
Original Article

Creating alternatives in science

Received (in revised form): 14th October 2008

Nicole G. Gravagna

is a Neuroscience PhD candidate at the University of Colorado Denver. She founded the Alternatives in Science Club and acted as President for the first 18 months. She is currently working to develop a biotechnology doctoral degree program at the University of Colorado Denver.

ABSTRACT Traditional scientist training at the PhD level does not prepare students to be competitive in biotechnology or other non-academic science careers. Some universities have developed biotechnology-relevant doctoral programmes, but most have not. Forming a life science career club makes a statement to university administrators that it is time to rework the curriculum to include biotechnology-relevant training. A career club can supplement traditional PhD training by introducing students to available career choices, help them develop a personal network and teach the business skills that they will need to be competitive in science outside of academia. This paper is an instructional guide designed to help students create a science career club at their own university. These suggestions are based on the experience gained in establishing such a club for the Graduate School at the University of Colorado Denver. We describe the activities that can be offered, the job descriptions for the offices required and potential challenges. With determination, a creative spirit, and the guidance of this paper, students should be able to greatly increase awareness of science career options, and begin building the skills necessary to become competitive in non-academic science.

Journal of Commercial Biotechnology (2009) **15**, 161–170. doi:10.1057/jcb.2008.51;
published online 18 November 2008

Keywords: career development; education; PhD; non-academic; biotechnology; biomedical

INTRODUCTION

For life scientists, training at the PhD level is an apprenticeship. Students are expected to learn the skills they need by taking a few classes and completing an extensive research project in an academic laboratory. Through observation and participation, students learn about experimentation, communicating research findings, funding future work and the general management hierarchy of the

academic laboratory. The PhD is considered a terminal degree, which would suggest that a person possessing a PhD is fully prepared to begin a career. Unfortunately, the truth is that the PhD degree alone is not complete training for any career. The curriculum traditionally does not include the basic management and business skills that both academic and non-academic-minded students need.

A few responsive universities have developed PhD programmes designed specifically to train scientists for careers in biotechnology. In particular, the University of California (UC) Davis offers the Designated Emphasis in Biotechnology (DEB) interdepartmental programme, which joins a

Correspondence: Nicole G. Gravagna
Department of Physiology and Biophysics,
University of Colorado Denver, AMC, 12800 19th Ave,
Mailstop 8307, Aurora, CO 80045, USA.
E-mails: Nicole.gravagna@ucdenver.edu

biotechnology-focused curriculum to a traditional PhD education in 27 different fields from entomology to civil engineering. Students graduating from the DEB programme are well trained in interdisciplinary problem solving, teamwork and social skills, as well as academics, says Dr Judith Kjelstrom, the DEB programme director since 1999. DEB students are rewarded with desirable jobs in both academia and biotechnology industry when they complete their studies.¹ The Biotechnology Programme at UC Davis incorporates a curriculum of coursework, an annual networking retreat, industry seminars and a 3 to 6-month internship at a biotechnology company.² The tight-knit programme produces well-rounded PhD scientists who have an enlightened understanding about research as seen from several perspectives.¹

Biotechnology is a strong economic force in the United States and the World. Although the majority of universities do not offer a biotechnology-focused doctoral degree, many are beginning to recognise the importance of including biotechnology in scientist training curricula. I propose that a student-run life science career club can act as an agent for change at a university, motivating administrators to recognise that biotechnology-relevant opportunities are needed for PhD students.

Career development through participation in a career club benefits not only graduate students earning master's and doctoral degrees but post-doctoral fellows as well. For the

purpose of this paper, 'student' will be used to denote any of these individuals.

Employers are looking for more than outstanding technical research abilities when hiring a science PhD. Skills generally associated with business are now considered a requirement. At a New York Academy of Sciences and *Naturejobs* symposium, scientists representing academia, biotechnology and drug discovery overwhelmingly agreed that successful scientists practise excellent science and also have strong soft skills.³ The soft skills that scientists notoriously lack are negotiation, budgeting, time management organisation and communication skills.⁴

To be competitive in biotechnology job hunts, scientists must show evidence of experience with leadership, teamwork, interpersonal skills, public communication and an understanding of the product development process.⁵ Above all, students need to learn the career options that are available to them.^{3,6} A career club can serve students by teaching soft skills and providing a venue to develop them. Also, a career club gives students a chance to explore possible career directions and facilitates opportunities to create a personal network in the non-academic community.

Many outstanding universities have cultivated biological science career development clubs (Table 1). These organisations often exist as volunteer-run operations within their host university, although some have become separate, not-for-profit organisations over time.

Table 1: Internet addresses for life sciences career clubs

<i>University</i>	<i>Organization name</i>	<i>Website</i>
University of Colorado Denver	Alternatives in Science Club	www.uchsc.edu/ais
Rutgers University	Designer Genes Club	http://aesop.rutgers.edu/~dgenes/
Harvard University	The Biotech Club ⁶	www.thebiotechclub.org
University of Pennsylvania	Penn Biotech Group ⁶	www.pennbiotechgroup.com
California Institute of Technology	Biotechnology Club ⁶	http://biotech.caltech.edu
Massachusetts Institute of Technology	BioMedical Business Club	http://web.mit.edu/bbc
Columbia University	The Biotechnology Club	www.columbia.edu/cu/biology/biotech/home.html
Johns Hopkins University	Hopkins Biotech Network ⁶	www.hopkinsbiotechnetwork.org/
Yale University	Yale Biotechnology & Pharmaceutical Society	www.yale.edu/ybps

CAREER CLUB TRAINING OPPORTUNITIES

A career club can provide valuable services to advance student career development. Depending on the needs and goals of the members, a career club aims to expose students to career options, introduce students to the scientific community, and teach soft skills. Through leadership and participation in seminars, workshops and conferences, students will develop the skills necessary to be competitive after graduation and attractive to future employers.

The training opportunities suggested here are very similar to those employed by the career clubs listed in Table 1 and the UC Davis Biotechnology Program as well as other university programmes not described. These opportunities are not costly or difficult, but they do require developing a relationship with local biotechnology companies. Although everything described here can be handled entirely by the students themselves, no student-run organisation can compare to a programme with a dedicated administrator to organise opportunities for students. It is important for universities to address student needs and respond with financial commitments.

Career development seminars and workshops

A monthly seminar is a fundamental service that a career club can provide for the university. Students can learn about non-academic science through lectures featuring scientists who have applied their PhD training and scientific knowledge to non-academic endeavours. Additionally, the club can invite experts to give workshops teaching basic business skills,⁴ *curriculum vitae* or resume building,⁷ interview preparation,⁸ office attire and etiquette outside the lab⁹ or technology transfer issues.

Club member interests will dictate the subject matter of seminars and workshops. Topics might include industry research,

government (research, policy or regulation), science writing, scientific law, translational research, entrepreneurship, biotechnology marketing and sales, commercial laboratory management, scientific entertainment, environmental conservation and forensic science. To find good speakers, it will be important for club members to begin meeting people in the scientific community outside the university. Optimal resources are scientific societies, biotechnology networking groups, Cafe Scientifique (an international science forum) and the local chamber of commerce. Of course, the availability of resources will vary by location, but most regions will have some type of organised scientific community. All regions have local groups such as the Rotary Club and Kiwanis Club, which might be two good resources to find local scientists. Additional contacts can be found through professors who know scientists outside academia and can provide an introduction. Also, some professors have been involved with non-academic science and may be willing to give enlightening lectures on their experiences.

As the club's network contact list increases, it will become obvious that there is no shortage of people who would love to have the attention of a room full of PhD students. Seminar quality reflects on the club, so it is best to be selective with speaking invitations (Box 1). Enjoyable and informative talks are concise, well prepared and relevant. However, even a great orator needs input from his hosts to give an enjoyable lecture. The speaker must know who is in the audience and have clear instructions about the lecture topic and depth.

A career club can produce a regular seminar series to educate students about career possibilities. Students will find plenty of guest speakers when they become active in the local scientific community. The club can ensure that seminars are high quality by choosing speakers carefully and helping them prepare a relevant lecture.

Box 1: Tips for great seminars

Planning seminars

- Choose seminar speakers carefully. An informative and enjoyable talk reflects well on the club.
- Prepare guest speakers in advance. Discuss the topic outline for the talk, the makeup of the audience and the desired length of the lecture.
- Thirty-minute talks are ideal. Use the rest of the hour for questions and discussion.
- Know whether your guest will need audiovisual equipment or a computer.
- Ask if your guest has time constraints. Do not exceed them.

Hosting guest speakers

- Pair each guest speaker with a student host.
- Through snail mail, send the guest a map of the campus. Highlight the route to the parking lot and the path to the seminar location. Include a parking pass if needed.
- Meet guests at the door and escort them to the seminar room. Point out the location of the restrooms. Provide water.

Box 2: Connecting with alumni

- Alumni are a great resource. Turn to them to find guest speakers, mentors and general network contacts.
- Ask professors whether they keep in touch with past students who have gone on to non-academic careers.
- Send a letter through the alumni association inviting alumni to participate in club events. Include a recent newsletter and a calendar of upcoming events.

Box 3: Non-academic mentorship

- Encourage students to choose a mentor who understands their career goals.
- Mentors can help students: decide which elective courses to take, choose conferences to attend, decide if an internship is necessary and find a job when you graduate.
- If the club maintains a digital list of potential mentors, be sure to keep sensitive information password protected.

Alumni as mentors

Most universities keep in touch with alumni for fund-raising purposes. A bioscience career club can tap into the alumni association or create its own alumni network for general career information, business ties and mentoring (Box 2). In my experience, university alumni working outside academia have been among the most enthusiastic in teaching students about alternative career possibilities.

Contacting university alumni will yield a pool of scientists who are willing to mentor students interested in their field of expertise (Box 3). The student-mentor relationship can range from email-only to a more extensive connection that includes regular face-to-face meetings. Mentors can answer general career development questions and suggest activities or classes that might aid in building a resume for a specific career. Ultimately, a mentor can be a student's best resource for finding a job after graduation.

Although choosing a suitable mentor is personal and should be a search that the student does individually, the club can help by building a list of willing mentors. Creating a list of mentors will help students overcome the difficult barrier of finding someone in their desired field that they can be confident is committed to helping them. Also, students who are currently mentored can discuss their relationship and experience so that others might get an idea of what to expect.

Alumni make good mentors because of the ties they have with students currently enrolled at their alma mater. The career club can foster mentorship by soliciting alumni and matching them with students. The resulting relationship is extremely beneficial to the student's career development and job search after graduation.

Meeting with biotechnology companies

Biotechnology companies scout highly ranked schools for new talent so that they have access to students immediately after graduation. Smaller schools may not get this attention automatically. To get noticed, students can invite local companies to visit with the career club. The meeting can include an overview of the company's goals and employment culture. If the company is hiring, they may want to set up interviews with students while they are visiting. Because companies are eager to meet talented potential employees, they are often willing to supply refreshments for the meeting or even give a donation to help support the club.

Getting noticed by biotechnology companies may require students to make the first contact. Meetings with companies can educate students about the potential employer, raise money for the club, and can lead to job placement for students ready to enter the workforce.

Attending or hosting a conference

Attending a conference is a great way to meet a large number of contacts in a short period of time. Often there are useful workshops

Table 2: International biotechnology conferences

<i>Biotechnology conferences</i>	<i>Web link</i>
BIO International Convention	http://bio.org/
Center for Biotechnology Life Sciences Summit	www.biotech.sunysb.edu
Student Biotechnology Network Biotech Expo & Conference	www.thesbn.ca/eventinfo.html
Biotechnology Institute Education Conference	www.biotechinstitute.org/events/event_list.php
Center for Entrepreneurial Development Annual Biotech Conference	www.cednc.org/conferences/biotech

along with the educational lectures at these meetings. A career club can organise a field trip for members to attend a large conference or can host its own. Table 2 is a short list of biotechnology conferences held in the United States each year (Table 2).

Some universities hold biotechnology conferences or symposia. Hosting a conference is a large undertaking that requires a great deal of organisation, time and commitment. Ideally, a university administrator can help with the details of planning the conference, but it is possible for students to do the work alone. In March of 2008, the Alternatives in Science Club at the University of Colorado held a successful conference in collaboration with the National Collegiate Inventors and Innovators Alliance (NCIIA). The NCIIA is a non-profit organisation, which helps universities create workshops in technology entrepreneurship through their Invention to Venture project. The NCIIA provides a very detailed guide to help students choose topics and speakers. They also assist with initial funding and encourage students to find ways to raise money through vendors and sponsors.

The benefits achieved through attending a conference and hosting a conference are very different. It is worth thinking about club goals before choosing to attend or to host. When attending a conference, club members will meet a lot of people and will learn about the topics discussed at the conference. By hosting a conference, students will build a business

relationship with the invited speakers, but likely will not have time during the event to meet the many visitors who attend. The main benefit of hosting a conference is that students will learn and practise business skills. During planning, students will learn to manage a project, communicate with the public, negotiate financial support and provide customers with a product.

Biotechnology conferences can be another great way for students to learn about science outside the university. Attending conferences allows students to meet a lot of relevant people and make network contacts. Alternatively, a career club can host a biotechnology conference and in doing so, the students will learn valuable business skills.

Workplace visits

An opportunity for students to spend time at a science workplace is an invaluable experience for students to better comprehend the non-academic work environment. Biotechnology companies enjoy hosting a small group of students so that they can show off their company culture and meet potential employees (Box 4).

Workplace visits can be a first step towards internships and job interviews. Students can observe an alternative career setting and determine if they could be happy in that type of work environment. Additionally, successful visits can cement a budding relationship between the club and the company. After the visit, the company may stay closely in touch with the club and advertise open employment positions as they arise.

In summary, a career club can provide students with services such as seminars,

workshops, meetings with companies, workplace visits, a mentorship programme and conferences. Each of these products furthers career development in different ways and satisfies different goals. The club should assess the needs of its members and the resources required when deciding which of these services to provide.

BUILDING THE TEAM

A career club requires only a small group of students to execute the programmes described above. An executive board can be assembled to oversee the administrative core details of running the club. A larger board of directors can disseminate news and information from the club to each department of the graduate school. Advisors are an important and necessary element. Club leaders will make better decisions after consulting the opinion of experienced people.

The Executive Board

The Executive Board consists of the President, Vice President, a Communications Director, a Financial Director and a Newsletter Editor in Chief (Box 5). Keeping the Executive Board a small, odd number allows for easier decision-making and efficient voting if disagreements arise.

President and Vice President

The President and Vice President are the prime motivators for the club. They are responsible for overall project management but not for directly leading the projects. The President and Vice President are responsible for guiding the goals and activities of the club. The regular workload for these two

Box 4: Preparing for workplace visits

- Ask club members to submit the names of companies that they would like to visit. Chose a few of the most popular and feasible suggestions.
- Determine the goals of the visit. Share them with the company liaison.
- Communicate with the company the number of students visiting, the arrival location, parking issues, length of stay and lunch arrangements.

Box 5: Executive positions and associated skills

- President/Vice President – Leadership, Networking, Product Development, Project Management
- Communications Director – Marketing, Web Design, Public Communication
- Financial Director – Finance, Risk Management
- Newsletter – Leadership, Journalism

officers consists primarily of amassing resources and empowering members to lead projects.

Communications Director

The Communications Director is responsible for advertising all club events. This person should join the mailing lists for local networking or science career organisations and communicate the relevant off-campus events through a central calendar. Knowledge of HTML or the ability to update a webpage is a major asset for this position. The Communications Director must thoroughly advertise club events to ensure that members attend. As PhD students are notoriously difficult to organise, it is recommended to use all university-sanctioned forms of advertisement (website, email, fliers and bulletin boards) to remind students of planned activities.

Financial Director

This person is the liaison between the club and the university financial offices. The Financial Director will keep track of income and expenditures and will devise budgets with event planners. The Financial Director may also lead fund-raisers if no regular source of funding has been procured. The Financial Director should also be responsible for making sure that all volunteers/donors are sent thank you notes.

Newsletter Editor in Chief

The Editor in Chief is responsible for writing and distributing the newsletter. The Editor in Chief should decide which club events get the most coverage, design the newsletter

layout and organise writers for small repeating columns if desired. The Editor in Chief should not write all of the articles alone, but should delegate the journalism to other members of the club who would like to gain more writing experience.

The newsletter is the archival record of the activities in which the club participated during the month or quarter. Having a record of club news is useful to anyone who missed an event. Furthermore, the newsletter can be sent with a letter describing the purpose of the club when requesting funding, access to facilities for a workplace visit or inviting a speaker. The newsletter shows the club is active and the format portrays the club purpose, history and ambition in a few pages.

The Executive Board should meet regularly during semesters. Recurrent topics will likely include the state of the budget and fund-raising, communications, specific issues about upcoming events and potential new projects. Final decisions that stem from these meetings should be communicated in summary to the members of the larger Board of Directors. Additionally, leaders of active projects may find it useful to attend the monthly Executive Board meetings.

The Board of Directors

The Board of Directors consists of the Executive Board members and a representative student from each department or programme of study. This distribution facilitates the dissemination of club information to each branch of the graduate school without a large time commitment on any one member. The needs of students in each department may be slightly different and

having a representative from each group ensures that those needs are heard. Members of the Board are responsible for meeting with club members and administrators in their programme or department. They should stay abreast of student needs and desires and should communicate them to the Executive Board.

The Board of Directors should meet quarterly. These meetings are primarily a venue to discuss the state of ongoing projects, and for members to take on leadership of new projects. Board meetings should be open to all club members.

Advisors

Membership and leadership in a career club is a learning experience for all participating students including Executive Board members. There is no experience required to lead this type of organisation; therefore, the Executive Board relies heavily on advice from experienced people. The club should seek input from as many knowledgeable experts as possible.

CHALLENGES

There are some potential challenges to starting a biological sciences career club. In our experience, student passivity tops the list; however, poor funding, unsupportive faculty and a lack of formal administration also stand in the way of club ventures. The good news is that these challenges are easily overcome through motivation and education.

Student passivity

Often students are not proactive in their own career development growth. This is primarily due to a busy schedule during graduate school but may also be due to a lack of urgency. Unfortunately, impending graduation is the only motivator for some students, but very little career growth can occur in the last few months while a student is busy preparing a thesis.

A positive strategy to career development starts in the first year of graduate school. Although many students will encounter periods of time when they cannot devote extra energy to career development, starting early ensures that growth can occur gradually. Also, career choices are ideally explored early, in case additional courses or training are required to achieve goals. The PhD training years can be used to establish lasting relationships with mentors and other scientists in the field.

Regular advertisement of career club events is extremely important to inform students of development opportunities. Even if only a handful of club members actively attend events, the activities described above can still go on. Small seminars can be more informal and allow students to interact directly with guests. Fortunately, a career club can be very small in membership, but still extremely beneficial to the students involved.

Funding

Many career club activities do not require much money, but a well-funded club will attract and educate more students. Students can pay for lunches, travel and other small fees out of pocket. However, providing food increases attendance to seminars, workshops and meetings. More students will travel if the club can cover the gas money required for workplace visits and attending conferences. Some activities like hosting a conference require significant sums of money upfront for catering, advertising and security.

Funding may come from a number of sources, the graduate school, individual departments, government grants (federal, state or local), private donations or fund-raisers. Additionally, you can approach local companies with advertising proposals (Box 6).

Unsupportive professors

Occasionally students will encounter professors who do not support the pursuit of a non-academic career. Science at the PhD level has changed greatly in the past 30 years, which

Box 6: Asking for sponsorship*Choosing the company to approach.*

- Contact companies that provide services that club members will use after graduation such as legal firms, finance companies, laboratory services and employment placement companies.

How to execute the deal

- Contact the Marketing Director.
- Be specific. Ask them to sponsor *X* number of seminars with *Y* number of attendees for *Z* number of dollars.
- Do not be shy. Companies are happy to pay for advertising to a target audience.

Box 7: Getting started

- Generate interest in a new career club by posting fliers.
- Create a handout packet that includes information about alternative careers.
- Hold a meeting to form the executive board and brainstorm to determine the interests of the club members.
- Seek out networking events in the community and encourage club members to attend.
- Register the club with the university and request instructions about how to navigate the administrative rules and regulations.

has caused a generation gap among scientists. Traditionally, after earning a PhD, a new scientist remained in academia as a professor and only students who failed as scientists left the university. In the past, that was a practical approach to science when the field was very different than it is today.

Historically, after World War II, PhD students were hired as professors directly after graduation due to a high demand. Some years later, the demand for professors began to decrease but universities continued to gradually increase the number of incoming PhD students.¹⁰ The post-doctoral fellow position was created to accommodate the imbalance. The imbalance has persisted and amplified. Currently, academic-minded individuals are often forced to take multiple post-doctoral fellowships before finally landing an assistant professorship position.¹¹

A career in academia is extremely competitive now, but it is still worth pursuing for those who prefer the academic

atmosphere. However, the university is no longer the only venue for research or scientific thought. With a rapidly developing biotechnology industry in the United States and abroad, there is a growing demand for scientists outside the university. Leaving academia after graduation is no longer a failure, but a choice, and often a goal.

A few professors will be unsupportive but most will encourage the activities of a career development club. In general, professors are educators who understand that all of their students will not share the same ideals and goals as they had in graduate school. Identifying and pursuing your goals is a worthy endeavour and, in general, students will be lauded for it.

Although there are some challenges to face when starting a career club, they are easily overcome. Box 7 is a list of steps that students can take to get a new career club off the ground (Box 7). The club can embolden students to take initiative in their own career

development through motivational advertisements and reminders. Attendance to club events can also be improved through greater funding. Providing free food and travel is often enough of an incentive to get students involved. Finally, the club will encounter some professors who are not supportive of non-academic science, but it is important to remember that the disparagers are in the minority.

CONCLUSION

Scientific training at the PhD level does not fully prepare students for a career in biotechnology or other non-academic science career. Fortunately, a career club can provide the additional training opportunities needed. Career clubs benefit a university by attracting savvy prospective students and educating the student body in skills related to the business of science. A small group of students can initiate and govern a career club even in universities where there are no pre-existing provisions for career development. Although there are a few challenges to creating a career club, the venture is manageable. Together, students can provide training opportunities for themselves through seminars, workshops, mentorship and conferences. At responsive universities, the interest that the club

generates will inspire the administration to develop a biotechnology-focused degree programme.

REFERENCES

1. Kjelstrom, J. (2008) Telephone Interview. In: N. Gravagna (ed.).
2. Kjelstrom, J. A. and Jamison-McClung, D. (2008) UC Davis Biotechnology Program. In: P. Yali Friedman (ed.) *Best Practices in Biotechnology Education*. Washington, DC: Logos Press, pp. 85–112.
3. Smaglik, P. (2004) The skills hunt. *Nature* 431(7004): 109.
4. Koen, D. (2005) Nuts and bolts. Soft skills. *Nature* 435(7038): 126.
5. Dahms, A. S. (2001) The US biotechnology industry: The importance of workforce quality in the maintenance of corporate competitive advantage. *Biochemistry and Molecular Biology Education* 29: 206–208.
6. Dibner, M. D. (1999) Career alternatives for scientists. *Nature Biotechnology* 17(8): 825.
7. Koen, D. (2004) Nuts and bolts. Selling your skills. *Nature* 427(6974): 570.
8. Koen, D. (2004) Nuts and bolts. Interview preparation. *Nature* 428(6982): 586.
9. Koen, D. (2003) Nuts and bolts. *Nature* 426(6966): 588.
10. Kaiser, D. (2002) Cold War requisitions, scientific manpower, and the production of American physicists after World War II. *Historical Studies in the Physical and Biological Sciences* 33(1): 131–159.
11. Schatz, G. (2004) Jeff's view. Postdocs. *FEBS Letters* 568(1–3): 1–3.