



ASPEN GLOBAL CONGRESS ON
SCIENTIFIC
THINKING & ACTION

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Overview

Originally scheduled to meet in Rome, Italy, the Aspen Global Congress on Scientific Thinking & Action took form as a virtual congress in March 2021. On this occasion, the Aspen Institute Science & Society Program (USA) and the Instituto Questão de Ciência (IQC, Question of Science Institute, Brazil), in partnership with the Aspen Institute Italia and EquiTech Futures, convened more than 100 scientists, scholars, journalists, and communicators from more than 50 countries around the world.

Through presentations by leading experts, small-group breakout sessions, and all-group discussions, the congress focused on global themes that transcend geographical boundaries: science literacy, science popularization, vaccines, climate change, medicine, and food biotechnologies.

The meeting, co-chaired by Aaron Mertz, Ph.D., a biophysicist and the founding director of the Aspen Institute Science & Society Program, and Natália Pasternak, Ph.D., a microbiologist and founder and president of the IQC, strived to lay the foundation for a roadmap to design and implement science communication strategies, to create a global network of scientists and science communicators with the aim of translating scientific thinking into action, and to build bridges among science organizations and groups globally.

Never before has it been more important to ensure the application of scientific *rationale* to formulate public policies based on solid scientific evidence, to promote scientific education and popularization, and to produce accurate and trustworthy scientific communication while holding industries, governments, and political leaders accountable for the global future.

Angelo Maria Petroni, who would have hosted the Global Congress in Rome, is the Secretary General of Aspen Institute Italia and holds the chair of Logic and Philosophy of Science at the University of Rome, where he also teaches Public Management. In opening the virtual congress, Petroni emphasized the importance of standing up for science through freedom of research, the pursuit of truth, and the right to produce and access science in the global context. In particular, Petroni stressed the recognition of science as a universal value.

Keynote Discussion

Standing Up For Data and Evidence in the Face of Science Denial

This historical moment has made it remarkably clear that it is increasingly urgent and relevant to stand up for data and to combat science denial. Ricardo Galvão's story teaches us just how much. Galvão, professor at the Institute of Physics of the University of São Paulo and former Director-General of the National Institute for Space Research in Brazil, became a scientific hero when he firmly stood his ground as politics and ideology challenged scientific data regarding deforestation of the Amazon rainforest. In conversation with Mariette DiChristina, Dean and Professor of the Practice in Journalism at the College of Communication (COM) at Boston University and former editor-in-chief of *Scientific American* for 10 years, Galvão told the story of how scientists, journalists, and government officials can stand up for science even when doing so is politically and professionally unfavorable. During the 2018 election campaign in Brazil, President Jair Bolsonaro made it clear he would completely modify the country's environmental policy. Among his proposed actions was to drastically reduce the power of IBAMA (the Brazilian agency responsible for environment control and enforcement) to inspect and apply sanctions against illegal deforestation in the Amazon rainforest. In other words, there would be no national parks or indigenous people's reserves created during his mandate, while mining in existing reserves would be encouraged. It is widespread knowledge that Bolsonaro's administration denied global warming, considered a "Marxist plot," and advanced the myth that curbing deforestation in the Amazon rainforest would be detrimental to economic development. At the time, Galvão was director at the Brazilian Institute for Space Research (INPE), the country's main institution for monitoring deforestation and fires using satellite systems. INPE had provided annual figures for deforestation since 1988 and daily warnings of possible new deforested or degraded areas since 2004. The data was directly made available to IBAMA in order to guide its enforcement actions. Using these resources, the government that preceded Bolsonaro's was able to reduce the deforested areas from over 27 thousand square kilometers in 2004 to slightly over 4,000 square kilometers in 2012. This achievement was hailed by *Nature* as the biggest environmental success story in a decade, Galvão remarked. However, when Bolsonaro was elected, INPE turned out to be an obstacle: the publication of scientific results could expose its "predatory actions." The data provided by INPE clearly indicated that the rate of deforestation in the Amazon was "substantially increasing." On June 2, 2019, one of the most important members of Bolsonaro's administration attacked the data from INPE in an interview with the BBC: the data was being manipulated and damaged the image of Brazil abroad. Galvão said he reacted to this accusation by sending an official and classified document to the Minister of Science, Technology, and Innovation explaining INPE's systems in detail, and asking for support in opening a direct dialogue between INPE and the Ministry of Environment. Galvão got no answer. Finally, on July 19, in an international press conference, Bolsonaro explicitly said that INPE's data was "a lie" and that Galvão was "possibly working for an international NGO against the interests of Brazil." "I took that as a direct punch to my scientific soul," said Galvão, "and a cowardly attack on my colleagues that honestly worked hard to provide the most reliable data on the Amazon's deforestation as internationally recognized." When it became clear to him that there was no more room for compromise, Galvão chose to react "strongly," openly defending the accuracy and integrity of the data provided by INPE. Two weeks later he was fired.

Galvão was nominated by *Nature* as one of the “10 people who mattered in science” in 2019 and, in 2021, he was awarded the Scientific Freedom and Responsibility Award from the American Association for the Advancement of Science.

Science communication is a crucial aspect of standing up for science. Until a few decades ago, the platforms for communicating science were the traditional ones: scientific journals, specialized newspaper sections, science museums, etc. However, the digital revolution and social media have



played a significant role in the way science communication has changed and in the way society interacts with science. According to Mariette DiChristina, social media platforms are “a double-edged sword”: on the one hand, people are sharing a lot of information; on the other, “not all of that information is good.” There has been a shift from a media ecosystem where gatekeepers of traditional media had processes for reporting, working with researchers and fact checking, DiChristina explained, to what “some people have called a democratization of media” where “we’re all participants” and where “voices of influencers can drown out the voices of experts at times.” Social media has certainly presented a challenge to science communication, as platforms don’t always allow a “thoughtful and detailed exchange of information and ideas.” In particular, social media has resulted in an acceleration effect, which leverages the circulation of misinformation—misinformation that is also fueled by harmful algorithms. This has, consequently, led to a polarization of opinions and the creation of echo chambers and bubbles where “we all sit comfortably with people who agree with us,” said DiChristina. This dynamic plays out with great difficulty in areas such as the pandemic or climate change, for example. In her conversation with Galvão, DiChristina explained how a peer-reviewed study has shown that those who rely more on social media tend to be the least well informed when it comes to knowledge of facts and data. Furthermore, the shift from traditional gatekeepers to a social media-led information scenario can lead to confusion, with “everybody saying everything at the same time whether they have expertise or not,” as well as to misinformation and outright denial. In this respect, Galvão pointed out that denialism is not just a question of denying scientific results but a new way of doing pseudoscience, which is aided by social media. This is why, on one hand, it’s crucial for scientists and science communicators to engage with the public and explain “how they know what they know,” while on the other, it is important to respond to denial and misinformation. *The Debunking Handbook* by John Cook and Stephan Lewandowsky introduces an effective technique—nicknamed “a truth sandwich” by DiChristina: in addressing a misperception, you (i) provide the fact, (ii) warn about the myth before providing it, (iii) explain the fallacy, and (iv) end with the truth again. Starting and ending with the truth can be a helpful tool when combating denialism. Galvão also pointed out that there is a discrepancy in what lay people and scientists understand as scientific uncertainty and questioning the results: a process which is intrinsic to scientific methodology and at the basis of scientific skepticism. Standing up for science, now more than ever, is a challenge and a crucial task but, Galvão and DiChristina concur, everyone can do their part in addressing misinformation and denialism.

Session 1

Building a Dialogue on Evidence and Values: Overcoming Science Denialism

Denialism is a complex issue, not only because it can pose a multitude of threats but also because comprehending it requires multiple lenses that look at the different interactions between science and society: understanding the cognitive biases that drive denialism, for example, or the sociology of science, or even who is a producer of scientific knowledge and who is a consumer, explained Abhilash Mishra, director of the Xu Initiative on Science, Technology, and Global Development at the University of Chicago and founder of EquiTech Futures, who chaired the congress's first session. Mishra called attention to how science denialism poses a threat not only to the advancement of scientific progress but also to the public good. The value of scientific evidence for a scientist or a science communicator might be different for a policymaker or a lay citizen. It is important to develop radical empathy, he said, and concluded with the author Brené Brown's quote, "we are not here to be right; we are here to make it right." Scientific denialism has not always developed uniformly globally, instead it differs from country to country, at times radically. Joy Y. Zhang, Senior Lecturer in Sociology at the School of Social Policy, Sociology, and Social Research at University of Kent examined what is driving distrust of scientific institutions specifically in China and India where science denialism is very different from that of the West. Taking the COVID-19 vaccine as a case study, Zhang identified a "leftist medical populism" at the state level, in both China and India, where the health and welfare of the people are pitched against established epistemic or political hegemonies and, often, foreign powers. In the case of China, it is evident, Zhang said, through the over-politicization of vaccines, as a means for the state to curb the Western lead in the vaccine development. There is also an orchestrated effort across Chinese state newspapers to openly question the evidence of Pfizer vaccines, for example. In India, Zhang continued, you can see traces of "leftist medical populism" pitching against a regional hegemony like China, meaning that India's early strategy involved means to contain China's vaccine territory. On the societal level, there is a "paradoxical resistance": both China and India have very high vaccine public confidence (above 95%); however, Zhang pointed out, that confidence does not automatically translate into coverage or inoculation, and the uptake has been very slow. Because Asian society's vaccine hesitancy is "not just reactive, it's also conditional," Zhang addressed the issue by proposing to diversify the scientists' profiles in communicating scientific data and to promote a collective and diversified participation from civil society, such as professional organizations.

The rhetoric of the skeptic movement being misappropriated by science deniers, briefly touched upon by Galvão during the keynote session, is not a new phenomenon. Amardeo Sarma, Chair of the Gesellschaft zur wissenschaftlichen Untersuchung von Parawissenschaften (Society for the Scientific Investigation of Parasciences), the Germany Skeptics organization and General Manager at NEC Laboratories Europe GmbH, explained that the skeptic movement does, in fact, go back more than 100 years and originally countered pseudo-medical claims while, in the more recent decades, moved into areas like global warming and vaccination. Skeptics like Sarma have learned over time that people are prone to deception and self-deception—in this context it is important to promote critical thinking, to identify myths and differentiate them from scientific evidence, and turn to the question of benefit vs. harm to people. "It's not about being right," Sarma said. "It's about what the consequences are if something just isn't true." It's about giving people knowledge that is going to help them make the right choices.

To counter pseudoscience and misinformation, however, facts might not be enough. Philipp Schmid, a behavioral scientist and Interim Lecturer for Statistics and Methods at the Department of Psychology at the University of Erfurt in Germany, pointed out that an effective message can mitigate the damage of science deniers. Schmid illustrated the communication triad: (i) the messenger, (ii) the receiver, and (iii) the message. To counter misinformation and science denialism, we need an efficient message like the truth sandwich, for example, or by uncovering the science deniers' rhetorical techniques, which rarely differentiate on the scientific spectrum (i.e., climate change denial, vaccine denial, etc.): fake experts, logical fallacies (such as *argumentum ad hominem*), impossible expectations (e.g., "stating vaccines should be 100% safe when no medication is 100% safe," said Schmid), conspiracy theories, and cherry picking. In constructing a message, the messenger is just as important, and having the wrong one might trigger a backfire effect. For example, Schmid said, for COVID-19-related issues, the messenger for citizens should be someone like a general practitioner, rather than a politician. This is important in order for the messenger to be credible and trustworthy and to identify with the audience—i.e., the receiver—and vice versa. Only by considering the three elements—message, messenger, and receiver—together is there a basis for effective messaging.



But, to use Lee McIntyre's words, what about those people who "have been marinating in scientific misinformation for years"? What about the "hardcore deniers"? How do you counter them? McIntyre, who is a Research Fellow at the Center for Philosophy and History of Science at Boston University, a Lecturer in Ethics at Harvard Extension School and the author of *Post-Truth* (MIT Press, 2018) and *The Scientific Attitude* (MIT Press, 2019), said it is important to remember that science denial "isn't a mistake, it's a lie" and, while you can counter misinformation for "some people out there who believe the lie," "what are you going to do about the liars?"—that is, those who spread denialism. In this sense, McIntyre reiterates the distinction between content rebuttal, based on facts, and technique rebuttal, which is more effective with "hard-core

deniers,” he said. At a flat-earth conference replete with science deniers, McIntyre said he had “more luck with technique rebuttal”: “I would ask them the Karl Popper question: ‘You say that this is about evidence, not faith—so tell me what evidence, if I had it, would convince you you were wrong.’ And they really couldn’t answer that question.” Other techniques that work with science deniers, McIntyre pointed out, are the use of graphs, the emphasis of scientific consensus, and admitting to some degree of scientific uncertainty as this often builds trust, which is key to counter misinformation and denialism. “What I think we’re suffering from with science denial is not an information deficit but a trust deficit,” said McIntyre.

According to Abhilash Mishra, to whom the panel circled back at the end of the session, science denial is, in some sense, the product of social inequality: on one hand, the process of doing science and participating in scientific knowledge production has become concentrated with fewer and fewer people in the last three decades; on the other hand, the values that are espoused by scientific experts seem to be “a little disengaged” from values that society at large might have—an example of this is the debate over lockdowns during the COVID-19 pandemic. This might create the perception that the values of public health experts are considered superior to those of the public, which, in turn, creates inherent distrust and fosters science denialism in society, Mishra explained. And he added that when science is “produced” by a small percentage of society, there’s going to be a natural trust deficit between society at large and the knowledge that has been produced. A natural consequence of this is that in societies that have a high social inequality rate, the distrust in social institutions is embedded in science because science becomes a representation of the institutions. Mishra’s proposal to address this issue is to recruit scientists in early stages of their careers and place them in different parts of the country, in underserved communities and rural areas, with the mission to build trust in science from the ground up and to be able to do so in a manner that involves the citizens in scientific evidence generation, rather than being completely disengaged from it.

The all-group discussion among members of the congress on overcoming science denialism led to other several key questions and points. What are the challenges as science communicators? There is an abundance in information but low trust, and the desire of diversifying audiences conflicts with outdated business models in the sector of science journalism. Further, in this context, it is important to support populations not represented in English-speaking media. This ties in with the concept of culture-sensitive science communication and the “one size fits all” issue (e.g., moral values in vaccine communication in certain religious groups). This led to the thought, by some participants, that “maybe we don’t need to convince everybody” and the question of where that threshold is. What works to counter denialism? Some possibilities include: posing people dilemmas/alternatives and framing the issue as a trade-off, the use of theater or humor to educate people about science as it has the effect of disarming people, and peer effects amongst denier groups, such as getting influencer-personalities to change their minds and leading change within their following. It is not just about the facts but also about common and shared values, so the proposal is to use them as an anchor, while avoiding communicating from a superior position. Although trust is a big issue, there still is an information deficit among the public, according to some participants. Possible solutions include: starting with school children, explaining the scientific process aside from scientific results, and considering health as a global value but being sensitive to the difference in how that value translates and how different questions change among countries and groups.

Session 2

Science Literacy and Popularization: Understanding How Science Works

Understanding how science works can be a powerful tool to spread science literacy. According to Simon Singh, British author, journalist, and TV producer specializing in science and mathematics, it's easier to protect the public by working with regulators rather than “educating the public.” Another way, Singh said, is to interact with the media: for example, if there is a false claim in the media, irresponsible reporting, or false balance, in order to keep the media as accurate, honest, and responsible as possible, it is important to make a complaint and make sure that it is not ignored. In the context of making information understandable and accessible, when you need a behavioral change, trust matters more than anything else: Singh introduced the idea of a “credibility spectrum” and to help people work out who they should trust so that if they put their trust in the right person or group, this enables them to make informed decisions. Investigating how science can be communicated means exploring many different avenues. In Japan, recently, many artists and creators in the manga field are incorporating science as material for their works, explained Masataka Watanabe, a Specially Appointed Professor at Tohoku University and president of the Japanese Association for Science Communication who has written several popular science books and translated many others from English to Japanese. For example, the manga *Cells at work!* (はたらく細胞), in which the two main characters are a red blood cell and a white blood cell, has sold five million copies in six volumes in Japan. According to Watanabe, its popularity can be traced back to the fact that science is not conveyed in the traditional sense (e.g., a textbook), but communicated to entertain. To this point, Singh explained that, in the UK, comedians introduce science and rationalism in their humor and because people like comedians and find them funny, audiences “buy into the ideas they’re trying to convey” by making science “attractive.”

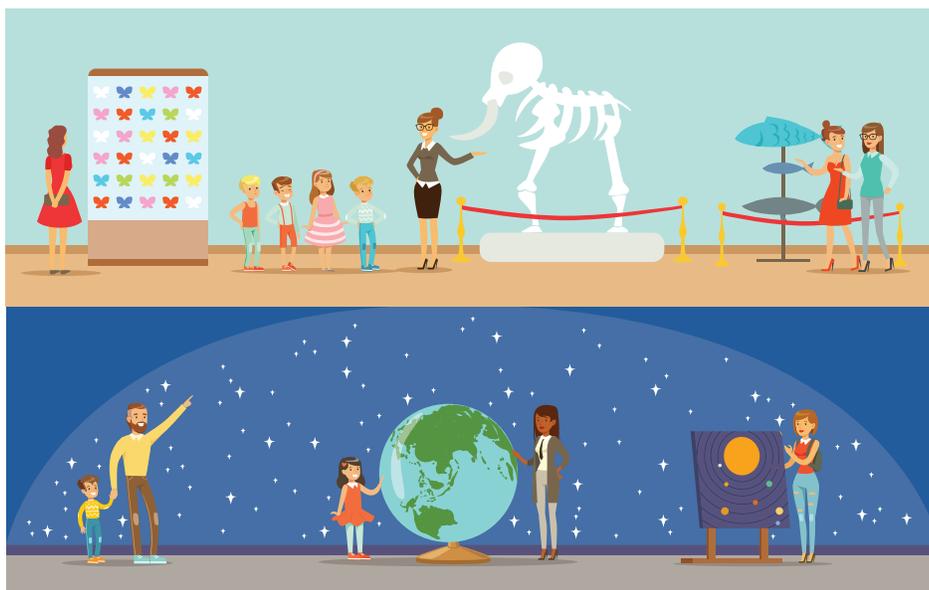
One of the biggest challenges in science communication is communicating the positive side of uncertainty, said Stuart Firestein, Chair of the Department of Biological Sciences at Columbia University in New York. According to Firestein, a lot of science is still “mired in determinism,” and scientists and science communicators have failed to communicate the value of uncertainty to the public, making space for the idea that “if something isn’t certain, it’s not worth communicating.” Scientific uncertainty is not unreliable, Firestein said, and “we’ve learned to use scientific uncertainty in very reliable ways”—evolution, for example, is based on random processes. Firestein highlighted a study that shows how one of the causes of depression is certainty because it removes a sense of agency, leading to a depressive or pessimistic state; instead, “uncertainty is full of possibilities.” According to an anecdote, President Harry S Truman wanted a “one-handed scientist”—i.e., a scientist that avoided the expression “on the other hand”—because he wanted to know with certainty what to do, but Firestein said “two hands are better than one,” and there are multiple ways to think about things. To bring the notion of uncertainty as a positive, a value, rather than a negative, is a great challenge of science communication. Nonetheless, Firestein sees science working best as a combination of hubris and humility: “we believe we can understand the universe and understand how the world works and, at the same time, we have a great deal of humility because we recognize that every time we learn something, all it does is open up ten new questions, and there’s so much more to learn—it’s that balance we need to present to the public about science.”

A synergistic element to science communication is science education. According to Ayelet Baram-Tsabari, Associate Professor within the Faculty of Education in Science and Technology at Technion, Israel Institute of Technology, the goal of science education is educating future citizens to identify when science is relevant to their lives and to find credible sources of information to use when needed. Scientists can be trained to communicate with the public. Science communication has nothing to do with “being a good scientist,” but to Baram-Tsabari, the question is not whether they communicate, rather who they communicate with: should all scientists communicate with diverse audiences? Of course, anyone can learn to do so, and the option of learning communication skills during scientific studies should be offered to students of science, but Baram-Tsabari encouraged consideration of the limited meaning of communication. Communicating is also about listening, engaging with someone one on one, translating information for teachers, and not just engaging with the public through media. In this way, many scientific experts can find ways to communicate, Baram-Tsabari said. Firestein added that many graduate students recognize the importance of communication and want to be involved in communication, but the challenge is to convince the scientific establishment.

That’s why it’s important that leadership within the scientific communities recognize communication as a productive use of time so that the process of communication-building is not just top-down but also bottom-up, Baram-Tsabari concluded.

The all-group discussion emphasized numerous essential elements to science communication: the importance of diversity and representation and to have good role models in science communication to

reach different audiences—role models are also important to build trust and, as reiterated multiple times, trust is crucial to communicate science. In pseudoscience, one of the easiest ways to attack someone in a debate is the “100% certainty” argument: this is why it’s important to not let uncertainty be equated with insecurity. When debunking pseudoscience and communicating about science, it is also important to talk about how science works (i.e., “this is how we know what we know”), to listen respectfully, to frame stories in ways they might be acceptable to different types of public, to be aware of language (e.g., the word “theory”) when the audience might understand something different, to communicate failure, and last but not least, to avoid alienating people by portraying scientists as “geniuses.” Other participants in the all-group discussion mentioned science festivals in local cities that attract the public and are a very effective tool for science popularization, and identified the implementation of immediate and longer-term channels to connect science and journalists for information verification. Another global perspective to think about is decolonization of science popularization and education sources, such as in textbooks, in which people of color are very rarely represented. Finally, attention was brought to tackle misinformation by teaching critical thinking, a crucial tool that nonetheless, is not going to solve all the problems.



Session 3

Risks and Dangers of Alternative Medicine

Alternative medicine has taken hold differently across countries. In Latin America, the use of alternative medicine is quite widespread because alternative practices are rooted in traditional healthcare and formal health systems, Roxana Tabakman, health writer and science journalist from Argentina, explained. Alternative medicine is not only accepted at the state level but also by medical associations and even in the academic world. The “result is that healthcare in Latin America is not as scientific minded as it should be,” Tabakman said. Among the alternative medicine “cures,” homeopathy and ozone rectal therapy are the most popular for COVID-19 in Brazil. Of the South American countries, Brazil is very prone to pseudoscience and doctors are still prescribing hydroxychloroquine for COVID-19 “as if there were no scientific evidence whatsoever proving that it doesn’t work,” said Natália Pasternak Taschner, President of the Instituto Questão de Ciência (Question of Science Institute) and Co-Chair of this Aspen Global Congress. Medications that are meant for other diseases are promoted by the ministry of health in Brazil as medications for COVID-19, to the point where the country “is becoming now a global hazard,” said Pasternak. Paradoxically, in general, people in Brazil are very favorable to vaccination (public polls say about 92% of the population are eager to get a COVID-19 vaccine), Pasternak pointed out, and the country has a very strong tradition of vaccination and a national public health care system that caters to more than 200 million people.

In India, alternative medicine, and homeopathy in particular, is extremely popular. Narendra Nayak, President of the Federation of Indian Rationalist Associations believes this is the result of the inadequacy of medical facilities, low income, and the population’s belief in superstition to the point that alternative medicine is rooted in “systems of belief” rather than “systems of science”—interestingly, alternative medicine is deeply associated with Indian tradition in the collective imagery, although it really originated in Germany. According to Nayak, alternative medicine should be banned because it results in harmful and dangerous outcomes, even though banning it might drive it underground and cause it to escape regulation.

One of the few institutions around the world with the specific mission to “separate science from nonsense” is the Office for Science and Society at McGill University in Montréal directed by chemist and author Joe Schwarcz. The office, Schwarcz said, gets many questions: from whether kissing golf balls for superstitious reasons might be the cause of contamination from pesticides, to which solvents are useful in opening a sealed urn. Schwarcz collects “medical devices” such as crystal pendulums and belly-button massagers and says that the claims that are made on behalf of all of the items are the same: they detoxify or eliminate parasites, regardless of what the device is. The placebo effect here plays a big role, Schwarcz explained, and sometimes this can be useful. However, the problem is distracting from conventional therapy that works, so “if someone is going to use a belly-button massager and forgo chemotherapy, then we have a very serious situation.” The biggest myth Schwarcz has to challenge is the conviction that if something is natural, it is perceived as safe and benign, while something that is synthetic is automatically dangerous. “This is not the case,” Schwarcz said. “The only way you can tell if a substance is beneficial or detrimental is by studying it.” The mantra is “evidence-based.” Nonetheless, Schwarcz pointed out that “quackery” cannot be wiped out

completely because it's "very seductive"—the idea of "simple solutions to complex problems" is what people look for, but "without being dogmatic or lecturing to people," it is crucial to ask the right questions to get people thinking and, in turn, to get them to ask questions such as whether something can be traced back to peer-reviewed literature, for example.

The term "alternative medicine" can also be tricky. According to Edzard Ernst, Emeritus Professor at the University of Exeter in the UK and author who has published the most on the subject, it would be much better to abandon the umbrella term and only talk about modalities (e.g., acupuncture, homeopathy, etc.). As a temporary solution, Ernst adopted the term "so-called alternative medicine" which shortens to SCAM. In any case, the term "alternative medicine" can still be quite useful as that's the term "people know" compared to other synonyms such as "integrated medicine," which might be even more confusing to the general public—according to Schwarcz, "real medicine is integrated medicine: you integrate whatever works." In the United States, especially, there are many efforts by "reputable institutions" to embrace alternative medicine departments and teaching, and Ernst



traces these efforts back to multiple reasons: money, "because universities are run like businesses and go where the money is"; "political correctness"; and the fact that "nobody wants to reject what seems to be fashionable," so universities "jump on the bandwagon." A further reason, tied to the last, is press coverage. The issue of alternative medicine is particularly poignant in Germany, where Ernst is from, so much so that many doctors use homeopathy. The question is: how to help mitigate the problem?

The all-group discussion among participants offered some potential solutions. First, it might be worth considering what we can learn from alternative medicine "doctors." They are good at empathizing, are patient, and offer a more centered healthcare. This, consequently, means people trust them. Alternative medicine is perceived as "safer," and it doesn't help that, in some instances, people are dissatisfied with conventional medicine. In some places, people don't even have access to conventional medicine (e.g., some rural areas). To complicate matters, conspiracy theories about Big Pharma feed into people's dissatisfaction with conventional medicine. Teaching communication skills to doctors and pressing politicians to act on the issue could be possible resolutions. Second, there is no international organization for alternative medicine—like the Intergovernmental Panel on Climate Change (IPCC) for climate issues, for example. Consequently, it is crucial to put more pressure on the World Health Organization to commit to a position to counter alternative medicine practices, although some participants have recognized this cannot be easy, as alternative medicine is a very big market with financial incentives. Acting on a political level and stopping the funding stream (e.g., stop alternative medicine practices from being reimbursed by medical insurances) become imperative.

Session 4

Dousing the Fires of Climate Change Denial

Climate change denial is also present to different degrees amongst different countries. Tim Mendham, journalist and Executive Officer of the Australian Skeptics, described the political cadre in Australia, where there are many climate change deniers at governmental level, and there is fear by conservatives that transitioning to renewable energy would wipe out the entire coal industry. This is why, overall, the Australian government has not committed to a net-zero emissions plan like other countries.

Climatology Researcher, former author of the 5th IPCC report and President of Association Française pour l'Information Scientifique (French Association for Scientific Information), François-Marie Bréon said that the climate change denial situation in France is vastly different considering the fact that “the government is taking it [climate change] very seriously,” and “only few individuals claim it’s not true or important.” The big question in France is nuclear power. There is an ongoing debate about it, so much so that the issue of tackling climate change “becomes a debate on nuclear.” According to Bréon, however, 80% of energy is still based on fossil fuel, and that should be the central issue.

In a country like Sudan, which, before 2019, had a corrupt and authoritarian government, climate didn’t surface at all as a priority: instead, the country was facing conflict, civil war, and a collapsing economy. “When I started climate activism in 2016, I found it really hard to mobilize people,” said Lina Yassin, climate activist from Sudan and Middle East and North Africa (MENA) Programme Manager at Climate Tracker, and “because people were focused on other priorities such as daily income” the level of climate awareness was extremely low. Today, the issue is surfacing more—compliant are the increasingly visible and tangible climate change effects to the MENA region. Bréon pointed out that, because Sudan has very little responsibility for climate change, it might be more “a question of mitigation rather than of responsibility” for Sudan.

In the context of climate change communication, Yassin highlighted that climate journalism is about identifying audiences and understanding them. For example, in Sudan, if the aim is to create general awareness across the public, it is important to avoid direct scientific articles but rather convey messages that target the human element (e.g., how climate change impacts people and families), which makes it more relatable and also allows for easier introduction of scientific information. Communicating about climate change has its own unique challenges, concurs Hajar Khamlichi, President and Co-Founder of the Mediterranean Youth Climate Network and Board Member of the Moroccan Alliance for Climate and Sustainable Development. Challenges include scientific jargon, opening up conversations about climate solutions to be more inclusive and accessible, and dealing with highly technical scientific reports with complex terminology largely incomprehensible to lay audiences. On the surface, Khamlichi emphasized, climate change communication is about educating, warning, informing, persuading, mobilizing, and solving the global emergency, but at a deeper level, climate change communication “is shaped by our different experiences, mental and cultural models underlying our values and world views.” Khamlichi uses the example of the term “theory” to explain this further: to someone in the sciences, a theory is the current

understanding of something, but for lay people a theory is “merely a conjecture;” this is demonstrative of the fact that there are substantial issues concerning public trust in science, “as well as the perception that climate change is only a distant threat.” In this sense, the role of the language in conveying climate change issues to different stakeholders, either the public or policy makers, is key. Khamlichi believes it is important to combine narrative storytelling, imagery, experiential scenarios, balanced with scientific information, and to deliver trusted messengers in group settings because, as already emphasized, “the messenger is as important as the message itself.” It is also crucial to acknowledge the difference between climate change action approaches between industrialized countries and the developing countries. “Audiences in developing countries generally do not need to be convinced that climate change is happening,” Khamlichi pointed out. “They see the evidence before their eyes in searing heat waves and increasing numbers of heat-related illnesses and deaths and in flooded food crops. What these audiences need is to make sense of what they are seeing, so as to understand their lived experience in a scientific context, to know what the future might hold, and to decide what they should do about it.” In other words, “they need to make the connection between the big picture and people’s experience between scientific and local knowledge.” For most people in the industrialized world, action on climate looks very different because developing countries also need to tackle persistent poverty and basic development needs such as drinking water provisions, sanitation, education, housing, and healthcare.

Even with the presence of the scientific climate consensus, communicating climate change is a complicated issue, particularly when it intercepts climate change denialism. John Cook, Research Fellow at the Monash Climate Change Communication Research Hub at Monash University in Australia and founder of the Skeptical Science website that counters climate misinformation, was the lead author of a well-known paper that determined the scientific consensus for global warming at 97%. The paper was widely attacked by deniers, because “people who opposed climate action were determined to keep the public confused about the climate change consensus and not supporting climate action,” said Cook, who is now working



on machine learning and training machines to recognize climate misinformation. According to Cook's research, the biggest category in climate change denial arguments is "attacks on climate science" and undermining the public trust in climate science and scientists. The countries where climate denial is greater (i.e., U.S., Australia, Canada, New Zealand, and the U.K.), Cook explained, tend to be countries where Rupert Murdoch's New Corps is very prominent. A study from the University of Queensland looked at the degree of polarization in different countries: the countries with the highest mix of fossil fuel energy in the country's energy sources are also the countries with the highest degree of polarization on climate change. Cook's conclusion is that (i) misinformation coming out through mainstream conservative media, like Murdoch press, contributed to denial and (ii) fossil-fuel-funded misinformation is a big driver for denial across different countries. So, what can we do to neutralize misinformation? Build resilience by explaining the techniques used to mislead, said Cook. For example, the denier argument that forces people to choose between the economy and the environment or, perhaps more relevant to the pandemic, between economy and public health, is what Cook categorizes as a false choice. "You can't have a healthy economy without a healthy environment," he said. The most effective way to respond to misinformation targeting climate solutions is the same way to respond to misinformation targeting climate science: expose the techniques used to mislead, as this increases resilience and results in a less likely probability of being misled.

Other considerations were brought up during the all-group discussion that followed the panel. In countering misinformation, it is important to recognize the different meaning tied to the word skeptical where scientific skepticism is not to be confused with skepticism linked to denial. In climate change storytelling, it is important not to portray people in personal stories about climate change as victims but as solving problems and joining together for solutions. Start from questions like: which countries have positive examples and successes? Participants agree that one of the best ways to inoculate people against climate change denial and misinformation is to expose the rhetorical techniques and to emphasize logic-based parallelisms, such as the one between the tobacco industry denial campaign and the climate change denial campaign.

Session 5

Defeating Vaccine Hesitancy Through Communication

It has never been clearer: Misinformation has been an obstacle to the control of the spread of coronavirus and has given impetus to anti-vaxxers who have become “more virulent than ever,” especially in the Western world, said Agnes Binagwaho, Vice Chancellor at the University of Global Health Equity and former Minister of Health in Rwanda. This is the result of global leaders who have politicized simple tools such as masks, for example, as well as scientific discoveries, “cultivating the illusion that scientific evidence is useless” said Binagwaho. “The spread of inaccurate information by global leaders through social media platforms or through direct official speeches, as well as their contribution to vaccine hesitancy and the refusal of wearing masks across the world have been and still are the best ally to the virus,” she added. It is crucial, in this context, to determine how to challenge this wrong perception of the pandemic, of the disease, and of vaccines.

There is a difference, however, between vaccine hesitancy and anti-vaxxer sentiment. Those who are hesitant will look for proper information and try to understand as much as they can so that, if well-guided, they can be persuaded to get vaccinated, while anti-vaxxers are “highly unreachable,” and they thrive on the anti-vax community by “reinforcing their messages internally,” explained Ovidiu Covaciu, Administrator of Vaccinuri si Vaccinare (Vaccines and Vaccinations), Founder of Coaliția România Sănătoasă (Romania Healthy Coalition), and Producer of Sceptici în România (Skeptics in Romania). Through this analysis, it is possible to pinpoint the exact element of divergence. “When you actively spread misinformation, you are taking steps towards anti-vax,” said Covaciu, and that is when “you become unreachable.” Anti-vax misinformation is a huge issue on social media, where “engaging content” that is also contentious and controversial, drives more clicks and views and, consequently, brings more money through financial incentives and advertisements. Covaciu has founded a Facebook group on vaccines and vaccination with more than 100,000 members. He believes the key to countering misinformation is creating a safe space to ask questions, a platform that doesn’t allow misinformation and that can offer scientifically-accurate answers to people asking questions.

According to Kavin Senapathy, a science, health, and parenting writer, science curiosity can push someone to “seek novel information even when it contradicts their political views.” Senapathy strongly encourages science communicators to think about what can increase science curiosity to mitigate pseudoscience and misinformation.

Vaccine hesitancy can be targeted on multiple fronts. Strategies to create partnerships for immunization at the local level, for example, are a crucial part of this process. According to Fara Ndiaye, Deputy Executive Director for Speak Up Africa, civil society organizations play a critical role in maintaining, restoring and strengthening immunization services at the country level. Ndiaye recognized it is important to work hand-in-hand with trusted—emphasis on trusted—civil society organizations that “will advocate for the importance of immunization at the country, regional, and global level,” and to ensure a more systematic and active engagement of civil society organizations and community partners to “advocate and identify

‘zero-dose children’ and missed communities.” Immunization as a matter for the government and government only is not a sustainable view in the long run, Ndiaye said, while civil society organizations can achieve equity and sustainability because they can have an impact on political will and accountability by monitoring and holding the government accountable to their commitments to agreed national objectives. Civil society organizations are also uniquely positioned to build communities of trust and confidence and can have an impact in generating demand in primary healthcare and immunization. In regard to African countries specifically, Ndiaye believes that to counter misinformation, it is important to “hear more from African scientists themselves” because “too often we envision vaccines and science that comes from abroad whereas, we need to provide the right platforms to African scientists, which will help build trust” and “shift how we communicate around science and vaccines.”

Vaccination is not always a choice. When talking about vaccination, “many people pretend it’s a choice,” said Noel Brewer, Professor at the Department of Health Behavior of Gillings School of Global Public Health at the University of North Carolina. It may seem like a choice, but there’s a lot of context that makes vaccination not a choice, Brewer pointed out. For example, is it available? COVID-19 vaccines are not available in many countries, and measles vaccines, for example, were under-available for a long period of time. Another factor



is whether people can get vaccinations (e.g., get time away from work, walk two days to get to the city center where vaccines are available, etc.). “Many of these [factors] become reframed as choices, a decision that people make, but that’s a mistake,” Brewer affirmed. According to Brewer’s research, three things lead to higher rates of vaccination: opportunity, socialization, and people’s understanding. For example, when a provider or healthcare worker recommends the vaccine, or if someone has already gotten another vaccine of any sort, or “if you merely intend to”—all these factors have a big influence on vaccination. As previously mentioned, the challenges revolve around countering misinformation, because “if we don’t fill the space with information, there’s going to be a vacuum, and a lot of people are going to fill it with misinformation,” Brewer said, but also around the opportunity of vaccination, such as logistical solutions like having on-site vaccination clinics, bringing vaccination to schools and people’s workplace, giving people automatic appointments or reminders, and scheduling vaccination by default—all these things are reliably effective, Brewer explained. On the other hand, misinformation likely affects vaccination uptake, too, as it undermines policymakers’ willingness to support the programs and policies that are effective. This is why we need strong public advocacy for vaccination, Brewer said. The options to address vaccine misinformation, again, are either to deal with the lies or to attack the deniers’ argument style, which is very effective, as climate change denial counter argument strategies show.

The all-group discussion identified a key aspect: trust. Thus, in tackling vaccine misinformation, it is fundamental to increase transparency of the media, offer alternative and accurate resources, adapt immunization strategies to the local context by elevating the voices of local scientists and making their work more visible, increase the role of organizations in supporting health messaging (introducing independent institutions which remove politics), create digestible science information to increase vaccine uptake, and last but not least, address the precautionary principle and the myth of zero-risk.

Session 6

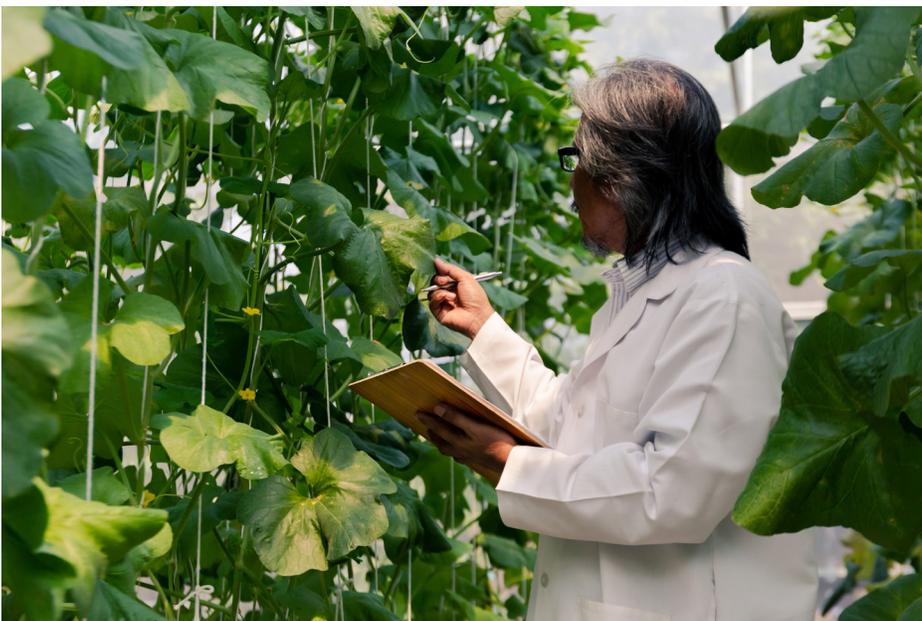
Food Biotechnology for a Sustainable Future

The debate on food biotechnologies has been ongoing for many years. Although biotech crops have been on the market for 25 years, 29 countries are growing them, and 70 countries have issued approvals, the debate has not subsided, and critics “are still busy cooking up pseudoscience” to derail technologies, said Mahaletchumy Arujanan, Global Coordinator of the International Service for the Acquisition of Agri-biotech Applications (ISAAA) and Executive Director of the Malaysian Biotechnology Information Centre (MABIC). There is a growing necessity to reframe the debate on future food productions, including gene-editing, and a need to change the narratives and re-strategize, Arujanan argued. Jon Entine, Founder and Executive Director of the Genetic Literacy Project and author, reflected on the existing tension between GMOs and organic. In the 1990s, in the United States, organic was a process for growing, and genetic engineering and biotechnology were processes for seed-development. There isn’t necessarily a tension between the two, Entine said. However, over the years, because of “the intervention of advocacy groups and mistakes within the agricultural industry in focusing its public relations and communicating benefits of biotechnology mostly to farmers” a polarization began to develop, and “what started as a potential for synergy between the two has become very acrimonious,” Entine added. In his view, the objectives of both are the same: sustainable food production, ample food, and protection of the environment, especially in this era of climate crisis. One of the identified issues is that biotechnology and gene-editing are portrayed as unnatural, even though “no food we eat is naturally developed”; rather, “they were all manipulated by man in one form or another,” said Entine. In this scenario, this mechanism leads to “a caricature of dangers of biotech foods or seeds, which is not higher than in conventional foods,” and there is a need to overcome this chasm. According to Entine, innovations in gene-editing open a new possibility and can, potentially, reduce diseases and cut the use of pesticides, both synthetic and organic, that could be toxic. In this sense, Entine is hopeful that gene-editing can provide “a door opening to a broader and more thoughtful discussion about how we get to a more sustainable agricultural future.” Sarah Davidson Evanega, Director of the Cornell Alliance for Science at Cornell University and Research Professor in the Department of Global Development with a joint appointment in the School of Integrative Plant Sciences in the College of Agriculture at Cornell University, appreciates that there is an unnecessary division between modes of agriculture: “we can have both organic management practices”—which, Entine emphasizes, is beneficial to soil preservation—“as well as innovative technologies in how to develop a seed, for example.”

In Europe, polls show the public is wary of food biotechnologies, but according to Angela Bearth, Research Scientist in Consumer Behavior at the Department of Health Sciences and Technology at ETH Zürich in Switzerland, it is important to ask the right questions when conducting large consumer surveys like those that guide policies and regulations: simple questions (e.g., do you want a normal potato or a potato grown with gene-technology?) trigger simple heuristics in consumers who rely on their feelings or on previous experiences, said Bearth. That is why one of the aims of her research is to go deeper and give people context when asking survey questions. Bearth also encouraged consideration of the misconception that “anything that is synthetic is bad” and, conversely, “anything that is natural is good”: this gives the suggestion that copper, a natural pesticide, would still be allowed even though copper has negative impacts on both the

environment and on health. It is important to understand and address these misconceptions. Research shows that people prefer synthetics when it comes to curatives (e.g., if they are sick), whereas they prefer natural substances for preventives: Bearth explained that this is why vaccines—which have biotechnology properties to them—are generally approved and accepted. Technically, vaccines are a preventative measure, but in the context of the pandemic they are perceived as a curative.

The distribution of food biotechnology use differs from country to country and continent to continent. In Africa, since 2020, seven countries have approved commercialization and cultivation of biotech crops. Nigeria made history by being the first country in the world to approve the cultivation of insect-resistant cowpea, also called Maruca-resistant cowpea.



In the context of reframing the discussion around biotechnologies, Margaret Karembu, Director of AfriCenter at the International Service for the Acquisition of Agri-biotech Applications (ISAAA), Africa region and pioneering chair at the Open Forum on Agricultural Biotechnology in Africa (OFAB—Kenya chapter), argued it is important to reflect on the kind of messaging, audience, and platforms. The narrative must change as well: “the fact that the technology was introduced

to help ‘poor Africans’” leads to the perception that the technology “is being pushed to vulnerable groups,” Karembu said. Karembu proposed multiple ways of overcoming these issues: (i) it is important to frame gene-editing as “a tool that is going to address real issues that are affecting the African continent,” such as farming, community, health, the environment, and even the industry and manufacturing sectors; (ii) recognizing the limits of these technologies and tools and making sure “we are not overclaiming what technologies can do”; (iii) identifying and ensuring the right language and platforms—for example the use of platforms that can cater to the large African rural population like radios and WhatsApp; and (iv) elevating the conversation and effort to communities working together globally.

According to Evanega’s analysis, biotech crops in the United States have been widely adopted based on the utility and benefits to farmers; the country grows 40% of the world’s biotech crops with only 1.8% of the population engaged in agriculture. If more than 60–70% of the population in many countries in Africa are engaged in agriculture and it comes down to the benefits for farmers, “why are biotechnologies rarely adopted in African countries?” Evanega asked. This comes down “not to the lack of demand by farmers” but to the “lack of political will and bravery and misinformation and things that have nothing to do with science but are other externalities.” Evanega argued that the technology hasn’t lived up to its potential: too few crops and too few countries have benefited from this tool. It’s important to avoid Western narratives, like the “guinea-pig narrative,” which are impeding adoption and political will in countries in Africa, and to spur innovation in-country by thinking more strategically about local, trusted, and relevant messengers, by overcoming the romantic notion of food and the “technophobia” around food, Evanega said. “When people see real utility and real need,” they are more likely to beat hesitation and adopt new technologies.

Suggestions in the all-group discussion included the creation of an international organization or panel, like the IPCC for climate, the definition of a scientific consensus on food biotechnologies, the implementation of teaching in order for people to “grow up with science,” and the inclusion of more scientists in regulatory negotiations. Moreover, to address the division between organic and biotech food by “demystifying what it means to be natural”—including the association whereby GMOs are “for the poor,” while organic is “for the rich”—with the aim of changing the victim/villain mentality, and to consider gene-editing as distinct from GMOs as negative associations are still in place.

Conclusion

The Global Congress brought together experts and leaders with the intention and hope of enabling the implementation of scientific and rational approaches to policy making and education. With speakers and members from all continents and many countries around the world, diversity and inclusion have been and will continue to be at the forefront of the Congress's mission, not only because, as Co-Chair Aaron Mertz said, "tackling the most pressing global issues requires collaboration across national boundaries" and building bridges among groups, but also because, as Co-Chair Natália Pasternak Taschner said, "in order to design meaningful global policy regarding human health and social and environmental justice, we believe in evidence-based solutions that incorporate social, cultural, and historical contexts."

Playbook

Our Goals as a Global Science Community

- Create a platform related to scientific thinking and skepticism to share results, projects, funding opportunities, communication strategies, and policy briefs
- Enact an IPCC-style panel and report for food biotechnologies, alternative medicine, vaccines, and other scientific fields that strongly intersect with global policies
- Pursue establishment of a “Special Rapporteur” for science in the context of the United Nations to combine thinking and action in international policies
- Use science diplomacy to promote scientific consensus and analytical thinking in setting global policies
- Promote ways in academia to institutionalize and value public science communication
- Include graduate students (and, more generally, undergraduates and high school students) of science departments to actively participate in these activities

Congress Chairs & Speakers

CONGRESS CHAIRS:

Aaron F. Mertz (*New York, USA*) – Director, Aspen Institute Science & Society Program

Natália Pasternak Taschner (*Brazil*) – President, Instituto Questão de Ciência (Question of Science Institute)

SPEAKERS:

Keynote Discussion: Standing Up For Data and Evidence in the Face of Science Denial

Mariette DiChristina (*Massachusetts, USA*) – Dean, College of Communication, Boston University; former Editor-in-Chief, Scientific American

Ricardo Galvão (*Brazil*) – Professor, Institute of Physics, University of São Paulo; former Director-General of the National Institute for Space Research

Session 1: Building a Dialogue on Evidence and Values: Overcoming Science Denialism

Chair: Abhilash Mishra (*Illinois, USA / India*) – Director, Xu Initiative on Science, Technology, and Global Development, University of Chicago; Founder, EquiTech Futures

Lee McIntyre (*Massachusetts, USA*) – Research Fellow, Center for Philosophy and History of Science, Boston University

Amardeo Sarma (*Germany*) – Chair, Gesellschaft zur wissenschaftlichen Untersuchung von Parawissenschaften (Society for the Scientific Investigation of Parasciences)

Philipp Schmid (*Germany*) – Behavioral scientist, Interim Lecturer for Statistics and Methods, Department of Psychology, University of Erfurt

Joy Y. Zhang (*UK/China*) – Senior Lecturer in Sociology, School of Social Policy, Sociology, and Social Research, University of Kent

Session 2: Science Literacy and Popularization: Understanding How Science Works

Chair: Richard Gallagher (*California, USA / UK*) – President & Editor-in-Chief, Annual Reviews, Publisher, Knowable Magazine

Ayelet Baram-Tsabari (*Israel*) – Associate Professor, Faculty of Education in Science and Technology, Technion – Israel Institute of Technology

Stuart Firestein (*New York, USA*) – Chair, Department of Biological Sciences, Columbia University

Simon Singh (*UK*) – Author, journalist, and TV producer, specializing in science and mathematics

Masataka Watanabe (*Japan*) – Specially Appointed Professor, Tohoku University

Session 3: Risks and Dangers of Alternative Medicine

Chair: Roxana Tabakman (Argentina) – Health writer and science journalist

Edzard Ernst (UK) – Emeritus Professor, University of Exeter

Narendra Nayak (India) – President, Federation of Indian Rationalist Associations

Joe Schwarcz (Canada) – Chemist and Director, Office for Science and Society, McGill University

Natália Pasternak Taschner (Brazil) – President, Instituto Questão de Ciência (Question of Science Institute)

Session 4: Dousing the Fires of Climate Change Denial

Chair: Tim Mendham (Australia) – Executive Officer, Australian Skeptics

François-Marie Bréon (France) – Climatology Researcher, Association Française pour l'Information Scientifique (French Association for Scientific Information)

John Cook (Washington, DC, USA) – Research Assistant Professor, Center for Climate Change Communication, George Mason University

Hajar Khamlichi (Morocco) – President and Co-Founder, Mediterranean Youth Climate Network; Board Member, Moroccan Alliance for Climate and Sustainable Development

Lina Yassin (Sudan) – MENA Programme Manager, Climate Tracker

Session 5: Defeating Vaccine Hesitancy Through Communication

Chair: Agnes Binagwaho (Rwanda) – Vice Chancellor, University of Global Health Equity; former Minister of Health of Rwanda

Noel Brewer (North Carolina, USA) – Professor, Department of Health Behavior, Gillings School of Global Public Health, University of North Carolina, Chapel Hill

Ovidiu Covaciu (Romania) – Administrator, Vaccinuri si Vaccinare (Vaccines and Vaccinations); Founder, Coaliția România Sănătoasă (Romania Healthy Coalition); Producer, Sceptici în România (Skeptics in Romania)

Fara Ndiaye (Senegal) – Deputy Executive Director, Speak Up Africa

Kavin Senapathy (Illinois, USA) – Science, health, and parenting writer

Session 6: Food Biotechnology for a Sustainable Future

Chair: Mahaletchumy Arujanan (Malaysia) – Global Coordinator, International Service for the Acquisition of Agri-biotech Applications (ISAAA); Executive Director, Malaysian Biotechnology Information Centre (MABIC)

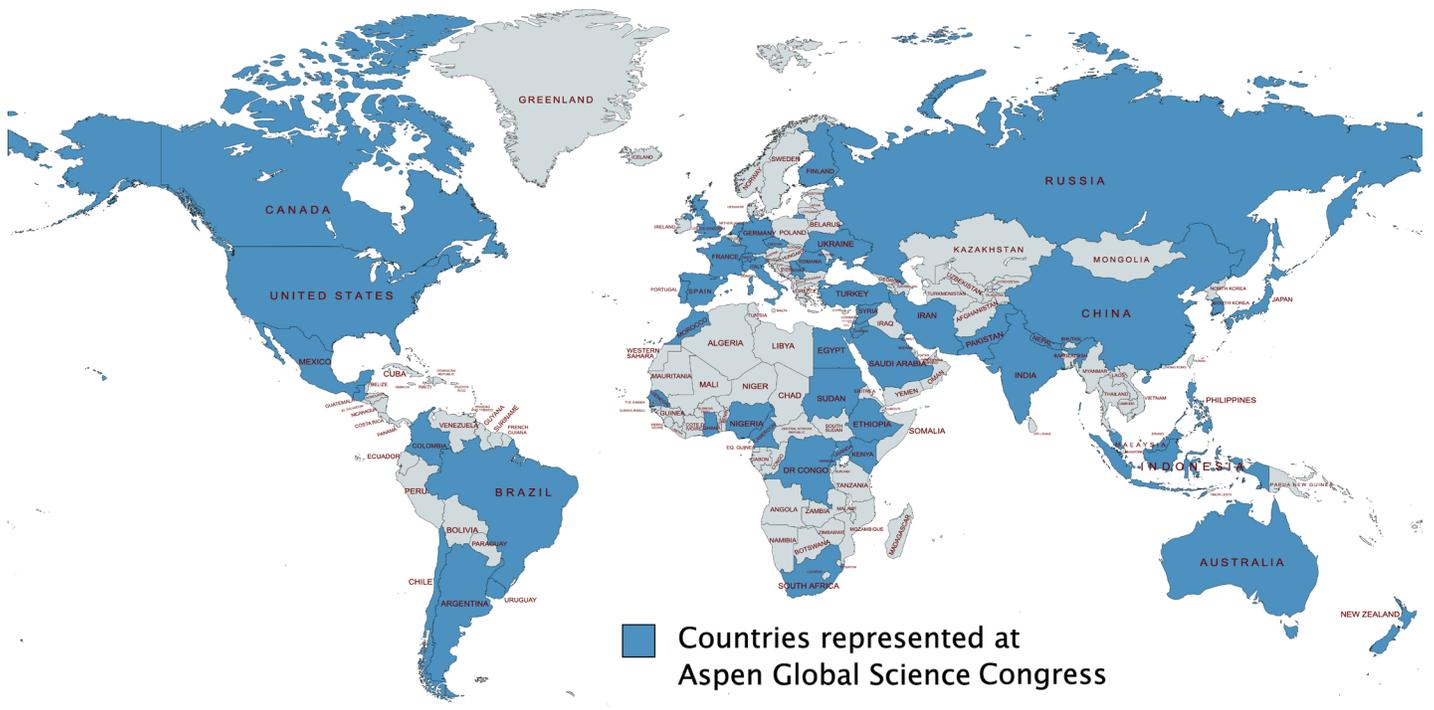
Angela Bearth (Switzerland) – Research Scientist, Consumer Behavior, Department of Health Sciences and Technology, ETH Zürich

Jon Entine (Ohio, USA) – Founder and Executive Director, Genetic Literacy Project

Sarah Davidson Evanega (New York, USA) – Director, Cornell Alliance for Science, Cornell University

Margaret Karembu (Kenya) – Director, AfriCenter, International Service for the Acquisition of Agri-biotech Applications (ISAAA)

Participants



Naglaa Abdel-Moneim Ahmed Abdallah (Egypt) – Head of the Arab Society of Genetics and Biotechnology; Director of the Egypt Biotechnology Information Center (EBIC) www.e-bic.net, International Service for Acquisition of Agri-Biotech Application (ISAAA)

Ali Albahrani (Saudi Arabia) – Founder and Presenter, Eureka Show

Saleem Ali (Delaware, USA) – Member, Scientific and Technical Advisory Panel, Global Environment Facility, United Nations Environment Programme

Paulo Almeida (Brazil) – Financial Officer, Instituto Questão de Ciência (Question of Science Institute)

Dheaya Alrousan (Jordan) – Chairman, Green Generation Foundation

Ross Andersen (Washington, DC, USA) – Deputy Editor, The Atlantic

Gonzalo Argandoña (Chile) – Science journalist and astronomy disseminator; Founder, Cabala Producciones

Faris Bukhamsin (Saudi Arabia) – CEO, Scientific Saudi

Russ Campbell (North Carolina, USA) – Senior Communications Officer, Burroughs Wellcome Fund

Yul Rae Cho (South Korea) – President, Korea Foundation for the Advancement of Science & Creativity (KOFAC)

Anne Claiborne (California, USA) – Health Science Policy and Strategy Lead, Chan Zuckerberg Initiative

Tinsley Davis (California, USA) – Executive Director, National Association of Science Writers

Catherine de Jong (Netherlands) – Anesthesiologist; Secretary, Vereniging tegen de Kwaksalverij (Dutch Society Against Quackery)

Daria Denisova (Russia) – Director, Center for Science Communication, ITMO University

Thomas Dorlo (Netherlands) – Pharmacometrician and clinical pharmacology expert; Board Member, Vereniging tegen de Kwaksalverij (Dutch Society Against Quackery)

Çiler Dursun (Turkey) – Professor, Faculty of Communication, Ankara University; Scientific Coordinator, Genovate

Ahmed El-Ghandour (Egypt) – Founder and presenter, Al-Daheeh YouTube show

Mónica I. Feliú-Mójer (Puerto Rico, USA) – Director of Communications & Science Outreach, Ciencia Puerto Rico

Cary Funk (Washington, DC, USA) – Director, Science and Society Research, Pew Research Center

Erez Garty (Israel) – Head of Science Communications, Davidson Institute of Science Education, Weizmann Institute

Susan Gerbic (California, USA) – Founder, Guerrilla Skepticism on Wikipedia

Akram Ghadimi (Iran) – Associate Professor, Department of Popularization of Science, National Research Institute for Science Policy

Rose Gidado (Nigeria) – Assistant Director of the Agricultural Biotechnology Department at the National Biotechnology Development Agency (NABDA); Nigerian Country Coordinator for the Open Forum on Agricultural Biotechnology (OFAB)

Laura Goodall (New Zealand) – President, Science Communicators Association of New Zealand

Alice Hazelton (Switzerland/UK) – Programme Lead, Science and Society, World Economic Forum

Jonathan Jarry (Canada) – Science Communicator, Office for Science and Society, McGill University

Marina Joubert (South Africa) – Senior Researcher, Centre for Research on Evaluation, Science and Technology (CREST), Stellenbosch University

Stéphane Kenmoe (Cameroon) – Scientist, science communicator, and television personality

Safa Khalaf (Jordan) – Community Outreach Officer, Phi Science Institute

Patience Kiyuka (Kenya) – Infectious diseases researcher

Claire Klingenberg (Czechia) – President, European Council of Skeptical Organizations (ECSO)

Robert Klitzman (New York, USA) – Professor of Psychiatry, Director of Masters of Bioethics Programs, Columbia University

Marko Krstić (Serbia) – Acting Director, Centar za Promociju Nauke (Center for the Promotion of Science)

Stella Levantesi (Italy) – Journalist, author, and photographer

Neta Lipman (Israel) – CEO, Israel Society of Ecology and Environmental Science

Soledad Machado (Uruguay) – Senior Team Member, Química d+; Founding Member, Bardo Científico

Hope Mafaranga (Uganda) – Science journalist; Assistant Regional News Editor, New Vision

Mahmoud Bukar Maina (Nigeria) – Founder, Science Communication Hub Nigeria

Mouhannad Malek (Syria/Germany) – Founder and Chairman, Syrian Researchers

Qaiser Majeed Malik (Pakistan) – Chairman, Pakistan Science Foundation

Afy Malungu Bobyondo (Democratic Republic of Congo) – Environmental communication practitioner; freelance editor, www.infocongo.org

Michael Marshall (UK) – Project Director, Good Thinking Society

Emily Gold Mears (California, USA) – Health and science advocate; author, *Discussing Dementia* blog

João Lourenço Monteiro (Portugal) – Vice President, COMCEPT: Comunidade Céptica Portuguesa (Portuguese Skeptical Community)

Michel Naud (France) – Director, Former President, Association Française pour l’Information Scientifique (French Association for Scientific Information)

Pablo Orozco (Guatemala / New York, USA) – Policy Affairs Associate, Cornell Alliance for Science

Carlos Orsi (Brazil) – Editor-in-Chief, *Questão de Ciência* (Question of Science) magazine

Daniela Ovardia (Italy) – Science journalist, neuroscientist, and neuroethicist; Scientific Director, Agenzia Zoe; Co-Director, Neuroscience and Society Lab, University of Pavia

Alexander Panchin (Russia) – Senior Researcher, Institute for Information Transmission Problems (Kharkevich Institute) and Member, Commission on Pseudoscience and Research Fraud, Russian Academy of Sciences

Carlo Papa (Spain) – Director, Enel Foundation

Helen Pearson (UK) – Chief Magazine Editor, *Nature*; journalist, science communicator, and author

Avital Percher (Washington, DC, USA) – Director of Partnerships, National Science Policy Network (NSPN); American Association for the Advancement of Science (AAAS) Science & Technology Policy Fellow

Marco Perduca (Italy) – Co-Founder, Science for Democracy

Rodrigo Pérez Ortega (Washington, DC, USA / Mexico) – Freelance science journalist; founding member, Mexican Network of Science Journalists

Massimo Polidoro (Italy) – Executive Director, Comitato Italiano per il Controllo delle Affermazioni sul paranormale (Italian Committee for the Investigation of Claims on the Paranormal)

Inez Ponce de Leon (Philippines) – Assistant Professor, Department of Communication, Ateneo de Manila University

Ángela Posada-Swofford (Florida, USA / Colombia) – Science, environment, and exploration journalist, lecturer, moderator, and book author

Alberto Quadrio Curzio (Italy) – Economics Professor; President Emeritus, Accademia Nazionale dei Lincei

Juan A. Rodríguez (Spain) – Secretary, ARP–Sociedad para el Avance del Pensamiento Crítico (Society for the Advancement of Critical Thinking); Editor, *El Escéptico* (The Skeptic) magazine

Rhodora Romero-Aldemita (Philippines) – Director, International Service for the Acquisition of Agri-biotech Applications (ISAAA) SEAsia Center

Iida Ruishalme (Finland/Switzerland) – Biologist and science communicator; author of *Thoughtscapism* blog

Mohamed Qasem (Kuwait) – Assistant Professor, Department of Electronics Engineering, College of Technological Studies; consultant on digital science content, Kuwait Foundation for the Advancement of Sciences (KFAS)

Ahmed Samir (Egypt) – Founder and Leader, *Egychology*

Gianna Savoie (New Zealand) – Director of Filmmaking, Center for Science Communication, University of Otago

Ximena Serrano Gil (Colombia) – President, Asociación Colombiana de Periodismo Científico (Colombia Association of Science Journalists)

Emily Shore (Canada) – Public Affairs and Communications Director, Office for Science and Society, McGill University

Sunil Babu Shrestha (Nepal) – Vice-Chancellor, Nepal Academy of Science and Technology

Nataliya Shulga (Ukraine) – CEO, Ukrainian Science Club

Tania Simoncelli (California, USA) – Director of Science Policy, Chan Zuckerberg Initiative

Thomas Tagoe (Ghana) – Lecturer, Physiology and Pharmacology, University of Ghana; Co-Founder, GhScientific

April Philippa Tash (France) – Programme Specialist, Lead for the Recommendation on Science, UNESCO

Tenaw Terefe (Ethiopia) – Assistant Professor, Faculty of Journalism and Communication, Addis Ababa University

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Michael Weisberg (Pennsylvania, USA) – Co-Director, Penn Laboratory for Understanding Science; Professor, Professor and Chair of Philosophy, University of Pennsylvania

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