

BOOKS & ARTS

The case of creation

Last year's Dover trial resulted in intelligent design being removed from the science curriculum.

The Battle Over the Meaning of Everything: Evolution, Intelligent Design, and a School Board in Dover, PA

by Gordy Slack

Jossey-Bass: 2007. 240 pp. \$24.95

40 Days and 40 Nights: Darwin, Intelligent Design, God, OxyContin® and Other Oddities on Trial in Pennsylvania

by Matthew Chapman

HarperCollins: 2007. 288 pp. \$25.95

Monkey Girl: Evolution, Education, Religion, and the Battle for America's Soul

by Edward Humes

Ecco: 2007. 400 pp. \$25.95

Kevin Padian

Three new books use as a centrepiece the court case of Kitzmiller *et al.* versus Dover Area School District, which played out for six weeks in late 2005 at the state capital of Pennsylvania. This trial was the latest in a series of American 'Scopes trials', named after the 1925 prosecution of Tennessee teacher John Scopes, who was fined \$100 for flouting a state law that prohibited the teaching of evolution in state-run schools. Scopes volunteered to be the test case, knowingly breaking the law. Famed attorneys Clarence Darrow and William Jennings Bryan argued the case. Scopes lost, Tennessee was ridiculed, a few other states passed similar legislation, and the divide between fundamentalists and secularists in the United States was irrevocably cleft.

Since the Scopes case, American jurisprudence has increasingly sided with the Enlightenment in a sequence of landmark decisions: yes, you can teach evolution; no, you cannot balance it with creationism; no, 'creation science' is not science; and so on. Then, in the late 1990s, a new kid on the block, intelligent design, began to flex its muscles and demand consideration as a viable scientific theory — but in the public arena, not the scientific one. Intelligent-design proponents, mostly right-wing Christians with more chutzpah than scientific acumen, gathered steam, money and eventually a grand strategy to "reverse the stifling dominance of the materialist world view, and to replace it with a science consonant with Christian and theistic convictions". They set up a think-tank, the Discovery Institute, and started to write op-ed pieces and lobby school districts to introduce their exciting new concept to children. A gullible and obstinate school



C. KASTER/APPHOTO

Pennsylvania parents, and their children, fought against the teaching of intelligent design in schools.

board in the middle of Pennsylvania's rolling hills was just crazy enough to buy it — and that was the start of the now-famous Dover case.

The characters on all sides of the Dover trial — judge, plaintiffs, witnesses, school-board members and attorneys — are colourful and complex, and the trial strikes at the heart of what still divides the US population, 400 years after European settlers arrived. Is the American tradition one of philosophical and political idealists, or of persecuted pilgrims who then turn around and ostracize anyone who doesn't agree with them?

The three books take different tacks and each has different strengths. The author of *40 Days and 40 Nights*, Matthew Chapman, is a great-great-grandson of Charles Darwin; his presumed vested interest in the proceedings is tempered by his own history as a school dropout, a movie screenwriter and a Brit with a perpetually bemused view of colonial antics. Still, his odyssey is a fulfilling one, and he seems genuine enough to get himself invited into many homes where insights and passions run deep. Gordy Slack, author of *The Battle Over the Meaning of Everything* and an experienced science writer and editor, likewise brings his own family baggage (his father is a staunch fundamentalist) to his account, but his reporting is more linear and his background research

deeper. Edward Humes in *Monkey Girl* is even more scholarly and thorough in his approach, and contextualizes the trial historically. Unlike Chapman and Slack, he does not insert himself into his narrative, but his views of the proceedings are no less clear.

The particulars of the trial are by now familiar (see *Nature* 437, 607; 2005 and *Nature* 439, 6–7; 2006). Dover's school board, against the advice of its teachers and attorney, required that high-school biology students be read a statement that among other things alleged that "gaps in the [evolutionary] theory exist for which there is no evidence" and that intelligent design is "an explanation of the origin of life that differs from Darwin's view". Students were referred to a supplementary text published by the Foundation for Thought and Ethics, *Of Pandas and People*, for more information on intelligent design. Eleven parents sued, engaging the American Civil Liberties Union and other top representation and scientific advice. The decision of Judge John E. Jones III slammed the "breathtaking inanity" of the school board, established its religious motive and actions, accepted the view of the scientific community that intelligent design does not qualify as science, and proscribed bogus criticisms of evolution in science classes. Intelligent-design proponents sputtered and

fumed; the usual right-wing commentators fulminated; no one has since taken the Discovery Institute seriously.

All three books, despite their regrettable titles, handle the basic story very well and recount some extraordinary moments. An OxyContin-addicted school-board member ranted on record: "Two thousand years ago someone died on a cross. Won't anyone take a stand for him?" and then denied that creationism had ever been discussed at board meetings. The school-board president claimed in his deposition that he did not know where the money came from to purchase the *Pandas* books, and then was shown the cheque from the other board member to his own father. Expert witness Barbara Forrest graphically showed that the authors of early drafts of *Pandas* had changed some 150 uses of terms such as 'creation' and 'creationist' to 'intelligent design' and 'design proponents', despite a 1987 Supreme Court decision ruling that 'creation science' was not science.

Where does the 'science' of intelligent design come from? Biochemist Michael Behe of Lehigh University in Bethlehem, Pennsylvania, is virtually the only scientist prominent in the movement; he has published popular books (for a review of the latest see *Nature* 445, 1055–1056; 2007) but no demonstrable peer-reviewed research on intelligent design. Behe's notions of 'irreducible complexity' and the status of intelligent design as science were shredded by attorney Eric Rothschild, who got him to admit that under his own definition, astrology would qualify as science.

Conspicuously absent from the trial was William Dembski, the other pillar of intelligent-design 'research', who holds advanced degrees in maths and theology but none in science, and believes that intelligent design is the Logos of the Gospel of John restated in the language of information theory. His notion of 'specified complexity', a probabilistic filter that allegedly allows one to tell whether an event is so impossible that it requires supernatural

explanation, has never demonstrably received peer review, although its description in his popular books (such as *No Free Lunch*, Rowman & Littlefield, 2001) has come in for withering criticism from actual mathematicians. Plaintiffs' attorneys were eager to take him apart, but Dembski exited the proceedings in a suspicious eleventh-hour dispute about having his own lawyer represent him in deposition.

All three books are entertaining and informative reads; on balance the nod goes to Humes for his comprehensive account, although Slack is concise and readable. Another book on the trial, by local reporter Lauri Lebo, is due out next year. It promises even more lively details of this perfect storm of religious intolerance, First Amendment violation and the never-ending assault on American science education. ■ Kevin Padian is professor of integrative biology and curator at the Museum of Paleontology, University of California, Berkeley. He is also president of the National Center for Science Education and was a *pro bono* expert witness in the Dover trial.

A lone voice in the greenhouse

The Callendar Effect: The Life and Work of Guy Stewart Callendar (1898–1964), the Scientist who Established the Carbon Dioxide Theory of Climate Change

by James Rodger Fleming

American Meteorological Society: 2007.
176 pp. \$34.95

Robert J. Charlson

With so much written on the subject of carbon dioxide as a cause of climate change, it seems to have a settled history. But the word 'established' in this book's subtitle moved me to ask who actually came up with this now well-accepted theory, and what the basis is for James Rodger Fleming's claim that the subject of his biography holds this honour.

There seems to be little doubt that in 1827 Jean Baptiste Joseph Fourier first articulated the idea that "light finds less resistance in penetrating the air, than in re-passing into the air when converted to non-luminous heat". In the 1860s, John Tyndall showed that CO₂ and water vapour both absorb and emit infrared radiation. Then, in 1896, Svante Arrhenius performed the first calculations of the sensitivity of Earth's temperature to changes in atmospheric CO₂. He went on to calculate (incorrectly) that it would take some 3,000 years for a 50% increase of its atmospheric content at the prevailing rate of coal consumption. He further calculated, on the basis of the measured infrared transmission of the atmosphere by Samuel Langley, that a 50% increase of CO₂ would warm Earth's surface by 3.4 °C.

So how did author Fleming come to state that the CO₂ theory was established by Callendar? It seems that this credit should be given to

Fourier, Tyndall and Arrhenius.

Callendar's seminal paper, 'The Artificial Production of Carbon Dioxide and its Influence on Temperature', was published in 1938, nearly half a century after these nineteenth-century works. During the intervening period, serious doubts had developed about the importance of changing atmospheric CO₂ as a factor in Earth's climate and a cause of ice ages. Competing theories — changes in Earth's orbital geometry or in solar output, the role of the oceans, the attenuation of sunlight by volcanic dust, and spectroscopic considerations such as water vapour and CO₂ absorbing infrared light in the same spectral regions — had seemingly brought the CO₂-climate field into a 'deep eclipse'.

Callendar's 1938 paper did not include a citation of Arrhenius's 1896 paper, although there are many parallels between the two. Callendar analysed just one set of data on atmospheric CO₂ content taken at Kew, near London, between 1898 and 1900. These data were taken near a source of CO₂ and were analytically very uncertain. From this analysis, he concluded that at around 1900 the free atmosphere over the North Atlantic region contained 274 ± 5 parts per million (p.p.m.) of CO₂. Then, after arguing that only a small fraction of the CO₂ from combustion of fossil fuels would dissolve in the ocean, he calculated from an estimated global production rate of CO₂ the amount

that he thought would be there in 1936 (290 p.p.m.), 2000 (314–317), 2100 (346–358) and 2200 (373–396).

With a simple model of the absorption of infrared radiation, he worked out the amount of global warming to be expected from his predicted CO₂ levels, concluding that temperature would then have been increasing at a rate of about 0.03 °C per decade. Callendar's 1938 attribution of early twentieth-century warming to CO₂ increase might have been believable if global cooling had not ensued in the 1960s and 1970s.

His result was based on many assumptions and he used no contemporary CO₂ data on which to base his estimates. Nonetheless, his prediction was almost correct and, along with his 1958 paper — which included large amounts of CO₂ data (albeit of dubious quality) — his 1938 publication did rejuvenate the CO₂ theory of climate change. I doubt that this amounts to establishing the theory, but it came at a time when the fields of geochemistry and climate dynamics were ripe for stimulation, especially during the International Geophysical Year (1957–58). Shortly thereafter, Charles David Keeling presented accurate data, and the rest of the story is history.

Callendar's work on climate change is just part of the story Fleming tells about Callendar's life in this well written and especially well documented book. ■

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Guy Stewart Callendar revived the CO₂ theory of climate change.