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Open Access and Scientific Integrity
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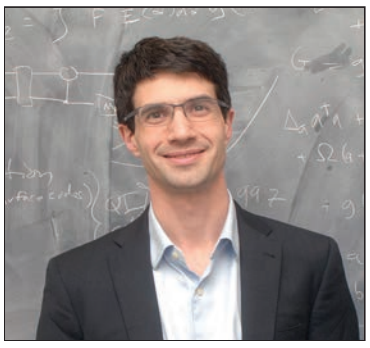
OSTP Emphasizes Quantum Computing

By Gabriel Popkin

One year into a presidential administration that has by turns ignored, alienated, and defunded scientists, one scientific community may have cause to celebrate: physicists in quantum information science. In mid-December, Jacob Taylor, a physicist at the National Institute of Standards and Technology (NIST), took the job of assistant director for quantum information science in the White House Office of Science and Technology Policy (OSTP).

Though OSTP has had quantum physics experts on staff in the past, Taylor's appointment is the first position dedicated solely to quantum information, a field that many scientists believe could revolutionize computing, communication, and cryptography.

"It's very heartening to hear that Jake is taking this position," says Steve Rolston, a physicist at the University of Maryland, College Park and former director of the Joint Quantum Institute, a partnership between the university and NIST. "It means someone in the administration still thinks this is a good idea."



Jacob Taylor

OSTP, formed in 1976 by an act of Congress, has waxed and waned over the decades. Under President Obama, it swelled to a staff of more than 100, who advised the administration on major policy matters from the response to the Ebola outbreak to efforts to rein in greenhouse gases. And under Obama, OSTP was led by a scientist, John Holdren, with both physics and engineering expertise.

But OSTP's ranks have thinned

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The Making of PRL: Mission, Material, Method

PHYSICAL REVIEW JOURNALS 125 YEARS

By Hugues Chaté and Reinhardt Schuhmann

We at *Physical Review Letters* (PRL) are pleased to celebrate the 125th anniversary of our parent journal, *The Physical Review* (journals.aps.org/125years). Over the years, that original publication has evolved into the APS Physical Review journal collection, and our relationship with these partner journals continues to be strong. Every year, our journals share the vetting of thousands of manuscripts and work together to improve the review process and the way papers are disseminated.

PRL's origins lie in a section called "Letters to the Editor" that debuted in *The Physical Review* in 1929. In 1958, responding to the growth of the section, then-Managing Editor Samuel Goudsmit spun those Letters off into a separate journal, *Physical Review Letters*. The year 2018 thus marks another anniversary, the 60th of PRL. The past 60 years have been very successful and as we begin our next 60 years, we look back at how PRL has evolved and share our vision for the future.

Consider PRL's original *mission*. Goudsmit conceived of PRL as a way to inform physicists of important developments across all of physics in a short format accessible to a broad readership [1]. It was an immediate success, and the model continues to serve PRL well. Important Letters across all subfields of physics have graced its pages over the past six decades, including those associated with many Nobel Prizes in physics (and a few in chemistry). We thank our authors for their continued submission of excellent results, and our reviewers for their service to us and to the community.

Our mission today is still very much the same: to provide a mar-

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2018 APS President Roger Falcone

On January 1, 2018, Roger Falcone became the 104th President of the American Physical Society. He is currently a professor of physics at the University of California, Berkeley. The interview has been edited for length and clarity.

What would you like members to know about your scientific background and current research?

I was an undergraduate in physics at Princeton, and then went to California for graduate school at Stanford and a Ph.D. in electrical engineering. I stayed on at Stanford as a research fellow, working in atomic and laser physics for a few years in the applied physics department, and then moved to Berkeley's physics department in 1983. I was chair of that department for 5 years, and for the last 10 years I was the director of the Advanced Light Source at Lawrence Berkeley Lab.

My research has generally involved the interaction of light with matter. Currently we study materials under extreme conditions of pressure and temperature. This means creating pressures up to a billion atmospheres and temperatures measured in millions of degrees, and examining the structure and properties of materials under those conditions.

Roger Falcone

The applications of our work extend from materials physics to planetary science, plasma physics, and fusion. My experiments now are at x-ray free electron lasers and large laser facilities, including the Linac Coherent Light Source at SLAC National Accelerator Laboratory and the National Ignition Facility at Lawrence Livermore National Laboratory.

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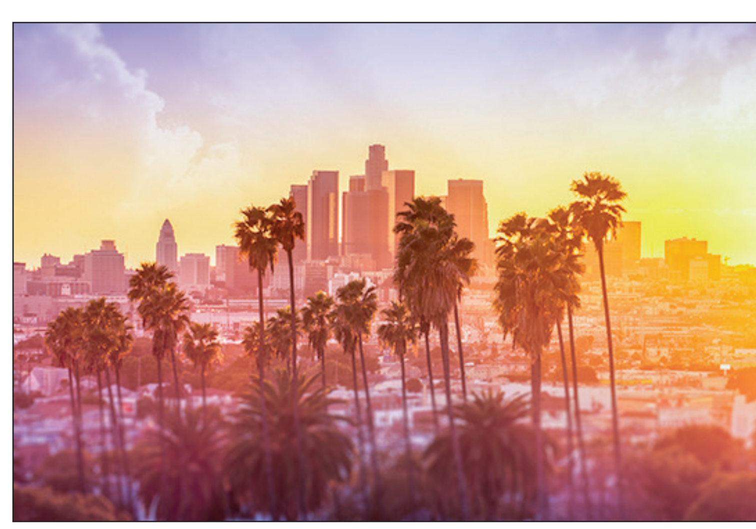
APS Strategic Planning Underway

Throughout 2018, APS leadership will be developing a new Strategic Plan for the coming years. This will update the previous plan (aps.org/about/strategy/) that covered 2013–2017. Input from APS members is vital for the success of this effort.

Please attend a **Town Hall gathering on Strategic Planning at the 2018 APS March Meeting** in Los Angeles on Thursday, March 8, from 1-2:30PM (check the website aps.org/meetings/march/highlights.cfm for updates on location). Meet with 2018 APS President Roger Falcone and CEO Kate Kirby to learn about the initiative and take this opportunity to provide input and thoughts about the future direction of APS. More information on opportunities for member input will appear in future issues of *APS News*.

2018 APS March Meeting Heads West

Around ten thousand attendees are expected to converge on the Los Angeles Convention Center (LACC) for the 2018 APS March Meeting. Running March 5-9, the conference will feature more than 1000 invited speakers, 10,000 presentations, and many workshops and special events. Be sure to check the meeting website for the latest times and locations (aps.org/meetings/march).



Among the highlights is the Kavli Foundation Special Symposium on Wednesday, March 7, featuring five distinguished speakers (2:30–5:30 p.m.). Barry Barish (Caltech) will review the latest discoveries from LIGO and talk about the new era of multi-messenger astronomy. Shoucheng Zhang (Stanford) will discuss one of the hottest topics in condensed matter physics—topological and quantum matter. Manu Prakash (Stanford) takes a wide view with a talk on "Frugal Physics and Global Health." Novel superconductors will be the subject of Ming Yi's (UC Berkeley) talk, and Amir Abo-Shaeer (Dos Pueblos Engineering Academy) will talk about his institute's programs.

Diversity topics will be central to a number of sessions in Los Angeles. On Sunday, March 4, Homeyra Sadaghiani (Cal Poly Pomona) will lead a seminar for undergraduate and graduate women on professional skills development (4–6 p.m.). On Wednesday, all are welcome to participate in a roundtable discussion on improving the climate within physics for gender and sexual minorities. The National Society of Black Physicists and National Society of Hispanic Physicists meetup on Wednesday will provide opportunities to gather and network. And the APS Forum on Education is sponsoring a reception (6:15–7 p.m.)

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Revised 02/28/18

Spotlight on Development

Irwin Oppenheim

APS is pleased to announce the establishment of the Irwin Oppenheim Award to honor the memory and celebrate the legacy of the founding editor of *Physical Review E* (PRE). APS has launched a campaign to endow this award and invites you to support it.

As the first best-paper award by a *Physical Review* journal, the Oppenheim Award will recognize outstanding contributions to physics by early career scientists who publish in PRE. Conceived by the late David Chandler, a former student and long-time friend of Oppenheim, this award is a fitting tribute to the beloved colleague, mentor, and friend to many—who most notably served as a senior editor of PRE from its inception in 1993 until 2002.

APS has launched a $90,000 endowment campaign to allow the Oppenheim Award to be given in perpetuity. We are enormously grateful to family members, friends, and close collaborators of Irwin Oppenheim who have already made commitments toward this goal, and we are currently seeking the balance in the form of tax-deductible contributions.

Gifts of any amount will be greatly appreciated and recognized on the Oppenheim campaign webpage; gifts of $100 or more will also be listed in the APS Annual Report. Moreover, gifts of $1,000 or more will help us get to our immediate goal of $60,000 by February 2018 more quickly—thereby allowing us to bestow the first Oppenheim Award at the special joint 2019 APS March/April Meeting in Boston.

For more information about the Award, what it will consist of, as well as Irwin Oppenheim's remarkable legacy, please visit the campaign webpage at aps.org/about/support/campaigns/oppenheim/.

Here you can also find details on making a gift, or please contact Irene I. Lukoff, APS Director of Development, at 301-209-3224 or by email: lukoff@aps.org

This Month in Physics History

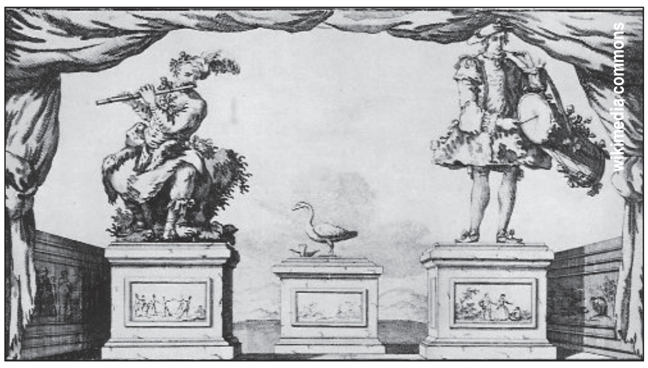
February 11, 1738: Jacques de Vaucanson Exhibits Flute-playing Automaton

In 18th century Europe, intricate mechanical creatures were all the rage among nobles and commoners alike. The undisputed master of life-like automatons was a French inventor named Jacques de Vaucanson, whom Voltaire dubbed a "new Prometheus."

Vaucanson was born in Grenoble, France, in 1709, the tenth child of a glove maker. Raised in poverty, the young Jacques showed an early interest in mechanical objects, and he was fascinated by the church clock whenever he accompanied his Catholic mother to confession. He built his own version of the clock at home. When his father died, the seven-year-old boy was sent to a monastery for schooling; he brought along a metal box filled with his parts and tools, the better to build a model boat. It interfered with his studies, but his math teacher was sufficiently impressed with the boy's drawings that he decided to help his student with the project.

Jacques de Vaucanson

Given his financial situation, Vaucanson decided a life in the clergy would give him the freedom to pursue his scientific interests on the side. So he became a novice in the Order of the Minims in Lyon, where he found a patron in a local nobleman and set up a workshop. When the head of the order came to visit, Vaucanson's sense of whimsy led him to build some rudimentary automata to serve dinner and clear the tables after the meal. The effort backfired: the visitor denounced the inventor's mechanical bent as "profane," and forced him to shut down his workshop.



Mechanical musicians and a defecating duck

A disappointed Vaucanson abandoned his plan to become a monk and withdrew from the order, running away to Paris instead, where historians believe he took classes in anatomy and medicine at the Jardines du Roi. He definitely found another patron to finance his dream of building lifelike automata. During an illness, he dreamed of a flute-playing automaton, which inspired him to design a real-life version, hiring local clockmakers and craftsmen to fabricate the intricate parts.

He unveiled his flute-playing creation at a public exhibition on February 11, 1738, and it was a huge success, drawing regular crowds for over a year. The wooden figure was painted white, the better to resemble a sculpture's marble, with a corresponding mechanism for every tiny muscle involved in the task. Thanks to an intricate set of pipes and bellows, the automaton could "breathe," and the mouth had a movable tongue, the better to control airflow through the flute. After struggling with motion of the wooden fingers, he wound up covering them in a soft glove-like skin. The automaton could play 12 different melodies.

His success brought an invitation to present his automaton to the French Academy of Sciences the following year. The academy judged the machine "extremely ingenious," and praised "both the intelligence of the creator and his extensive knowledge of mechanical parts." However, court musician and flautist Johannes Joachim Quanta found the playing shrill, probably due to the limited motion of the robot's mechanical lips. As audiences grew bored with his flute player, Vaucanson built a second automaton, a tambourine player with a repertoire of 20 tunes.

But the inventor's masterpiece was a gold-plated, life-sized Defecating Duck automaton that could quack, rise up on its legs, and boasted what Vaucanson claimed was a functioning digestive system—perhaps inspired by its inventor's own lifelong struggles with digestive ailments. The duck would swallow grain and a "chemical factory" in the stomach would decompose the food, excreting the waste in front of a live audience. Decades later, a magician named Jean-Eugene Robert-Houdin—who built his own automaton—discovered that Vaucanson had tricked his audiences with a clever artifice: the digestion wasn't real. The waste was actually pre-stored bread crumbs dyed green to look like digested grain.

The mechanical duck was a smashing success, and Vaucanson would up touring Europe with his creations. Voltaire memorably observed in 1741 that "without the voice of le Maure and

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Special Commentary

Open Access and the Integrity of Science

By Matthew Salter and Michael Thoennessen

Another article on open access? After all, what's left to discuss? Surely open access means that all research is made freely available online without pesky paywalls, right? Well, yes and no. Open access makes things available to all, but there are some costs and risks that need to be thoughtfully addressed.

APS has long supported the principles of open access and its potential benefits for both authors and readers, as it is entirely consistent with APS's mission to advance and diffuse the knowledge of physics. The Society places a high priority on access to science for the good of society, for example by making its journals free to read at all U.S. public and high school libraries. APS also takes an uncommonly liberal stance on self-archiving, allowing authors to post the final published version of their papers on their laboratory and institutional websites. And APS is a proud founding member of CHORUS—a non-profit organization that tracks publicly funded research articles and works to increase their public accessibility.

Our view of open access is laid out in the APS Statement on Open Access published in 2009 which reads "*The APS supports the principles of Open Access to the maximum extent possible that allows the Society to maintain peer-reviewed high-quality journals, secure archiving, and the Society's long-term financial stability, to the benefit of the scientific enterprise.*"

And there's the tricky part: how to provide open access while still operating both a scholarly publishing program that offers robust, high-quality peer-review, and a professional science society that runs activities—meetings, education programs, and science advocacy to name but a few—that ensure the health of the physics enterprise.

Publishing a high-quality, rigorously peer reviewed scholarly article is a complex process, involving steps such as selecting expert referees, managing the peer reviewing process, editing, copyediting, typesetting, and archiving it to make it widely discoverable. Beyond those familiar steps, there are more than 100 other things that editors and publishers do.

Publishers have traditionally recouped the costs of these steps by selling journal subscriptions to institutional libraries and other customers. However, open access eliminates the need for journal subscription by removing the article paywall. An alternative is to replace subscriptions with an Article Processing Charge (APC), which is paid by authors and/or their institutional research offices.

APCs allow for unrestricted access, but this system shifts publishing costs directly onto authors and their institutions. So, researchers and their institutions are faced with the prospect of using money that could support research to pay to publish open access. Given already tight federal science budgets, APS is concerned that this presents a risk of reducing the nation's overall research investment.

APCs vary considerably from journal to journal and publisher to publisher, depending on such factors as the selectivity of the journal and its perceived prestige. One way of reducing costs and thereby holding down APCs is for journals to cut back on the number and extent of their services by moving to a lighter-touch peer-review model.

One of the dangers of moving in

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International News

Human Rights of Scientists – A Matter of Global Concern

By Robert French

The APS Committee for the International Freedom of Scientists (CIFS), which was established in the mid-1970s, presently comprises nine members and is chaired by Shelly Lesher of the University of Wisconsin, La Crosse. The committee is responsible for monitoring concerns about the human rights of scientists and recommends to the APS leadership action to be taken in particular cases. Recently APS, acting on the recommendation of the Committee, approached the Iranian Government regarding the arrest and trial of Ahmadreza Djalali, a permanent resident of Sweden who specializes in emergency medicine. He has been sentenced to death in Iran for allegedly passing state secrets to Mossad (Israel's secret service) following a deeply flawed and coercive interrogation and trial. His cause has been taken up by scientific and international non-governmental organizations as well as governments around the world.

CIFS is one of a number of organizations actively concerned with the human rights and freedoms of scientists. There has been long-term involvement in this field by scientists in the United States through bodies such as the Committee of Concerned Scientists, established in 1972; the Standing Committee on Scientific Freedom and Responsibility of the American Association for the Advancement of Science, established in 1976; the Committee on Human Rights of the National Academy of Sciences, established in 1976; the Committee on the Human Rights of Scientists of the New York Academy of Sciences, founded in 1978; and the Committee on Scientific Freedom and Human Rights of the Association for Computing Machinery, founded in 1980 [1]. Also engaged in this area are the American Chemical Society and Sigma Xi, the worldwide honor society for scientists and engineers [2].

The human rights and freedoms recognized in international human rights instruments as applicable to all human beings have particular importance in their application to scientists. Those rights and freedoms were prefigured in the *Universal Declaration on Human Rights*, promulgated by the United Nations on December 10, 1948. This year is the 70th anniversary of that Declaration. An important sequel to the Declaration was the *International Covenant on Civil and Political Rights* [3]. The rights and freedoms which it recognizes, and which are found in other international instruments and national laws, include:

- the right to freedom of thought and conscience and religion;
- the right to freedom of expression including the right to seek, receive and impart information and ideas of all kinds regardless of frontiers;
- the right to freedom of association with others.

There are in addition science-specific commitments which are embraced in the so-called "right to science" in Article 15 of the *International Covenant on Economic, Social and Cultural Rights* [4]. The "right to science" embraces the freedom that is indispensable to scientific research and creativity and the right of everyone to enjoy the benefits of scientific progress and its application. The parties to the Covenant also agree to take steps necessary for the conservation, development and diffusion of science.

Scientific developments, theories, and opinions may challenge established order, vested interests and entrenched worldviews. History, including recent history,

Robert French

tells us that there are many ways, some crude and direct, some subtle and indirect, in which scientific freedom can be abrogated or restricted by governments and sectoral interests and by elements of the scientific community itself.

There is a long history of scientists who made discoveries, propounded theories, and expressed opinions and then suffered at the hands of authorities to whom their discoveries, theories, and opinions have proved inconvenient. Legendary names whose stories are partly obscured by historical uncertainties and subsequent myth-making include Bruno, Copernicus, and Galileo. In more recent times there are accounts of scientists working for government agencies or other institutions whose expressions of opinions on politically sensitive areas such as climate change science have been restricted by the invocation of contractual powers or laws or regulations governing their employment.

Other constraints on scientific freedom to share the results of research work may arise out of confidentiality clauses imposed by contracts or otherwise on those working for industrial or commercial enterprises that may or may not be undertaking government research. The purpose of

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Vaucanson's duck, you would have nothing to remind you of the glory of France." It was also immortalized in Thomas Pynchon's novel *Mason and Dixon*, in which the duck attains consciousness and chases a chef across the United States. Alas, the infamous duck is believed to have been destroyed when the museum in which it was purportedly housed burned down in 1879.

Eventually Vaucanson grew bored with his automata and sold them off to a trio of businessmen. King Louis XV had just appointed him inspector of silk manufacture, in hopes of making the silk industry in France competitive with its rivals in England and Scotland. Far ahead of his time, in 1745 he invented the first automated loom, and hoped to introduce punch cards to the industry. But the weavers revolted, fearing for their jobs, and pelted him with stones as he walked through the streets. Vaucanson retaliated by building a loom powered by a donkey, declaring that "a horse, an ox or an ass can make cloth more beautiful than the most able silk worker."

This did not go over well. The king came to his inspector's defense and cracked down on the weavers, forbidding them from public meetings, issuing fines, and imprisoning some of them. Yet they persisted in their protests, and the king relented after a year. Fifty years later, Joseph-Marie Jacquard would succeed where Vaucanson failed with an automated loom.

Vaucanson died in Paris in 1782. His vision of an automaton capable of reproducing digestive functions was finally realized in 2006, when a Belgian conceptual artist named Wim Delvoye unveiled his "Cloaca Machine," a mechanical and chemical apparatus that really did digest food and turn it into waste, carefully vacuum-sealed in specially branded bags and sold to eager art collectors. (See youtube.com/watch?v=TCSDHWOqvNI)

Further Reading:

Riskin. J. 2003. "The defecating duck, or, the ambiguous origins of artificial life," *Critical Inquiry* 29:4. 599-633.

Wood. G. 2003. *Living Dolls: A Magical History of the Quest for Mechanical Life*. London: Faber.

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where you can learn about current diversity efforts spearheaded by APS, the Committee on Minorities in Physics, the Committee on the Status of Women in Physics, the Committee on Education, and the LGBT+Physicists group.

On Sunday before the main sessions get underway there will be an orientation for new attendees (5–6 p.m.) with a crash course on navigating the meeting and using the mobile conference app, and information about how APS can help make the best of your conference experience. The orientation will be followed by the APS Official Tweetup (6–8 p.m.) where the mavens of social media will gather and refreshments will be served.

Also on Sunday, attendees can learn about the state of the art in several areas. There will be morning tutorial sessions on density functional theory, thermoelectric materials, spintronics, and quantum information (8:30 a.m.–12:30 p.m.) and afternoon tutorials on hybrid quantum systems, quantum critical systems, and the Mathematica software program (1:30–5:30 p.m.). The tutorials require pre-registration and a fee is charged.

The APS Division of Polymer Physics will hold a short course on gels and elastomers on Saturday and Sunday, and the Topical Group on Soft Matter will hold a Sunday short course on machine learning for soft materials research. Both require pre-registration and payment of course fees.

Two workshops for grad students and postdocs are scheduled for Sunday as well. The APS Topical Group on Energy Research and Applications and the Forum for Early Career Scientists are co-sponsoring a workshop on "The Future of Sustainable Approaches to Energy" (closed for applications). And the Forum for Outreach and Engaging the Public will host a workshop on "Improving your Presentation." The latter requires pre-registration and a $20 fee.

The APS Prizes & Awards Ceremony will take place on Monday, March 5 (5:45–6:45 p.m.) and will honor numerous individuals for their research excellence and service to the physics community. The March Meeting Welcome Reception (6:45–8 p.m.) will be held in the main exhibit hall immediately following the awards session.

The *Physical Review* editors invite you to their 125th anniversary celebration on Tuesday, March 6, in the LACC Concourse Foyer from 4:30–6:30 p.m. The editors will be available to answer questions, hear your ideas, and discuss your comments about the journals. Light refreshments will be served. Then, on Wednesday, March 7, editors from *Physical Review Letters* and *Physical Review* will provide information and tips for new referees and authors. This session is aimed at anyone looking to submit to or review for any of the APS journals, as well as anyone who would like to learn more about the authoring and refereeing processes (11:15 a.m.–12:45 p.m.).

Wednesday is Industry Day at the meeting, sponsored by the APS Forum on Industrial and Applied Physics. This year's theme is "Big Data and Physics: Bits to Knowledge," which highlights how Big Data impacts our work, our daily lives, and physics research.

On Wednesday evening (6:30–7:30 p.m.) James Kakalios will give a Public Lecture on "The Physics of Superheroes" in Petree Hall of the LACC. This will be followed by a session on "Federal & Private Funding Opportunities in Condensed Matter Physics & Materials Science" (7:30–8:30 p.m.).

Also on Wednesday, there will be a staged reading of the play "Silent Sky" by Laura Gunderson (8–9 p.m.). The play is based on the life of astronomer Henrietta Swan Leavitt and her experiences as a woman in the male-dominated culture of the Harvard Observatory in the early 1900s. The play will be performed by the International City Theatre of Long Beach, CA, and will be followed by a discussion with the actors and a historian of science. Later that same evening, bring your singing voice to the Rock-n-Roll Physics Singalong (9–10:30 p.m.) for physics tunes and light refreshments.

Throughout the week, there will be a full program of activities for students: Future of Physics Days (FPD) are events just for undergraduate students. Sponsored by APS and the Society for Physics Students, FPD offers undergrads the opportunity to present their research, learn about grad school and career options, and connect with the scientific community. There will be undergraduate research sessions, career and professional development workshops, an undergrad-only lounge, and a graduate school fair All attendees can learn about careers in the private sector, participate in a job expo, and register for a Careers in Physics Workshop.

For more information visit the meeting website at aps.org/meetings/march/

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such restrictions may be to protect potential intellectual property or national security interests. The justification for such restrictions is always debatable and their benefit always contestable. This is, of course, an area in which scientists to some extent may have a choice about the terms and conditions on which they will do their work. It would be unrealistic, however, to pretend the choice is always an easy one, particularly in a tight job market.

The existence of constraints on scientific freedom to publish is properly a matter on which the scientific community can organize and develop guiding principles rather than responding to particularly egregious cases.

The rights and freedoms of scientists to pursue their own lines of inquiry have frequently intersected with the general issue of the role of science in society—particularly where so much scientific endeavour depends upon the allocation of public resources. An aspect of that general issue is the tension between basic research, whose outcomes are uncertain, and applied research and development directed to specific publicly determined problems and priorities.

Debate about that tension gave rise, during World War II, to the establishment in the United Kingdom of a Society for Freedom in Science. The Society was created in opposition to a movement in the United Kingdom partly inspired by developments in the Soviet Union, which favored central planning of scientific effort. Three founding propositions upon which the Society rested were:

- The increase of knowledge by scientific research of all kinds and the maintenance and spread of scientific culture have an independent and primary human value.
- Science can only flourish and therefore can only confer the maximum cultural and practical benefits on society when research is conducted in an atmosphere of freedom.
- Scientists in countries not under dictatorial rule should cooperate to maintain the freedom necessary for effective work and to help fellow-scientists in all parts of the world to maintain or secure this freedom [5].

The debate between the priority to be accorded to basic and applied research respectively, to scientific autonomy in the pursuit of lines of inquiry on the one hand and accountability in the use of scarce public funds on the other continues into the present time. There are, of course, many examples of basic research with little apparent practical application that have had the most profound effects upon technological development and society. It was curiosity that led Faraday to a relationship between magnetism and electricity and Maxwell to a mathematical explanation of electromagnetism. It was curiosity that led Dirac to propose the existence of the positron, a hypothesis not vindicated experimentally for four years. Positron emission tomography, nuclear magnetic resonance spectroscopy, and magnetic resonance imaging may all be seen as the outcomes of foundational scientific curiosity, as may the discovery of the maser, which led to the invention of the laser [6]. There are many such cases. The value of scientific freedom to society is a value which can be founded upon countless examples of those kinds.

Perhaps the most challenging issue in relation to scientific freedom is the threat to the freedom of scientists as spokespersons for freedom generally and as public dissidents in repressive societies. Such a role, exemplified by Andrei Sakharov and the Chinese physicist Fang Lizhi, is a natural product of the scientific culture, of skepticism about unfounded claims and of commitment to freedom of inquiry and expression.

In all of these areas, the scientific community through its organized bodies including CIFS has an ongoing and indispensable part to play. The forces of reaction and constraint on scientific freedom are always with us, in our own societies in subtle ways and unsubtly in floridly repressive societies.

Robert French is a member of the APS Committee for the International Freedom of Scientists. He was Chief Justice of Australia from 2008 to 2017 and is presently Chancellor of the University of Western Australia, from which he graduated in Science (Physics) and Law in 1968 and 1971.

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1. Minker, J. *Scientific Freedom and Human Rights* (IEEE Computer Society Press, 2012) 7-9.
2. Guidotti, T. L. Scientific Freedom and Human Rights (2018) 73 *Archives of Environmental and Occupational Health* 73:1.
3. Opened for signature 19 December 1966, 999 UNTS 171 (entered into force on 23 March 1976). Signed by the United States in 1977 and ratified in 1992.
4. Opened for signature 16 December 1966, 993 UNTS 3 (entered into force on 3 January 1976). Signed by the United States in 1997 but not yet ratified.
5. McGucken, W. 'On Freedom and Planning in Science: The Society for Freedom in Science 1940-1946' (1978) 16(1) Minerva 42, 48.
6. Thomas,J. M. 'Intellectual Freedom in Academic Science Research under Threat' (2013) 52 Angewandte Chen Int Ed, 5654-55.

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this direction is a "race to the bottom" in which journals compete on price, paring back their processes in an effort to deliver ever lower APCs, putting the quality of the journal in jeopardy. So researchers would be placed in a difficult position: wanting to be sure that they get the best peer review and services possible, while keeping their research budgets in the black. Under these circumstances, it's only natural that authors will seek out lower cost (or free) open access journals. However, the risks associated with using ultra-cheap journals are well documented and there is a danger that an overemphasis on lowering cost may end up damaging public confidence in published research and hurting the integrity of the overall scientific process.

Balancing the benefits and risks isn't easy. Open access is a visionary concept that in principle allows the free flow of scientific information, with numerous potential benefits for humankind. However, it must be implemented in a way that ensures the quality and integrity of the disseminated scientific results and the overall progress of science.

Fortunately, we have time to sort this out, since national policies are still being developed. In the near term, APS has become a participant in SCOAP^3—an international consortium for the large-scale open access publishing of high-energy physics research, coordinated by CERN. This is a significant test of open access. By participating in SCOAP^3, APS will be able to continue to evaluate how open access can be achieved to the benefit of the physics community.

The lively debate around open access will no doubt continue. That's entirely as it should be, and APS looks forward to being right in the center of the action—speaking up for the importance of maintaining the integrity of the scientific record, as well as promoting cost-effectiveness and easier access to scientific research.

Matthew Salter is the APS Publisher. Michael Thoennessen is the APS Editor in Chief.

Education & Diversity Update

PhysTEC Request for proposals

The Physics Teacher Education Coalition (PhysTEC) project is soliciting proposals for new sites. To date, PhysTEC has funded over 40 institutions to educate greater numbers of highly qualified physics teachers.

We expect to fund up to four comprehensive sites to substantially increase the number of physics teachers and address all PhysTEC key components. Initial proposals will be due mid-April; full proposals (if invited) will be due in July; and funding begins August 2019.

If interested, you are encouraged to attend the 2018 PhysTEC Conference, where a workshop will be held about the request for proposals.

A webinar will also be held after the 2018 PhysTEC Conference on February 13, 2018 to answer any questions regarding the request for proposal process.

Professional Skills Seminar at 2018 APS March Meeting

Undergraduate and graduate women in physics are welcome to attend a 2-hour seminar on Sunday, March 4. The seminar, led by Dr. Homeyra Sadaghiani, a professor of physics at Cal Poly Pomona, will focus on professional skills that students can use to negotiate a position in academia, industry or at a national lab, interact positively on teams and with a mentor or advisor, think tactically, articulate goals, enhance their personal presence, and develop alliances. Participants will be eligible for one-night hotel reimbursement. Register at aps.org/meetings/march/diversity.cfm by February 9.

Sites Announced for 2019 Conferences for Undergraduate Women in Physics (CUWiP)

The 2019 APS CUWiPs will be hosted January 18–20, 2019 at the following sites:

- College of William and Mary
- Michigan State University
- Northwestern University
- Texas A&M University–Corpus Christi
- The College of New Jersey
- The University of Alabama
- University of California, Davis
- University of California, Santa Barbara
- University of Massachusetts, Amherst
- University of Washington
- Utah State University

Also, if your institution is interested in hosting an APS CUWiP in 2020, please visit go.aps.org/cuwiphost and submit an Expression of Interest by September 1, 2018.

APS Committee on the Status of Women in Physics (CSWP) Updated Effective Practices

The APS CSWP has just completed a review of their best practices documents concerning the recruitment and retention of women in physics. The Committee has updated the recommendations to reflect current practice and re-framed them as "effective practices." You can visit go.aps.org/cswppractices for a full list.

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What is the role of the President at APS?

I think the role of the president is to ensure that priorities expressed by our members are addressed through APS programs and plans for the future. That means working with our volunteers, together with APS staff who know our organizational history and have the skills to implement our missions. By having elected leadership, we can help ensure coordination between the efforts of staff and members.

As our membership and the broader world change, and as our students become the new professionals, APS will evolve: How can we improve our meetings? How do we want to structure our activities in publishing? How can we advocate for science, with both governments and the public? How can our outreach be most effective? The president can help guide APS in responding to the consensus on answers to these questions.

Being in the presidential line specifically involves four years of activity, with the president working with a vice president, president elect, and past president. This structure helps ensure responsiveness and continuity.

There are other structures within APS, including membership units and other volunteer groups, the Council of Representatives, and the Board of Directors. The Council largely deals with the Society's scientific mission and priorities, while the Board has responsibility for overseeing management and fiduciary responsibilities. These units distill ideas from members, but also make decisions and take deep dives into issues that are important to APS.

We also have a Board Executive Committee (BEC) that includes the presidential line, Treasurer, CEO, and Speaker of the Council; it has a weekly video conference. Part of the president's role is to convene the BEC, and incorporate input received from staff, various units, and individual members, so we can respond in a timely way.

What are your key priorities for the year ahead?

The APS mission statement can be summarized as "being the leading voice for physics." There are several areas that I see as priorities for the Society in 2018 that can help ensure we will be that leading voice.

First, our role in disseminating our knowledge of physics has always been in the forefront, and it must remain strong and be of the highest quality. As I understand our history, APS was originally formed to coordinate meetings of physicists. A few years later APS took over *The Physical Review*, to disseminate physics through peer-reviewed publications. Of course, there will continue to be changes in relevant and supporting technologies, but meetings and scientific publications will remain core activities for APS.

We should advocate for the enterprise. That means engagement with government and private sector entities, and involvement in education. We should also enhance public understanding of science. So many people are interested in science but don't practice it professionally. They are excited about our work and hungry for insight, and we can feed that.

Because scientific research is so dependent on government funding, we also need to advocate for appropriate policies for science. We can also advocate for science to influence broader government policies. As examples, we should provide appropriate scientific background to improve international relations and energy policy.

Next, I want to ensure that APS has impact. We should articulate the value of APS to all of our constituencies, whether that means government officials, the university, national lab and private sector communities, or scientists internationally who are involved because they publish in our journals or come to our meetings, or join our universities, labs, and companies. Explaining the value we add to their work is important.

Additionally, there are specific issues that involve economic policy and security where we can help. We can articulate the role of science in innovation, economic growth, and empowering people, as well as in national and global security. We want to be present for discussions in these areas.

Next, we must consider the future. I'm excited that we will develop a new APS strategic plan this year, and we are doing that in a careful and professional way. We are seeking member and staff input from the very beginning of the process, with planning committees to tackle individual topics. We've hired a consultant to assist us in developing the plan and facilitating interactions, to make sure that all ideas are considered.

I don't see strategic planning as a tactical exercise, where we only say we are going to do X or Y, but the plan will lay out options, strategies, and rationales for new ideas. As we move forward in coming years, as resources become available and people want to champion certain causes, we will be able to look at the strategic plan and say, ok, now is the time for us to do this or that. Implementation of programs will be determined by the desires and efforts of members and leadership in the future.

Finally, we not only need great programs and ideas, but we have to ensure fiscal and organizational sustainability. Right now the Society is in good financial shape, but that doesn't mean we can be complacent. We want to make sure our activities are sustainable, and we should be making the case to government agencies or private donors for new resources. We have to articulate the added value of what we want to do.

What do you see as the main challenges facing APS?

The way scientists disseminate their work is evolving. While I believe that we haven't seen major changes in how meetings are handled (people want to get together and talk, and that hasn't changed for generations), from the lengthening and growing number of scientific papers, to the reduction in printed journals, to the expanded flow of information and search capabilities on the Internet, the way we publish scientific information has been changing. We need to react to and maybe get out ahead of upcoming changes, including the movement to open access.

Fundamentally, the idea of peer review shouldn't and probably won't change, as it allows us to develop consensus, and test understanding of what might be right or wrong. Science is both democratic and hierarchical, in the sense that we admire and reward quality from anywhere; this implies that peer review will remain, but logistical aspects of the current system could evolve.

Anticipating the evolving ways we disseminate and review science is very exciting. I want APS to be in a leadership role in providing the services that our communities want and need.

How can APS members get involved?

For strategic planning, we will be setting up a web portal for suggestions and comments. We will also be holding town hall meetings and interviews with leaders of units. So, joining and participating in the many APS units is a way to help. But even if somebody just wants to quietly participate, they could throw in some good ideas, join in a town hall meeting, or at least give input via the portal; we expect to have that up and running by the time of the APS March Meeting in Los Angeles.

Final thoughts?

I've been an APS member for decades, having joined as student, but when I jumped more deeply into the work of the Society, I was surprised by the breadth of our activities, which I didn't see as a regular member. I knew about my specific units, and how meetings and awards were organized. But when I joined leadership, and saw, for example, the extent of our educational activities and advocacy work, and the complexity of editorial activities, etc… it's really an amazing enterprise you can't begin to understand unless you jump in!

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dramatically under President Trump, with staffing levels less than half of what they were under Obama. (The office's bare-bones website does not include a current staff list or organizational chart, but a spokesperson said the office currently employs 50 people.)

Not all has been quiet on the science front, however. In August, OSTP's deputy chief technology officer Michael Kratsios and Office of Management and Budget director Mick Mulvaney released a policy memo highlighting quantum computing as one of several emerging technologies they see as key to "American prosperity." Taylor will help OSTP ensure the government's investments—some $200 million to $250 million per year spread across more than a half-dozen agencies, according to various estimates—are guided by "smart federal policy," Kratsios says. "Jake's experience at NIST and work with top QIS [quantum information science] research institutions will help with the important inter-agency coordination and policy alignment that OSTP manages."

Taylor, a theorist whose research spans both basic and applied physics, has a track record of bringing together disparate sectors of the quantum research universe. A NIST symposium he co-led in October explored how U.S. agencies can work with tech giants like Google and IBM and with smaller startups to build a quantum industry. And he spearheaded the 2014 founding of a Joint Center for Quantum Information and Computer Science, a partnership between NIST and Maryland intended to accelerate the development of quantum computer science as a research field.

"Jake's a wonderful ambassador," says Chris Monroe, a physicist at Maryland and cofounder of ionQ, a quantum computing startup based in College Park. "He can speak to any audience about the potential of quantum." Monroe also supports an increased governmental role in quantum research. At an October House Science Committee hearing, he encouraged Congress to fund a "National Quantum Initiative" that would substantially ramp up federal spending; the concept recently gained an endorsement from Walter Copan, who was confirmed as NIST director in October. Having a quantum expert in the White House "is not a bad thing" for advancing this agenda, Monroe says.

Agency representatives also applaud OSTP's addition of quantum expertise. "The level of federal investment is now getting large enough that some active form of interagency collaboration and coordination is really important," says Steve Binkley, deputy director for science programs in the Department of Energy's Office of Science, which funds quantum research at several national laboratories in hopes it could help discover new materials and address basic physics questions.

Carl Williams, a deputy director at NIST who worked at OSTP during the Bush and Obama administrations, adds that the office could help in "managing the hype" around quantum information. The technology is often described as a game-changer, but both the scope of its most important applications and the size of the commercial market are unclear.

Large investments by other countries make the need for high-level coordination more urgent, adds Jason Matheny, director of the Intelligence Advanced Research Projects Activity, which funds quantum computing research with cryptography and machine learning applications. Recent reports suggest that China may be spending up to $10 billion to build a new quantum research center, and the European Union has announced a 10-year, $1-billion "flagship" program in quantum technology. While the U.S. currently holds a lead in developing quantum technology, "I think our advantage is fragile," Matheny says.

Taylor's hire "is a good sign, particularly given the importance of quantum computing and quantum communications, and how aggressive China has been in increasing their investment in quantum technologies," agrees Tom Kalil, former deputy director of OSTP in the Obama administration. But he notes a discrepancy with Trump's 2018 budget proposal, which would have cut U.S. research funding by around 17%, including at agencies that fund quantum information research. "The real question is whether the Administration will follow through with increased funding."

Taylor's position is a two-year rotation, and he will continue to manage his research group at NIST on a part-time basis. He says he doesn't yet have a specific agenda at OSTP, and declined to explicitly support a federal quantum initiative. But he hopes to help quantum information make the leap from university and government labs to a commercial industry. "It's a transformative time for the field," he says. "There are opportunities to do wonderful things, and there are opportunities for failures as well. My job to make certain the wonderful things happen."

And he invites physicists and others to tell him how they think the government can help push quantum information science forward. "A large part of what I'm doing in the next few months is listening."

The author is a freelance science writer based in Mt. Rainier, Maryland.

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ketplace for physics research, where readers can find the crucial results across every subfield, not just those that are hot. This requires a careful balance—we must publish many good papers across all of physics, but not so many that individual papers get lost, and not in numbers that become indigestible for readers. For this reason we recently pushed again to raise the bar for publication in PRL, and now publish about 50 Letters per week. For now this is a good number that we aim to maintain.

Beyond its mission, the *material* PRL publishes has evolved, and is now quite different from what the early issues offered. The original content was more focused on nuclear and particle physics. Condensed matter physics was then a small component, and many topics that are prevalent today, such as quantum information, biological physics, and cold atom physics, did not yet exist. We strive to ensure that the scope of the journal matches the interest of the authors and readers. We are a physics journal, but today's physics research is much more about interwoven disciplines—physics with chemistry, biology, materials science, and others. So, we ensure that PRL is also a home for the best interdisciplinary work that is significant for physics.

Another change in published material is the format. The original idea was that Letters be around 800 words, but this strict length limit was only enforced in 1966. The four-page limit we use today is similar to that imposed in 1971 [2], even as ink-on-paper has given way to online publication, and we view it as beneficial: short, self-contained articles are often better written, a plus for busy readers.

As for *method*, our principal tool is peer review. Early on, with no web hosting or arXiv preprint repository, publication speed was more of an issue, and there was little time for detailed peer review. Editors reviewed papers themselves, or obtained minimal input from local colleagues. As submissions grew, editors and their local contacts were overwhelmed, and almost all manuscripts were reviewed externally. More recently, the number of submissions again grew too large to handle, and we now send about three-quarters of submissions out for external review. We carefully select these, often seeking advice from other editors or an Editorial Board member. Other journals that are very selective seek expert input on a much smaller fraction of submissions.

The PRL reviewers have a different role as compared to other journals. Of course we ask them to comment on the validity of the manuscripts and suggest improvements as applicable. In addition, we want them to remark on importance, interest, and relevance for PRL [3]. One constant throughout PRL's history is that editors take the input from reviewers as advice [4]. Quite often the recommendations are not unanimous and the final decision is then made after weighing all available input.

Editors of the *Physical Review* journals have also introduced various highlighting mechanisms for a selection of published articles. At PRL, the editors choose about one Letter in six as an *Editors' Suggestion*. These letters are specifically marked on the PRL website and accompanied by a tweet from @PhysRevLett. Many Letters are also covered by the APS online publication *Physics*, which publicizes interesting results for a broad audience, including a large network of journalists.

Finally, PRL, like the rest of the *Physical Review* family and physics itself, has become very international. About 70% of PRL submissions and published Letters now come from outside the U.S. The composition of our editorial team reflects the broad international distribution of authors. Today the PRL editors hail from twelve countries. We feel that it is important for the editors who handle manuscripts to represent the authors who submit them.

Over the last 60 years, PRL has become the global, go-to physics journal, offering a unique combination of breadth, quality, and long-term value. We expect the globalization of PRL to continue, and to stay connected to this community, many of our editors travel around the world to attend conferences and give talks. The journal is fortunate to have an excellent team of talented and experienced professional editors. If you see one of us, ask questions, give feedback, and pass along your thoughts (or email prl@aps.org). We will be happy to respond. Our success relies on the whole physics community. With continued community support, we foresee a bright new 60-year cycle for PRL.

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PRL Lead Editor Hugues Chaté is a senior scientist at CEA-Saclay, France, and Chair Professor at the Beijing Computational Science Research Center in China. Editor Reinhardt Schuhmann has been with PRL full-time for more than 25 years

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physicists to claim priority, and for research patrons to gain prestige for the research activities they supported.

The introduction of page charges did not solve the financial issues, though. The community of American physicists was rapidly increasing and, as a consequence, the published material continued to grow. And so did the deficit. In 1932, the APS Council decided to cut expenses, and Tate proposed to achieve this by reducing the number of pages. This decision, motivated by pressing financial constraints during the Great Depression, had a tremendous effect both on physics writing and the practice of refereeing. Papers had to be much shorter and all nonessential information, like the historical evolution of a scientific problem, was considered superfluous.

At the time, refereeing practices at *The Physical Review* (and everywhere else) lacked coherence. Tate himself made most of the decisions without consulting other experts, and only some of the submitted papers were sent to another referee, who was usually a member of the editorial board. During the 1930s, however, the referees came to assume a role quite different from that they had before. Now, a referee had to work out ways to reduce the paper length and to determine if the paper was really worth the expense to publish it, which led to an overall tightening of acceptance criteria.

This change was not provisional. Quite the contrary, it became standardized in 1935, when Tate and his assistant editor began sending the referees a questionnaire intended to guide their evaluation of the submitted manuscripts. The questionnaire was divided into two three-question parts. The first asked for the evaluation of the content, while the second required a careful judgment about the form. In the questionnaire the length issue appears to be of primary importance, as referees were asked to suggest possible ways to reduce the length of the paper in both the content-related and form-related parts (5).

The introduction of the questionnaire was Tate's last major change. By 1935, *The Physical Review* had acquired a stable position as one of the leading physics journals, and some of the papers published in the RMP were playing pivotal roles in furthering research in newborn fields of physics by indicating promising lines of investigation for the future.

The 1950s to the Present

Tate died in 1950, and one year later *The Physical Review* entered a new era under the editorial management of Samuel A. Goudsmit, who also played an influential role in shaping the journal's style, as is carefully discussed by physicist and historian of science David Kaiser (6). Among Goudsmit's innovations were the creation of *Physical Review Letters* in 1958, which transformed the "Letters to the editor" section into a separate and extremely influential periodical. At the same time, under the pressure of an exponential increase of submitted papers and of specialization issues, refereeing practices became a systematic peer-review system around 1960, when it became the norm to send submitted papers to more than one external referee before they could be accepted for publication. In 1970, he oversaw the split of *The Physical Review* into *Physical Review A-D*, four separate journals in distinct research areas (*Physical Review E* came after Goudsmit, in 1993).

The innovations I briefly outlined here were all consequences of the specific needs of a defined community in particular historical periods. While these needs changed, most of the abovementioned practices showed an enormous amount of resilience and became standardized at the international level during the second half of the twentieth century, in conjunction with the dominant role American physics assumed in the Western world during the Cold War.

In my view, this story is instructive for three different, but interrelated, reasons. The first is the enormous dynamism showed by *Physical Review* journals in the introduction of new practices and how these modifications were strongly linked to dramatic changes in the social composition and scientific interests of the American physics community. It was during a time characterized by a generational change, by radical transformations with the advent and development of quantum mechanics and later by the demographic change caused by the arrival of a sizeable number of European refugees in the 1930s.

The second striking feature is that while all these changes were intimately connected to the needs of a specific national community in a particular historical period, some of them became shared international standards. This process invites thoughts about the development and evolution of communication structures, such as well-defined editorial norms, that are usually taken for granted by working scientists. Not all of the history discussed here was the result of explicit discussions between the scientists themselves. The international process of standardization, for instance, was also related to social and political forces that were well beyond scientists' reach. This might signal that well-established norms are not necessarily the best ones and that they might be changed if new needs point toward different directions.

This brings us to the last point of relevance, which relates to what this story might imply for the current debates on scientific publishing. For instance, the peer-review system has problems and is far from being the well-defined practice that is sometimes uncritically assumed. And what about the possibilities and challenges posed by the Internet and the World Wide Web in terms of open distribution of scientific knowledge, speeding up of publication of novel ideas, and solutions for information overload? Many of the concerns of the historical actors involved in the editorial decision-making of *The Physical Review* are very similar to those of today's scientists.

Yet the general context now is quite different. It is unlikely that today individual journals will be able to promote the same kinds of innovations as those implemented by *The Physical Review* in specific historical periods, because the scientific community is much more interconnected at the global level. More importantly, publishing norms are nowadays inextricably related to evaluation criteria for the assessment of scientific productivity and creativity of both persons and institutions. Finally, the relationship between online repositories such as arXiv.org (strikingly, administered by the same university that initiated *The Physical Review*) and academic journals is still very much unsettled. While these repositories allow for prompt and open publication of scientific results, highly ranked scientific peer-reviewed journals are the only recognized venues for the certification of the validity and importance of these results. The lack of a clear relationship between these communication formats does not enable us to clarify what the new role of academic journals should be in this evolving scholarly environment.

In the present situation, the production of new standards will probably require shared international agreement about the best practices, but well established institutions, and APS is certainly is one of those, might start experimenting with new modalities that combine the different and sometimes contrasting needs of openness, speed, and quality assessment in the publication of new scientific knowledge.

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The Back Page

Early Editorial Practice at *The Physical Review*

By Roberto Lalli

This year marks the 125th anniversary of the founding of *The Physical Review*. When it was started in 1893 at Cornell University, the journal was the first periodical entirely devoted to physics published in the United States. Its founders sought to support the professionalization of American physics and, at the same time, to increase the role of Cornell in this process. For decades, the international physics community considered the journal an expression of a rather marginal national scientific community. Today, the various descendants of *The Physical Review*, including *Reviews of Modern Physics* and *Physical Review Letters,* are among the most prestigious physics journals in the world.

This anniversary provides an occasion to reflect upon the history of APS scientific publications, on the historical transformation from a relatively peripheral publication to a leading physics journal during the 1930s, and to consider the implications this story has for the current debates and challenges of scientific publishing. Usually, the relevance of a scientific journal is measured by what it contains, which can be judged by the number of scientific breakthroughs that have appeared in its pages (see the 125th anniversary timeline at journals.aps.org/125years). This number is certainly impressive for the *Physical Review* portfolio.

In this article, however, I will focus on the container rather than on the content, namely, on the scientific policies and editorial practices implemented by APS editors and the historical evolution of these practices. While scientists might be tempted to see this as marginal to what is considered the "real" scientific work—producing new knowledge—editorial practices and policies strongly shape their daily scientific activity. Not only do editorial procedures affect the dissemination of findings, but also the way in which researchers acquire new knowledge by reading their peers' papers, and in some cases these procedures can influence the researchers' own scientific agendas. Scientific publications are not neutral receptacles of knowledge produced elsewhere. They are active and powerful agents that have a deep impact on the production, certification, and diffusion of scientific knowledge.

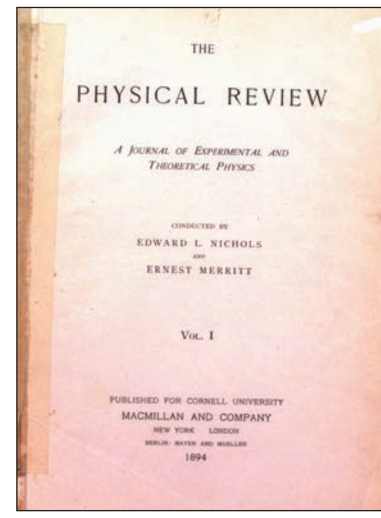
Most practices today are taken for granted, such as the peer-review system and the publication of an abstract preceding each article. They are so embedded in scientists' daily activity that such practices have acquired an almost universal character, but they are the result of specific historical contingencies and became standardized only after World War II. In the definition and standardization of these practices, APS has played a particularly relevant role from the late 1920s onward.

Early Days

APS was founded in 1899, but it was not until 1913 that *The Physical Review* was taken over by the Society. This change, which was not uncontroversial, was intended to increase the prestige of the journal and attract more publications by American physicists of the younger generation who still preferred to submit their best work to more established British journals. From then on, editorial responsibility was given to a salaried managing editor and an Editorial Board composed of nine APS members, all elected by the Society for a three-year term. The managing editor was the only figure who could be re-elected indefinitely, which implied that he (always "he" in those days) could, at least in principle, provide strong editorial continuity and realize his vision of the journal. Over time, this structure would provide a very fertile ground for the introduction of powerful innovations in physics publishing.

One of the first changes that distinguished *The Physical Review* from European scientific periodicals came soon after World War I, along with similar innovations in the *Astrophysical Journal.* Starting in 1919, articles appearing in these two periodicals were required to be preceded by a synopsis. Abstracts were of course not new, but *heading* abstracts were uncommon at the time; abstracts were published apart from the original papers, usually in dedicated abstract journals.

The change was due to physicist Gordon S. Fulcher, who worked at the Research Information Service of the National Research Council between 1919 and 1920. His main goal was to develop a methodology of analytic abstracting that would allow information to be communicated and catalogued quicker and more effectively. At *The Physical Review*



Gordon Fulcher (left) was managing editor of *The Physical Review* from 1923 to 1925. He introduced the systematic use of abstracts in the journal. John Tate (center) was editor from 1926 to 1950 and had an energetic management style and clear editorial vision. He may have done the most to shape the journal during this time. The first paper published in *The Physical Review* was on infrared spectroscopy (right).

he worked initially as an abstractor, in 1921 he joined the Editorial Board, and in 1923 he became managing editor. In this period he solidified the norm of the publication of heading abstracts written by the authors themselves by providing the rules that had to be followed to maximize the value of the practice.

Fulcher's meticulous editorial work improved the abstracts and the general style of the published papers. This approach was greatly valued by many members of APS, but did not favor rapid publication. In the early 1920s physicists in the U.S. felt frustrated that new physics concepts were originating in Europe, while American physicists were respected solely for their experimental contributions to test theories and formulas developed elsewhere. The first major American

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contribution to the new physics was the discovery of the Compton effect, named after Arthur Holly Compton, who predicted the effect and confirmed it empirically in 1922. While the paper with the detailed report of the breakthrough was submitted in December 1922, six months elapsed before publication, creating great distress because of the issues with priority this delay could have caused. A paper by Dutch physicist Peter Debye on the same topic was in fact published much more rapidly in the German journal *Physikalische Zeitschrift*.

At the end of 1925, Fulcher was not re-elected to the position of managing editor and his analytic abstract approach was abandoned as excessively time-consuming. However, the publication of clear and comprehensive heading abstracts written by the authors remained a legacy that still shapes modern scholarship both in terms of writing and reading practices, well beyond the boundaries of physics. Historians are not exactly sure how this practice became standardized, but we know that in 1924 the Sub-Committee of Bibliography of the Committee of Intellectual Co-operation of the League of Nations resolved to promote the use of heading abstracts and recommended the rules adopted by *The Physical Review*.

The Tate Era

Fulcher was succeeded by John T. "Jack" Tate, who remained in charge from 1926 until his death in 1950. Tate was probably the editor who more than anyone else shaped the style of the journal. During his editorship the American physics community passed from a peripheral position to a leading role, and so did *The Physical Review*. One might say that American physics and *The Physical Review* "came of age," as John van Vleck put it (1), at the same time. No doubt, the two were related, but the increasing prestige of the journal was not the simple consequence of the change of status of the American community. Tate's editorial management actively helped American physicists in their attempts to compete with other national communities when these were still perceived to be far ahead in the production of new knowledge in physics.

Tate had an energetic management style and clear editorial vision. The rationale behind the innovations he introduced was of a completely different nature than that behind the policies implemented by Fulcher. Tate was responding to authors' need to get credit more than to the readers' need to rapidly find useful information. The first three most important changes were all inaugurated in July 1929. The first two were a consequence of the necessity to speed up the publication of papers: *The Physical Review* passed from being a monthly publication to being issued every two weeks, and a new section called "Letters to the Editor" was established "for the prompt publication of reports of important discoveries in physics," following the success of a similar section in the journal *Nature* (2). The third change was the publication of a new quarterly periodical, initially called *Physical Review Supplement*, but shortly after renamed *Reviews of Modern Physics* (RMP)—which was envisaged to be the first scientific periodical entirely dedicated to the publication of complete critical reviews of the status of research fields in physics (3).

As Tate himself declared in a letter to Raymond T. Birge, "with these reforms [APS] will now have under its auspices about the most complete mechanism for publication that exists anywhere" (4). The competition with European communities, especially German physicists, in the race for priority was the rationale for the first two reforms, and Tate was authorized by the APS Council "to incur whatever expense [was] necessary" in order to pursue this goal. RMP arose from the desire of American physicists for an alternative to the excessive compartmentalization of physics. While Tate was following models and examples from other journals in different disciplines, the "mechanism" he created was quite new. It was in fact the realization of a grand vision where APS members, on the one hand, were able to publish (and read) quick reports of important results and, on the other, could have easy access to critical reviews that favored a comprehensive view of what was going on in various branches of physics.

Growing Pains

These innovations entailed an enormous growth of the number of papers published by APS. This growth was not free of charge. Many more pages had to be printed and the costs for publication ballooned, leading to a substantial deficit from 1929 onward. The stock market crash of 1929 and the depression that followed prevented APS from increasing the membership dues to cover the deficit of the journal. Because of this situation the APS Council decided to introduce a voluntary page charge, which was to be covered by the research patrons of the authors publishing in *The Physical Review*. While the introduction of a page charge was mostly a consequence of the financial situation, it confirms that in the minds of those who managed the journal its function had changed: The journal was now the preferential place for American

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