

## NEWS AND VIEWS

# Bridging cross-cultural gaps in scientific exchange through innovative team challenge workshops

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Recently 46 undergraduate and graduate students, post-doctoral fellows, faculty and staff from Peking University (PKU) and University of California San Francisco (UCSF) gathered in Beijing for the inaugural PKU-UCSF Team Challenge Workshop in Quantitative Biology. The event was fast paced and highly intense, as teams worked on pre-selected scientific challenges in a four-day time frame, with daily presentations and critique. The workshop was intended to stimulate innovative thinking and scientific creativity via close team collaborative work. Attendees not only interacted with each other intellectually, but also had many opportunities to socialize, and the UCSF participants were treated to a good taste of Chinese culture. For the Chinese students, it

was the first time that most of them ever participated in this type of workshop, which aimed to help them discover their creative potential. Here, we describe how the workshop was organized, and highlight lessons we learned in the process so that hopefully more scientists can benefit from this type of dynamic team challenge and effective educational tool.

### BACKGROUND AND RATIONALE

Our team challenge workshop was organized via a unique collaboration between the UCSF Center for Systems and Synthetic Biology and its sister center at PKU, the Center for Quantitative Biology (CQB) with the goal of laying out a roadmap for new ideas in cutting-edge topics in quantitative biology. In addition, it was our hope that resulting project ideas from the brainstorming and the interaction amongst the participants would act as springboards for further collaborative projects and student exchange between the two universities.

China has been investing heavily in biomedical research, and has a large pool of talented young scientists who have excellent quantitative biology training. Many major advances in science — and especially in emerging fields — requires collaboration between scientists in countries where many of these investments are taking place, such as in the US and China. However, the cultural assumptions and attitudes toward the practice of science differ significantly between the two countries. Much of the collaborative, innovative and creative spirit infused into the US educational system still lags behind in China.

UCSF has experience in collaborative, team-based



Opening night of PKU-UCSF Team Challenge Workshop

approaches to science and many of the graduate school courses are now taught via team challenge mechanisms. This method is partly based on collaborations some scientists at UCSF have had with the Palo Alto-based design firm IDEO and utilizes many of their successful strategies for ‘design thinking’ [1,2]. Normally, teams go through successive rounds of brainstorming, research and discussion, and then present their ideas to other teams for further critique and redirection. We hoped that by implementing these team challenge approaches in joint PKU-UCSF workshops, it could break down some of the cultural and language barriers, leading to better communication between scientists at the two universities and to insights into how to best leverage the strengths of each country. For example, sharing UCSF’s experience with team challenges, combined with PKU participants’ strong quantitative backgrounds, would hopefully encourage innovation and creativity from all participants, leading to new ideas and solutions to complex problems in biology.

UCSF and PKU have had important scientific relationships through Professor Chao Tang, who has been a UCSF faculty member and Director of the PKU Center for Theoretical Biology. Over the past several years we initiated an exchange program for the International Genetically Engineered Machine (iGEM) team students, and have had a number of talented PKU students come to work at UCSF or enter UCSF graduate programs. Chao Tang recently left his formal appointment at UCSF to become director of the CQB and to co-direct the joint Peking-Tsinghua Center for Life Sciences. Thus, this departure incentivized the Center for Systems and Synthetic Biology at UCSF to think about ways to keep the PKU-UCSF relations strong, and to hopefully lead to expanded scientific exchange and collaboration between the two institutions.

## PRE-WORKSHOP PLANNING AND PARTICIPANT RECRUITMENT

A significant amount of preparation went into the organization of our workshop on both the UCSF and PKU sides. Similar to the highly successful UCSF & Chile ‘Science & Friendship’ Program, the intention was to keep the workshop intimate, to combine both scientific discovery and social activities, and to focus on young scientists from both countries in the hopes of building lasting relationships between the next generation of scientific leaders.

The organization of the workshop started about 10 months prior. The main stages of planning were:

- **Structuring the workshop**
- **Advertising, recruitment of participants**
- **Selecting topics**
- **Forming the teams, assigning homework**

### • Planning social activities

Since recommendations that ideal group sizes for brainstorming are between 6–12 people, it was decided to keep the workshop to about 40 participants, divided into 4 teams of approximately 10 participants each. The workshop was supported through funding from PKU’s CQB and the UCSF Center for Systems and Synthetic Biology, with additional travel funds from the California Institutes for Quantitative Biosciences at UCSF.

The process of selecting participants and choosing the scientific topics for the brainstorming sessions first started at UCSF. Ideas from Center members were solicited, and 4 senior graduate students and 7 postdoctoral fellows were selected based on their interests and the team challenge ideas they submitted. The team challenge format and topic ideas that might work best for a 4-day team challenge workshop was discussed during several pre-workshop meetings. It was quickly realized that the topics needed to be framed within the context of a concise ‘challenge question’ and be a question that could unify the group around a concrete goal. In addition, the topic needed to be framed in such a way that after 4 days of brainstorming, a tangible outcome or set of deliverables could be envisioned. During the meetings, participants were encouraged to pair with another participant and write up the following for each topic idea: 1) the challenge question, 2) a paragraph providing background and context, 3) anticipated outcomes, 4) a vision of how the 4 days might be spent, and 5) ideas for homework that could be distributed to team members one month before the workshop start. These topic ideas and outlines were placed on a Wiki page for further discussion amongst UCSF participants and to share with PKU.

Meanwhile, on the PKU side, the tasks were not only to advertise the workshop and attract participants, but to also familiarize potential participants with the team challenge format ahead of time. For these action items, it turned out to be critical to have a UCSF graduate student, Zhiyuan Li, go to PKU to advertise the workshop and coordinate the participant recruitment. Zhiyuan was familiar with the team challenge concepts from her graduate work at UCSF, but had also attended PKU as an undergraduate. Together with Chao Tang, Zhiyuan made announcements for the workshop and created an online discussion forum (<http://bbs.ctb.pku.edu.cn/putc/index.php>) linked to the UCSF Wiki page. Zhiyuan also led several pre-workshop discussion groups where she talked about the brainstorming and team challenge concepts. Interested participants were encouraged to participate in the online discussion forum, either commenting on the ideas already posted by UCSF participants or to suggest new topic ideas themselves. Applicants were selected based on both their participation in the online forum and pre-workshop meetings, as well as on the ideas they submitted. The

selected participants were from different backgrounds (both computational and experimental) and from a range of career levels (undergraduate to postdoctoral), with the majority of Chinese participants being at the graduate level. In addition to selecting participants for the 4-day workshop, a call for poster presentations was announced to undergraduates of PKU, Tsinghua University, Chinese Academy of Sciences, and National Institute of Biological Sciences, as part of the opening night reception.

The final team challenge topic ideas were selected one to two months before the workshop. Each team had two or three team leaders or facilitators (usually the participants who had originally proposed the topic idea). The rest of the participants were organized into one of 4 teams (receiving their 1st or 2nd topic choice), with an eye toward equal distribution of UCSF vs PKU participants, computational vs experimental backgrounds, and a diverse range of career levels from undergraduate to postdoctoral. Each team averaged roughly 2 undergraduate students, 6 graduate students and 3 postdoctoral fellows. After the 4 teams were announced and names/email addresses were exchanged, the teams worked to further discuss and frame the team challenge questions with the team leaders through online discussion forums. Team leaders assigned pre-workshop homework and participants also communicated ahead of the workshop through Skype journal clubs and email exchange. 'Face sheets' were constructed for each of the participants, containing photos and a short description of their background and interests. The facesheets were distributed in a handout on the first day of the workshop.

We organized several team-based lunches and dinners such that the individual team members could get to know each other well during the course of the workshop. Other meals and social activities were interspersed to promote cross-team interactions, and on three evenings, all participants were together as one large group. In addition, all participants could participate in sight-seeing tours arranged in and around Beijing for two days following the workshop itself.



Workshop participants visit the Forbidden City in Beijing

## TOPICS AND FLEXIBLE STRUCTURE OF THE WORKSHOP

The four cutting edge topics (out of at least 10 original proposals) that were selected for the workshop were the following:

- **What is the future of optogenetics?**
- **How to manage cell stress in engineered metabolic pathways?**
- **How can microfluidics be used as cheap diagnostics?**
- **What controls cell size?**

These topics were reflective of some of the personal interests of participants, as well as the fact that there are scientists both at UCSF and PKU with experience in these areas. The first three topics were more applications-based, while the 4th topic on mechanisms of cell size was more of a basic scientific question, and thus could perhaps be more challenging for a team challenge format.

Although team leaders were asked to have ideas as to how the 4 days of the workshop might be structured, the first day of brainstorming within the teams was also designed to give all participants a chance to discuss the topics and challenge questions in more detail, and would allow teams to decide as a group as to how their next 3 days would be spent. In this way, all participants could have more of a voice in the structure of the workshop, which would be quite unique compared to most conferences and workshops that scientists normally attend.

The format we used for the team challenge consisted of daily cycles of brainstorming, voting, research, presentations and critique, and project redirection. The brainstorming and following synthesis was divided into two phases: one open-minded and one critical (Figure 1).

In phase one, participants used post-it notes and large foam core boards to write down as many ideas as they could within a limited time (i.e., go for quantity, not quality). Ideas were then clustered and arranged into conceptual groups. In phase two, participants were encouraged to be more critical and voted on ideas which they felt were of most interest and/or were most feasible. The teams would then consider the votes, and through extensive research and discussion, worked on converting their abstract ideas into something more tangible and concrete. At the end of each day, the teams would give 10-minute presentations on their project ideas to all the participants, and receive feedback and critique from the other participants and from a panel of faculty from UCSF and PKU.

A similar format was followed for the next three days as the teams went through rounds of expansion and contraction in reaching their final project ideas (Table 1). A two-page proposal was collected from each team on Day 4 where they detailed their final project idea,





Figure 1. Brainstorming and following synthesis.

Table 1. Overview of the structure and agenda for the 4.5 day inaugural PKU-UCSF Team Challenge Workshop in Quantitative Biology.

Day	Arrangement
Day 0	Opening reception and poster session. Teams met in person for the first time and did a short brainstorming exercise on the topic “How to improve collaborations between UCSF and PKU”.
Day 1	Initial brainstorming by each team on their challenge topic/question. Clustering of ideas. Presentations from each of the 4 teams to all participants; voting from all participants on each team’s ideas; teams develop roadmap and outline their schedules for the next 3 days.
Day 2–3	Team breakout sessions; cycles of brainstorming, synthesis and clustering, voting, and project development; team presentations at the end of each day, followed by critique by all participants and project redirection.
Day 4	Final group discussions and presentations outlining future roadmap for each topic. Teams submit final 2-page proposal outlining overall vision, providing 2–3 feasible next experimental steps.

including two to three relatively simple, next experimental steps that could be performed as part of follow-up PKU-UCSF student exchange projects.

## POST-WORKSHOP OUTCOMES, FEEDBACK, AND FOLLOW-UPS

It is often difficult to obtain measurable outcomes from organizing such a workshop. For instance, many of the effects this particular experience had on the students and postdocs who participated might only become evident down the road and at different stages of their careers. Comments from our anonymous post-workshop survey were overwhelming favorable (Table 2), although the participants also provided valuable suggestions on how to improve future workshops. These include making sure the English proficiency of the participants is sufficient and that shy students should be encouraged to give more of the presentations (team members took turns presenting, and every team member did present at least once). In addition, there was a recommendation that we give an overview of how to give presentations (i.e., the art of the ‘two-minute pitch’) at the beginning of the workshop, as some of the participants were not used to giving clear short talks. Lastly, many participants felt the time for the final presentations should have been longer (daily presentations were limited to 10 minutes) and that more stakeholders or possible funding bodies could have been present at the final presentations. Some participants suggested we encourage each team to turn their two-page proposal into a grant proposal, such as a Grand Challenge proposal for the Gates Foundation.

A few specific workshop outcomes are, however, evident on both the UCSF and PKU sides. The PKU Executive Vice President and Provost Wang Enge attended the workshop and presentations on the afternoon of Day 2, and he expressed interest in supporting future



Prof. Enge Wang surveys ideas from the team challenge brainstorming sessions

PKU-UCSF team challenges. Given, in our view, the success of the inaugural workshop, both sides would like to continue the workshop on a yearly or biyearly basis, with the location possibly alternating between PKU and UCSF. PKU is also providing stipends for short-term (ca 3 months) exchanges for students to work on collaborative project ideas that originated in the workshop. Currently, we have arranged for a PKU undergraduate student from the optogenetics team to visit UCSF from January to April, 2013, to carry out pilot experiments based on the team’s proposal. Since the UCSF leadership has interest in promoting and fostering international scientific exchange between UCSF and China, this program is a pioneer for how an exchange program might be structured, but obviously many details need to be worked out for it to be successful and sustainable in the long term (i.e., visa requirements, short-term housing, student stipends, etc.). Lastly, the workshop has also provided an excellent opportunity to screen and recruit talented PKU undergraduate students interested in graduate programs in the US. Given the intense interactions with the participating students over the course of the workshop, we have been able to provide letters of recommendation for several undergraduates applying to graduate programs at UCSF and elsewhere.

**Table 2.** A sample of participant comments from an online anonymous survey conducted at the end of the workshop. 83% of the participants responded, providing valuable feedback for future workshops.

“The workshop was absolutely amazing. I think it worked way better than expected...the thing that was most helpful for the Chinese students was to see a research project develop from some vague ideas into a full proposal.”
“More deadlines! ...The deadlines forced us to crystallize our ideas into something tangible.”
“I liked the open ended structure and the fact that the participants had a lot of say in the direction of the workshop...”
“As to my favorite part, I think I like all parts of the workshop, the reception, the crazy ideas born in brainstorming, the talk to decide our final topic, and the exciting process to realize it in details...”
“My favorite part is the group searching for papers and group discussions...I think its much more effective than one working alone.”
“I think the topic for each group is very promising and the final presentations were so exciting. The discussions during workshop days were less active than I expected...maybe it’s because some people are too shy to express themselves in a foreign language :). We should encourage them.”
“Some of the students were very active while some of them were very shy. The team leaders should pay attention to balance and give a chance to all of them.”
“Dedicate some time to teach students to do presentations. Try teaching the concept of the elevator pitch. Accept only students with moderate or high English skills (students with only very poor English skills do not benefit from the type of workshop).”

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