

## **SIAM Activity Group Life Science Charter Renewal Application**

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on the Life Sciences (hereafter called SIAG/LS). In the fall of 1999, the SIAM Council and the SIAM Board of Trustees, under the aegis of SIAM, formed the SIAG/LS by electronic mail vote with an initial operating period between January 1, 2000 and December 31, 2002. The Council and Board have renewed the SIAG/LS charter eight times thereafter.

According to its Rules of Procedure, the objective of the SIAG/LS is to foster applications of mathematics to the life sciences and research in mathematics that leads to new methods and techniques useful in the life sciences. Its proposed functions were to organize minisymposia at the SIAM Annual Meetings with scheduling coordinated by the SIAM VP for Programs and the SIAM VP at Large with the SIAG/LS Chair. Furthermore, a major function of the SIAG/LS is to organize a biennial SIAM Conference on Life Sciences.

Statistics:

The SIAG/LS had 834 members as of December 31, 2019; of those, 390 were students and 444 were non students.

Its purposed functions were:

The SIAG on LS will organize activities in Life Sciences. The SIAG is expected to:

1. Subject to the conditions of ARTICLES III and IV, the SIAM Activity Group on Life Sciences will conduct sessions at regular SIAM meetings, conduct special meetings, and participate in organizing publications in the areas of Life Sciences and its applications.
2. The SIAG shall not present awards or otherwise recognize scientific achievement, professional service, or the like without prior approval by both the SIAM Major Awards Committee and the SIAM Council of the award criteria, the method of selection of recipient(s), the nature of the award, and all other aspects, if any, of each such award must have the prior approval of the SIAM Board of Trustees.

Other activities can include:

3. Organize minisymposia at the SIAM Annual Meeting in years where there is no SIAG conference.
4. At least once every seven years either organize a track of at least six minisymposia at the SIAM Annual Meeting or have an activity group meeting held jointly with the annual meeting. The VP for Programs and the VP at Large will coordinate the scheduling with the SIAG chair.
5. Organize a biennial SIAM Conference on Life Sciences. The SIAG will consider dovetailing specialized workshops and conferences with the SIAM Annual meeting or other SIAG conferences. The chair of the conference organizing committee shall be either the program director or the chairperson of the SIAG or their designee. The organizing committee must be approved by the VP for Programs at least 16 months before the conference.

6. With the approval of the SIAM Program Committee, the SIAG may organize special sessions at SIAM meetings, and conduct special one- or two-day meetings immediately before or after a regular SIAM meeting. Other SIAG meetings may be organized only with the approval of the SIAM president and vice president for programs.

The SIAG has complemented SIAM's activities and supported its proposed functions. The answers to the questions below indicate how this was accomplished and what the officers propose as the future directions for the SIAG.

List all current officers of the activity group (including advisory board, if relevant).

Chair: Victoria Booth, University of Michigan

Vice Chair: Suzanne Lenhart, University of Tennessee

Program Director: Angela Reynolds, Virginia Commonwealth University

Secretary: Lisette de Pillis, Harvey Mudd College

1. How is the field covered by the activity group doing? Is it growing, is the focus shifting? What have been the significant advances over the last three years?

The field of biomathematics continues to grow. The number of journals dedicated to this field is larger than ever. The NSF has a funding program within the Division on Mathematical Sciences (DMS) on Mathematical Biology, and the NIH has a study section on Modeling and Analysis of Biological Systems. In addition, NSF and NIH have multiple biomathematics programs that bridge their interests, including DMS/NIGMS and CRCNS (Collaborative Research in Computational Neuroscience), and the NIH Brain Initiative has multiple funding calls focused on theory and modeling driven approaches. There are also more graduate programs with a focus on biomathematics than ever before. During the past two decades, two research institutes, the Mathematical Biosciences Institute at The Ohio State University and the National Institute for Mathematical and Biological Synthesis at the University of Tennessee, have promoted biomathematics through research workshops, training programs and conferences. In 2018, NSF DMS joined with the Simons Foundation to launch four new centers to bring mathematical perspectives to the biological search for the "Rules of Life." The work at these centers are focused in biological applications at the cellular level and below. The four centers are headquartered at the Georgia Institute of Technology, Harvard University, Northwestern University and the University of California, Irvine. Each of these centers provides graduate and postdoctoral training opportunities, hosts research workshops and holds larger research symposia focused on mathematical approaches to understanding biological systems. Finally, many new activities and funding opportunities are available to work on COVID-19 related research.

The range of mathematical applications within biology is enormous, and includes applications at the molecular level (e.g., structural biology and gene transcription pathways), the intracellular level (e.g., cell cycling and metabolic networks), intercellular level (e.g., neural networks and immune responses), tissue level (e.g., cardiac and respiratory systems), and at the level of organisms (e.g., epidemiology, ecology, and descriptions of social interactions). Evidence that mathematics is being used in these topics is clear from the titles of journal articles, and from funded grant proposals. It is evident that the breadth of topics subject to mathematical modeling and analysis, and the prevalence of mathematical approaches and methodologies in biology, continue to grow at a great rate. Importantly, there is an ever-growing emphasis in the

field on collaboration with experimental biologists. This reflects the belief in the biological community that greater quantitative analysis and modeling is needed, and that this is facilitated through interactions with mathematical scientists.

In addition, the range of mathematical approaches being applied to biological questions continues to grow. While more traditional mathematical approaches involving ordinary and partial differential equations, as well as statistics, continue to play an important role in many applications, techniques from other areas, including machine learning, stochastic processes, agent-based models, algebraic geometry, graph theory, probability, topology, etc., are now used to address wide ranging topics in the biological sciences.

2. How is the activity group doing? Is it remaining vibrant? Is the size of the SIAG stable or increasing? How is the SIAG keeping up with the changes in the field? How are the broader interests of SIAM reflected in the activities of the SIAG?

SIAG/LS membership has held steady over the past 2 years with 834 members as of December 2019 which is similar to the member numbers of 844 and 849 in 2018 and 2017, respectively. Of the current 834 members, 390 are students, which is again similar to the past 2 years (401 and 394 in 2018 and 2017, respectively). Compared with other SIAGs we are doing quite well. There are only five other SIAGs with membership greater than ours (as of December 2019).

3. Please list conferences/workshops the activity group has sponsored or co-sponsored over the past two years, and give a brief (one sentence or phrase) indication of the success or problems with each.

In August 2018, the SIAM Conference on the Life Sciences was held in Minneapolis, Minnesota with 349 registered attendees. In addition to the 8 invited speakers, there were 61 minisymposia, 10 contributed talk sessions and a special tutorial session titled “Math, Music and the Brain” given by Daniel Forger (University of Michigan) which included an off-site organ demonstration and recital of “The Mathematical Bach”. The well-attended evening poster session included 30 posters with prizes awarded to the top posters as judged by a panel of faculty members.

The 2020 SIAM Conference on the Life Sciences was scheduled for June 8-11, 2020 in Garden Grove, California, but was postponed due to COVID-19 restrictions. This was unfortunate considering the meeting was on track to be one of largest held outside of meetings joint with the SIAM annual meeting. There were 99 minisymposia scheduled along with 88 contributed talks and 42 posters. In addition, a tutorial session was scheduled on “Deep learning applied to differential equation models” and the organizing committee was coordinating a mentoring session and a funding panel. The meeting was set to co-locate with the 2020 SIAM Conference on Mathematics of Planet Earth.

In lieu of the in-person meeting, a virtual online series will be held during June 8 – July 2, 2020. At the time of writing, many of the invited speakers have agreed to give their talks online live with recordings posted on the conference website. All minisymposium organizers have been given the opportunity to hold their sessions online. Additionally, live sessions will be held for presenting the SIAG/LS Early Career Prize, the SIAG business meeting and a social/mentoring event. To support our community with in-person opportunities, SIAG/LS will organize a track at the 2021 SIAM Annual Meeting and will encourage submissions from minisymposium organizers and speakers from the 2020 LS conference.

These data indicate that the SIAG/LS conferences are well attended both in terms of total attendance and number of minisymposia.

4. Please indicate the number of minisymposia directly organized by the activity group at the last two SIAM annual meetings. When did the SIAG last organize a track of minisymposia at an annual meeting or meet jointly with the SIAM Annual Meeting?

\*Because of the number of Activity Groups, the current guidelines are that an Activity Group should organize a track about every seven (7) Annual Meetings or meet jointly with the Annual Meeting within a seven (7) meeting period.\*

The SIAG/LS meeting was last held jointly with the SIAM Annual Meeting in 2016. At the 2018 SIAM Annual Meeting there were three minisymposia (MS140, MS160, and MS161) that were organized in response to a call from the SIAG earlier in the year. Many other minisymposia were clearly relevant to the field, including MS9, MS96, MS123, MS134, MS148, and MS168. In 2019 SIAM participated in ICIAM and the 2020 SIAM Annual Meeting has been cancelled because of COVID-19 restrictions and only select sessions will be held virtually.

The SIAG/LS has expressed to SIAM an interest in holding the 2022 SIAG/LS meeting joint with the Annual Meeting.

5. Please indicate other activities sponsored by the activity group, to include newsletters, prizes and web sites. Have each of these been active and successful?

The activity group sponsors a mailing list in which conferences, new software, new books, jobs, and other items of potential interest to the community are posted. This is used frequently, with 10 or more postings made each month and should therefore be considered successful.

The SIAG/LS website continues to provide information on upcoming meetings, related SIAM News publications, the SIAG Early Career Prize, how to post to the mailing list, and a member list. Other useful items are links to SIAM books, and archives of charter renewals, business meeting minutes and conferences. This website provides useful information for the SIAG/LS members and the biomathematics community in general, and we look forward to the revised version in development under SIAM Engage to debut in July 2020.

The SIAM Activity Group on Life Sciences Early Career Prize, established in 2016, is awarded to an outstanding early career researcher in the field of mathematics applied to the life sciences, for distinguished contributions to the field in the three calendar years prior to the year of the award. The 2020 SIAM Prize committee consisted of the SIAG LS members:

Linda Allen, Texas Tech University

Elizabeth Cherry, Rochester Institute of Technology

Carson Chow, National Institute of Health

Karin Leiderman, Colorado School of Mines

Mark Nelson, University of Wollongong

The 2020 prize will be awarded to Kevin Hannay, Schreiner University, "for his major advancement of coupled oscillator systems through identification of a new macroscopic reduction that captures properties of phase distributions observed in experimental data." The awarding will take place virtually during the online series replacing the SIAG/LS 2020 meeting.

6. What activities are planned and proposed for the next period of the charter? Please describe scheduled and suggested future activities in detail.

The current focus of the SIAG/LS is on scheduling and organizing the virtual online series in lieu of the in-person meeting. The 2020 program was one of the largest and we hope to maintain the enthusiasm and momentum for the SIAG despite the COVID-19 disruptions.

Plans for the 2022 meeting await electing the new set of officers, however, the SIAG/LS has expressed interest in joining the SIAM Annual Meeting in 2022. The SIAG/LS is considering opportunities to interface with the Society for Mathematical Biology (SMB) at the SIAG/LS conferences and at the SMB annual meetings.

7. How can SIAM help the activity group achieve its goals?

The most important function of the SIAG/LS is running the SIAM Conference on the Life Sciences every other year. This meeting remains very popular, with continued growth in the number of minisymposia and registered participants. It is one of two meetings run by and for the mathematical biology community. The other, run through SMB, is often held outside of the United States, making the SIAM Life Sciences meeting the only large conference geared towards biomathematics consistently held within the US or Canada.

8. How can the activity group help SIAM in its general role of promoting Life Sciences?

By renewing the Life Sciences charter, SIAM will be maintaining an important resource for mathematicians working in the life sciences.

The SIAG/LS requests that the SIAM Council and Board of Trustees renew its charter for a 2-year operating period beginning January 1, 2021

Signed,



Victoria Booth, SIAG/LS Chair

June 1, 2020