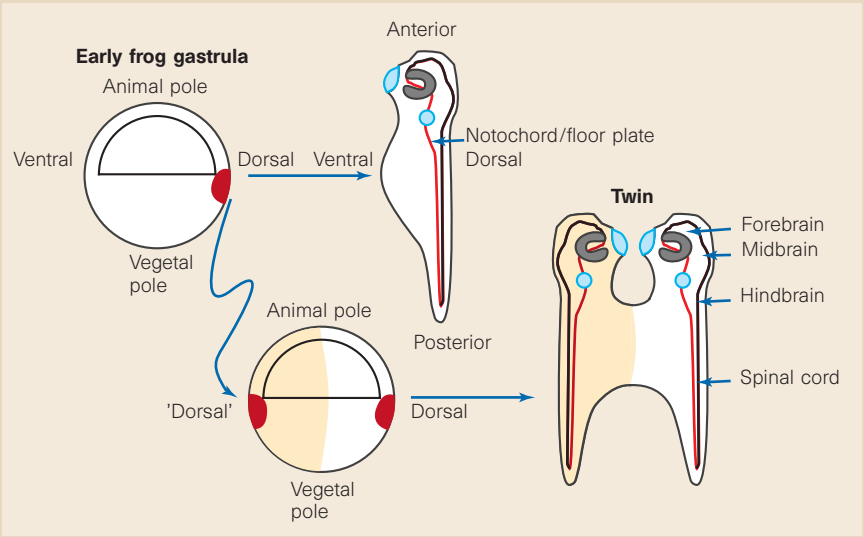
Origins of the organizer



The organizer was defined over 70 years ago by Hilda Mangold and Hans Spemann, in grafting experiments with amphibian embryos[1]. When a small group of mesodermal cells of the dorsal lip (which first begin gastrulation movements) is grafted to the ventral side of a host sibling embryo, this develops a complete twinned body, with two perfectly organized head-to-tail axes. Because the graft gives rise to only a small part of the secondary axis, dorsal lip cells (and descendants; red) were proposed to be endowed with 'organizing' properties that induce a change in the fate of surrounding cells (yellow). This, and similar results obtained in a variety of species[1], together with the evolutionary conservation of the axial structures, indicates that the organizer – the dorsal lip in amphibians, the shield in fish and Hensen's node in birds and mammals – is a central source of patterning information for the formation of the vertebrate body plan.

secreted head-inducing factor that is expressed in the anterior endodermal component of the early organizer, but not in the late organizer. And in mice a *Cerberus*-like gene is expressed in the AVE but not in the node[11].

It is possible that, in mice, an ANB is induced by the AVE. Likewise, the ANB in fish and frogs may be induced by the 'AVE-like' cells of the head organizer (or even Nieuwkoop's centre or the yolk syncitial layer).

Alternatively, a putative ANB in mice could be a distinct entity that overlies the AVE, the two organizers having temporally distinguishable signalling properties. Induction of a putative ANB by the organizer in frogs could account for the induction of forebrain markers by planar signals[12]. The function of an early ANB organizer in frog embryos could also explain why all newly induced neural tissue in animal cap ectoderm has an anterior (forebrain) character. Moreover, an endogenous ANB could synergize with a transplanted organizer, to create the complete anteroposterior pattern in the twinned axis (see box).

How these early organizing centres are induced, and what molecules mediate their actions, are questions that need to be answered to understand the logic and mechanisms of neural anteroposterior patterning.

The emerging view is that interrelated and interdependent organizing centres located at boundary regions, in particular the anterior (the ANB) and posterior (the organizer) boundaries, pattern the neural plate via planar signals (Fig. 2). In this sense, the early midbrain/hindbrain boundary[13] represents yet another organizing centre involved in later neural anteroposterior patterning. □

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Daedalus

Winter in slumberland

Winter is a depressing time, particularly for old people trying to keep fed and warm on an inadequate pension. The British government makes special payments to such folk in cold weather. In the face of similar winter hardships, many animals simply hibernate. They allow their body temperature to fall to some low value, and their metabolism slows to a crawl. Even big mammals, such as bears, hibernate. So Daedalus is now exploring the possibilities of human hibernation.

Cold has two competing effects on the human body. The metabolic rate slows down, reducing the demand for oxygen and fuel; but at the same time, the heart and lungs slow down as well, reducing the supply of these essentials. For a few degrees of cooling, these effects stay in balance. Surgical patients can be cooled slightly to extend the time for which the heart or brain can be isolated. But at about 25 °C the balance breaks down; the lungs may keep going but the heart is likely to stop. To become practical, human hibernation will have to keep the blood moving somehow.

The obvious idea, fitting the heart with a pacemaker and forcing it to beat, seems not to work — at least, not in rabbits. But Daedalus recalls that volunteers in centrifuges, or those subjected to negative pressure below the waist, can have as much as 20% of their blood drained down and 'pooled' in the lower part of the body. So DREADCO engineers are devising a sort of 'iron heart', by analogy with the iron lung. Each of the subject's limbs is placed in a sealed cylinder, and big sealed cups are placed strategically against his body. By sucking and blowing on these containers in a suitable rhythm, the blood can be shunted peristaltically from region to region around his body. The iron heart will never approach the pumping efficiency of the real thing. But it should circulate the blood sufficiently to meet the greatly reduced oxygen demand of a hibernating pensioner.

A refrigeration unit and various monitoring controls complete the DREADCO Hibernator. The user will be placed in the device and chilled into dreamless oblivion. Like a hibernating animal, he may need to be woken at rare intervals to eat and excrete; but essentially winter will cease to exist for him. And, of course, he will cease to exist for the government. In the municipal Hibernatorium, chilled pensioners in bulk will sleep the winter away at trivial cost to the Nanny State.

David Jones