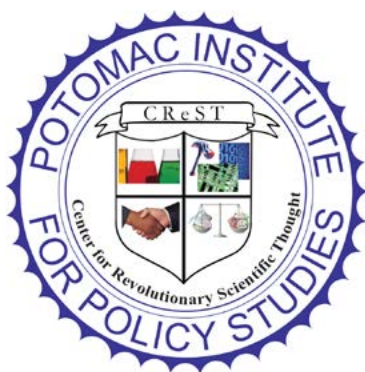


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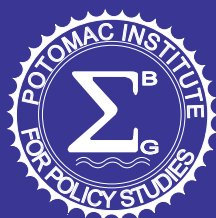
THE ECONOMICS OF OPEN ACCESS: INTERNATIONAL AND DOMESTIC IMPLICATIONS



FEATURED SPEAKERS

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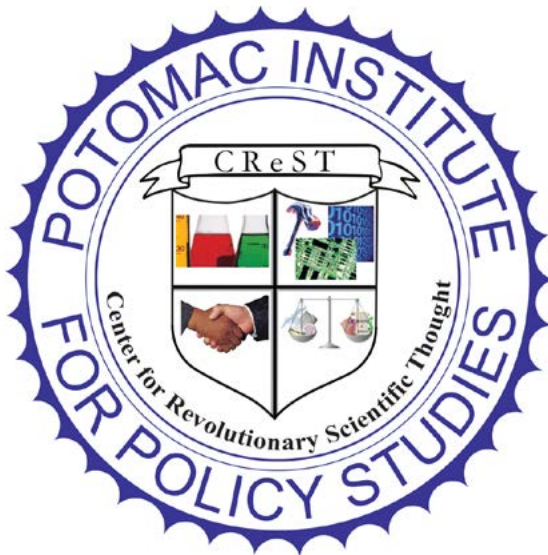
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AGENDA

SEMINAR THE ECONOMICS OF OPEN ACCESS: INTERNATIONAL AND DOMESTIC IMPLICATIONS

MODERATOR

MICHAEL S. SWETNAM

CEO and Chairman, Potomac Institute for Policy Studies

INTRODUCTION

ALAN MOGHISSI

Board of Regents Member and Senior Fellow, Potomac Institute for Policy Studies

PANELISTS

ALAN LESHNER

CEO, AAAS and Executive Publisher, Science

HEATHER JOSEPH

Executive Director, Scholarly Publishing and Academic Resources Coalition (SPARC)

OPENING REMARKS

MICHAEL SWETNAM

It is my privilege to welcome you here to the Institute today for a discussion on open access issues. It is great to see some friends, staff, and members of our Board of Regents joining us for this important discussion today. For those of you who have not been here before, the Potomac Institute for Policy Studies is a not for profit science and technology policy research house here in Washington, D.C. For almost 20 years, we have been engaged in the discussion of science and technology and how it affects our society. We believe strongly that helping policymakers understand how science and technology can inform their decisions is a key part of what science should be about here in the Washington, D.C. area. For 20 years, we have engaged various forums like this one to bring people together to discuss the issues surrounding science and technology in our country and our society.

Today, I'm honored to be the host for the discussion of one of the most fundamental issues surrounding science and technology – an issue important not just in the United States but, in fact around the world. That issue is access to research and science that is produced. Who owns what? What are the proprietary and publishing issues in an age of expanding technology? At its outset, it sounds like a simple question. Isn't science something that belongs to all of us and shouldn't access be open? But it turns out, as you will hear today and I am sure many of you know, it's a very thorny issue. Science not only moves mankind forward in our understanding of the universe but it is also increasingly behind most economic development in the world. The question of access to science and ownership of science is very thorny, indeed. We want to discuss ways of recommending solutions to policymakers that are not just keeping science moving forward and incentivizing business, but are also incentivizing the population to continue to support and fund science. This goal is not just critical to our economy but in fact to the continued advance-

ment of the human race. This, I believe, is one of the most important issues of our time and we are very proud that we are hosting a forum for this discussion. I would love to be able to say that, coming out of this forum, we will be able to write a document with definitive recommendations for our policymakers. Unfortunately, that will not happen today, but at least we can say that we're contributing to the discussion and hopefully contributing to the ideas that will help policymakers work through this issue.

I'm going to ask Professor Alan Moghissi, who has been a member of the Board of Regents and a Senior Fellow at the Potomac Institute for many years to kick the session off with some discussion of the topic. Alan and I have co-authored a couple books together and have been involved in issues in and around science and technology policy for a decade. I believe he is an expert on such topics ranging from peer review to his chosen field of regulatory science. I think he's the perfect person to kick off and frame this issue, so let me turn the podium over to Alan Moghissi for the beginning of the discussion. I also want to give my sincere thanks to our panel members who have agreed to help us with this issue. These are people we've been associated with before, and we'd like to thank them for joining us again here, today.

INTRODUCTION

ALAN MOGHISSI

Thank you. Let me also welcome you all here today. I am honored to be associated with the panel members here. The Potomac Institute has been involved in peer review for a number of years. In May of 2009, we organized an international workshop on peer review and published its results in a peer-reviewed journal. In recent years, we have addressed a number of potential shortcomings of peer review, as related to scientific publishing.

We at Potomac are very lucky to have a number of talented and enthusiastic interns who have been involved in a number of studies, including most recently, a survey of about 350 major journals on how they perform their peer review. We identified at least three major issues: one is open access, so I am delighted today to see that open access is being discussed here. The second one is, surprisingly, review criteria, which are the questions given to the peer reviewer. The third one, even more surprising, is what is the role of the editor at the journal? As Mr. Swetnam mentioned, the issue of open access is being discussed today and hopefully the discussion will lead to some thoughts on where we go from here. We are aware that some of these issues are being addressed during conferences that are periodically organized by the biomedical community. However, there are numerous other scientific disciplines that would benefit from a discussion of these and related subjects. In order to respond to these needs, we are considering initiating a periodic conference on peer review. We would appreciate not only comments from panel members but also from others on desirability, topics to cover, and related activities.

PANEL TRANSCRIPT

ALAN LESHNER

I am the CEO of AAAS and the executive publisher of *Science* and the *Science* family of journals. A tremendous amount has been said and discussed about open access. I prefer the term “public access” to “open access”. I think the term “open access” has become jargonized to the point where everybody has their own definition of the jargon. Now we have green and orange, yellow and gold access. It has gotten sufficiently complicated and can be difficult to keep track of the definitions.

Let me just say that I first became aware of the issue in the late 1990s when I was an institute director at the National Institutes of Health (NIH). Harold Varmus and many of our colleagues began to talk about the need to ensure ready access for patients and their families to the products of the NIH’s work. Dr. Varmus had an excellent idea, which fundamentally was the point that we should find ways to make information that is wanted and needed available to patients and their families as quickly and easily as we could. From that comes a much more complicated set of issues around when we should make results of scientific work available to scientists and to the public, and under what business model?

My perspective changed a bit and became more complicated when I moved to AAAS and became the executive publisher of a business that in fact produces *Science*. I think it is important that AAAS is a relatively unique form of a publisher. We publish a very high visibility journal that is not a traditional journal. It is both multidisciplinary and multicomponent: there is a large and elaborate news organization, there is an elaborate set of commentaries included in the journals, and there are, of course, the research articles. We are also a non-profit organization that is driven by a mission to advance science and to serve society. Everything that we do is di-

rected towards that mission, one point of which is to expand communication among scientists and the rest of the public.

I think that the biggest surprise when I got to AAAS is just how expensive it is to publish a journal like *Science*. It costs \$52 million a year to publish *Science*. We get 14,000 manuscripts a year, and we publish about 800 papers. We have 27 full-time professional editors (copy editors, compositors, and all the related people). We have a large journalism staff, an office in Cambridge, England, that represents mostly Europe, and a new office in Beijing. About 200 people work for AAAS publishing.

The idea of public access became more complicated because there was a lot of pressure around what sounded like a set of ideologies that said, “Do the right thing”. The right thing in this context is that since the public paid for the research, we ought to be giving it back for free. I have to say that, like many of my colleagues who publish journals, I think this is the right thing. If I could afford to carry this out, I would do it immediately. I believe that is true of some of our competitors. I believe that if someone came up with a business model that would work in order for us to produce *Science* magazine – that our readership of about 1 million seems to love – then we would do it because it is the right thing. For me, the argument in this discussion has to get off of the ideology and onto the practicality of how to do it. I can tell you that the leaders of other journals do not have a vastly different view. If we could do it, we would. We are a mission-driven organization.

One thing that might interest you is that our business models have changed dramatically over the last years. When I first came to AAAS, the business model was that two thirds of the revenue came from advertising in the print publications and a third came from circulation. That has switched. That is, now two thirds of our revenue comes from circulation and a third comes from advertising. Of that, 65% is print advertising and the rest is online advertising. It turns out that online advertising is a lousy business model.

Let me speak a little bit about our policies. I really only have one core point that I'll input. We've had a policy of making everything freely available on our site at 12 months, and we've had that policy in effect since 1996 when *Science* went online. We now have site licenses at virtually every university and research institution in the United States, most of Europe, and now much of Asia. Now, the very large majority of scientists in the world have immediate access to everything that we publish. We are members of every group such as HINARI and AGRA that provide immediate electronic access to anyone in well over a hundred developing countries so the scientists whose institutions cannot pay for it still have access to our journal as long as they have access to the Internet, which is a bigger issue than whether they have to pay for the journal.

We make all papers with high public health relevance freely available to anyone immediately, and it turns out now that we somewhat started the green public access model. We were one of the first journals to do this, and obviously not all journals, including some of our competitors, provide this amount of access. The last thing I will mention about *Science* is that we follow the rules of the NIH, the UK, and everyone else. I noticed that in the recent draft legislation of the America Competes Act, also known as the First Act, the 12-month compromise that was worked out many years ago as a compromise for smaller publishers has now been changed to a 24-month embargo. The 12-month compromise was doing very well, and I do not quite understand why that has changed. However, given the amount of public access we provide, and the amount of access provided by many non-profit publishers and most for-profit publishers, an interesting question that I do not have the answer to is whether or not it matters who pays for publishing – the author, the reader, or the funder. My biggest issue with the funder paying is that many funders cannot pay or will not pay enough money. For example, if you take the \$52 million per year that is needed to publish *Science* and divide that number by the 800 papers that we publish, that is an enormous amount of money per paper that is needed to pay for publishing. Even if we were able to cut out sections of the journal and somehow decrease the price to \$25 mil-

lion, we are still looking at an order of magnitude of \$25 thousand per paper published. Even if we could become efficient enough to decrease the cost down to \$15 thousand, a majority of institutions in poor countries could still not afford for their scientists to publish their work. One of the issues that has come up with a model recently discussed in the United Kingdom is that some people believe that universities would begin to encourage people publish their research in third-tier journals because they would be cheaper. Of course, no one wants this to happen.

I think the critical question up for discussion asks where all of this is going to go and where should it go. Everyone knows that my position is that if I would make public access available immediately if I thought I would still be able to pay the bills, I truly would do it. I just cannot figure out a business model that would allow us to continue to produce the high-quality journal that we are committed to, and that our readers seem to want, and make it work in an efficient way. Although the most important question over time will not be concerned with what the publishing model will be for traditional journals. My personal view is that we will not have traditional journals in the not-so-extremely distant future. When I came to AAAS in 2001, I was told that print publishing would be gone in five years. The truth is that a lot of print publishing actually is gone, however, our current print-run is at about 130,000 a week, which is close to the same number it was in 2001. While print publishing has not disappeared, many young scientists read online and do not read entire journals.

My view is that scientific communication itself will learn to take full advantage of the possibilities of multimedia, interactive communication and that scientific communication, assuming that it can figure out the issue of quality control needed for reading efficiency, is going to change dramatically in the future. What we should be doing is spending a tremendous amount of time and energy trying to lead that effort, or at least enable the scientific community to evolve in whatever way it should. I do not pretend to have any idea what I am talking about other than the fact that tremendous opportunity exists for future innovation. Today, we are all very hung-

up on what the current business model is, but I truly think that the business model of the moment will be irrelevant at some point, hopefully during my lifetime.

HEATHER JOSEPH

I am the Executive Director of an organization called SPARC, the Scholarly Publishing and Academic Resources Coalition. We are a membership organization of several hundred academic and research libraries. As such, we represent the largest single customer base for journal publishers all around the world. Our organization is a bit unique, because we are not simply a membership organization in the traditional sense of holding meetings, issuing publications, and doing community building. Rather, we were formed in the late 1990s, specifically charged by the library community to be a catalyst for action to look at finding ways for the library community to act collectively to find ways to use the Internet to better and more broadly disseminate the results of scientific research and scholarly research, at large. Librarians are generally on campus in the business of being entrusted with providing access to our researchers, to our faculty, to our students with the latest and the best of the highest quality information in order for them to do their scholarly work. Thus, the idea of delving into looking at being able to use the Internet for the purposes that it actually was created, to actually encourage and leverage broader dissemination of the results of research, was something that our community saw very appealing and feels very strongly about.

Part of the reason that the library feels so strongly about this is in relation to Dr. Leshner's description of the cost of publishing *Science*. I thought that was fascinating. While that type of journal is unique in that it is multidisciplinary with news, commentary, job listings, and many other materials, the model is only slightly different than traditional scholarly society published journals. However, what is important to the library community is that cumulatively,

Science, with its \$52 million a year price tag, is just a piece of the larger puzzle – a very real, very robust market for scholarly journals.

Scholarly journals have now become a commodity. I think people are very surprised to find out what a high-priced commodity this market actually represents. Annually, the STEM journal publishing industry earns more than \$9 billion in revenue. Libraries, as I previously mentioned, form the single largest customer base as we represent 80% of the revenue base for the average scholarly journal. This means that the library community is shouldering about a \$9 billion price tag annually, which we would be delighted to continue to do it if we had enough money. We could afford to continue to do this if we expected that our library budgets would increase year in and year out to measure it with the general average price increase for subscriptions that we've seen in the journal marketplace, but that is not the case. When SPARC was first founded, the economics of the marketplace were daunting for academic and research libraries, generally experiencing double-digit price increases for the majority of price increases every year. This meant that 10-15% increases in subscription prices were not out of the ordinary. SPARC was formed to find ways to push back and attempt to find a way to use the Internet to somehow control pricing or create competition in the marketplace. Interestingly enough, although we are now tagged with the moniker of being the leading open access advocacy organization in the world, which is a tag that I wear proudly, we did not start out advocating for open access. We started out looking for ways in which universities and the university library community could introduce competition into the marketplace in the form of lower-cost subscription journals.

It's very difficult to meet that scale, as I wager Dr. Leshner would back me up on. We had some individual projects, some community and discipline-based publishing projects, that made a good start, but scaling it up to compete in a \$9-billion-dollar-a-year marketplace is something that the library community realized is a bit beyond our realistic goals.

In the early 2000s, the idea and concept of open access began to surface in different intellectual and policy circles, most notably a meeting that was convened by the Soros Foundation in Budapest in 2001, where academics, librarians, publishers, researchers, and philosophers were brought together and asked to essentially answer this question: If we could envision, collectively, a way to rebuild the system of how scholars and researchers share the results of their work using the Internet that would best benefit the academy, what would it look like? And the answer that came out of that meeting in 2001 was this concept of open access. I agree with Dr. Leshner that the definition of open access has become huge, and there are about as many of them out there as the fingers on my hands and toes on my feet.

I think that it has been very important for SPARC and for our community to focus in on a specific definition of open access and to really use that initial vision and definition as the end goal of our advocacy, and working to collectively move the academy toward. It is a different definition of public access, the definition of open access that we use is the free, immediate availability, on the open Internet, of those research results that scholars and scientists have traditionally produced without expectation of payment, coupled with the right to use that information fully in the digital environment. For us, the idea of scholarly journals and subscriptions carrying a high price tag were symptoms that made us aware that there was probably a better way that we could leverage the system to become more efficient and effective in a variety of different ways. We could mitigate cost, but we could also maximize the utility of scientific information in the digital environment.

When SPARC talks about open access and open access policies, we try to keep our eye on that two-pronged definition – the idea that you are doing scientific research, you’re getting results, and those results only gain value when you can not only access those results and read them freely but when they can be used and built upon freely and fully in the digital environment.

We've done a lot at SPARC to promote and advance both aspects of open access – access and reuse. Again, Dr. Leshner had a great lead in with the green, orange, gold, purple, platinum, magenta, and who knows what the color of the day of open access is – but our concern is not over the route one may use to acquire open access, but rather supporting a sustainable, scalable mechanism to enable open access. People talk about the gold road to open access but what they are really talking about is fully supported open access journal publishing, finding the magic bullet to be able to have a business model that allows you to do full peer review, full scientific editing and quality control, and pay the bills at the end of the day. If you turn a profit, great! There is nothing saying that is not a laudable and desirable goal for open access publishing. However, it is just one mechanism to reach that definition of open access and enable that definition to become a reality. The green road that you will hear a lot about is simply another mechanism – specifically, if an author cannot find the perfect open access journal to publish an article in, there is another way the article can be made openly available, which is to deposit a copy of the article in a digital repository that allows anybody, anytime to obtain your article and to use it fully in the digital environment.

We actually think that there are two other good and important mechanisms that can potentially get us to that end goal. One is, not surprisingly, educating authors on the rights that they have under current copyright law. As the author of the scientific publication, being able to control the downstream use of your article. I was a journal publisher for 15 years before coming to SPARC. One of the behaviors that we saw all the time was during one of the last things that happens in the course of preparation for article publication in a scientific journal. Specifically, when an article would be accepted for publication, I – as the managing editor – would call or email the author and say “I need your copyright transfer form before I can schedule you for publication in an issue”. And ninety nine times out of one hundred the author would say to me “Can you email it to me or fax me a copyright now?” I then would receive the completed copyright transfer form from the author within thirty seconds.

Everyone wanted his or her papers published. They did not read the copyright transfer form and did not have any idea what rights they were assigning to me as the publisher.

As publishers, we were not being sinister; copyright provides an important set of safeguards, protections and enablers for ensuring the veracity and downstream use of scientific articles. We can make it work for us in different ways. An important route for enabling that full definition of open access is to have authors understand that they can sign over the full bundle of copyrights, or they can unpack it and say, “I am happy to assign to the publisher the right to distribute my work for an exclusive distribution period of x amount of time, but I would like to be able to post a copy of my own article on my website, or in an open digital repository, or use it in classroom for amounts more than 50 copies without having to go back to the publisher and either ask for permission or pay for it.” So we view that as another important route.

Finally, we have been spending a lot of time over the past ten years trying to enable a policy environment that helps to encourage the academic, research, and scientific community at large to make a move toward a more open system – making open the desired norm in scholarly publishing. The NIH policy was the first step in the United States toward moving to recognize that in the policy environment, we have a specific subset of research that we can get our arms around, and this is the research that is funded – in the NIH’s case, using tax dollars that the NIH invests on behalf of taxpayers. That subset of research, it seems, was a very good starting point to try out some policies that include the understanding that we can’t mandate that people make their research available on day one, or what will happen? Publishers like Dr. Leshner will go out of business tomorrow, and that is just the end game. That’s how the economics work out.

But perhaps there is a compromise that will allow us to help manage a transition and examine what a transition plan might look like

over time, that will move the door from completely closed to more open. We would like it to be fully open, but will we get there? I hope so, but in the meantime utilizing policies that have safeguards built in such as embargo periods that protect specific distribution periods and copyright ownership for publishers. Right now, most of the policies we have do not address full digital reuse rights for articles. They are simply read-only policies. The NIH policy is an access policy – public access. Not an open access policy in terms of enabling reuse. We are taking these little baby steps down the road towards open, and that we are still in 10 years into it and it pains me most days to say that we are still in the very early days of trying to figure out how to manage this transition and expand policies that are tested, proven, and are effective, like the NIH's policy. Perfect them, tighten them, move them more toward open and expand them to other disciplines.

Dr. Stebbins can talk a little but about the expansion on the U.S. front, but what I would put on the table is simply that we have a very complex market, but we have a very symbiotic market where the buyers of the information are generally housed in the institutions that produce information. We have very close working relationships, in general, with non-profits, publishers, and academy-based publishers, so the policies that we advocate for and that we would like to see discussed more fully are those that take into account these relationships and try to leverage them in a rational and full way.

OPEN DISCUSSION TRANSCRIPT

MICHAEL SWETNAM

There have been some great questions and great thoughts raised here. I would like to come at it from a different argument all together. I hope you will agree when I am done that it comes back to the point and issue of value proposition in the journal publishing world today.

There is a tremendous problem about information on the Internet today – the wonderful information revolution that we are in that makes everything available globally, in seconds. From events captured in realtime by street cameras, to things that people say and write. All of this is having a profound effect on the publishing world. One of the big issues with this great avalanche of data, poorly termed the “big data problem”, is the veracity or validity of any and all information on the Internet today. What is valid and what is not? When everything people say and write – fact or fiction – is available and there are very few filters, sorting useful information from bad information becomes a tremendous challenge.

Dr. Moghissi and I have written something we call “Best Available Science”, with the objective of helping policymakers judge the value of science. There are a variety of types of science: mature science, embryonic science, theory, and pseudo-science. Helping a policymakers understand all the differences is really tough. It turns out that as the amount of data grows exponentially, almost daily, the problem of sorting good from bad data becomes harder and harder and it becomes a real commodity to be able to help someone identify what is valid and what is not. It turns out that there is real value in helping people sort the good from the bad. The publishers provide this service, although they may not realize it, it is becoming the most valuable thing they do. The traditional publishing model is selling the distribution of information. It has traditionally

been all about selling a product that distributes words and pictures around the globe. That is the model that has been built on since the invention of printing. The problem is that the key component of that value proposition, the distribution of information is becoming free. The key capability or product provided by publishers, in their old value model, is dying.

But publishers have been doing something else the last 400 years that is more valuable today than ever before. It hardly costs money to distribute anymore; the Internet has dramatically reduced the cost of distribution. But because it used to cost a lot of money, publishers went to great lengths to vet what they published. So, when something was actually sent through the very expensive process of printing, it had been reviewed and edited closely. When one went to the library and checked the card catalog, somebody had gone to great lengths to make sure that the books in that catalog had some validity behind them before they received an ISBN number and went into the card catalog.

Peer reviewed journals go to great lengths to make sure the peer review was valid. For example, out of the 14,000 submissions to *Science*, AAAS only selects the best 800 for publication. Publishers put an awful lot of effort into that and it costs a lot of money. Publishers used to do that because it cost a lot of money to print and distribute and they could not afford mistakes. Guess what? It costs less today to put those 14,000 entries out there on the Internet, but it's really valuable to know what are the 800 best. The distribution might be close to free, but the great staff at AAAS are putting in much effort to sort out the best 800 articles. That is worth every penny that it cost you to do that.

Today I can use Google, or others, to find any information but these services do not tell me what is valid and what is unreliable. The vast amounts of information make it very difficult to find the most relevant, accurate, and real information without a filter. The filter is now the most valuable asset. Science journal publishers rely on peer review and editors to filter the worthy or "publishable" sci-

ence. Publishers, particularly of scientific journals, help us sort and apply a level of validity to information today.

I would propose that the value proposition in the publishing world is no longer publishing. The value proposition in the printing world is no longer printing. The value proposition in the journal world is that you are now the judge, you are providing the peer review. That is a very different way of looking at journals, but maybe that is the way that will better justify their cost.

Alan Leshner

One of the issues that Heather raised that is an important one for publishers is around rights of reuse. You may be interested to know, we allow people to post their papers, the final accepted version of the manuscript, on their own website the day that it is published, and therefore it is accessible. But what you cannot do is sell it. That restriction varies in how much it bothers people, but fundamentally we never violate that because once you start selling it, then you're selling our product, not just your product. Another concept that came to my mind is the distinction between something being available and something being used and usable. So the point is right, that we are in fact the judges or quality control and what we are trying to do is to say these are some of the most interesting, best papers and we would love to find ways to get people to increase the readership of articles. Even with the extensive use of PubMed and PubMed Central at NIH, the biggest source of people reading actual articles in *Science* magazine is Google. This issue of how to do quality control in a manageable way is a big one, and one that would be well served by having a conference on peer review. I think if we could figure out efficient mechanisms that take full advantage of interactive electronic technology in a way that could monitor the quality of the review being conducted on the paper as well, that might be a great solution to the perplexity of it.

Many years ago we were approached by a foundation to help the Obama administration with their open government initiative and develop a platform that could do, in effect, scientific crowdsourc-

ing of new and exciting ideas. I thought that if we went out and we posed a question to the world, we would get a lot of garbage back. How are you going to analyze the signal and the noise? I was told that, in fact, there was already technology to evaluate and process responses and find what ideas were useful. We ran that project for five years, and it did in fact generate a tremendous amount of input and a lot of useful ideas for various government agencies, but we never solved the filtering problem. I think in publishing, the biggest, most difficult thing to solve is finding a cost-effective way to do that filtering and make sure that what we're telling the scientific community has a mechanism to increase their efficiency. No one wants to read every article out there, that's not so efficient. That would help solve all of these issues, it would also help move us towards my idea that the world of the future is going to be vastly different, and it will be vastly different in part because people will figure out the answer to that – they will have the solution of how do you do quality evaluation.

I don't believe that 15 years from now a scientific article will look at all like it looks today. Although, I was reading an article this morning about reproducibility and one of the biggest problems is that people are publishing less and less of their detailed methodologies because they're trying to save space, and that's posing an array of different problems. So whatever an article will be, however it will be evaluated, communicated and made available as rapidly as possible, is going to be where scientific communication goes.

Heather Joseph

I think you just made the case for the second half of the open access definition of insuring full digital reuse. You rightly raised the point that there is an issue of reuse that is buying and selling, commoditizing the non-commercial cost. The more important aspect of reuse to the open access community is enabling tech mining, data mining – the deploying of these new technologies that can help you sort, filter, and identify who is doing what with your science. Without being able to enable the free utility of that kind of tech-

nology on the full corpuses of whatever our digital articles of the future look like, we are limiting our ability to come up with these new quality filters.

Alan Moghissi

The subjects that you're raising are both extremely important. My interest in the subject was reproducibility, the validity of the scientific claims. The way we do that now is through peer review. In the issue of open access or public access, there are three categories of journals. One: Large publishing houses, like *Science*. You have many, many more manuscripts than you can publish and therefore you have plenty of manuscripts to publish. The second category of journals – of which I had the fortune to be able to editor-in-chief of two of them – is where you receive enough manuscripts, there are not many, but it is sufficient. By far the largest number of journals are the journals who do not receive enough manuscripts, therefore they have a financial incentive to publish the results. There is the situation in which an author submits the manuscript and the journal, which gets paid \$1000 or \$1500, will just publish the paper regardless of its validity. The development of a reasonable peer review process was the reason we started the study that I described earlier – specifically examining how to manage the peer review. We have indeed identified processes – and hope to continue to identify processes – that can evaluate how a journal performs peer review. To make a long story short, I think the peer review is really the key.

Elizabeth Nolan, Optical Society

One of the things that has been pointed out is that clearly the value proposition for publishers is the vetting. We want to be the source of the best knowledge in whatever field of work. I think that the next big change for us is also the technology, which has been discussed. The publishers are investing millions of dollars in their platforms, search engines, thesaurus and filters, so that when a researcher does try and find that data, that they retrieve it more quickly, so that has become another value proposition for publishers that doesn't come free. So dissemination isn't really free, it is actually quite costly, and it is becoming a much bigger cost where

copy-editing has become commoditized. I think that the technology piece, because of the cost and ongoing innovation, is going to be what really drives publishers in the future and how we are able to make what we do happen. And so I just want to clarify that it's not that dissemination is free, it's actually quite costly – just maybe not like it used to be.

Audience Member

I'm glad that the topic of replication and reproducibility came up. It is a little bit more complicated than just saying that you can separate the wheat from the chaff by having those articles that are peer reviewed be your source of information. You can have a great article that is peer reviewed, that seems to have very significant results, that other researchers cannot reproduce but reviewers are not able to tell in advance. You might have another 15 people who have collected similar data and did not get significant results, but that never sees the light of day because it cannot get through the process to get into *Science*. It is not surprising there is nothing significant about it, but the fact is that 15 people found a negative result and only one found a positive result, and that is the one that got published. I'm not offering any kind of solution, I'm just saying that this issue of open access is more complicated – so as more journals and papers come out, it might help us to look at the aggregate rather than just those that are peer reviewed. The other issue I wanted to bring up is that the discussion today has so far only concentrated on the publication of articles and not data. That is another big issue: open access to data.

Heather Joseph

I wanted to make a quick comment on that. I should have issued a disclaimer at the beginning of my talk. I am on the board of directors of the Public Library of Science (PLOS), which is the largest open access journal publisher in the world. There are two things that PLOS is doing that I think are important to this conversation. One is that PLOS recently implemented an open data policy, specifically to get at this issue of reproducibility. As a journal publisher, one of the things we want to ensure is that, in every possible instance, the

original data set that the article originated from is also made available, so that other people can work from that original data set. That requires a huge investment – it requires partnerships, requires new technology. So as a publisher, we’re looking at partnerships with the academy, data centers, new providers, and different kinds of services that can provide that back end. Those partnerships, to me, are the beginning of the nexus of what Dr. Leshner is describing as the next generation of what we are communicating as publishers. Once we start really routinely making that bundle of data available in addition to the reduced data that is the article, people are going to demand more and more of that. But that is underway, and that does require a technology investment, and although PLOS, as an open access publisher, does not charge at the point of access, it does charge an upfront article processing fee.

The other thing that I wanted to mention about PLOS is this idea of volume. This is another really interesting development in the publishing world over the last 5 years. So, PLOS has a journal called *PLOS ONE*, which is the single largest journal in the world right now. *PLOS ONE* has this really interesting characteristic, which has stressed *PLOS ONE*’s publishing process. It launched five years ago and it published around 2500 articles in its initial year. It doubled in size in its second year, and then doubled again in its third year, fourth year, and fifth year. It is on track to double in size again this year. Thirty two thousand articles were published in that single journal alone and it rejects about 60% of the articles that it receives. It is a “mega-journal” phenomenon. The review process is really difficult. There are not enough reviewers in the world that are going to be able to keep up if the journal keeps doubling in size. The idea of using traditional peer review systems and technology that we have is failing because they are not scaling.

PLOS is being forced to really examine this question of how peer review takes place (e.g., before the article has been accepted or once it has been accepted)? Where can we reasonably expect this to take place? When is the most efficient point in time for the review to take place? Who does the review? Is it always going to be a

jury of peers or is this going to be technology-assisted in some way? Are we going to crowdsource this? The question of how we are going to do this is literally in front of us right now, in order to keep the publication of this mega-engine going.

Alan Moghissi

Your example has essentially shown that we should have a conference on this matter.

Heather Joseph

We're in desperate need. I really do think that these are not theoretical questions but rather that they are quite concrete.

Alan Leshner

May I ask a few questions? We have previously brought up the point of data availability. At *Science*, we require that authors are willing to make their data available the minute the paper is published. I am having trouble understanding the counterargument. It is not about propriety because the paper is already published. It is not as if you are going to make less money because someone else has access to all of this data. In my AAAS role, I think that the reproducibility issue is one of the most dangerous and damaging issues for science. If we cannot reproduce the results of published articles, then that means that a) we are publishing poor science and/or b) we are publishing trivial science and giving it greater import than it deserves. We all know the problem with some pharmaceutical companies avoiding publishing negative clinical trials, but the reproducibility problem goes way beyond clinical trials. Marcia McNutt, the Editor-in-Chief of *Science* has an [editorial about reproducibility](#) that came out this past Friday. If you think about the most potentially damaging thing to the reputation that science holds in our society, this reproducibility issue could be the killer. We are publishing and disseminating out to the world peer-reviewed articles that no one can reproduce. There is something going fundamentally wrong, I think.

Heather Joseph

I do wish that Michael Stebbins was here, as he was largely responsible for helping see the White House directive through to fruition. It was controversial when it came out because it almost marries the issue of making articles and data available at the same time. There was a lot of debate in the community about keeping these two policies separate – that articles are very separate animals from data. I think the White House was actually very smart at coming up with different criteria for when and where data needs to be made available. For publicly funded research, we need to make articles and data coupled under the same umbrella available to the community.

Jennifer Buss, Potomac Institute for Policy Studies

For the results that are being published, I think there is a third option. We might not be recording enough data in the lab, given the day-to-day variations such as pressure changes or airflow changes. This variation affects data collection in that you could be using the exact same samples from a day before and obtain different results. If you have that difficulty in your own lab, how does one trust what is seen in someone else's publication? That is one of the problems for graduate students going through their research process.

Alan Leshner

Should we be publishing more robust findings, instead of more of the minor flukes?

Jennifer Buss

Of course. Those are the same types of research problems that are happening in clinical trials. I agree with you, and maybe there is an issue of needing more sensors and recording information to describe the exact environment of the study. The point is, how do the reviewers know that this is a fluke and not a robust finding without all the negative results being published as well?

Alan Leshner

We have been approached by the American Statistical Association, offering to help investigators with the statistics they use. By and large, the ways that researchers are using most statistics are very unsophisticated.

David Han, Office of Naval Research

I want to go back to the model that we have been discussing. It seems to me that open access, or public access, is clashing with the current model, which is more of a free enterprise. You would have very efficient publishers – highly regarded and well reputed – providing a higher volume of “price-tag” value deliveries. We currently have impact factors, as we all know, as rating systems and it is like asking which sort of competition you want to enter. Do you want to enter a competition at your community, state, national, or international level? This is the model that evolved over time and during that time, reputations were built. It is centered in a free market base, in my view. What you are trying to do is provide this value-driven product, open to the public, at no cost. This really clashes with the market-driven model. We are talking about evolutions or revolutions of the way that we disseminate information. Publishing is no longer that difficult. We are looking at the vetting process within with this sort of value-driven, market-driven kind of system and still have to somehow bridge the gap between this market-based type versus the type that is open to all at no cost.

We could really think about an alternative. As has been mentioned previously, in the next 10 to 15 years, publishers might not look the same any more. Maybe the vetting process needs to evolve as well. If we look at popular songs and artists who begin their careers on Youtube, they are concerned with how many views they get. One used to not be able to access and review an article until after it was published and disseminated, a slow and tedious process. Now, if you search correctly, you can see something written by someone on the other side of the world, instantly. We have experts who may be able to provide meaningful social media interaction (e.g., Facebook “likes”, Twitter conversations). It is a very open way of evaluating

certain things and judging their value. Crowdsourcing has its own pitfalls and you have to be careful about it. If you come up with a reasonable and smart way of extracting that kind of wider base for evaluation, we may be able to do it in the next 10 or 15 years.

Heather Joseph

You have just described something that is happening in the open access journal publishing community. This is the rise of an open-source set of alternative metrics at the article level, which cannot occur in a closed environment. You really need full usage of the article and an open environment. The metrics that are being experimented with now are based on individual articles rather than the impact factors used as a proxy for the set of articles. It is actually granularly attached to your article that measures everything from social media interactions, to mentions on a blog, to form geographical mapping capabilities. These are the kinds of things that allow you to paint a more complete picture of what is happening to your peer-reviewed article once it is released. You might think, “Who cares if my article gets 17 tweets?” What’s interesting about the granularity of these new metrics is that those 17 tweets are linked to personal profiles, and you can track who tweeted about you. Was it someone in your discipline, or was it someone who you never anticipated? The idea of these new metrics allows us to think about supplementing and augmenting, or even replacing – if you want to think radically – the single measure of the impact factor. We can begin to broaden the palette of metrics that we have available for assessment.

Audience Member

Academic institutions are not radical. That is going to be the real issue because what drives the people who are writing the articles are tenure and promotion. The tenure and promotion committees do not look at how many tweets an article may have. They care about how many articles you have in these top-tier journals, and I think this is going to put the brakes on these big changes to a publication. The way that institutions value the products of science is slow to

change. One thing that would really help in getting data out there is changing the way that it is valued as a product by tenure and promotion committees.

Heather Joseph

Over the last 18 months, our most common request is from library deans or directors saying that they have heard about article-level metrics. They want you to come to campus and talk about what these things are. They want to know if there is anything to these metrics that has potential value to them in doing their jobs. The door is open and they want us to come in as a Trojan horse. They say, "Come in and talk about the library and open access, but really focus on these article-level metrics." Adoption of anything new, like open access, is slowed by the fact that researchers, scientists, and everyone act in their own self-interest. The idea that open access is good for society and good for science is not one that many early adopters followed. When scientists can see that this is good for them because their research evaluation committee is going to value the fact that their work is more widely seen or cited, then we can start to see changes. We are an advocacy organization so we go in and talk about what is possible and available. There are also now non-profits and for-profits that are beginning to attack these metrics. They are going in to talk to repository managers on campus or research evaluators who can help you understand how to use these metrics and how to do your job better and more efficiently. The bigger uptake we get on people understanding this idea, the faster things are going to start to move.

Kathryn Schiller-Wurster, Potomac Institute for Policy Studies

I am glad you raised the idea of the public good. We are a policy institute, and I wanted to bring the discussion back around to policy. The U.S. government is the funder for a lot of scientific research, and it seems like there should be some public good role for the government. I would like to get your perspective on what you think the policy solutions are here.

Heather Joseph

At SPARC, we firmly believe that the public deserves access to the results of research that is publicly funded. We also believe that the way research funders will get the largest value out of their investment is by making the results of research more widely accessible. The way research results increase in value is for them to be shared, discussed, used, and built upon. This fuels faster science and faster discoveries. It provides access to segments of the population who did not previously have access (e.g., small businesses and entrepreneurs). Alan and I were talking earlier about innovation and where it takes place. Big companies can afford to subscribe to journals. A lot of the innovation that we see taking place comes from start-ups, who do not have access. My colleague, John Wilbanks, tells the story of start-ups at Silicon Valley, who cannot afford to pay for subscriptions but still get access to articles by paying stipends to graduate students in exchange for access to articles. The VP for Research of Autism Speaks said when she left her job at Scripps on a Friday, her library card was cut off before she started at Autism Speaks that Monday. She said that she luckily knew librarians who would trade access to articles for a bottle of wine. It was like a black market in PDFs. Public access and the return on public investment should not depend on workarounds. I think that policies that provide a reasonable balance for the public to get access to this information while still maintaining the publisher's ability to do the value additions that are so important to ensuring quality are the right policies to pursue. I think we have examples of them in the NIH policies.

Alan Moghissi

Let me make an observation. We recently published a paper called "The Wakefield Effect". Some of you may know who Wakefield was. He was apparently a well-known British physician who published a widely distributed paper claiming that vaccinations would cause autism. My assessment, as well as many others' assessment, was that it did a lot of harm by making this claim. He was dead wrong. He fabricated the work and published it in a highly prestigious journal called *The Lancet*. The point is that the validity of published material in a scientific journal makes the world of difference.

Let me make the comparison between the legal system and the scientific process. Does the legal system make mistakes? Yes, and it has been demonstrated that convicted people can be proven innocent through new technology. The point is that there are not alternatives in the publishing world. There are two models: you write a paper and put it on the Internet, or you submit a paper to a journal and undergo peer review to establish its validity. Now, is peer review perfect? Absolutely not. We know that, and Dr. Leshner mentioned several problems with it. There is something called the “Matthew Effect,” and I have seen it so many times. Because a person is chairman of a department of x, y, and z, they are then “qualified” to peer review a, b, and c. But in fact, they may not be qualified. The point is that there really is no other choice. Therefore, to me the emphasis – and the reason I started a book on peer review – was to determine if open access is better in terms of public service than not open access? I believe that there is no answer to that yet.

Audience Member

I agree with you that there are only a few alternatives in the vetting process, but let me cite my personal experience. Publishing papers in a journal often feels like at times turning something into a black box. You hope that you will have some type of open dialogue with the viewers, but sometimes it turns into a one-way street. So my experience in publishing in a journal – versus say, in a conference – is that I found that conference publications are often more open. The acceptance rate is typically higher and more informative as a third person because if you are giving an oral presentation open to the public, anyone can raise questions on the thesis you are making. Also in a conference you are no longer under the protection of those few in peer review. If I listen to one’s presentation and realize that the presenter was pretty much just clobbered, then my opinion about that paper is going to change. Right now if it is a journal paper, we really don’t have that. I believe some additional public base opinions and feedback would really provide value. For instance, in the example Dr. Moghissi cited about one scientist who claimed and made certain kinds of assertions in publications, only

a few had vetted the thesis. Of course, there is a huge danger, but the danger can often be mitigated by other perspectives. Now I call this data fusion because that's my business, and you use multiple sources of information to come up with the most optimal solution. So there are other models or other combinations of models perhaps using what we have as well as maybe new sources that we could perhaps mold right now. Maybe this is the kind of form that we can consider so we can produce the types of third perspectives that can then be injected into the process.

Heather Joseph

Dr. Leshner, I would be really curious to hear, and I don't know if *Science* has tried this, but a lot of publishers have tried open comments associated with articles. Who uses them?

Alan Leshner

Very few people comment, and when they do, they are often dumb.

Heather Joseph

The question is, "How do you incentivize people to comment?" One of the potential utilities of article-level metrics is that scientists seem way more willing to chat away about an article on Twitter than they do in the comments section attached to the article, but they will often refer back to the article.

Alan Leshner

We just did some focus grouping on scientific communication. It is very interesting that particularly young scientists do not want to go on record saying negative things about articles. They will give you their personal characteristics, and they will put their own work up to be raised, but they are not interested in a public critique of somebody else.

I think this point about article-level metrics is that we hate impact factors. It's been used in countries where you don't get a job if you

haven't published in *Science* or *Nature* or something similar. But having said that, you have to find a way to evaluate the quality of the paper that is being used. My scientific field was hormones and behavior, and I conducted some of the original work on pre-menstrual tension. You can imagine some of the readership and citation of some of our work. Some of it was not so great, but it got a lot of attention. So I think if this movement of article-level metrics can move forward, it will serve not only the universities' needs for evaluation, but will also change the ways in which journals are looked at. So in that sense I applaud it very much.

Heather Joseph

The good thing about the movement for article-level metrics is that they are trying to talk the open-talk as well as walk the open-walk. So they are open source, and they become more valuable the more widely they are deployed when you have things to compare against. So any publisher that wants to use them can pick up the source code and deploy them on their article today. Its definitely becoming more widely used.

The other thing that is interesting is that funding agencies, and that includes U.S. public funding agencies, have started to have discussions about the fact that because of the OSTP (Office of Science and Technology Policy) directive, part of the requirement is that articles be made accessible through some kind of publicly available, permanently accessible, digital repository. Federal funding agencies are now saying, "Well, we are going to have to show how much value is in these articles that we are funding." That's going to be the next question. Now that the articles are available and out there and people are using them, we are going to be asked by our agencies to say, "Who is reading them? Do people care about them? What do they think?" And so they are actually interested in exploring, at some level, some set of metrics, potentially using some of the article-level metrics that can help them talk about the value of the public

research investment. I think its kind of the Wild West, but there's tremendous potential in opening up this playing field.

Audience Member

We keep coming back to this point that we need a new business model to address open access. I was just wondering, what are the next steps that we should be taking to try and formulate something? Should we be convening publishers, or having the government lead conversations? And additionally, should we have the public be voicing their support for this issue, should they be involved in any way?

Alan Leshner

Once you start mobilizing public support, it becomes a policy/political advocacy issue. I would like to have the public's input, since there are a lot of really smart people out there, and I will tell you that we are regularly convening people from the business community, who are a lot smarter about business than we are, to try to get ideas about other business models. By the way, we try to get non-science related business people; they're the smartest ones.

Heather Joseph

In terms of business models for open access journals, I think there's still this conception out there that there is only one business model, and people generally refer to it as author-paid. People get really worried about the idea of authors paying for their own publications. The Bohannon Study that was in *Science* highlights the ways that this author-paid model can be perverted, for lack of a better word. But the idea of article processing fees, or the idea of paying upfront to cover the costs of publication, can be a legitimate business model when used properly. Yet it's in use by only about 40% of open access journals. It happens to be used by some of the biggest ones, but one thing that I think is encouraging is that the models are beginning to diversify, and we are seeing other models come into play. For instance, Latin America does not like the idea of impact factors, or of having to publish for an impact factor for employment. Rather, in Latin America, we are seeing universities and funders combine their resources to fund open access journals and the idea of com-

mercial publishers in Latin America is in fact almost unheard of at this point. Huge numbers of open access journals, over one thousand, coming about of Brazil, Columbia, Peru, and Chile for example, are using a combination model that has the funders pay and the universities make up the difference. Whether it's library funds being diverted from paying for subscriptions to help support open access funds, provost funds, or whatever they are, this is a new and emerging model. Creative models coming out of the developed world include the *PeerJ*, a new journal that is using a model based on scholarly society membership. In this membership model, you pay a flat fee for membership in the journal, and you are allowed to publish as many articles over the course of your lifetime as your membership fee supports. So a fee of \$199 allows for publication of 2 peer-reviewed articles a year for the duration of your membership. It's a volume driven model, and it's predicated on the unproven notion – the currently tested notion – that every author and the list of co-authors have to pay the fee for the article to be published. So the volume is generated in a variety of ways. This is backed by Tim O'Reilly, a venture capitalist and publisher, and he sees this as something we should test. In this model, there is peer review, but open peer review. It is voluntary, you can be anonymous, or you can have your review follow that article through publishing.

Alan Leshner

What if I pay, and it's a lousy article? Are you going to publish it anyway? Or will you give me my money back?

Heather Joseph

They would publish your article; you only pay for the articles that are published. Thus, if you are rejected, you still don't get your money back. You paid for a membership. But it's also a different psychology, and getting to this idea of why do people join scholarly societies. Why are there so many scholarly societies struggling to attract younger members? What's the feeling of being a member of an organization or a scientific guild? Whether this works or not, we'll see. But I think it's encouraging to see this diversity in the ecosystem.

Audience Member

I do think that journals are trying to encourage that if authors are publishing, they also need to participate in all parts of the ecosystem. But I don't know if this is a criterion.

Heather Joseph

There are open access journals supported by sponsorships, corporate sponsorships, and that opens up a whole other potential can of worms. But there's this sense at least that it's not a monolithic model.

Bob Hummel, Potomac Institute for Policy Studies

I spent 17 years as a faculty member at New York University. However important this process of vetting and evaluation and public dissemination is, and however expensive it is, it still seems to me to be only a portion, albeit an important portion, of a bigger enterprise, which is this business of science and academia and knowledge generation. This really touches home with me as an academic in a fairly narrow field. I was in computer vision, and eventually with my name in the field, I started getting a lot of articles for review. I understood that it was part of my job as a faculty member to do as honest a job at reviewing as I could, but it got to the point where I was spending one fourth of my time as a referee for submitted articles, and to do a proper job on a serious paper was several days work. Now who was paying my salary? Well there was certainly money coming from grants and DARPA (Defense Advanced Research Projects Agency), but most of the money paying my salary was tuition. So it seems to me one of the problems here is that the inputs and outputs don't match. The inputs were a lot of students who didn't really care all that much about these research papers and the vetting, and a lot of the outputs are to the broader scientific community who do care a lot but weren't really paying.

Heather Joseph

That idea of peer review being a sharecrop for the higher education community and the scientific publishing enterprise is a really important point that I think gets lost in conversation. I think that

universities in general are willing to make the investment to support the time and the effort of academics to do peer review. But when we look at the business models and we talk about the value that publishers add – publishers manage the peer review process and do scientific editing – but the actual peer review is contributed by the academics either in labs or on university campuses. So this notion of providing adequate support has to be holistic and take into account the contributions that are significant from the university community.

With regard to being inundated with requests to peer review, I don't know how we can solve this problem. I don't know how we can make more people who are willing to peer review and who are qualified to peer review. I do know that as a managing editor, one of the things that we did regularly were notations in our online peer review systems. So, for instance, don't send Bob any more articles until February because he is going to say no, that we are burning him out. We literally have burnout notations in our peer review system.

Audience Member

One of the guys from ScholarOne has developed an enterprise where you get paid as a peer reviewer. I think its \$250, but I can't remember the exact dollar amount. My company put this idea out to our membership and it was pretty universal that it's taboo. There's this idea that you're not going to get paid to do peer review because then you are paying somebody to say, "Yes, my science is good." So there is a perceived conflict of interest as well as this notion that it's not what the scientific enterprise should be about. This is just what I have heard, and I haven't heard any statistics on how this system is doing.

Heather Joseph

I mean I would love if three of the largest biomedical funders gave me money and said, "We are never going to charge the authors, and we'll cover all the costs of publishing." It just isn't realistic. But one of the things that say eLife is doing is putting pressure on the community to speed up the peer review process. Their val-

ue added to the system right now is 6 weeks max, and they're very transparent about their turnaround time and that notion of submitting an article and having it going into a black box and not hearing back for 12 months.

Alan Moghissi

Unfortunately, the time has come to close this meeting and the need for optimization of the peer review process is really the last word that I think needs to be considered. We thank you so much and are most grateful to our outside panelists and audience members for being here today.

SPEAKER BIOGRAPHIES

MICHAEL S. SWETNAM

CEO and Chairman, Potomac Institute for Policy Studies



Michael Swetnam assisted in founding the Potomac Institute for Policy Studies in 1994. Since its inception, he has served as Chairman of the Board and currently serves as the Institute's Chief Executive Officer.

He has authored and edited several books and articles including: *Al-Qa'ida: Ten Years After 9/11 and Beyond*, co-authored with Yonah Alexander; *Cyber Terrorism and Information Warfare*, a four volume set he co-edited; *Usama bin Laden's al-Qaida: Profile of a Terrorist Network*, co-authored with Yonah Alexander; *ETA: Profile of a Terrorist Group*, co-authored with Yonah Alexander and Herbert M. Levine; and *Best Available Science: Its Evolution, Taxonomy, and Application*, co-authored with Dennis K. McBride, A. Alan Moghissi, Betty R. Love and Sorin R. Straja.

Mr. Swetnam is currently a member of the Technical Advisory Group to the United States Senate Select Committee on Intelligence. In this capacity, he provides expert advice to the U.S. Senate on the R&D investment strategy of the U.S. Intelligence Community. He also served on the Defense Science Board (DSB) Task Force on Counterterrorism and the Task Force on Intelligence Support to the War on Terrorism.

From 1990 to 1992, Mr. Swetnam served as a Special Consultant to President Bush's Foreign Intelligence Advisory Board (PFIAB) where he provided expert advice on Intelligence Community issues including budget, community architecture, and major programs. He also assisted in authoring the Board's assessment of Intelligence Community support to Desert Storm/Shield.

Prior to forming the Potomac Institute for Policy Studies, Mr. Swetnam worked in private industry as a Vice President of Engineering at the Pacific-Sierra Research Corporation, Director of Information Processing Systems at GTE, and Manager of Strategic Planning for GTE Government Systems.

Prior to joining GTE, he worked for the Director of Central Intelligence as a Program Monitor on the Intelligence Community Staff (1986-1990). He was responsible for the development and presentation to Congress of the budget of the National Security Agency, and helped develop, monitor and present to Congress the DOE Intelligence Budget. Mr. Swetnam was also assigned as the IC Staff representative to intergovernmental groups that developed the INF and START treaties. He assisted in presenting these treaties to Congress for ratification. Collateral duties included serving as the host to the DCI's Nuclear Intelligence Panel and Co-Chairman of the S&T Requirements Analysis Working Group.

Mr. Swetnam served in the U.S. Navy for 24 years as an active duty and reserve officer, Special Duty Cryptology. He has served in several public and community positions including Northern United Kingdom Scout Master (1984-85); Chairman, Term limits Referendum Committee (1992-93); President (1993) of the Montgomery County Corporate Volunteer Council, Montgomery County Corporate Partnership for Managerial Excellence (1993); and the Maryland Business Roundtable (1993). He is also on the Board of Directors of Space and Defense Systems Inc., Dragon Hawk Entertainment Inc., and the Governing Board of The Potomac Institute of New Zealand.

A. ALAN MOGHISSI, PhD

Board of Regents Member and Senior Fellow, Potomac Institute for Policy Studies



Dr. Alan Moghissi is a Senior Fellow at the Potomac Institute for Policy Studies. He also serves as a Member of the Board of Regents.

He previously served as co-editor of the peer-reviewed journal, *Technology*, which the Potomac Institute edited in cooperation with the Institute for Regulatory Science.

After more than two decades of federal service at the U.S. Environmental Protection Agency (EPA), Dr. Moghissi formed the Institute for Regulatory Science (RSI) in early 1985. While at the EPA, he held a number of positions including that of Principal Science Advisor for Radiation and Hazardous Materials. In addition, he served as the Director of the Bioenvironmental/Radiological Research Division and Manager of the Health and Environmental Risk Analysis Program. Later on, Dr. Moghissi joined the University of Maryland Baltimore as Assistant Vice President, and Temple University in Philadelphia as Associate Vice President. At both universities, his portfolio included operational aspects of environmental health and safety.

Dr. Moghissi's research has dealt not only with his primary area of education which includes biological and environmental kinetics, but increasingly with the development and implementation of the concept of Best Available Science (BAS) in societal (including regulatory) decisions. Dr. Moghissi has written over 400 papers including several books, and has edited a number of scientific journals. He received his training in Zurich, Switzerland and Karlsruhe, Germany where he received a doctorate degree in physical chemistry.

ALAN LESHNER, PhD

CEO, AAAS and Executive Publisher, Science

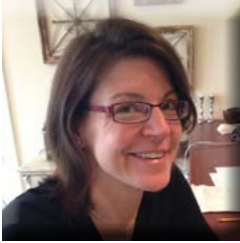


Dr. Alan I. Leshner has been Chief Executive Officer of the American Association for the Advancement of Science and Executive Publisher of the journal *Science* since December 2001. Before coming to AAAS, Dr. Leshner was Director of the National Institute on Drug Abuse (NIDA) from 1994 to 2001. Before becoming Director of NIDA, Dr.

Leshner had been the Deputy Director and Acting Director of the National Institute of Mental Health. He went to NIMH from the National Science Foundation (NSF), where he held a variety of senior positions, focusing on basic research in the biological, behavioral and social sciences, science policy and science education. He has been a Director at National Science Board since 2004. Dr. Leshner is an elected fellow of AAAS, the National Academy of Public Administration, the American Academy of Arts and Sciences, and many other professional societies. He is a Member of the Institute of Medicine of the National Academies of Science. He serves as a Director at American Association for the Advancement of Science. Dr. Leshner received A.S. in Psychology from Franklin and Marshall College in 1965; M.S. in Physiological Psychology from Rutgers University in 1967 and Ph.D. in Physiological Psychology from Rutgers University in 1969.

HEATHER JOSEPH

Executive Director, Scholarly Publishing and Academic Resources Coalition (SPARC)



Heather Joseph has served as the Executive Director of the Scholarly Publishing and Academic Resources Coalition (SPARC) since 2005. In that capacity, she works to support broadening access to the results of scholarly research through enabling open access publishing, archiving and policies on a local, national and international level.

Ms. Joseph is also the convener of the Alliance for Taxpayer Access, a coalition of universities, libraries, patients advocacy groups, consumer groups, and student organizations who work to ensure that results of publicly funded research are openly accessible to the public. The group has been a leading voice on U.S. open access policies, including the landmark public access policy issued by the National Institutes of Health (NIH), and the recent White House Directive mandating public access to publicly funded research across all U.S. science agencies.

Prior to coming to SPARC, she spent 15 years as a publisher in both commercial and not-for-profit publishing organizations. She served as the publishing director at the American Society for Cell Biology, which became the first journal to commit its full content to the NIH's pioneering open repository, PubMed Central, and subsequently served on the National Advisory Committee for the project.

Ms. Joseph serves on the Board of Directors of numerous not-for-profit organizations, including the Public Library of Science. She is a frequent speaker and writer on scholarly communications in general, and on open access in particular.

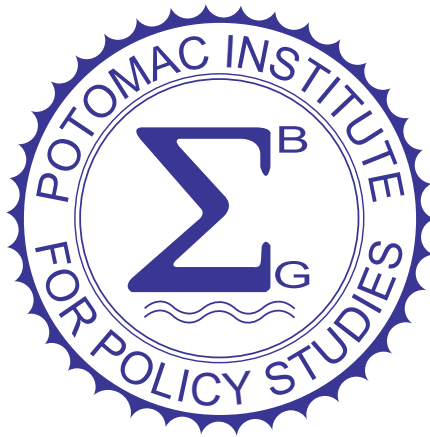
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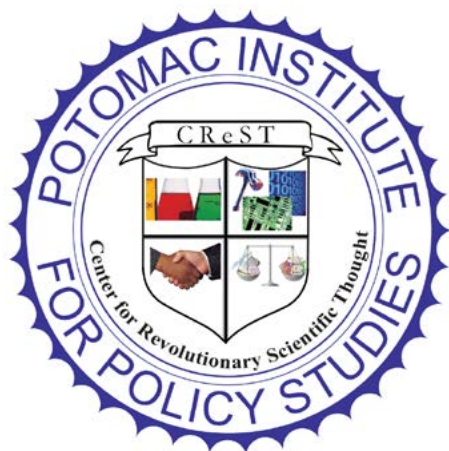
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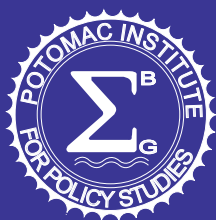


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