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## Researchers in a Brave New Web 2.0 World

Over the past two decades, the Web has revolutionized the way scientific information is disseminated, and this shift has been accompanied by an increasingly paperless and wireless landscape. Scientists now routinely submit their research to journals, search for relevant work, communicate with collaborators, and register for scientific meetings digitally. Over the past decade, a new set of Web-based tools which include blogs, user-generated video and image Web sites, and professional forums have burgeoned and are collectively dubbed Web 2.0 (1). Comprising online innovations which readily facilitate the posting of content, as well as social networking tools which allow users to interact more readily with one another, Web 2.0 has blurred the distinctions between the creators and users of content. Instead of static webpages, content in this brave new world is dynamic and often subject to revision and commentary in real time. However, a recent survey from the United Kingdom indicates that while the use of online resources in research remains important, that usage of the most common Web 2.0 tools for academic scholarly communication is currently lagging behind (2).

The analysis, which was commissioned by the Research Information Network, a policy forum funded by U.K. national libraries, research councils, and higher education funding councils, surveyed approximately 1% of all full-time academics in the U.K. In addition, the analysis included in-depth interviews and case studies focusing on providers of specific online tools. The responses to the survey represented a broad distribution in terms of primary scientific discipline, academic role, and age. Only 13% of respondents admitted to using Web 2.0 tools such as blogs, wikis, and social networking Web sites for scholarly communication at a frequency of once a week or more; 45% used these tools occasionally, and 39% did not use them at all. There was variability based on discipline; for example, those working in the field of computer science and mathematics were more than twice as likely to be users of these tools for scholarly communication as those engaged in the physical sciences. Also, those engaged in collaborative research were more likely to use Web 2.0 tools than those who conducted research independently. In addition, there was variability based on gender; 65% of males surveyed used these online tools compared to 50% of females. Interestingly, however, there was no clear pattern which could be discerned from the age of respondents.

Why are more researchers not making use of many of the new online tools available for scholarly dissemination? Currently, while most researchers are interested these tools, the primary reason for not adopting is a lack of clear understanding of the benefits of doing so. Another hesitation centers on the quality of content released via many existing Web 2.0 outlets. A third concern centers on credibility. Many researchers are wary of using online tools which are presently deemed less credible than the traditional modes of communication through peer-reviewed publication and presentation at professional conferences.

The third concern is the easiest to alleviate. As noted in the survey, most researchers who use Web 2.0 tools see these in a supplementary role augmenting collaborative and communicative practices, not replacing current modes of scholarly communication. And while surveys indicate that few researchers think peer review in the most-common avatar

cannot be improved (3), the uptake of nontraditional open review and publication of data has so far been modest (2).

The questions regarding quality of content and the benefits in participating are harder to address. On a broader level, these are not specific to scientific research. Last year, the technology company Google launched Google Wave as an online web application designed to facilitate communication and collaboration in real-time. In August, Google announced suspension of development of this tool as a standalone product citing low user adoption (4). Many technologies fail, and for the adoption of any new technology, users need to order to overcome initial inertia. This is no different for Web 2.0 tools.

Questions which were not included in the survey underscore some of the technical barriers to acceptance: how does usage of some of these Web 2.0 tools for scholarly communication among researchers compare to usage for personal purposes? It is likely that a fraction of those who do not use these online tools for scholarly communication find these tools useful for other purposes. It would also be worthwhile delving a bit deeper and analyzing if early adopters of one Web 2.0 tool are also more receptive toward embracing other ones. Finally, there are the nontrivial problems of delineating the boundaries of Web 2.0 and matching the specific objectives of researchers to particular tools. For example, researchers who might not be blogging about their work might be engaged in optimizing research discovery tools, curating citation databases, or collaboratively annotating genomic or structural meta-data. Many tools are discipline-specific, and chemists might be expected to use a tool such as SciFinder more frequently than many researchers in other disciplines. Arguably, all of these tools are also encompassed by a broad definition of what constitutes Web 2.0.

Where does this leave scientific organizations? Researchers who participated in the survey clearly indicated that they felt that publications and meetings were the most important modes of scholarly dissemination available to them. Overwhelmingly, they also voiced the opinion that they were more likely to try new online tools if their colleagues were also more accepting of these modes of communication. As the world's largest professional scientific organization, the American Chemical Society continues to provide traditional channels of scholarly dissemination through publications and meetings. The Society is also complementing these channels with online tools such as ACS Network, blogs, specific community sites, wikis, and podcasts.

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