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Wake Up!

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The world of professional publishing, of scholarly communication, is in a state of profound transformation. In some fields, for example physics and computer science, researchers have embraced this transformation and are forging new policies and better customs. In my experience, however, mathematicians are one of the most conservative research communities, clinging to old habits in spite of the opportunity to improve their working life. The impetus for this blog at this time is the death of Klaus Peters, a publisher who, more than any other that I have met, saw publishing in mathematics as a service to the professional community and strived tirelessly to find new ways to assist our community. But the changes that have happened in the commercial publishing world deeply disturbed him. I want to make a plea to my colleagues to spend more time considering how we should shape this aspect of our profession and then being open to radical changes: you have nothing to lose

but the chains that are binding you to capitalist exploitation and you can gain a freer, simpler world to work in.

Book and journal publishing have been rocked by two major changes during my lifetime. The first was the takeover of smallish niche publishers by their CFO's, subsequent mergers and the entry into this business of private equity firms. The second was the expansion of the internet to a state where it can provide instant availability of whole libraries everywhere at your fingertips.

Let me start with the first. In the 50's my first wife worked for Houghton-Mifflin, reading (and usually rejecting) submittted fiction. In those days, it was typical for an author to form a life-long relationship with a specific editor who would see him or her through the ups and downs of their creative muse and become an intimate friend. This sleepy world is nicely captured in J. L. Carr's satire *Harpole & Foxberrow, General publishers*. This is also the world in which the greatest mathematicians of the world (including Hilbert, Einstein, Courant, Caratheodory, Hecke, etc.) could write in 1923 a letter of appreciation to Ferdinand Springer for saving the then leading journals *Mathematische Annalen* and *Mathematische Zeitschrift* from bankruptcy. This letter is displayed in the sidebar. There was at that time a partnership between authors and specialized publishing firms that understood their needs and tried to serve them while doing business. Klaus recalled this spirit when he met Ferdinand Springer sometime in the 1960's in these words:

One day my phone rang: "Springer here, please come to my office." Ferdinand Springer, the legendary publisher, did not usually deal with junior members of the staff nor had I been formally introduced to him. I went to his office unsure what this all meant. His personal secretary kindly advised that I should listen and quietly excuse myself when the 'audience' was over. On entering his office I was greeted warmly as the new mathematics editor. Mathematics was one of Springer's favorite programs. He then proceeded to explain the raison d'etre of a publisher: to facilitate the work of the authors by taking away the burdensome aspects of editing, producing, and most importantly distributing their work widely. He made it very clear that these added values were the justification of a publisher's existence.

His fierce loyalty to authors and editors is confirmed by another story. When Ferdinand Springer sought to leave the occupied city of Berlin after World War II to rescue his family, he was stopped at a military control post. The commanding Russian officer demanded an explanation. Springer identified himself as a publisher of scientific books and journals (in his mind that was explanation enough) whereupon the officer commanded, "Tell me the names of the editors of such and such journal!" Springer had retained the names of Russian scientists and editors on the masthead of the journals they had served, despite the war. As he recited these names, the officer suddenly

> interrupted, "That's me, and I am honored to meet you." He provided Springer with free passage which allowed him to rejoin his family.

Klaus went on to nearly single-handedly rejuvenate Springer-Verlag's mathematical program bringing it back to its pre-WWII status of the leading math publisher in the world. He introduced the Lecture Note series and got to know most of the leading mathematicians of his generation, often soliciting new books from the world's top experts. But things changed: in the late 70's, the CFO was made the director with the final say and Klaus and Alice resigned in protest. In Springer's own self-published history, Klaus's role was erased. At the same time, the small math publishers were being swallowed up or their math series discontinued (van Nostrand, Wiley-Interscience, Benjamin, etc.). One saw journal prices for the leading journals go sky-high and prices of later editions of older books were raised to match those of the newest books. Circulation took second place to quarterly profits, often based only on library sales. Klaus and Alice continued to seek a position where the traditional values of publishing were respected, moving to the Swiss publisher Birkhauser until it was swallowed by Springer, then to Harcourt-Brace-Jovanivich until it was bought by General Cinema and finally striking out of their own as *AKPeters*.

The buyout and merger mania in the pursuit of higher profits and the abandonment of

"service" continued. A controlling interest in Springer itself was bought by the privately held publishing and mass-media conglomerate Bertelsmann in 1999. When they put Springer on the market in 2002, a group of us at the Beijing ICM tried a last ditch attempt to appeal to the Mohn family who owned Bertelsmann for an alternate solution. A letter signed by the Presidents of the IMU, ICIAM, EMS and the math societies of Germany, France, Canada and the US was sent to Dr. Mohn, recalling the partnership of Springer and the math community and asking him to consider the formation of a not-for-profit foundation to continue this partnership. The letter is reproduced in the sidebar. Subsequently, Springer has been sold three times to private equity firms: in 2003, to the British investors Cinven and Candover who acquired and merged both Kluwer Academic Publishers and BertelsmannSpringer; next to the private equity firm EQT Partners and the Government of Singapore Investment Corp.; and again in 2013, to yet another private equity firm BC Partners. Only Mitt Romney seems to have missed the boat. If you think a large part of our professional life is not mortgaged to capitalists, perhaps you have spent too much time thinking only about theorems. Private equity buys a firm for one and only one reason: they believe they can squeeze more profits out of their operations, i.e. out of us mathematicians (and our societies and libraries). As Klaus put it in a piece entitled "A Vanishing Dream" on which he was working a few weeks before his death:

> Alice and I feel that we have lived a dream

> to preserve and provide a service that was once considered worthwhile. I mean "publishing as a service". ... That this concept (with few exceptions of small individual publishers) is widely lost is no secret but what bothers me intellectually is the fact that publishing companies can be run financially successfully without an intellectual mission and without thought to optimize sales (by numbers of copies) or to produce well-edited and designed books. They compensate these shortcomings by optimizing the bottom line through skimping on editorial and production cost and offsetting revenue loss from smaller per-title sales (by number) by inflating prices.

Let's talk about the second huge change in our professional life: the internet. It was not clear to me, at least, in the early 1990's how the internet would do anything to our working lives except speed up communication, replacing some types of letters by emails. What opened my eyes was when Philippe Tondeur proposed that the math community could and should digitize *the entire corpus of mathematical books and journals* and make them available to all and sundry: a *World Mathematical Library*. Wow -- was this really possible? Of course, its practicality is obvious now and Google has gone even further, seeking to digitize all written material. From this, it's only a small step to ask: why put math on paper at all? If something is on the web (and not password protected), anyone can get it and either read it on the screen or print it out if

they prefer.

Full of enthusiasm for this brave new world, Peter Michor and I worked to involve the IMU. We set up its Committee on Electronic Information and Communication (CEIC) that, we hoped, would help mobilize the mathematical community in navigating this transition. Now I realize how naive this was, not because the early dreams were unrealizable but because human nature is complicated and fast action was needed to stay ahead of aggressive publishers. A big meeting of all the groups doing digitization of math was organized in Washington DC where the various obstacles were discussed and it was proposed that the IMU could serve as an umbrella group coordinating the half dozen initiatives that had been started. But it was a case of "all Chiefs and no Indians": none of the digitizers wanted to cooperate if this meant modifying their ongoing efforts. I had two chances to talk at length with John Ewing, then Executive Director of the AMS, but his conservatism made him very reluctant to consider any radical change in the math publishing business model. The AMS was at that time dependent on the traditional model and John was building up its 100 million dollar nest egg. On the CEIC, John's deep knowledge of copyright complexities resulted in stymying all pro-active initiatives that might have been taken then. It was not long before the commercial publishers asserted that their copyrights blocked wide electronic sharing of older articles and found a new source of revenue in these older articles that they had previously thought were worthless. Springer has locked up its back issues in "Springer Link". Note how

different this is from the idea of a library where everything published is available for nothing. In yet another twist, "open access" journals with exorbitant per article charges (e.g. 3000 euros!) are now proliferating. More recently Springer realized that even books out of copyright could generate new revenue and offered authors the "benefit" of keeping their books in print indefinitely by voluntarily extending copyright to infinity. Actually, you can get nearly all math books free online at the rogue Russian "Genesis Library", with websites libgen.in and gen.lib.rec.ec (most of my books are there -- help yourself). Which is better: lunch money royalties once a year or wider free distribution of your books?

Let's speculate on what an internet-based professionally controlled working environment might be:

- All journals would be online and free, including all their back issues.
- A selection of libraries would maintain paper copies and mirror online content.
- Journals would all maintain their current refereeing policies so they continue to certify the quality level they are known for, while unrefereed websites like the arXiv would offer immediate dissemination.
- All mathematical books would be available online, with the author(s) free to choose their business model, i.e. self publish (as in present day Springer Lecture Notes) or work with a publisher providing editing, formatting, print versions and advertising by agreement.

Of course, I hear loud cries of "who pays?". Yes, it's not free. But moving to something like the above would free up large amounts of library money currently being spent for overpriced journals, e.g. Springer and Elsevier (maybe even shaming NYU into reducing its ridiculous price for Communications in Pure and Applied Math). The cost of running an online journal is certainly fairly small, though by no means zero. There are no printing, mailing and storage costs and no subscription record keeping. Refereeing is done for nothing, manuscripts are prepared by the author in latex with fixed formatting packages so they are ready to post, editing beyond a spell check is a luxury we can omit, esp. in our multi-lingual world where the niceties of grammar are increasingly forgotten or never learned by foreign speakers. (I can't resist describing the "law of conservation of **s**" that I learned from my student Tai Sing Lee -- "several author**s** write; one author write**s**".) I don't feel that finding funds for such journals can be too big a problem, especially considering the above mentioned library funds.

Mathematicians, by nature, want to concentrate on their work and resist worrying about the mechanics of communicating their results to their colleagues. But business models for publishing are changing rapidly in this digital age and whether the ultimate control rests in our hands, the hands of the professional community, or in the hands of financial concerns who shift money from sector to sector following the scent of profit this is something we ought to be aware of. I hope that the new pro-active CEIC, the great interest shown at the Seoul ICM in three panels on the impact of the internet and

mathematical publishing and the AMS's introduction of online journals all indicate that the whole community is coming to grips with this choice.

April 2: I received the following in an email from Marius Kempe:

> With regard to your most recent blog post, which I of course completely agree with: in order to drum up support you might also want to mention the decline in book quality over the last 30 years - digital reprints, poor typography and paper quality, little or no editing and copyediting, etc. Some of this is no doubt due to various social and economic factors, but the commercial publishers' desire for profits has also played a role, I think.

I can live with this quality. The post WWII Dover reprints were low quality too but allowed poor grad students to buy priceless treasures. Furniture is now all veneer, very rarely solid hard wood.

April 4: Thomas Krichel cc'ed me on his email to Thierry Bouche, (both very involved in digitization projects), commenting on my blog:

> He is certainly right that the fact that libraries throw so much money at toll-gating publishers is the main impediment to change in scholarly communication.
>
> But what regards this group, it is mainly

> the lack of concrete small-step forward projects that seems the problem.

Yes, maybe there are no small steps. I had a conversation with Stuart Shieber, a Professor of Computer Science at Harvard who started their 'Digital Access to Scholarship at Harvard' that is exploiting loopholes in copyright law to allow its faculty to post all their papers. He suggested that something like a *phase transition* would take place when a majority of scholars became aware of their being exploited. All it takes is mathematicians refusing to submit papers to commercial journals and demanding that their professional societies and university presses expand their publications. Your paper appearing in the *Inventiones* should be an embarrassment, like wearing a mink coat, not an honor.

April 6: an email from my good friend Al Marden, Professor Emeritus at U.Minn. I wholly agree with his comments, some being bits of good news, some bad news:

> 1. My book (DM: *Outer Circles*, a great book) is being published by CUP (which calls itself the oldest publisher in the world), and my editor is David Tranah. Their books are not cheap, they do have to not make losses. In return they spend effort in making sure I am not violating copyrights, correct my Latex, they know how to insert colored pictures (some borrowed from *Indra's Pearls*--thank you David), they use an attractive font, etc.

2. There is the effort by Mathematical Science Publishers (MSP), initiated by Kirby, to publish math books, especially in geometry and topology, more cheaply and efficiently. Their books still need a wider circulation and display, in particular in our own library here. There is also AMS and Princeton U Press among the 'nonprofit' and noncommercial math publishers. More Journal editors of prestigious journals, like Inventiones, , should do as the editors of the former Topology journal did do, resign and restart their journals under a noncommercial publisher. This is the rationale of MSP, and it has worked.

The big profits in math are made with Calc books; millions have been made by Stewart. The most successful of these are pushed and marketed by big companies. How many sales reps have come to your office? Mathematicians too like to make money, when they can!

3. Most math papers (at least those I have looked for), esp those published in Annals and seemingly most other good journals are accessible from the internet now, some requiring an agreement with our library to do so. (DM: it would be nice if everyone used the arXiv though, saving time wasted in google searches.)

4. Here is an example of outrageous pricing. Many of us believe Lars Ahlfors text, *Complex Analysis*, is still the best intro, modulo some updating. Yet McGraw Hill is now selling it, the 3rd edition from

> 1979, for the outrageous price of about $250, and it is reprinted with poor typography. (Fortunately students seem to get the Chinese edition for a few dollars.) Altho I have frequently complained to McGraw Hill, it has no effect. I even offered to update the book, but that offer too was declined.
>
> PS: Klaus was also a great supporter of the late, great Geometry Center. He published the important *Word Processing in Groups* (David Epstein, et al), and the Thurstonesque videos.

April 10: The following was posted by Thomas Arildsen from Aarhus using Disqus but classified oddly as spam. Let me instead simply put it up myself.

> Great post! This is a point of view expressed increasingly by various scholars, and one that I definitely support.
>
> I am, however, afraid that it is going to be extremely difficult to change the culture among authors, because we rely on traditional journals for one important reason: which journals we get published in is used to gauge our worth as researchers and scientists. I definitely think this is wrong, but we will probably not have much luck changing the publishing culture without changing this fact. I am working on an idea that I hope can contribute to this.

> For now, publishing platforms such as http://www.sjscience.org/, https://thewinnower.com/, https://peerj.com/, and https://www.scienceopen.com/ are very inspiring.

April 13: I received an email from another old friend, Bernard Teissier, who has thought deeply about these problems. He enclosed his very interesting editorial in the EMS Newsletter in 2013:

> The advent of electronic publication has been changing our documentation practices for a quarter of a century but, compared to what has been happening in the last few years, the change in the previous years has been a sort of analytic continuation from the previous era. During that period, journals have created electronic versions and some e-only journals have been created at the initiative of learned societies or groups of mathematicians, sometimes with scientific success, for example in probability theory. But this and the advent of freely accessible preprint archives have not deeply affected the definition of what a mathematical journal is. During that period also, we have heard visionaries explain how wonderful it would be if everything were freely accessible on the web, in Open Access (OA). It was also the time when electronic access allowed publishers to their journals more and more, selling them in large interdisciplinary batches.

This was the major change in the business model and has succeeded because of many librarians' desire to maximise the number of publications to which their users have access. The financial and scientific drawbacks of bundling for the end users were not immediately apparent but now they are.

Apart from the beautiful dream of having everything freely accessible, one of the motivations of the OA movement has been to fight the financially predatory behaviour of some publishers, based in large part on the bundling technique. Indeed, we mathematicians have criticised the publishers' bundling as much because of its cost as because of the deleterious effect it has on the average quality of publications. It essentially annihilates the influence of readers' judgment and, in particular, the moderating effect which that judgment has had on the creation of new journals.

In the last few years we have entered a new phase. The day of OA has finally dawned; it is supported by everyone and policymakers have been convinced that publicly funded research should be freely accessible for all as quickly as possible. But now that OA is no longer a dream, we must cope with the problems of reality: how to build an economically sustainable publication and retrieval system providing OA but also all the necessities of science, such as the creation of an organised corpus of validated and cross-referenced results in their final form, as our libraries

have been providing for centuries, and the preservation of this corpus for the distant future. All these activities are essential for our work and that of our successors and have a cost, which however must not be grossly exaggerated to satisfy shareholders' greed. We must also build a system which is scientifically sustainable. This may seem provocative, since OA is supposed to boost research, but in reality it has its dangers. For example, the multiplication of freely accessible, potentially useful documents competing for our attention makes visibility more and more important. With the growing greed of institutions for visibility they tend to rely more and more on evaluation tools which measure visibility and not true scientific value (admittedly a lot harder to measure but so much more important!) and when applied to promotions, hiring and grants, this leads to an ecosystem of science which many, and not only mathematicians, consider to be disastrous.

If we do not react strongly to this trend, in less than ten years we will be evaluated by ratings agencies which will induce universities to invest more in subject A and less in subject B because A has a greater impact factor and therefore will increase the visibility of the university (such agencies already exist: see Academic Analytics, http://www.academicanalytics.com). This behaviour is of course not new but it will become much more systematic and, well, 'scientific'. The more access is free, the

more visibility becomes a merchandise: a new object of greed. Also, if we do not help our libraries to adapt their role of preservation and help in the access to documentation, we may find ourselves in the hands of private academic data-mining companies which will, for a fee of course, do for us and our students what librarians do now (only it will be on the basis of bibliometry). Major publishers are already investing in such companies. In the process, our libraries will disappear (see Odlyszko's article, http://de.arxiv.org/pdf/1302.1105.pdf). The extent to which they are ignored in discussions on OA is truly amazing.

I believe that we need to consider overhauling the system in its totality: publishing ideas and knowledge, organising their accessibility, preserving them forever and evaluating the quality of research.

It is not enough to experiment with new business models, for example e-journals, which can offer OA because they are managed by dedicated volunteers and supported by a generous institution or association. These experiments are useful but if they remain just that, they compete not only with commercial publishers, which is often a part of their purpose, but also with the academic publishers, which are so precious to us and which are severely handicapped in this time of change because they do not often have the means, financial or otherwise, to make the necessary investments, while the big

publishers do. These experiments also contribute to the proliferation of journals and increase the need for time spent refereeing by researchers. There are already voices advising the replacement of referees, which are so difficult to find, by statistics of downloads. Do we really want that?

We do need new business models, and experiments, but they must be compatible with a general vision. For example, few experiments in mathematics involve some measure of scientific control by the readers, as the old subscription system did. It seems that for them the OA economy is entirely a supply-side economy, à la Reagan. From this point of view, OA is the Universal Bundle of publishing and so it has the defects of bundles but worse! It is claimed that, like in the pre-OA era, the scientific quality is guaranteed by the refereeing system but in an OA world, where it is so easy to publish, if the editorial committees and the refereeing system are of course still necessary, they are no longer sufficient. We need other regulatory systems to prevent the proliferation of journals and papers which are published for the sake of publishing, a practice encouraged by bibliometry.

There are many new propositions for the funding of OA publication. The least imaginative, which is a brutal and thoughtless adaptation of the classical 'readers pay the costs' system to OA, is the 'Authors Pay the Costs (APC)' system,

cleverly named 'Article Processing Charge' by the publishers. In spite of protestations to the contrary, it will create a documentation bubble and, in addition, puts the researcher under the scientific control of some funding authority and in need of spending even more time with funding requests. It is also, in the end, quite expensive with the charges now requested. Unfortunately, it is supported by an energetic lobby of publishers and some scientists outside mathematics, who are used to it for historical reasons (colour pictures in the life sciences) and who see nothing wrong with it. Most mathematicians reject it as an outrage to freedom and a threat to the quality of publications but some others disagree and believe that it is a viable model provided the financing system is tightly controlled and not driven by greed. I believe that in this regard the honest ones will unfortunately serve to justify predatory behaviours. More acceptable alternatives where institutions such as libraries pay for services (refereeing, editing, attributing compatible metadata, preparing for long term preservation, etc.) rendered by the publishers are being experimented. Being more original, they are less well understood by politicians but are developing well, in particular in the humanities (see Freemium, http://en.wikipedia.org/wiki/Freemium) and should be studied by us.

In the new ecosystem, journals and documentation portals should have the support of a reasonable number of

libraries or other public institutions, based on a positive judgment of users on their quality. This support should be conditional on the acceptance by the journal of a charter of good practice covering all the aspects of publishing.

This would help to pare down mediocre journals and in particular keep out 'predatory publishers' (see http://en.wikipedia.org/wiki/Predatory_open_access_publishing) in which the APC guarantees no serious refereeing or long-term preservation but just posting on some website. If the Gold APC system prevails, and there is no enforcement of a charter of good practice, in a short time it will be extremely difficult to distinguish predatory, mildly predatory, not-too-serious and serious journals. By serious of course I do not mean those with a high impact factor but those who do their job seriously, from refereeing to metadata and contribution to a stable corpus and ensuring very long-term preservation of what they publish.

The support could take the form of 'crowd funding' or subscriptions by consortia of libraries or institutions, again based on scientific judgment by competent people and not usage statistics. In this spirit, the French National network of Mathematics Libraries (RNBM) has negotiated a national subscription to all the journals of the EMS Publishing House and is negotiating a similar one with the French Mathematical Society. These subscriptions are funded by the CNRS but they could

just as well be funded by a consortium of universities. Alternatively, universities could devote an incompressible part of their budget to the support of academic journals offering OA, chosen by researchers. This should be encouraged by governments as 'good practice' for universities.

Other good practices concern the balance between in-depth scientific judgment (which has its dangers) and bibliometry (which is dangerous by nature).

In the new ecosystem, hiring and promotion committees as well as grants committees will make explicit in writing how much of their decision is based on an in-depth scientific judgment of the work and how much on the reputation or the impact factor of the journals in which it is published.

Libraries will make explicit in writing how much of their decision to buy, subscribe or unsubscribe is based on an in-depth scientific judgment by competent scientists and how much on the reputation or the usage statistics or impact factors of the journals.

Concerning the problem of referees, I propose that some institution (for example, the EMS) should organise rather large groups of journals (to preserve anonymity) which would every year publish a list of referees found particularly meritorious by the editors. Those distinguished in this way could use it in

their CV as a valuable recognition.

In conclusion, the notion, implicit in the discourse of many advocates of the APC, that we need to replace our existing system by OA and APC journals and 'there is no alternative' is part of the intoxication propagated by the APC lobby. The definition of the future system of mathematical documentation is, I think, still, in part and for a little while, in the hands of mathematicians, but not through an explosion of new journals which would guarantee a chaotic transition. It is, rather, through a daily discipline: in the decision to publish; in the decision to post articles, pre and post-refereeing on a free access archive with a long life expectation (remember that a lot of our research is already in OA thanks to these archives), in the time taken to referee, in the evaluation of research by reading papers and not by the reputation of journals, in supporting the journals with good practices, in particular for corpus-building and copyright freedom, in fighting energetically the author-pays system and the misuse of bibliometry, in helping the libraries to make the transition, and in working to convince academic authorities that it is in their interests, and also a part of their remit, to support such a system instead of following the lures of visibility merchants and giving them money cut out from the documentation budgets (it has happened). Of course one of our main collective tools to do this is the learned societies which represent us but our individual actions are crucial.

I replied:
I think it is important to frame the problems a little bit differently. I think two trends are being somewhat confused here and I'd like to recall some ideas of Pittman. My original blog concerns the transformation of smallish publishers with a mission into giants controlled by financial firms and I concentrated on bringing to light how much, esp. at Springer, has changed. Quite different from this is the simple fact that the quantity of mathematical research going on today is surely at least 10x that of a century ago, probably more. Here I don't mean counting journal articles, so many of which are junk, but actual new results a researcher needs to know to be at the "frontier". Any growth of this size changes the nature of any enterprise. How do we achieve efficient communication so the people who need to hear of such and such a result do hear about it?

The second problem gets mixed up with the first through the proliferation of junk journals but even without these, it is a huge problem. It causes harmful specialization and fragmentation of research, where many mathematicians narrow their focus to tiny sub-sub-areas. I remember Pittman giving me an earful about the need for new "review" journals that would provide help, organizing the current state of an area so all practitioners were up to speed and certifying what had now been proven. Teissier mentions a few times that librarians can be a help to point users in good directions. Maybe so in France -- this has never been my experience. The level of expertise needed to organize well the body of research in any area is extremely high, too high

for generalists. And then there are the unexpected links between distant areas, arguably the most important to bring to light. (Talking about this makes me feel quite old! I have tried, for example, to see where the "meat" is in the efflorescence of Voevodsky's vast vision, so far unsuccessfully.) But I believe Pittman's ideas should be pursued and extensive reviews are one thing that is needed. Nothing has taken the place of the 18th/19th century encyclopedias.

On April 19, I received an email from Dick Palais voicing strong support for the views above and in which he stated "I am attaching some material concerning a related matter, the phenomenon of what I call "citation scamming" which tends to exacerbate the problems that David discusses." This is indeed a major issue with commercial publishers and the material he sent me is here.

June 16: WONDERFUL NEWS. The NSF has just announced a policy that all NSF funded research has to be available via public access within one year of publication. This should start the ball rolling.

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