stage specificity of the *t* lethals has been largely derived from morphological studies of developing homogyzous embryos *in utero*. The general interpretation has been that the *t* alleles affect specific cell types within the embryo. Recent work by Wudl and Sherman (*Cell* **9**, 523; 1976) has suggested that some *t* mutations are general cell lethals and do not affect a single cell type. When individual t^{w5}/t^{w5} embryos are cultivated *in vitro*, all the different cellular derivatives die; control explants of normal embryos survive favourably in these conditions. Wudl and Sherman also claim that the t^6 mutation may be a simple cell lethal, although Erickson and Pedersen (*J. exp. Zool.* **193**, 377; 1975) have obtained different results. Later acting t^{w18} mutations exhibit more specific cell lethality since homozygous embryos will develop in ectopic sites, are histologically anaplastic, but devoid of mesodermal derivatives (Artzt & Bennett *J. natn. Cancer Inst.* **48**, 141; 1972). Thus it is possible that there are two classes of *t* mutations, those which are lethal for all embryonic cell types and those which have cells that can escape the homozygous condition.

Whether or not the molecules carrying the *t* antigens are involved in cellular interactions in development remains an open question. The complexity of the cellular specificity of *t* mutations, the *T/t* locus genetics and the antisera make the task of answering it difficult. The isolation in culture of cell lines carrying particular *t* haplotypes will avoid the problems associated with sperm cytotoxicity and eventually allow biochemical characterisation of these antigens as with the F9 (Jacob *Immun. Rev.* **33**, 3; 1977). The identification of another antigen, PCC4, expressed by multipotent embryonal carcinoma and spermatozoa, but only on the inner cell mass of the newly implanted blastocyst (Gachelin *et al. Devl Biol.* **57**, 199; 1977) lends support to the view that surface changes are coincident with important determinative events in the embryos. □

Food lost to pests

from Robert M. May

FOR crops of grain in mediaeval times, a rough rule of thumb said that of every three grains, one was lost to pests or in storage, one was for next year's seed, leaving one to eat. The yield from modern crops is much greater, and the fraction to be set aside for seed is negligible, but the fraction lost has changed surprisingly little.

Drawing together information compiled by the US Department of Agriculture, Pimentel (*Bull. Ent. Soc. Am.*

Migration of a spreading axis

from Peter J. Smith

THAT part of the East Pacific rise which separates the Pacific plate to the west from the Nazca plate to the east between 0°S and 34°S is the most rapidly spreading section of the world oceanic ridge system. Some of it is also among the most complicated insofar as there may be two very small crustal plates lying between 22°S and 26°S and between 32°S and the triple junction at 34°S, respectively (Herron *Nature phys. Sci.* **240**, 35; 1972). Elsewhere, however, the spreading régime appears to be fairly simple, not least in the area around 31°S which has recently been investigated by Rea (*Earth planet. Sci. Lett.* **34**, 78; 1977). Here the topographic axis of the rise is now continuous and almost linear. But as Rea has discovered, it has not always been so.

Evidence for past deviations comes chiefly from the magnetic anomalies in the region. The axial anomaly is straight as is that associated with the Matuyama-Gauss reversal at 2.41 Myr. But the anomalies associated with the Olduvai event at 1.73 Myr and the Brunhes-Matuyama reversal at 0.7 Myr are curved. Moreover, in the southern part of the survey area the Jaramillo event anomaly at 0.92 Myr is offset about 10 km right laterally. Thus although the spreading régime may be simple now and may have been simple more than 2 Myr or so ago, things were evidently more complicated between times.

Rea interprets these data in terms of local migrations of the spreading axis, following Blakely (*Geology* **3**, 35; 1975) who invoked a similar phenomenon to explain spreading rate variations in the northeast Pacific. The axis of the East Pacific rise at 31°S was straight about 2.41 Myr ago but then gradually became more and more concave to the east until it broke in such a way that the southern section was offset to the west compared with the northern section. The break soon healed, however, leaving a continuous, but curved, axis which gradually became straight again. Throughout much of this period the spreading was also asymmetric (greater towards the east) and the total spreading rate varied.

The details of these axial migrations are, of course, specific to the area under investigation; but the underlying processes are more general. It appears to be significant, for example, that when the axial offset occurred, the result was not to move the axis further in the direction of curvature but to return it to a more central position, presumably closer to the underlying magma source. In fast spreading areas the relatively thin lithosphere cannot confine the spreading centre as easily as can the much thicker lithosphere in slow spreading regions, and so the axis tends to waver. When the axial curvature becomes too severe, however, it is relieved by offsetting which reduces the geographical deviation between the ridge axis above and the magma source below.

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22, 20; 1976) has shown that in the US in 1974 the losses in agriculture to insects were 13%, to diseases 12%, and to weeds 8%. This sums to 33% of the annual crop lost to pests, broadly defined. Corresponding average annual losses to pests throughout the decade 1951–1960 were 13% to insects, 12% to diseases, and 9% to weeds, and throughout the decade 1942–1951, 7% to insects, 11% to diseases, and 14% to weeds: over this span of time, losses to insects and plant diseases increased, while losses from weeds decreased.

Although the overall fraction of US crops lost to insects has increased despite the application of insecticides, important reductions of insect losses have been made on some crops. Thus

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the fraction of the potato yield lost to insects has declined from around 22% in 1910–1935 to 16% in 1942–1951 and 14% in 1951–1960. In contrast, losses in the apple crop (mainly due to codlin moth and apple maggot) in the same time intervals have been 10%, 12% and 13%; this reflects both decline in cultural controls formerly practised in orchards and increased emphasis on cosmetic aspects of marketing. For corn, a major grain crop, insect losses increased from around 4% in 1942–1951 to 12% in 1951–1960: contributing factors appear to be the continuous cultivation of corn on the same land year after year (increasing susceptibility to rootworm), and the planting of corn types that are less resistant to insect depredations. In all, about 1.2 billion pounds of pesticides (insecticides, herbicides, fungicides), or about 6 pounds per person, are at present