unfamiliar. The large audiences at Brain Awareness Week indicate overwhelmingly their eagerness to learn about the brain, but if these audiences leave with the impression that scientists have discovered that communication between humans arises from coloured blobs in our left hemispheres, then we have missed the essential humanity of brain sciences. Encouragingly, the dialogue between brain researchers and their lay audiences is growing, thanks in good measure to the Dana Alliance, so, strangely enough, things will probably turn out well. How? I don't know. It's a mystery. ■

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Portrait

Updating Hooke

In an immaculate seventeenth-century interior reminiscent of Jan Vermeer's painted rooms stands Robert Hooke, who died 300 years ago. He is equipped with a set of instruments, including the microscope needed for his *Micrographia*. Isaac Newton, whom some say is responsible for the loss of the only authentic painting of Hooke, lurks outside the window. Glancing out uneasily, Hooke teasingly spins his globe. This ingeniously contrived 'photographic' image (right) is Guy Heyden's winning entry in the competition "Portraying Robert Hooke – Recreating the Hidden Genius". Heyden carries off the £500 prize, awarded by the Royal Institution of Chartered Surveyors and the Royal Society. The brief was to create a "replacement" portrait, not as a recreation of the lost picture but in a twenty-first-century style. Just as Vermeer used the high-tech of his day, a camera obscura, so Heyden has used a computer to create a 'reality' analogous to the optical realism of the paintings known to Hooke. **Martin Kemp**

There and back again

The Development of Animal Form: Ontogeny, Morphology, and Evolution
by Alessandro Minelli
Cambridge University Press: 2003. 342 pp. £55, $75

Axel Meyer

"There and back again", the alternative title of J. R. R. Tolkien's *The Hobbit*, is a fitting way to describe the intellectual journey that every generation of self-respecting biologists has travelled since Ernst Haeckel, Karl Ernst, Ritter von Baer, Georges Cuvier and Johann Wolfgang von Goethe before them. What they and, in cycles of 20 years or so, intellectual giants such as John Tyler Bonner and Stephen Jay Gould have tried to understand is the interwoven relationship between development and evolution. Every new generation of comparative biologists goes 'there' and advances the field further, building on the insights of the previous generation's work by applying new methods and techniques. But much of what had been thought about a generation before is often forgotten and, importantly, new questions are raised as well. So, every generation of biologist goes 'back again' to this big issue.

Selection can only act on things that are developmentally possible. In other words, developmental mechanisms constrain evolutionary possibilities, and they are often very conservative, carrying the "load" of previous evolutionary lineages, as Alessandro Minelli puts it. Sometimes, however, as in the case of the direct and indirect development (without and with free-swimming larvae, respectively) of closely related species of sea urchin, development can also be surprisingly variable. But how do developmental mechanisms themselves change during evolution, and how does evolution in turn affect development? Every generation of biologists during the past 180 years or so has made progress on the quest for a deeper understanding of these questions, through both the conceptualization and the application of the new techniques of their time.

Gould's 1977 historical treatise *Ontogeny and Phylogeny* (Harvard University Press) was probably the most influential contribution to this field in the previous generation. In its current reincarnation the field now has a name, evolutionary developmental biology, or evo-devo, and is influenced by the thinking and research of a new range of scientists, including Minelli.

What new ideas have emerged in the past 10–15 years? In a nutshell, the comparative application of molecular developmental methods that are interpreted in a rigorous (often molecular) phylogenetic framework. Recent comparative developmental and genomic studies have yielded the apparently paradoxical insight that many genes (particularly Hox genes) and their interactions in genetic networks are astonishingly conserved in evolution. These results were unexpected and raised the question of how the diversity of body architecture in different phyla has arisen, given that genetically so much has remained the same during the past several hundred million years. The historically static view of homology proposed in the nineteenth century by Richard Owen, and still widely taught today, has also been revolutionized by these comparative developmental studies and, in my opinion, has been largely abolished. Subsequent phylogeny-based theories of homology are increasingly being questioned because it is unclear whether developmental processes and mechanisms should be part of the definition of homology. Minelli carefully dissects the concepts of absolute and relative or partial homology into its components and discusses them from an evo-devo perspective.

'Renaissance man' is a term often used for a member of the (now all too rare) breed of scientists who have a wide range of intellectual interests — those who are still real scholars. This seems a very appropriate descriptor for Minelli. If you want to make significant advances in the ancient evo-devo field you need to be able to see the big picture and — listen up students — know the old literature. Minelli's daily bread-and-butter research deals with the taxonomy, systematics and comparative morphology of arthropods, particularly the myriapods, which have many segments. But he has long been an important contributor to evo-devo with his conceptual work on segmentation, modules, homology, appendages and body axes, all of which is founded on an impressive knowledge of biodiversity and comparative morphology. This impressively scholarly book summarizes and further develops his work of the past 30 years on basic features of the organization of animals, such as body axes, symmetry, segments, appendages and homology.

Rather than asking small questions, Minelli presents insightful hypotheses and concepts. If you want to look up from your myopic concentration on your single model system and broaden your horizons, you should read this book. It is a 'must read' for any practitioner in the fields of developmental and evolutionary biology — fields that, at long last, are beginning to be unified. ■

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