from which they derive is widely held to be useful.

One view is that cancer cells sometimes or always express antigens which are normally only to be found or are only found in large amounts in foetal tissues. Seen thus, malignancy is a form of dedifferentiation. The carcino-embryonic antigens and α-foetoproteins which are commonly found associated with certain kinds of cancer and which normally are characteristic of foetal tissues exemplify this point. The notion is attractive and is accumulating evidence. On page 225 of this issue of *Nature*, Castro and his colleagues report an experimental approach to the problem which might eventually show how an understanding of foetal antigens can be used in cancer therapy and perhaps even prophylaxis.

A mixed bag of foetal tissues was inserted under the kidney capsule of syngeneic or allogeneic recipient mice which were either normal or immunologically incompetent (by prior thymectomy, irradiation and bone-marrow injection). In normal mice neither syngeneic nor allogeneic foetal tissues grew well though syngeneic adult cells did. In the mice which were immunologically deprived foetal tissues of both kinds grew well and manifested differentiated cells of many sorts. Castro and his colleagues suggest that the failure of syngeneic foetal tissues to grow well in normal mice may indicate that there is a response against foetal antigens. Acting on this suggestion they went on to induce or transplant tumours in mice which had "rejected" syngeneic foetal tissue. In neither instance was a suppression of the malignancy observed; quite the contrary, the induction time was shortened and the growth of the transplanted tumour was enhanced. It might have been better had tumours which are known to express particular foetal antigens been used rather than chemically-induced tumours of ill-defined antigenicity. Nevertheless these studies do point the way for further and more specific experimentation.

From a Correspondent

CHEMOTAXIS

Nematode Orientation

from a Correspondent

NEMATODES are largely studied as parasites in man, animals and plants and few critical data on their behaviour and sensory physiology are available. *Caenorhabditis elegans*, and a few other nematodes, are, however, becoming the focus of considerable attention as basic biological models. *C. elegans*, which is about 1 mm long, can be maintained in the laboratory on bacteria or in axenic culture. As with other nematodes, many tissues, including the nervous system, have constant numbers of cells, and there are less than 300 neurones in *C. elegans*. It has a generation time of a few days, is a protandrous hermaphrodite, can be mutated in ethylmethane sulphonate and the mutants can be stored in nitrogen.

Tracks of three wild type adult *C. elegans* responding to gradients of NH_4Cl in a thin layer of agarose. The worms were placed on the plate at the points marked by dots and were allowed to make tracks for 15 min. The gradient ranged from 50 mM in the centre of the plate to 0.05 at the edge, and it changed little during the time of tracking (from Ward, *Proc. US Nat. Acad. Sci.*, **70**, 819; 1973).

Ward (*Proc. US Nat. Acad. Sci.*, **70**, 817; 1973) believes that the study of behavioural mutants can lead to a correlation of behavioural alterations with underlying changes in anatomy, physiology and biochemistry. This will identify the neural circuitry mediating the behaviour and may reveal molecular mechanisms by which nerves operate. The ultimate correlation may be between single gene defects and specific patterns of behaviour.

Ward used the wild type and selected mutants of *C. elegans* to study its chemotactic behaviour and set out to identify the attractants, the location of receptors, and the mechanism of orientation. Chemical gradients were established in 'Sephadex' or agarose and the orientation to and accumulation within high concentrations of attractants did not differ between larval stages and adults. *C. elegans* moved towards cyclic AMP and cyclic GMP at initial concentrations of 0.2 to 3.2 mM, but were not attracted by 3′-CH_2 AMP, $N^6O^{2'}$-dibutyryl-cyclic AMP, 3′ AMP and 5′ AMP. Certain, but not all, anions and cations were attractive, as were OH^- and some amino acids, but sugars were not. When cyclic AMP at 2.5 mM was distributed uniformly in 'Sephadex' before the establishment of a cyclic GMP gradient, normal orientation to cyclic GMP was eliminated. This suggests that both molecules act on the same receptor site. The presence of cyclic AMP did not affect orientation to Cl^-, and Cl^- and Na^+ did not compete. At concentrations of 0.3 M and above, the salts were repellent.

When moving over 1.5% agarose, *C. elegans* inscribes tracks and detailed analyses of its orientation are possible (see figure). Ward found that wild type individuals swam in relatively straight lines up to the gradients, but outside gradients or in areas of uniformly high concentrations, they turned, spiralled and frequently reversed. A slow mutant with degenerate muscles oriented equally as well as the wild type, but took eight times as long, demonstrating that orientation is independent of the forward velocity. Ward concludes that orientation is determined by the lateral movement of the head, and is therefore by clinotaxis. Results of experiments on other mutants with cuticular "blisters" support the notion that the amphids are chemoreceptors, an assumption which is likely to lack electrophysiological support for some time. The sensory receptors on the tail, the phasmids, seem not to be involved in the orientation response.

POLYPEPTIDES

The Missing Magnitudes

from our Molecular Biology Correspondent

PERHAPS the best justification that nowadays remains for the study of synthetic polypeptides as a twig, if not a branch, of molecular biology is that they allow theories of the kinetics of conformational transitions to be put to the test, and that the analysis of the kinetics of rapid processes in general has an undoubted relevance to a variety of interesting biochemical systems. The theory of the order–disorder transition of polymers in solution has reached a state of considerable refinement, and the indications are that it can account rather well for almost all the available experimental facts. As regards the archetypal case, that of the α-helix-random coil transition in synthetic homopolymers, quantitative data are sparse, however, since relaxation times in the microsecond region are involved, which are not accessible by the temperature-jump or related techniques. With the use of the Ising lattice formulation, Schwarz calculated the kinetic characteristics of such transitions taking account of the existence of nucleation and propagation processes in the formation of ordered