Going Broad As Well As Deep: The WIREs Model and the Challenges of Interdisciplinary Publishing

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If I may be forgiven for improperly stretching an analogy, a physicist needs a biologist like... well, like an English Tory needs a Liberal Democrat. Each is the product of a particular culture, a certain background, a distinctive way of thinking about how and why things happen; each is engaged in examining the features of the observed world, but each uses a different language to describe it. These are somewhat grudging partners, at times even scornful of one another's philosophical positions, but each recognises the necessity of working closely together to solve certain complex and difficult problems.

I am tempted to continue in this vein, but I suspect this is as far as the metaphor will profitably take me. Let me turn instead to the world of scientific research to develop my theme. It is a self-evident truth that many of the biggest and hardest and most interesting challenges in science require close collaboration amongst researchers of different backgrounds and skill-sets. The Human Genome Project, now 20 years old and considered by many to be one of the most successful Big Science projects of all time, is the product of a dynamic alliance of molecular biology with novel sequencing technologies and innovative bioinformatics tools. The development of accurate computer models of the geosphere and biosphere, to take another topical example, has brought together a diverse coalition of atmospheric and oceanic thermodynamicists with (amongst others) global ecologists and experts in high-performance computing. Even the talented theoretical and experimental physicists at the Large Hadron Collider would admit to the need for some good, solid electrical engineering to make their machine work properly.

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There is a countervailing argument, however, that increasing *specialisation* has been at least as important in the success of these ambitious projects; that deep expertise is an invariable necessity. How, then, do we reconcile these apparently conflicting requirements? The output of the global research community is prodigious (in 2008, more than 1.5 million journal articles; that's a stack of paper reaching two miles into the sky), and will undoubtedly continue to grow. Setting aside arguments as to whether all this publishing is really necessary or useful, it is apparent that the task of maintaining a high level of proficiency in more than one field is beyond the cognitive resources of most scientists. The genuine polymath, alas, has become a rare breed, perhaps even now close to extinction. The expansive natural philosophy of Newton and Leibniz in the seventeenth century, or even that of Albert Einstein and Niels Bohr two and a half centuries later, is no longer a viable career. Our modern research culture is one in which scientists prosper by devoting their energies to progressively narrower and more arcane investigations.

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The American engineer and science administrator Vannevar Bush, recognising the extent of this troubling incompatibility between breadth and depth, proposed an interesting technological solution. Writing in the July 1945 issue of the *Atlantic* magazine, he described a future device known as the *memex*, in which countless thousands of books, periodicals, and photographs would be stored on microfilm for rapid retrieval, thereby placing vast quantities of information at a researcher's fingertips.

The owner of the memex, let us say, is interested in the origin and properties of the bow and arrow. Specifically he is studying why the short Turkish bow was apparently superior to the English long bow in the skirmishes of the Crusades. He has

dozens of possibly pertinent books and articles in his memex. First he runs through an encyclopedia, finds an interesting but sketchy article, leaves it projected. Next, in a history, he finds another pertinent item, and ties the two together. Thus he goes, building a trail of many items. Occasionally he inserts a comment of his own, either linking it into the main trail or joining it by a side trail to a particular item. When it becomes evident that the elastic properties of available materials had a great deal to do with the bow, he branches off on a side trail which takes him through textbooks on elasticity and tables of physical constants. He inserts a page of longhand analysis of his own. Thus he builds a trail of his interest through the maze of materials available to him.

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This passage is almost eerily prescient in its depiction of a process that is now familiar to any scientist or student. And yet, as we have seen, the *memex* cannot solve the problem of information overload. Human skills and qualities (selection, editing, curation, communication, collaboration) are in many ways as important as they have ever been.

So, where does this leave us? Interdisciplinarity and specialization are both essential to solving the difficult problems in science, but they are mutually antithetical. To make matters worse, it is not always clear what we mean when we speak of interdisciplinary research. Most kinds of experimental science require expertise in more than one field, but they manifest their integrative qualities in very different ways. A gathering of experts on climate change, for example, might include sociologists and economists as well as physicists and ecologists, while attendees at a symposium of systems biologists would be distinguished in a more nuanced way by their relative expertise in methods from

network analysis and control theory as opposed to the more traditional reductionist approaches of molecular biology. Nevertheless, few people in the world of science would disagree with the assertion that interdisciplinarity is a good thing, and that it should be promoted and encouraged by our funding agencies, by our research institutions, and by our scientific publishing industry.

Such was the thinking that led to the concept of the Wiley Interdisciplinary Reviews, WIREs for short. How could we take that roomful of climate researchers and persuade them to collaborate on a scientific publication that would genuinely meet the evident needs of the field? How might we design a novel kind of review journal that would allow for effective sharing of important new systems perspectives in biology?

We also had a second, rather different, mission for our new publishing model. In recent years, traditional reference publishing in the sciences (that is, specialised encyclopedias and handbooks) has begun to suffer from something of an identity crisis, prompted in part by the burgeoning of ‘free stuff’ on the web, and in part by the growing pressure on scientists to publish in established, impact-factored journals from which they can derive some measure of professional credit. We wondered how best to combine the highly valued, tried-and-tested features of scholarly reference works (carefully curated editorial structure, comprehensiveness, authority) with the high visibility and scientific credit-worthiness of the review journal literature.

I am pleased to say that we have been able to find a model that so far works rather well, scientifically and editorially speaking. Briefly, it goes like this. We begin the process of developing a new WIREs title in the same way as if we were publishing a traditional encyclopedia, by working with our academic editors to map out the information space according to a detailed taxonomy of topics and subtopics. We then populate this structure with articles of different types—overviews, advanced reviews, focus articles, opinions, and editorial commentaries—to provide multiple entry points to the content, and proceed to commission these articles from the most distinguished scientists we can persuade to write for us. Recognising that it is one thing to attach the ‘interdisciplinary’ label to our

publication, and quite another for our contributors actually to write in an interdisciplinary way, we provide carefully crafted article templates that help, encourage, and cajole our authors into positioning their contributions such that they will be useful and accessible to readers in adjacent fields.

Over the past few years, I have been given plenty of reasons for not trying to start a new programme of interdisciplinary scientific publishing, especially not one that also involves the introduction of a new publishing model.

So far, so good. But we also need to solve the second part of the puzzle, namely, how to give our WIREs articles their due prominence in the scientific literature. To do this, we create a formal serial publishing structure, as for a journal, with volumes and issues and an ‘early view’ component to enable timely online publication. As commissioned articles are approved by the editorial board, each is assigned both to its relevant location in the taxonomy described above and to a volume and issue. Hence, as we publish the content in well defined serial slices—thereby meeting the fundamental requirements of abstracting and indexing services such as PubMed and Thomson Reuters—we are also populating our predefined encyclopedic topic structure. Seen from one direction, our new WIREs publication looks very much like a review journal; seen from another, it is not very different from an online encyclopedia. Flexible cross-referencing to related articles in the same publication, and to other relevant publications and resources, completes the process by providing full connectivity within the online environment.

Wiley Interdisciplinary Reviews titles

<i>Title</i>	<i>Launch date</i>
<i>WIREs Nanomedicine and Nanobiotechnology</i>	January 2009
<i>WIREs Systems Biology and Medicine</i>	July 2009
<i>WIREs Computational Statistics</i>	July 2009
<i>WIREs Climate Change</i>	January 2010
<i>WIREs Cognitive Science</i>	January 2010
<i>WIREs RNA</i>	July 2010
<i>WIREs Data Mining and Knowledge Discovery</i>	January 2011
<i>WIREs Computational Molecular Science</i>	January 2011
<i>WIREs Developmental Biology</i>	July 2011
<i>WIREs Membrane Transport and Signaling</i>	July 2011
<i>WIREs Energy and Environment</i>	January 2012

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‘No self-respecting scientist would publish their best work in an interdisciplinary journal.’

‘Scientists are less likely to cite interdisciplinary journals; you’ll never achieve a decent impact factor.’

‘These new cross-cutting fields are just passing fads; give it a few years, and they’ll be on to the next big thing.’

‘It’s a hybrid model, neither a book nor a journal; your back-office systems won’t be able to handle it.’

‘Librarians won’t know how to categorize this stuff; this will really hurt your sales.’

And so on. As a counterpoint to this, I have never had such a gratifyingly positive response to a proposal as when I first began canvassing opinions from the scientific community on the WIREs publishing model. Phrases such as ‘fabulous idea!’ and ‘go for it!’ and ‘do this before somebody else does!’ are, in my experience, rarely seen from academic reviewers. Encyclopedia projects that had previously been moribund were given a new lease on life as

WIREs titles. Ideas for new WIREs projects began to come so quickly that we had to call a time out.

It is too early to say what the long-term scientific and commercial success of this publishing programme will be. There are various uncertainties and unsettling thoughts. For example, to what extent can the careful positioning and title-level features of the WIREs remain relevant in our highly competitive online ecosystem, if the organism on which selection primarily occurs is the individual article rather than the entire journal? To put this another way, how much does branding matter, and can the qualities of the publishing model be effectively manifested at the article level? My answers to these questions remain on the positive side. I am confident that the WIREs will in the future play an important role in reconciling the overwhelming importance of specialisation in science with the pressing need for collaboration across the disciplines. In science, as in politics, pragmatic alliances and hybrid approaches can sometimes bring about unforeseen results. □