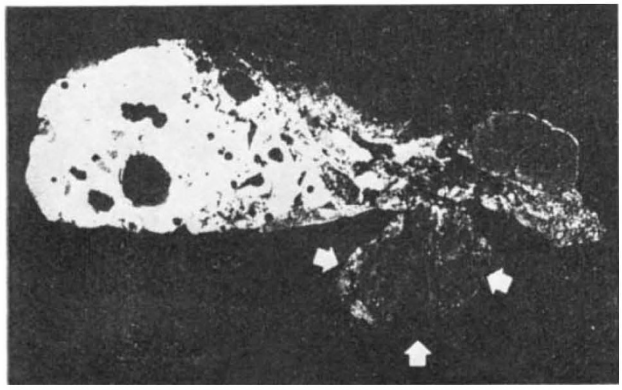

Fig. 4. Whole body sagittal section of a tumour-bearing mouse (Ehrlich adenocarcinoma) 10 min after the intravenous administration of 10 mg/kg of mitomycin *C*. The test organism is *E. coli*.

medium; in fact, the persistence of inactive radiolabelled byproducts of the chemotherapeutic agent may obscure the localization of the effective antifungal or cytotoxic activity. Furthermore, these methods are cumbersome and expensive and therefore self-limiting for broad screening of tumour affinity.

The autographic method employed in our laboratories over a period of years in our opinion overcomes these difficulties, allowing us to appreciate the presence of cytotoxic and antifungal drugs together with all their variously active byproducts, and to obtain a true map of their distribution and of their possible affinity for tumours.

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APPLIED SCIENCE

Rapid-response Atmospheric Oxygen Monitor based on Fluorescence Quenching

THE energy acquired by matter when it absorbs electromagnetic radiation is normally converted to heat, but in some cases much of the energy may be re-emitted as fluorescence or phosphorescence. Fluorescence is often quenched (that is, its intensity is reduced) in the presence of oxygen. The degree of quenching depends on the probability of an encounter between a molecule of oxygen and a fluorescent molecule in its excited state, and the energy that would otherwise be emitted as fluorescence is transferred to the oxygen. This effect has been used as the basis of a portable instrument to measure the atmospheric oxygen tension (British Patent Application No. 46674/66). Various prototype devices have been constructed and tested.

In principle, the partial pressure of oxygen in a gas can be measured by bubbling the gas through a solution of a fluorescent material exposed to exciting radiation, and measuring the intensity of fluorescence. For example, the fluorescence from the polycyclic aromatic hydrocarbon fluoranthene dissolved in cyclohexane solution is considerably quenched when air at normal pressure is bubbled through the solution. Apart from practical difficulties, however, such a device would be slow to respond to changes in the partial pressure of oxygen in air. This sluggishness has been overcome by using polyethylene as a matrix for the fluorescent material. A film of polyethylene, 25 or 50 μm thick, is soaked in cyclohexane solution containing fluoranthene and is then blotted dry, after which the solvent is evaporated. The resulting film shows changes in fluorescence a few seconds after being exposed to a gas of different oxygen partial pressure. Unfortunately, the loss in mobility of the fluorescent molecules on being contained in a solid rather than in a liquid results in a considerable lowering of the quenching efficiency. Similar results are obtained with silicone and natural rubber films. Rapid response and high quenching efficiency, however, can be combined by using porous 'Vycor' glass as a matrix for the fluorescent material. A cyclohexane solution containing fluoranthene is absorbed in the pores of the glass and the solvent is evaporated leaving the fluoranthene adsorbed on the surfaces of the pores. The higher quenching efficiency is presumably a result of the greater ease with which the oxygen molecules can reach those of the fluorescent material. The relationship between partial pressure and quenching indicates that the oxygen is strongly adsorbed on the surfaces of the pores in the 'Vycor' glass.

One prototype instrument consisting of a miniature ultraviolet emitting glow lamp, an ultraviolet transmitting filter, a fluoranthene/'Vycor' or fluoranthene/polyethylene disk, an ultraviolet absorbing filter and a cadmium sulphide photoconductive cell responded to nitrogen, air and oxygen as shown in Table 1. With nitrogen, the particular photocell used gave currents at 12 V of about 40 μA with fluoranthene/'Vycor' and 80 μA with fluoranthene/polythene.

Table 1. RESPONSE OF A PROTOTYPE INSTRUMENT TO NITROGEN, AIR AND OXYGEN

Test gas	Percentage of fluorescence quenched	
	Fluoranthene/'Vycor'	Fluoranthene/polythene
Nitrogen	0	0
Air	41·0	2·8
Oxygen	63·5	9·9

The gas, the oxygen tension of which is to be measured or monitored, is pumped or allowed to diffuse into a light-tight chamber containing the device. A diffusion system is more suitable for a portable instrument, and a chamber of sintered metal allows sufficiently fast diffusion. The fluorescent disk can be protected from contaminating vapours by a layer of activated charcoal.

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