is, in fact, exactly such a gap in material accounts of life. Collectively they offer, she writes, 'an unexpected and far-reaching result: they find that attempts at artificial life have rarely been driven by an impulse to reduce life and mind to machinery' (p. 1). But that is not my impression. The engineers, scientists and philosophers featured in most of these essays seem to have been materialists and mechanists. The thrust of Sylvia Berryman's essay, for example, is that 'a few ancient Greek thinkers did look to their technology in order to understand how the functions of organisms might be realized' (p. 43). Grafton argues that Fontana 'showed how to use mechanical devices, instead of the magician's circle and incense, to create the same psychologically effective illusions' (p. 55). And Timothy Lenoir suggests that the time is nearing when 'the biological and the digital [will be] no longer ontologically distinct but [will] inhere in one another' (p. 216). The chapters by Maisano, Sober and Evelyn Fox Keller have similarly materialist overtones.

Nevertheless, Riskin has a point. To determine if would-be designers of life assumed a role for something beyond the merely mechanical, one would have to know what is meant by merely mechanical. If what is meant is a billiard-ball collection of parts with linear relations, then she is right. She persuasively suggests that the non-mechanical elements that have been supposed to fill in the Gap have undergone shifts: in the ancient and early modern period, the Gap was filled by Soul; after the seventeenth century, it was filled by Consciousness; in the twentieth century, it was filled by Information. Another purported non-mechanical element of artificial life in the twentieth century was the notion of 'emergence', discussed here in the essay by Bernadette Bensaude-Vincent.

Despite its subtitle, *Genesis Redux* is overwhelmingly historical rather than philosophical. Yet the essays are written from a stimulatingly wide variety of disciplinary perspectives: intellectual history, cultural history, anthropology, women's studies, literature, philosophy and, of course, history of science. Elizabeth King is a sculptor. These eclectic essays will entertain and educate. Many of them are also quite short. I wished that Sylvia Berryman's wonderful nine-page contribution on the mechanistic understanding of life in the ancient world was longer. But concision is often a virtue, and this volume can be recommended to anyone interested in the history of artificial-life research, and the history of the life sciences more broadly.

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Bernadette Bensaude-Vincent and William R. Newman (eds.), **The Artificial and the Natural: An Evolving Polarity**. Cambridge, MA: MIT Press, 2007. Pp. viii + 331. ISBN 978-0-262-02620-8. £25.95 (hardback).
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This admirable book deals with a topic of fundamental importance in Western thought. The editors are justified in describing this volume as 'the first collective effort' (p. 3) by historians of science, art and philosophy to focus specifically on the distinction between the artificial and the natural from antiquity to the present day. In a dazzling display of scholarly virtuosity, the contributors grapple with the ambiguities, cultural values and moral issues that inevitably accompany the concepts of art and nature. The essays show that practical and philosophical considerations over mimicking, perfecting and outdoing nature's productive powers may be found throughout history and continue to have ontological, epistemological and moral consequences. In addition to the contributions discussed below, we have chapters on 'The three pleasures of mimesis according to Aristotle's *Poetics*' (Francis Wolff), 'Art and nature in ancient mechanics' (Mark J. Schiefsky), 'Forms of art in Jesuit Aristotelianism (with a coda on Descartes)' (Dennis Des Chene), 'The artificial and the natural: Arcimboldo and the origins of still life' (Thomas DaCosta Kaufmann), 'Leibniz's theatre of nature and art and the idea of a universal picture atlas'

(Horst Bredekamp), 'Eighteenth-century wetware' (Jessica Riskin) and 'Overtaking nature? The changing scope of organic chemistry in the nineteenth century' (John Hedley Brooke). Each essay is rigorously argued and offers a thoughtful and thought-provoking discussion of an aspect of the complex relationship between art and nature.

The book opens with Heinrich von Staden's masterful chapter on 'Physis and technē in Greek medicine'. Von Staden argues that the Hippocratic belief in inviolable natural regularities underpinned medical practice. He discusses the semantic range of *physis* (normally translated 'nature'), *technē* (often translated 'art') and *dynamis* (rendered by 'faculty', 'quality' or 'property'). According to von Staden, important new meanings of these words developed in Greek writings beginning in the fifth century BCE. The Hippocratic work *On the Technē* describes how medical *technē* discovers 'forcible constraints' which compel nature to reveal signs of otherwise invisible processes (p. 29). Diagnosis depends upon interpretation of these signs but this difficult process (akin to foreign translation) takes time, leaving less time for medical intervention. There are striking parallels between Hippocratic characterizations of the relation between *technē* and nature and those of early modern experimentalists. The editors quite rightly point out the 'seemingly Baconian fashion' in which natural processes are altered through forcible constraint (p. 10).

William R. Newman's chapter, 'Art, nature, alchemy, and demons: the case of the *Malleus maleficarum* and its medieval sources', shows us that even in the unsuspected context of demonology, the key issue is the extent to which art can alter nature. Newman's contribution focuses on the interjection of alchemy into scholastic debates concerning the limits of demonic power, illustrated in the well-known manual on witch-hunting, the *Malleus maleficarum* of 1487. Alchemy, he argues, provided a 'test case' because it was the only art which promised to transmute species by inducing new substantial forms in matter (p. 109). Anthony Grafton's contribution, 'Renaissance histories of art and nature', focuses on Tommaso Campanella's *City of the Sun* and Francis Bacon's *New Atlantis*. He suggests that both were inspired by the assemblage of spectacular artefacts in sixteenth-century *Kunst- und Wunderkammern*. Grafton points out that, notwithstanding the anachronism, Bacon's and Campanella's utopian enterprises came to be regarded by later generations as blueprints for 'modern laboratories and scientific states' (p. 187). Both men, he observes, look forward to Descartes and other later figures, 'who would make the possibility of material improvement in the human condition one of the most powerful slogans of the New Philosophy' (p. 188). Here again, we encounter the theme of art progressing beyond nature. Salomon's House in the *New Atlantis* produces entirely new species of plants and animals. Similarly, the 'fusion of magical and technological traditions', found in Henry Cornelius Agrippa's *De occulta philosophia* and taken up by later writers, emphasized the idea that art could transform nature 'in radical ways' (p. 201).

The fascinating case of Spinoza is the subject of Alan Gabbey's chapter, 'Spinoza on the natural and the artificial'. From the perspective of Spinozan metaphysics, Gabbey explains, there can be no distinction between art and nature. Spinoza's single principle, Nature or God, determines all effects. All bodies (including the human composite) are produced deterministically in accordance with the laws of nature. What, then, is the status of human artifice? Gabbey argues that Spinoza (himself a lens grinder) does not prohibit the use of 'everyday language' when talking about artefacts (p. 226). He concludes that Spinoza resolved the tensions found in Descartes's letter to Constantin Huygens of March 1638. Descartes writes, 'you have to explain what the laws of nature are, and how she acts in the ordinary way, before you can show properly how she can be applied to effects to which she is not accustomed' (p. 232). In this regard, it is interesting to recall that Bacon believed that knowledge of a fixed *natura naturans* was essential if bodies (*natura naturata*) were to be radically transformed. For Descartes and Spinoza, too, knowledge of *natura naturans* – the fixed laws of nature – is vital for material and spiritual well-being. Bernadette

Bensaude-Vincent's chapter, 'Reconfiguring nature through syntheses: from plastics to biomimetics', reviews various twentieth-century biochemical ventures – polymer chemistry, combinatorial chemistry and biomimetic chemistry. She makes the important point that the concepts of art and nature are 'mutually constructed' (p. 293). The promoters of synthetic polymers, for instance, viewed nature as 'a finite collection of products rather than as a continuous process of generation. No *natura naturans*, it was a *natura naturata*' (p. 297). Plastics, by contrast, have infinite metamorphic potential.

With the recent burgeoning of interest in artisanal skills, experiment and the science–technology relationship, this excellent volume will undoubtedly be of interest to readers of this journal. In the turn to practice, the art/nature dichotomy has not received the attention it deserves. The distinction between the artificial and the natural, the essays show, is a major theme throughout the cultural and intellectual history of the West.

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Steve Fuller, **Dissent over Descent: Intelligent Design's Challenge to Darwinism**. Cambridge: Icon Books, 2008. Pp. v + 272. ISBN 978-184046804-5. £12.99 (hardback).
Nathaniel C. Comfort (ed.), **The Panda's Black Box: Opening up the Intelligent Design Controversy**. Baltimore: Johns Hopkins University Press, 2007. Pp. xv + 165. ISBN 978-0-8018-8599-0. £13.50 (hardback).
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What contribution can historians, sociologists and philosophers of science make to the debate about 'intelligent design' (ID) – a movement which the sociologist–philosopher Steve Fuller describes in his new book as 'scientifically credentialed creationism' (p. 1)?

Fuller famously testified on behalf of ID in a Pennsylvania courtroom in 2005, and his latest book on the subject is bold, original and intensely thought-provoking. It is also bizarre, chaotic and not entirely reliable. The central historical idea of *Dissent over Descent* is that belief in the intelligent design of nature has been central to modern science, and that the ID movement thus represents a truer continuation of the scientific tradition than Darwinism. Philosophically, Fuller tries to argue that the practice of science cannot be adequately justified if purpose, design and intelligibility in nature are denied. A third, more sociological strand of the book suggests that professional bodies such as the Royal Society and the National Academy of Sciences are involved in peddling a narrow and dogmatic Darwinian orthodoxy under the guise of an alleged 'scientific consensus'. These are important themes and Fuller pursues them with vigour. At its best, Fuller's writing on this subject is reminiscent of Paul Feyerabend's bracing intellectual anarchism, which provided a potent antidote to unthinking scientism. Fuller's complaints about the intellectual inconsistencies of the defenders of Darwinism, and of allies including the 'theistic evolutionists' who seek to combine Christian belief with Darwinian orthodoxy, are sometimes well made. But the book's merits are overshadowed by methodological and argumentative failings.

Fuller comes at his subject from endless different starting points, hurtling at it again and again from unexpected angles, and rarely developing any point in a sustained manner. The deliberately anachronistic use of 'intelligent design' – a term which took on its present meaning only in the 1990s – to describe the views of historical figures including Isaac Newton, Joseph Priestley and James Clerk Maxwell is misleading. Chapter headings that sound quite reasonable rarely correspond with the ensuing content. Chapter 2, entitled 'Was Darwin really a scientist?', drifts rapidly away from this question into perplexing discussions of philosophy and theology ranging from Galileo, Nazism, vivisection and Peter Singer to medieval Islam, the Socinian heresy, Friedrich Engels and Theodosius Dobzhansky (in that order). Fascinating links could be made