Navigating Collaborative Grant Research

Marie and Pierre Curie, Watson and Crick, Brin and Page. Collaboration pays, so funding agencies are promoting team research. At the same time, fields that demand multidisciplinary cooperation such as translational medicine, climate science, and systems biology are on the rise. Running a successful collaboration, especially one with several leaders at multiple sites, means thinking like a CEO: vetting partners, delegating responsibilities, and making tough management decisions. Researchers in multisite, multi-investigator projects need to adjust their grant-writing approach, work culture, and even career strategy. **By Chris Tachibana**

Mark Gerstein

Scientific collaborations can be as casual as swapping ideas over coffee; they can be as monumental as the Manhattan Project, the Large Hadron Collider, or the Human Genome Project. They are increasingly how we do science. Around the world, funding agencies are emphasizing collaborations for many reasons—most, of course, financial.

"Resources are shrinking," says **Alicia Knoedler,** associate vice president for research, University of Oklahoma. "So government, industry, and some private funders prefer a collaborative approach." Getting experts to work together on a problem can be more effective than supporting many separate projects. Sharing equipment in core facilities avoids duplication and reduces maintenance. Many funding agencies want to see commercialization of research discoveries and translation of results into clinical practice, which requires crossdisciplinary work. For example, the Health Care Systems Research Collaboratory, which received $11.3 million in 2012 from the National Institutes of Health (NIH) Common Fund, is supporting research partnerships between academic scientists and health care systems to improve clinical practice. **Michael Katze,** University of Washington microbiology professor and lead investigator for collaborative NIH programs that use systems biology approaches to investigate viral-host interactions, puts it bluntly: "The NIH is impatient with basic science," he says. "They want a shorter drive to vaccines and other applications."

Actually, the NIH, which created a multiple principal investigator (PI) option only in 2006, is a bit late to the game. The National Science Foundation (NSF) has a longer history of collaborative science models, beginning with its Engineering Research Centers in the 1980s. Knoedler says the NSF is still a leader in funding interdisciplinary collaborations, with the Science and Technology Centers and the Industry & University Cooperative Research Program. Other U.S. government-funded research consortia include the Department of Energy (DOE) Innovation Hubs and Energy Frontier Research Centers, and the Department of the Interior Regional Climate Centers. The National Network for Manufacturing Innovation has funding through the DOE and Department of Defense to move innovations, for example in biotechnology or nanotechnology, to market. And the new brain initiative could bring more collaborative opportunities, possibly as NIH program project grants.

NIH program project grants fund investigators who are working on related projects that draw on shared resources. An example is the $20 million supporting the Breast Cancer Surveillance Consortium (BCSC). The BCSC collects longitudinal data from several mammography sites nationwide, with information on over 10 million mammograms so far. These and other data are used to study breast cancer risk factors and the effectiveness of breast cancer screening, diagnosis, and treatment. Centralized administrative cores increase efficiency and BCSC communication channels enhance research. "The science is improved from the synergy created by working together instead of independently," says **Diana Miglioretti,** Dean's professor of biostatistics, University of California Davis School of Medicine; senior investigator, Group Health Research **continued>**

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Institute; and BCSC co-PI. But programs like the BCSC aren't built in a day. That's why development experts say the first step of collaborative science is assembling a research team.

Strong Relationships

"My most important advice about collaborations," says Knoedler, "is to build strong research relationships in advance." All collaborators must know they are crucial members of the research team or they'll drop the ball or drop out. And tokenism shows in a proposal, says Knoedler. "It's obvious to reviewers when people have just been placed on a team and not integrated into it."

Creating a functional crossdisciplinary research team requires serious vetting. Choose senior investigators because agencies tend to fund people with an established record. Look for team players. Katze selects collaborators who are experts in their field and people he can count on to deliver results that integrate into the overall project goals. Establish real, meaningful collaborations, he says. Don't include people just to check off grant requirements.

Ruedi Aebersold agrees, saying his most effective collaborations have been with tight, focused teams on time-limited projects. Aebersold, a professor at the ETH (Swiss Federal Institute of Technology), is the founding executive of Systemsx.ch, a partnership of 12 Swiss universities and research institutions that funds interdisciplinary systems biology projects. Like Katze, Aebersold transitioned from single-laboratory to multi-investigator work when, in the late 1990s, the doubling of the NIH budget coincided with the rise of systems biology, a data-driven field that brings together biologists, computer programmers, bioengineers, and statisticians. From 2002 to 2009, Aebersold was the PI of an NIH center grant to develop proteomic technology. Based on its success, his advice is: "Resist the urge to be expansive." If you include all possible collaborators you'll create a bloated, unproductive team and as PI, you'll be in the uncomfortable position of needing to cut people later.

In fact, Aebersold and other scientists bemoan collaborative European Union (EU) grants that almost demand inclusion of partners from specific sectors, such as small business, and geographic regions, such as countries without a strong research infrastructure. These mechanisms reflect the EU mission of economic growth, stability, and social cohesion among members. "But instead of sprinkling money around," says Aebersold, "the most efficient collaborations focus a lot of money on a few groups." A laboratory that receives a substantial chunk of funds will make the project a high priority, says Aebersold, who says a good example of funding small teams of committed researchers is the Synergy Grants.

Agnes Kulcsar is the call coordinator for the European Research Council (ERC) Synergy Grants. The ERC is the EU's arm for funding investigator-driven projects and in 2012, the ERC Scientific Council established the multi-investigator Synergy Grant program. The goal, says Kulcsar, is "encouraging a small group of researchers to jointly address challenging and interdisciplinary research and unconventional approaches, to see what breakthroughs or even new fields of research emerge." To meet this broad goal, the proposals are flexible in project size, topic, and team composition—with no trans-nationality requirements. Projects funded so far range from the humanities to quantum physics to clinical science. After the current round of proposals is reviewed and funded, the program's value will be evaluated in early 2014.

Kulcsar reinforces the importance of the research team. The most important criterion for Synergy Grants, she says, is showing that "everything has come together—the right challenge and strong scientific partners with fully complementary expertise working on a project that only these people can do, and only at this time." The common factor in all the successful applications so far, says Kulcsar, is a sense of unity and exciting science. That excitement comes from careful, meticulous planning.

Diversity and Unity

Once you have your research dream team, set ground rules, says **Barry Bozeman,** an Arizona State University professor of public policy who is studying the dos and don'ts of collaborations for the NSF. "People focus on getting the money and don't worry about other issues until it's too late," he says. "Intersector work can be fraught with misunderstanding and managing a heterodox team is hard." Scientific disciplines differ in their norms about authorship and credit, work culture, and expectations about intellectual property rights and distribution of results. Discuss those issues in advance, says Bozeman. The decision-making process and the budget should be clear as well as the division of labor and timelines, he says. "Let people know what they are expected to do and when."

Your team needs money, so to find funding, **Peter Larsen,** director of research development at Michigan Technological University recommends networking with funding agency program officers and signing up for alerts from relevant agencies. Search in funding databases such as Pivot, SciVal Funding, or Grant Forward, which require an institutional subscription, or free databases like Grants.gov. Knoedler suggests using keywords such as "center," "hub," and "regional." Focusing on limited submission opportunities can find an agency's most high-profile and likely collaborative proposal calls.

Next, write a focused, concise proposal. Grant development experts such as Knoedler and Larsen say that writing collaborative proposals requires exponentially more time and a different mindset than writing a single-project grant. You must highlight the diverse expertise of your team while conveying commitment to a common goal. For NSF grants, you must demonstrate a broad impact on society. "Allow extra time for editing," says Larsen, "since many different specialists are involved. And have an independent reviewer read the proposal to make sure it reads as a unified whole and not a collection of individual projects." Finding a reader who is not on the team and not a potential competitor or reviewer can be difficult, but networking through your institution's development office can help. Reviewers are looking for excellence in the research, not buzzwords, says Kulcsar. She says continued>

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Featured Participants	Additional Resources
Arizona State University www.asu.edu	**European Research Council Synergy Grants** erc.europa.eu/funding-schemes/synergy-grants
Breast Cancer Surveillance Consortium breastscreening.cancer.gov	**Grant Forward** www.grantforward.com/index
ETH www.ethz.ch/index_EN	**Grants.gov** www.grants.gov
European Research Council erc.europa.eu	**National Institutes of Health: Multiple Principal Investigators** www.grants.nih.gov/grants/multi_PI
Group Health Research Institute www.grouphealthresearch.org	**National Organization of Research Development Professionals** www.nordp.org/funding-opportunities
Michigan Technological University www.mtu.edu	**National Science Foundation** www.nsf.gov
University of California Davis www.ucdavis.edu	**Pivot** pivot.cos.com
University of Oklahoma www.ou.edu	**SciVal Funding** www.funding.scival.com
University of Washington www.washington.edu	
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that at the ERC, reviewers want to feel that "no matter what, it will be interesting to see what comes out of the project. Even if it is not exactly what is planned, something groundbreaking will result from this collaboration."

Kulcsar and Aebersold both say that professional EU grant consulting companies are not necessary. Although these companies help navigate the exceedingly complex EU applications, says Aebersold, universities and research institutions often have their own experts who can help, saving the expense and time demands of outside consultants. However, if your university or institution does not have the infrastructure and personnel to manage large, multisite grants, start hiring. You simply must have a project manager to guide proposal development and herd the various PIs once you get funded. Knoedler says, "You're foolish if you don't. In fact, if you don't write a manager into your grant, it's a sign to reviewers that you don't know what you're doing." However, scientists are often reluctant to spend money on a manager.

Well, most scientists. The Katze group has so many collaborative grants involving hundreds of people that it has its own administrative hub for finances, writing, and administration. **Lynn Law,** a research scientist in the Katze group, moved from doing bench science to managing collaborative projects. "I hold people accountable, get everybody on same page, and make sure they have same goals," she says. "The PIs that Michael brings in are used to being their own bosses so working as team doesn't always come easily to them." Many scientists have poor management skills, says Katze, but these skills are essential to running big collaborative projects. His advice: "Learn to delegate, trust people, and don't micromanage them. Let them grow into their job."

Success at large collaborative projects, says Katze, requires being good at all the things scientists are often bad at. "You have to be outgoing and entrepreneurial and take risks," he says. "As the PI, if people don't come through, you have to make hard decisions and cut them from the project." Katze trains his students and postdocs to be collaborators and leaders of multi-investigator projects. But most of the scientific world is still adjusting to collaborative science, especially when evaluating people for hiring, promotion, and tenure.

Collaborations and Careers

Early career scientists considering a multi-investigator project should weigh the experience, networking opportunities, and prestige of a high-profile national or international collaboration against the disadvantages. For example, being on a multiple-PI grant could affect NIH New Investigator status, which gives special consideration to researchers applying for funding if they have not previously received major NIH grants. Another disadvantage is being author number 53 in publications from the project, since first authorship is used to evaluate job and tenure candidates. Says Aebersold, "Personally, I value someone who can operate in a collaborative environment, but when we advertise for a position, we get hundreds of applications. It's flawed, but we focus on first authorship because it's hard to evaluate contribution to a consortium."

But **Mark Gerstein** has a collaborative career strategy. Among other initiatives, his group contributes to ENCODE (Encyclopedia of DNA Elements), supported by NIH to define functional genomic elements; the DOE Systems Biology Knowledgebase (KBase) for data sharing and analysis; and the internationally funded 1000 Genomes Project on human genetic variation. "I'm used to being a cog in a big machine," says Gerstein, a professor of biomedical informatics and computer science at Yale University. Collaborating, he says, lets him contribute to research that has a greater impact than single-laboratory studies. Gerstein recognizes that this work doesn't fit in the tenure-track groove, though. "Most universities expect you to bring in your own money and publish your own papers, so I do that as well." Gerstein first puts students and postdocs in his lab on large collaborations, then gives them smaller follow-up projects for their own first-author papers. This strategy has placed lab members in faculty positions around the world. Early career scientists should also keep department chairs, deans, and other administrators informed about their participation in large collaborations so those contributions are recognized and valued.

Collaboration has pros and cons, says Gerstein. "Sometimes you have to wait to publish until the consortium is ready, and you can't always do things the way you want to. But the benefit is being on high-impact publications and highly connected work. For these projects," he says, "the whole is greater than the sum of the parts, and I've profited from being part of the whole."

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DOI: 10.1126/science.opms.r1300136