Round-table discussion minutes

Date: August 3rd, 2009

Time: 5:07 pm – 6:30 pm

Location: UFABC

Attended by: All 2009 Hands-on participants

Questions: Each question was submitted by a Hands-on School participant

Co-Chairs: Harry Swinney and Kenneth Showalter

Minutes: Dayle Jogie, Lucas Müssnich and Horacio Tapia-McClung

Question 1: Switching from Physics to Biology

The first question was read by co-chairman Dr. Harry Swinney. The question asked whether it was a wise decision for a Post-Graduate Physics student to switch to Biology. In addition, he prompted audience members to recommend steps necessary to make a smooth transition between fields. The question was initially directed to Dr. Erin Rericha, a former graduate student of Dr. Swinney.

Dr. Rericha suggested that present times are quite conducive for those who wish to move from Physics to Biology. She alluded that present day biology was much more quantitative in nature than previous times. Thus, there was much need for physicists, whose mathematical expertise was required for analysis of data sets. As opposed to previous generations, Dr. Rericha stated that Biologists now embrace Physicists in their laboratories. On another note, Dr. Rericha urged scientists to do research in areas that truly interested and excited them ("areas that make their heart race"). A PhD takes over four years to complete, and can be completed only if a preliminary enthusiasm level exists.

Dr. Woodrow Shew conveyed a more negative view than Dr. Rericha. He believed that it was very difficult to transition from one field to another. Thus, if any switch were to be made, he would recommend that it be done at the end of a PhD, perhaps at the post-doc level. His PhD was in Fluid Dynamics, and he later switched to Biophysics and Neuroscience. In his view, it takes five to seven years to become an expert in any given field, and only at that point is one given attention by the scientific community.

Dr. Shew replied that being published is a challenging task. He was initially trained as a physicist, and noted that writing in biology is different than in physics. There are cultural nuances that are reflected in the field of biology as opposed to those in physics. He feels as if he is in between both cultures.

Dr. Michelle Girvan indicated that she frequently works with biologists. In her view, some biologists embrace physicists and mathematicians while others do not. Physicists are seen by some biologists, primarily as their workers and statisticians. She advised that a physicist should not go to a biology advisor who simply uses him as a device for solving the biologists' problems.

Question 2: Scientific and academic abilities of Latin American students

The second question was then read by Kenneth Showalter. The question asked for general thoughts on the scientific and academic capabilities of Latin American students; specifically, what are their strengths and weaknesses.

Dr. Daniel Goldman started off the discussion. He was uniformly impressed with all students, and thought that his interactions within the Hands-On sessions were similar to those he has at Georgia Tech. He then proceeded to give views on the first question, which asked about transitioning from Physics to Biology. Dr. Goldman has a PhD. in Physics, and did a post-doc in Biology. In his opinion, it was important to first find a mentor to tutor him. You can then apply physics tools to biological problems. In addition, one must be quite enthusiastic when approaching any subject matter, for one must immerse himself in the subject to become successful.

Dr. Swinney and Dr. Showalter briefly interjected Dr. Goldman during his comment. They indicated that the students from the Hands-On Workshop were a very select group, and not absolutely comparable to those that he usually interacts with.

Subsequent to Dr. Goldman´s comments, Dr. Swinney attempted to answer the second question concerning Latin American students. In his view, students from Latin America were comparable in aptitude to those from the United States. In addition, he gave a view-point on Physics students, stating that they generally knew how to improvise. As an example, he listed Dr. Rericha and Dr. Goldman as his former graduate students, who would simply submit completed work to him for approval prior to publication. Thirdly, undergraduate Latin American students often have less hands-on laboratory experience than their American counterparts.

Question 3: Army funding for Hands-on School

The third question, announced by Professor Showalter, aimed to clarify why the United States Army had funded the Hands-On School.

Professor Swinney stated that Professor Roy had attained the funding from the US Army, and he (Swinney) had gotten funding from the US Office of Naval Research. He lamented that the United States military had the largest budget in the world, and only a small amount of it was spent on scientific research. Money for research was offered in the form of grants; once given, no questions on spending were asked by the defense department agencies. Professor Swinney indicated that a proposal was put forward by scientists (not by a defense department) for the school, and the grants were simply awarded to support the school. Grants from defense department (in contrast to "contracts") do not require that the awardees deliver a product; the funds are granted to support research.

Leandro Alonso claimed that Professor Swinney answered how, and not why the army had funded the school. Professor Swinney reasoned that the motivation was in creating an educated scientific community.

Bruce Rodenborn then commented that this was one of the good deeds that the army does.

Dr. Mark Shattuck suggested that the army provided funding with the hope that technology could ultimately be developed to create weapons.

Karl Schmitt indicated that people do collaborations and share ideas. The military aims to generate new ideas and we as physicists can contribute to this knowledge. He also suggested that someone may have convinced the military that we can percolate new ideas. This perhaps set the underpinning for creating technology for US warfare.

Professor Swinney briefly stated that if the army and navy fund conferences where people work together, then it is less likely that they will fight each other.

Professor Showalter stated that the US Army wanted to develop scientific intellectual infrastructure. For example, the BZ reaction would never be used in chemical warfare.

Dr. Shattuck interjected that this may be true. It may also be false in the sense that chemical warfare can be enhanced from the concepts of chemical diffusion.

Question 4: Good qualities for young scientists and researchers to have

The fourth question was read by Professor Showalter. It asked attendees what quality they found more important in young scientists or researchers: attaining good grades in classes or being innovative and coming up with new ideas?

Arjun Yodh was the first to answer this question and he said that, for him, it was more important to have innovative and creative students.

Professor Showalter added to Yodh's comment that in order to get there, a student also needs to have good grades. In other words, getting good grades is necessary but not sufficient in ensuring success.

David Boy wondered how students could let professors know that they are innovative and creative young researchers.

Alex Susemihl replied that participating in activities like the Hands-On Research School in Complex Systems was a great way to do it. These activities facilitated interactions with teachers.

Professor Showalter pointed out that students from developing countries should consider getting involved in one or several of the programs offered by the International Centre for Theoretical Physics (Trieste, Italy). This would facilitate interactions with professors and could serve as a tool for networking. The ICTP offers schools and other programs in many areas like biology, physics, mathematics; one of which is the Hands-On School. The Center usually covers traveling and local expenses and its resources are among the best opportunities in science for the developing world.

Karl Schmitt suggested that students should try to engage with professors who are doing subject matter interesting to them. By talking and expressing interest in what the professors are doing, students will be noticed by professors.

Oscar Enriquez asked for the criteria used by the organizers of the Hands-On School in selecting participants, as most of the participants were unknown to the organizers. Were the motivation or recommendation letters used?

Showalter answered that only the best and brightest participants are chosen to attend this school.

Swinney added that the directors chose participants based in part on ideas presented in motivation letters. Applicants who indicated that they would use ideas from the school to do new and innovative things were most likely to be chosen.

Mark Shattuck then returned to the question initially posed in Question 4. In his view, students who interested him most were those who had ready-made and enthusiastic answers of their past endeavours. He concluded by saying that as a student you have to be excited about the work you have done and be able to communicate that to others.

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Michelle Girvan commented that in addition to creativity and innovation, enthusiasm is necessary for students to be recognized by faculty. As well, students should take projects in their own directions, have their own ideas, and develop them to find their own niche in the research they are doing.

Question 5: Financial support and opportunities for Latin American students

The fifth question was directed by co-chairman Swinney. It asked about financial support and opportunities for doing science in Latin America.

As a member of the host country, Professor Calbas commented that in Brazil there is no general procedure for attaining financial support. Necessary conditions involve being engaged in a research group and having a supervisor.

Swinney then directed this question to Dr. Nicolas Mujica of Chile. Mujica claimed that students these days have more opportunities than ten years ago. This includes the possibility of travelling and buying books and equipment for their research. In his view, institutions presently have more resources than a decade ago and are using these resources to assist students.

Swinney concluded this discussion by encouraging the creation of links between those that have common interests; have someone visit your home institution and department or go and visit their institution. If a department does not have funds, it is sometimes possible to go to the administration and get invitation letters to send to colleagues, and most institutions respond positively to these invitations to their faculty or students. Additionally, most administrations try to provide monetary support for a visitor's local expenses, such as lodging and meals. The invited person can then take the invitation to their home institutions and get support for traveling. The important thing to keep in mind is to have some commitment of both sides to develop some interaction.

Question 6: Access to scientific articles for students in the developing world

To this question, Professor Showalter firstly stated that many researchers in fact put their manuscript pdf's available to the public via their webpages, and that Professor Swinney would address the legal side of the issue to the participants.

Professor Swinney stated that the American Physics Society (APS) can make their journals available at no cost to countries with low per capita income, but to do that someone has to ask for it. If one is in a country which is below some per capita income, one can ask for a free subscription. Other countries may pay modest amounts for national subscriptions. For example, China has paid for access to all APS journals (including back issues from the start of Physical Review in 1893) for all its citizens. He could not tell the precise values, but it was of the order of 10^6 US dollars. Being a country of 10^9 persons, this resulted in a cost of less than 10^{-3} dollars per person each year.

In addition, Professor Swinney stated that journals which are published by professional ("learned") societies tend be more accessible than those published by commercial publishers - in fact, professional societies exist to promote science while commercial publishers exist to make money – and that there is a clear trend in professional societies to facilitate more open access to their journals.

Faculty member Karl Schmitt added that students and researchers should try looking for abstracts of articles in an author´s homepage. In the worst case, one could ask for articles by sending the author an email, even though this practice may not be as quick as downloading it from a webpage. "Scientists want to share their work, not hide it", said Karl. Another option would be to search at www.arxiv.org, which provides open access to electronic preprints ("e-prints") in Physics, Mathematics, Computer Science, Quantitative Biology, Quantitative Finance and Statistics.

Professor Swinney highlighted this last point saying that many scientists and most physicists nowadays put their manuscrips on www.arxiv.org at the same time when the manuscript is submitted to a journal for review, and anyone is able to download them for free. "They are instantly available", said the professor. A good feature of arxiv.org is that any scientist who has put his pre-print on can later add the revised article after it has been published, as long as the article is formatted by the author (that is, not the copyrighted pdf directly from the journal). [Later note added by Swinney: policies regarding the arxiv.org vary with publisher; the publisher American Physical Society (APS) is less restrictive than some other journals.]

Professor Shattuck added that in the U.S., an author is permitted to put on his own webpage the published format of his article. In case of putting it on other webpages, the author then has to change its format "but you can just LaTex it, and it stays almost the same as the printed version."

On what relates to the APS, Professor Shattuck noted that the association is looking for new countries to which it can give access to journals. “There is someone [of the APS] just for that. But there has to be some income. People need to be paid”, even though the cost per paper for the APS is US $1,500 dollars, in contrast to US $10,000 per paper for commercial publishers. Another option would be to ask the ICTP. As commented by professor Sen, ICTP also has access to many scientific journals and magazines, and it will send a copy of any need article if asked.

Andre Chalom raised the question of data availability by commenting that when a paper is published, it contains only a small fraction of the obtained data, the part that was analyzed, while most of the raw data is kept unknown. He thinks that this raw data can also be interesting to many people and having access to it for others would also be very beneficial. To this, Showalter replied that nowadays most U.S. universities provide all of their Ph.D's theses electronically and they are available to anyone; these theses contain lots of data.

Bruce Rodenborn added that a collaborator in his research group is working to organize massive data sets. The project has the goal of finding any data set in the world, collecting that data and organizing it so that future researchers don't have to collect the data again. Then any researchers can have the data available for them to work on. Information can be found at http://infochimps.org/

Mark Shattuck commented that in most APS journals it is possible to submit extra material, which accompanies the published work and is available on-line together with the publications. [Later addition: the extra material is called *EPAPS*: Electronic Physics Auxiliary Publication Service.] As examples, he listed videos, raw data, computer codes and anything that may supplement the published document.

Participant Horacio Tapia McClung then asked how people in developed countries could help improve underdeveloped scientific communities.

Rodenborn commented that professional organizations such as the APS are set up to help promote science. [The official mission of the APS is "to advance and diffuse the knowledge of physics."]

Showalter commented that researchers generally aim to get published in recognized journals. For a developing researcher, it is more beneficial to seek major publications prior to local journals.

Karl Schmitt said that making a good list of references is crucial to making your name known in any community. Contacting the authors of articles is good practice; it enables one to talk about his own papers.

Professor Swinney concluded this discussion by making a last pitch to www.arxiv.org. He added that they put keywords in articles which relate to other similar articles.

Question 7: State funded education in developed and developing countries

"Why is tertiary education in developed countries not free?"

Professor Swinney commenced by answering that most U.S. universities are state funded institutions, although the most globally recognized institutions are private. [Later clarification by Swinney: in the U.S., "public" universities are operated by state or local governments while "private" universities are independent of government control, except that the research funds that they receive from governments must be spent following government rules. Both "public" and "private" universities are nonprofit, that is, unlike a business, they cannot make a profit and they do not pay taxes.] Swinney listed MIT, Harvard, Cornell, Stanford and Yale as examples of private institutions, which are quite expensive, costing up to US $40, 000 a year in tuition. While these private universities are better known than the public universities like the state universities such as the University of Maryland, University of West Virginia, University of Texas, Georgia Tech, the majority of the students in the U.S. attend public rather than private universities.

Professor Showalter then proceeded to answer, quoting UFABC's Vice-President's opening speech: the importance of state funded education in developing countries is clearly to raise the quality and standards of higher education.

Faculty member Syamal Dana then commented that India's universities are generally publicly funded. However, Indian students have the perception that private institutions are more prestigious.

Alex Susemihl commented that most of the Brazilian universities are publicly funded or free. Private institutions in Brazil generally don't do research. Professor Shattuck added that both state funded universities and private universities in the U.S. are supported in varying degrees by the tuition that students pay.

Professor Swinney then indicated that poorer US students can apply for, and usually get state funding to pay their tuition.

Participant Leonardo Alonso then intervened and clarified the content of the question. He wished to know why students in developed countries pay for university, while those from developing territories do not.

Erin Rericha indicated that it's misleading to think that all US students pay for their tertiary education. Graduate students [in science and engineering] usually get a stipend, which is sufficient to live on. Swinney added that most science and engineering graduate students in the U.S. also do not pay tuition.

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Karl Schmitt said that a large percentage of the U.S. schools, public and private, offer scholarships. As an undergraduate, he attended a private institution that was not well-funded, yet half of his tuition was still subsidized.

Dr. Dana then asked if private institutions in the U.S. generate profit. Swinney answered that universities are non-profit organizations. There are a few institutions that are “for profit” and they have to pay taxes; these schools are typically for training technicians (for example auto or air conditioning repair) and do not award either a Bachelors degree or more advanced degrees.

Bruce Rodenborn then stated that the basic difference between developed and developing countries has to do with the economical profile of students in each country. As an example, he mentioned that if universities in Brazil charged tuition to be paid by students, the socio-economical group targeted would not be reached. He also added that in the recent years, universities in the US increased their tuitions, so many students borrow money to pay tuition, which can make the students seriously indebted by the time they graduate with a Bachelors degree.

Participant Lucas Müssnich then added that one of the main differences among different countries relates to how different societies see science, to which Leandro Alonso answered that in Argentina people are mostly agrarian and therefore need less high technology.

Question 8: Applied science vs. basic science in developed countries

According to Professor Sen, right after independence India opted to do basic research, which laid the foundations for applied sciences in India.

Participant Alex Susehmil then added that although basic science is important, it requires long term investment, and perhaps it would be better for developing countries to do applied science instead. He also noted that in Brazil there is a lot of resistance against doing applied science.

To this, Professor Shattuck replied that, in a way, applied science may pay for itself because it produces technology, whereas basic science needs more funding. He also stated that the U.S. government should spend more on basic science.

Susehmil commented that Brazil's industry does promote basic science, thus generating little funding for this purpose.

Faculty member Karl Schmitt then asked if one felt it was easier for developing countries to concentrate efforts in applied or in basic science.

Syamal Dana then answered that basic science is less expensive and is easier to implement than applied science. One cannot predict the benefits of investing in technology.

To finish this discussion, Colombian Andrés Gonzalez made a statement about basic versus applied science in his country. In his opinion, Colombian agencies tend to look for “poor technology”. As an engineer with a taste for basic science, he thinks that agencies are funding questions which are not worth answering. They search to answer short-term problems, whereas they should be looking for long-term ones. “Many times I need to convince people that my basic science is worth funding, and it shouldn't be like this”, finished Andrés.

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Question 9: Time spent writing grants vs. doing research

Local organizer from USP's Physics Institute, Professor Iberê Caldas complained that Brazil's regulatory laws precluded ease of attaining funds. The intense bureaucacy creates long delays in receiving financial support. The control of funding in Brazil is getting worse every day – they deal with research as if they were investigating someone.

In another direction, Professor Shattuck said that writing proposals for grants is intensive. The shortage in the number of people getting funded in the U.S. in recent years has forced researches to submit twice as many funding proposals than before. He commented that one of his colleagues submits about 20 grant proposals annually. Professor Shattuck lamented that society has elevated experts to the extent that they cannot fully dedicate themselves to their practice. He, for instance, spends more time performing administrative duties than actually doing teaching and research.

Professor Daniel Goldman showed the other side to the coin. He writes between 4 to 6 grant proposals per year, each of which takes about a month to prepare. In his view, the time spent in methodically drafting proposals makes him plan his research more efficiently. It forces him to think about problems, giving him a framework to perform his job, and avoiding random walks. To Goldman, the 'self-funding' times of Galileo and Newton no longer exist. It is the state of our present day science, and one should accept this reality.

Susemihl claimed that the process of research is not always done in a systematic framework, but involves more random walks. Research cannot always be planned before-hand, and predicting the evolution of your work may actually be a drawback.

Goldman rebutted that much of scientists' proposals are actually for work already completed. This is the 'dirty secret' of applying for grants. Thus, although a researcher may claim that he needs funding for one topic, he may use the funds for a completely different one. The issue here is in simply attaining the funds, and making your draft as appealing as possible.

Professor Swinney then talked about funding during the post war period in the U.S. and Europe. In those times, the general paradigm in Europe was for funding laboratories; funds would be first allocated to a research centre, and then the monies were more or less equally distributed among researchers. This European model represented a more egalitarian approach than the American approach. In the U.S., researchers would submit proposals to get funded. He claimed that in asking for grants, one needs results to show that he knows what he is doing. Once a grant is provided, there is more freedom to do pursue one's own interests.

Goldman quickly stated that the hardest part of the job is getting funds.

Swinney finally stated that in the U.S. research has had good vitality, even though grant-writing was an integral part of it, indicating that there are values which come with this activity. He, being in the frontline of research, compared it with democracy: it is a 'messy' system, but nobody has come with one which is 'better'.

Professor Shattuck then commented that the grant system is effective in sifting out bad proposals. However, injustices are inevitable since the ratio of grants available to excellent projects is very low. He recently served on a grants committee which reviewed 40 proposals. Of those, half were good, and a quarter were excellent. Only three grants were distributed.

Professor Pöschel had an opposing viewpoint than his American counterparts. In his opinion, the time used to write grants is well spent.

At this juncture, the round-table discussion was concluded by Professor Showalter. Paraphrasing Dr. Rericha, he urged participants to follow their passions, and do things that truly enthuse them. Scientists are not rich in the monetary sense, but they are rich in other ways. He then asked participants to help place the chairs in their original positions.

Discussion adjourned at 6:31 pm.