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# Perceptions of invited seminar speakers and seminar organizers across university biology departments in virtual formats

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Research seminars are a staple within biology and other science, technology, engineering, and mathematics (STEM) departments across academic institutions. During the COVID-19 pandemic, academic institutions across the U.S. had to rapidly transition courses, research programs, and other events from in-person to virtual environments—and departmental research seminars were no exception. We explored the perceptions of biology department seminar speakers and organizers regarding the benefits and challenges they experienced in the virtual format. We asked three primary research questions: (1) What challenges and benefits do invited seminar speakers in biology departments perceive regarding presenting seminars in the virtual environment? (2) What challenges and benefits do organizers of biology department seminars perceive regarding organizing seminars in the virtual environment? (3) How did biology department seminars change during the transition from an in-person to virtual format? In total, 39 seminar organizers and 90 seminar speakers completed surveys focused on their perceptions of virtual seminars. Using descriptive statistics and thematic analysis, we found that numerous benefits and challenges are perceived by seminar speakers and organizers regarding virtual seminars. Speakers and organizers perceived similar benefits of virtual seminars including accessibility and diversity, while perceived challenges included the loss of professional networking opportunities and academic community. There was overwhelming consensus from speakers and organizers alike that virtual departmental seminars are professionally and academically valuable. However, while speakers' chief motivator was in furthering their own networks, research collaborations, and research visibility, organizers primarily valued their own students' or trainees' career development as well as their own departmental community. Together, these findings demonstrate the potential benefits of continuing virtual seminars outside of the context of the COVID-19 pandemic from an equity perspective while also highlighting issues that must be addressed by organizers and attendees to ensure seminars retain their value.

## KEYWORDS

seminar, colloquium, department, biology, virtual, perceptions, benefits, challenges

## 1. Introduction

Academic research seminars—sometimes also referred to as colloquia—are a staple within biology and other science, technology, engineering, and mathematics (STEM) departments across U.S. institutions (Nittrouer et al., 2018). While the format and content of research seminar series may vary widely across biology departments and institutions, they provide a venue in which invited scientists—both within and beyond the department and university—can disseminate their research, build collaborations with faculty and trainees (e.g., undergraduates, graduate students, and postdoctoral researchers), and strengthen their curriculum vitae (CV) (Carter et al., 2018; Nittrouer et al., 2018; Hagan et al., 2020). Additionally, those invited to present research seminars may also benefit from a bolstered academic reputation and promotion within their field (Nittrouer et al., 2018).

During the start of the COVID-19 pandemic, academic institutions across the U.S. had to rapidly transition courses, research programs, and other events from in-person to virtual environments—and departmental research seminars were no exception (Bottanelli et al., 2020). While some biology departments simply did not offer their regular research seminar series, others continued to provide research seminars—albeit often online via video-conferencing platforms with virtual speakers presenting from their homes. As challenging as this adjustment was, virtual seminar series in biology and other STEM departments are generally less costly and more inclusive of speakers who would not otherwise have been able to present in-person (Achakulvisut et al., 2020; Bottanelli et al., 2020).

Despite the significance of departmental research seminars across biology departments, the experiences and demographics of invited seminar speakers as well as the perceptions and processes of individuals involved in organizing departmental seminar series are understudied. Thus, we sought to explore the perceptions of biology department seminar speakers and organizers, particularly in regard to the benefits and challenges they experienced in the virtual format during the first year of the pandemic. We administered two distinct surveys—a seminar speaker survey and a seminar organizer survey—to answer three primary research questions:

1. What challenges and benefits do invited seminar speakers in biology departments perceive regarding presenting seminars in the virtual environment?
2. What challenges and benefits do organizers of biology department seminars perceive regarding organizing seminars in the virtual environment?
3. How did biology department seminars change during the transition from an in-person to virtual format?

## 2. Materials and methods

### 2.1. Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Review Board of Cornell University ID#2102010125. The participants provided their written informed consent to participate in this study.

### 2.2. Seminar organizers

#### 2.2.1. Study participants

To better understand the experiences of biology department seminar speakers and organizers, we first identified a subset of R1 institutions, R2 institutions, and community colleges (CCs) for inclusion in our study through stratified random sampling. Minority-serving institutions (MSIs) are institutions that serve minority populations, including Historically Black Colleges and Universities (HBCUs), Hispanic-Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), and Asian American and Pacific Islander Serving Institutions (AAPISIs). MSIs can be classified at any of the Carnegie Classification levels, thus our sampling of MSIs in this study often also overlapped with institutions' identification as R1s, R2s, or community colleges.

As part of our sampling methods, we used datasets available from the U.S. Department of Education's Database of Accredited Postsecondary Institutions and Programs.<sup>1</sup> This database was cross-referenced with the list of Carnegie Classified R1 and R2 Universities,<sup>2</sup> a U.S. State Department list of MSIs (Assembled for Fullbright Program<sup>3</sup>), and a list of community colleges in the United States.<sup>4</sup> For any redundant entries from the random sample of MSIs that matched those in our samples of R1, R2, or CC, additional MSIs were drawn from the random sampling. We also included random sampling from the list of additional MSIs because MSIs can often be defined inconsistently, and we wanted to ensure that we were recruiting a sufficient number of this institution type for our sample. For each institution, we noted whether their biology department webpage listed a seminar schedule for either the current term at the time of our study (Spring/Summer 2021) or prior terms (Fall 2020 or earlier), as well as contact information for the seminar organizer(s). We then contacted each seminar organizer and requested that they complete the seminar organizer survey described below. For departments where seminar information was not listed or an organizer was not noted, we contacted the department head and/or general department contact email. In total we contacted 132 R1 institutions, 128 R2 institutions, 67 community colleges, and 33 other 4-year universities. Of the contacted institutions, 100 identified as MSIs. We acknowledge that there are many institution types we did not specifically sample from, such as Doctoral/Professional Universities (R3s), comprehensive universities, and liberal arts colleges. To ensure our sampling methods were manageable (and within the scope of our IRB protocol), we limited the scope of recruited institution types to R1s, R2s, and community colleges. Further, while we thought it would be interesting to compare the biology department seminars of R1s and R2s against community colleges, generally community colleges host departmental seminars infrequently (McFarland and Pape-Lindstrom, 2016). We assumed that institutions classified as having high research activity would more regularly host departmental research seminars, and thus would be more likely to participate.

1 <https://ope.ed.gov/dapip/#/home>

2 <https://carnegieclassifications.acenet.edu/>

3 <https://fulbrightscholars.org/sites/default/files/documents/MSI-master-list.xls>

4 [https://en.wikipedia.org/wiki/List\\_of\\_community\\_colleges](https://en.wikipedia.org/wiki/List_of_community_colleges)

### 2.2.2. Seminar organizer survey

The seminar organizer survey ([Supplementary Appendix 1](#))—designed and administered in Qualtrics—consisted of multiple questions asking about institutional and departmental demographics and format of departmental seminars before (i.e., in-person) and during the pandemic (i.e., virtually). Additionally, we asked seminar organizers to indicate who generally selected seminar speakers in their department and to describe the process of speaker selection, in addition to questions about their seminar series budget and perceptions of the benefits and challenges of organizing virtual seminars. For seminar speaker recruitment, the final portion of the survey asked organizers, if possible, to provide resources (e.g., website URLs, word documents) of past and planned seminars in their department from 2019 to 2021 including speaker names and contact information. All seminar organizers who completed the survey were faculty at their institutions. The survey was administered in Spring 2021 and took on average 30 min to complete. See [Table 1](#) for the number of respondents across institution types, including the Carnegie Classification and the number of MSIs for each.

## 2.3. Seminar speakers

### 2.3.1. Study participants

The names and contact information for all seminar speakers recruited for our study were initially provided by the seminar organizers when they completed the seminar organizer survey. Of the 488 speaker names we received from seminar organizers and subsequently emailed in Fall 2021, 90 seminar speakers completed the seminar speaker survey described below. See [Figure 1](#) for a summary of seminar speaker demographics.

### 2.3.2. Seminar speaker survey

The seminar speaker survey ([Supplementary Appendix 2](#))—which was also designed and administered in Qualtrics—consisted of multiple questions asking about institutional demographics and the speaker's current position, career track (i.e., academia, industry, other), and demographics. We also asked the speaker what general topics they covered in their invited seminar ([Table 2](#)), when they presented the invited seminar, and the format of the seminar. Further, speakers described their perceptions of barriers to and

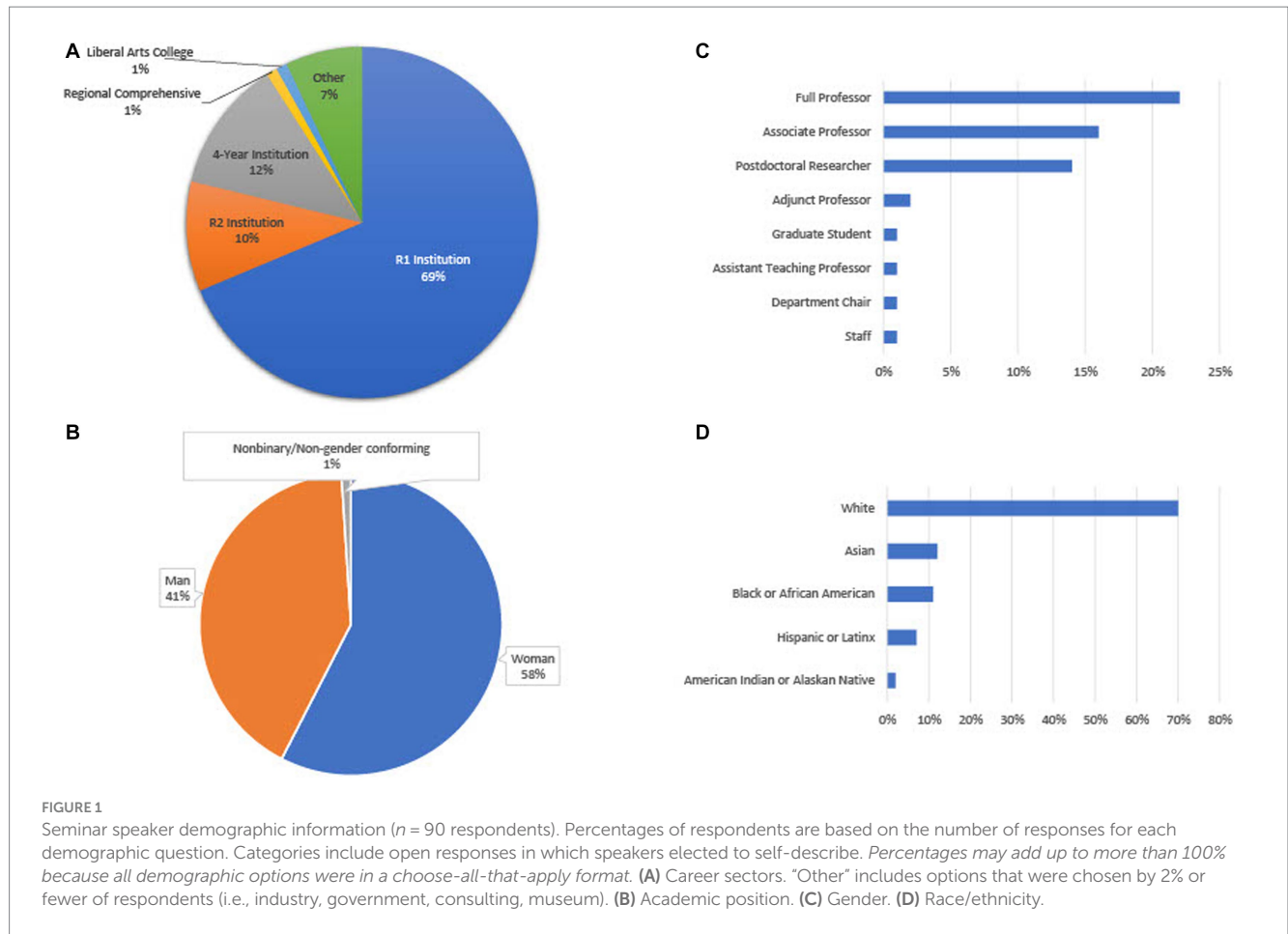
benefits of representing academic seminars in virtual versus in-person settings, as well as the importance of hosting and presenting seminars. Speakers could also self-report which institution invited them to present a seminar, which generally aligned with the speaker's own institution types noted in [Figure 1](#). Inviting institutions consisted of R1s (52%), R2s (40%), Master's Colleges and Universities—Larger Programs (4%), and Doctoral/Professional Universities (4%). One limitation to note is that no speakers from the community college seminars responded to the speaker survey. The survey was administered in Fall 2021 and took on average 23 min to complete. Both the seminar speaker and seminar organizer surveys were designed by the authors (AH and RH) and intended to better describe the experiences and demographics of those involved with biology departmental seminars. Colleagues provided feedback on the clarity and wording of the survey questions throughout the iterative survey development process.

## 2.4. Data analysis

We used descriptive statistics to summarize close-ended (i.e., quantitative) survey responses and thematic analyses to analyze open-ended (i.e., qualitative) survey responses from both seminar organizers and seminar speakers. We inductively coded open-ended responses into emergent themes using Dedoose software ([Bogdan and Taylor, 1989; Aronson, 1994; Dedoose Version 9.0.46, 2022](#)). During this iterative process, AH and RH independently read through and developed themes for each seminar organizer open-ended response, discussed disagreements until we came to consensus on a codebook, and independently coded each response ([Thomas, 2006](#)). In our study, coding refers to categorizing open-ended survey responses based on common themes and ideas we included in our final codebook. AH and RH then collaboratively re-read the open-ended responses to ensure alignment with the final coding scheme and re-coded (i.e., categorized an open-ended response as a better aligned code or theme) if necessary. If certain responses needed to be re-coded, AH and RH again discussed the most relevant codes to apply until consensus was reached. A similar process was also used to develop initial themes and a final codebook, and then code responses for the seminar speakers' open-ended responses.

TABLE 1 Participating institutions by type.

Institution type (Carnegie classification)	Total #	# Minority-Serving Institutions (MSIs)
R1 (Doctoral Universities—Very High Research Activity)	17	2
R2 (Doctoral Universities—High Research Activity)	14	2
D/PU (Doctoral/Professional Universities)	1	1
M1 (Master's Colleges and Universities—Larger Programs)	4	3
Community Colleges (Associate's Colleges and Associate's Dominant)	3	3



**TABLE 2** Seminar topics reported by speakers ( $n = 88$  respondents).

Seminar topic	# Respondents
Biology research	78
Cell/molecular biology	25
Ecology	11
Evolutionary biology	9
Microbiology	6
Organismal biology	7
Other (see below)	17
Diversity, equity, and inclusion	6
Trainee career development	6
Teaching and learning	4
Job interview	2

Note that code counts for subthemes (questions indented under each primary question in the table) may not add up to the total code count for the primary question, as open response questions could be dual-coded into multiple themes. This survey question was open response.

### 3. Results

We first present general results on the importance of departmental seminars across both seminar speakers and organizers, followed by responses from the seminar organizer and seminar speaker surveys. While responses on both surveys indicate distinct experiences in planning and speaking at virtual departmental

seminars during the pandemic, there are also shared emergent themes and perceptions as described by the seminar organizers and speakers. Survey questions have been shortened in the summary tables for conciseness; for the full set of survey questions, see [Supplementary Appendices 1, 2](#).

#### 3.1. Perceived importance of departmental seminars for organizers and speakers

An open response question we asked to both seminar organizers and speakers was *What do you believe are the most important reasons for hosting/presenting seminars?* As emergent themes from both organizers and speakers overlapped extensively, we include the responses from each group in [Table 3](#). Some of the most frequently cited responses were gaining biology knowledge, offering faculty and student professional development, and fostering research connections and collaborations ([Table 3](#)).

#### 3.2. Seminar organizer survey

##### 3.2.1. Seminar speaker selection criteria and logistics

In the seminar organizer survey, the first set of questions focused on how seminar speakers were chosen in the respondent's department and how this process changed, if at all, during the transition to virtual

TABLE 3 Perceived importance of departmental seminars for organizers and speakers (organizers:  $n = 38$ , Speakers:  $n = 88$ ).

Importance	Speaker code count (%)	Organizer code count (%)
Biology knowledge...		
Exchange of scientific perspectives and ideas	26 (29.5%)	10 (26.3%)
Learning from fields outside of expertise	14 (15.9%)	8 (21.1%)
Sharing and learning about new and leading research	11 (12.5%)	6 (15.8%)
Enhance student learning of research/scientific process	7 (8.0%)	4 (10.5%)
Faculty professional development	35 (39.8%)	8 (21.2%)
Research connections/collaborations	27 (30.7%)	9 (23.7%)
Visibility (for self/department)	15 (17.0%)	4 (10.5%)
Student/trainee professional development	12 (13.6%)	17 (44.8%)
Meeting and mentoring students	11 (12.5%)	0
Sharing with new audiences	10 (11.4%)	0
Feedback	8 (9.1%)	0
Community	7 (8.0%)	9 (23.7%)
Representation of scientist diversity	6 (6.8%)	4 (10.5%)
Representation of scientific career paths	4 (4.5%)	9 (23.7%)
Trainee/personnel recruitment	4 (4.5%)	0

Note that code counts for subthemes (questions indented under each primary question in the table) may not add up to the total code count for the primary question, as open response questions could be dual-coded into multiple themes.

seminars. As seen in Table 4, the majority of seminar speakers were selected by faculty in the department. Further, most seminar organizers who responded to the survey indicated their department modified the speaker selection process during the transition to virtual seminars; the most frequent reported change was that speakers from more diverse locations and institutions could be invited, including more international as well as speakers from HBCUs and other MSIs. However, it is important to note that this change coincided with a renewed interest in diversity, equity, and inclusion (DEI)-based work and may not be directly due to the need for accessible virtual seminars during the pandemic. The top priorities for virtual seminar speaker selection were ensuring a broad representation of speakers as well as biology topics, though many other priorities were mentioned by organizers. Most organizers also noted that their seminar budget changed during the pandemic when they were hosting virtual seminars; generally, this change was a decrease in funds allocated for seminar speakers due to budget cuts at most universities.

### 3.2.2. Perceived challenges and benefits of seminar organizers

In the seminar speaker organizer survey, the second set of questions focused on the organizer's perceived challenges and benefits of organizing virtual seminars. As seen in Table 5, the most cited challenge was a loss of community, followed by more logistical work, fewer opportunities for speaker interactions, and low attendance and engagement. The most commonly referenced benefits were that a broader pool of seminar speakers could be invited, followed by reduced costs of virtual seminars, greater accessibility, and a greater number of speakers were willing to participate.

## 3.3. Seminar speaker survey

### 3.3.1. Seminar speaker logistics and demographics

In the seminar speaker survey, the first set of questions focused on logistics of virtual seminars presented by the speakers, as well as demographics (Figure 1). We should note that we did not observe any noticeable patterns in speaker perceptions across race/ethnicity nor gender. Particularly for race/ethnicity, this could be due to the skewed number of white speakers in our sample and/or the fact that the race/ethnicity demographic questions were "choose all that apply" and thus participants could choose multiple identities. Even if patterns did exist, we would need to be cautious of overgeneralizing emergent themes to non-white speakers or speakers from other less-represented demographics, especially since speakers from these groups comprised a much smaller portion of the sample.

### 3.3.2. Perceived challenges and benefits of seminar speakers

In the seminar speaker survey, the second set of questions focused on the speaker's perceived challenges and benefits of presenting virtual seminars. As seen in Table 6, the most cited challenge was experiencing fewer personal interactions during their virtual seminar "visit," followed by less connection and engagement with the seminar audience, technical or logistics issues and related anxiety, and physical presentation limitations (e.g., not able to gesture to the audience as effectively). Numerous benefits were referenced by seminar speakers, the most frequent being that no travel and a shorter time commitment were required; that virtual seminars were easier for parents, caregivers, and those with disabilities to participate in; and that the technology needed to host virtual seminars (e.g., video conferencing platforms



**TABLE 4 Seminar speaker selection criteria among biology department seminar organizers (*n* = 38 respondents).**

	Code count
Speaker selection process	
Who in your department generally chooses speakers for seminar? (CR)	
Faculty	30
Graduate students	18
Postdocs/research staff	10
Changes to speaker selection with Virtual Switch? (OR)	
No	13
Yes (If yes, explain.)	32
Able to invite from more locations/international	14
Invited more diverse speakers	4
Invited more speakers overall	3
Invited fewer speakers overall	2
Changes to seminar topics/scope	2
Changed recommendation/approval process	2
Difficult to recruit speaker nominations from department	2
Priorities for speaker selection (OR)	
Broad representation of...	24
Speaker demographic diversity	18
Biology topics	15
Professional levels (faculty, postdocs, students)	5
Careers outside academia	3
Interest...	10
To department	7
To students/trainees	5
Cost	7
Research quality and expertise	6
Networking/professional development for...	
Students/trainees	6
Faculty	5
Speaker presentation skills/Engagement	5
Local relevance	4
Speaker reputation	3

Note that code counts for subthemes (questions indented under each primary question in the table) may not add up to the total code count for the primary question, as closed response questions were “choose all that apply,” and open response questions could be dual-coded into multiple themes. OR = open response survey question, CR = closed response survey question.

like Zoom) was more familiar to speakers than before the pandemic. Several other less commonly cited benefits are noted in [Table 6](#).

## 4. Discussion

Despite the significance of departmental research seminars across biology departments, the experiences and demographics of invited seminar speakers as well as the perceptions and processes of individuals involved in organizing departmental seminar series are

**TABLE 5 Challenges and benefits of organizing virtual seminars among biology department seminar organizers (*n* = 38 respondents).**

	Code count
Challenges of virtual seminars	
Loss of community...	18
Less human connections and networking	17
No cameras on	3
Requires more logistical work	11
Less interaction with speaker	11
Low attendance/engagement	10
None	2
Benefits of virtual seminars	
Broader pool of speakers...	23
Can invite far-away/international speakers	21
Facilitates broader range of topics	2
Facilitates more speaker demographic diversity	2
Low/no cost	16
Accessibility...	14
Recordings can be re-used/watched later	6
More attendees able to join	5
More questions/participation	3
Attendance by alumni, outside colleagues, family, and community	2
Easier logistics than in-person	2
More speakers willing/able to participate	5

Note that code counts for subthemes (questions indented under each primary question in the table) may not add up to the total code count for the primary question, as open response questions could be dual-coded into multiple themes. Both questions asking organizers about their perceived challenges and benefits were open response.

understudied. Departmental seminars are particularly important to explore in light of the COVID-19 pandemic, when academic institutions across the U.S. had to rapidly transition their departmental research seminars to virtual formats.

### 4.1. Seminar speakers and seminar organizers ascribe different values to the practice of academic seminars

Academic seminars clearly hold value: if they did not, organizers and speakers alike would not have gone to lengths to continue seminars in virtual formats during the COVID-19 pandemic. When asked directly about the value of seminars, speakers' top responses were (1) Faculty professional development, (2) Research Connections/Collaborations, (3) Exchange of scientific perspectives/ideas, and (4) Visibility. In contrast, seminar organizers chiefly found value in (1) Student/Trainee Professional Development, (2) Exchange of scientific perspectives/ideas, and (3/4) Community and Representation of scientific career paths. This illustrates a clear difference in values between speakers and organizers: speakers' chief motivator was in furthering their own networks, research collaborations, and research visibility, while organizers primarily valued their own

**TABLE 6 Challenges and benefits of organizing virtual seminars among biology department seminar speakers ( $n = 88$  respondents).**

	Code count
<b>Challenges of virtual seminars</b>	
Fewer personal interactions...	58
During seminar	42
Outside of seminar	23
Less connection with audience	53
Tech/logistical issues and related anxiety	27
Cannot convey information with gesturing/physical movement	6
Positive responses	48
Less (or not) difficult	20
Few (if any) barriers encountered	28
<b>Benefits of virtual seminars</b>	
No travel	61
Shorter time commitment	34
Easier for...	20
Parents and caregivers	15
People with disabilities	4
Introverts	1
Familiar space/technology	17
Less anxiety and stress	15
Wider attendance	13
Cheaper	12
Good for the environment	11
Global speaker invites	11
Can use notes/script	8
Better Q&A	7
Less formal	6
Less tiring	6
Logistical ease	5
<b>Negative responses</b>	
Less (or not) easy	14
Few (if any) benefits	7

students' or trainees' career development as well as their own departmental community.

Though some invited speakers viewed themselves as mentors to students they visited with (12.0% of respondents), overall speakers viewed seminars chiefly through the lens of their own career advancement. One speaker expressed both of these perceptions in their response:

“I think sharing scientific research with the greater research community, no matter the specific discipline, is important to scientific progress. It helps the scientific community in general. Hosting and presenting seminars is also a great way to network, whether as a speaker or as an audience member. I always found it rewarding to connect with speakers who do similar research as

you or what you hope to do one day. As a grad student, I always asked professional development questions and many of [the speakers'] tips helped me in my own journey to find a career that I would feel satisfied with.”

However, it is important to note that while seminar organizer respondents came from a mix of institution types, the sampled speakers invited by them were primarily from R1 institutions.

While seminar organizers listed speaker demographic diversity as a top priority for speaker selection, relatively few organizers described representation of scientist diversity as a key value in hosting seminars. In other words, there was misalignment in the criteria organizers used to select speakers and their perceptions of why departmental seminars are valuable. Similarly, while some speakers noted representation of diverse scientists as an important role of seminars, it was a relatively uncommon code, though one speaker emphasized the importance of departmental seminars as a venue for diverse scientists to present their work:

“I also think seminars are a great way for underrepresented scientists to be highlighted more in the scientific community and also provide inspiration for other underrepresented people (especially students) to stay in science.”

Organizers focused on the value of seminars to student careers and development and did not seem to view representation of diverse scientists as a component of this. However, representation of scientist diversity can be key for career development, especially among students from underrepresented groups. Interacting with scientific role models that reflect their own identities can strengthen students' science identity, the conceptualization of oneself in relation to science. Science identity is an important predictor for graduate school matriculation and intentions among graduate students to stay in science (Carlone and Johnson, 2007; Stout et al., 2011; Merolla and Serpe, 2013; Young et al., 2013; Estrada et al., 2019).

## 4.2. Virtual seminar organizers and speakers perceive similar benefits of accessibility and diversity

Both organizers and speakers perceived similar themes of increased accessibility and diversity in regard to the benefits of virtual seminars. Many participants referenced that virtual seminars grant more opportunities to diversify the speaker pool, as no travel is required by the invited speakers and little to no funding is needed on behalf of the inviting institution. This is especially important in light of the call to expand the diversity of invited departmental seminar speakers to better align with the diversity of early career scholars in STEM fields (Hagan et al., 2020), and because of the many diversity, equity, and inclusion (DEI)-based discussions spurred by the murder of George Floyd and subsequent anti-racist movements in 2020. More diverse seminar speakers—including women and those from underserved racial and ethnic groups—have the potential to serve as academic role models and improve underserved students' sense of belonging and identity in STEM (Gurevitch, 1988; Nittrouer et al., 2018; Evangelista et al., 2020; Hagan et al., 2020; Lambert et al., 2020). In our study, both organizers and speakers noted the lower cost

associated with hosting virtual seminars, as well as the increased ease with which biology departments were able to extend invitations to national and international speakers. The costs associated with travel in academia are often prohibitive, especially for early career scholars (e.g., graduate students and postdoctoral researchers) (Sarabipour et al., 2020) and departments with limited budgets for seminars (Bottanelli et al., 2020). Additionally, others have reported the potential challenges associated with international travel for academic purposes (e.g., visa issues) (Sarabipour et al., 2020), which could further hinder a department's ability to diversify their pool of invited seminar speakers. As one seminar organizer noted in their survey response:

“It allowed participation of people who might not otherwise have been able to present, including speakers from Europe and across the country. [Before the pandemic] our seminar budget was historically more limited, and we were encouraged to invite speakers from more local institutions.”

However, we are cognizant that we cannot fully disentangle the cause of increased diversity of virtual seminar speakers based on our survey results. The transition to virtual seminars coincided with both the pandemic and a renewed interest in DEI-based work; thus, we do not want to conflate or overgeneralize our findings related to increased seminar speaker diversity, as most organizer survey respondents did not comment on whether their departments considered diverse speakers in the pre-pandemic era.

Another beneficial aspect of virtual seminars noted by many organizers was how accessible such events were to the departmental community and the sense of connection they fostered among departmental members. For example, one organizer mentioned:

“Virtual seminars allowed alumni, friends and colleagues from all over the place to attend these critically important talks. It also allowed for the possibility of staying connected in a disconnected year, even for people who were living elsewhere.”

Seminar speakers also discussed a similar theme of accessibility, but more often did so in reference to their own accessibility rather than that of seminar attendees. One speaker even noted the importance of virtual seminars for faculty who may have a limited ability to travel due to family commitments:

“I could go places I would not have [been able] to go [to] otherwise. I could go and not leave my family at home. I WISH this had been an option when kids were younger. I really missed out on a lot of talks because of that. I feel my career has never recovered.”

This speaker's sentiments are unfortunately common across STEM fields, as many individuals and professional organizations have voiced their concerns regarding the lack of childcare options and general family support at in-person academic conferences in recent years (Calisi et al., 2018; Langin, 2018). This issue is even more significant considering that research shows that having a child negatively affects the career mobility of women, but not men, and that this negative affect is amplified for women of color (Calisi et al., 2018).

In regard to increased accessibility, some seminar speakers referenced the more inclusive features of presenting seminars in virtual platforms for those with disabilities or non-native speakers:

“I think being able to ask questions in the chat enables people to connect more than if they have to speak up to ask, and the virtual format allows people to control their own volume and include subtitles.”

“[Virtual seminars] can be better for inclusivity. It is cheaper to attend and present [which improves] inclusivity, and there are platforms to provide closed captioning etc. for those with disabilities.”

Closed captioning, volume control, and the ability to participate in a virtual seminar from the comforts of one's home or office improve accessibility for a number of groups, including those who are hard of hearing, those who do not speak English as their first language, and those who may simply have excessive background noise or limited internet bandwidth in their viewing location (Bottanelli et al., 2020). Some organizers and speakers in our study also noted that virtual seminars are easier to record and share with those who cannot attend live sessions due to myriad reasons such as being in a different time zone or family commitments, which is supported by the literature (Bottanelli et al., 2020; Sarabipour et al., 2020).

### 4.3. A loss of professional networking opportunities and academic community are key challenges for virtual seminars

Informal networking is critical for success in academia: it plays a key role in professorial hiring and reputation building (Van den Brink and Benschop, 2013). Exclusion from networking opportunities by academic gatekeepers, including academic seminar invitations from faculty and seminar organizers, can disproportionately affect individuals that are part of underrepresented groups in academia (Van den Brink and Benschop, 2013; Nittrouer et al., 2018; Hutto et al., 2022). In line with this, the most common code among seminar speakers regarding the value of seminars was faculty professional development such as networking. Thus, it is highly relevant to the utility of virtual seminars that the speakers identified fewer personal connections and networking opportunities in the virtual setting. Virtual seminar speakers reported fewer interactions in the seminar itself and outside of the seminar; in-person seminar visits usually entail meetings around campus with various faculty and students, and this was often lost in virtual experiences. These experiences are key moments for informal networking between the invited speaker and faculty at the institution as well as informal networking between the invited speaker and student trainees. This was mirrored by responses of seminar organizers, who also reported having less interactions with the speaker in a virtual format. As one speaker mentioned:

“I think the biggest loss of virtual seminars are one-on-one or small group meetings that typically occur during visits. I have formed collaborations, met with potential future students, networked, etc. during seminar visits. I think this is a big loss of the virtual format.”

Another challenge of virtual seminars was a loss of community and human connection. Speakers commonly reported feeling less “connected” with the audience in virtual seminars, and organizers



cited this loss of community as a key challenge for virtual seminars. As one seminar organizer noted:

“The talks themselves generally work just fine in a virtual setting. However, all the other speaker interactions (grad student lunches, meeting with individual faculty and lab groups, engaging science conversations over dinner) are definitely lacking ... For both grad students and faculty, it makes all of those less tangible benefits of connecting with other scientists almost impossible.”

This response resonates with the framework that academic seminars, which are widely employed in academia and have been around since at least the 1700s, can function as an “emotional community” (Karlsohn, 2016). In fact, seminar organizers reported that community was a key aspect of the value of holding departmental seminars.

How can virtual seminars address these important shortcomings? Organizers and speakers alike can implement practices to increase interactions between the speaker and audience using tools such as break-out rooms, Slack, Slido, and Miro (Bottanelli et al., 2020). Organizers can also promote informal interactions that mimic an “in-person” visit using tools that replicate meet-the-speaker tables at conferences or one-on-one meetings that have been employed at scientific conferences (Vaggi et al., 2014).

#### 4.4. Limitations

Based on the sufficient sample sizes of participating seminar organizers and speakers and reaching points of saturation in the most common emergent themes, we did not feel that any additional survey questions had to be included in the current study, nor did we feel that our study was missing important aspects of organizer or speaker perceptions by omitting certain questions. However, we recognize that our participants were primarily from R1 and R2 institutions and that participating seminar speakers were dependent on which seminar organizers elected to participate in our survey. As with any voluntary survey-based research, there was also the potential for response bias in our sample as participants were self-selecting; this may have contributed to skewed participant demographics as well. We may have had fewer MSIs and community colleges participate in our study because (1) many community colleges fall under the realm of MSI, and (2) generally, community colleges host departmental seminars infrequently (McFarland and Pape-Lindstrom, 2016). While we hope our findings encourage discussion about the benefits and challenges of virtual seminars, and the significance of departmental seminars in general, we acknowledge that the survey responses from seminar organizers and speakers in our study may not reflect the perceptions of these populations across all institutions. Thus, future studies should focus on describing perceptions of virtual seminars at a broader range of institutions such as community colleges and minority-serving institutions, or even explore a single benefit or challenge that we found in our current work in more detail.

### 5. Conclusions and recommendations

In answering our original research questions, we found that numerous benefits and challenges are perceived by seminar

speakers and organizers regarding virtual seminars. Speakers and organizers perceived similar benefits of accessibility and diversity, while primary perceived challenges included the loss of professional networking opportunities and academic community. Further, while there was overwhelming consensus that departmental seminars are valuable, speakers’ chief motivator was in furthering their own networks, research collaborations, and research visibility, while organizers primarily valued their own students’ or trainees’ career development as well as their own departmental community.

We hope that our findings encourage biology and non-biology departments to reflect on the benefits, challenges, and value of seminars. As inclusivity and accessibility were commonly reported benefits of virtual seminars, we recommend that departments further diversify their invited speaker pool and consider how to make seminars more accessible to speakers and participants (e.g., recording seminars, including closed captioning, offering a virtual option). Additionally, for seminars offered as a virtual option, departments should discuss how to mitigate the loss of networking and community perceived by participants in our study. For example, small group meetings on Zoom with faculty, graduate students, or postdoctoral researchers, rather than one-on-one meetings, could foster a sense of togetherness while also limiting awkward “small talk” often experienced during one-on-one interactions. Developing departmental norms for virtual seminars and interactions with seminar speakers could also improve the sense of community and quality of networking with the seminar speaker, as departmental members may feel more comfortable in their interactions with the speaker as well as each other.

Academic seminars hold value—both virtually and in-person—and should continue to be included as vital parts of biology departments with consideration of the potential benefits and challenges associated with the modality selected.

### Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

### Ethics statement

The current study involving humans was reviewed and approved by the Institutional Review Board of Cornell University ID#2102010125. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

### Author contributions

AH and RH conceptualized the study, designed and validated the survey instrument, sent the survey to participants, analyzed the data, prepared visualizations, prepared the original draft of the manuscript, and edited the manuscript. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2023.1227186/full#supplementary-material>

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