporation of thermodynamics into cosmology is that during both the expanding and contracting phases of the oscillating model entropy increases, so that the "arrow of time" is constant. To follow the repeated 'bounce' through the initial/final singularity Landsberg and Park cheat a little by simply reversing the collapse at very great density, so that it becomes an expansion with the same speed. This may not be entirely valid, since it carries over information from one cycle to the next, but because the collapse phase proceeds more rapidly than the preceding expansion, this means that successive cycles of the oscillation start out faster and faster, expanding to greater and greater radii before they collapse in their turn, with each cycle taking longer than the last. This behaviour is in line with that of earlier oscillating models, but even