CANCER CELLS

Chemical Vaccines

from our Cell Biology Correspondent

CANCER cells and cells transformed *in vitro* by chemicals or tumour viruses are about ten times more susceptible to agglutination by lectins such as concanavalin A or wheat germ agglutinin than are normal, untransformed cells. That much is generally agreed by those workers who have used lectins to investigate the surfaces of cancer cells. Why cancer cells are more agglutinable is of course still a matter of dispute; one camp argues that transformation leads to the exposure of previously cryptic lectin-binding sites whereas the other, which currently seems to have the upper hand, contends that it is the distribution of these sites rather than their number which differentiates the two classes of cells, the cancerous and the normal. But in any event there is a difference and it is common to all cancer cells, a fact which Shier has exploited in a remarkable set of experiments published in the current issue of the *Proceedings of the US National Academy of Sciences* (**68**, 2078; 1971).

Shier argues that because cancer cells are more readily agglutinable by wheat germ agglutinin than are normal cells (and he was assuming that this difference reflects a difference in the number of receptor sites exposed), it might be possible to immunize mice against tumours by raising an immune response against the wheat germ agglutinin receptor site. Exploiting Burger's discovery that this receptor is a soluble glycoprotein containing N-acetylglucosamine, he performed what seems to be an almost ridiculously simple and over-optimistic experiment, but the long shot has paid off handsomely.

Shier prepared a synthetic wheat germ agglutinin receptor site by condensing dimeric N-acetylglucosamine residues onto the sodium salt of poly-aspartic acid and as a control he crossed linked polypeptide backbones without adding the N-acetylglucosamine residues. Having shown that wheat germ agglutinin has a much greater affinity for the synthetic receptor than for the control, the crosslinked polypeptide, Shier complexed the receptor and the control to methylated bovine serum albumin and used the two complexes (antigens A and B) to immunize mice in the presence of Freund's adjuvant. Two sets of mice, one immunized with the receptor-albumin complex and the other with the control antigen B, were then challenged with various numbers of cells of two BALB/c myeloma cell lines. Mice immunized with the synthetic receptor antigen rejected at least five-fold more tumour cells than those immunized with the control antigen B. Furthermore, the time taken for palpable tumours to develop after exposure to a large dose of the chemical carcinogen 3-methyl cholanthrene was significantly greater after immunization with the receptor antigen than after immunization with the control. Mice which had been immunized with the receptor antigen grew normally and their cellular and humoral immune responses were not impaired although wound healing, as judged by liver regeneration, was slightly impaired compared with that of mice immunized with the control antigen.

In short, Shier seems to have raised an immune response not only against transplanted tumour cells but also against the progression of cells transformed *in vivo* by a chemical carcinogen by immunizing against the wheat germ agglutinin receptor sites. No doubt hosts of laboratories will now be urgently mobilizing their chemists to prepare the antigens Shier has used and numerous variations on his theme, in attempts to confirm and extend his fascinating observations, which, although they defy simple interpretation, provide a most novel and promising lead to the pipe-dream of immunotherapy for cancer. It can only be hoped they are not too good to be true.

Atlantic Islands and Continental Drift

EVIDENCE has been accumulating that the Eastern Canary Islands (Fuerteventura, Lanzarote and Concepcion Bank) may play an important part in the fit of Africa and North America before continental drift. The most recent of such fits is by Dietz and Sproll (*Nature*, **226**, 1043 ; 1970), who suggest that the most prominent gap (the Ioni Gap) is well matched by the East Canaries block. A small strike-slip translation of the East Canaries would essentially fill this gap. Deitz and Sproll's proposal that the East Canaries constitute a sialic continental fragment (a microcontinent) detached from the African margin is therefore attractive to geophysicists.

Before this idea is accepted, however, it is essential to take into account other evidence which might point to an origin for the Canary Islands (perhaps recent oceanic volcanism) fatal to the hypothesis. The bathymetry of this general region (from US Naval Oceanographic Charts) reveals that Fuerteventura, Lanzarote and Concepcion Bank together form a single elongate and largely submerged plateau lying subparallel to the African coast, with a submarine morphology not at all suggestive of a volcanic plateau. In contrast, the Western Canary Islands are revealed as rudely circular volcanic piles with much more steeply sloping sides than the East Canaries plateau. Seismic refraction and reflexion profiling, combined with gravity data (see, for example, Bosshard and Macfarlane, *J. Geophys. Res.*, **75**, 4901 ; 1970), suggests strongly that the four most westerly Canary Islands do not form part of the African continent but are independent volcanic edifices lying on essentially oceanic crust. The geophysical work shows Gran Canaria to lie in a transitional area between oceanic and continental crust, but is at present inadequate for defining the crustal structure around Fuerteventura and Lanzarote, although it suggests that it is essentially continental.

The purely geological evidence bearing on this question is the subject of much controversy. The occurrence of carbonatites on the Eastern Canaries (but not on the Western Canaries) might be thought to constitute further evidence in favour of their continental nature, because recent surveys of carbonatite occurrences (*Carbonatites*, edited by Tuttle and Gittins, Interscience, 1966) show that they are typically found in fracture or rift zones in old shield areas.

Carbonatites were in fact reported from Fuerteventura by Fuster *et al.* in 1968, and from the Cape Verde Islands (which also have a bearing on this question) in 1965 by Assuncao *et al.* But the distinction between hydrothermal carbonate rich rocks and carbonatites is sometimes difficult on petrological grounds alone. In next Monday's *Nature Physical Science*, Allegre *et al.* report the results of carbon, oxygen and strontium isotopic ratio studies of rocks from Fuerteventura and the Cape Verde Islands which show them unequivocally to be true carbonatites. Portuguese geologists (Assuncao *et al.* have already suggested that the occurrence of carbonatites in the Cape Verde Islands could be explained if these islands were situated in the Mesozoic Mid-Atlantic Rift Valley when the North American and African continents started to drift apart. This suggestion can now be applied also to the Canaries.

It is worth noting that further support for this idea can be derived from the pre-drift fit of Dietz and Sproll, which results in the Fuerteventura carbonatite occurrence being located in fairly close opposition to the Canadian occurrences in the provinces of Ontario and Quebec. Nevertheless, problems remain for the petrologist in that the host rock of the carbonatites in Fuerteventura is a mafic and ultramafic plutonic formation similar in most of its features to the basements occurring in the truly oceanic islands of La Palma and Gomera.