BOOKS & ARTS

Calamity gene

When biotechnology spins out of control.

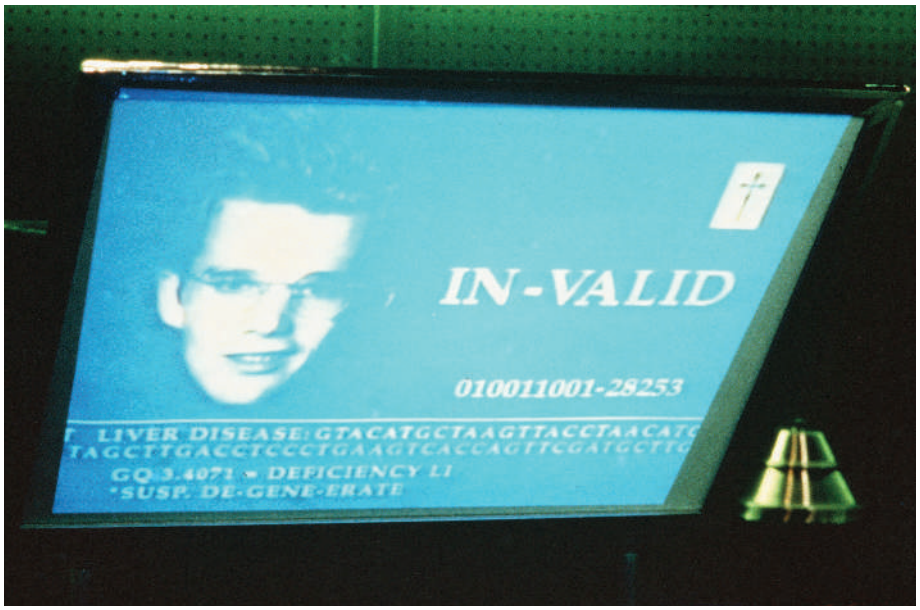
Next
by Michael Crichton
HarperCollins: 2006. 448 pp.
$27.95, £17.95

Michael A. Goldman

At last, a Michael Crichton novel you can put down, a vilification of science that does not make compelling reading. *Next* is a veritable catalogue of what could go wrong with biotechnology. This is what would happen if every patent attorney and judge had a prefrontal lobotomy (done the humane way using RNA interference, of course), in case the bioethicists hadn't warned you already. Crichton tries to address every aspect of the biotechnology craze at once, giving the book too many simultaneous plotlines to follow. The result is no single story you really want to stick with to the end.

The book is certainly entertaining at times. There is a smart-beaked African grey parrot named Gerard, rather self-centred and with a British accent. In exile because he imitated his owner's husband in a liaison with another woman in the house, Gerard manages to help a chimpanzee with a raspy voice and bad grammar rescue an ordinary little kid from being abducted for his liver. Meanwhile, a cocaine-addicted good-for-nothing thirty-something finally snorts a concoction that turns his life around: an experimental virus containing a human 'maturity gene'. The transgenic orangutan who curses in Dutch could use a whiff of that stuff as well. Body parts and eggs are traded like commodities, and genetically engineered fish display illuminated advertising billboards on their sides. I admit that Crichton had me going with the *Tyrannosaurus rex* in *Jurassic Park*, but somehow that was a bit more believable, and had a lot more suspense.

One story line concerns BioGen's ownership of Frank Burnet's cell line, which produces a cancer-fighting compound. BioGen gets a legal judgement that says they own Burnet's cells, wherever those cells happen to be. When BioGen's own lines are contaminated, and Burnet himself has disappeared, the company employs bounty hunters to collect the 'property' from Burnet's daughter and grandson. Dave, the genetically enhanced chimpanzee, effects a rescue. The Burnet family's attorney challenges the property decision. After an exasperating hearing, a judge finally hands down a reasonable decision — this is the first time that *Next* seems like anything other than an unabashed condemnation of biotechnology. Human cells, the judge says, are different from other forms of property, as one might still be attached to them, especially when they are in an unwilling body.



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The big screen: the film *Gattaca* portrayed a future in which opportunities are dictated by genetic tests.

Crichton uses extant biotechnology company names, such as BioGen and BioRad, even if he does capitalize them differently and change the trademarks. Even California senator Dianne Feinstein plays a part. Craig Venter seems to have escaped, but there's a spiritual and influential scientist at the National Institutes of Health associated with the thrill-seeking gene. And a prominent divorce attorney to the stars discovers the value of genetic testing — for everything — in determining whether or not a parent is a good candidate for child custody.

As in his previous novel, *State of Fear* (HarperCollins, 2004), Crichton pleads his case clearly and succinctly in an author's note at the end of the book. He lists five points, which I take up in turn.

First, Crichton contends that we should "stop patenting genes" because vague claims render it impossible to do useful research and paralyse scientific progress. Although this idea has been bandied about, there are powerful contrary arguments. Patent protection actually encourages the publication of results, and requires a full description of an invention so that it can be used by others. Patent enforcement typically does not occur until a competitor is ready to market a commercial product, at which time a user licence can be negotiated; basic research is not excluded. Crichton's claim that a patent on 'noses' would exact a licence fee from perfume manufacturers is too broad an interpretation; a patent on a gene clearly does not even extend to a drug that inhibits the activity of the product of that gene. We do, however, have a problem if patents are granted too broadly and on too little information, relying strictly on enforcement actions to ascertain validity.

His next claim is that we should "establish clear guidelines for the use of human tissues". In *Next*, and in a commentary in *The Wall Street Journal* on 15 December 2006, Crichton describes a case in which a court upheld the right of Washington University to keep possession of prostate-cancer tissues donated by patients of William Catalona when he moved to Northwestern University. The ruling was astounding in that it ignored the wishes of 6,000 patients who had expressly consented to the move, thereby asserting that patients had no control over the tissues once they had left the body. This apparently contradicted the patient consent forms, which said that patients could withdraw from the study at any time, and

that tissues would be used only for the specified purpose. Crichton makes an important point about the Catalona case, but the portrayal of this issue in *Next* is extreme.

Crichton thinks we should "rescind the Bayh–Dole Act", which allows US universities to claim ownership of patents derived in whole or in part from federally funded research done in the academic setting. He believes that this 1980 act has turned universities into money-hungry corporate monsters no longer motivated to seek truth, but rather to prove the efficacy of the pharmaceuticals their research labs produce. Thus, he contends, university faculty can no longer be relied on for an unbiased opinion on anything, let alone a reliable piece of data. The jury is still out on the Bayh–Dole act, but academic institutions and scientists would probably be looking beyond tuition payments, gifts and federal grants for funding with or without Bayh-Dole.

Most readers of *Nature* would surely agree with Crichton's other claims, that we should "pass laws to ensure that data about gene [therapy] testing is made public" and "avoid bans on research".

The book could have a role as a conversation starter for a course in bioethics. Most students would find it more entertaining than the typical textbook, and it covers a similar range of issues. There is no doubt that our scientific capabilities and our imagination have already gone well beyond the reaches of law and ethics, even though *Next* exaggerates the extent. The book is a reminder that we need to educate professionals in medicine and law about biotechnology so that the field's gargantuan potential, which Crichton's book never denies, can be realized safely and equitably. It never hurts to have this highlighted on *The New York Times* bestseller list. ■

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The two faces of science

The Intelligibility of Nature: How Science Makes Sense of the World
by Peter Dear
University of Chicago Press: 2006. 242 pp. $27.50

Richard Yeo

In 1690 the philosopher John Locke imagined a man with "microscopical eyes" many times more acute than the best microscope. Such a man, he conjectured, might grasp the deep "texture and the motion of the minute parts of corporeal things", but "would be in a quite different world from other people… I doubt, whether he, and the rest of men, could discourse concerning the objects of sight." We can surmise that the scientific explanations such a person offered might not be intelligible to others.

Intelligibility may be difficult to define but it plays a crucial role in the claim of science to offer credible accounts of nature, argues Peter Dear in his elegant book *The Intelligibility of Nature*, which is richly informed by scholarship in the history of science. Locke's point looks prescient when we consider the development of quantum mechanics from the 1920s. Its successful predictions of experimental phenomena were aligned with the disorienting prospect of an acausal, probabilistic world. Dear argues that by this time, 'instrumentality' — the power to produce and predict effects — had surpassed intelligibility as the main basis of scientific authority. The leitmotif of his book is that science has availed itself of two self-supporting, albeit circular, rationales: its account of the structure and processes of nature is backed by the success of instrumental techniques (such as the use of electron microscopes and DNA profiling); and explanations of why certain techniques work are grounded in intelligible, even if speculative, accounts of the natural world.

In Western culture there is an abiding distinction between understanding nature and doing things with it. This was formulated by Aristotle as *episteme* versus *techne* (the Latin equivalents are *scientia* and *ars*). Natural philosophy, the discipline responsible for seeking a causal understanding of natural qualities and processes, was classed as *scientia*, whereas mathematics, which deals with quantities that need not apply to real things, was regarded as a practical craft charged with measurement and computation. As Dear stresses, Isaac Newton's universal law of gravitation — the great scientific achievement of the seventeenth century — was viewed as a mathematical accomplishment. Although highly sophisticated, it was in the same class as utilitarian calculations of the relative movements of the stars and planets involved in almanacs and horoscopes. Moreover, Newton eschewed any account of what gravity was or how it acted at a distance in a vacuum. He did not provide a natural-philosophical explanation of the kind attempted by René Descartes, for example, who sought to understand celestial motion in terms of bodies in a fluid medium using the analogy of straws in the eddy of a river. Such an account was deemed intelligible, even if not demonstratively true. Newton's reluctance meant that his theory lacked intelligibility, even though it possessed striking instrumentality, as judged by the predictive power of the inverse-square law.

In discussing various scientific domains from the seventeenth century to the present, including celestial mechanics, taxonomy, atomism, natural selection, electromagnetism and quantum physics, Dear meditates on this

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Isaac Newton (left) and Antoine-Laurent Lavoisier were central to the creation of modern science.