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SIAG 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 four times thereafter. The SIAG/LS had 870 members as of December 31, 2010; of these, 375 were students.

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.

The SIAG/LS 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/LS.

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 application of mathematics to the study of the life sciences continues to be an area of significant activity and rapid growth. Biologists are becoming more accepting of the contributions mathematics can make to the life sciences, and more theoretical mathematicians, using a greater variety of mathematical approaches, are addressing the interesting and challenging mathematical problems arising in models from the life sciences. Anecdotally at least, the increased appreciation of modeling within the biological sciences is reflected in an increased request for modeling in calls for grant proposals put out by the National Institutes of Health and in the reliance of mathematical and computational methods in studies of pharmacokinetics by pharmaceutical companies. The recent National Science Foundation "Dear Colleague" Letter on "Unsolicited Proposals at the Interface of the Biological, Mathematical and Physical Sciences" (NSF 11-010), which cites significant increases in the numbers of proposals combining mathematics and biology and encourages future submissions of such proposals, provides additional evidence about the growth of our field.

A major trend in our area is that the acquisition of biological data, in many biological realms such as ecology, epidemiology, genetics, intracellular processes, neuroscience, and physiology, has continued to accelerate, facilitated by mathematics and statistics (e.g., allowing for fast gene sequencing). This trend poses a range of challenges and opportunities in

algorithm development, statistical analysis, parameter estimation, and model development and analysis and is evident in the program of our last conference, LS10 (see below). An example of a recent success in this area is the use of DNA microarray data to computationally predict the existence of previously unknown interactions of DNA replication and mRNA expression, later confirmed experimentally.

Interaction between modelers and experimentalists, as well as the emergence of interdisciplinary researchers who combine both approaches, has led to a greater emphasis on the inclusion of biological detail in models, enhancing the need for more sophisticated computational methods. For example, continued progress has occurred in implementing large-scale models of physiological systems, including the brain, as well as the development of models combining multiple scales and multiple physiological systems, such as models that link neuronal controllers with musculoskeletal mechanics. A related area of progress is the development of hybrid experimental systems in which biological components interact directly with computational models, with potential application in new types of experimental investigations, in robotics, and in the development of brain-computer interfaces for clinical applications. Finally, important advances have occurred in methods to incorporate stochastic effects into models and in the emergence of new understanding of the possible constructive roles that noise can play in biological systems.

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

The activity group continues to grow, as evident in its membership numbers:

YEAR	2002	2003	2004	2005	2006	2007	2008	2009	2010
TOTAL MEMBERS	423	512	511	509	641	687	811	837	870
STUDENT MEMBERS	61	173	157	157	199	236	313	360	375

Part of this growth is a rise in the number of student members, which as of 2010 constituted 43% of the group and which is indicative of a vibrant, growing field. The attendance at the SIAM Conference on the Life Sciences jumped from 365 registrants in 2008 to 1247 in 2010. While this jump reflects the fact that the meeting was held jointly with the SIAM Annual Meeting in 2010, it is interesting to note that there were only 159 registrants at the 2004 Life Sciences meeting, even though that was also held jointly with the Annual Meeting.

To help members keep up with changes in the field, our recent Activity Group conferences have each featured a Forward Looking Session as well as a Lee Segel Forum panel discussion (named after a mathematical biologist who made outstanding contributions in mentorship as well as research). In 2010, the Forward Looking Session consisted of a panel discussion and question-and-answer session on areas that are ripe for progress in the quantitative study of the life sciences and methodological advances that may have a large research impact in the field. The 2010 Lee Segel Forum considered computational tools and training for quantitative biology, which are key issues in ensuring that group members are prepared to keep up with future trends in the area and which also align well with the broader interests of SIAM both in computational methods and in trainee development.

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

The SIAG on LS organizes the biennial SIAM Conference on the Life Sciences. The list of past LS conferences may be found at

<http://www.siam.org/meetings/archives.php#lifescience>.

The LS10 Conference was held in Pittsburgh in conjunction with the 2010 SIAM annual meeting. As noted above, the attendance at the meeting was very large, which led to concerns about large numbers of parallel sessions but ensured that attendees enjoyed a wide variety of educational, scientific, and networking opportunities. Completed evaluation forms indicate a high level of satisfaction with the meeting, particularly the talks, the breadth of topics, and the strong coverage of certain particular topics (e.g., brain dynamics).

The LS08 Conference was held in Montreal. Evaluations were positive for this meeting as well. An innovative feature was the inclusion of a Public Lecture, by Stuart Kaufmann, and associated reception. The lecture brought in a huge audience, which filled the available auditorium space, included many people from outside of the meeting, and sparked interesting discussions. There was also a popular and extremely well attended government funding agency panel discussion. The NIH Interagency Modeling and Analysis Group put together a large number of minisymposium sessions, which brought in many attendees but led to some sense that meeting events were segregated into two separate streams. Another challenge was that a hotel strike occurred during the meeting; nonetheless, the meeting went forward as planned with relatively little negative impact.

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 at an annual meeting?

The LS10 Conference coincided with the 2010 SIAM Annual Meeting. For the 2009 Annual Meeting, a SIAG/LS member (Jonathan Rubin) was on the Organizing Committee and organized a minisymposium track. Another SIAG/LS member (Steve Coombes) delivered a plenary lecture.

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/LS website is set up to provide members with information on a range of topics, such as relevant upcoming meetings, journals, and book publications. It includes a listing of member names and research areas. The group has not been particularly active in updating this site, and doing so will be part of the group activities in the near future. There is also a SIAG/LS email list, which is active and is moderated by the group Secretary, Laura Miller. To avoid duplication, the group policy is not to use this list for meeting and job announcements that also would be submitted to the Society for Mathematical Biology's SMBnet. All SIAG/LS members are encouraged to sign up for the free SMBnet electronic digest.

At the 2008 and 2010 LS Meetings, prizes were awarded for best graduate student posters and for best undergraduate student posters, including a monetary component provided from the meeting organizers' discretionary funds allocated by SIAM. At both meetings, the decision was made not to run Contributed Talk sessions and to include all contributed works in

the poster session instead, in keeping with traditional conference formats in the life sciences. As a result, the poster sessions were large, lively, and quite successful, cited by some participants as the highlights of the meetings.

As noted above, another very successful element of the 2008 meeting was a Public Lecture delivered by Stuart Kauffman, "Reinventing the Sacred: Science, Faith and Complexity". This lecture attracted an audience that packed the auditorium. A video of the lecture was taken and can be viewed online, on the LS08 website.

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

The next SIAM Conference on the Life Sciences is being planned for August, 2012, in San Diego, with Tim Lewis and Mette Olufsen as Co-Organizers. The Lee Segel Forum will be continued at this meeting. The meeting will have a session dedicated to significant advances in the general field of mathematical biology. Organizers are also specifically aiming for participation of medical and biomedical researchers with an interest in quantitative methods, starting with the selection of an Organizing Committee member with medical expertise and extending to inviting a plenary speaker and promoting minisymposium organization by members of this group.

In addition to updating the website as mentioned above, some other ideas for near future activities have been put forth. One idea is to solicit short articles on recent new developments in the quantitative study of the life sciences, a "What's new in..." series, to be posted on the group website. Alternatively or as a complement to these formal articles, a suggestion has been raised to maintain a more open online forum for member discussion of significant advances and grand challenges in the quantitative study of the life sciences. We are also considering setting up a gallery of interesting images and videos emerging from research efforts in this area. We expect to implement at least a subset of these online options soon, to help establish the SIAG/LS website as a source for the exchange of ideas among members. Another idea under consideration is to promote and coordinate the organization of minisymposium tracks at biological meetings in which many SIAG/LS members participate or which are attended by potential future group members, to enhance SIAG/LS visibility within these interdisciplinary communities. This idea will be discussed among group officers and members, before the development and implementation of more concrete and detailed plans.

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

We appreciate the dedication of SIAM staff to the support of SIAG/LS conferences. Assistance in advertising the LS12 meeting to SIAM members as well as the world-wide mathematical biology community would be highly valuable. Continued assistance with website management will also be helpful. If we do decide to organize minisymposium tracks at meetings outside of SIAM events, then some form of SIAM official participation may be desired, but this remains to be seen. SIAM also can provide lobbying support and contact information for the discipline in terms of research grants available from NIH, NSF, NASA, DOE, DOD, ONR, Howard Hughes, and other organizations supporting quantitative research in the life sciences.

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

The 21st Century is being called the Century of Biology. Certainly biology and medicine are extremely active and exciting fields of science at the present time, and this situation is expected to continue over the next several decades. New experimental methods such as imaging and genetic manipulation allow (and force) biologists to become much more quantitative. SIAM will greatly benefit from these directions as more and more experimentalists seek out computational tools and expert collaborators to enhance their research. The SIAG/LS Conferences highlight computational advances that may be useful for addressing cutting edge questions in the life sciences and provide a venue to catalyze interdisciplinary collaborations involving applied mathematics and computational sciences. In general, the activities of the SIAG/LS will make SIAM visible to life sciences and clinical communities and will provide a natural entry point for members of these communities into the realms of applied mathematics and computational science.

Many sessions at SIAM Meetings and papers within SIAM journals, particularly the SIAM Journal on Applied Dynamical Systems, are based on work motivated by questions in the life sciences. By disseminating our research through these SIAM outlets, SIAG/LS members help showcase how mathematical and computational tools can find new uses in this area and how biological questions can motivate new mathematical and computational developments. As exposure to such advances draws more mathematicians to enter biology, SIAM through the SIAG/LS will be in a good position to represent them.

The SIAG/LS requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning January 1, 2012.

Signed



Jonathan Rubin
Chair, SIAM Activity Group on Life Sciences
May 26, 2011