

SIAM Activity Group Life Sciences 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 nine times thereafter.

This SIAG has 794 members, including 319 student members, as of December 31, 2021.

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.

Its purposed functions were:

1. Organize minisymposia at the SIAM Annual Meeting and ICIAM in years where there is no SIAG conference.
2. 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.
3. Organize a biennial SIAM Conference on the 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.
4. With the approval of the SIAM Program Committee, the SIAG may organize special sessions at SIAM meetings. 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: Krešimir Josic

Vice Chair: Dean Bottino

Program Director: Nick Cogan

Secretary: Alexandra Jilkine

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 mathematical biology field continues to grow, alongside the development of technologies that make it possible to gather ever more data of increasing quality. The need for quantitative methods in epidemiology has been particularly pronounced during the pandemic shining a light on the successes and shortcomings of our present modeling efforts. Funding for research in mathematical biology remains strong: This includes NSF programs within the Division on Mathematical Sciences (DMS), a dedicated NIH study section on Modeling and Analysis of Biological Systems, as well as several joint NSF/NIH programs. Of particular note is a recent call for proposals for a national institute devoted to mathematical biology with an overall budget of \$10M per year, which will be jointly funded by the NSF and the Simons Foundation. This is nearly 10 times larger than the funding received by most current institutes in the mathematical sciences. Therefore, the number of graduate students and postdocs in the field is likely to increase considerably in the near future. Fortunately, the job market for mathematical biology remains healthy, with most graduating students and postdocs finding jobs in either academia or industry.

The number of journals in the field also continues to grow, and mathematical biologists publish widely both in dedicated journals, as well as journals in biology, medicine, biophysics, and beyond. While SIAM does not have a journal devoted to mathematical biology, one can find articles in different SIAM journals on the subject. In particular, an upcoming issue of the SIAP is devoted to mathematical biology, and depending on the success of this issue, a formal proposal for a SIAM journal on the topic may be forthcoming. This effort involves SIAG LS officers.

The role of mathematics in biology has been compared to that of a microscope (but better!). Mathematical and statistical methods allow us to analyze data that would otherwise make little sense and develop and analyze models that uncover the biological mechanisms underlying experimental observations. Mathematical methods have been applied at the molecular, intra-, and inter-cellular levels, at the level of organisms, and the level of societies. The number of new topics studied by mathematical biologists continues to grow along with the development of new experimental techniques in biology. While traditional mathematical methods are still widely used, new methods (both analytical and computational) are of increasing importance. In recent years questions in biology have often driven new developments in machine learning, stochastic processes, agent-based modeling, topological data analysis, graph theory, probability, and other fields of applied mathematics and statistics. Mathematical biology will thus continue to be a field of increasing importance at the interface of biology and mathematics and a driver of new developments in both areas.

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 is healthy but has decreased somewhat over the past 2 years, with 794 members as of December 2021 compared to 834 in 2019. This decrease is in line with the overall decrease in SIAM membership during the pandemic. Of the current 794 members, 319 are students, a decline from 2 years ago (390 in 2019). This decrease in student membership seems to follow a general trend across SIAM. While the decrease in membership is not dramatic, a goal of the activity group leadership should be to increase student membership, as well as membership of mathematical biologists working in the industry over the next few years.

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 July 2020, the SIAM Conference on the Life Sciences was held remotely. This conference was held jointly with SIAM Conference on Mathematics of Planet Earth (MPE20). There were 7 invited speakers, 99 minisymposia (compared to the 61 in 2018), two prize talks, and a minitutorial focusing on deep learning. There were also 16 contributed sessions and a poster session held jointly with MPE20.

The activity group leadership has also worked with the NSF-Simons Center for Multiscale Cell Fate Research at UC Irvine to organize two working group meetings at the institute. Proposals were solicited and reviewed by the AG officers, and a selection proposed to the Institute leadership. The selected proposals were accepted for funding, and the working groups consisting of 4-8 faculty from different institutions in the US and overseas will meet at UC Irvine for one week each this summer, with all costs covered by the institute.

In addition, SIAG LS officers worked with the organizing committee of the SMB Annual Conference in summer 2021 to organize a special session on Industrial and Academic Interactions Within the Life Sciences Community. The mini-symposium, and the entire meeting was virtual. The speakers included Jae Kyong Kim (KAIST), Ami Radunskaya (Pomona College), Dean Bottino (Takeda Pharmaceuticals), and Rada Savic (UCSF).

The activity group leaders are also actively involved in organizing the next SIAM Conference on the Life Sciences, which will be held jointly with the annual SIAM meeting in July of 2022. The schedule for this hybrid meeting is nearly complete.

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?

The last track of minisymposia at the annual meetings was organized in 2014. The 2016 SIAM LS was held jointly with the annual meeting as is 2022. At the 2020 SIAM Annual Meeting, there was one minisymposium organized in response to the call from the SIAG earlier in the year.

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 SIAG officers moderated posts on SIAM Engage, which replaced the previous mailing list for the SIAM LS community. SIAM Engage has been used to alert members to upcoming conferences, new

software, new books, job opportunities, and other items of potential interest to the community. There have been about 5 posts weekly, an increase from the 10 or so monthly posts to the abovementioned mailing list.

SIAG LS officers have also started a Twitter account to help advertise similar opportunities to the wider community of mathematical biologists. The officers post and repost tweets of interest several times a week. Although the number of followers is still relatively small at about 60, it is steadily growing, and posts are often amplified by accounts with more followers. This account also helps raise awareness of the SIAG LS, and SIAM in general.

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:

Denise Kirschner (Chair, University of Michigan)
Mark Lewis (University of Alberta)
Sharon Lubkin (North Carolina State University)
Cheng Ly (Virginia Commonwealth University)
Helen Moore (Applied BioMath)

The 2022 prize will be awarded to Dan Wilson for developing “powerful and accurate extension of phase reduction of coupled oscillators that reduces the dynamics of a large population of oscillators to a small number of variables, addressing long-standing limiting assumptions.” The awarding will take place during the SIAG/LS conference in July 2022.

In addition, the activity group chair has contributed an interview with Dr. John Cook on the topic of running a mathematical consulting business to SIAM News. The officers are planning two further articles for SIAM News.

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

As in the past, one of the main activities is to help plan the organization of the conference, as well as the formation of diverse award committees. The present officers will hand over the Twitter account to the incoming officers. They will also organize a meeting with the new officers and Qing Nie, the Director of the NSF-Simons Center for Multiscale Cell Fate Research at UC Irvine to explore possibilities for further collaboration.

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, and we expect that a return to in-person meeting will be accompanied by an increase in interest. It is one of two meetings run by and for the mathematical biology community. The other meeting run through SMB, is held outside of the United States in alternate years, making the SIAM Life Sciences meeting the only large conference geared towards biomathematics consistently held within the US or Canada. SIAM has been very helpful in running this meeting.

SIAM Engage has been a good way to reach the SIAG LS members. There have been 155 posts made since its launch, and the posts are reaching 654 registered members.

8. How can the activity group help SIAM in its general role of promoting applied mathematics and computational science?

At present, 87% of the members of the SIAG LS group are in academia. Given the large number of mathematical biologists that work in industry, the activity group could do a better job reaching out to this community and ensure a larger representation in SIAM. This could be done by recruiting more officers from industry and making sure that a sufficient fraction of minisymposia during the biannual SIAM Life Sciences conferences are of interest to this community.

This SIAG/LS requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning January 1, 2023.



Krešimir Josić, SIAG/LS Chair

May 19, 2022