

gardens damaged the ecosystem and put people's health at risk.

This danger was first made clear to the public by Rachel Carson in her book *Silent Spring* (Houghton Mifflin, 1962), in which she described the changes in the natural world brought about by the use of chemicals. Since then, in part as a result of Carson's book, there has been a very slow change in our priorities, although many people argue that much more needs to be done to restore an ecosystem in which humans and other species are in a stable relationship. In a few years it may seem obvious to everyone that our pollution of the atmosphere by the consumption of hydrocarbon energy sources was even more reckless than our use of pesticides.

The use of new knowledge, then, is a double-

edged sword. Pesticides led to real benefits, but their careless use was harmful. This is surely the situation in many cases, such as atomic energy and dynamite. It was even the case when a sharp stone was first stuck on a stick to make an axe that could be used to kill animals or chop sticks for firewood, or to kill people.

Carlson ends the book with the interesting suggestion that legal proceedings should be possible in cases of science or technology being misused. He draws on a comparison with the Wall Street crash in 1929, which led to greater regulation of the financial world. In some of the scientific cases he discusses, surely legal redress would already be available if inaccurate information was provided. However, this would not be the position at present if someone merely argued a case in a book or scientific

paper, as was the case in the development of eugenic policies.

Everyone in the scientific community has a responsibility to assess the value of our work realistically and to broadcast both the risks and the benefits, argues Carlson. In determining our attitude to scientific and technological advances, perhaps even more important than the effect of any failures is our tendency to take new things for granted very rapidly. Research has contributed a great deal to our way of life, and none of the sceptics would wish to go back even to the nineteenth century. But it can also do great harm. Let us have ambitious research, but cautious application. ■

Ian Wilmut is director of the Centre for Regenerative Medicine, University of Edinburgh, Edinburgh EH16 4TJ, UK.

Painting the whole picture?

Visions of Nature: The Art and Science of Ernst Haeckel

by Olaf Breidbach

Prestel: 2006. 304 pp. \$100, £55

Philip Ball

When *Nature's* centenary issue of 1900 listed the most important scientists of the age, only one German biologist was included: Ernst Haeckel, professor of zoology at the University of Jena. Reckoned to have been instrumental to the introduction of darwinism to Germany, Haeckel has also inspired generations of scientists with his stunning drawings of the natural world. He is perhaps most widely known now as the author and illustrator of *Art Forms in Nature*, a series of plates published between 1899 and 1904 that showed the marvellous forms and symmetries of creatures ranging from radiolarians to antelopes.

Few scientists of his time were more complicated. He was the archetypal German Romantic, who toyed with the idea of becoming a landscape painter and venerated Goethe. He promoted a kind of historical determinism, akin to that of the philosopher G. W. F. Hegel, that sat uncomfortably with Darwin's pragmatic rule of contingency. Haeckel's view of evolution was a search for order, systematization and hierarchy that would reveal far more logic and purpose in life than a mere struggle for survival. His most famous scientific theory, the 'biogenetic law', which argued that organisms retrace evolutionary history as they develop from an egg ('ontogeny recapitulates phylogeny'), was an attempt to

extract such a unifying scheme from the natural world.

It can be argued that this kind of visionary mindset, with its strong preconceptions about how the world ought to be, does not serve science well. Haeckel supplies a case study in the collision between Romanticism and science, and that tension is played out in his illustrated works. This is something that Olaf Breidbach's

lovingly produced book *Visions of Nature* never really gets to grips with. Indeed, the book has a curiously nineteenth-century flavour itself, declining to grapple with the difficult aspects of Haeckel's life and work.

For example, historian Daniel Gasman and others have proposed that Ernst Haeckel's influence on German culture at the turn of the century was pernicious in its promotion of a 'scientific' racist ideology that fed directly into Nazism. However, Breidbach goes no further than to admit that Haeckel became a "biological chauvinist" during the First World War, and that "sometimes the tone of his writing was overtly racist". Breidbach admits that his book is not a biography as such, more an examination of Haeckel's visual heritage. Yet one could argue that Haeckel's dark side was as much a natural consequence of his world view as was *Art Forms in Nature*.

The claim that Haeckel doctored images to make them fit with his preconceived notions of biology is harder to ignore in this context. He was even accused of this in his own time, particularly by his rival Wilhelm His, and to my eye the evidence looks pretty strong (see *Nature* 410, 144; 2001 and *Science* 277, 1435; 1997). But Breidbach skates over this issue, alluding to the allegations only to suggest that the illustrations "instructed the reader how to interpret the shapes of nature properly".

On the whole, Breidbach simply explains Haeckel's reliance on image without assessing it. Haeckel's extraordinary drawings were not made to support his arguments about evolution and morphogenesis; rather, they actually were the arguments. He believed that these truths should be apparent not by analysing the images in depth but simply by



Ernst Haeckel's images portrayed his preconceived view of the world.

Drifting into art

Oil is derived from plankton, those drifting, microscopic organisms in oceans and lakes that so inspired nineteenth-century biologist Ernst Haeckel. In recognition and celebration of his work, the oil company Shell has sponsored this three-dimensional artwork by British fashion embroiderer Karen Nicol. Called *Out of the Blue into the Black*, it emerged from Nicol's observations of plankton at the School of Ocean Sciences at the University of Wales, Bangor.

The embroidery can be seen on 6–8 February as part of the exhibition 'Plankton in Art', which accompanies the American Society of Limnology and Oceanography meeting in Santa Fe, New Mexico.

The exhibition, which pays homage to Haeckel's illustrations, includes the extraordinary photography of Guido Mocafico, as well as items of jewellery, glass, wood carvings and quilting. It also features a video based on the patterns of movement of zooplankton in water, produced by Japanese scientist Ai Nihongi, accompanied by music from jazz musician Akira Sakata.

A rare treat will be the evening performances of the animated documentary *Proteus*, directed by David Lebrun. Named for the sea-god of Greek mythology, the documentary describes the conflicting scientific and romantic visions of the sea in the nineteenth century, using some cleverly animated illustrations from the period.

Proteus pivots around the story of Haeckel and includes fast-spinning sequences of hundreds of his images, each morphing convincingly into the next. But different threads are interspersed, reflecting the contradictory times in which Haeckel lived. The industrial revolution was blasting the romantic notion of nature while at the same time revealing the extent of its wonders. The film pits *The Rime of the Ancient Mariner* by Samuel Taylor Coleridge, for example, against the laying of the first transatlantic telegraphic cables. Broken cables hauled from the pristine deep sea beds revealed the teeming, plankton-rich life at depths previously assumed to be lifeless.

A. A.



K. NICOLA/JONES

looking at them. "Seeing was understanding," as Breidbach writes. But if that's so, it places an immense burden of responsibility on the veracity of the images.

This is the nub of the matter. Breidbach suggests that Haeckel's drawings are schematic and that, like any illustrator, Haeckel prepared them to emphasize what we are meant to see. But of course, this means we see what Haeckel wants us to see. Quite aside from whether he hid any nascent appendages that challenged his biogenetic law, consider what this implies for the plates of *Art Forms in Nature*. They are some of the most beautiful illustrations ever made in natural history — but it seems clear that Haeckel idealized, abstracted and arranged the elements in such a way that their symmetry and order was exaggerated. They are pictures of platonic creatures, of the ideal forms that Haeckel intuited as he gazed into his microscope. Their very beauty betrays them. They are, as Breidbach says (but seemingly without critical intent), "nature properly organized". In this way, "the labour of the analyst was replaced by the fascination of the image". Absolutely — as 'fascinate' originally meant 'bewitch'.

It is not as if Haeckel did not have the alternative of photography, as microphotography had been used as early as the 1850s. But Breidbach simply recapitulates the arguments against an overreliance on the veracity of photography, pointing out that what one sees is determined by the technology. That is true, and it is apt to give photography a false authority. But are hand-drawn images really any better — let alone those rendered with such apparent skill and realism that their schematic nature is disguised? Indeed, Haeckel felt compelled in 1913 to publish *Nature as an Artist*, a series of photographs of his subjects that demonstrates, he said, that "there can be no talk of reconstruction, touching up, schematization or indeed forgery" in his drawings. It was a remarkable work but it leaves us wondering why Haeckel did not use photographs in the first place.

Another danger of drawings is that they tend to reflect the artistic styles of the day. Haeckel's drawings fed into the florid, nature-inspired designs of the art nouveau and *Jugendstil* schools, but he was more influenced than influential. His medusae look like William Morris prints precisely because they have had

that visual aesthetic imprinted on them. Breidbach says that for Haeckel, as for Goethe, "aesthetics is the foundation of his view of nature". But is that a good thing? As the historian Ernst Gombrich has pointed out, artistic styles create unconscious biases and errors. When Gombrich speaks of the artist who "begins not with his visual impression but with his idea or concept", he might as well be talking of Haeckel. And what happens when the cultural aesthetic moves on — does nature have to follow suit? Breidbach points out that by using the visual language of his age, Haeckel helped to make science accessible to the public. But 20 years later, modernism had rendered his arabesque style old-fashioned.

As director of the Ernst Haeckel Museum at Jena, Breidbach has access to Haeckel's notes and sketchbooks, and he makes good use of them. But perhaps because of his position he felt unable to dig too deeply into the problematic areas his subject raises. So although this is undoubtedly a gorgeous book, and the questions it raises are fascinating, I can't help feeling that it represents an opportunity missed. ■ Philip Ball is a consultant editor for *Nature*.