**Topical Conference**
**"OPPORTUNITIES IN BIOLOGY FOR PHYSICISTS"**
**January 30 – February 1, 2004**
***Wyndham Hotel, San Diego, CA.***

# CONFERENCE SUMMARY

## Background and Audience:

In 2002, the American Physical Society (APS) organized and held the first "Opportunities in Biology of Physicists" topical conference in Boston, MA, as a way of informing physicists, particularly those just entering the field, of opportunities emerging at the interface of physics and biology. Because of the tremendous success of the first conference, it was decided to organize a second conference, similar in nature and focus, but with different presentation topic areas. Again the intended audience would be graduate students and postdocs considering applying methods of physics to biological research, and those who advise others on such opportunities.

## Organization and Planning:

A Steering Committee of outstanding researchers, with Robert Austin of Princeton University and Herbert Levine of the University of California, San Diego as co-chairs, was appointed. Several members of the steering committee were volunteers who helped plan the first conference. Conference calls were held on April 30 and July 25, 2003 and most of the planning was conducted by email. Five major topic areas were identified as areas of particular importance for the future and a list of potential speakers in each area was developed. The areas identified were as follows:

- Bioinformatics, Genomics and Proteomics
- Pattern Formation and Self-organization
- Systems Neuroscience
- Signal Transduction Networks
- Biological Nanotechnology

A tentative budget was drawn up. It was decided that a special effort should be made to secure external funding to provide travel grants of up to $500 for graduate students and postdocs.

## Participants:

Email messages were widely distributed to APS members, announcing the conference and a notice about the conference appeared in the APS member publication, *APS News*. A website was established to provide detailed information about the conference and enable people to apply and request a travel grant. Because the Steering Committee wanted to limit attendance to 200, people interested in attending were required to apply before receiving a formal registration form. Those requesting travel grants were asked to provide information regarding their current area of interest/study and how they thought they might benefit from attending the conference. 208 travel grant applications were received and 75 individuals were selected to receive financial assistance.

## Conference:

A complete program with the names of all speakers and Steering Committee is provided. 204 people, including 110 graduate students, 33 postdocs, senior faculty members and researchers, steering committee members, speakers, and panelists, attended the conference.

One of the highlights of the conference was a poster session/reception after the first day of talks. Nineteen organizations which either have programs or provide funding in biophysics research fields, presented posters. The reception provided an extended informal time for conference participants to network and discuss areas of interest. Another highlight of the conference was a "Lunch with the Experts" for all graduate students. A free box lunch was provided and participants signed up to sit at a table hosted by one of the conference "experts". All 110 graduate students participated.

While not organized as part of the conference, the physics department at the nearby University of California, San Diego provided a reception and tours of campus research facilities on the second evening of the conference. Approximately one hundred conference attendees participated in this event.

## Follow-up:

All of the speakers did an excellent job of planning their talks for physicists with little or no knowledge of biology. Most of the talks can be viewed on the web at: www.aps.org/meet/biology-physics2/weblectures.cfm

A post-conference survey of participants was conducted shortly after the meeting. A summary of responses to the 11-question survey with some comments is attached. A complete list of comments for all questions will be provided upon request.

## Funding Agencies:

- Alfred P. Sloan Foundation
- Borroughs-Wellcome
- Department of Energy
- National Institute of Standards and Technology
- National Institutes of Health
- National Science Foundation
- Office of Naval Research

## Travel Grants:

| | |
|---|---|
| Graduate Students | 56 |
| Post Docs | 15 |
| Total | 71 |

## Attendance:

| | |
|---|---|
| Graduate Students | 108 |
| Post Docs | 33 |
| Faculty Members | 19 |
| Other Senior Researchers | 9 |
| Total Participants | 169 |

# Opportunities in Biology for Physicists

A Topical Conference of the American Physical Society

**January 30 - February 1, 2004** **Wyndham San Diego at Emerald Plaza**
**San Diego, California**

## CONFERENCE SCHEDULE:

### FRIDAY, JANUARY 30, 2004: DIAMOND ROOM

8:30 am OPENING REMARKS Judy Franz and Bob Austin

SESSION 1: Bioinformatics, Genomics and Proteomics
(Chair, Laura Garwin)

8:45 - 9:30 Edward Marcotte, University of Texas, Austin
"Bioinformatics of protein function and interactions"

9:30 - 10:15 Michael Laub, Harvard University
"Using DNA microarrays to infer genetic networks"

10:15 - 10:45 COFFEE BREAK

10:45 - 11:30 Jeff Hasty, UCSD
"Engineered gene circuits: a playground for physicists and applied mathematicians"

11:30 am - 12:45 pm LUNCH WITH THE EXPERTS: CRYSTAL II ROOM
(Graduate Students Only)

SESSION 2: Pattern Formation and Self-organization (Chair, Terry Hwa, UCSD)

1:00 - 1:45 Eric Wieschaus, Princeton
"Morphogen gradients and size regulation in Drosophila embryos"

1:45 - 2:30 Herbert Levine, UCSD
"A physicist's view of Dictyostelium aggregation"

2:30 - 3:15 Ned Wingreen, NEC
"E-coli's division decision: modeling Min-protein oscillations"

3:15 - 3:45 COFFEE BREAK

3:45 - 5:00 FRIDAY PANEL
"How to work in the physics/biology interface and survive" (Chair: Jose Onuchic)

Panel Members:

| | |
|---|---|
| Alexander van Oudenaarden, MIT | Dan Rohksar, Univ. of CA, Berkley |
| Elena Rivas, Wash. Univ., St. Louis | Valery Kalatsky, UCSF |
| George Grüner, UCLA | Andrea Liu, UCLA |

5:00 - 7:00 pm RECEPTION AND POSTER SESSION: CRYSTAL BALLROOM

## SATURDAY, JANUARY 31, 2004: DIAMOND ROOM

SESSION 3: Systems Neuroscience (Chair, David Kleinfeld)

9:00 - 9:45 am Sebastian Seung, MIT "Dynamics of neural networks"

9:45 - 10:30 Charles Gilbert, Rockefeller University
"Neural mechanisms of perceptual learning"

10:30 - 11:00 COFFEE BREAK

11:00 - 11: 45 Peter Detwiler, University of Washington
"Optical studies of direction selective cells in the retina"

11:45 am - 1:00 pm LUNCH

SESSION 4: Signal Transduction Networks (Chair, Ned Wingreen)

1:00 - 1:45 John Spudich, University of Texas, Houston
"Microbial rhodopsins: transducing light to biological energy and information"

1:45 - 2:30 Erin O'Shea, UCSF
"Systems analysis of budding yeast"

2:30 - 3:15 Jim Ferrell, Stanford School of Medicine
"Bi-stability in cell signaling"

3:15 - 4:00 Bonnie Bassler, Princeton University
"Small talk: cell-to-cell communication in bacteria"

4:00 - 4:30 COFFEE BREAK

4:30 - 5:30 SATURDAY PANELS

"Funding Opportunities"

Panel Members:
Denise Caldwell, NSF
Paula Flicker, NIH
Aravinda Kini, DOE
Debi Vought, Borroughs Wellcome Fund
James Deye, National Cancer Institute, NIH

"How to get a post-doc position and other career advice" (for Grad students):

Panel Members:
Ka-Yee Lee, Univ. of Chicago,
Bob Austin, Princeton
David Kleinfield, UCSD,
Deborah Fygenson, UCSB,

6:00 pm RECEPTION AND TOUR OF PHYSICS FACILITIES
on the campus of the University of California, San Diego
(RESERVATIONS REQUIRED, Buses leave hotel promptly at 6 pm)

**SUNDAY, FEBRUARY 1, 2004 DIAMOND ROOM**

SESSION 5: Biological Nanotechnology
(Chair, Robert Austin)

9:00 - 9:45 am Carlos Bustamante, UCB
"Grabbing the cat by the tail: packaging of DNA by single particles of bacteriophage phi29"

9:45 - 10:30 George Grüner, UCLA
"Detecting biomolecules with nanoscale electronic devices"

10:30 - 11:15 Miriam Rafailovich, SUNY - Stonybrook
"Physics and biology: having fun at the interface"

11:15 - 11:45 CONFERENCE WRAP-UP

## CONFERENCE STEERING COMMITTEE:

Robert Austin (Princeton), Co-Chair
Herbert Levine (UCSD), Co-Chair
Laura Garwin (Bauer Center for Genomics Research)
Aihua Xie (Oklahoma State Univ.)
Deborah K. Fygenson (UCSB)
Ned Wingreen (NEC)
Ka Yee Lee (Univ. of Chicago)
Jose N Onuchic (UCSD)
David Kleinfeld (UCSD)
William Bialek (Princeton)

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National Institute of Health

**APS "OPPORTUNITIES IN BIOLOGY FOR PHYSICISTS"**
**CONFERENCE SURVEY**
***Final Results***

Responses: 115

Q1:[ ] Overall, did the conference provide you with a sense of the important science occurring at the interface between physics and biology?

| | |
|---|---|
| Yes | 112 |
| No | 3 |

Comments:
*(Available on request)*

Q2: [ ] Overall, do you think that the conference will help you in your career planning?

| | |
|---|---|
| Yes | 96 |
| No | 18 |

Comments:
*(Available on request)*

Q3: [ ] Did you find the topics chosen for the plenary talks to be interesting and presented in a way that you could understand them?

| | |
|---|---|
| Yes | 105 |
| No | 9 |

What changes would have helped?
*(Available on request)*

Q4: [ ] Did you find the panel on "How to survive the change" to be useful and interesting?

| | |
|---|---|
| Yes | 74 |
| No | 33 |

Comments
*(Available on request)*

Q5: [ ] If you attended the panel on "Funding", did you find it to be useful and interesting?

| | |
|---|---|
| Yes | 39 |
| No | 11 |

Comments:
*(Available on request)*

Q6: [ ] If you attended the panel on "Finding a Post Doc", did you find it to be useful and interesting?

| | |
|---|---|
| Yes | 51 |
| No | 18 |

Comments:

*(Available on request)*

Q7: Are you a:

| | |
|---|---|
| Student | 70 |
| Post doc | 22 |
| Faculty member | 18 |
| Other | 5 |

Q8: [ ] If you are a student and attended the "Lunch with the Experts" did you find this to be useful and interesting?

| | |
|---|---|
| Yes | 60 |
| No | 8 |

Comments

*(Available on request)*

Q9: [ ] What was the best thing about the conference from your point of view?

1. Overall, the conference was nicely planned. The best thing about the conference was the exposure to key people in the field and general idea about the bio-physics interface. The breadth of the topics was very good, the panels went pretty well, the reception was nice and UCSD campus visit was very well thought of. My only objection is the conference room. Diamond room was a poor choice due to the low ceiling and pillars. Having been unable to see the bottom third of slides (low ceiling) or the speaker (pillars) was very annoying.
2. 1. The visit to the UCSD labs. Inspired me to visit other labs on my own campus to broaden my knowledge and to learn something new. 2. The right people, the right amount of talks, and convenient location. I fully enjoyed it. This is the best conference I have ever been to! A+++++
3. The quality of the speakers, and the fact that it was a well-organized and smoothly run event.
4. The speakers who were excellent, in particular Ned Wingreen, Herb Levine, Peter Detwiler, and Bonnie Bassler.
5. To see what physicists can do in biology and to hear about encouraging comments and advices.
6. The fact that we were in a different environment with people who have different point of views than we are used to. It is a good idea to know and to try to communicate with people involved in other disciplines than our own. I think these kinds of conferences are very beneficial to researchers involved in both fields biology and physics. Once we

participate in this kind of gathering, our mind becomes more open and we become less arrogant about ourselves.

7. It covered a lot of topics, that are new (it avoided protein folding)
8. 1. I heard some stories from biology and realized what they do are not too mysterious. 2. I met some experts who transferred to biology and knew it's not too difficult to make the transition.
9. Networking
10. The very vide range of topics that were covered. Many of the invited speakers were outstanding.
11. Location.
12. The most important thing for me is getting exposure to the subjects of research and the people doing the research.
13. Lunch with experts
14. Meeting people who are working in biophysics area.
15. The best part to me was talking to a diverse group of physicists who had made progress in biology. Talking to people during the breaks and at the lunch were most helpful.
16. Talking with other participants and people who are interested in the same things, looking for the same opportunities and excited about making a contribution.
17. The best part of the conference was the small size, the selection of topics, easy access to the conference speakers and panel discussions to air our questions and concerns. And the weather was absolutely gorgeous!!
18. quality and breadth of the speakers
19. The chance to interact with both people already working in the field, and also with people like me that are just starting out.
20. The lunch with the experts and the opportunity to meet other physicists researching in biology. The UCSD poster session was also very good.
21. Trip to UCSD to visit the labs
22. atmosphere was great and refreshing. could mix freely with the experts.
23. It was in San Diego - nice place and close to home.
24. To see people involved in the field and hiring PostDocs. To find what areas of Biology accept physicists.
25. To be exposed to things happening in the field and to people who are making them
26. I enjoyed meeting many students struggling with the same issues as me. I learned some interesting science. It left me inspired to look for a position that is outside of my current field once I finish my Phd.
27. Lunch with the experts.
28. Meeting other graduate students!
29. I enjoyed all of the talks. I thought that they were more helpful than the panel. The reception/poster session was also very helpful.
30. Stimulation and up-to-date information on current research in selected areas of biological

physics. It would have been useful to distribute hard copies of the portions of the March APS Meeting epitome that dealt with biological physics to show the great extent of activity in this area.

31. The coverage of a large range of areas where physicists are contributing to biological problems was probably most impressive. So in that sense the diversity of talks, as opposed to a narrowly focused meeting, was what I found most appealing.
32. The excitement and thirst for knowledge was palpable among all participant. This was awesome. The choice of speakers was outstanding.
33. Get to know what was I thinking and what is the reality about it.
34. A purely educational conference with well-presented talks by experts! This was great!! I paid my own way out-of-pocket, and it was worth it.
35. The size.
36. It gave a very interesting overview of some of the current "hot" topics in biophysics -- very important to understand the why and how's.
37. The hybridization of the fields. Observing this process is quite an experience.
38. In my opinion, for a physicist considering transition to biology, it is important not only get the overview of the current biological topics, but to understand in what ways physics may be useful in biology, and how to start dialog with biologists. In this sense I found this conference of a great value, because the topics were presented not only by leading scientists in the field, but also by people who are themselves open to interdisciplinary approach, and to physics in particular. The worst thing that could happen is the speakers who would frighten everyone off biology in fear of future competition for funding. What I found on this conference was a series of great and very useful talks, that expanded my horizon, and gave a confidence that transition is real and possible. And the speakers were helpful, and welcomed my inquiries despite obvious differences in the way of thinking and problems of terminology. Great conference!
39. How much I learned about biophysics.
40. Meeting people who either already did the transition or are in process of doing that, good organization, excellent talks
41. I discovered how vast the whole bio-physics arena is. Also the huge scope for a statistical physics person to create an impact in genomics and proteomics. Overall it made me 10 times more open towards pursuing bio-physics problems in the future and seriously consider switching fields. It was three days worth spent! Overall a good conference.
42. Meeting people
43. organization was perfect.
44. Seeing the kind of people who are doing this work at the interface and how they got there. Getting a taste of what it might be like to work in interdisciplinary research. Opening my eyes to some of the opportunities available in the field and realizing the diversity and breadth of research areas.
45. The conference gave me a chance to get a glimpse of this vast, fast moving area. Also, it gave me a certain level of confidence that I can successfully change into the area.
46. The trip to UCSD was by far the high point. The informal poster session and the tour of the labs was very rewarding.
47. It was good to meet a lot of new people with similar research interests at all levels of

career development

48. Exposure to the field.
49. The conference itself. I am glad that APS provided students such valuable information for their possible future.
50. I am open to listening about 'Biology Stuff'. I never imagined that I may consider doing research in something that has to do with Biology, but I know find it extremely exciting may after all do it. Meeting fellow graduate students who were at the interface or were moving into it....was extremely important for me.
51. Nearly all the presentations were interesting, useful and exciting.
52. I really really enjoyed the talks. All of the talks were truly fascinating and after each one I wanted to work for that individual speaker. Of course, the conference location was ideal.
53. Talks & Interactions & appropriate breaks
54. Exposure to a broad range of interesting work and ideas, and the contacts and potential contacts I was exposed to.
55. Excellent choice of speakers. Thanks for keeping the number of talks during a session to just two. It gave us a chance to get refreshed before the next talks.
56. The talks. I found some of the topics rather more interesting than I had expected to, so it was good exposure.
57. The presentations were at the right level for people who were not in those fields. The duration of the presentations and the question-answer time was very adequate. Being in a small group (compared to the typical APS conferences) made it very easy to communicate with other participants. It was very well organized and the presentations were very interesting. Overall it was an excellent conference.
58. Wide range of high quality research presented, as well as the lab tour and discussion sessions which were open and engaging.
59. It provided interesting overview to Biophysics for physics student who do not have biology background.
60. I liked the broad overview over a range of topics. You also did a great job preparing the speakers for their audience - none of them used too much lingo, unexplained acronyms, etc. Overall, a very nice conference! Here's a big thank you to all organizers.
61. Every speaker tried to avoid too much jargon.
62. good overall scope, e.g. it included information about science but also about funding, general career advice, etc.
63. The best thing about the conference for me was changing my perspective of what can be done in physics. These opportunities, even short ones, are invaluable in that I can take of the academic blinders that grow on physicists and see new opportunities to attack exciting problems with physical methods.
64. Lunch with the Experts; Funding panel; Lab visiting.
65. The best thing for me is to see what is out there and who is out there looking for opportunities.
66. It exposed me to the issues of interest in biology, and helped me place such work in the context of the kind of science I do for a living. (I must make special mention of the optical tweezers set-up at UCSD that I found very exciting to watch in action).

67. It helped me to decide what I want to do. THANK YOU!
68. I don't think most talks are that interesting, but the best thing is I got chance to talk to other people who have similar board spectrum of interest.
69. learning what is done on the field
70. Panels and San Diego.
71. 1."Finding a post-Doc" section was organized better than I thought. And the panel selection was outstanding. 2.Most of the research topics were useful and the speakers gave really good presentations.
72. (1) The great speakers; (2) the "plenary" format of the talks--I could follow almost everything that was said; (3) the scope of the work that was discussed--gave me some sense of the possibilities in each of the fields that were discussed
73. Interaction with so many individuals and topics.
74. I have now an overview of the current relevant topics, and have a better view as to how to approach this new field. It has been very interesting to get the explanation from the experts for non-experts. Although some of the presentation really went into a bit much technicalities, the overall presentations were very good.
75. I wish I went to a similar conference when I was a grad student.
76. Getting to see so many different people who had made their way out by diversyfing into the biological world
77. it was set up in a way which promoted interaction between students and between students and faculty. the best part for me were the discussions i had with others.
78. Speakers were approachable, talks focused on overview of trends without expert vocabulary Web lectures were made quickly available with transparencies and videos Listing of websites Lab tour and poster session at CTBP
79. The format and motivation--we need more conferences like this one, but please use the Boston OIBFP meeting as a model. The San Diego format was obviously the same, but I think it's crucial to get the right speakers--people who want to see a successful interplay between physics and biology and don't have an unhealthy bias towards either field.
80. The best thing is APS financial support and excellent speaker.
81. The broad overview of the field of biophysics and meeting people involved in the field
82. I cannot choose between: 1. An overview of several important areas where physics and biology meet. 2. (This is a very personal reaction.) The Saturday morning talks on systems neuroscience.
83. not too big, well-chosen speakers (speakers had interesting work to discuss, but also were able to give good, clear talks)
84. The best thing is that we have an excellence chance to meet people from biology and see what can we do as physics students. I think the poster section is very good because we can really talk to the presenter.
85. Excellent talks on cutting edge questions in biology where physics might contribute
86. The panel discussions regarding 'how to find a post-doc' and 'how to survive at the interface'. I think students learn a lot by listening to other people's experiences as well as advice from experts.

87. The small size of the conference made it easy for students to speak with professors, which we normally do not have a chance to do at large conferences.
88. Learning what is out in the field of biophysics.
89. Its organization and the friendly APS staff members
90. The realization that biological physics is a very dynamic field with a lot of cutting-edge and exciting problems.
91. small and intimate. Can really talk to PIs and understand how they have moved from physics to biology
92. Meeting the other students and postdocs was great. The tour of CTBP was nice, especially the hard work that Kleinfeld's lab put into the tour (I didn't tour the other labs). Actually, I suggest a longer time slated for a UCSD visit, because the campus looks great.
93. I particularly enjoyed the talks by Seung, Bassler, and Bustamante plus the visit to UC San Diego, where we toured the lab of David Kleinfeld and discussed several posters with their presenters. I appreciated the opportunity to present a poster on Friday evening and to discuss the work with various attendees at that time.

Q10: [ ] Do you think that APS should plan other similar topical conferences on areas of science that interface with physics?

| | |
|---|---|
| Yes | 103 |
| No | 5 |

Suggestions:

*(Available on request)*

Q11: [ ] If you received a travel grant, how important was it for your attendance at the conference?

| | |
|---|---|
| Important | 51 |
| Not Important | 4 |

Comments:

*(Available on request)*

**The American Physical Society**
**Biology Conference Grant**
**As of May 17, 2004**

| | Private Contributions & Meeting Revenue | Government Grants | Total |
|---|---|---|---|
| **Contributions:** | | | |
| Government Grants (NSF, DOE, NIH, ONR) | | 49,500.00 | 49,500.00 |
| Alfred P. Sloan Foundation | 10,000.00 | | 10,000.00 |
| Burroughs Wellcome Fund | 10,000.00 | | 10,000.00 |
| Meeting Registration Fees | 14,470.00 | | 14,470.00 |
| Total Revenue | 34,470.00 | 49,500.00 | 83,970.00 |
| **Direct Expenses:** | | | |
| Facility Rental | 9,031.95 | | 9,031.95 |
| Audio Visual | 8,270.57 | | 8,270.57 |
| Poster Boards, etc. | 2,950.00 | | 2,950.00 |
| Reception | 8,611.76 | | 8,611.76 |
| Other Food | 8,608.93 | | 8,608.93 |
| Telephone | 81.45 | | 81.45 |
| Overnight Mail | 111.84 | | 111.84 |
| Meeting Travel Grants | 46,886.76 | | 46,886.76 |
| Staff Travel | 2,931.47 | | 2,931.47 |
| Miscellaneous | 531.60 | | 531.60 |
| Total Direct Expenses | 88,016.33 | 0.00 | 88,016.33 |
| Net Loss (direct expenses only) | | | -4,046.33 |