In a characteristically revealing episode, Woolfson outlines how molecules such as haemoglobin change their form reversibly to good adaptive effect in the lives of, for instance, penguins and crocodiles. The folding of haemoglobin makes its affinity for oxygen suit the changing physiological demands during diving. Elsewhere, he mentions that fungi and yeasts use a protein-based system of inheritance to a small extent. Perhaps this is a relict of a previously more important mode, ousted as determination of protein sequences by genes became the norm. If the protein-only theory of prion disease is indeed correct, then the strain variation in scrapie, for instance, must be based on fine changes of conformation that can pass from generation to generation of the host. This could be of great importance for the prospects of dealing with vCJD.

Woolfson has written a remarkable book, in a new literary form, to elucidate these problems, both for biologists and for a much wider audience. He carefully avoids obvious jargon. At the same time he coins a lot of his own terms as he leads readers towards fresh ways to comprehend the actual biological world by introducing them to possible alternative worlds. He does this by interspersing throughout the book episodes of science fiction, leading us like a modern Alice through dreamy wonderlands of potentiality. These imaginative excursions serve to depict many levels of complexity. We tour landscapes of whole animals, of RNA, DNA, information and more — though he does not include an epigenetic landscape, such as C. H. Waddington used as a metaphor for the action of genes during development. Each provides vast choice and illustrates how what we have had in evolution is but a tiny sample of what might have been. Few readers will fail to be helped out of the mental rut that tends to limit the imagination of most of us.

Suggesting experiments is far more difficult, and the author is less successful in this. Indeed, at one point he says: "We are obliged to sit back and wait for the appropriate experiments to be conducted". The book is, however, laced with unexpected curiosities. Explaining analogue memory, he tells how Puccini, auditioning singers for the part of Rodolfo in *La Bohème* and hearing Caruso for the first time, exclaimed, "Who sent you to me? God?".

Life Without Genes is excellent for certain readers, but for whom is not so clear. Some people may be annoyed by its stylistic idiosyncrasy. Others may think it would have been better if shorter; but many will be charmed by it and be grateful for the mental jerks it encourages us to take. Most will learn a lot, but may be irritated by the lack of an index, or even reference from the text to the extensive bibliography. HarperCollins, please note. ■

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Science in culture

A celebration of civilization

Seven Hills: Images and Signs of the 21st Century, an exhibition at the Martin-Gropius-Bau museum in Berlin, running until 29 October.

Alison Abbott

This is not the usual apocalyptic vision of science, nor is it the didactic, self-consciously 'entertaining' public-understanding-of-science display to which the German public is usually subject. This grandiose exhibition in Berlin places science and technology alongside the other aspects of culture that define our civilization, in a distinctly intellectual and sophisticated juxtaposition.

The 'Seven Hills' of the exhibition, Berlin's millennium project, are thematic installations created by the authors of our civilization — artists and architects, as well as scientists — and displayed in a nineteenth-century building in east Berlin.

The themes are big and somewhat abstract: nucleus, jungle, cosmos, civilization, knowledge, faith, dream. The overall aim is also big and somewhat abstract, portraying the essence of our social evolution. Each installation is designed by a different architect and different teams of scientists. Ken Adam, the Berlin-born film architect best known for creating the style of James Bond films and *Dr Strangelove*, has made in the building's central atrium a cathedral whose windows are represented by a five-metre-diameter particle detector suspended below the atrium's glass dome and above a pyramid of displayed objects, many shown from their inside view. The main focus is a globe whose burning interior erupts through magma canals to the surface. Below the globe, robot dogs and the Japanese P3 humanoid — the world's most advanced robot — stalk the busy floor, around DNA sequencers and other high-tech hardware. Other displayed artefacts, for example the skull of philosopher René Descartes and the brain of the nineteenth-century biologist Ernst Haeckel, serve as reminders that these technical advances are but the products of the human mind, individually ephemeral but feeding the collective memory that is our civilization.

The message conveyed by the Jungle installation is that nature is no longer natural, but bends to the will of our culture, even in matters of conservation. The immense statue of Athena, on loan from the neighbouring Pergamon museum, stonily monitors visitors to the Knowledge installation, with its displays of the artefacts that have been used to record knowledge, from parchments to computers, and those representing the political and religious institutions that control knowledge and its acquisition.

The architectural design of the Faith installation is a huge sphere splintered into ever-smaller fragments symbolizing the fragmentation of religions during the history of civilization. The Dream installation, which deals with subjectivity,

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The glowing globe, part of the exhibition's 'Nucleus' installation.

the preserve of both artists and neuroscientists, is housed in a theatrical set of rooms created by Japanese stage designer Kazuko Watanabe.

The work of artists from every century cuts through each installation. A huge seventeenth-century painting by Johann Melchior Roos, *The Menagerie of Landgrave Carl von Hessen-Kassel*, newly restored for the exhibition, opens the Jungle installation, which also displays sixteenth-century watercolours by naturalist Giorgio Liberale, and the shocking works of the contemporary artists Jan Fabre, who makes sculptures from beetles, and Cornelia Hesse-Honegger, whose drawings record the anatomical deformations of bugs collected from around nuclear power plants.

Most of the installations feature hands-on tricks. In Jungle, one can interact with a sculpture of the Indian goddess Kali, viewing fantastic worlds literally through her eyes; in Space one can walk through a revolving tunnel that conveys a feeling of weightlessness.

But the exhibition is not play. Nor does it attempt to aestheticize science. Rather it integrates science into a complete aesthetic representation of civilization. The whole is also an optimistic statement about Berlin, which seeks to integrate its torn twentieth-century history into world civilization, the metaphoric Seven Hills, and into a positive future. This optimism is also represented by the participation of Ken Adam, a Jew forced out of Berlin during the rise of Nazism in the 1930s. Those Berliners rooted more prosaically in the present see not the optimism, but the DM28 million price tag presented to the reunified, but bankrupt, city. ■

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