Envisioning Tomorrow's Earth (During a Rather Different Yesterday): Some Highlights of the 2020 AAAS Annual Meeting

Ava English, Jessica Scarfuto, Emma Stogsdill, Sarah Allen, Margaret Preigh, and Barbara Gastel

Standing-room-only sessions. Crowds at receptions and forums. Clusters of people viewing exhibits and posters. Children, parents, and grandparents thronging to Family Science Days. Such was the 2020 American Association for the Advancement of Science (AAAS) Annual Meeting, held in Seattle, Washington, on February 13–16. Themed, perhaps ironically, "Envisioning Tomorrow's Earth," the meeting occurred at a time very different from that weeks later, when COVID-19 was declared a pandemic and organizations worldwide postponed their conferences or moved them online. The annual meeting content, which spanned many areas of science and its context, retains relevance, however. The current report presents highlights of some sessions on topics that are likely to interest science editors and others involved in the communication of science.

Communicating Science Seminar

A daylong seminar on communicating science preceded the formal opening of the annual meeting. The following sections discuss some highlights. In addition to the sessions summarized, the seminar included another plenary session, titled "Building Community for Inclusive Public Engagement with Science," and other breakout sessions. Further information, including videos, is available at https://www.aaas.org/programs/annual-meeting/2020-communicating-science-seminar.[1]

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Engaging with the Media on Science-Society Topics

By Barbara Gastel

This plenary session brought together researchers and practitioners to discuss communicating about science via popular media. It began with 3 presentations. Open discussion occupied the last half of the session.

Robin Nabi, of the University of California, Santa Barbara, spoke on the role of emotion in influencing reactions to science news. She noted that although journalism research has focused largely on the cognitive aspect of news, factors conferring newsworthiness—such as novelty, drama, and relatability—relate to emotion. She then summarized a study on how the emotional aspect of a story can influence the audience. For the study, news stories were developed that framed equivalent content on mitigating climate change in terms of either loss or gain. Whereas loss frames tended to yield fear and depression, gain frames tended to engender hope and increase policy support and advocacy. Nabi also discussed how headlines can convey varied emotions and thus have varied effects. A key takeaway, she stated, was that scientists and journalists should consider the emotional aspect when deciding how to present information.

Lisa Johnson, of CBC News, Vancouver, British Columbia, discussed the problem of false balance in science reporting. She observed that as journalism has become increasingly fast-paced and newsrooms have been shrinking, journalists have faced more pressure to fall back on approaches such as giving equal weight to both sides. Although such approaches may suit political stories, she said, they tend to be inappropriate for science stories. Noting that opinion does not equal evidence, she called for giving appropriate weight, rather than necessarily equal weight, to different positions. Later, quoting her former professor as saying "lead with what you know," she emphasized the need to

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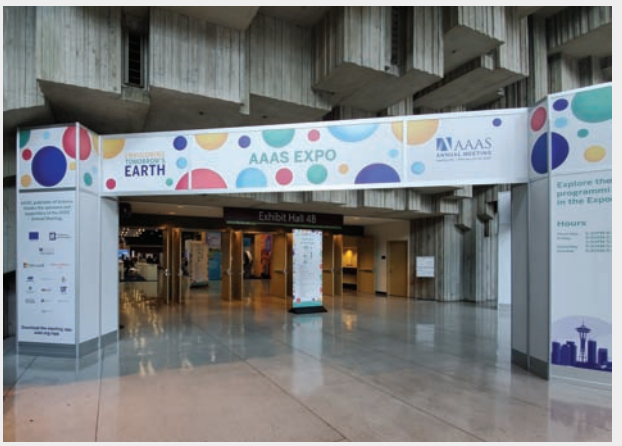
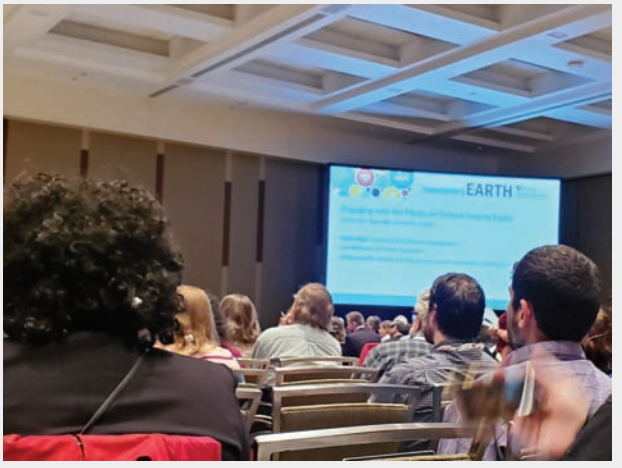


Exhibit hall entrance.

show what is known and where uncertainty exists and thus to help define the debate.

The last speaker, Jeffrey Duchin, of Seattle and King County and the University of Washington, addressed aspects of communicating about issues of public health significance. In doing so, he discussed how messaging about the then-emerging coronavirus situation was evolving. He closed with a series of questions, including what the science behind science communication is and how science communicators and public health professionals can best collaborate to serve the public.

Wide-ranging open discussion followed. Themes of questions included whether ethical issues arise about framing information so as to yield desired results, what responsibilities exist when presenting novel and uncertain science, and what to do when groups use findings from science communication research to spread misinformation. In response to a request for advice on communicating science to children, it was noted that children—and others—love stories. The value was mentioned of establishing a strong base of science coverage during normal times, rather than mainly reporting crises. Finally, noting losses of funding as coverage has moved online, Johnson stated, "Pay for news that you think is good."



Session attendees.

Science Outside the Box: Rethinking Relevance for Millennial Engagement

By Ava English

In this breakout session, representatives Geoff Hunt from LabX and Jen Benoit-Bryan from Slover Linett Audience Research discussed their findings from a 2018 U.S. national survey of millennial engagement with science. LabX, a program of the U.S. National Academy of Sciences, is designed to engage young adults with science through various activities. LabX partnered with Slover Linett to identify the interests and preferred learning methods of millennials in order to develop effective science education programs.

Millennials were defined in this study as individuals 18 to 37 years of age. The researchers administered a 20-question survey to gauge interests, preferred methods of learning, and interest in science and science-related topics. The term "science" was not defined for the participants. Through the panel-based research platform AmeriSpeak, the researchers gathered data from 3,993 individuals. They then analyzed 1,003 high-quality responses from this sample. The survey was administered only in English.

The researchers developed a "science affinity score" to indicate individual respondents' implicit interest in science. This score reflected the number of responses that reflected indirect interest in scientific concepts—for example, by showing an interest in how things work or expressing enjoyment of science or science-related forms of entertainment. According to their scores, respondents were categorized as having low, moderate, or high science affinity.

Unsurprisingly, the high-affinity group expressed the most interest in learning about science. Members of this group were also more likely to seek online learning experiences than were members of the low-affinity group, who tended to prefer in-person modes of learning. The moderate-affinity group was the most likely to attend events. Each group indicated being more inclined to attend educational experiences that also emphasize having fun.

Another finding was that millennials understood the application of science to tackle large-scale problems,

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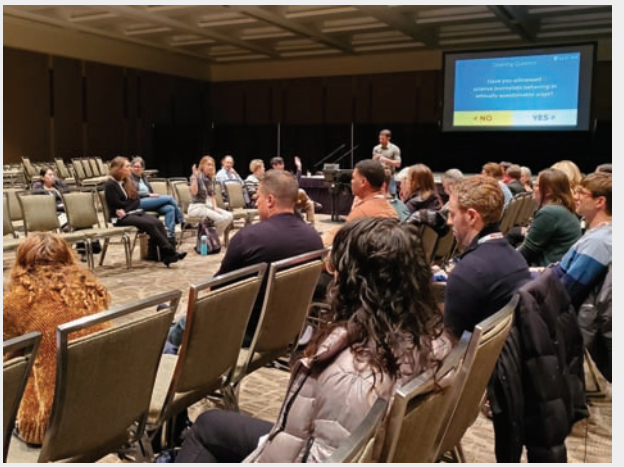

Town hall session titled "Developing Ethical Guidelines for Science Journalism."

such as environmental issues, but that they did not see how science could be used to address their immediate local concerns other than education. Important local concerns cited by this age group included the economy, housing, and crime. More information about the methods and results of the survey is available at https://labx.org/audience-research/.[2]

LabX has been applying the findings of this study to design programs targeting the moderate-affinity group. A goal of the programs is "to meet people with what they care about," Hunt noted. LabX has thus been tailoring programs to allow the participants to apply the concepts in their day-to-day lives. So far, it has found community partnerships to be effective.

Scientific Sessions

Multiple sets of concurrent scientific sessions constituted the core of the AAAS annual meeting. Often, these sessions addressed science in its broader contexts, including that of communication. Reports on several communication-themed sessions follow.

The Reproducibility Revolution: Impacts on Science, Journalism, and Society

By Margaret Preigh

This session addressed the challenges science faces in reproducing results. It also addressed how members of the scientific community can contribute to the enforcement of responsible reporting practices.

Victoria Stodden, of the University of Illinois at Urbana–Champaign, opened the session by introducing 3 types of reproducibility: empirical, statistical, and computational. "Empirical reproducibility" refers to the physical manipulation of matter to see whether, when the same steps are repeated, a researcher finds comparable results. "Statistical reproducibility" asks whether a researcher has chosen the correct statistical tests. "Computational reproducibility" refers to how transparent the researcher's computational methods are and whether these methods can be trusted. Stodden noted that both statistical and computational reproducibility present new challenges in the modern era of big data. "There is a mismatch between traditional scientific dissemination practices and modern computational research processes, leading to reproducibility concerns," she said.

Daniel Engber, Ideas Editor at *WIRED*, expanded on this idea, invoking the phenomenon of p-hacking. When reproducibility concerns arise about more technical aspects of a study, such as techniques or statistics used, it can become difficult for a journalist to know whether their source is reputable. For this task, Engber recommended investigating items such as the credentials of study authors, research context, meta-analyses, and expert opinions on the topic. Engber pointed out that despite concern that a reproducibility crisis exists, public trust in science has remained constant, perhaps indicating that the public believes that the self-correcting nature of science will catch errors eventually, or perhaps indicating that the public just doesn't care.

Ivan Oransky, co-founder of Retraction Watch, closed the session by saying that although reproducibility concerns should be acknowledged by the scientific community, scientific misconduct is a far larger threat. Of the approximately 1,500 retractions Oransky catalogs annually on his blog, he said approximately 60 percent are clearly due to misconduct. Oransky's discussion concluded with the suggestion to adopt post-publication peer review, which allows for scrutiny of research beyond the initial review process. Such an approach could support the self-correcting vision of science, in which the scientific community acts as a watchdog to root out misconduct and reproducibility errors. However, Engber argued, science may not self-correct quickly enough.

During the panel discussion at the end of the session, questions came largely from scientists concerned with the conceptual nature of this problem. Because the lines between accidents, misconduct, and replication errors are thin, some scientists expressed concern that an accusational culture might be too quick to condemn researchers who have made honest mistakes. Discussant Simine Vazire, of the University of California, Davis, concluded the session by acknowledging these concerns and noting that further work

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within the community is necessary to ensure reproducibility and enforcement of responsible practices. "There is this uncomfortable gray area between honest error and misconduct," Vazire said. "Transparency is not enough. We have to actually check."

Detecting, Combating, and Identifying Dis- and Mis-information

By Sarah Allen

In this session, panelists discussed how to navigate "fake news" and stressed that it comes in 2 forms: misinformation and disinformation. Misinformation is unintentionally inaccurate, whereas disinformation is deliberately false or misleading.

Emma Spiro, of the University of Washington, said disinformation and misinformation saturate informal communication channels, especially social media. And on social media, this unverified, inaccurate information spreads much faster than other information, she said. A small rumor, for instance, can escalate to the national level through retweets. When the rumor's origin is malicious, the goal is not to convince people of anything specific but to "undermine trust," Spiro explained. People who create disinformation rely on other people to share their harmful content because social media users "make emotional decisions," she said. Spiro's advice: Pause and consider why something on social media incites emotion before reacting or sharing the information.

In contrast to Spiro, Dan Gillmor, of Arizona State University, hypothesized that traditional news media may be a greater source of misinformation than social media. Thus, he discussed mainly how shifts in the journalism landscape may affect fake news. For example, he said the 24-hour news cycle may encourage news outlets to generate stories—even if the sources for these stories are questionable. He said that journalists "sometimes on purpose, but hopefully only by mistake, are amplifiers for misinformation." But Gillmor emphasized that more research is needed on fake news and major news outlets. He also suggested that the public's lack of media literacy may contribute to the spread of misinformation. Gillmor recommended increased news education for students and also called on the media to be more transparent with consumers. "The media have a key role to play—journalists in particular—in helping improve these literacies," Gillmor said.

The final presenter, John Beieler, of the Office of the Director of National Intelligence, focused on how artificial intelligence (AI) systems can be manipulated to become less effective in detecting fake news. To spot fake news, AI systems are trained with a specific set of data, much as email spam filters are, Beieler said. If an AI system is trained to detect stop signs, for example, it will pick up any red octagon with white text in the middle. But if a red octagon with white text also has, say, a yellow square on it, the system will mislabel it. Beieler said people who understand this training trick the system to let disinformation slip through—a process called data poisoning. Beieler identified other reasons that AI systems inconsistently detect fake news, such as lack of word predictability. An AI system could never accurately predict the headline "A Fleet of M&M-Shooting Drones Is the Black-Footed Ferret's Last Hope" because M&Ms, drones, and ferrets are not commonly associated. "AI can be a helpful tool," Beieler said. "But it is just that: a tool."

Saving Science Journalism: Actions for Science Communication Researchers

By Jessica Scarfuto

The panelists at this session presented the results of 3 case studies in which science practitioners and communication scientists worked together to determine best practices for reaching out to public audiences.

Pamela Rosenstein, of NOVA, reported the results of a study that aimed to see whether social media can help users learn more and engage more deeply with scientific topics. NOVA partnered with the University of California, Santa Barbara, to assess user engagement for the multiplatform project NOVA Wonders, which was produced in spring 2018. The most effective technique, they found, was the use of simulcasts in which users could interact directly with the scientists. "We found that the semi-structured learning environment with an active facilitator was very important," Rosenstein said, contrasting it with a passive approach such as putting up some posts and hoping that someone will respond.

Craig Rosa, a producer for the web series Deep Look from stations KQED and PBS, along with Asheley Landrum, of Texas Tech University, presented the results of a study examining why Deep Look's audience was disproportionately male (70%). Deep Look is a YouTube series that by all accounts is successful, having 1.4 million subscribers and 200 million views. The gender disparity in its viewership could not be fully accounted for by the fact that YouTube's overall audience is 60% male. So, was YouTube's algorithm to blame for targeting more men than women in suggesting Deep Look, or were women simply less drawn to the content, which often focuses on arthropods, cephalopods, and other creepy crawly "gross" things? The researchers found that it wasn't so much the disgust factor that determined female audience but the topics themselves and titles. When the videos were about sex and romance, such as their video

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titled "The Ladybug Love-In: A Valentine's Special," that helped, Landrum said. Cute titles helped, too. "The only thing that seemed to push them away was when the titles had a lot of alliteration or assonance or consonance in them," she said.

Julia Griffin, digital science producer for PBS News Hour, and John Fraser, president and CEO of New Knowledge Organization Ltd. (now known as Knology), presented the results of a 4-year study looking at how to optimize science reporting to reach 18-to-35-year-olds. Early-career adults, they said, are relentlessly plagued by the stereotype that they have no attention span. But their research found that this was not actually so. "Rather, the majority have developed excellent editorial skills for navigating a wealth of resources and determining what's relevant and how to cull content that isn't efficient," Fraser said. Griffin and Fraser found that producing content with these things in mind, such as optimized videos to be viewed on Facebook, can have enormous payoff.

Science Communication Strategies for Building Relationships with the Public

By Ava English

Moderator Anthony Dudo, of the University of Texas at Austin, opened this session by stating that too often in science communication, scientists and science communicators prioritize the needs of science rather than those of the community. To bridge the gap between science and the public, Dudo said, the focus should shift from disseminating scientific information to building community relationships. The speakers at this session then discussed ways to work toward this objective.

To achieve individual connection, Jayatri Das, chief bioscientist at The Franklin Institute, presented a listening technique inspired by the motivational interviewing model. This technique is a person-centered form of guiding conversations to develop understanding between individuals. The motivational interviewing process involves asking open-ended questions, responding with affirmation, listening reflectively, and summarizing one's understanding from listening to one's partner. Das said that this communication method allows science communicators to demonstrate care for the people they are working with and additionally uncover shared values.

Nalini M Nadkarni, a professor at the University of Utah, reported finding common ground between scientific and faith-based communities by using trees as a symbol. Trees have both spiritual and ecological significance, Nadkarni said. She said that she studied various religious texts to find references to trees and visited churches to determine what occurs there. She then created a sermon that discussed the commonalities she had found between ecological and religious values. She offered this sermon to religious communities to share her findings. She also began mapping trees in churchyards with her students in order to continue developing this connection. Booklets describing species of trees growing in these churchyards and on other sacred grounds were then created for the congregations.

Nadkarni used the framework from this experience to develop the STEM Ambassador Program, which is intended to facilitate exchange between scientists and members of the public. "The goal was to build relationships with open-minded exchange," she said, "with a public emphasis on reaching those who cannot or do not engage with science by a traditional outlet." Information about this program is available at https://stemap.org/.[3]

The last part of this session focused on community inclusion in research. "We need to co-create science projects that have practical benefit to communities," Marilú Lopez-Fretts of the Cornell Lab of Ornithology said. The Cornell Lab has collaborated with the Metro Atlanta Urban Farm to develop the NOISE Project, which promotes understanding about the effects of noise pollution on human and environmental health through community education programs.

Bobby Wilson, CEO of Metro Atlanta Urban Farm, provided historical context, noting scientific institutions' longstanding lack of community involvement in identifying and addressing needs. "What you do for us, and not with us, is not for us," Wilson said. He said that working on the NOISE Project with the Cornell Lab has given him a seat at the table to address the needs of his community. Wilson also stated the need to bring more students of color into scientific institutions. Lopez-Fretts concurred, stating, "Different perspectives bring wholeness to scientific research."

Cultural Connections: Communicating Science to Communities and Congress

By Emma Stogsdill

Science communicators emphasize outreach, but often only some population segments are reached. At this session, speakers discussed sharing science with less-often-reached communities.

Kei Koizumi, who has long worked in science policy, began the session by discussing codeswitching between the languages of science and policy, relating it to experiences with intersectionality in his own life. He said, "Intersectionality is this theoretical framework for understanding how aspects of one's social and political identities, such as gender, race, class, sexuality, and disability, might combine to create unique modes of discrimination." He noted that "our multiple identities can create unique sources of being unique." The current standards for science communication,

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he stated, must shift toward accepting cultural differences in understanding as valid instead of recognizing these differences as incorrect or "other."

Another way to engage communities in science is by bringing children into the discourse. Parents often report that they had never believed that climate change was occurring, but when their children came home and showed them what was happening locally, they have been more willing to see science through a less political lens. As early as kindergarten, children are being asked to do things that a scientist would do. These ideas serve as a basis for Science Storytellers, a public engagement program in which children interview scientists and share their stories. "It's easy for a lot of us to forget in this field that not everybody gets the chance to talk to scientists every day," said speaker Jennifer Cutraro, founder and director of Science Storytellers. "Part of what we are aiming to do is to break down those walls and get kids and scientists to see each other as people."

José González, of Latino Outdoors, focused the final part of the session on how to be culturally responsive in communicating science. He said, "Culturally responsive science communication doesn't just literally translate, it also culturally translates, keeping codeswitching in mind." Codeswitching is the process of shifting between linguistic codes (languages or dialects) depending on the social or conversational context, often within a single conversation. But this can be tricky. "Avoid Hispandering," González said, noting the "fine line between acknowledging and patronizing an ethnic group." He warned against having one's biases inform the identity of Hispanic when communications are drafted.

The speakers told several stories about reaching people on their own terms. An overarching message was that doing so broadens and betters science communication.

Career Workshops

At the AAAS annual meeting, more than 2 dozen 90-minute workshops offered knowledge and skills for career development in science and related realms. The following sections discuss highlights from 2 of the workshops about communication of science.

How to Make Compelling Outreach Videos When Your Science Seems Dull

By Jessica Scarfuto

Your science might not involve chasing grizzly bears in Alaska, but that does not mean it's dull. With a little creativity, it can seem as interesting to everyone else as it is to you. This was the focus of the session presented by Colleen Harvey, Blake Fajack, and Emily Lea, who are graduate students in Montana State University's Science and Natural History Filmmaking program. The session was co-coordinated by Theo Lipfert and Sarah Lanier, both also of Montana State University.

Step 1 in making a compelling science video is to define your goals, Harvey said. Are you trying to raise awareness or to inform? Where and how do you plan to share your science? Are you making an hour-long video or a 30-second Instagram post? Defining these parameters will help zero in your focus for the next part: showing what you do. Whether you spend your days making models, writing equations, or using giant robots, this is the most important part of your job! If you are excited about it, other people will be too.

Once you have established an audience, purpose, and medium, it's time to look at delivery. One Hollywood trick? "If you want to be perceived as a genius, write equations on glass," Harvey said. Or, for a more nostalgic feel, chalkboards might be the way to go, since they are viewed as romantic and historical. Or if writing or drawing doesn't work well for your branch of science, using physical models or props might be an option.

Fajack presented tips for making high-quality videos on a budget. "The only thing a professional camera will give you over a regular camera is freedom of the settings," he said. This means that using an iPhone or GoPro is fine as long as you can control your environment. A variety of smartphone attachments such as fisheye lenses, ring lights, and external microphones are both affordable and readily available, and they can significantly improve your video quality.

Lea then spoke on the importance of sound in making a compelling video. "You can have absolutely stunning footage, like BBC quality, but if your sound is going in and out … eventually it's going to become completely unbearable to watch," she said. So how do you get clean audio? First and foremost, be aware of your surroundings. You might not notice the sound of air conditioners, cars driving by, or centrifuges in the room, but they can be incredibly distracting to viewers. Lea recommended trying to turn off everything you can in the room (as long as you remember to turn it back on!) and, if you need to record just the audio, get creative! Recording under a blanket, speaking into a full closet, or getting in your car to drive to somewhere quiet are a few of her tips.

Whatever method you decide to use, make sure the message is simple, Harvey said. "If someone can't explain it back to you, it needs work."

The (Gross) Anatomy of Responding to Peer Review Commentary

By Emma Stogsdill

Gross anatomy is concerned with the structure of organs and tissues visible to the naked eye. In contrast, peer review can be "completely opaque" and "difficult to discern,"

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said Andres De Los Reyes, of the University of Maryland, College Park. In this workshop, De Los Reyes provided information and advice that can help authors move the peer review process from something so vague into something as apparent as gross anatomy. Key points from De Los Reyes, a psychology professor who is active in research training, included the following:

- *Authors have a say in who will review their manuscripts.* By choosing journals on the basis of their editorial boards, or by suggesting reviewers, authors can tailor their submission experience.
- *An editor at the journal reads the manuscript and peer reviews and decides to either accept, reject, or provisionally accept a manuscript.* Many manuscripts fall into the "revise and resubmit" category. In this case, the author revises the manuscript in accordance with reviewer commentary and returns it for further consideration. If a manuscript doesn't make the cut, the author should be told as soon as possible, so that submission to another journal can proceed.
- *Emotionally charged responses rarely pay off.* Before addressing the requests for revision, authors should let the editor's decision sit until they are confident in their ability to respond reasonably.
- *Authors should embrace revision with open arms.* "When we are submitting our papers for review, we are getting free advice from our reviewers—take that advice to heart," De Los Reyes said. Although it may be difficult, the author generally should make all of the suggested changes. "The review and resubmission process will take a month or less if you commit to addressing one comment every day," De Los Reyes said. If there is something an author cannot bear to change, there must be an airtight reason to keep it. In this situation, De Los Reyes suggested to either cite the data that led to that decision or admit that there may not be enough data to make the requested change—noting it as a limitation of the study.
- *Tiny errors can be seen as indicating sloppy work.* Therefore, authors should be thorough when proofreading manuscripts for resubmission.
- *The cover letter accompanying a resubmission should conclude with a broad acceptance of future revisions.* Saying something like "We would be pleased to make any further revisions" reminds the editors and reviewers that the author is eager to publish and is willing to endure their scrutiny, as difficult as it may be.

Although everyone's experience will vary, awareness of these points can streamline the peer review process for authors and editors alike.

The 2021 AAAS annual meeting, themed "Understanding Dynamic Ecosystems," will convene entirely online. Plans for the meeting, to be held February 8–11, are continuing to evolve. For the latest information, see https://meetings.aaas.org/.[4]

References and Links

1. https://www.aaas.org/programs/annual-meeting/2020-communicating-science-seminar
2. https://labx.org/audience-research/
3. https://stemap.org/
4. https://meetings.aaas.org/