There is still a long way to go before fusion can be counted amongst the alternative energy sources. The figure of merit, which is the algebraic product of plasma density, temperature and containment time is still two orders of magnitude from the critical value. But the many problems of developing these reactors are being tackled in the right order and after the conference last week some more of them are known to be soluble. □

Growth factors for tumours

from Robert Shields

A VARIETY of cells transformed by murine or feline sarcoma viruses lose the ability to bind epidermal growth factor (EGF) to cell surface receptors. However, cells transformed by DNA viruses, avian sarcoma viruses or infected with non-transforming RNA viruses show normal binding of EGF (Todaro *et al. Nature* **264,** 26; 1976). Two types of explanation can be advanced for these observations. The more prosaic (and more likely) is that the sarcoma gene product directly or indirectly interferes with the amount or function of EGF receptors. Indeed it has been shown recently that mutant cells defective in the glycosylation of cell surface proteins have diminished amounts of EGF receptors on their surfaces and it seems quite possible that transformation by certain sarcoma viruses might have a similar effect (Pratt & Pastan *Nature* **272,** 68; 1978).

The more intriguing proposal put forward by Todaro and his coworkers (for which they produce no evidence) is that virally transformed cells are producing EGF or an EGF-like substance that competes with authentic EGF in the assay for the receptors. Since EGF is a growth factor for a number of cells this could mean that the transformed cells producing EGF would be permanently stimulated to grow. This could account for the lowered requirement for exogenous growth factors often shown by transformed cells. There are precedents for cells producing material that interacts with receptors on their own surface, as lines of neuroblastoma cells both produce and respond to nerve growth factor (NGF) (Bradshaw & Young *Biochem. Pharm.* **25,** 1445; 1976).

In a recent paper (*Nature* **272,** 356; 1978) De Larco and Todaro produce more direct evidence for the synthesis of growth factors by tumour cells. They report that a line of human fibrosarcoma cells produces a growth factor similar to MSA, a growth factor which was first described as the product of a rat liver cell line grown in serum-free medium (Dulak & Temin *J. cell. Physiol.* **81,** 153; 1973). The molecule is a member of the family of closely related hormones, the somatomedins (see *News and Views* **267,** 308; 1977; **270,** 665; 1977); like the somatomedins MSA has non-suppressible insulin-like activity (Dulak & Shing *J. cell. Physiol.* **90,** 127; 1977), a specific binding protein (De Larco & Todaro *op. cit.*) and is a growth factor for cultured cells (Rechler *et al. Eur. J. Biochem.* **82,** 5; 1978). Exactly which member of the human somatomedin family is produced by these fibrosarcoma cells will have to await more sophisticated analysis.

This is not the first report of MSA-like material synthesised by tumours. Patients with various non-islet cell tumours and suffering from hypoglycaemia have elevated serum levels of MSA-like material whose non-suppressible insulin-like activity accounts for the hypoglycaemia (Megyesi *et al. J. clin. Endocr. Metab.* **38,** 931; 1974) and the tumours contain particularly high concentrations of the molecule suggesting that it is being produced by the tumour itself (Hyodo *et al. J. clin. Endocr. Metab.* **44,** 1175; 1977). The normal site of synthesis of somatomedins is not known although the liver seems a likely candidate (Van Wyk *et al.* in *Advances in Metabolic Disorders* (eds Luft & Hall) **8,** 127 (Academic Press, New York, 1975)). However, such a diverse collection of tumours seem to make somatomedins that some at least

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Aromatic polyamides

from Paul Calvert

ONE of the early heroes of polymer science is W. H. Carothers who did much of the original synthesis and development of aliphatic polyamides, nylons, and made a great deal of money for his employers, E. I. Du Pont, in the process. Nowadays synthetic fibres make losses rather than profits and a polymer chemist with a new textile fibre would probably be told to go away and lose it. In this light it is encouraging to read a series of papers by P. W. Morgan and his coworkers, also of Du Pont, on aromatic polyamides, which remind us that industrial research can still be both useful and interesting.

In a paper first presented when he was given the Witco Award by the American Chemical Society in 1976, Morgan reviews the synthesis and properties of aromatic and other rigid polyamides (*Macromolecules,* **10,** 1381; 1977). These polymers are of interest because they are resistant to high temperatures, they dissolve in only a few very polar solvents such as concentrated sulphuric acid and amide solvents, they often form liquid crystalline solutions, and if spun into fibres from those solutions they form fibres with very high modulus and strength.

The succeeding three papers in the same issue of *Macromolecules* go on to describe the properties of these liquid crystalline solutions in more detail. The viscosities of solutions of poly(1, 4-benzamide) increase as a function of polymer concentration, then abruptly start to decrease at a critical value corresponding to the onset of opalescence in the solution. At higher concentrations the liquids consist of a mixture of isotropic solution and more concentrated nematic liquid crystalline solution. The polymer is partly fractionated with more high molecular weight chains in the anisotropic phase. Fibres spun from liquid crystalline solvents and heat treated reach strengths of 4×10^5 psi and moduli of 2×10^7 psi. NMR and infrared studies of poly(1, 4-benzamide) in dimethylacetamide-lithium chloride mixtures suggest that the polymer molecules exist associated to the chloride ions to form a negatively charged chain which pairs with a dimethylacetamide-Li^+ complex, giving a neutral chain which dissolves. One would like to know a lot more about these associations, particularly because of the analogy with protein solutions. On standing or in a magnetic field the anisotropic phase becomes uniformly oriented and transparent. Under these circumstances one can see ellipsoidal droplets of the isotropic phase, distorted from spherical by the surrounding anisotropic liquid.

These materials are in use as high temperature and reinforcing fibres, but relatively little has been published in the past apparently because of industrial secrecy. These papers should stir up considerable academic interest in these materials.

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