PALAEOBOTANY

Vascular pipe dreams

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THE definitive evidence of vascular tissue in the axes of *Cooksonia pertoni*, presented by Edwards *et al.* on page 683 of this issue[1], finally confirms the belief held by many palaeobotanists — *Cooksonia* was indeed a vascular plant. The discovery strengthens the position of *Cooksonia* as an ancestral vascular plant (Fig. 1) and supports generally held ideas regarding the evolution of early land plants.

Cooksonia pertoni is of upper Silurian

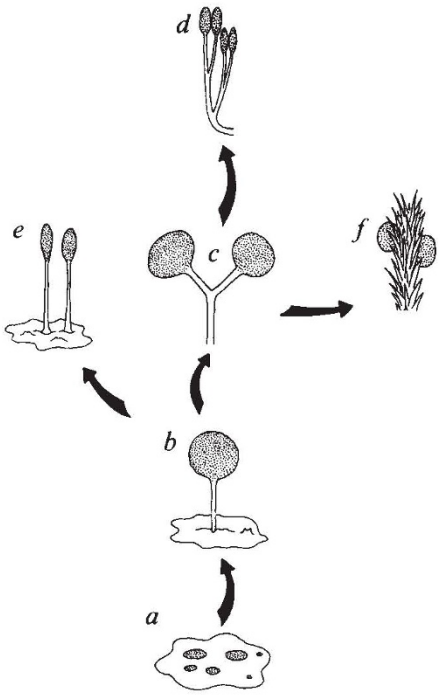

FIG. 1 A possible phylogeny of land plants illustrating the important position held by *Cooksonia*. *a*, A thalloid alga bearing simple sessile sporangia (stippled). *b*, A thalloid gametophyte supporting a simple sporophyte consisting mostly of sporangium. *c*, *Cooksonia*, a branched sporophyte. *d*, An early Devonian vascular plant showing dichotomous branching and numerous sporangia. *e*, A simple bryophyte, possibly derived from *b*. The lycophytes (*f*) appeared at about the same time as *Cooksonia* and may be derived from a similar ancestor.

to lower Devonian age — that is, is some 400 million years old — and was first described in 1937 (ref. 2). It was a regularly branched plant only a few centimetres in height, bearing rounded spore-bearing structures (sporangia) at the end of upright axes. The apparent simplicity of this structure gives the plant a kind of 'totipotency' in terms of its potential for the subsequent evolutionary development (in Devonian vascular plants) of the more complex branching patterns of the sporophyte. The discovery of thickened tubes in *Cooksonia* therefore provides the basis for the elaboration of not just the morphological traits, but also the water-conducting system. It is the dual role of water transportation and support performed by vascular elements within sporophytes that has permitted the increase in size beyond the diminutive *Cooksonia* to the arborescent state seen in a number of plant groups later in the Devonian.

Despite the earlier absence of evidence regarding its vascular nature, it has for some years been known that *Cooksonia* possessed other crucial characteristics generally associated with land plants[3]: a cuticular covering, stomata and thick-walled spores[4,5]. But such a combination also occurs within bryophyte sporophytes, and so the status of *Cooksonia* in terms of its relationship with the two main groups of land plants, the vascular and nonvascular, remained unclear.

Investigation of slightly younger Devonian material[6,7] has begun to reveal the distribution of the four main types of water-conducting tissues found in early land plants — simple elongate tubes; S-type cells[6] with an inner microporate layer covering the thickening within the tube; G-type cells[6] with simple annular thickenings; and tracheids with scalariform pitting (Fig. 2). Simple tubes and S-type elements are present in the axes of many of the early Devonian plants but not within the lycopods, where the G type predominates. Tracheids are not encountered unequivocally until the late early to middle Devonian. Significantly, some living liverwort gametophytes, such as *Takakia* (considered primitive within this group[8]), possess the S-type element.

The vascular elements found in *Cooksonia* do not appear to have an inner microporate layer, and were probably of the G type. However, the morphology of the plant bears less resemblance to the lycopods and more to the other contemporary groups where S type and unornamented tubes occur. It seems most reasonable that tracheids with scalariform pitting should emerge ultimately from the G-type element, this being a satisfactory hypothesis for the occurrence of tracheids in lycopods but less adequate in explaining their presence in the presumed descendants of the S-type plants. The occurrence of G-type elements in *Cooksonia* offers the possibility that tracheid-like elements were present relatively early amongst some nonlycopod groups. Other groups possessing S-type elements (including ancestral

RÉSUMÉ

Gangliomodulin?

GANGLIOSIDES are components of membranes, especially in nerve cells, and play a still ill-defined part in proliferation and differentiation of cells. H.Higashi *et al.* (*J. Biol. Chem.* **267**, 9831–9838; 1992) have looked for and found a ganglioside-binding protein from brain cytosol, which, on examination, turned out to be nothing other than calmodulin. Gangliosides are known in certain cases to affect the activities of enzymes that are themselves controlled by calmodulin. A second paper in the same issue, by H. Higashi and T. Tamagata (9839–9843), reports on such a system in which the gangliosides bind to both the enzyme and its regulator, calmodulin. A scheme, involving the displacement of gangliosides from the enzyme by the calmodulin, is elaborated.

Down the tube

THE axion, proposed to explain why neutrons do not have the large electric dipole otherwise expected, is supposedly a nearly massless particle (like the neutrino) with no angular momentum (unlike any other elementary particle). They should be produced copiously in the Sun and other stars — if they exist. The problem is finding a suitable telescope to pick them up; a long length of vacuum tubing surrounded by magnetic fields is what is called for, and can be found in most particle accelerators. But these are hardly manoeuvrable. However two straight sections of the LEP storage ring at CERN point just 1.4° from the midsummer sunrise position, note F. Hoogeven and R. G. Stuart (CERN preprint TG.6457/92) — as future archaeoastronomers may spot, they add mischievously — and twice a year (in summer and winter) the Sun shines straight through them for about 20 seconds. Could LEP enjoy a transitory change from particle factory to astronomical telescope?

Model prospects

IN a report to appear in next week's *Science* (3 July), M. B. Agy and colleagues show that the pigtail macaque is susceptible to the type-1 human immunodeficiency virus. The work stems from the need to find a different animal model for research into HIV-1 — chimpanzees can be infected with the virus (although they do not develop AIDS) but are an endangered species. Pigtail macaques are not, and the eight individuals inoculated by Agy *et al.* all showed heavy and persistent infection with the two virus strains used. The species may well turn out to be at least as appropriate as the chimpanzee as a model for examining the initial course of infection with HIV-1 and evaluating potential vaccines.