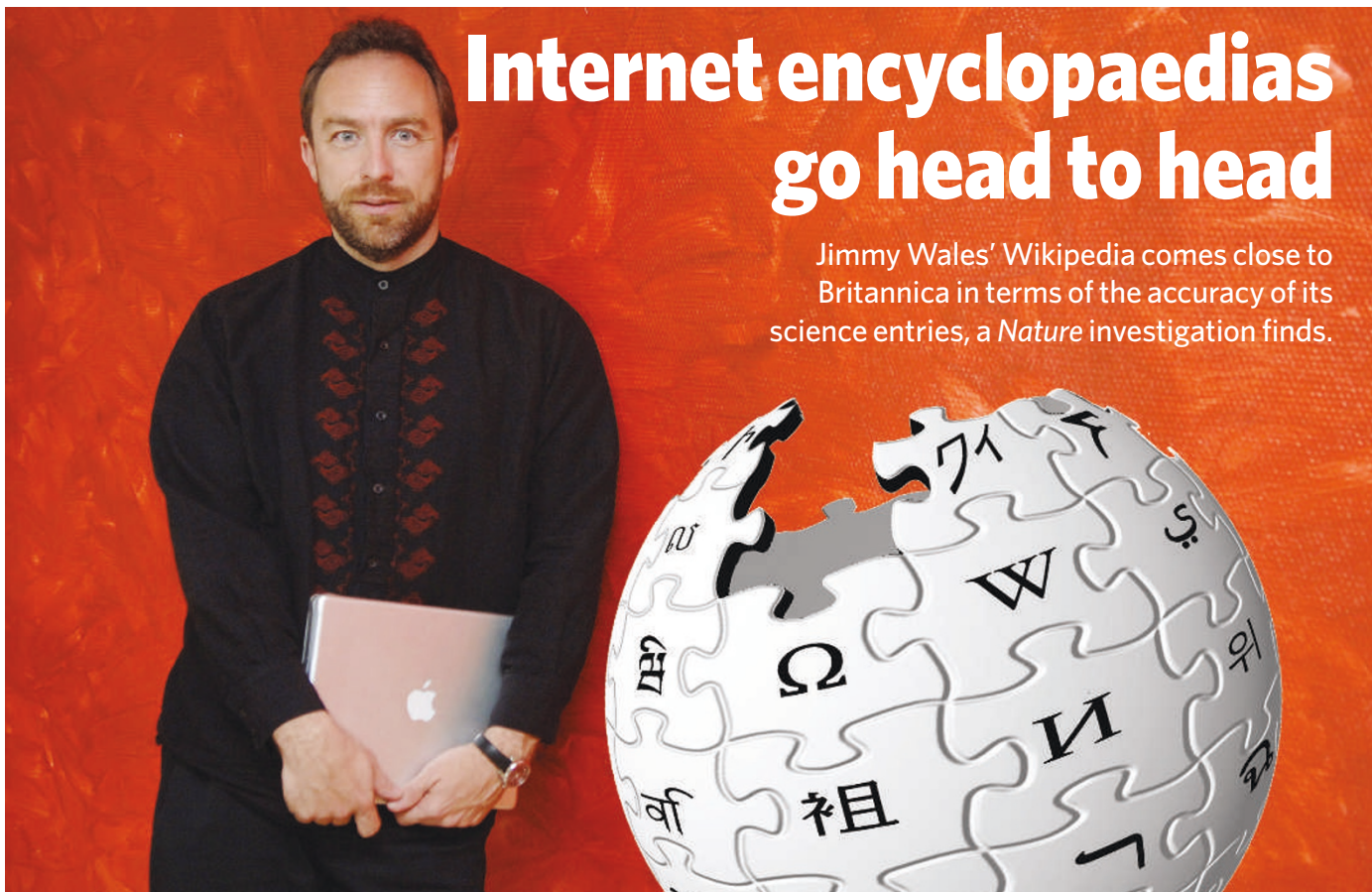


SPECIAL REPORT

Internet encyclopaedias go head to head

Jimmy Wales' Wikipedia comes close to Britannica in terms of the accuracy of its science entries, a *Nature* investigation finds.



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One of the extraordinary stories of the Internet age is that of Wikipedia, a free online encyclopaedia that anyone can edit. This radical and rapidly growing publication, which includes close to 4 million entries, is now a much-used resource. But it is also controversial: if anyone can edit entries, how do users know if Wikipedia is as accurate as established sources such as Encyclopaedia Britannica?

Several recent cases have highlighted the potential problems. One article was revealed as falsely suggesting that a former assistant to US Senator Robert Kennedy may have been involved in his assassination. And podcasting pioneer Adam Curry has been accused of editing the entry on podcasting to remove references to competitors' work. Curry says he merely thought he was making the entry more accurate.

However, an expert-led investigation carried out by *Nature* — the first to use peer review to compare Wikipedia and Britannica's coverage of science — suggests that such high-profile examples are the exception rather than the rule.

The exercise revealed numerous errors in both encyclopaedias, but among 42 entries tested, the difference in accuracy was not

particularly great: the average science entry in Wikipedia contained around four inaccuracies; Britannica, about three.

Considering how Wikipedia articles are written, that result might seem surprising. A solar physicist could, for example, work on the entry on the Sun, but would have the same status as a contributor without an academic background. Disputes about content are usually resolved by discussion among users.

But Jimmy Wales, co-founder of Wikipedia and president of the encyclopaedia's parent organization, the Wikimedia Foundation of St Petersburg, Florida, says the finding shows the potential of Wikipedia. "I'm pleased," he says. "Our goal is to get to Britannica quality, or better."

Wikipedia is growing fast. The encyclopaedia has added 3.7 million articles in 200 languages since it was founded in 2001. The English version has more than 45,000 registered users, and added about 1,500 new articles every day of October 2005. Wikipedia has become the 37th most visited website, according to Alexa, a web ranking service.

But critics have raised concerns about the

site's increasing influence, questioning whether multiple, unpaid editors can

match paid professionals for accuracy. Writing in the online magazine *TCS* last year, former Britannica editor Robert McHenry declared one Wikipedia entry — on US founding father Alexander Hamilton — as "what might be expected of a high-school student". Opening up the editing process to all, regardless of expertise, means that reliability can never be ensured, he concluded.

Yet *Nature's* investigation suggests that Britannica's advantage may not be great, at least when it comes to science entries. In the study, entries were chosen from the websites of Wikipedia and Encyclopaedia Britannica on a broad range of scientific disciplines and sent to a relevant expert for peer review. Each reviewer examined the entry on a single subject from the two encyclopaedias; they were not told which article came from which encyclopaedia. A total of 42 usable reviews were returned out of 50 sent out, and were then examined by *Nature's* news team.

Only eight serious errors, such as misinterpretations of important concepts, were



THE NATURE PODCAST
Listen to Wikipedia founder Jimmy Wales talk about our survey and more at www.nature.com/nature/podcast

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Kurt Jansson (left), president of Wikimedia Deutschland, displays a list of 10,000 Wikipedia authors; Wikipedia's entry on global warming has been a source of contention for its contributors.



he was the 13th, to more significant inaccuracies. Wikipedia, for example, incorrectly describes how Mendeleev's work relates to that of British chemist John Dalton. "Who wrote this stuff?" asked another reviewer. "Do they bother to check with experts?"

But to improve Wikipedia, Wales is not so much interested in checking articles with experts as getting them to write the articles in the first place.

As well as comparing the two encyclopaedias, *Nature* surveyed more than 1,000 *Nature* authors and found that although more than 70% had heard of Wikipedia and 17% of those consulted it on a weekly basis, less than 10% help to update it. The steady trickle of scientists who have contributed to articles describe the experience as rewarding, if occasionally frustrating (see 'Challenges of being a Wikipedian', below).

Greater involvement by scientists would lead to a "multiplier effect", says Wales. Most entries are edited by enthusiasts, and the addition of a researcher can boost article quality hugely. "Experts can help write specifics in a nuanced way," he says.

Wales also plans to introduce a 'stable' version of each entry. Once an article reaches a specific quality threshold it will be tagged as stable. Further edits will be made to a separate 'live' version that would replace the stable version when deemed to be a significant improvement. One method for determining that threshold, where users rate article quality, will be trialled early next year. ■

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Additional research by Declan Butler, Jenny Hogan, Michael Hopkin, Mark Peplow and Tom Simonite. Supplementary information available online at www.nature.com/news/2005/051212/full/438900a.html

detected in the pairs of articles reviewed, four from each encyclopaedia. But reviewers also found many factual errors, omissions or misleading statements: 162 and 123 in Wikipedia and Britannica, respectively.

Editors at Britannica would not discuss the findings, but say their own studies of Wikipedia have uncovered numerous flaws. "We have nothing against Wikipedia," says Tom Panelas, director of corporate communications at the company's headquarters in Chicago. "But it is not the case that errors creep in on an occasional basis or that a couple of articles are poorly written. There are lots of articles in that condition. They need a good editor."

Several *Nature* reviewers agreed with Panelas' point on readability, commenting that the Wikipedia article they reviewed was poorly structured and confusing. This criticism is common among information scientists, who also point to other problems with article quality, such as undue prominence given to controversial scientific theories. But Michael

Twidale, an information scientist at the University of Illinois at Urbana-Champaign, says that Wikipedia's strongest suit is the speed at which it can be updated, a factor not considered by *Nature's* reviewers.

"People will find it shocking to see how many errors there are in Britannica," Twidale adds. "Print encyclopaedias are often set up as the gold standards of information quality against which the failings of faster or cheaper resources can be compared. These findings remind us that we have an 18-carat standard, not a 24-carat one."

The most error-strewn article, that on Dmitry Mendeleev, co-creator of the periodic table, illustrates this. Michael Gordin, a science historian at Princeton University who wrote a 2004 book on Mendeleev, identified 19 errors in Wikipedia and 8 in Britannica. These range from minor mistakes, such as describing Mendeleev as the 14th child in his family when

"Scientists' involvement would lead to a multiplier effect. Experts can help write specifics in a nuanced way."

Challenges of being a Wikipedian

Vaughan Bell, a neuropsychologist at the Institute of Psychiatry in London, UK, has reworked Wikipedia's entry on schizophrenia over the past two years. Around five others regularly contribute to the reworking, most of whom have not revealed whether they have academic backgrounds. Bell says that is not a problem, as disputes are settled through the discussion page linked to the entry, often by citing academic articles. "It's about the quality of what you do, not who you are," he explains.

While admitting it can be difficult

settling arguments, Bell says he often learns something by doing so. One user posted a section on schizophrenia and violence that Bell considered little more than a "rant" about the need to lock up people with the illness. "But editing it did stimulate me to look up literature on schizophrenia and violence," he says. "Even people who are a pain in the arse can stimulate new thinking."

Others, particularly those who contribute to politically sensitive entries, have found the editing process more fraught. William

Connolley, a climate researcher at the British Antarctic Survey in Cambridge, has fought for two years with climate-change sceptics over the entry on global warming. When Connolley was insulted by one of the sceptics and the editing became a 'revert war' — where editors repeatedly undo each others' changes — the matter was referred to the encyclopaedia's administrators.

Two of Connolley's opponents were banned from editing any climate article for six months, but it was a bumpy process. The

Wikipedia editors who oversaw the case took three months to reach a decision. They also punished Connolley for repeatedly changing the sceptics' edits, placing him on a six-month parole during which he is limited to one revert a day. Users who support Connolley have contested the decision.

"It takes a long time to deal with troublemakers," admits Jimmy Wales, the encyclopaedia's co-founder. "Connolley has done such amazing work and has had to deal with a fair amount of nonsense." **J.G.**