Preservation in bogs

SIR—Doran *et al.* (*Nature* **323**, 803; 1986) have shown reasonable histological preservation of 8,000-year-old brain tissue from a bog site, yet they have not given an explanation for why the tissue preservation should be so good. We suggest that it is due to tannic acid and related compounds contained in the bog fluids. We have demonstrated excellent ultrastructural preservation of osteocytes from the 11,000-year-old antlers of an extinct Giant Irish Deer. In this case preservation in the bog environment is so good that cytological features, such as mitochondria, rough endoplasmic reticulum, Golgi elements and nuclear pores are clearly demonstrated.

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How many reactor accidents?

SIR—Edwards[1] is correct that Islam and Lindgren[2] have failed to recognize that their distribution function is a likelihood function. But he is incorrect in asserting that their conclusions are unwarranted and in assuming that physicists do not know how to work with small samples. In fact Islam and Lindgren's likelihood function has been used in particle physics for over fifty years to make estimates of particle decay rates when the number of events in an experiment is small[3]. Their approach yields not only estimates of the accident rate and probabilities but also the familiar standard errors and confidence limits without resort to Edwards' less familiar support function.

The estimate of r, the accident rate, is given by the maximum of the likelihood function. The standard error is conventionally quoted as the value(s) of r for which the likelihood L, falls to $e^{-1/2}$ of its maximum value. And the (one-tailed) confidence limits on r are set by solving for r in the integral equation;

$$\int_r^{\infty} L_N \int \mathrm{d}r = P$$

where L_N is the normalized likelihood function. These values of r can then be used to obtain estimates, standard errors and confidence limits on the probability P_T of accidents within the next T years.

The two events over a cumulative 4,279 reactor years of operation[4] give the estimate $r = 1/2{,}140^{-2{,}620}_{1{,}000}$ reactor years with a one tailed 95% confidence limit $r > 1/5{,}240$ reactor years. In the next ten years 28 reactors are expected to be decommissioned and 156 are expected to come on line giving 4,900 reactor years of operation[4]. The probability of one or more accidents in the next ten years is then $P_{10} = 0.90^{+0.09}_{-0.26}$ with a 95% confidence level of $P_{10} > 0.60$. Thus one has a quantitative estimate of how small the probability of accident is likely to be.

Given that there have been two major accidents in the world's reactor inventory over 4,280 reactor years of operation the odds are 20:1 ($p > 95\%$) that in 100 identical ensembles of reactors 60 ensembles will have one or more accidents within ten years. A similar calculation shows that even if the world's reactors are phased out over the next 25 years the probability of major accident is $P_{25} = 0.994^{+0.005}_{-0.09}$ with $P_{25} > 0.88$ at 95% confidence.

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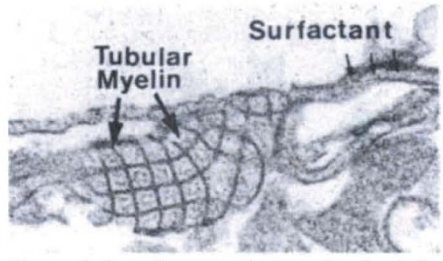
Alternative solutions

SIR—The small grid-like mystery object of Wolstenholme *et al.*[1] may be a fragment of 'tubular myelin', which is the contracted or non-spread form of lipoproteinaceous pulmonary surfactant. Fetal surfactant has been identified in human amniotic fluid[2], and the tubular myelin form is commonly observed. The dark-stained squares probably represent protein which is perhaps stained during chromosome preparation.



Transmission electron micrograph of tubular myelin in the lung of a rat exposed to asbestos. Taken from ref.3.

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SIR—Wolstenholme *et al.*[1] have probably observed a well-preserved area of a meshwork of the nuclear lamina lining the nucleoplasmic surface of the inner nuclear membrane which supports the interphase chromatin. It is unusual to observe any remnant of lamina in a metaphase preparation, but two chromosomes in the figure appear to be sticking to lamina.

Full boxes in the pattern could represent the cytogenetic manifestation equivalent to the points of anchorage of the interphase chromosomes (telomeric ends and fragile sites) onto the laminar surface, thus reflecting the packing of chromosomes during interphase in a 'coded' form. The average crossover space of the human lamina is 0.52 μm. A 'decoded' picture of the pattern of native nuclear lamina of *Xenopus laevis* oocytes can be found in a past issue of this journal[2].

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Archaeopteryx, the primordial bird?

SIR—In view of the highly critical review of our book *Archaeopteryx, The Primordial Bird: A Case of Fossil Forgery* (*Nature* **324**, 185; 1986) I would like to bring to your notice recent developments that would seem to have vindicated our views.

The issue hinges on whether or not the material on which feather lines are impressed, and of which a few extraneous blobs exist elsewhere on the fossil surface, is comprised of a cement which is foreign to the rock. At our request the museum authorities supplied us with a sample of the suspect material and of the native rock matrix. These samples have now been examined by Dr Lee M. Spetner and his colleagues in Israel using a scanning electron microscope and X-ray spectroscopy. The sample from the rock matrix shows a characteristic crystalline structure exactly as in other specimens of Solnhofen limestone, with identical X-ray resonance spectra. But the sample from the suspect material shows a non-cystalline structure resembling that of amorphous material bound by an organic glue. X-ray resonance spectra showed large amounts of silicon as well as lead and chlorine which are certainly alien to native Solnhofen limestone.

These striking differences in texture and composition between the suspect regions and the native matrix are, in our view, a strong indication that this dispute will eventually be resolved in our favour. The results have been communicated to the British Museum along with a request for further samples of material from the fossil for examination with a view to narrowing down the possible organic compounds that are involved in the 'glue'.

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