



Binning Singletons: Mentoring through Networking at ASM Microbe 2019

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ABSTRACT The American Society for Microbiology (ASM) national conference, Microbe, is the flagship meeting for microbiologists across the globe. The presence of roughly 10,000 attendees provides enormous opportunities for networking and learning. However, such a large meeting can be intimidating to many, especially early career scientists, students, those attending alone, and those from historically underrepresented groups. While mentorship is widely valued by ASM and its members, finding concrete ways to develop new and diverse mentoring opportunities can be a challenge. We recognized the need for an initiative aimed at expanding peer-to-peer mentoring, facilitating networking, and providing support for Microbe attendees; therefore, we created the program Binning Singletons for ASM Microbe 2019. The program consisted of five steps named after tools or phenomena in the profession of microbiology: (i) Identify the Singletons (e.g., individuals attending alone), (ii) Bin the Singletons, (iii) Horizontal Transfer, (iv) Quorum Sensing, and (v) Exponential Growth. These steps resulted in the matching of participants unsure of how to get the most out of their conference experience (e.g., singletons) with mentors who assisted with meeting planning, networking, and/or impostor syndrome. Started on social media only a month before ASM Microbe 2019, the program successfully launched despite limited time and resources. Binning Singletons improved inclusivity and networking opportunities for participants at the conference. Here, we discuss what worked, and what can be improved, with an eye toward development of the Binning Singletons model for future conferences to provide opportunities to increase inclusivity, networking, and accessibility for singletons and build a stronger scientific community.

KEYWORDS Microbe, mentoring, networking

MENTORING IN STEM

Conference attendance and networking are crucial elements of a successful career in STEM (science, technology, engineering, and mathematics), as they both allow for scientists to communicate their research, identify collaborations (e.g., grants and publications), and elucidate job opportunities. However, for early career scientists, students, and those from historically underrepresented groups, engaging in conferences and building networks can be intimidating. A pervasive issue in science is the feeling of isolation, which is often exacerbated at large conferences when individuals (e.g., singletons) attend alone. Singletons is the term for DNA sequences that appear only once, which are often tossed in bioinformatic pipelines as they are viewed as being “too weird to be credible.” The feeling of isolation can be perpetuated by not finding a network at a conference or within one’s science area. Mentoring is a solution to these challenges, and many scientific societies and conferences have established formal mentoring programs for these groups to advance their scientific experiences. Mentoring programs established by scientific societies and conferences have a variety of

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 Growing Peer Cultures. Binning Singletons: Mentoring through Networking at ASM Microbe 2019. A grassroots program to promote mentoring and networking through peer-to-peer interactions. #BinningSingletons @DeniseAkob @AmandaLynGunn @JoeTCJ @BSingletons

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formats and activities, including mentor-mentee pairings, networking/mentoring workshops, mentor coaching, career panels, mentoring-specific mixers or meals, and poster judges.

Examples of successfully established mentor-mentee pairing programs include the Coastal & Estuarine Research Federation (CERF) Biennial Conference (1–9) and Goldschmidt, an annual, international biogeochemistry conference (1–5). These programs are both aimed at helping novice attendees make the most of their conference by pairing them with experienced attendees, and their websites provide information to guide the mentor pairs (1–9). Mentors connect with mentees before the conference to help plan sessions, posters, and exhibits to attend. At the conference, the pairs meet early in the conference either at a Mentoring Program breakfast (CERF) or at the ice-breaker mixer (Goldschmidt), and on an ad-hoc basis as suits each mentor-mentee pair. A key job of mentors is to help mentees network; the Goldschmidt Mentor Program specifies that mentors introduce their mentee to at least five colleagues (1–5). Both programs are clearly successes, as CERF has run their program since at least 2013 and 300 attendees participated in the first year of the Goldschmidt Mentor Program (2014) (10).

Additional formats for mentoring programs include networking/mentoring workshops and special sessions and events during conferences. The American Society for Microbiology's (ASM) Microbe Academy for Professional Development (MAPD; formerly known as the Undergraduate Research Institute) is a 2-day career development and networking workshop, which provides students tools for navigating undergraduate through late graduate work (11). Additional examples are the career development and networking opportunities at the Society for Advancement of Chicanos/Hispanics and Native Americans in Science's (SACNAS) annual meeting and ASM's Annual Biomedical Research Conference for Minority Students (ABRCMS) (12, 13). These conferences host networking meals, professional development sessions, and career panels (13).

The diverse mentoring programs described above are excellent examples of how scientific societies and conferences can provide support to early career scientists, students, and those from historically underrepresented groups. Through such mentoring programs, scientists can build and expand their networks and further their career development, and the scientific community can improve the diversity and culture of science.

THE ORIGIN STORY

The idea for Binning Singletons was conceived during ASM Microbe 2018 in Atlanta, GA, USA, where while networking, several seasoned ASM members lamented about less than satisfying experiences at large scientific conferences. Themes emerged where many scientists felt isolated when attending alone and overwhelmed by the breadth of the meeting as first-time attendees. From this began a brainstorming session about the needs of early career scientists, students, and first-time attendees in terms of both improving experiences at conferences and supporting scientific networking. Discussions landed on the need to develop a program to connect self-identified participants with mentoring opportunities. The program would be inclusive where participants could identify themselves as mentors or mentees, and it would facilitate peer-to-peer interactions to help with networking, as well as provide advising and support to reduce feelings of isolation.

From these discussions, Binning Singletons was born, and the general idea and plan were shared as a thread on Twitter (with the tag #binning_singletons) shortly after ASM Microbe 2018. Feedback was very positive, both from experienced Microbe attendees as well as scientists across disciplines who attended other conferences. In 2019, ASM expanded the reach of the MAPD but did not institute a meeting-wide mentoring program. With just over a month to go before ASM Microbe 2019 in San Francisco, CA, USA, microbiologists who liked or commented on the original #binning_singletons thread were contacted via Twitter and asked if they would be interested in planning and being a mentor for the program, if initiated. The request was met with widespread,

enthusiastic support, and quickly the program identified 10 mentors for Microbe 2019, as well as several other supporters who were not attending ASM Microbe in 2019 but were eager to help in any way they could. Twitter was used as the primary tool for connection and recruitment, leveraging connections between microbiologists on social media to expand to a larger group of people. An attempt to alert those not on social media to the program was made in the form of an e-mail that was sent to nearly 50 people at more than 35 universities to promote the program. An outline was developed to explain the program and promote participation (see Text S1 in the supplemental material). By the time the meeting started, there were 15 mentors, several others involved to various degrees in the planning and logistics, and 34 attendees signed up as self-identified singletons.

HOW DOES BINNING SINGLETONS WORK?

To market an independent mentorship opportunity to conference attendees, a platform was developed that would use the in-signaling of field-specific language that was catchy enough to appeal to a broad range of individuals (see Text S1 in the supplemental material). The analogies are explained below.

(i) Identify the Singletons. In DNA sequencing, a singleton is a sequence of DNA that appears only once. When assembling reads or defining operational taxonomic units (OTU), these sequences are usually binned with others of high similarity. The analogy to ASM Microbe attendees is the ability to be binned with others who also feel isolated, and a mentor to guide them, who may or may not be in a similar microbiology subdiscipline. Singletons would thereby have a cohort from the start of the meeting, and exposure to the mentor's networks will help them grow their own network.

Surveys were constructed asking people to self-identify as singletons or mentors, along with demographic information regarding current position, institution, ASM track, what they were most nervous about, two primary goals for the conferences, and the type of field (industry, government, medicine, academia) they would like to be grouped with (Text S2). The mentor survey was nearly identical except in the place of primary goals it asked how they could best help others navigate the conference and omitted what the potential mentor was most nervous about (Text S3). Several different versions of the forms were used during recruitment, typically with different introductory information to appeal to a broader range of participants. Suggestions of respondents and mentors greatly refined the final version of the forms used.

(ii) Bin the Singletons. Using the data provided by the singletons and mentors, experienced attendees were binned with two to four singletons each, whom they would assist before and during the meeting. The mentors included faculty, journal editors, postdocs, government researchers, and one Ph.D. student. The mentors were provided the names and contact information of the singletons in their bin 10 days before the beginning of the conference. They were encouraged to make contact and learn what the singletons needed and set expectations for the meeting. Since some singletons were nervous about more issues than others, they were encouraged to communicate clearly with their mentors what they needed and expected. Mentors were also sent the CERF Mentorship Program website (7) as a guide to being a good mentor, along with a list of all singleton presentations at the conference. All participants were also sent a Code of Conduct for the program (Text S4).

(iii) Horizontal Transfer. In nature, bacteria often share genes among themselves, despite not being descended from the same ancestor in a process referred to as horizontal gene transfer. The end result is an organism (and eventually a population) gaining a functionality that did not arise from evolution in that line but is nonetheless valuable. This was the analogy for the transfer of knowledge and networks from the mentors to the singletons.

All groups were strongly encouraged to meet at or before the first full day of the conference and to have ways to get in touch with one another. If the singletons had similar interests as the mentor or were unsure about how to navigate such a large meeting, they were encouraged to spend half a day or the entire day with the mentor.

The knowledge gained from observing how an experienced attendee handled the meeting and their interactions with friends and colleagues is hugely valuable and not easily replicable for someone attending alone or for the first time.

The most variable parts of the program were the interactions between mentors and singletons, as each mentor was different, and the needs of each singleton varied across the groups. Some participants, both mentors and mentees, had many commitments, which made them potentially less available to their groups. A more formal program incorporated into Microbe by ASM could provide additional structure and guidance on how groups should interact. In the case of the Goldschmidt Mentor Program, the formality still allows for flexibility and positive experiences that have allowed the program to persist and grow over 5 years of conferences.

(iv) Quorum Sensing. Quorum sensing in bacteria occurs when bacterial cells regulate gene expression in response to changes in cell density. For the purposes of the Binning Singletons program, it describes getting all the different bins of singletons together at a mixer at the end of the first full day. The mixer was held off-site, but since it was held immediately after ASM Microbe's Happy Hour, several of the mentors knew one another personally and were able to introduce singletons to different mentors with whom the mentor thought the singleton might have some common interests. Several of the singletons also knew one another from Twitter, the main social media platform used during recruiting, and introduced the members of their bins to people they already knew. This resulted in new networks of scientists capable of supporting one another intellectually, professionally, and socially.

The limited funding for the mixer added logistical challenges and unexpected benefits. We held the mixer at a small gallery which required participants to travel to the location and the food consisted of snacks purchased at a local grocery store. Prices were kept down because alcohol was not served, and this made the event more inclusive to younger participants and those who do not consume alcohol. In the future, even greater inclusivity could be achieved by incorporating the mixer into ASM Microbe, which would lessen the logistics of travel to another location. We received support for our initiative verbally and on social media from several company representatives with many expressing willingness to contribute to improving future meeting experiences for singletons.

(v) Exponential Growth. In bacterial cultures, the exponential growth phase describes when bacteria in favorable conditions double their numbers rapidly. In the context of Binning Singletons, it describes that effect on the singleton of a larger network, a supportive mentor, and lower anxiety associated with imposter syndrome or isolation in a large meeting. Immediately after the mixer and throughout ASM Microbe, several groups of participants went out socially, groups found one another on Twitter using the associated hashtag, and participants recognized one another by the custom Binning Singletons buttons that each received (Fig. 1).

Before the start of the meeting, all participants were provided a list of presentations by active Binning Singletons members and others who supported the initiative, as well as a list of singletons and mentors, and other scientists and organizations to follow on Twitter. One way to improve accessibility would be to incorporate the list of presentations into the official ASM Microbe conference app.

FOLLOW-UP

Anecdotally, the Binning Singletons initiative was a success gauged by the number of participants who were connected to larger networks. Word-of-mouth feedback during the meeting, and since the meeting, suggested that participants benefited from the program. To assess the impact, an anonymous survey was sent to each participant to measure how well the program met their needs (results of the survey are shown in Table S1 in the supplemental material). The survey addressed the respondent's overall experience and goals, likelihood of future participation, opinion on program communication, the bins, and the mixer, and we received 32 responses (~60% response rate). In Fig. 2, we present summary statistics of the participant responses for the survey

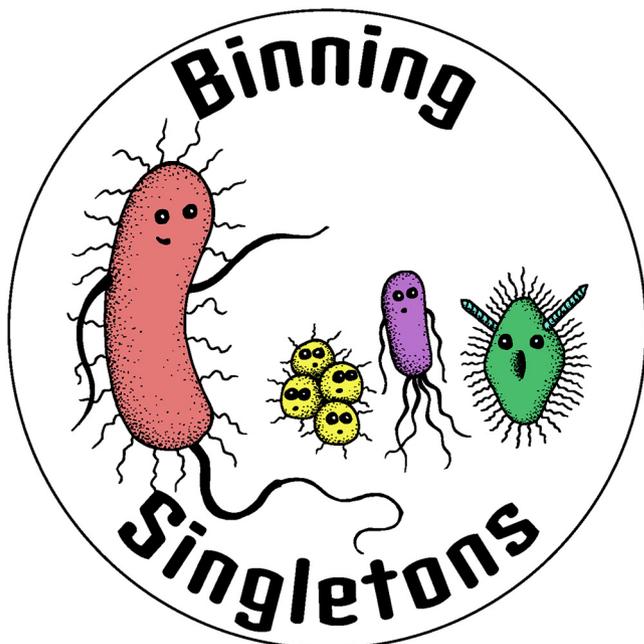


FIG 1 Binning Singletons logo. The logo was used to promote the program on social media and in person, as each participant received a custom Binning Singletons button at the start of the meeting. (Logo designed by Frank Santoriello.)

categories Overall, Communication, Bins & Goals, and Mixer. To calculate summary statistics, all numerical value answers for all questions in a category were averaged for each participant using Prism v8.2.1 (GraphPad Software, San Diego, CA). As Binning Singletons was an informal ad hoc effort, the methods were not reviewed by an institutional review board.

When asked to rate their overall experience from 1 to 5 (5 being the best), 56.5% of respondents rated it a 5, 39.05% rated it a 4, and 3.1% rated it a 3 with an average rating of 4.53 (Fig. 2). This supports the anecdotes that most participants had positive feelings about the program. While there is certainly concern that nonrespondents may not have rated the program as highly, the number of people who rated the program as a 4 or 5 represented more than 60% of all participants, regardless of response to the survey. When asked if they would like to participate in Binning Singletons at ASM Microbe 2020, 35 combined responses were positive (this is greater than the number of survey respondents because there were several levels of participation offered). About 14%

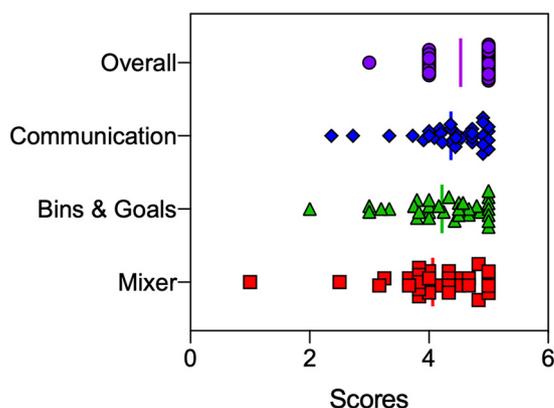


FIG 2 Scatter plot showing the average ratings per participants for the categories of questions in the follow-up survey. Bars represent the average score for each category. A total of 32 responses (~60% response rate) were received.

declined because they do not plan to attend Microbe next year, while one response was a definitive “No.”

COMMUNICATION

The survey responses indicate that overall communication was effective for Binning Singletons with an average rating of 4.37 (Fig. 2). When asked how well information was communicated from organizers, the average rating was 4.44 ± 0.88 (mean \pm standard deviation). When asked how well information was communicated within the bins, the responses were different, with an average rating of 3.84 ± 0.85 . These data correlate with the written responses that indicated some issues of communication between mentors and their groups. This is an area where clearer expectations of mentors and singletons might have helped, and a mentor also responded that better guidelines for mentors would be helpful. While the CERF guidelines were shared with the mentors, clearer expectations for all parties would likely benefit participants.

THE BINS AND GOALS

The survey asked participants about their satisfaction with their bins and the goals they selected when registering; the average rating for all questions in these topic areas was 4.22 (Fig. 2). An issue that really stood out was respondents' satisfaction with their bins (matches) either as a mentor or singleton with only a third of respondents (34.4%) being fully happy with their matches. However, only 6.1% of participants were actively dissatisfied (rating of 2), indicating relative success creating bins. Field mismatch prevailed as the reason respondents were dissatisfied with their matches. Since the matches were made primarily based on conference goals, this number of field mismatches is not terribly surprising. Perhaps a larger number of participants would yield a greater number of mentors with strengths that overlap a singleton's goals, as well as their field. Presenting the opportunity to be a mentor or singleton at registration would likely increase awareness and participation, resulting in a greater number of better matches. Overall, respondents were satisfied with how well their goals for the conference were addressed based (average ratings ranging from 4.0 ± 1.03 to 4.56 ± 0.89).

THE MIXER

As noted, the mixer was held off-site at a location within 0.5 miles of the Moscone Center, which entailed walking on the part of attendees, and the food was snack food bought at local grocery stores. Overall, respondents were happy with the mixer (average rating of 4.02, based on all survey questions on this topic) indicating that it was a beneficial aspect of the program (Fig. 2). The location was not ideal, based on responses, but this could be improved by moving the mixer into the conference venue. The time, immediately after ASM Microbe's Happy Hour on Friday night, was well received with the majority of respondents (53.1%) rating it as a 5. The food and efforts to include nondairy and vegan options were generally well received. The mixer satisfied attendee's ability to meet new people, with an average rating of 4.48 ± 0.70 .

IMPACT

The initiative found a receptive audience at ASM Microbe 2019. Organizers, mentors, and singletons were recognized by their pins and approached by attendees they had never met before asking about the initiative. Participants (besides the corresponding author) and others sent more than 100 tweets before, during, and after the conference that used the #binning_singletons or #binningsingletons hashtags. These tweets were used to promote the program, to connect people online, to set up dinners, lunches, and other meetings, and to promote mentorship and advertise career opportunities. A number of ASM Microbe attendees who had not seen the recruitment campaign on social media met singletons and mentors at the conference and expressed an interest in future participation. Comments in the survey referred to the initiative as a safe and inclusive environment, which was a major goal of the program. One respondent to the survey noted that Binning Singletons completely changed their experience at ASM Microbe for the better and that they would highly recommend it. Binning Singletons

was recognized by members of the ASM Council on Microbial Sciences (COMS) committee at the ASM Town Hall held at Microbe when an audience member asked how to make the experience of attending better for new attendees.

FUTURE DIRECTIONS

Binning Singletons was a highly successful initiative given the limited resources (time and funding) that faced the program. It is a prime example of how enthusiasm, creativity, and commitment can come together to improve the community and experience of ASM Microbe attendees. The 2019 Binning Singletons effort highlighted the interest in and need for a formal peer-to-peer mentoring program at ASM Microbe. We envision that the success of Binning Singletons will allow for mentoring efforts to grow at ASM Microbe and more broadly for the ASM community.

To improve future Binning Singletons, we need to coordinate with ASM and integrate program participation into meeting registration like mentoring programs associated with other conferences. Incorporating the mentoring program into registration would make it more broadly available to the ASM community and reach those that do not use social media. Registration for the program will require a detailed survey that will help bin mentors with mentees to improve matches and experience for participants. By incorporating Binning Singletons into ASM Microbe registration, the pool of mentors is likely to increase, resulting in enhanced matchmaking between mentor strengths and singleton needs within the same ASM track. Singleton and mentor matching will require a small committee consisting of representatives from across the ASM tracks to make appropriate bins. Further, communication and guidance for participants, especially mentors, also requires revision and development, as singletons reported having some issues with communication. While some information was provided to the mentors to aid in mentorship, this can be refined based on existing guidance for other conferences and literature on the topic of mentoring. By providing more structured communication and guidance, there will be better-defined expectations for all participants and a more uniform experience for singletons. A key component of Binning Singleton's success was the mixer because it brought together all the different bins and reinforced the *esprit de corps* participants receive in an environment in which they felt accepted and valued. The new connections made between members of different bins are vital nodes in the participants' new professional networks. Creating an environment conducive to mixing and moving among different groups is helpful for facilitating networking. In future years, having the mixer on-site at the conference or in an ASM Microbe-affiliated hotel would increase participation and serendipitous connections to be made between participants, friends of the program, and other supporters.

The success of the 2019 Binning Singletons program portends well for the future as a platform for growing the ASM community and enhancing the experience of ASM Microbe attendees. While the growth of a peer-to-peer mentoring program at ASM Microbe will require a lot of work and commitment, the existence of long-term mentoring programs at other large conferences highlights the needs and rewards for the scientific community. The Binning Singletons model will require minor modification and streamlining for a larger capacity. However, this model system is now a proven structure that can be easily adapted for expansion and the needs of the diverse ASM community. The authors and participants of the Binning Singletons 2019 look forward to watching the program grow to support the diverse ASM community and especially early career scientists and those from underrepresented groups.

SUPPLEMENTAL MATERIAL

Supplemental material is available online only.

TEXT S1, PDF file, 0.2 MB.

TEXT S2, PDF file, 0.1 MB.

TEXT S3, PDF file, 0.1 MB.

TEXT S4, PDF file, 0.1 MB.

TABLE S1, XLSX file, 0.02 MB.

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Binning Singletons is now associated with TallCuppaJoe LLC.

The views expressed in this paper are those of the authors and do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency.

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