the population in bunches. By combining the genes of individuals that differ in the placement and number of their mutations, sex manufactures mutationally loaded individuals for the Hatchet. The key point in this theory is that additional mutations must cause escalating damage. (For the example of the hypothetical book that was copied, sentences not only get harder to read, they get harder to read at an accelerating rate with each error.)

Is this assumption correct? Ridley argues it is, on the basis that it "follows from the way our bodies are built." However, scientists don't accept ideas purely because they make logical sense; they test theory with data. As Ridley concedes, "it will take facts to decide whether bad genes really do more damage as their numbers increase." Data collected so far suggest that the Hatchet is unlikely to be a general explanation for why sex is retained. Mutation rates are too low in organisms that still might have the ability to reproduce clonally (*3*) (not an option for any mammal), and consistent synergism between mutations is not detectable (*4*).

In his final chapter, Ridley borrows from 19th-century natural historians who saw angels as higher on the complexity hierarchy than humans. With tongue in cheek, he contemplates the habits of such celestial creatures. Clearly, Ridley tells us, angels must have sex and it must be of a form that concentrates errors even more effectively than does our Earthly method. Otherwise, they would mutate themselves into oblivion. I would only add that if they do have sex, they also suffer from parasites.

References and Notes

1. R. S. Howard, C. M. Lively, *Nature* **367**, 554 (1994).
2. The term "Hatchet" was coined by M. Turelli to describe the action of the explanation widely known as the mutational deterministic theory.
3. P. D. Keightley, A. Eyre-Walker, *Science* **290**, 332 (2000).
4. S. F. Elena, R. E. Lenski, *Nature* **390**, 395 (1997).

NOTA BENE: COMMUNICATION TECHNOLOGY

The Webs We Weave

Instant messaging, online romance, hackers, and nouveau riche technologists are only a few of its legacies. "It" is not the Internet, but the telegraph: the world's first world-wide web. Telegraphy was slow in coming, but after the first electric message traveled from Washington, D.C., to Baltimore, Maryland, on 24 May 1844 the consequences were explosive. Within a short time the world was wired; landlines connected every major city and transoceanic cables linked continents. Eventually, the telephone replaced the telegraph and boom gave way to bust—a cycle that was to be, and still is, repeated. As our own age comes down from the Internet hype of the 1990s, we can now see that we've been here before. These parallels propel an exhibit of information technology in the rotunda of the National Library of Medicine in Bethesda.

The Once and Future Web
Worlds Woven by the Telegraph and Internet
a play by Jerry James
May and June 2001, National Library of Medicine, Bethesda, MD.

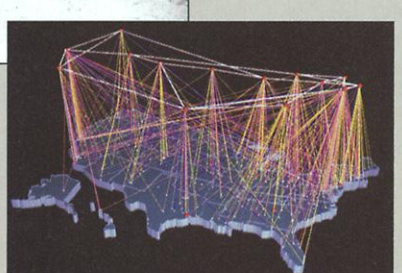
The Once and Future Web
Michael Sappol and Hunter Crowther-Heyck, Curators
National Library of Medicine, Bethesda, MD.
www.nlm.nih.gov/onceandfutureweb

The Once and Future Web had its genesis when NLM director Donald Lindberg chanced upon science writer Tom Standage's book *The Victorian Internet* (Walker, New York, 1998). Standage argues that telegraphy was the first global communications network, and Lindberg insightfully recognized in this notion the possibilities for an exhibit comparing the new and old information ages.

Although not exhaustive, the exhibit captures the key moments in telegraphy, from its early days in France as a purely visual net of semaphore-like relays, through Samuel Morse's breakthrough code system, to telegraphy's rapid incorporation into commerce. The curators, Michael Sappol and Hunter Crowther-Heyck, have assembled a wonderful collection of information-technology artifacts in a compellingly presented display. The exhibit is set up in a ring, with the inside wall of the display devoted to telegraphy and the outer wall showing parallel developments of the Internet.

A walk through the exhibit gives a connected view of how each of these technologies evolved and of their social impacts. The development of Morse's code is framed against the creation of the first useful internetworking protocol (TCP/IP) by Robert Kahn and Vinton Cerf. Criminals are always early adopters of technology; the fraud and deception by telegraph hackers are neatly contrasted with popular fears about cyberporn and online scams. And the hype of the telegraph, which led to immense fortunes for some (though not its inventors), parallels our own era: dot-dash and dot-com.

Riding an encouraging trend that enlists theater to dissect and comment on technology (as in Michael Frayn's *Copenhagen*), the Library of Medicine commissioned a short play to accompany their exhibit. Playwright Jerry James has deftly packed a lot of history into a witty 40 minutes. Minimal in design, the piece is staged in a corner of the Library's History of Medicine reading room, and that provides all the backdrop that is needed. Cast for four actors, the play begins with an amusing account of an 18th-century experiment with a line of Carthusian monks holding copper wires, and a jolt of static electricity—the first demonstration that electric pulses could travel great distances and carry pain, if not information. James follows this with a rapid-fire tour through Morse's invention, the dawning of computers, and the creation of the Internet. Despite a few tired notes (such as a chorus line of "nerds" wearing taped-up glasses), the play wins by wit; how often do you get to see the founder of IBM as The Godfather? While not heavy going, the work does offer some provocative commentary on how sometimes outsiders make the breakthroughs: Morse started as a portrait painter, and the man who bankrolled the first transatlantic cable admitted not knowing a "telegraph from a tulip."



Enabling connections. In the 1880s, telegraph wires cluttered New York City. A century later, the National Science Foundation put together a high-speed, inter-network backbone, NSFNet, which became the heart of the Internet.

It makes sense that the National Library of Medicine, an information technology organization of increasing sophistication, would host an exhibit such as this. One hopes for more cross pollination between scientists, museum curators, and performing artists—a vital way to reach the public that rides the infotech roller coaster. To update a famous quotation of Santayana, those who ignore the past are doomed to be swallowed by the hype of the present.

—DAVID VOSS

CREDITS: (LEFT TO RIGHT) BROWN BROTHERS; DONNA COX AND ROBERT PATTERSON/NCSA