SCIENCE & TECHNOLOGY

Journals Galore

THE SOURCE: "Seriality and the Search for Order: Scientific Print and Its Problems During the Late 19th Century" by Alex Csiszar, in ***History of Science***, Sept.–Dec. 2010.

If a scientist publishes new findings in a journal and no one reads the article, did that scientist still make a discovery?

That question is not very relevant to researchers today because powerful online databases ensure that a publication won't be lost to history. But for scientists in the 19th century, a sudden profusion of specialized scientific periodicals combined with the absence of a tracking system for publications made the threat of obscurity very real, writes Harvard historian Alex Csiszar. One English physicist remarked that "the rediscovery in the library may be a more difficult and uncertain process than the first discovery in the laboratory."

When scientific journals emerged in the 17th century "they would have been among the last places to look to find authoritative knowledge claims," Csiszar says. Books and monographs, and even informal correspondence among colleagues, not periodicals, were the agreed-upon space in which to document scientific advances. Like newspapers and gazettes of that era, the early scientific journals were not seen as reliable. Many functioned more as specialty news sources, summarizing findings from books.

The development of organizational systems such as comprehensive indexes and bibliographies lagged behind the proliferation of journals. For scientists, this meant that simply knowing what was known was often impossible. Zoologists, for example, found it increasingly challenging to determine whether a species identified as new really was unknown to the scientific establishment. One complained, "Nearly the whole lives of zoologists will come to be spent in libraries, until the thing gets so intolerable that someone suggests that we burn all the books and start afresh from nature."

Moreover, in the period before scientific journals established their authority, credit for discoveries was often contested. In 1846, when Neptune was first observed by telescope, a French publication credited astronomer Urbain Le Verrier with having earlier predicted the planet's existence. British astronomers protested that John Couch Adams had done so first, in a conjecture that was unpublished but "a subject of common conversation" among his friends. One Frenchman responded

EXCERPT

The Light Bulb Myth

Scientists themselves have done little to disabuse the public of the view that they have thought-bubble moments of brilliance which they then toil to confirm. That's in part because the myth is tidier than the truth. "We retrofit that idea of hypothesis-driven science in part because scientists are too embarrassed to admit that they were stumbling around in the data and stubbed their toe on a finding," said Chris Hilton, senior archivist at the Wellcome Library, which specializes in the history of science. In the biomedical sciences, where we worship at the altar of the randomized controlled trial, the supremacy of the hypothesis is written into our codes of conduct; you are forbidden not to have one. When bright-eyed epidemiology students ask me about "fishing" (our more organic term for data mining), I have to tell them it is streng verboten *to trawl through their data until they net some association that will be statistically significant and thus give them a "result." We protect against this wickedness by requiring researchers to tell us what questions they will be answering before they have enrolled a single person in a clinical trial.*

—**ELIZABETH PISANI**, an epidemiologist and writer, in ***Prospect*** (Dec. 2010) that the only "rational and just way to write the history of science is to rely exclusively on publications having a precise date."

Over time, that position prevailed. By the beginning of the 20th century, authoritative scientific journals were the place to establish credentials and make findings public. In 1902, Britain's Royal Society initiated the publication of the *International Catalogue of Scientific Literature*, an annual index running 17 volumes in length and covering all major areas of scientific research.

The rise of journals posed a problem that was bigger than how to organize publications; it was a question of how to organize the entire field of science. Before journals, a common metaphor for nature was a book. Nature was a self-contained, intelligible document that scientists could "read." But by 1900, the metaphor had changed. Mathematician and physicist Henri Poincaré referred to nature, as Csiszar puts it, "as a vast expanse of print matter, a body the scientist did not so much read through, as search, select from, and catalog." The medium, it seems, represented the message.

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School for Slugs

THE SOURCE: "Learning Degree Zero" by D. Graham Burnett, in ***Cabinet***, Fall 2010.

Undersea slugs don't know the three Rs, but they can learn just enough to be the perfect specimens for scientists who study how learning occurs.

When neuroscientist Eric Kandel gave his acceptance speech after winning the Nobel Prize in Physiology or Medicine in 2000, he puckishly flashed a Photoshopped picture of a giant undersea slug sporting a Nobel medal on the screen behind him.

Aplysia californica is not just any old slug, but "the creature upon which much of the modern scientific understanding of learning has been built," writes D. Graham Burnett, a Princeton historian and an editor of *Cabinet*.

The first half of the 20th century saw halting progress in the quest to understand what exactly learning is. German psychologist Hermann Ebbinghaus identified the "learning curve," and Russian physiologist Ivan Pavlov famously trained animals to respond to certain stimuli in what he called "classical conditioning." But when it came to describing how learning actually happens, scientists were stymied. Psychologist Karl Lashley joked in 1950, "I sometimes feel, in reviewing the evidence, . . . that the necessary conclusion is that learning is just not possible."

The study of what are called "model organisms" has produced many core scientific discoveries. Where would genetics be without fruit flies? In the early 1960s, Kandel was looking for the model organism for the science of learning. Dogs and rats were too complicated, their behavior too intricate. He "wanted to study learning in an animal built for the very simplest kinds of information acquisition and storage," Burnett says. "An animal that could be understood as a little laboratory learning-machine: limited behavioral repertoire; large, simple wiring; a resilient metabolism; and, ideally, small teeth (no one likes getting chomped by lab animals)."

Enter *Aplysia californica,* a large slug that lives in the kelp forests and rocky reefs off the Pacific coast of the United States. An individual specimen can weigh more than 10 pounds. The slugs' skin is translucent, allowing them to turn the color of the kelp they eat and hide from predators. "When scrunched up contentedly, they look a bit like rabbits," Burnett notes. *A. californica* conveniently has huge neurons, and relatively few of them to boot (about 20,000, whereas mammals