

OPEN ACCESS

UVM's Gary Ward, Ph.D., works to make the results of scholarly research available to all who can benefit from them.

STORY AND PHOTOS
BY CAT CUTILLO

Gary Ward, Ph.D., UVM professor of microbiology and molecular genetics, remembers the precise moment he decided to champion for change in scientific publishing.

"I remember it clear as day," says Ward. The "aha moment" was at the 2000 annual meeting of the American Society for Cell Biology. The keynote speaker that year was Nobel laureate Dr. Harold Varmus who was the former director of the National Institutes of Health (NIH).

"Instead of talking about science he talked about publishing," says Dr. Ward.

Historically, the biomedical community has been at the mercy of a scientific publishing system that exclusively owns the copyright on any published material and restricts reader access to that material. Scientific authors sign over all rights and sometimes have to pay the publisher to re-use their own research. >>

Even government-funded research that results in published literature hasn't been freely accessible to everyone who needs and wants those results. Publishers have set a high subscription rate with profit margins approaching 40 percent and a university library's ability to subscribe to a scientific journal has largely been a function of their financial structure resulting in problems with equity, inclusion and blocked access to information on critical issues like world health.

That night in 2000, Varmus talked about a concept that would come to be known as "open access." He wanted to create an NIH-funded publishing platform for people doing NIH-funded work and make results available to the public freely and quickly. Frustrated in that effort, he announced in his keynote that he and his colleagues, Patrick Brown, M.D., Ph.D. and Michael Eisen, Ph.D., were launching a boycott-petition that ultimately collected 35,000 signatures from scientists worldwide who pledged to only publish in, edit, review for, and subscribe to scholarly journals that made their content freely available within six months of publication. PubMed Central was created as an NIH-sponsored archive to host these freely available papers.

"That keynote just completely lit my fire on this issue. Subconsciously, I knew that as scientists we completely hold the cards to how publishing works because we are the workforce," says Dr. Ward. "Yet we're a fairly conservative bunch and afraid to actually execute our leverage. These guys were executing their leverage and it was really exciting to me," says Ward. Over the years his own frustration had grown after repeated instances of not being able to access scientific literature he needed.

Soon after that 2000 encounter, Ward joined the leadership of the American Society for Cell Biology. The initial boycott-petition had raised awareness but it didn't result in immediate change. Instead, Varmus, Brown and Eisen had refocused their efforts and founded the Public Library of Science (PLOS), an open access publishing operation that launched two journals, PLOS Biology and PLOS Medicine. They have since expanded into seven open-source journals.

Over the past two decades, Ward has been a leading advocate to improve access to scientific literature. He was a member of the Executive Committee of the American Society for Cell Biology (ASCB) from 2002 to 2008. He authored ASCB position papers on open access, wrote editorials, submitted testimony to Congress and visited congressional offices to speak in support of legislation requiring authors of government-funded research to make their results available to the public. He was appointed a member of the U.S. National Library of Medicine (NLM) Public Access Working Group and then chair of the NLM National Advisory Committee that oversees the operations of PubMed Central. Additionally, he served as the chair of the PLOS Board of Directors from 2011 to 2018.

"He was pivotal to shepherding PLOS into its next phases of growth and expansion and dedicating countless volunteer hours to the organization and its mission," says Meredith Niles, Ph.D., another open access advocate and assistant professor in the University of Vermont Department of Nutrition and Food Sciences and the Food Systems Program.

Ward identifies six shortcomings in the current system of scientific publishing: access and re-use; time to publication; assessing research reliability and quality; assessing research

significance/impact; literature as a static, non-interactive "graveyard of data;" and the issue of "who pays, and who profits."

Traditionally, scientific journals have required authors to sign over their copyright on everything in their published material.

"I've been in the situation myself where I've published some data and then I want to use a particular figure in a review article I'm writing and I have to either get permission or pay the publisher to use my own data in my own review," says Ward.

According to Ward, the government spends nearly \$40 billion per year on biomedical research but the results of that published research are not available to everyone who needs it or wants it.

"There is a real problem with not everybody having access to taxpayer-funded research," says Dr. Ward.

Additionally, access to the scientific literature is based largely on the library budget of a university, so a library in Sub-Saharan Africa won't be able to afford the same subscriptions as the University of Vermont, who won't be able to afford the same subscriptions as Stanford University. Equity and inclusion are key factors for Ward, particularly for world-health issues. Ward, whose work focuses on parasitic diseases says, "The democratization effect of making information available to everyone will put everybody on a level playing field in terms of their ability to build on that literature."

Christopher Burns, who is the Curator of Manuscripts and University Archivist in the Silver Special Collections Library at the University of Vermont, says the traditional publishing model with its rising costs have had a dramatic impact on library budgets.

"Part of the core mission of libraries and librarians has always been about access to information," says Burns. He says that despite the advent of the Internet and the possibilities of access that exponentially increased, the business model that's evolved to disseminate academic journals has created new barriers of access.

"Librarians have been raising their voices about the absurdity of the traditional publishing model and advocating for a much more open model for quite some time now," says Burns.

Ward notes that it often takes 12 to 18 months from a research manuscript submission to its appearing in print. He says the Chan Zuckerberg Initiative in the San Francisco Bay Area calculated that the rate of scientific progress would increase five-fold over 10 years if studies were published as preprints. A preprint is a scientific paper that precedes formal peer review and publication in a scientific journal. Preprints are available for free online before the paper is published in a scientific journal.

"There's a real opportunity cost to the way our current system of publication works that has real ramifications especially when you're talking health. It takes that much longer for those breakthroughs to be translated," says Dr. Ward. "The sooner results become available and the more people that have access to those results, the quicker they'll be built upon and the faster the whole scientific enterprise will proceed."

Two or three people determine the quality and accuracy of each piece of work during a peer review. Ward says not only does this process slow down the publication time, but he feels it also creates a false sense of security in a piece's accuracy.

"There shouldn't be this institutionalized reliance on a single static evaluation of whether something is good or correct," says Ward. "We should be looking at the quality and accuracy of a piece over its whole lifetime." Ward says a prime example of backlash is

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the controversy around vaccines and autism that was published in *The Lancet*.

"Its arguably one of the most heavily reviewed journals in the world. They really pride themselves on the quality and the rigor of their review. This piece of work was clearly wrong and got published. And because it was published in *The Lancet* and was peer reviewed, there are people today who still believe it. Even though it has been thoroughly disproved," says Ward.

"You need to uncouple the act of publishing from the act of evaluation," says Ward. "So people will look at [research results and conclusions] with appropriate skepticism." Ward would like to eliminate the pre-publication peer review system entirely and establish a post-publication review and evaluation system that evolves over time and invokes the "wisdom of the crowd" through a public commenting system. To go along with that, appointing a peer editorial group to identify particularly good preprints after they are posted would be a useful way to provide the recognition scientists need for their career advancement. In this model, "[Editors] become selectors rather than rejecters," says Ward.

Ward sees the peer review process often failing to evaluate the significance and impact of work, and feels the "impact factor" of certain journals has been overrated.

UVM's Meredith Niles conducted a study that analyzed how the Journal Impact Factor (JIF) is currently used in review, promotion, and tenure at institutions in North America and recently published her findings on the open-source site eLife.

Niles concluded that 40 percent of research-intensive institutions and 18 percent of master's institutions in North America explicitly mention the "impact factor" or very closely related terms in their reappointment promotion tenure documents. And of those 40 percent that mention the "impact factor" of the journal, 63 percent of them specifically associate that metric with quality.

"It has now become an integral part of the academic reward system but it's based on marketing," says Dr. Ward. "The over-reliance of where you publish, the title of the journal that you publish in being a surrogate for quality, that is the problem that perverts the incentive system in science," he says.

Ward says he agrees with social-cognitive psychologist and professor Dr. Brian Nosek's published assertions that what's good for scientists in terms of career advancement is not well aligned with what's good for science.

"The goal becomes to publish in those journals rather than publish what's right," says Dr. Ward. "It leads scientists to consciously or subconsciously cut corners and give the most favorable interpretation of their data and leave out the negative data."

Ward points to data that shows a single paper in the top hierarchy of journals is not a good predictor of future success.

"You have to have a fully baked beautiful narrative to publish in those journals. It creates hyper-competition and a huge amount of stress for post docs out looking for a job. They think that it's a right



of passage," says Dr. Ward.

The first scientific paper was published in England by the Royal Society in 1665. Dr. Ward says the PDF of today is not much different and doesn't effectively capture the richness of collected data and the

way it interconnects. He believes published papers should have the capacity to be modified to reflect new techniques, correct original conclusions that were disproved with, ideally, a public commenting system instituted for conversation.

"It should be a piece of art that's continually evolving," says Dr. Ward.

"When all the papers are housed in the silos of individual publishers and there are these restrictions on what you can do with the content it doesn't allow things to be interconnected," he says.

Instead, he hopes to create a culture for commenting and tap into the same pay-it-forward mindset that drives scientists to donate their time to peer review papers for scholarly journals. He believes commenting will add depth to the literature and allow scientists to share informed experience that accelerates each other's research.

Scientific publishing is a big business, with big profit margins for publishing companies. Ward says this system evolved because, when papers were mostly communicated in print, there were a lot of costs associated with printing and distributing. Many journals only offer online editions now, but subscription prices have not dropped accordingly, and the copyright arrangements have remained.

"We do the work and then we give away our product. It's not like a photographer or a musician. We give our product to the publisher and the publisher then uses the free services oftentimes of editors and almost always from peer reviewers providing expert evaluation. The publishers package it up and make a lot of money."

As for the future, Ward believes in a combination of several instituted changes in scientific publishing, with preprints being at the forefront. Another model Ward watches is SCOAP3, a global partnership of 3,000 libraries, funding agencies, and research institutions from 46 countries and intergovernmental organizations that has formed an agreement with publishers to dedicate some subscription fee money for open access.

Niles says Ward is not only helping to change the future of scientific publishing through his leadership but also through his mentorship.

"He's been an incredible mentor to me—helping me as an early career researcher navigate the academic process and tenure, and giving a voice to early career researchers in the scientific publishing process, which was not really there before," says Niles.

Ward says his message to early career researchers is to not abandon the system altogether but to continue working in the imperfect publishing system to try to change it from within.

"There are things we can do that won't necessarily damage our career in any way but can start to nudge the battleship in a better direction," he says.

For Ward, thinking globally and acting locally boils down to one simple motivating truth.

"The main reason for open access is things will happen faster. When there's human health involved, there's an opportunity cost that we should all care about." VM