AIP
American Institute of Physics

LETTER REPORT

FACETS | Future of Association Convening: Envisioning for The Sciences

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American Institute of Physics
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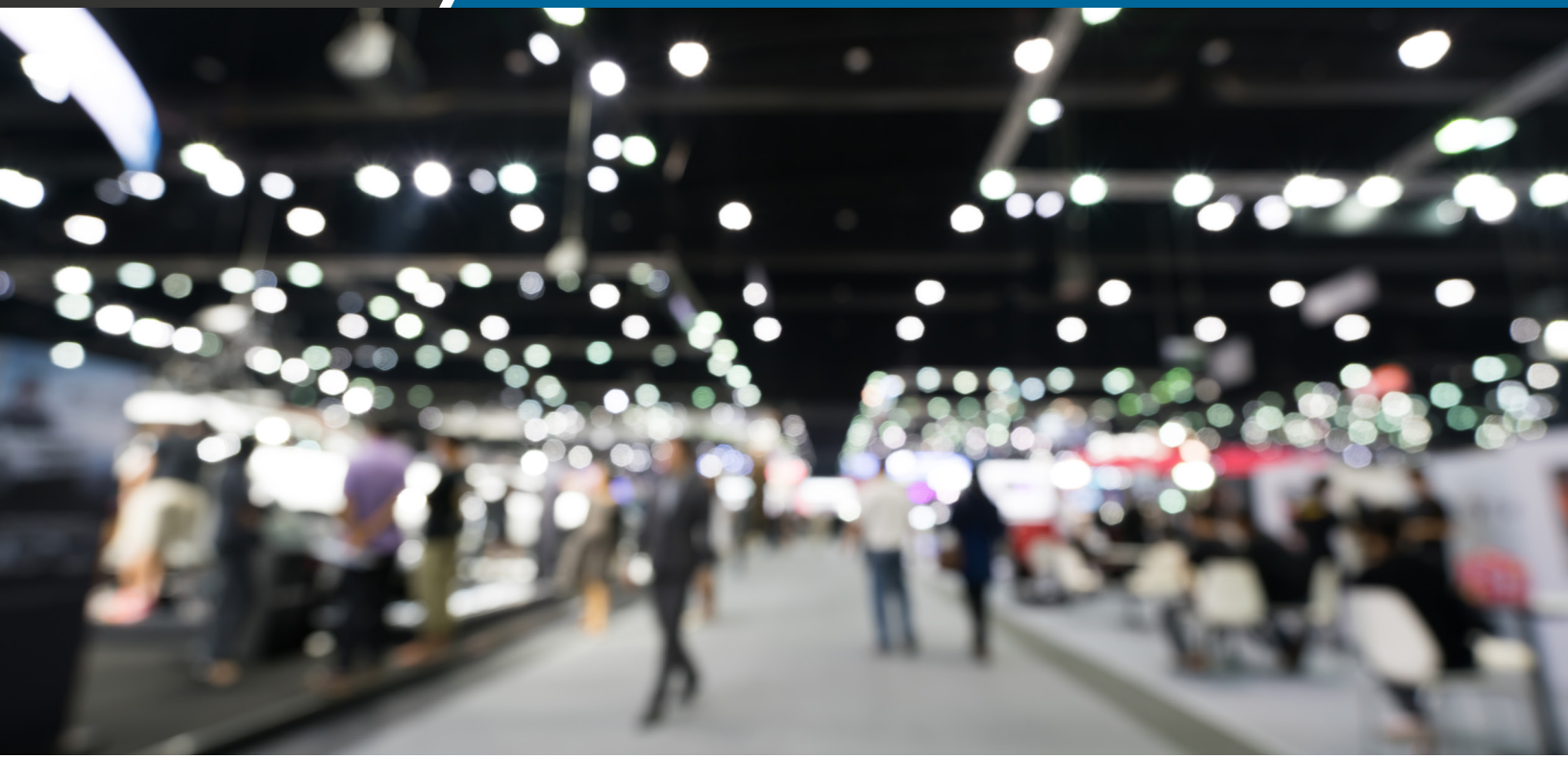

Preface

Scientific conferences are a vital element in the research process. They bring us together and advance our fundamental understanding of the world and its benefits for society. In essence, scientific conferences are communities and crucibles for exchanging results and ideas. They enable faster problem-solving and the application of collective intelligence, spurring innovation. They strengthen current collaborations and forge new ones. They inspire and support attendees—from students to senior scientists—throughout their careers. And they provide avenues for shaping the priorities of funding agencies and for sharing with the media, policymakers, and the public at large ground-breaking news that demonstrates the return on our collective investment in research.

Opportunities for professional development abound, particularly for early-career scientists who gain new experiences, find a new audience, connect with others in their field or related fields, and frequently discover new job prospects. Conferences are ideal venues at which scientists can meet with publishers about an article in press; where vendors can develop business relationships and hold demonstrations of lab equipment and industrial wares; and where funding agencies and other stakeholders can discuss financial support and learn about the latest advancements in the field.

At an event filled with so many types of interactions, it may be difficult to imagine the conference of the future and the ways in which societies can effectively communicate results and serve scientists better than they do now. But that's the charge presented to this Letter Report panel in this time of COVID-19 and rapid technological change—to envision transformations to the scientific conference

format and to its various forms of communication. In addition to sharing ideas, society conferences are at their best when they foster a sense of belonging among all participants. The challenge is to make the experience even more valuable for the scientific community, its partners, and policymakers.

The pandemic has compelled scientific societies to dive headfirst into the virtual environment, and we are gaining valuable knowledge about the potential to reach a global audience and improve accessibility at many levels. We are also learning that certain valuable aspects of face-to-face conferences are not easily replicated. Even so, societies are quickly refocusing their efforts, converting planned in-person conferences into virtual events. This past year, societies have experimented with virtual conferences—using a variety of methods in a short amount of time—giving us a unique opportunity to evaluate our learnings thus far about the pros and cons of different approaches. As many societies are planning virtual and hybrid events for the coming years, now is the time to reimagine what's possible. What lessons have we learned this past year? How can we apply those lessons and grow the value of our future convening activities? How can scientific societies become an even greater catalyst for scientific progress for the benefit of humanity?

Reimagining the conferences of the future—or at least for the next 2–5 years—is an exciting journey into creativity that will allow us to blend the best features of conventional and virtual formats and to accelerate our understanding and application of science for the betterment of society. Although no one, ideal solution exists for the diversity of our community's needs, this Letter Report panel offers many ideas and an appendix of examples from which any conference convener can draw on for inspiration. We can try "experiments," review the results, and create innovative, new conference experiences, much like the process by which scientific knowledge is built.

This report is not meant to offer formal, defined recommendations but does offer ideas and suggestions to inspire further thought and dialog. Our Letter Report panel is made of advisors, each with years of experience, representing major stakeholder groups. Not every point raised in the report represents the consensus of the Letter Report panel, but each idea is an opportunity for the scientific community to consider how they approach convening activities.

A note on terms: This report uses the term "conference" to refer to any event that consists of contributed and invited scientific sessions and provides scientists the opportunity for professional development. Although elements of our Letter Report have applicability to many different forms of convening, even outside the scientific context, our main focus will be traditional scientific conferences designed to disseminate research and build connections between members of a field's community.

CONTENTS

Executive Summary

In a world where scientific conferences have been forced into new and unusual shapes by the COVID-19 pandemic, our report looks at what are the essential, irreducible elements of the scientific conference. We find that no matter what forms or structures conferences take in the future, certain fundamental activities will be present, including scientific exchange and education, networking and connecting, and celebrating achievements in our fields. Just as important is the practice of conference design, with intentional planning for the user experience; safety; diversity, equity, and fairness; and environmental stewardship. We discuss methods for approaching conference planning to capture these essential elements in ways that are not wed to past tradition and can evolve to meet the needs of the modern scientific community.

From there, we discuss what future conferences will look like. We expect conferences in the future to provide **greater opportunities for inclusivity and engagement.** Digital platforms can facilitate extended discussions and collaboration before, during, and after a conference has taken place. Oral and poster presentations might be scheduled prior to the physical conference via a digital provider. That might allow the focus of the actual conference to shift toward questions, exchange of ideas, and networking, which have been the primary drivers for in-person conferences in the past. As technologies mature and become more pervasive, virtual attendees can increasingly participate in those interactions without regard for former barriers such as physical location and cost of travel. Asynchronous and closed-captioned recordings can help mitigate other personal barriers to participation.

Conferences of the future will **extend access to the science** reported at scientific conferences beyond traditional audiences and beyond the temporal duration of "the conference." The conference becomes a pinnacle in a series of convening activities, some society orchestrated, others audience driven. They become the driver for synchronous participation and drive asynchronous learning and exchange. This shift requires change of stakeholder behaviors as well, so it will be gradual. Not all stakeholders are seeking such change, but demand for greater access to content and networking seems to be increasing.

Conferences of the future will **leverage partnerships of all kinds**—with sponsors, exhibitors, industry, academia, and other societies—for tangible, mutual gain and in support of the wider scientific enterprise. One of the greatest opportunities—and one of the greatest challenges—in this era of increased connectivity and integration will be for scientific societies to develop ways to deliver value across boundaries, reaching new audiences, new partners, and adjacent disciplines.

Accepting that future convening activities will be quite different from those to which societies are accustomed is the first step in envisioning a successful future. The next step is embracing the possibilities—and after that, forging ahead, experimenting to identify your society's sweet spots (i.e., which tactics fit with your society's unique needs), and continuously evolving in response to changing stakeholder wants and needs.

Ingredients for success, from strategic to tactical, include:

- Keeping focus on how to best achieve the society's mission;
- Developing an overall strategy for meetings and conferences that outlines the new vision for convening and links to the organization's strategic plan;
- Empowering staff and volunteers to experiment with building new events/ experiences;
- Applying the principles of design thinking and user experience design;
- Leveraging technology and tools to facilitate knowledge sharing and networking;
- Making content accessible (multifaceted, i.e., who, when, where, and how);
- Expanding reach and science outputs by embracing diversity and fostering a sense of belonging;
- Making conferences safe for all;
- Recognizing the increasing emphasis on and community values for environmental stewardship;
- Fostering robust partnerships;
- Being agile and responsive to external forces that could potentially impact the conference;
- Diversifying revenue-generating tactics to stabilize the business model.

Our Letter Report panelists explore these various facets of the conference planning ecosystem throughout the following report and posit questions for societies to consider when envisioning their own future. Taken together, this report suggests how the future of convening can benefit all stakeholders, from the scientific community, to partners, industry, academia, and the greater society itself, as a new sustainable business model is forged.

Fundamental Elements of Scientific Conferences

What do society conferences of the future look like? What forms or structures can they take? We have introduced the need to embrace change, but there are fundamental elements that need to be stewarded into the future—activities that conferences of the future will continue to deliver in some form. There are also fundamental facets of conference planning and design, facets that every conference, no matter how large or small, no matter the format, should incorporate. This section will take stock of what we ought to keep, what we can adapt, and how we might deliver future convening activities.

Retooling well-established conference practices can seem overwhelming—especially with so many moving parts. By maintaining their primary focus on their missions, societies are better equipped to affect change. When connected to defined strategy, for the organization and—even better—for the society's conferences and convening activities, the process of charting new directions is easier. Organizers can refer to these strategic guideposts when making decisions.

Fundamental activities of scientific conferences

Science exchange & education

Scientists have always come together in groups to share, both formally and informally, what they have discovered on their own. Sharing of information is critical for the advancement of science. What tactics do that most effectively?

In-person conferences promote discourse and dialog around research, but in many respects still follow passive learning as discussion time during sessions and between talks is limited.

As conferences shift from the more traditional one-way transfer of information from presenter to attendee, societies can develop new methods of communication to prompt easy interactions among both in-person and virtual attendees. Using digital tools, text, audio, and video chat options can all be incorporated to facilitate discussion, whether attendees are on-site or remote. Those options may even elicit a livelier discussion than is typical in traditional in-person settings. Those reluctant to engage presenters and others may be more likely to chime in with comments or questions due to the possible anonymity of a virtual connection.

Conferences have also become key venues for continuing education, short courses, and even supporting professional development activities, such as mentoring others and exploring how to make the next career move. In-person experiences make those activities more effective and engaging, but virtual events have the potential to expand their impact and reach.

The emergence of the COVID-19 pandemic has not reduced our desire for that connectedness. Rather, it has forced us to reimagine how conferences could change.

Networking & connecting

The emergence of the COVID-19 pandemic has not reduced our desire for that connectedness. Rather, it has forced us to reimagine how conferences could change. Building your network, connecting with peers, and meeting potential collaborators are essential elements of any conference.

In traditional conferences, networking is often informal and somewhat serendipitous, although innovative activities like speed-networking and dedicated networking events have helped in this regard. Entry into chance get-togethers is seen as an advantage of in-person conferences, but some groups such as students and early-career scientists who are not yet well connected to an area of research have found this difficult. Networking can be especially challenging for attendees who may have to contend with bias, discrimination, and exclusion.

In the virtual environment, networking and connecting can be even more challenging, as the in-person experience of meeting new people or connecting with existing colleagues cannot be replicated easily. However, technologies attempting to simulate the experience and technologies that introduce completely new ways of collaborating and networking are improving at a rapid pace. Moving forward, consider multifaceted approaches to connecting the community—different techniques for this are discussed in the **Future of Science Exchange** section.

Celebrating achievements

In whichever meeting format, the tradition of honoring those who have made significant contributions to the field will continue to be an important part of convening. Celebrating colleagues' achievements brings the community together and illustrates how individuals and teams have key roles to play in advancing the mission of the society. Societies can produce short videos to promote, beyond the conference, their award winners and their accomplishments. While this report does not address this area in detail, the Letter Report panel acknowledges its place as an essential element of a society's convening activities.

Fundamental components of conference planning

"People ignore design that ignores people," says Frank Chimero, the author of *The Shape of Design*. Design principles can help create meaningful experiences for an organization and a community. The benefits are multiple: attendee satisfaction, greater loyalty to the society, and increased potential for the society to pursue its mission.

Incorporating design thinking

According to Tim Brown, chair of IDEO, "Design thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success."

Design thinking is an iterative process used to challenge assumptions and redefine problems to identify alternative strategies and solutions that might not be instantly apparent. It compels us to see challenges from different angles, to test solutions, and continuously evolve and improve. It challenges us to turn off autopilot and helps keep us from growing stale.

Embracing principles of design thinking helps societies plan the **right** experience for the intention of the conference. It is important to note that the experience will be different for audiences depending on their unique needs and how they participate—face-to-face/virtual/hybrid—due to the nature of their environments.

Designing for the stakeholder/attendee

User experience design is hardly a new concept but one not often employed to its full extent. Incorporating this essential element into conference planning helps societies deliver meaningful, memorable experiences to stakeholders. Understanding audiences will be critical as societies design their future conferences. Identifying common wants and needs of stakeholder groups can help societies create tailored experiences to meet those needs. Individuals are selective about how they spend their time; learning more about participants' needs and past experiences at your conference can help planners design for improved engagement. What makes a certain conference stand out from the others? What

makes individuals want to come back? Conferences of the future will incorporate user experience design to help build affinity toward the conference and the society, with greater positive impacts on membership and conference attendee retention.

Designing for safety

Sharing knowledge and building community can only happen when participants feel welcome, safe, and protected in their environment. Safety can take many forms. In our current pandemic era, health safety is obviously paramount. But even before the pandemic, physical safety and other forms of harm have been a concern. Societies would be wise to recognize that risk of physical harm can vary among attendees (increased, for example, by local laws, demographic identity, or other considerations) and take steps to mitigate risk to attendees as much as possible. Further, many members of the scientific community have experienced bias, microaggressions, harassment, etc., so that they felt they were not welcomed, accepted, or respected by their colleagues at conferences.

It is an unfortunate reality that some conference participants must take on the burden of designing their conference experience around physical and emotional safety. This burden disproportionately falls on women and people from underrepresented or minoritized groups who face greater risks of discrimination and harassment for bringing their full authentic selves to the conference. Virtual formats may give attendees more options to mute unwanted harassment or quickly log off from uncomfortable situations, but this is not a panacea. Meeting designers can reduce the burden for individuals by integrating safety into the design process from the beginning. This aspect is addressed further in the **Accessibility and Audience Reach** section.

An empathetic perspective is critical when designing conferences for safety. Thinking through each aspect of the conference and forecasting the participant experience will help societies identify safety protocols and engender trust and confidence among attendees. Only by creating policies that ensure a respectful exchange of ideas free from physical and emotional harm and by creating a culture that enforces these rules can societies be sure that their events provide a real forum for education and community.

Designing for diversity, fairness, and equity

To foster an equitable and inclusive environment that appeals to all attendees from all your society's stakeholder groups, consider the composition of the conference organizing committee itself. Does it have diverse representation from among the various stakeholder groups? Is the planning group intentional about assuring that all voices and backgrounds are treated equitably, are represented, and are included as speakers and presenters? Later in the report, we discuss how allowing for more virtual participation in planning committees can help diversify participation by reducing barriers like travel costs and other factors that prohibit travel.

Designing for the environment

By following environmentally sound practices in developing and holding conferences, scientific societies recognize the increasing emphasis on and community support for environmental stewardship. They also acknowledge the important role science plays in caring for the environment.

Efforts may include using LEED-certified spaces and conference centers with strong public-transportation infrastructures. Organizers can limit printing documents by using apps and other technology solutions. They can also leverage local food sources and provide recycling cans. Consider promoting carbon credit purchase options to in-person attendees to help offset participant travel impacts. Exhibitors could be encouraged or directed to only offer giveaways that are more environmentally friendly, for example, avoiding materials that are not easily recycled.

As conferences evolve into a combination of virtual and in-person experiences, our environment will benefit in many ways. Fewer people congregating at an in-person conference means less travel, less physical waste, fewer printed materials, and a lower carbon footprint.

Designing for agility

The conference of the future must be **agile and responsive** to certain but unpredictable changes in our world. Environmental scanning will be an integral part of the planning process for future conferences, helping us to monitor, analyze, and respond with efficiency to external developments such as, for example, visa restrictions, disinformation campaigns, the emergence of new fields and applications, etc. Practicing agility will also help organizers retool quickly in response to immediate and unforeseen developments, such as a global pandemic, government shutdowns, and natural disasters.

Questions to consider:

- How can societies effectively involve volunteers in conference design?
- How can societies get out ahead of conference design with limited resources and real deadlines around holding the next conference?
- How can societies prioritize what design elements to work on first?
- User experience design can be controversial and reinforce stereotypes. How can societies avoid this when creating tailored experiences for stakeholder groups?

Structures and Forms of Convening

This section addresses the different modalities in which societies convene, from traditional distinct in-person events to progressive virtual, distributed, or collocated convening activities. We introduce some potential approaches for societies to consider and draw attention to possible benefits and drawbacks that can result.

Structures of conferences

Conferences have traditionally been organized at single locations at fixed times for in-person experiences. Aside from the global pandemic, movement toward virtual and hybrid events has been fueled by increasing calls for access by those unable to attend in-person events and calls to reduce the carbon footprint of conferences. The shift has also resulted in the inclusion of more attendees and less travel. The pandemic has given societies a real-time lesson in how the format and platform for their meetings affects participation and the way science is shared.

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Traditional in-person conferences have ranged from society-wide ventures with broad audiences to more topically focused get-togethers with fewer attendees. Collaboration and discussion often occurred in post-presentation gatherings, in hallways, and during targeted or chance encounters. They typically included little, if any, discussion time during sessions and presentations, or virtual engagement. Presentations, posters, plenary sessions, and professional development sessions were generally not easily accessible to persons who were unable to attend a particular talk or session or did not attend in person. Available materials were typically print literature, some of which could be found online, including abstracts and proceeding papers.

It must be acknowledged that in recent years many societies have worked to enhance participation and audience reach. Tactics have included engaging via social media, recording select content, livestreaming, using interactive Q&A, enabling the sharing of supplemental content online, and other methods. COVID-19 has compelled societies to accelerate these trends. The main takeaway is that even though scientific conferences have a long history of traditional structure, it is not set in stone and can be changed to reimagine a new future for scientific convening.

Goal alignment

Innovating the structure of the conference of the future will depend on the goals of the society that hosts it. For example, virtual conferences have the potential to help societies trying to reach a wider audience, be more inclusive for presenters and speakers, or reduce carbon impacts. In-person events might be better suited for societies looking to forge connections, especially collaborative or collocated conferences with other societies or with academic and industrial partners. As such, conference formats should be aligned with the organization's overall strategic goals and convening activity objectives.

Session development

Options to develop specific sessions could be implemented organically. Crowdsourced ideas for sessions could be voted on by the society's membership, for instance. The society might also leverage network analysis to identify common topics or research areas for inclusion. This technique involves using tools like machine learning, statistical analyses, data tags, and others to identify who might know whom based on work with other authors, similar areas of research, overlapping areas of research, etc. Conference organizers could also allow the submission of abstracts on new research, and new sessions (or even specialized conferences) might be planned based on those abstracts.

A move toward structuring new types of sessions around discussions held during prior conferences can be achieved with a variety of approaches. To allow more time for multidirectional communication among in-person and remote virtual attendees, presentations could be prerecorded in advance of a physical conference and archived afterward for ongoing reference. Platforms that allow virtual comments to proliferate among attendees before, during, and after the physical conference are another option. This action could also include the ability to interact with not just the presenter, but all the coauthors who contributed to the work, which would be especially beneficial for junior colleagues.

Data on participants' interests, publications, and past presentations could also be collected and used to develop customized sessions and suggested conference schedules for participant groups. Artificial intelligence applications can help streamline this process. Tailoring sessions and unofficial tracks at the stakeholder group level, or even individual level, could especially support those who might otherwise feel overwhelmed by the large number of sessions to choose from.

Artificial intelligence has great potential as a tool, but it is not without possible drawbacks. Algorithmic bias, or lack of fairness that results from the performance of a computer system, is a real threat to people from underrepresented and minoritized groups. It will be important to ensure that AI does not introduce bias and exclusion by tracking people into one kind of session or event.

Location and forms

The pandemic has amplified the need for serious thought about where and how we convene. At the highest level, the future of convening will be omni channel due to participant demand. Omni channel is a cross-channel content strategy in which participants will be able to view content when they want and how they want and engage with whom they want when they want. Extending the ability to engage with the community and content will be critical to ensure the advancement of scientific collaboration.

Accessibility issues for those who cannot easily travel—because of physical or other disabilities, visa issues, family obligations, or financial constraints, for instance—are well known. Conferences of the future will be able to **offer a participant experience outside of a particular destination.** For example, could in-person conferences be run at multiple locations, perhaps even around the world, to allow for international engagement in different time zones? Regardless of whether there are multiple physical venues or one physical venue with integrated virtual participation, this shift presents new logistical and financial challenges for societies but also for convention centers, hotels, and airlines—the whole conference enterprise. (This report discusses business models in the last section.)

Hybrid convening, participation, and challenges

It is reasonable to expect a rise in hybrid conferences in the future. As a result, organizations may see an opportunity for **attendee acquisition** as their reach will be extended. Virtual attendees may be compelled to attend the event face-to-face the following year if the digital experience creates a fear of missing out.

That said, hybrid events could make the distinction between virtual or in-person attendance a false dichotomy. Integrated virtual elements could enhance the in-person experience, for example, by enabling them to view presentations that they missed, by participating in topic-specific virtual networking activities, and so on. Attendees might also choose to attend in person for part of the conference but go virtual for other parts.

Organizers or volunteers who run the hybrid sessions must be adept at using the available tools to navigate the engagement of both in-person attendees and remote ones. Providing training to those in charge of these more complicated sessions could help to better equip those on the front lines to handle challenges that arise.

Field trips out of the convention venue have also been central features in many conferences. Although they have their own accessibility issues, field trips have spurred collaboration and certainly helped to educate and inform participants. Societies must wrestle with how to capture the value of these events for any virtual attendees and for others with accessibility needs.

Fully virtual convening

An entirely new paradigm for convening, fully online and digital, is now clearly possible. It may be feasible, if value and connectedness can be assured, that a fully digital form of conference can be an additional product for organizations to deliver to their communities.

There are some challenges to virtual access over which organizers have little control, such as time zone challenges for synchronous-only events, participants' competing responsibilities (home and work), and reliable access to high-speed internet or adequate hardware and software. Being mindful of these issues when selecting technologies and platforms can help organizers reduce barriers for participation.

Our great challenge

Clearly virtual and hybrid conferences create new demands on conference organizers' staff and budgets. Potential revenue streams are discussed in the **Building a Sustainable Business Model** section that would mitigate the cost of this extra planning, but the workload concerns are very real. Societies must weigh the demands of these efforts when choosing potential methods for integrating virtual participation.

Scientific societies are being called to diversify, to expand access, to meet stakeholder demands for engagement, and to amplify connectivity. This will be our future, and this is the great challenge before us.

Questions to consider:

- People gravitate toward people who share the same interests. How can organizers design conferences to help attendees meet like-minded enthusiasts? How can organizers help attendees break out of their bubbles and engage in comfortable conversations with differently minded people?
- How can organizers better understand the audience experience? What elements of the experience will be different for virtual or in-person attendees? Which elements affect both audiences?
- How can societies ensure that commitments to venues for in-person activities are met and not compromised by digital/virtual offerings? What is the likelihood of in-person attendance being affected by virtual attendance options?
- If presentations and other educational content are free and digital, will researchers pay to attend a conference that is primarily discussion or a series of question/answer sessions? What new systems need to be created to provide free and digital content to the association? What are the opportunity costs?
- What is the right balance for forms of attendance that will bring the most benefit to the most people?
- How will we build and understand the needs of a virtual audience?
- Can the poster presentation experience be effectively reproduced online in content, quality, and quantity?
- Do large groups of presentations need to be accommodated in a finite space and time anymore? Could perpetual posters be the future?
- What limitations do you face by offering your event at a single point in time?
- How does extending the duration of conference content affect the way that attendees engage with your content? Does it make it easier for them to access it? Does it make it harder for them to find dedicated time to review the material?
- How can societies deliver autonomy while retaining and expanding the dialog and the exchange that can result from temporal delivery? While enabling asynchronous exchange and connections? While not compromising the business model of conference registration?

Future of Science Exchange

The pandemic has disrupted scientific conferences for the short term, but the shift to virtual formats has yielded several innovations that could be incorporated into our conferences for the long term. We are learning about greater opportunities for inclusiveness, accessibility, and engagement, creative ways to deliver content through digital platforms, the concept of expanding the traditional duration of a conference, and more. This section presents a few thoughts on approaches that scientific societies might consider to improve the sharing of science and the discourse that results from engaging one's peers.

Our vision is that science exchange will be more broadly accessible—before, during, and after scheduled scientific conferences—and will foster dynamic interactions between presented content and conference participants.

A vision for success – Our desired end-state

Our vision is that science exchange will be more broadly accessible—before, during, and after scheduled scientific conferences—and will foster dynamic interactions between presented content and conference participants. Whichever way one attends a conference (in-person/virtual/hybrid), the experience will be equitable and useful to all participants. Prior to the main live event, participants will have the opportunity to watch any prerecorded oral and poster presentations and pose questions/comments to speakers and other attendees via a platform's designated chat or text function. During the live conference, the focus for sharing science shifts toward engagement, discussions, and networking, all of which have been value drivers for in-person conferences in the past. Interactions between presenters and attendees are free from bias and harassment, and networking is facilitated in ways that make building connections easy among all those participating.

Conferences will offer greater value if attendees can access their content beyond their actual duration. They will be of greater significance to conference sponsors and industrial partners as well, insofar as the use of digital technology and data can be exploited for analytics. Finally, conferences will provide more opportunities to engage with local media and the press, which highlight the advances presented there.

Rethinking conference content

At the heart of achieving the envisioned state of science exchange will be how scientific societies can adapt conference content beyond traditional live, in-person presentations. This section explores tactics for driving the exchange of information more broadly. The following section of this report, **Accessibility and Audience Reach,** will address more specifically how that shift changes the way participants engage with meetings and opens up the conference to new audiences.

Offering asynchronous content

Many scientific societies have had to abruptly shift to completely virtual conferences during the pandemic. These have been successful thanks to technologies that provide both synchronous (live) and asynchronous (recorded) content and engagement. The latter has the advantage of being available on demand. Intellectual property implications of asynchronous content are discussed later in this section.

Oral and poster presentations might be scheduled prior to the physical conference via a digital provider. That would allow the focus of the actual conference to shift toward questions, discussions, and networking, which have been the primary drivers for in-person conferences in the past. As technologies mature and become more pervasive, virtual attendees can increasingly participate in those interactions.

By having more content and networking opportunities available before the event, attendees can watch the lectures and possibly decide which live question and answer sessions they will attend. After the event, societies could make as many recorded presentations available as possible, with questions and answers linked to the video and ways to share ideas. It might help to think of the end goal of conferences as becoming an omni channel with maximum flexibility, with content and engagement on demand.

For conferences held in multiple locations to allow for more engagement, perhaps in different time zones, asynchronous content can be viewed, shared, and discussed at different times. Live feeds and on-site conferences or events that include virtual components can also connect the different spokes of the conference hub.

Alternative ways of presenting

Consider new methods of presenting research results besides talks and posters, including ways that provide greater accessibility for those who are neurodiverse. Interview-style formats and panel discussions are two options. Both can be conducted live at a conference in ways amenable to virtual attendance and later asynchronous posting. Authors could also be invited to create prerecorded

two-minute speed talks as part of the presentation submission packet; those talks could be stitched into trailers that run in the background throughout the conference or between sessions for the virtual audience.

By scheduling content prior to the physical conference, societies can also identify posters and presentations that are popular—not just by looking at which had the most views, but also which ones prompted people to linger longer. That data can help inform the conference schedule by showing which topics are likely to draw the most interest from attendees.

Future conference presentations may include contributions by multiple coauthors rather than one single presenter. While there may be a designated presenter, virtual components could be added to enable interaction with more collaborators or members of the research team. Some societies have already begun to introduce this feature in some form.

Societies may also consider supplementing the conference's technical presentations with nontechnical versions that run outside the session's time window.

Conference tours & demonstrations

Other conference experiences could be made available in ways not previously possible—through tours or demonstrations (whether outreach, equipment, or software demonstrations) that are recorded and available to a broader audience. Virtual reality technologies are maturing and may be able to offer fun, unique, and engaging experiences.

Increasing audience engagement

Multipronged strategies

Using multifaceted approaches to connect the community will benefit on-site and remote attendees alike. Online chat lounges, digital boards displaying social media feeds, and online voting on questions posed for discussion can factor into in-person, hybrid, or virtual conferences alike.

Some attendees may appreciate other forms of communication introduced in the conference setting—the visual arts, poetry, and music, for instance. Those features could certainly diversify audiences and allow for more creative ways to convey information.

Live Q&A sessions can take many nontraditional forms, such as chats with headlining speakers, trivia sessions, online board games, etc. Risk taking and experimenting with various methods of connecting attendees are markers of innovation.

Leveraging technology

In addition to content delivery, technologies could also be used to foster interactions before and after the conference takes place. Anyone chatting online during a session could be prompted via text or email to continue their conversation or to consult repositories of sessions on similar topics.

New, robust technology is currently being developed to help create chance and intended encounters in a virtual space. Twine, for example, is one online tool that pairs people up for one-on-one or team conversations; Gather.town, letslunchpool.com, and Slack are other options that connect virtual attendees.

Opportunities will emerge for using participant data (mined from "my schedule" conference app selections or self-reported "about me/my interests" surveys) as well as artificial intelligence to connect people who are likely to have shared interests in science and more. Making such services opt-in will help satisfy individuals with varying comfort levels about the information they share. Earlier in this report, we noted concerns with algorithmic bias; keeping this consideration top-of-mind when selecting tools and vendors can help planners avoid unintended bias.

Keeping current on available technologies will be an important key to success. This could be very time-consuming, as technologies develop at a rapid pace. Regularly partnering with other societies to share experiences and to coordinate vendor demonstrations about available technologies could help. Be mindful that every new tool brings with it accessibility considerations—*Will it be usable by all participants?*—and learning curve considerations—*How quickly will participants be able to use it efficiently?*

Scheduling considerations

To increase engagement, consider mitigating screen fatigue; this applies to in-person meetings (darkened room with successive presentations) and to virtual (online). Having a diverse range of sessions and presentation formats may help reduce fatigue and provide more consideration for neurodiverse attendees. Breaks in conference schedules can also function as networking opportunities.

Protecting content

A robust plan for protecting participants' intellectual property will be needed. The demand for accessing content beyond the temporal scope of the conference is increasing, but most participants will couple that demand with safe sharing. Societies will have to ensure that researchers' rights are respected and avoid dilution of the society brand where this research was shared. Societies may consider treating recorded content similarly to preprint journal entries and use identifiers such as DOIs to reinforce intellectual property rights.

Leveraging content

Valuable content shared and curated as part of the conference can be preserved and offered to a range of constituents, including society members, other stakeholders, and the general public. Such access can be used to promote the scientific organization, attract new members, and reach new global target groups.

Questions to consider:

- What prerecorded, asynchronous content could be used to engage attendees before conferences and broaden the reach of scientific presentations?
- If attendees have the freedom to watch sessions when and where they want, how can you engage them with their newly found flexibility and ensure meaningful scientific exchange, particularly with presenters?
- How can societies create opportunities for researchers to easily identify possible collaborators across fields and research areas?
- How can conferences help attendees expand their networks beyond their area of research, institutions, and current interests, seeding opportunities for broader collaborations?
- What stories do societies have that connect their research communities and create excitement?
- How can you maximize the positive impact of your conference and raise awareness of the science being exchanged for those in the local region geographically?
- Are there ways that you could partner with other professional societies to foster more interdisciplinary collaboration?
- How can a society ensure that the presenters' data/research results are protected, and fears of scooping are abated?

Accessibility and Audience Reach

This report uses the term “accessibility” in the broadest sense of the word. It includes not only the idea of creating conferences that are accessible to people with disabilities, but also the discussion of engaging a wider network of people who can consume the conference content. The previous section discussed the possibilities of opening up access to content. This section talks about how to engage our audiences more fully, about inviting in new, nontraditional participants, and about sharing the story of our science to an expanded audience and an interested public. This section also discusses how societies can help all members of the conference community feel that they belong. Important considerations for diversity, equity, inclusion, and belonging come to bear. These considerations are not distinct but rather are intertwined with every aspect of the conference.

Similarly, this section’s use of “diversity” is also broad. It includes stakeholder diversity (related to dimensions like career stage, geographic location, economic sector, etc.) and also demographic diversity (related to dimensions like race, ethnicity, gender identity and expression, sexual orientation, people with disabilities, etc.).

Societies can begin by taking stock of the current state of diversity in conference participation: Do your organization’s conferences attract and retain international participants? People from underrepresented and marginalized groups? Early-career members? Students? Public audiences? Examining which audiences are not currently participating can help a society identify barriers. What can be done at the organizational level to make the environment more welcoming and inclusive?

Investigating why diverse groups might not be actively involved will provide societies with an opportunity to engage members from such groups and potentially provide insight about the culture they have cultivated—and how it needs to change.

Broadening participation

Including participants at differing career levels

Going back to the principles of user experience design, organizers could create sample conference schedules tailored for different career levels, such as undergraduates, graduate students, postdocs, early-career, and late-career scientists, to help them structure their meeting experience. These schedules could include nontechnical sessions aimed at the development of soft skills and other professional development activities, as well as networking events for participants at different career stages.

Beyond the discipline

Participants should include everyone who has a role in the value chain that makes science possible and should not be limited to the scientists, engineers, and/or educators who typically make up society membership or the conference audience. These include, for example, scientific equipment suppliers and manufacturers, publishers, innovators outside the discipline creating breakthroughs, interested media and celebrities, and science-oriented politicians, influencers, and advocates who call for action. In other words, participants should include all those who make irreplaceable contributions. And the conference should also include programming that supports their inclusion and leverages or amplifies their contributions.

Generally, it is uncommon to see vendors, members of industry, and those outside a society in such groups. While it is natural for a society to want to keep control over its own conferences, societies may find value in bringing in voices from outside of the organization.

Generally, it is uncommon to see vendors, members of industry, and those outside a society in such groups. While it is natural for a society to want to keep control over its own conferences, societies may find value in bringing in voices from outside of the organization.

Actively seeking varied stakeholder collaborators can increase the value of a conference for everyone. Although practical boundaries would need to be enforced—for example, barring a program from being overly informed by a single company—societies can explore expanding their view from their usual constituencies in the conference planning process. Their participation and

collaboration may produce ideas that might not otherwise emerge. It also encourages industry, academia, and other stakeholders to be more than bystanders. A new partner can add fresh perspective and enthusiasm for new participants to attend the event.

Collaborating with broader stakeholder groups in conference design

In the context of society conferences, inclusion starts with society leadership and the program committee. Conference planning committees typically comprise members with a history of active involvement but who often build their program largely in the image of those that came before. The homogeneity this process engenders can limit new ideas and ways of thinking.

When designing conferences of the future, it's critical to consider the important values of diversity, equity, and inclusion in the planning process. People from underrepresented and marginalized groups could be actively included in conference planning decision-making bodies to advance those goals.

Storytelling

Although research is based on data, storytelling can be a powerful design principle to engage the media and invite the public to learn about our science and expand our audience. Societies can provide training and invite presenters to contribute stories explaining their discoveries and potential real-world applications. These stories could become part of a library of conference content that is available to the public.

Members of the press can help extend the reach of interesting content. Many societies have media programs in place, providing promotion of select presentations that are likely to engender public interest. Such programs are often effective in drawing press coverage. Inviting any presenter to contribute stories or explanations of their work could potentially generate more options for engagement, either by making it possible for staff to flag and promote important research to the media, or by helping the media choose content to promote from a content library.

Building community for all

A vision of the future

This section envisions a future where scientific societies embrace diversity, equity, inclusion, belonging, and accessibility (DEIBA) as fundamental values. By extension, these values are well incorporated in all aspects of their conference operations, spurring greater participation by all.

Including the whole community in DEIBA efforts

Societies can charge conference organizers with engaging scientists with diverse backgrounds and experiences as committee members, invited speakers, and discussion panel members. Professional development sessions can be offered for all current members on broader DEIBA topics and methods for fostering inclusive excellence; those sessions may be held synchronously while being recorded for

later asynchronous dissemination. Topics could include awareness of unconscious or implicit biases, the way power and privilege affect science and the people who do it, active bystander training, how to ally with people from underrepresented and marginalized groups, and how to incorporate inclusive practices. Consider taking a hard look at a broad array of audience-reach metrics. Including the whole of the community is mission critical, as science cannot optimally advance without leveraging all potential brainpower and perspectives.

Any road to success first and foremost requires that societies make pathways to leadership open, transparent, inclusive, and supportive of all.

Pathways to more diverse participation and leadership

Any road to success first and foremost requires that societies make pathways to leadership open, transparent, inclusive, and supportive of all. When filling volunteer positions, leaders often find themselves hard-pressed to identify new members to engage. When open calls for volunteers fall short of filling the roster, leaders often ask themselves, "Who do I know who would do this?" Indeed, seeking out specific individuals and asking them to take on a role is one tactic that works in cultivating new leadership. People often feel more compelled to serve if they are asked. But those not connected to the inner circle obviously miss such opportunities. There are a few ways to help broaden the pool.

For example, societies could step up communication efforts. Societies can start by inviting anyone interested to attend committee meetings, to learn more about the work of the committee and the role it plays in the society. Documenting and publishing information about how anyone can become involved, at the many different tiers of volunteer leadership, is an important step. Examples of relevant information include how to join a committee, how to propose a session or an event, how session moderators, committee chairs, and awards committee members are chosen, and how to become elected leaders, etc. Acknowledging and thanking volunteers is also important for their continued engagement. Providing dedicated leadership development training for volunteers will help them to perform better in their roles while enhancing their own professional development. Including a virtual means of participation in volunteer roles can also help diminish some hurdles.

Conferences have often served as convening venues for various leadership groups, such as executive boards, medals and awards committees, fellowship committees, research advisory groups, and administrative and technical committees. Societies can better enable diversity by allowing members to join and participate remotely. It is important, however, that measures be taken to allow remote participants to fully engage by wholly integrating the digital component, for example, by giving

everyone the opportunity to engage virtually and dialog through that medium.

There are many pathways to accessibility and inclusion. Incorporating the principles of design thinking and user experience design into planning can help societies craft experiences in which participants feel safe, can educate others, and can effectively network with colleagues.

Tactical measures for inclusivity and belonging

Besides offering a regular remote option to conferences, scientific societies can increase the engagement, participation, and the sense of belonging felt by members from underrepresented and marginalized groups with a variety of overtures. Here are a few suggestions, some of which your society may already be doing, some of which may be expansions on your current offerings.

Supporting people from underrepresented and marginalized groups

Targeted support for underrepresented and marginalized groups can include providing physical or virtual space for group events. Raising the visibility of scientists from underrepresented and marginalized groups is another key element of support. One way to do this is to invite people from diverse groups to be plenary or keynote speakers, session conveners, and session presenters. Another is to ensure that nomination processes and award selection committees include diverse candidates, which can positively impact the diversity of those receiving honors at conferences.

Societies can provide targeted support to attendees from underrepresented and marginalized groups. This includes direct support, like offering travel grants to students from HBCUs, MSIs, and tribal colleges, or providing spaces for affinity group events. Societies can provide the technological means to enable these groups to gather in a hybrid fashion at conferences and remotely between conferences. Additionally, societies can engage accessibility experts to help them think through providing supports to people with disabilities.

Making members of underrepresented and marginalized groups a key part of planning and evaluation can make organizing efforts more effective for the entire community.

Because of COVID-19, societies should be aware that the accessibility needs of their community may have changed. Reaching out to the membership and conference community to learn about new difficulties they may face and what barriers may stop them from fully participating in society events can help organizations create solutions tailored to their individual communities and goals.

Societies can involve students and early-career members in the planning of the conference, provide opportunities for them to create their own mini conference within the conference, provide a network of mentors, or offer professional development workshops specific to their areas of interest.

For all of these efforts, making members of underrepresented and marginalized groups a key part of planning and evaluation, with mechanisms in place that allow direct communication with society leadership, can make planning efforts more effective for the entire community.

Supporting policies

Not feeling safe is a major barrier to access. As mentioned earlier, harassment remains a real threat to many members of the scientific community, both at conferences and in the workplace. If conference planners fail to take active measures to prevent harassment and discrimination at their events, they will make it harder for events to benefit from the talents of their entire community. This is not just a moral imperative; lack of safety inhibits the free exchange of ideas that scientific conventions support.

To attract and retain diverse society members and conference participants, clear policies that govern behavior, such as codes of conduct and antiharassment policies, are necessary. Consider multiple ways of promoting these policies to attendees throughout the conference, such as through flyers with QR codes, in the program, through the conference app, etc. These codes of conduct and antiharassment policies will need to apply to all conference formats, whether in person, virtual, or hybrid. Note that most existing codes and policies may likely need to be reviewed and updated, as virtual components of conferences present specific challenges. For example, guidance should be clear about what is and is not allowed to be posted in virtual rooms by attendees.

Antiharassment policies and codes of conduct only work when enforced; simply stating that the society is against harassment and discrimination is not enough. As such, societies might also need to review their related reporting, investigation, and response protocols so that they are clear and understood by all and so that those responsible for investigations can address concerns quickly and carry out their work with integrity. Consider establishing a dependable and knowledgeable point person or office to handle investigations and determine what steps are to be taken, depending on the complaint.

Conduct policies that extend to awards and recognitions, journal article publication, and beyond to broaden accessibility to other society offerings. Other practices can support accessibility as well. Examples include being clear on how participants'

identifying information will be shared with other attendees and using name tags (physical or digital) with affiliation and the option of preferred pronouns for all conference attendees.

Sample AIP Member Society conference codes of conduct and antiharassment policies can be found on AIP's website. The Societies' Consortium on Sexual Harassment is a resource for model policies. Though currently available only to member organizations, the consortium plans to share these policies more broadly. Also see the **Additional Resources** section at the end of this report for more sources of materials.

Other barrier-reducing efforts

Some societies have created support programs, such as groups of identifiable volunteers who are able to provide an attendee with support, advice, information, or physical assistance as confidentially as possible. Such programs can be successful only when coupled with consistent volunteer training that is updated regularly.

Conference organizers can draw on design thinking to consider which accommodations might positively impact different groups. "Quiet rooms" where people, especially neurodiverse individuals, can rest and recharge could benefit attendees, as could separate lactation rooms, and gender-neutral bathrooms. For all these types of accommodations, consider multiple options scattered across the convention area, especially for conferences with large footprints.

Scientists presenting at poster sessions can be especially likely to experience harassment, as these are largely unmonitored events. When societies shift back to in-person conferences, organizers might rethink poster-hall layouts and whether to post antiharassment signs. Poster halls are also very densely populated and difficult for those with physical disabilities and/or who are neurodiverse. Triangle-shaped hubs of poster boards placed around the room provide more space for movement, although admittedly, there can be a tradeoff with less poster space.

Safety is also about being able to interact with colleagues and feeling welcome, accepted, and respected. Those feelings may be threatened by society culture. Does your society's culture embrace all participants? What might your society regularly recalibrate to develop a continuously more welcoming, inclusive culture?

What virtual engagement means for accessibility

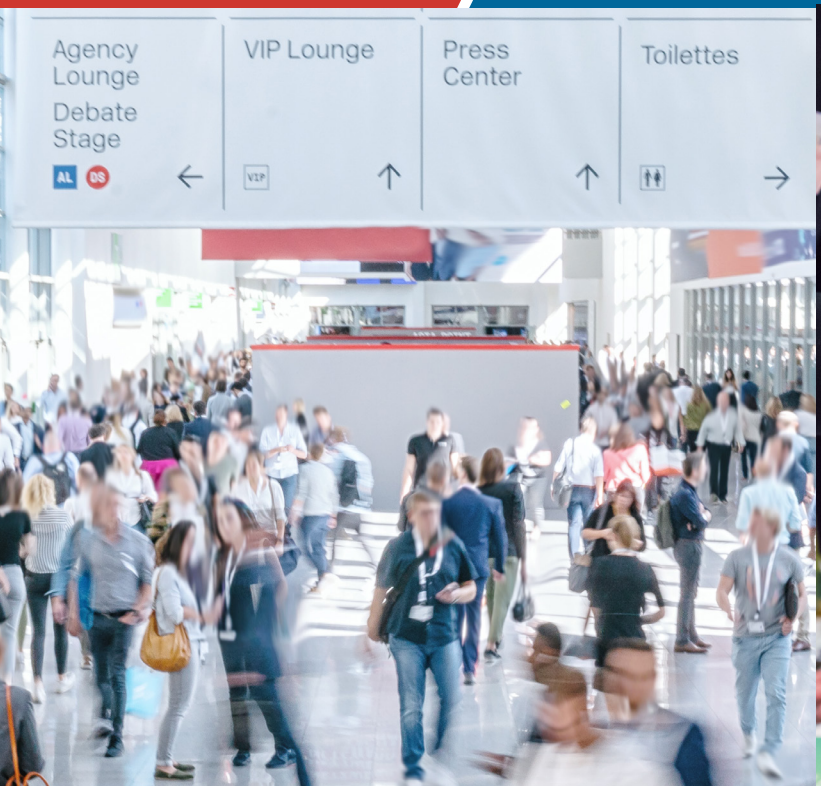
One of the most impactful ways for societies to address accessibility concerns is to continue offering regular remote access to conferences. Virtual participation provides remote access to conferences that is more flexible than in-person conferences and reduces many of the previously mentioned barriers to participation. It can lower the overall cost of attendance, potentially with registration but certainly with travel costs. Virtual participation provides

opportunities for engagement for those who cannot or find it difficult to travel due to personal reasons or limitations. Closed captioning may be available to people with hearing loss, and translation services may be available to international attendees in a way that is difficult to do in person.

Most importantly, from a mission and reach standpoint, virtual participation opens the conference to a much wider audience. Beyond the science community, conferences could welcome public audiences (both local and remote) to participate in innovative ways—via virtual public lectures, tours, and remote demonstrations, for instance. New opportunities for increased access abound.

Questions to consider:

- Do your organization's conferences attract and retain international participants? People from underrepresented and marginalized groups? Early-career members? Students? Public audiences? Is the culture of your conference welcoming to all?
- Who are the decision makers for your conference design and program planning? Are they from diverse backgrounds? Do any have expertise in DEIBA? Do they have authority?
- What can be done at the organizational level to make the environment more welcoming and inclusive for conference attendees?
- Does your society's culture embrace all participants and continuously consider how to evolve its culture to do so?
- Has your society considered the many types of diversity that our members bring and the ways that people who identify with multiple marginalized identities experience our conferences?
- Has your society considered and addressed the ways that bias can be present in a virtual environment?
- Are your society's codes of conduct and antiharassment policies robust and up to date? Are there any gaps? Are they accessible to your attendees in digital and physical formats?



Conference Partnerships

The power of partnership is well known to most societies that collaborate with each other or with outside organizations to achieve their aims. Yet societies often treat traditional conferences as solo endeavors, and their insular approaches are potential barriers to optimizing the value of their conferences. This section focuses on how societies might engage all types of partners—sponsors, exhibitors, industry, academia, and other societies—to create a more beneficial conference for all involved. Fundamentally, these groups are and will be valued stakeholders and potential partners, not just passive participants.

Collaborations

Our approach to partnership in this section is purposely broad. It encompasses not just sponsors, exhibitors, and industrial representatives who are often engaged to help fund a conference, but also academia, other societies, and research organizations. For those groups to become partners in the truest sense, they must participate in ways that go beyond financial transaction. Identifying synergies where each partner will benefit can set the stage for a successful collaboration where all parties benefit.

How should that be achieved? How can the integrity of the scientific program be preserved while still welcoming those with special interests? Most importantly, what kind of partnerships benefit attendees most? No single answer fits all cases, but there are perspectives to consider.

Acknowledging the challenges

Traditionally, scientific conferences have been single-society events developed through the effort and commitment of volunteer members serving on the program committee(s). Joint or shared conferences can run quite successfully; such collaborations can be mutually beneficial, but they are not without their challenges. Partnering societies must share benefits and liabilities, be prepared to potentially lose constituents to the other organization, and must negotiate the conference's design. Those complications have remained obstacles during the move to virtual events.

In recent years, exhibiting industry partners have noted their decreasing returns on investment at physical conferences, where a sea of booths in a confined space does not often generate the leads a company desires. Virtual conferences have not fared better. Most virtual attendees have little motivation to visit virtual booths. Without the draw of live demonstrations, serendipitous networking, and social events that often occur in the exhibit space, virtual exhibitors are hard-pressed for engagement. Early experiments have shown the limitations of virtual halls, and recent experience with live events suggests that the exhibitor role is ripe for a refresh. The challenge before us is developing a new paradigm for collaborative value.

Partnering with other societies

Societies can work together to preserve a conference's value for themselves and still improve the experience for partners. The collaboration does not have to result in a joint conference; it can start small. Societies might agree to offer reciprocal attendance or discount prices to each other's members. "Sister" societies in similar fields are likely to see more obvious benefit, but collaborations between interdisciplinary societies could potentially bring more value by encouraging cross connections that may not have occurred otherwise. The same is true for co-promotion and co-advertising of events.

Societies can also explore combining elements of their conferences—whether virtual, in person, or hybrid—with other associations. For instance, a consortium of societies might host a common career fair or a joint poster gallery, benefiting from the economy of scale but also sharing content across communities. By entering into agreements with venues and vendors as a buying consortium, collaborating societies can also provide negotiating muscle and enjoy the financial discounts.

Perhaps the most advantageous collaboration is the simple act of sharing information—about a society's event experiences, members' opinions, and best practices. Certainly, many groups have learned from each other during the pandemic about how to pivot to virtual events, with both formal and informal forums being created to bring event organizers from various societies together. It would behoove the science community to continue that practice post-pandemic.

Thinking broadly about partnerships

Identity-based groups

To advance the DEIBA objectives of a society, organizers could consider actively seeking out mutually beneficial partnerships with minority-serving institutions, women- and minority-owned businesses, and identity-based scientific professional societies (e.g., the National Society of Black Physicists).

Beyond the booth

Improving the value of conferences for corporate sponsors and vendors can further enhance the important role those groups play at scientific society conferences.

To develop new sponsors and sources of conference revenue, why not ask representatives from industry what problems they are seeking to solve?

To develop new sponsors and sources of conference revenue, why not ask representatives from industry what problems they are seeking to solve? Going back to the prior discussion on user experience design, sponsors and exhibitors might be given specific attention by event organizers to understand and try to meet their needs for an optimal conference experience. For example, do they desire branding and name recognition? Better connection with attendees? Help with product demonstrations? More on-site sales, etc.? Different needs will require different approaches from societies.

Most critical may be including exhibitor representatives in networking events and providing them with the ability to hold one-on-one meetings. Event organizers can devise a system of applying analytics to capture traffic and visitor data at physical booths and their virtual counterparts and use this data to inform the artificial intelligence solutions mentioned earlier. The results would also be useful in understanding the exhibitor's relevance to most attendees.

Just as asynchronous content can be used to extend the reach of scientific content, exhibitors have the potential to enhance their outreach. Recorded demos and information sessions can be used to reach potential consumers, and societies can extend the vendor/participant connection opportunities beyond the duration of the conference. Virtual platforms can often provide flexible advertising packages to exhibitors and sponsors that are not limited by the physical and time constraints of an on-site event.

Academia

Scientific societies have always had a symbiotic relationship with academia, with both focused on disseminating and advancing the state of knowledge. At many scientific conferences, academics make up the vast majority of conference

attendees. However, institutions of higher education are often courted as vendors, or participants in a graduate school fair, rather than as stakeholders seeking more advantageous partnerships.

Universities are well suited to provide event space, lodging, and technological resources for smaller society conferences that do not require convention centers. In hybrid conferences, in-person attendance is likely to shrink along with needs and expenses. In addition to cost savings, academic partnerships will strategically connect university researchers with societies and help both during a period of financial uncertainty.

Questions to consider:

- How can scientific societies overcome the reluctance to build partner conferences in the future?
- Could societies explore membership and conference fees that allow for reciprocal access at multiple events?
- What might peer review and common calls for abstracts look like across societies?
- What does corporate social responsibility mean in a virtual environment? In a hybrid event that combines virtual and in-person events, how can one engage with local venues?
- What will career fairs, exhibits, and recruitment look like in the future? Are there ways for them to flourish in a virtual environment?

Building a Sustainable Business Model

Like publications, conferences serve to communicate and share research news among members. They are also a vital source of revenue, critical to the success of many societies. Conference revenue often funds other aspects of a society's work, such as policy, outreach, education, and development.

By and large, societies will be well served by adopting a multifaceted approach to revenue generation, which can help stabilize the business model.

Accessing more data

The typical business model in a society has been to collect revenue through attendee registration and exhibitor registration fees; speaker, abstract, and poster fees; and sponsorships. Other financial returns are sometimes garnered through volume discounts on hotel room rates and subsidies from visitors bureaus. Grant funding from government agencies may be occasionally available as well.

That model has served societies well for years. But as content has become more diversified and preserved in online archives, a growing need has emerged for access to information beyond the confines of traditional in-person conferences. That need presents an opportunity: Providing easy access to old content and new data is a potential source of revenue.

New exhibitor and sponsorship opportunities have likewise emerged with the recent shift to more virtual-conference components. The new income can be used to fund various aspects of a society's mission, including initiatives that allow students and early-career researchers to participate in conferences more easily.

The conference can be more than a single ephemeral event.

Recipes for success

Our vision is for more diversified approaches to revenue generation beyond various registration fees. The conference can be more than a single ephemeral event. Seeking funding from more groups and across different channels before, during, and after the conference can lighten the financial load for individual attendees and make conferences more inclusive in the process.

As the pandemic rolled out across the world, organizations moved nearly uniformly to a fully digital, online conference model. What was not so uniform was the approach to pricing. Some organizations sought to capture the same revenue as in-person conferences and left registration rates at the same level. In some such cases, attendance suffered; in others, the price had no bearing on attendance. Many societies provided substantial discounts and, in some cases, free access.

Granted, this move was largely intended to be a temporary solution. Costs for delivering a virtual conference are real and quite substantial for hybrid models. It is a challenge for societies to raise awareness about the costs associated with these models; the technological and staff investments are significant. Online does not mean free, and that has been difficult for some to grasp. Some organizers have expressed doubts that fully digital virtual conferences will be able to capture the same level of revenue as in-person conferences. Conferences can be financially successful if managed carefully. The digital content produced from in-person conferences can produce revenue before the conference, with early-access fees to prerecorded content, and afterward, with long-term access to newly recorded content.

Likewise, financial sustainability is not just about creating new revenue channels but about lowering costs as well. As noted in an earlier section, societies can work in partnership with others to reduce administrative and technological costs and achieve economies of scale. At the same time, societies will need to maintain focus on their overall mission and service to end-users as they maximize revenue.

Providing easy access to old content and new data is a potential source of revenue.

Reaching for the future

Societies stand to benefit from a diversification of tactics in their business models, and the right mix will look different for every society. Choice of approaches will rely on the presence of industrial and corporate sponsors and whether the conferences are meant to break even or to generate enough money to fund other activities. The suggestions outlined here can apply to in-person, virtual, and hybrid conferences.

Modular customization

Historically, registration fees have been tied to the on-site experience and thus shared by the relative few who could make the trip to the event. By introducing a virtual component to conferences, costs can be spread among a greater audience. That includes users who would never have been able to attend the on-site event, as referenced in our section on accessibility.

In a virtual environment, there are also greater opportunities to create more modular conference tracks and associated modular pricing. As noted in the previous section, customized sessions and conference tracks tailor the conference experience to individual needs. Individuals who might not otherwise attend a conference might be interested in partial attendance. For example, some might be interested in just keynote addresses or discussion panels, others in only science content, and others only the exhibition or networking features. Many societies already offer flexible

registration options, but there is more to explore here. Business models that take advantage of modular options could potentially capture a greater audience and generate more revenue.

An even greater potential can be achieved by extending access to conference content such as recorded presentations, discussion panels, and poster sessions, beyond the fixed number of days required for an on-site event. A society's overall recorded holdings may reside in an online library or in a communal database along with the holdings of other societies. Collaborative platforms that provide access to the repository could be made available through a variety of licensing models—pay-per-view for single items, such as a keynote presentation, or an annual subscription to a growing content library, or a one-time purchase of a full conference's contents. As discussed before, intellectual property rights will factor into any sharing platform devised by a society.

Value-based pricing

Some societies have begun looking at a pricing strategy that sets prices for conferences primarily according to the perceived value to the participant, rather than according to the cost of delivering the conference or historical price schedules. As opposed to looking inwardly, value-based pricing compels the society to better understand its stakeholders.

Sponsors, exhibitors, and industry

Efforts to attract sponsors, exhibitors, and other industry partners will need to go beyond efforts to simply reproduce the physical conference exhibitor space with an online duplicate. As discussed in the **Conference Partnerships** section, more consultation with these stakeholder groups could help identify ways to deepen engagement and make their contributions a more meaningful part of the overall conference experience for mutual benefit. Like societies and conferences themselves, different sponsors and exhibitors will have different aims.

Education and training

Certain aspects of traditional conferences have enduring appeal and generate income, such as offering short courses for continuing education. However, soft skill development might have untapped potential. Managerial skills, budgeting, project management, and working in or leading a team are often required skills for career growth but not necessarily part of a scientist's formal education or training. Societies stand to better serve their memberships and stakeholders by offering such professional development trainings and can diversify their revenue streams in the process. Virtual platforms can provide access to short courses and training by a nearly unlimited number of attendees at a significantly reduced cost.

Membership opportunities

Societies can leverage conferences to attract new members by casting a wider net and including nontraditional attendees, such as scientists and engineers working

in small companies, those in other fields that interface with the science community, and science enthusiasts. Societies can also leverage conferences to introduce first-time attendees, often students and early-career individuals, to the benefits of society membership, including networking, educational resources, and a connection to a broad community of scholars. For nontraditional audiences, consider new benefits especially designed around their interests and needs.

Questions to consider:

- What are the appropriate pricing models for conference information—in person, virtual, or hybrid?
- What considerations—for example, licensing of intellectual property—should be made when recording and sharing conference content, potentially for revenue to the society?
- How can societies that have been providing conference recordings and supplementary material online for free switch to charging for these features?
- How do scientific societies ensure the compliance of attendee and speaker data and recordings with the EU's General Data Protection Regulation?
- As an organization, what are the other disruptors related to your current business model?

Conclusion

The COVID-19 pandemic has forced the scientific community to break out of our molds and provided us opportunities in the virtual-conference arena to solve problems in fresh ways. Yet with the immediate need to go virtual with our conferences, there was little time to think creatively. Now that the scientific community has gained experience with new ways of convening, we can build on this great potential for our future, forging new ways to share science and build community in ways that are accessible, equitable, and grounded in excellence.

The changing demands of our stakeholders are compelling us to envision the possibilities for tomorrow. It is possible, and imperative, to construct new methods of convening that serve stakeholders from all positions and backgrounds. Conferences and meetings have been a cornerstone of the scientific enterprise for generations. The future of association convening will build on that legacy and translate what we have learned from these game-changing times into a brighter way forward.

Additional Resources

Section 1: Fundamental Elements of Scientific Conferences

Brown, Tim (2021 March 30). *Design Thinking Defined.* IDEO. https://designthinking.ideo.com/

International Design Foundation (2020). *What is Design Thinking and Why Is It So Popular?* Retrieved from https://www.interaction-design.org/literature/article/what-is-design-thinking-and-why-is-it-so-popular

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Appendix: Innovative Meetings to Consider

Although the Letter Report focuses on the future of scientific convening, present meetings can provide inspiration for innovative ways to bring communities together. Our panelists have identified several events that have facets event planners might consider as they prepare for the next two to five years of conferences.

Not every conference listed achieves the full vision of this report. Not every conference listed is related to science, as there is much to learn from meetings outside of the academic space. Some of the innovative elements we have observed are not unique to a single meeting or society—these events are examples of a broader concept. Far from an exhaustive list, these examples can provide new perspectives and more concrete examples of how scientific convening can be reimagined.

Examples from Scientific Societies

AGU Chapman Conferences

Description: "Chapman Conferences are interactive, turnkey meetings focused on solving challenges in a specific scientific field. Chapman conferences can be held virtually, in-person, or as a hybrid conference. These transformative conferences should be goal oriented, and conveners should consider alternative session formats as well as brainstorming sessions and team exercises to stimulate outcomes during and after the meeting. Conveners are responsible for scientific planning and programming. AGU team members offer logistics and organizational expertise. Proposals are reviewed four times a year by AGU scientists who provide feedback to conveners."

What's interesting? These one-off topical conferences are based on proposals from the field and typically attended by about 100 people, held over several days. The format allows for deep focus on a specific topic and showcases a distributed model of responsibility where individual scientists have the freedom to experiment and tailor a presentation to their needs, with guidance and support from the society staff.

Conference for Undergraduate Women in Physics

Description: "APS Conferences for Undergraduate Women in Physics (CUWiP) are three-day regional conferences for undergraduate physics majors. The goal of APS CUWiP is to help undergraduate women continue in physics by providing them with the opportunity to experience a professional conference, information about graduate school and professions in physics, and access to other women in physics of all ages with whom they can share experiences, advice, and ideas. The national and local organizing committees of APS CUWiP strive to create a welcoming environment for all, including undergraduate women and gender minorities. A typical program will include research talks by faculty, panel discussions about graduate school and careers in physics, presentations and discussions about women in physics, laboratory tours, student research talks, a student poster session, and several meals during which presenters and students interact with each other."

What's interesting? CUWiP is made of several regional annual conferences, with events scheduled so that all participants in all regions can join in simultaneously. They make efforts to build community, including a quick video chat to take a "group" picture of all the regional meetings together, and drive home that this is one event in many places. This format allows for a larger

number of attendees with reduced travel and registration costs and diverse tours, speakers, etc., based on location. Other societies can copy this format to reduce travel and registration costs while increasing overall reach.

American Public Health Association Annual Meeting

Description: "The APHA Annual Meeting and Expo is the largest annual gathering of public health professionals. Thousands of people attend, and thousands of new abstracts are presented each year, making the APHA Annual Meeting the most influential meeting in public health. In addition to the Annual Meeting and Expo, we bring the public health community together with our Policy Action Institute, which features elected leaders and policy experts in the public and private sector inspiring us with ways to put policy in action to improve community health. And we host other events throughout the year."

What's interesting? With a large membership of more than 25,000, spanning science to government to advocacy, the Annual Meeting's approach to "special" sessions allows various proposals to link together under subthemes in a way that connects disparate audiences.

Society of Women Engineers "WE 20"

Description: "For more than six decades, SWE has given women engineers a unique place and voice within the engineering industry. Our organization is centered around a passion for our members' success and continues to evolve with the challenges and opportunities reflected in today's exciting engineering and technology specialties. We promise that the strong, diverse women that you meet and learn from will leave you feeling personally inspired and reinvigorated to take on the world."

What's interesting? After moving to a virtual format, the length of the meeting expanded in multiple ways. Actual sessions were spread over two weeks, compared to the typical one-week span for the physical meeting. Session materials are now available for up to one year, unlinking the conference from a single point in time.

Conference organizers also employed gamification, gathering data on how attendees engaged with conference content and publicizing achievements with badges and recognition throughout the conference. The event made it easier to access content and celebrated attendees who engaged with the conference materials.

Examples from the Broader Scientific World

Gordon Research Conferences

Description: "The Gordon Research Conferences provide an international forum for the presentation and discussion of frontier research in the biological, chemical, physical, and engineering sciences and their interfaces. GRC is a nonprofit organization dedicated to building communities that advance the frontiers of science. Our conferences bring a global network of scientists together to discuss the latest pre-publication research in their field. GRC's unique format focuses on discussion and provides conferees with the opportunity to network informally during free afternoon times."

What's interesting? These small conferences showcase a radically different way of convening the scientific community. Typically, an intimate group of 30–50 people meet in a retreatlike format and focus on a narrow topic. This intentionally curated community serves as a great opportunity to engage world experts on particular issues.

Science Foo Camp

Description: "Foo Camp is an informal conference format pioneered by O'Reilly Media, a leading book publisher and event organizer in the field of information technology. There is no predefined agenda, instead attendees collaboratively create one from start to finish the first evening, with little if any boundaries to what can be discussed. Since the first O'Reilly Foo Camp in 2003, these events have become legendary and much imitated, leading to the first Science Foo Camp in the summer of 2006."

What's interesting? Science Foo Camp changes the structure of the traditional meeting. It has no fixed agenda and places more emphasis on discussion and networking than on the traditional series of talks and one-way transfer of information from high-level attendees to newer attendees.

This is a concrete example of the "unconference" approach, which flips the traditional model of having much of the time and focus be on formal presentations, which is then followed by short opportunities to ask questions or network. In this new approach, the focus is on the discussion and networking. This could be translated easily into a virtual or hybrid event where talks are prerecorded, and the actual meeting can focus on in-person discussion on those talks which attendees have already viewed.

Climate Summit

Description: "To accelerate climate action in the short term, the Midwest Climate Summit is structured as a two-part event, with a series of virtual keynotes and workshops in Fall 2020 (the Think Tank) that will set the stage for a recognition of the new commitments and increased ambition of Summit partner organizations in Spring 2021 (the Summit)."

What's interesting? Funded by the Bloomberg Foundation, this two-off event (workshops in November 2020 and larger Summit in April 2021) includes participants from across sectors (academia, NGOs, municipalities, students, activists), with a focus on Midwest solutions to climate challenges. This unique event is focused on a specific topic, in a constrained time frame, concentrating on regional aspects of an international program. This type of event could model how regional groups or areas that make up a relatively small part of a society can function in a virtual world.

Examples from Culture

SXSW

Description: "Featuring a variety of tracks that allow attendees to explore what's next in the worlds of film, culture, music, and technology, SXSW proves that the most unexpected discoveries happen when diverse topics and people come together. With one unified conference spanning different tracks of programming, you'll find more opportunities for networking, learning, and discovery than ever before at SXSW."

What's interesting? This event was created as a way to bring attention to a specific topic (musicians) in an outlier area (Austin) by inviting highly acclaimed musicians and people related to the music industry into their city. At many societies, some constituent groups feel disenfranchised from the main functioning of the group. Can the concepts that made SXSW so successful be applied to elevating our disenfranchised constituents?

Burning Man

Description: "The mission of Burning Man Project is to facilitate and extend the culture that has issued from the Burning Man event into the larger world. Burning Man Project will bring experiences to people in grand, awe-inspiring and joyful ways that lift the human spirit, address social problems, and inspire a sense of culture, community, and civic engagement."

What's interesting? In addition to the notable physical design that has evolved for the event, several elements of their ethos are interesting, as the scientific community looks at how to make meetings sustainable. That includes their principles of radical inclusion, where anyone can attend and participate with no gatekeepers, as well as their values of decommodification and self-reliance.

TEDx

Description: "TEDx is a grassroots initiative, created in the spirit of TED's overall mission to research and discover 'ideas worth spreading.' TEDx brings the spirit of TED to local communities around the globe through TEDx events. These events are organized by passionate individuals who seek to uncover new ideas and to share the latest research in their local areas that spark conversations in their communities. TEDx events include live speakers and recorded TED Talks, and are organized independently under a free license granted by TED. These events are not controlled by TED, but event organizers agree to abide by our format and are offered guidelines for curation, speaker coaching, event organizing, and more. They learn from us and from each other. More than 3000 events are now held annually."

What's interesting? Through the TEDx format, any organizer around the world can plan and hold a meeting. TEDx can teach societies how to maintain a brand reputation using a uniform set of guidelines and parameters for planning, organizing, and conducting a meeting. Societies can also learn how to facilitate and accelerate communities of shared knowledge who can participate live in a smaller event based on their topics of interest and be connected to others across the globe.

Examples from Industry

C2

Description: "C2 Montréal is the most forward-thinking business event in the world. Named best conference four years running, C2 is much more than just simply a conference. We combine progressive and inspiring content in a highly creative, festival-like setting that will blow your mind. At C2, guests transform into active participants who aren't afraid to dive right in. C2 is for business leaders who want to lead the pack."

What's interesting? Similar to SXSW, C2 continues to attract the most innovative and inspiring speakers. It has created a place for experimentation and experience. The community is spectacular and can be an example of how to fully engage diverse audiences.

This event experiments and tries new things. Often organizations get stuck in the same agenda, the same way of doing things. C2 creates a multisensory experience each year in Montréal and attracts a diverse group of thinkers and innovators. This event not only fosters unique learning opportunities, but it also helps create and /foster meaningful, impactful and meaningful one-on-one meetings.

Dreamforce

Description: "Dreamforce is an annual four-day event that brings together the entire Salesforce community. It's an experience that celebrates Trailblazers and customer success. Dreamforce is where Trailblazers from all over the world gather to share their stories, their successes, and learn from each other. Started in 2003, Dreamforce has grown into more than a conference—it's an experience like no other. From inspiring keynotes and sessions to visionary thinking to discovering the future of technology to actually changing the world, it's an empowering four days."

What's interesting? Dreamforce is a conference by Salesforce (a customer relations program for companies with software-based services). Prior to the pandemic, they made a VERY cohesive experience; the theme was emphasized throughout the conference, and they were able to bring that cohesion to their 2020 virtual conference. They sent out swag bags and badges beforehand to bring an immersive experience home for the attendees. They also hosted virtual talks and networking events after the conference.

Audio Engineering Society (AES) Show, Fall 2020

Description: "Created by the industry, for the industry, as a non-profit volunteer-based organization, designed to inspire, educate and promote the technology and practice of audio, by bringing leading people and ideas together. AES events are the industry benchmark in education, innovation and networking."

What's interesting? The meeting offered a unique "field trip experience" that gave participants virtual livestreamed tours of famous recording studios from around the world. Such an event could not have happened outside of the virtual space, showing how a digital format can create unique experiences and make materials more accessible. Anecdotally, attendees who had not attended the physical meetings in decades were enticed to join in the virtual conference, partially due to the lower barrier to entry.

AIP Panel on the Future of Association Convening: Envisioning for The Sciences (FACETS)

Chair

Christine McEntee
Principal, CWMcEntee LLC, Former CEO, American Geophysical Union

Members

Linda Allen
Director of Scientific Meetings, American Physiological Society

Gabriel Filippelli
Editor-in-Chief, GeoHealth

Amandeep Gill
PhD Candidate, University of Nevada, Reno

Lauren Kane
Chief Strategy Officer, Morressier

Alex Lazinica
CEO, Underline

Kevin B. Marvel
Executive Officer, American Astronomical Society

Jamie Murdock
Managing Vice President of Sales, Maritz Global Events Company

Brian Papa
Associate Executive Director, American Meteorological Society

Lily Wang
Professor and Associate Dean for Faculty and Inclusion, College of Engineering, University of Nebraska – Lincoln

Staff Liaisons

Liz Dart Caron, Chief of Staff, American Institute of Physics
Frank Graeff, Member Society Liaison, American Institute of Physics
R. Mark Wilson, Senior Associate Editor, *Physics Today*

Consultation Group

Other experts who consulted on report drafts and provided additional commentary and insights for the panel's consideration:

Jen Ives, Associate Director of Meetings, American Meteorological Society
Seth Kahan, Founder & CEO, Visionary Leadership
Donna Kastner, Managing Director, Enlighten 123
Jason Maxey, 2018 Conference Organizer, The Society of Rheology
Lauren Parr, Vice President, Meetings, American Geophysical Union
Vanessa Bridges, Meeting Planner, American Institute of Physics
Rachel Ivie, Senior Research Fellow, American Institute of Physics
Arlene Modeste Knowles, TEAM-UP Program Manager, American Institute of Physics

Panel Member Brief Biographical information

Christine McEntee (FACETS Chair), Principal, CWMcEntee LLC, Former CEO, American Geophysical Union

For more than 25 years, Christine McEntee has made her mark as an association leader and innovator, guiding some of the most prominent membership organizations through reinventions in governance, membership, programs, public policy, and outreach. Most recently she served as CEO of the American Geophysical Union, a leading professional global scientific society that annually serves over 100,000 Earth and space scientists. Prior to that, McEntee served as the chief executive at the American Institute of Architects and the American College of Cardiology following her tenure as the executive vice president of the American Hospital Association.

Long active in the not-for-profit organization community, McEntee has served on numerous boards, is an ASAE fellow, and has been recognized with numerous awards, including the CEO Update Professional CEO of the Year, Crain's Chicago Business Under 40 Movers and Shakers, and ASAE's Women Who Advance America Award. She is a regular spokesperson to the media and professional audiences.

Linda Allen, Director of Scientific Meetings, American Physiological Society

Linda Allen serves as Director of Scientific Meetings at the American Physiological Society. Her passion for physiology fuels a desire to create collaborative events that facilitate scientific discovery to improve human and animal health. A core tenet is that the scientific meeting experience must bridge searchers and seekers through intentional design. Linda cofounded the MoCo Meeting Planners Group, a basic science planners forum, as a vehicle to improve scientific meetings through emerging technologies and design.

Gabriel Filippelli, Editor-in-Chief, GeoHealth

Gabriel Filippelli is a Chancellor's Professor of Earth Sciences, a courtesy Professor of Global Health, and directs the Center for Urban Health at Indiana University. Filippelli is a biogeochemist with broad training in climate change, exposure science, and environmental health. Filippelli has published broadly, including publications in Science, Nature and Geology as well as in specialty journals and in popular press. He has personally directed over $9M of research funding over his career and is currently a co-PI on the $55M Indiana University Prepared for Environmental Change Grand Challenge initiative. He is the editor-in-chief for the journal GeoHealth, published by the American Geophysical Union. Filippelli is a fellow of the International Association of Geochemistry and former National Academy of Sciences Jefferson

Fellow, where he served as a senior science advisor for the State Department, with a policy portfolio including Science Cooperation in the Arctic, and Antarctic climate change.

Amandeep Gill, PhD Candidate, University of Nevada, Reno

Amandeep Gill is a PhD candidate at University of Nevada, working with Dr. Alla Safronova on theoretical high-energy-density plasma physics. She currently serves on the SPS/Sigma Pi Sigma Physics Congress Executive Planning Committee. Her past work includes serving as the SPS associate zone councilor for zone 18, vice president of external affairs of the Nevada graduate student government, and as western regional vice chair of the National Association of Graduate-Professional Students.

Lauren Kane, Chief Strategy Officer, Morressier

Lauren Kane is chief strategy officer of Morressier, providing virtual-conference solutions for professional and academic organizations and a platform for critical early-stage research. Prior to joining Morressier, she served as CEO of the strategic consultancy Delta Think and COO of the nonprofit scientific publisher BioOne. With 17 years in scholarly communications, Kane has extensive experience working with societies, research organizations, and publishers to effectively navigate the evolving market landscape. A frequent industry contributor, Kane proudly serves as the 2020–2021 president for the Society for Scholarly Publishing (SSP). She holds a BA from Georgetown University and an MBA from the University of New Hampshire.

Alex Lazinica, CEO, Underline

Alex is an experienced CEO, engineer, and robotics/AI scientist, with expertise in business development and building organic distribution channels. He is also a pioneer of the Open Science movement, and cofounder and chairman of the board of IntechOpen, the world's largest publisher of open access scientific books. After obtaining a master's degree in mechanical engineering, he continued his PhD in robotics at the Vienna University of Technology. There, he worked as a robotics researcher within the university's Intelligent Manufacturing Systems Group, as well as a guest researcher at various European universities, including the Swiss Federal Institute of Technology Lausanne (EPFL). Alex published more than 20 scientific papers, gave presentations, served as a reviewer for major robotics journals and conferences, and cofounded the International Journal of Advanced Robotic Systems, the world's first open access journal in the field of robotics. This was a pivotal point in his career, as it was the pathway to the foundation of IntechOpen, with its focus on addressing academic researchers' needs. Alex personifies many Underline and

IntechOpen key values, including the commitment to developing mutual trust, openness, and a spirit of entrepreneurism. Today his focus is on defining the growth and development strategy for Underline.

Kevin B. Marvel, Executive Officer, American Astronomical Society

Kevin B. Marvel has served as the executive officer for the American Astronomical Society, the largest professional organization for researchers in astronomy and related disciplines, since July of 2006. He began work with the AAS as associate executive officer for public policy in 1998, establishing the society's public policy program, and became deputy executive officer in 2003. Before taking up a position with the American Astronomical Society in 1998, he served as a postdoctoral fellow at the California Institute of Technology's (CALTECH's) Owens Valley Radio Observatory. He received his PhD in astronomy in 1996 from New Mexico State University.

Kevin is the author of numerous articles, both scholarly and general interest, book chapters, and two books. He regularly speaks to the public about astronomy and will happily teach anyone to recognize the bright constellations while talking endlessly about the latest discoveries in astronomy. He serves on the Executive Board of the National Capital Area Council of the Boy Scouts of America and has served on the governing boards of the Council of Engineering and Scientific Society Executives (CESSE) and the American Institute of Physics.

Jamie Murdock, Managing Vice President of Sales, Maritz Global Events Company

Jamie Murdock is managing vice president of sales for Maritz Global Events Company and has the responsibility of leading the strategic sales team in cultivating new customers for the organization. He is passionate about inspiring his team to be curious and encourages collaboration across all departments and a wide array of resources. He holds a BS in business from Cornell University's School of Hotel Administration. Prior to joining Maritz Global Events, Jamie led the national sales team for Disney Destinations. He also held sales executive leadership roles at Zentila, Hyatt Hotels & Resorts, and Gaylord Hotels, where he was recognized as the Sales Person of the Year and received its CEO's Leadership Excellence Award. Most recently he was awarded Citizen of the Year by Maritz Global Events and received the Maritz Global Events Masters Club Division Award. Jamie was named one of the Top 500 People in Events by BizBash in 2018 and 2019.

Brian Papa, Associate Executive Director, American Meteorological Society

Brian is currently the associate executive director of the American Meteorological Society (AMS). In this role he oversees the operations of the AMS's functional departments, including the AMS Meetings Department. Brian also directly manages the AMS's IT/Project Management Department. Since starting at AMS in 2006, Brian has been involved in the transformation of multiple departments in the organization to leverage new technologies and workflows to increase efficiency and productivity and to better engage with AMS members. Brian has a MS in the atmospheric and oceanic sciences from McGill University and is PMP certified. Over the course of his career he has been both a meeting attendee and presenter, and now works closely with the AMS Meetings Department to drive strategy and growth. In 2020 the AMS held its largest Annual Meeting, associated with its centennial, and is preparing to have its first entirely virtual Annual Meeting in January 2021.

Lily Wang, Professor and Associate Dean for Faculty and Inclusion, College of Engineering, University of Nebraska – Lincoln

Lily Wang is a professor in the Durham School of Architectural Engineering and Construction, and associate dean for faculty and inclusion in the College of Engineering at the University of Nebraska – Lincoln. She received her BS in civil engineering with a certificate in architecture from Princeton University, and a PhD in acoustics from the Pennsylvania State University. Her research focuses on a variety of room acoustic and noise control topics, including human comfort and performance in acoustics sound fields found in classrooms, offices, and restaurants; uncertainty in acoustic measurements; and room acoustics computer modeling.

Wang is a fellow of the Acoustical Society of America (ASA), board certified by the Institute of Noise Control Engineering, a professional engineer licensed in acoustics through the state of Oregon, and a recipient of the ASA Hunt Postdoctoral Fellowship, ASA R. Bruce Lindsay Award, NSF CAREER Award, and ASHRAE Ralph G. Nevins Physiology and Human Environment Award. She has also received a number of teaching and mentoring awards, including the ASA Student Council Mentoring Award. She has served as ASA president (2018–19), vice president (2015–16), and chair of the ASA Technical Committee on Architectural Acoustics (2004–07).