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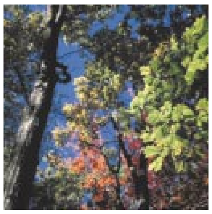
John Bryant takes a closer look at some of this month's Original Articles



Wood for the trees

Those who work with wood, and even those who just burn it, know of the immense variation in texture and density amongst the many tree species. It is density, or more correctly, specific gravity, that has been investigated by **Woodcock and Shier (University of Hawaii-Manoa, pp. 529–537)**. Across the range of tree species, values of specific gravity between 0·12 and 1·4 have been recorded. However, wood specific gravity also varies within a species and within individual trees. It is widely assumed that changes in wood density reflect changes in conditions experienced by a tree during its lifetime. In many species, wood specific gravity increases radially from inside to outside; this is thought to be a response to greater mechanical stresses such as wind loading as the tree enlarges. The authors reasoned that in any one species, canopy trees were likely to be more exposed than sub-canopy individuals; thus it would be expected that individuals that form or protrude from the canopy would show a greater radial increase in wood specific gravity than those in the sub-canopy. But their data from a mixed hardwood forest in Massachusetts, USA, revealed a more complex situation. Of three species studied in detail, only *Acer rubrum* exhibited a radial, inner to outer, increase in wood specific gravity. In *Fagus grandiflora* and *Tsuga canadiensis* an opposite trend was very marked. There was some relationship between canopy position and specific gravity: the inner wood of canopy trees had a higher specific gravity than that of sub-canopy trees, but the reverse was true for the outer layers. Also, the maximum specific gravity of the wood was higher in canopy trees than in sub-canopy trees. As the authors so rightly put it: 'The number of factors that may influence specific gravity is quite large . . .'. There is extensive scope here for further research.

Sinking carbon into nitrogen metabolism

It is very interesting to read some of the predictions made by plant molecular biologists in the late 1970s. At that time, many of the hopes for plant GM (which still had not actually been developed) were unrealistic. One favourite, which we still sometimes hear from school students, was the transfer of nitrogen-fixing capabilities to non-leguminous plants. One lab famously predicted that N_2-fixing wheat would be available by the year 2000. One feature that these predictions lacked was an understanding of the effect of nodulation and N_2-fixation on the host plant's physiology. The metabolic cost of establishing and maintaining nodules is significant. But, does the sink strength of nodulated roots differ between plants entirely dependent on N_2-fixation, and what about plants where external nitrate is also available? These question have been part of a very detailed investigation by **Voisin *et al*. (Dijon and Montpellier, pp. 539–546)**. The authors maintained pea plants in the presence and absence of nitrate, and manipulated photosynthetic rates to give a range of concentrations of available photosynthate. The carbon partitioning in the two sets of plants was very similar. They showed identical trends in terms of photosynthate going to the roots: the actual amount going to roots went up but the proportion of net photosynthate went down as photosynthetic rate increased. Furthermore, in both, the comparative pulling power of the roots declined as the plants started to flower, and had declined to a very low level during seed filling when seeds became the major sink. In some ways, these results are surprising: based on the metabolic cost of N_2-fixation, we might expect that roots relying entirely on N_2 would act as stronger sinks than nitrate-fed roots. All this is a clear reminder not to make assumptions; Francis Bacon's 17th-century call to test by experiment is still very relevant.

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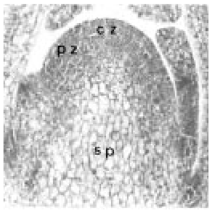

SAM's speedy response to stimulus

Annie Jacqmard has very recently retired from the University of Liège after a long and distinguished career. She has made a significant contribution to our understanding of the cellular processes involved in the induction of flowering, and it is thus fitting that we focus on her paper (**Jacqmard *et al.*, pp. 571–576**). It is now well known that in many dicot species, acceleration of cell division in the shoot apical meristem (SAM) is an early event in the floral transition. It has been suggested by Dennis Francis at Cardiff and by Georges Bernier at Liège that this is a prerequisite for subsequent reorganization of the SAM. In the paper discussed here, the authors have examined, in more detail, the timing and localization of the changes in cell division pattern in *Arabidopsis thaliana*. Plants were kept in short days and were thus maintained as rosettes. Flowering was then induced by exposure to a single long day of 22 h. Mitotic activity in the SAM begins to increase within 24 h of the *start* of the long day, i.e. before the movement of the floral stimulus from leaves to apex is complete. The stimulation of cell division is particularly marked in the central and peripheral zones, and the distinction between these two zones then becomes less marked. The rib meristem (below the central zone) exhibits a smaller increase in mitotic activity and there is no renewal of cell division in the pith derived from the central zone. These changes lead to an enlargement of the SAM that is evident by 44 h, slightly preceding the start of floral meristem initiation. This careful work has thus shown that cell division activity in the SAM is exquisitely sensitive to the floral stimulus and raises interesting questions about the control of the process at the molecular level.

Actin CAPped for cell enlargement

The size and shape of plant organs results from a combination of many interacting factors. These include cell numbers, polarity of cell divisions, and the direction and extent of cell elongation. Environmental cues and cell–cell signalling are involved, and within cells the activity of the cytoskeleton is important. This latter aspect has been the subject of a study by **Barrero and colleagues (Tokyo and Iwate, pp. 599–603)**. Cyclase-associated protein (CAP) is an actin-binding protein that occurs widely in eukaryotes, including plants. The protein is specific for actin monomers and promotes depolymerization of F-actin filaments. CAP-induced depolymerization has been shown to be involved in regulating cell size and polarity in drosophila, and the question is whether the same is true in plants. The authors have cloned a CAP-encoding gene from *Arabidopsis thaliana* and have inserted it into tobacco plants under the control of an inducible promoter. The latter feature enabled them to activate the gene at particular stages of seedling growth. The results of over-expression of the CAP gene were very clear. Leaves formed after induction of the gene were misshapen and very much reduced in size compared with leaves of control plants. This was the result of significantly reduced cell elongation of epidermal and mesophyll cells; there was no decrease in cell number. The authors compare these results with those previously obtained with *A. thaliana* itself where over-expression of the CAP gene led to a reduction in cell number and in cell expansion. The difference between the effects in the two plants may be genuine, i.e. cell numbers are under different controls in the two species, or may simply arise because of the differences between homologous and heterologous over-expression. In either case, the results imply a role for the actin cytoskeleton in regulation of organ size and shape, and thus pave the way for further investigation.

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