β subunit of mitochondrial F_1-ATPase to a large enzymatically-active fragment of bacterial β-galactosidase results in the presence of β-galactosidase in the mitochondria of yeast cells transformed with the chimaeric gene; the enzyme activity is resistant to added protease[8]. In a similar approach, the addition of 61 amino-terminal residues of a protein of the outer mitochondrial membrane to the amino terminus of the same β-galactosidase fragment has been shown to be sufficient to bind the β-galactosidase to that membrane[9]; in this case the enzyme is susceptible to added pro tease. The most impressive result is the transport of the mouse cytosolic enzyme dihydrofolate reductase into isolated yeast mitochondria when 22 of the 25 amino acid residues of the prepiece of cytochrome oxidase subunit IV are fused to the amino terminus of the reductase[10]. The fusion proteins transported across both mitochondrial membranes in the matrix space. In more recent experiments it has been shown that the first 15 amino acid residues of the prepiece are sufficient for retargetting (G. Schatz, personal communication). All these experiments indicate that the carboxy-terminal sequences of imported mitochondrial proteins are not required for correct targetting; some portion of the amino-terminal sequence is all that is required.

Other experiments have shown that it is possible to redirect globin from the cytoplasm into the endoplasmic reticulum, both *in vivo*[11] and *in vitro*[12], by fusing it with appropriate sequences from secreted proteins. Of particular interest is the identification of the locational signal in the secreted protein ovalbumin, which has no prepiece, as residing in amino acid residues 22–41; attachment of this sequence to the amino terminus of chimpanzee α-globin results in the sequestering of the fused protein in the endoplasmic reticulum of *Xenopus* oocytes[11].

Future work will determine how far these exciting observations can be extended to other locational sequences and to other cytosolic proteins. This ability to retarget proteins will not only stimulate more incisive experiments on the mechanism of protein transport, but also will allow the directed genetic modification of metabolic pathways in the subcellular compartments of eukaryotic cells. □

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John Ellis is in the Department of Biological Sciences, University of Warwick, Coventry CV4 7AL, UK.

Atmospheric chemistry

US plans for increased research

from S.A. Penkett

TOGETHER with a greater understanding of chemical phenomena in the lower atmosphere, the past decade has brought predictions of a series of potential anthropogenic catastrophies, such as the greenhouse effect and a nuclear winter. To try and rationalize this situation and to provide a solid basis of fact, a panel of the US National Academy of Sciences (NAS), chaired by R.A. Duce, has recently advocated a large international effort in basic atmospheric science, concentrating on the troposphere. The programme will be led by the US National Science Founation (NSF), National Aeronautic and Space Administration and National Oceanic and Atmospheric Administration. The proposals are published in a report entitled *Global Tropospheric Chemistry: A Plan of Action* (National Academy, Washington D.C. 1984). As well as outlining the need for a programme and proposing specific large-scale experiments in the atmosphere, the report presents an almost encyclopaedic synopsis of existing knowledge, sufficient to form the basis for an advanced university course in atmospheric chemistry.

Tropospheric chemistry deals with the chemical cycling of many nutrient elements that are essential for biological activity. It therefore becomes a study of the pathways of many minor constituents through the atmosphere and draws its format from other earth sciences, such as geochemistry and hydrology. A typical cycle is made up of many individual processes. It begins when gases in various chemical forms are emitted from the biosphere, either over land masses or over the ocean, and there is a need to quantify in detail the emissions from various biomes, such as tropical forests, agricultural areas and oceans. The emitted gases are spread by air movements and the resulting composition of the atmosphere will vary greatly according to the location of the source area and the chemical reactivity of the compound in question. Thus large-scale experiments are required to study the global variability in atmospheric compositions. For now, this is probably best done by aircraft and ships, but remote sensing from satellites of certain key molecules, such as CO, H_2O vapour and O_3, is highly desirable.

The many trace gas species undergo chemical transformations which are driven by the photochemical production of free radicals and peroxides in the troposphere. For example, in the case of carbon, CH_4 is oxidized to CH_2O in the gas phase by hydroxyl radicals. This can then be photolysed to CO, which is ultimately converted to CO_2, again by reaction with hydroxyl radicals. Other atmospheric reactions include the conversion of SO_2 to H_2SO_4, this time by reaction with soluble peroxides in cloud droplets. Comprehensive tests of the photochemical theory, which attempts to explain the presence of free radicals and peroxides in the troposphere, are essential.

The molecular products of the oxidation processes tend to be more easily removed from the atmosphere, either by rain or by gaseous absorption at the Earth's surface. The report calls for large-scale experiments to study the removal processes in detail, including budgetary experiments on cyclonic storm systems for wet removal and flux experiments on many gases for dry removal. Particular studies will investigate the nature of transfer processes which occur at interfaces such as the ocean surface and the tropopause.

In addition to the need for field and laboratory experiments, the report draws attention to the need to develop numerical models of increasing insight and complexity. This will probably need little encouragement, to judge by the plethora of theories and predictions that have already been based on a very limited data set.

There is no doubt that a large programme of research into the fundamental processes of atmospheric chemistry is needed; in many cases, the analytical capability is already to hand and the observation platforms are available. There is also no doubt that the programme needs to be international. Atmospheric gases are widespread across the world. A positive response has already been made to NSF and NAS by the UK Natural Environment Research Council, and others are expected. Whether, in the present financial climate, the necessary funds will be made available for this quiet revolution in atmospheric science remains to be seen. Meanwhile, a panel, chaired by R. Cicerone and W. Prinn, and consisting of US and non-US atmospheric scientists, has been set up to prepare estimates of cost and feasibility for a variety of programmes. This, it is hoped, will provide a specific stimulus for the funding agencies. □

S.A. Penkett is at the Atomic Energy Research Establishment, Harwell, Didcot, Oxfordshire, OX11 0RA, UK.

Corrigendum

IN the obituary of Milan Hašek (*Nature* **313**, 96; 10 January 1985) by P.B. Medawar and L. Brent, "negative hydridization" should have read "vegetative hybridization".