Schematic side view of the *Xenopus* embryo at late blastular stage, with the future dorsal midline to the right. Shaded areas across the equatorial region represent the first-induced sectors referred to in the text, while the matching arrows beneath represent the belief that two specific arrays of vegetal-inducing signals are responsible for induction. The long black arrowheads represent the idea that signalling systems for further organization could relate to the progressive distance from the first signal sources within the marginal zone, and the function of DMZ as a new source for signalling into VMZ. Both of these dimensions tend to map onto the head → tail organization of the future body. Also indicated is how the cell sheet forming the animal pole region can be excised for culture in a simple medium with purified proteins (or without them, if whole eggs have been pre-loaded with an ectopically transcribable RNA) to test candidate developmental signalling molecules. It can be seen that the extent of animal pole taken, and the age of the donor blastula, could affect the interpretation of such tests.

perfection stem from the spatial crudity of this experiment, in relation to some pattern of source localization or signal timing that attends normal development? That speculation remains worthwhile in my view, but the reductionist approach may nevertheless have been vindicated by the identification of two powerful new players whose injection in this way does induce head along with the remaining dorsal axial pattern.

The Wnt proteins (the founder member of which was the oncogene *int-1*, in turn cognate with the *Drosophila* segment polarity gene *wingless*) might seem good candidates for pattern organization in embryos. They are matrix-associated on secretion so that their effects might spread only slowly and across some six cell diameters⁵. Most though not all members thus far cloned from *Xenopus* or mammals — as well as the *Drosophila* homologue — are effective in achieving head pattern in blastomere injection or comparable experiments (L. Christian, Washington University, Seattle; L. Dale, Birmingham University). One such effective RNA is present at the right vegetal location and times to be a candidate in normal development (M. Ku). Noggin (R. Harland, University of California, Berkeley), a more conventionally secreted protein but one with no known

relatives to date, cloned directly from *Xenopus*, has very similar properties to the Wnt proteins in RNA-injection experiments.

On balance, Noggin and Wnt proteins are deemed themselves not to be inducers (that is, able to effect a change in specified state in naive animal cap cells *in vitro*, like activins and FGFs). Rather they may modulate the effects of inducers locally, leading to enhanced DMZ states that allow development of the anteriormost body parts. This raises the possibility that inducers as such play less critical spatial roles in the organization, while other adjunct signals, in modulating the local character of induced states, adopt those roles — for example Noggin and/or a Wnt protein as 'dorsalizers' (R. Harland). Thus the animal hemisphere from early stages, before overt induction, may become cryptically patterned or graded in responsiveness by the regional influence of such molecules from more vegetal cells (or, conceivably, by direct inheritance from egg structure).

Evidence of such cryptic pre-organization of the 'uninduced' animal hemisphere has been controversial since before the molecular breakthrough. Modulators might, after all, be synthesized as immediate downstream consequences of induction rather than being received as signals ahead of time. At the meeting, this controversy took the form of contention over whether animal hemispheres, of particular ages, are or are not subregionalized in the local responsiveness of their cells to activin *in vitro*. Laboratories separated merely by the Atlantic Ocean differ as to whether groups of animal hemisphere cells from ventral sides of blastulae, cultured in a simple salt solution with particular concentrations of the protein, can give rise to the unambiguous tissue notochord as dorsal animal cells are agreed to do.

While such episodes recur, the field remains a rich store of human as well as intellectual interest. But, quite properly and indignantly, grass roots postdocs and students ask why lab heads cannot spare the jetfare that would enable pairs of young, clever and open-minded people to sit down side by side with their tungsten needles and activin samples, and find out what is going on. □

Jonathan Cooke is at the MRC National Institute for Medical Research, Mill Hill, London NW7 1AA, UK.

1. Smith, J. C., Price, B. M. J., Van Nimmen, K. & Huylebroeck, D. *Nature* **345**, 729–731 (1990).
2. Smith, J. C., Cooke, J., Green, J. B. A., Howes, G. & Symes, K. *Development* **107**, Suppl. 149–159 (1989).
3. Slack, J. M. W., Darlington, B. G., Heath, J. K. & Godsave, S. F. *Nature* **326**, 197–200 (1987).
4. Kimelman, D., Abraham, J. A., Haaparanta, T., Palisi, T. M. & Kirschner, M. W. *Science* **242**, 1053–1056 (1988).
5. Jue, S. F., Rogers, S. B., Rudnick, J. A., Varmus, H. E. & Brown, A. M. *C. Molec. cell. Biol.* **12**, 321–328 (1991).

A light grip

MODERN high-performance cars are limited by the fundamental laws of friction. All the forces acting on the car come from the reaction of the tyres on the road; even with unity coefficient of friction these forces cannot exceed the weight of the car. Four-wheel drive, antilock braking systems, power steering and so on all try to get as close to this limit as possible. Racing cars try to exceed it: they use 'negative lift' surfaces which push the car down onto the road and increase its effective weight. But what we really need, says Daedalus, is a sticky tyre.

At first sight, this seems obviously unworkable. Conventional repeated-stick surfaces — such as office labels and adhesive putties — absorb a great deal of energy during each stick–unstick cycle. A tyre so coated would have enormous drag. But Daedalus recalls the chemistry of photodecomposition. Light excites the electrons of a chemical bond into some antibonding orbital. The bound atoms are not merely uncoupled; they are actively pushed apart. In the dark, they can recombine again. It all happens in picoseconds.

So DREADCO chemists are devising a photoactive tyre surface. Its marginally stable molecules are easily disrupted by daylight; its illuminated surface is populated largely by antibonding orbitals. But as the tyre revolves, each section in turn is pushed against the road. The daylight is cut off, and the photoactivated free radical surface reverts to a bonding state. It reacts with the road surface, gluing itself firmly in place. Meanwhile, at the trailing edge of the tyre, light leaks in from behind. It continuously excites the emerging surface back to the antibonding state; it unsticks instantly, and is positively repelled from the road.

Thus four-wheel drive, antilock braking and so on will be rendered obsolete. Fitted with DREADCO's phototires, any car will enjoy utterly tenacious roadholding — at least in daylight. At nightfall, of course, it will grind to a halt, glued irretrievably to the road until the next day. Some car owners would welcome this defence against nocturnal theft; but for those who wish to drive at night, lamps could be mounted under the wheel-arches to shine on the tyres.

DREADCO's photoadhesive technology should find other markets too. Photoboots for runners and mountaineers would transform these sports, while photogloves would give a grip of iron to pole vaulters, steeplejacks and hammer welders. Both would be welcomed by mariners on storm-tossed barques and bus conductors on hilly or ill-maintained routes.

David Jones