CellPress
REVIEWS

Science & Society

Just Enough Cooks in the Kitchen: Key Ingredients for International Collaboration

Janna M. Schurer,[1,2,*]
Sinh Dang-Xuan,[3] and
Marwa Farag[4,5]

Research approaches that cross disciplinary silos, industry sectors, and political borders are now increasingly prioritized for tackling issues of global concern. Nevertheless, team science can be challenging. The goal of this article is to help researchers proactively consider factors influencing conflicts and successes with an emphasis on the health sciences.

Numerous issues of the modern world, including climate change, emerging infectious diseases, antimicrobial resistance, trade globalization, wildlife conservation, poverty and food/water security, have been recognized as so complex that single-discipline approaches are unlikely to make a sustained, positive impact. Several fields (e.g., One Health, Ecohealth, and Planetary Health) have emerged that encourage scientists to work collaboratively beyond traditional disciplinary, sectoral, or political boundaries to develop integrative solutions to the world's 'wicked' problems [1]. Furthermore, translational programs that guide research from laboratory bench to policy are recognized as critical to developing evidence-based policies for the public good (Box 1) [2]. For parasitologists, these approaches might be business as usual. Many parasites have complex life-cycles, with life stages that traverse food/water systems, soil, vectors, animals, and/or people, and researchers studying

such organisms quickly find themselves approaching the boundaries of their professional training. It's also possible that researchers who surround themselves with fecal matter, intestines, and worms are naturally enthused about interacting with people. Team research can be immensely rewarding as well as challenging. The goal of this article is not to produce a prescriptive 'how-to' guide, but rather to highlight some of the key ingredients that we believe are foundational to achieving success when collaborating with international partners.

Working with Paradigm Differences

Aretha Franklin said it best: 'R-E-S-P-E-C-T!'. Though scientists strive to remain neutral while testing hypotheses, there is no doubt that we harbor biases for and against disciplines other than our own (the qualitative versus quantitative debate is a classic). Some of us were trained to use one particular method; or worse yet, to consider all alternatives as second-rate options. Inflexible attitudes towards other methods or disciplines rarely work well in cross-border collaborations. Techniques that are feasible in one country might not work in another due to limitations in infrastructure, resources, technician training, availability of reagents, or differences in pathogen strains. When we open ourselves to hearing new perspectives, we often encounter major paradigm differences in study design, analysis techniques, participant engagement, and reporting. It's an easy default to reject unfamiliar methods, especially if we have no information about the validity of a competing method or if we have not yet built trust with a team member. Ultimately, team science suffers when credible, talented individuals feel discouraged from bringing their ideas to the table. Selecting teams strategically, being open to new ideas and scientific norms, creating opportunities for team members to provide feedback on participation, and committing

to an atmosphere of mutual respect can all help teams overcome paradigm differences. Inviting office or laboratory colleagues into the field so that they can fully understand the challenges faced in data collection can help in building consensus on study methods and team trust. However, disengagement of the public funding for research is a serious challenge for collaborative multidisciplinary multicountry research because it is typically costlier and requires relevant public agencies to be on board in all countries involved. One example of the direct effect of the shortage of funding is restricted budgets for field visit site travel; limited opportunities for researchers to meet in person and establish initial working relationships in turn affects the success of collaborative efforts.

Communicating with Purpose

Communication might be THE most important tool for maximizing productivity, maintaining partnerships, and ensuring that cross-border projects are mutually beneficial. It might also be the most challenging. We encourage teams to agree on engagement parameters at an early stage to avoid common pitfalls related to timelines, workload, finances, coauthor order, data ownership, and project objectives. For example, coauthorship expectations can vary dramatically between countries, and for that reason, guidelines have been developed to help scientists adhere to a gold standard of academic norms[i] (Table 1). Once a project is underway, regular face-to-face or video conference meetings help to keep projects on task, facilitate peer-to-peer learning, and keep individuals meaningfully engaged and contributing to decision making from start to finish. Fortunately, there are now a wide range of options to facilitate regular dialogue between groups spanning time zones at no or low cost (e.g., Skype, Zoom, Webex, Whatsapp). These strategies allow teams to combine brain power,

<div style="background:#e8e8e8">

Box 1. Examples of Translational Bench-to-Policy Research Projects

Throughout the world, bench-to-policy programs are demonstrating the value of international, cross-cultural, and cross-disciplinary collaborations in reducing the burden of infectious diseases. Here are a few examples of successful long-term collaborations where scientists have thought outside the box to implement sustainable solutions to complex problems:

• Walrus meat testing to prevent trichinellosis in Inuit communities of northern Canada [5]

  ○ Meat testing prior to community distribution, rapid dissemination of test results by radio, coordination with health services to trace-back and treat potential patients

• Ecosystem health approach to opisthorchiasis prevention in Khon Kaen, Thailand[ii]

  ○ Community engagement, education, environmental monitoring, disease surveillance, and enhanced access to treatment

• New World Screwworm eradication in Florida, USA[iii]

  ○ Release of sterile flies to disrupt screwworm breeding, surveillance of wildlife, livestock and companion animals, public education campaign, environmental monitoring

• Global Guinea worm eradication program[iv]

  ○ Safe drinking-water solutions, trace back of human and animal cases, community engagement, environmental monitoring

• *Echinococcus granulosus* eradication from Iceland [6]

  ○ Icelandic language education materials, parasite control legislation (including dog tax and destruction of infected offal), civic engagement to enforce animal husbandry norms

</div>

networks, and resources to solve problems before they delay deliverables, as well as to celebrate progress.

New teams often need time to smooth out initial bumps as individuals struggle to communicate effectively, build trust, navigate power dynamics, and agree on project parameters [3]. Mistakes happen, and the work can feel as though it's dragging on while everyone gets up to speed. For that reason, simplify communication by avoiding acronyms and jargon, explaining your paradigms, and explicitly stating your work preferences. It can be as easy as telling people that you prefer reminders about upcoming deliverables, stating that you welcome constructive criticism, or informing your team about cultural, religious, or family commitments that limit your productivity during certain time periods (e.g., Table 2). Give the

team basic insight into your discipline (e.g., by drawing out a parasite lifecycle to highlight its complexity). Fortunately, teams that are committed to collegiality and productivity often improve quickly, developing short cuts for communication, discovering strengths and weaknesses, and learning to support each other. Becoming educated about communication differences across cultures and disciplines might pose initial challenges, but ultimately it is a lifelong, transferrable skill that promotes understanding in a variety of settings.

Like it or not, English has become the primary language for publications seeking an international audience. Another important aspect of international communication is the barrier posed by team members who speak different languages. Conversations between such team members take longer

and are more likely to suffer misunderstandings regarding content. Face-to-face discussions, learning to interpret body language across cultures, employing an interpreter, and proceeding with patience can help to ensure that ideas are clearly communicated and understood. Moreover, Anglophones can contribute to a sense of camaraderie and goodwill by learning polite greetings and basic phrases in the languages of their coauthors. Sharing a written account of meeting minutes can be helpful to those with better reading comprehension than verbal comprehension, and also provide accountability for action items. Overall, these strategies ensure that diversity in language skills do not result in team members being excluded from contributing their ideas in a meaningful and interactive way.

Sharing Work, Credit, and Liabilities

Most readers can likely recall a time when they joined a team where the work was not equitably divided, and where group cohesion suffered as a result. Being a good team player means sharing the workload, contributing resources, and being actively engaged from start to finish [4]. It also means that individuals presenting on behalf of a team acknowledge their collaborators, foregoing personal agendas to represent the team's unified perspectives. This solidarity is as important when a project is receiving positive attention (e.g., awards, publications, speaking engagements) as when it is not (e.g., external criticism, funding cuts, manuscript rejections).

This solidarity is also useful for building careers. In academia, where conference presentations, publications, awards, and media interviews are painstakingly recorded for hiring, tenure, and promotion committees, appreciation towards junior team members is most helpful when delivered in a manner that can be celebrated on a curriculum vitae. This could include

Table 1. Examples of Common Issues and Potential Solutions for Those Engaged in International Collaboration

Issue	Potential solution(s)
Cultural barriers	- Educate yourself about colleagues' culture(s) and include cultural exchange as an icebreaker topic at an initial meeting - Discuss cultural differences relating to time (e.g., urgency in meeting deadlines), business etiquette (e.g., starting a meeting by asking about family life versus starting business), communication norms (e.g., explicit versus implicit), gender norms (e.g., barriers to education equity)
Language barriers	- Make a mutual effort to improve language skills - Hire a translator - Find opportunities for non-Anglophones to present research in their mother tongue
Lack of transparency in coauthorship criteria	- Discuss coauthorship criteria in initial meetings - Use international standards as a reference
Disengagement from research project	- Use a team performance management assessment tool[v] to monitor group cohesion/effectiveness and make changes as necessary - Foster an environment of accountability and appreciation
Deadlines not met	- Collect information on common delays (e.g., reagent shipping times, climate, government approval) in countries where data collection is occurring prior to making timelines - Use of project management strategies to collectively build a long-term timeline with short-term deadlines indicating team progress - End meetings by agreeing on action items, responsible personnel, and deadlines
Knowledge/skill gaps	- Explicitly create a team culture of accompaniment, knowledge exchange, and capacity building - Be willing to teach skills (even when it would be faster to do the task alone), and to learn skills - Learn the education/career goals of junior members and support opportunities for promotion

Box 2. Key Considerations for Collaborations between High- and Low-Income Country Researchers

Although resource gaps can be a major source of stress, it is clear that high- and low-income groups have much to offer each other, especially when non-monetary resources are considered. Often, researchers in high-income countries have easier access to funding, technology, and education resources, while lower-income researchers understand the local cultural, geopolitical, and disease context, are informed about research priorities, can troubleshoot implementation logistics, and are able to stretch a dollar far beyond its reach elsewhere. Here are a few considerations for working across resource gaps:

- Engage at all levels of the research process (from grant writing to research completion) to ensure that projects are locally relevant, feasible, and culturally appropriate.
- Build capacity by fostering multilateral knowledge exchange that goes beyond scientific methods to include geopolitical and cultural context.
- Develop health innovations with financial and technological sustainability in mind and avoid donations of equipment that don't match local needs, technician training, or infrastructure capacity.
- Adhere to the highest standards of ethical clearance, particularly if one country lacks ethical review infrastructure.
- Make it a priority to walk a mile in your collaborator's shoes by visiting each others' countries, field sites, and research institutions.

equitably splitting resources for attending conferences or workshops, copresenting work, or facilitating opportunities to attend continuing education workshops. Principal investigators are instrumental in facilitating such opportunities for students, postdoctoral fellows, and early investigators, especially those who operate in low-to-middle-income countries (Box 2). Because institutional requirements for graduation, tenure, and promotion vary between countries, principal investigators should learn about local norms so that they can best mentor their junior colleagues for success. Institutional leaders also play an important role in supporting team science; for example, by giving candidates with few first or last authorship publications an opportunity to explain their specific project responsibilities, by ensuring smooth transitions between incoming and outgoing team members, and by planning for long-term success.

Valuing Mutual Enthusiasm/Curiosity

Even the most engaging, innovative, or world-changing projects suffer periods of ennui. It is especially difficult when team members have different world views, speak different languages, live on separate continents, and operate under different scientific norms. Shared enthusiasm for project objectives helps teams to tackle obstacles collaboratively, ensures that the project remains a top priority for each individual, and contributes to the long-term success of a team. The fear of missing out on the next eureka moment is a powerful motivator for team members to arrive at meetings prepared and with deliverables in hand. Along the same lines, an opportunity to learn new skills from a research collaborator is a big perk in an industry that is constantly seeking the next innovation or discovery. A well-managed team is more likely to succeed with short-term goals, experience satisfaction with the process, and to stay together on the long road from basic science to policy output.

Table 2. Examples of Events That Might Delay Productivity in Participating Regions

Event	Approx. length	Time period
Lunar New Year		
Cambodia/Laos/Myanmar/Thailand	1 week	Mid Apr
China/Korea/Mongolia/Tibet/Vietnam	23 days	Late Jan–early Feb
Islam		
Ramadan	1 month	Lunar calendar
Eid al Fitr/Eid al Adha	3 days/5–7 days	Lunar calendar
Juddaism		
Passover	7–8 days	Late Mar–Apr
Hanukkah	8 days	Late Nov–late Dec
Hinduism		
Diwali	5 days	Mid Oct–mid Nov
Christianity		
Easter	4 days	Mar–Apr
Christmas and New Year's Eve	1–2 weeks	Mid Dec–Jan 1
Secular		
Children school holidays	Various	Various
Maternity/paternity leave	Various	NA
Weddings and funerals	Various	NA
Major sporting events	Various	NA

Preparing for Politics

In addition to navigating the intricacies of internal team dynamics, groups engaged in international collaborations should be prepared to navigate the realities of government and institutional roadblocks. Global health has become a huge market with many agencies, firms, and academic institutions involved, all with their own internal and external agendas and interests. It is inevitable in this situation to have some level of corruption which is not only financial but also intellectual. Researchers who plan to work on collaborative research projects that cross country and disciplinary lines need to be aware of this reality and demand transparency as much as possible. Around the world, countries have varying bureaucratic structures in place to facilitate, manage, or limit researcher access to data and/or stakeholders. In some cases, potential participants might steer clear of researchers,

wanting to avoid government backlash. In other cases, the time and resources required to get government or institutional research approval might be prohibitive or violate ethical guidelines (e.g., bribes). Spending time to develop good rapport with varying government entities can be instrumental in ensuring a high level of coordination and support for research projects, and in maintaining productivity. Adhering to the highest scientific standards has the best chance for affording a research team international recognition, which in turn will hopefully promote independent and free access of data. Above all, teams must work cohesively and cautiously to ensure the safety of all team members – especially those placed in politically sensitive locales.

Resources

[1]Department of Infectious Disease and Global Health, Cummings School of Veterinary Medicine at Tufts University, North Grafton, MA, USA
[2]University of Global Health Equity, Kigali, Rwanda
[3]Center for Public Health and Ecosystem Research, Hanoi University of Public Health, Hanoi, Vietnam
[4]School of Public Health, University of Saskatchewan, Saskatoon, Canada
[5]School of Public Administration and Development Economics, Doha Institute for Graduate Studies, Doha, Qatar

*Correspondence: jschurer@gmail.com (J.M. Schurer).
https://doi.org/10.1016/j.pt.2018.09.005

References

1. Davi, M. (2017) Checklist for One Health epidemiological reporting of evidence (COHERE). *One Health* 4, 14–21
2. Black, N. (2001) Evidence based policy: proceed with care. *Br. Med. J.* 323, 275–279
3. Tuckman, B. (1965) Developmental sequence in small groups. *Psychol. Bull.* 63, 384–399
4. Choi, B. and Pak, A. (2006) Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness. *Clin. Invest. Med.* 29, 351–364
5. Proulx, J.-F. *et al.* (2002) Novel prevention program for trichinellosis in Inuit communities. *Clin. Infect. Dis.* 34, 1508–1514
6. Beard, T. (1973) The elimination of echinococcosis from Iceland. *Bull. World Health Organ.* 48, 653–660

Letter

Plasmodium: More Don'ts

Geoffrey Ian McFadden[1],*

In a previous missive I explained why you cannot turn the genus name for malaria parasites (*Plasmodium*) into a plural noun