CAREERS

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COLLABORATIONS

A single cog in a complex machine

If they remain vigilant, early-career researchers can reap benefits from taking part in big international projects.

BY SARAH KELLOGG

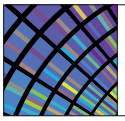
Catherine Luria has little doubt about the benefits of participating in a big, international collaboration. Luria, a marine microbiologist beginning her third year of graduate study at Brown University in Providence, Rhode Island, is examining how changes in sea-ice coverage and blooms of phytoplankton affect bacterial diversity from season to season. She has literally gone to the ends of the Earth to join a collaboration: the Palmer Antarctica Long Term Ecological Research (LTER) project on the western coast of the Antarctic Peninsula.

Luria will return to Antarctica this month, and several more times over the next two years, taking a week to travel there to spend two months with about 25 researchers and another dozen support staff involved in LTER. While there, she will characterize the water column, collect water samples and measure bacterial and phytoplankton abundance and bacterial production in the lab. She will examine microbial growth rates, physiology and community composition under different conditions.

"It's a huge networking opportunity at this stage in my career," says Luria. Thanks to the collaboration, she will be able to work with many more measurements than she would have on her own. "What has proved to be especially helpful is having access to data," she says. "Suddenly I'm able to dip into this pool of high-quality, curated data going back a decade or more. I have the ability to get more meaningful results. It's not data from a snapshot of when your grant just happened to be funded."

High-profile international research projects can bring together hundreds, if not thousands, of scientists. Joining one is no guarantee of professional success for an early-career researcher, but it does provide an exceptional environment for learning, and access to crucial data and networking opportunities that can advance personal research and open professional doors.

Team science practised on a huge scale not only yields ground-breaking results, but can also establish and fortify careers, as researchers have found in ventures such as the Human Genome Project; the ATLAS particle-physics experiment at the Large Hadron Collider at CERN, Europe's particle-physics laboratory ▶



ENCODE
Encyclopedia of DNA Elements
nature.com/encode

near Geneva in Switzerland; or the Encyclopedia of DNA Elements (ENCODE), a project to define the functional elements of the human genome (see page 45).

"Research careers are built inside big collaborations, and a measure of the success of university-based research groups is the number and quality of prominent positions within collaborations that are held by the group's members," says Ricardo Gonçalo, a particle physicist at Royal Holloway, University of London, who has worked on ATLAS.

Positions in big consortia are highly sought after, but drawbacks to participating include limited access to principal investigators; constant jockeying for recognition; the pressure to subjugate personal research to elevate project research; the risk of getting lost in long lists of authors on publications; and the difficulty of distinguishing individual work from group work. Having so many people in a project "implies a lot of politics, different ways of behaviour that affect our interaction, many rules", says Patricia Conde Muíño, a physicist at the Laboratory of Instrumentation and Experimental Particle Physics in Lisbon, who worked on HERA-B, an experiment at the DESY particle accelerator in Hamburg, Germany, that included 32 institutes and 250 collaborators from 13 countries. "One thing that sometimes is complicated is the internal competition. This is stronger in the physics groups, where there are literally hundreds of people trying to do the same thing as you," she adds.

"These are incredibly exciting and important projects, and they're seen as the future of science by some."

VALUE ADDED

Veterans of consortia say that it is crucial for young scientists to consult experienced investigators when considering whether to join a project. They should weigh their research objectives and career goals, and assess how their strengths and weaknesses might be elevated or strained on a high-profile project. Although it is impossible to know how individual graduate students or postdocs will fare in such intense environments, it is important for them to go into projects with their eyes open to potential challenges. Those who don't proactively seek to develop their skills and network with established researchers may end up being little more than Anonymous Author Number 16 on a 40-author publication.

The search for a high-profile collaboration begins most effectively with a review of personal career goals and how best to achieve them. Large consortia often represent just one step on a long career path. Young scientists can use self-assessment tools and resources to look at their core competencies and to evaluate long-term goals to see how a large project could match their aims.

Armed with this knowledge, postdocs should talk to trusted faculty members or mentors, and seek out scientists from the collaboration who are speaking or presenting posters at conferences. These people can alert the young scientist to research opportunities and provide key contacts to enable them to visit labs and meet principal investigators. The aim is to find the project that best fits the young researcher's professional interests and personal circumstances, and networking is the most efficient way to do that (see 'Look before you leap').

Joining a high-profile collaboration opens the door to research and colleagues that may previously have been out of reach, while also providing the rare opportunity to explore cutting-edge research in a competitive and well-funded environment. The intimate collaborations of smaller-group research are lost, but access to international experts gives young researchers great opportunities at this crucial time in their careers.

High-profile projects also give researchers a chance to learn new methods and processes from international colleagues who bring very different approaches to the scientific enterprise. "I think this brings enrichment, and hopefully you're able to pick the best from each and have a more powerful research team," says Teresa Fonseca Martin, a former particle physicist who spent seven years at ATLAS (she left this year to become a school teacher). "It is true that different cultures have different ways of working, but by paying a bit of attention, it is easy to learn about it and work with it."

Many of these opportunities involve learning softer skills, such as professional etiquette, leadership and management, communication and networking, and how research is conducted. These can be important for junior researchers who may be operating outside their home country for the first time and have had little contact with scientists from other countries. International consortia, says Fonseca Martin, also provide opportunities to develop a global network of colleagues and friends, as well as a chance to learn about the cultures of different countries.

FIGHTING ANONYMITY

A big, prestigious team-science effort can not only boost a career but also sink one — or at the very least, waste the time of an early-career researcher. In particular, benefits can be offset by a numbing anonymity, especially for participants on the lowest rungs of the research ladder. The number of institutes and individual scientists involved turns large consortia into complex ecosystems that must be negotiated, whether researchers are trying to get credit for their lab work or attempting to stand out in a long list of names on a publication. Indeed, Ewan Birney, ENCODE's analysis coordinator at the European Bioinformatics Institute in Hinxton, UK, argues that the aims of individual participants in ENCODE and other big collaborations shift, from striving for excellent science that leads to publication and career success, to striving for maximum data output

WHAT TO EXPECT

Look before you leap

Early-career researchers in high-profile, international projects often struggle with how to stand out in a crowded field of graduate students and postdocs. Here are some tips to consider before — and after — joining a large project team.

- Seek advice about potential projects and principal investigators from knowledgeable advisers and researchers who have been associated with similar projects.
- Assess your personal and professional interest in the research, including whether the project will advance your career.
- Review the potential laboratory and research locations.
- Find out whether the principal investigator provides the mentorship and support you want.
- Seek opportunities for first-authorship on your own work within the project by carving out a special niche in the research.
- Look for chances to co-author publications with the principal investigator.
- Volunteer to take on administrative tasks for the project, such as writing papers, assisting in interviews and arranging meetings. This will help you to get your name recognized and acquire leadership skills.
- Accept opportunities to co-supervise PhD students with the principal investigator on discrete research projects within the collaboration.
- Try to discover something new in the research or to use a new technique that advances the project.
- Schedule regular meetings with the principal investigator to update him or her on any progress.
- Build good relationships with other early-career researchers on the project and set up meetings or web seminars to exchange information about their research.
- Look for chances to work at the main project site as well as at your home laboratory to raise your profile with senior investigators. S.K.


N. MURGAI

Marine microbiologist Catherine Luria is part of a major ecology consortium in Antarctica.

in the hope of contributing as much as possible to a community resource — usually a big data set (see page 49).

"Certainly there's an allure to a big project, but there's also a clear career risk of being lost in a very large crowd," says Julie Klein, who studies interdisciplinary teams at Wayne State University in Detroit, Michigan. "These are incredibly exciting and important projects, and they're seen as the future of science by some." They are also massive and unruly, she adds, in terms of the competition for attention. "It is often difficult to find one's place in a collaboration of 3,000 scientists," agrees Gonçalo. "At first it seems that every good idea you come up with has already been tried by someone else."

STAND OUT IN THE CROWD

Nearly ten years after starting work on ENCODE, Jason Lieb, a biologist at the University of North Carolina at Chapel Hill and director of the Carolina Center for Genome Sciences at the university, says that standing out in a large team often means taking on extra work. He recommends that new members of the team improve their standing with the principal investigator by taking on extra roles, such as assisting in writing papers, hiring graduate students and scheduling group activities, and perhaps splitting their time between the large project and a smaller one in their home lab, with the aim of writing an independent paper with the principal investigator. Experienced postdocs say that developing leadership skills also helps a researcher to get noticed.

Another potential downside for the young scientist is the administrative effort required to operate these vast projects. For example, the scale of ATLAS, which includes about 3,000 physicists, has resulted in the development of an unhealthy, sluggish bureaucracy, says Fonseca Martin. These projects "don't necessarily get the best out of the people, and they sometimes make difficult the recognition of people's achievements and contributions," she adds, referring to assigning authorship and opportunities for promotion. Sometimes, says Fonseca Martin, a researcher's management abilities can become more important than their scientific ones.

Major collaborations often require much logistical effort, such as organizing meetings and conferences, notes Lieb. "People are tasked with certain jobs, and there's often a chance to take leadership positions in these jobs. If you're willing to try that, it's a good way to cut your teeth on a project." He adds that those who have taken on and performed effectively in such positions can demonstrate to their institute or university that they are team players who could, for example, make contributions to administrative tasks as tenured faculty members.

Along with taking on extra tasks, researchers can increase their profile by visiting and working in other labs involved in the collaboration. This helps them to build contacts and disseminate their research widely. "Projects that do better have postdocs or graduate students spend two or three months working in a lab at another site and then go back to their home institution," says Jonathon Cummings, who studies scientific collaboration at Duke University's business school in Durham, North Carolina.

But some researchers caution that graduate students and postdocs should be wary of becoming too closely associated with a single project, however glamorous, in case they become pigeonholed by peers and potential employers. "I worry that I'll be viewed as the 'person who works in Antarctica' and that will shape what I do later on," says Luria. "People are so interested in the place and fascinated by what we're doing, so it would be easy as a young scientist to have this experience become the defining quality of my work. I'm loving being in Antarctica and being a part of this project, but I'm trying hard to make sure it doesn't define me for the rest of my career."

Getting involved in a high-profile consortium can indeed be a headache, but it is often worth the effort, says Lieb. "People complain that these consortia are very clubby and difficult to get into," he says. "It's kind of true, but there's a reason why it's true. Once you've done it, you're more qualified to do it again. If you're able to get in early and demonstrate your skill at working on a project of this size, you're more likely to get another shot." ■

Sarah Kellogg *is a freelance writer in Washington DC.*

EUROPE

Investment increases

Research and development (R&D) investment by European companies is on the rise, according to *The 2012 EU Survey on R&D Investment Business Trends*, a European Commission report released on 20 August. The survey of 1,000 large companies across all sectors predicts an average R&D boost of 4% a year until 2014. Chemical companies project an increase of 5.5%, and oil and gas producers 4.6%. "Employment costs are more than half of total R&D costs," says Alexander Tübke at the Institute for Prospective Technological Studies in Seville, Spain, a co-author of the report, "so an important share of R&D increases should translate into new employment." But, Tübke notes, any resulting researcher recruitment is likely to be in countries with lower labour costs, such as India and China.

EDUCATION

Teachers lack resources

Full- and part-time teaching faculty members without tenure at US academic institutions face challenges that detract from their work and negatively affect their students, says a report released on 23 August by the New Faculty Majority Foundation in Akron, Ohio. A survey of 500 contingent faculty members found that they often don't know until days before a class begins that they are to teach it, and that most have no access to office or lab space, phones or computers. Such practices compromise students' educational experience, the report argues. Maria Maisto, executive director of the foundation, adds that uncertainty and lack of office space also hinder development of student–mentor relationships.

ENTREPRENEURSHIP

Advice for protégés

To benefit from mentoring, fledgling entrepreneurs should be honest with their advisers about business issues such as cash flow; seek out mentors with similar values, personality or interests; and develop trust through frequent meetings, says a study based on a survey of almost 400 protégés (E. St-Jean *Int. J. Training Dev.* **16,** 200–216; 2012). Entrepreneurs who achieve good relationships with their mentors can build management knowledge and skills and improve their visions for their companies, says author Étienne St-Jean, who studies business management at the University of Quebec at Trois-Rivières in Canada.