C. PARENT, T. JIN & P. N. DEVREOTES

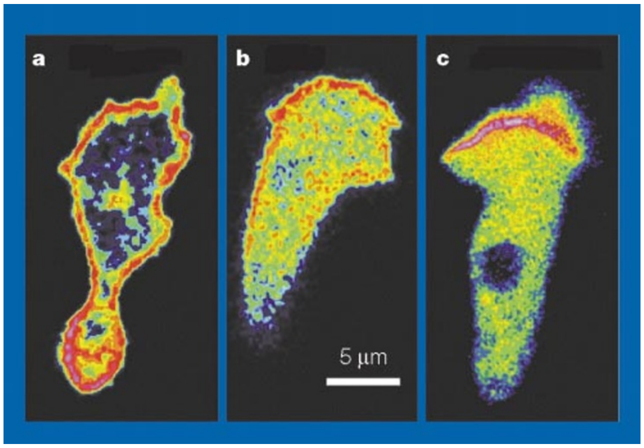

Figure 1 **Localization of signalling events in *Dictyostelium* cells undergoing chemotaxis. Each cell was stimulated by chemoattractant (top of each frame). Chemoattractant receptors** (a) **and G-protein β-subunits** (b) **are uniformly distributed on the cell surface, whereas proteins with lipid-binding pleckstrin-homology domains** (c) **are selectively recruited to the leading edge. The distribution of each protein was imaged in cells where the endogenous gene was replaced by a green-fluorescent-protein fusion construct. Regions of highest fluorescent intensity are in red.**

CRAC, a protein necessary for receptor activation of adenylyl cyclase; the protein kinase, PKB, which is required for cell polarization; and PHD1, which is required for chemotaxis. Membrane association of the PH-domain proteins can be blocked by inhibitors of phosphatidylinositol-3-OH kinase (PI(3)K) or null mutations in two partially redundant PI(3)Ks. These results show that cellular polarity can now be analysed at the molecular level.

Green fluorescent protein has also been used to follow the behaviour of differentiated pre-spore and pre-stalk cells as they sort from each other to form specific tissues[3,4] (J. McNally, Natl Insts Health; H. Levine, Univ. California San Diego). Videomicroscopy and computer simulations show that changes in relative adhesion may be important in cell sorting. Expression of two proteins connected with cell adhesion, lagC (a relative of I-CAM) (C.-H. Siu, Banting and Best Inst., Toronto) and ampA (which is related to the disintegrin family) (D. Blumberg, Univ. Maryland), is restricted to the stalk-cell precursors. The phenotypes of null mutants in either gene are completely consistent with roles in cell-type-specific adhesion. The GFP approach has also been used to follow the way individual cells move within the multicellular organism as it responds to light (K. Miura, Univ. Munich) or to waves propagating from the anterior (C. Weijer, Univ. Dundee).

Dictyostelium shares many properties with animal cells but also has several features of plants. For instance, cellulose microfibrils reinforce the extracellular matrix after cells have aggregated, and form the stalk of the fruiting body[5]. The gene encoding the catalytic subunit of cellulose synthase has been difficult to pin down in plants, but has been discovered in a screen for *Dictyostelium* mutants that fail to make cellulose (L. Blanton, Texas Tech.). Mutant fruiting bodies are unable to support their own weight, and collapse soon after they form. Further studies have shown that there is a single gene for cellulose synthase, making *Dictyostelium* an especially attractive test system for expression of putative plant cellulose synthase genes as well as for uncovering accessory proteins.

Medical interest in *Dictyostelium* will also be stimulated by the discovery that it can be infected by the intracellular bacterial pathogen *Legionella pneumophila* (J. Solomon, Tufts Univ.). In human lung macrophages and *Dictyostelium* amoebae, the bacteria escape from the phagocytic pathway, grow in vesicles inside the host cells, and eventually burst them. Genetic screens for resistant strains of *Dictyostelium* can now be used to uncover host functions manipulated by this stealth bacterium.

Although a characteristic of *Dictyostelium* research is its breadth, it must be seen in the round (J. Bonner, Princeton Univ.): "One must never lose what Barbara McClintock called, 'the feeling for the organism'. It makes no difference at what level one works, whether it be molecules or ecology or any level in between: all is lost if one forgets that *Dictyostelium* is an organism. In this way one can keep one's work in tune with nature; in this way one can see the all-important connections between all the levels of inquiry." ■

William F. Loomis is in the Department of Cell and Developmental Biology, University of California at San Diego, La Jolla, California 92093, USA.
e-mail: wloomis@ucsd.edu
Robert H. Insall is in the School of Biosciences, University of Birmingham, Birmingham B15 2TT, UK.
e-mail: rhinsall@pugh.bip.bham.ac.uk

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** International* Dictyostelium *Conference*, Bar Harbor, Maine, 14–19 August 1999. http://www.sp.uconn.edu/~knecht/

Daedalus

An actively cold wind

Wind-power, says Daedalus, is a mixed ecological blessing. Even a very windy site crowded with noisy turbines delivers only a modest amount of electrical power, rather unreliably. Much power these days goes to cool and air-condition buildings. Daedalus reckons the wind could do the job directly.

He points out that a guided air-stream can develop a temperature gradient, a fact exploited in the vortex-tube refrigerator. Air blown helically into a cunningly shaped tube divides into a hot stream and a cold one. The power for this thermodynamic feat comes from the motion of the air itself. So, says Daedalus, it should be possible to give a building a subtle aerofoil shape, such that the wind blowing past it cools it by the vortex effect, while discharging the waste heat into a separate stream downwind. Buildings with strange shapes are highly fashionable these day, and not only in Sydney and Bilbao. But could the design be practical? Commercial vortex-tube refrigerators use air at several atmospheres. Even a strong gale efficiently harnessed would produce less than a degree of cooling.

Daedalus is undaunted. He will give his building regenerative cooling. Banks of internal heat-pipes, with their almost infinite effective conductivity, will return the initial cooling to the incoming wind. The next cycle of cooling will be that much greater. This cooling too will be returned to the incoming wind, and so on. When the required degree of cooling has been reached, the heat pipes will be throttled back.

The shape to do all this will be subtle indeed. Daedalus's starting design echoes those chimneys whose helical vanes direct the wind upwards no matter from which direction it blows. The rising vortex will have its greatest cooling effect on the roof, from which heat-pipes will recycle the cold to incoming ground-level air again. By reversing the vanes, the building can intercept the heated airstream instead, thus allowing the wind actively to warm the building. With its large cross-section, the structure will capture far more energy than any turbine; and as a distributed heat pump, it will be able to deliver many joules of heat or cold for every joule of intercepted energy. The instantaneous heating or cooling effect will vary wildly with the gusting of the wind, but the thermal mass of the structure will smooth it out well. Daedalus's wind-conditioned buildings will be a major contribution to ecological engineering. **David Jones**