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Simple guide for starting a research group

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Introduction

Conducting cutting-edge research and scholarship becomes more complicated with each passing year; forming a collaborative research group offers a way to navigate this increasing complexity. Yet many individuals whose work might benefit from the formation of a collaborative team may feel overwhelmed by the prospect of attempting to build and maintain a research group. We propose this simple guide for starting and maintaining such an enterprise.

We believe that responsible conduct of research and scholarly activity can be established, valued, and passed on through thoughtfully-formed collaborative groups. Therefore, each of these pieces of advice can contribute to conducting research with integrity and transparency.

While this guide is ordered in a generally applicable sequence, the ordering does not represent a hierarchy, and the sequence of application may depend on discipline (e.g. social sciences versus physical sciences) or topic. Throughout the article, we use the term research “group,” but one might reasonably substitute “team” or “lab.” We believe that the principles for starting a research group are generalizable and scalable in most cases, but we have noted cases where the scale of the group or discipline-specific issues will need to be considered.

1. Establish a Leadership Structure

In order to pursue research goals effectively and efficiently, core members of a research group should agree upon a primary leader. While a manager may oversee many day-to-day operations (see #5), the leader accepts ultimate responsibility for activities and the conduct of the group. The leader is: responsible for establishing the direction of the research agenda; accountable for the group’s budget and deliverables; aware of all activities in the group; responsible for managing the physical space in which the group conducts those activities; crucial in establishing the culture of the group, and addressing unacceptable activities and behavior (Van Noorden, 2018) ; and, responsible for being an exemplar for research rigor and integrity. The Lab Leadership and Management Best Practices Checklist (Professionalism & Integrity, 2018) is a simple self-assessment to help identify management strengths.

A strong communication network among group members is critical for research success. Leaders should disseminate a list of contact information including all researchers and personnel in the group, as well as conduct regular individual and group meetings to monitor and discuss research progress. While leaders should provide suggestions to group members as appropriate, they should also be open to others’ suggestions for their own improvement, and improvement in the management of the group.

The management provided by a leader depends greatly on the scale of the group. The leader of a small group can often manage most of the group activities.

However, leaders of large groups need to delegate responsibilities. The size of a group often evolves, and the leader's approach must adapt to these changes.

In managing interaction among members, group leaders should: ensure equity in individual workspaces; give credit where credit is due; compliment successes, while helping students and researchers to learn from "failures"; dissuade unfriendly competition; and, promote an environment in which group members are eager to help and support one another.

At the core of any group is an idea that captures the underlying goals and values shared by the individuals who contribute to making it function as a collective entity. This group ethos may take the form of a mission, vision, business model, etc., and can be written down, revisited, and discussed. In some cases the ethos may never be formally articulated, but individual members nevertheless share a common vision. The group ethos must develop and evolve, and the leader must work to foster it. Eventually it will solidify, and become a legacy that reflects the core identity of the group as a whole.

2. Devise a Research Plan

Whether the mission is to continue work based on earlier efforts, or to open up a fundamentally new line of inquiry, the group must map out plans for reaching both long-term and short-term goals. Once the group has devised a clear research agenda, it should then focus on outlining how that agenda will be implemented, including choice of research tools or methodologies (Teach the Earth, 2016).

The planning process should include a strategy for sharing results with appropriate members of the research community, and, in some cases, with the broader public (e.g., via conference presentations, peer-reviewed publications, technical reports, and other modalities (see #9)). As part of this dissemination strategy, the group should establish and implement data management policies regarding data sharing, ownership, and documentation (see #7).

3. Obtain Funding

Obtaining funding for a new group, laboratory, or project can be one of the most critical elements in sustaining the effort. Either the leader or the group as a whole must watch for potential funding opportunities, and commit to writing excellent proposals in response to those that align with the group's objectives and capacity.

The following strategies can be helpful in organizing funding efforts.

- Develop and maintain a matrix of small to large funding opportunities. For each, the group should learn all about each funder and what they are seeking to accomplish, and build a network of contacts at funding agencies who know the group's work (face-to-face meetings may be valuable).
- Think creatively about different funding mechanisms that may meet the group's needs (e.g., external support, internal support, partnerships, or private support).

- Work with the institution's research office or sponsored programs administration to identify funding opportunities and to get help with writing proposals.
- Recruit the team needed to be successful, including key external partners; the team should be sized to the scale of the project.
- Develop a detailed plan to complete and submit each research proposal; opportunities can be lost through underestimating the preparation needed.
- Finally, and perhaps most importantly, follow the instructions completely, and do not deviate from guidelines and specific requirements stated in the announcement.

Proposals rarely succeed in the first round. Obtaining feedback on an unsuccessful proposal can improve not only the formulation of a future proposal, but also the project itself. While being receptive to feedback after a failed proposal can be difficult, those groups who do not revise properly in repeat attempts for funding often fail to recognize the germ of success in the responses.

4. Obtain Equipment and Ensure Safety

Perhaps most relevant for a traditional scientific laboratory, the group must assess its available space, determine what resources are available, and identify what additional resources are needed (funds, grants, personnel, equipment, etc.). Purchasing equipment is a time-consuming yet critical task. Researchers may be required to get multiple quotes for large purchases, and make long-term decisions about warranties, maintenance plans, budgets, and cost sharing; an institution's instrumentation center may be able to offer assistance in this area. Once purchased, the group must carefully allocate space for equipment, supplies, and personnel.

Safety and compliance are of prime importance. All members of the group should be familiar with relevant safety regulations and compliance requirements, particularly in labs. To that end, the leader should:

- Devise and implement a safety plan that spells out responses to hazards and emergencies, including those related to physical hazards (obstacles, high voltage/pressure/temperature sources), biological materials, chemicals, and radioactive materials.
- Ensure that labs are equipped with proper safety equipment (e.g., sinks/showers, safety eyewear, fire extinguisher, fume hood, biohazard disposal receptacles, eye-wash station, and automated external defibrillators (AEDs), if applicable).
- Provide safety (including emergency response) training to all personnel, and update and review it as necessary.
- Conduct routine inspections of labs and equipment, establish clear expectations of adherence to safety protocols and policies when conducting research activities, and ensure that safety procedures are followed (University of Pennsylvania, 2017; North Carolina State University, 2018; University of Illinois, 2018).

5. Hire Additional Personnel

Group leaders should hire strategically with the goal of building a strong, collaborative team (Howard Hughes Medical Institute and Burroughs Wellcome Fund, 2006). After thinking carefully about how an individual will support a group's mission, leaders should hire people who fit with the professional culture, are genuinely interested in the research, and are hardworking team players (Wickner, Dunlap, & Trumpower, n.d.). When hiring, leaders should consider not only research skills and experience, but also individual characteristics and interpersonal interactions. Current group members or experienced people outside the group can have valuable input and may offer diverse perspectives on potential hires. Further, leaders should check references before making a final decision.

If funding allows, group leaders should consider hiring a manager to take care of the day-to-day running of the group, including supervising personnel. A good manager will prevent myriad headaches, and will free other group members to attend to their responsibilities. If unable to hire a manager, the group leader should seek training in personnel management early on in preparation for handling the inevitable issues that arise (Van Noorden, 2018). Leaders should work closely with the institution's human resources department on personnel matters, as they may be unaware of relevant policies, processes, and practices at the institution (Andrade, n.d.).

The group leader should plan adequate time to train new personnel and oversee their work, create a clear outline of all training requirements, and assign a group member responsibility for ensuring that everyone is trained appropriately. The group leader should be involved in training whenever possible. In addition to developing technical skills, all personnel should have a grounding in research ethics, and assistance to help them connect that information to their everyday research activities. Along with talking with group members about standards and expectations (Wickner, Dunlap, & Trumpower, n.d.), the group leader should encourage them to ask questions and to own their mistakes, as openness helps to promote an atmosphere of integrity. To introduce new hires to the group's research culture and ethos, the leader or manager can develop a contract that outlines the group's requirements, standards, and expectations that all personnel review and sign can.

6. Create, Review, and Maintain Standard Operating Procedures

Consistent research practices across all members of a research group are crucial to the quality and integrity of the resulting data. The leader or manager should ensure that standard operating procedures (SOPs) for all research procedures are documented, describing in detail how core activities will be performed (World Health Organization, 2009). Written SOPs are necessary for fostering good research practice and establishing reproducibility.

Examples of procedures often documented in SOPs include ordering supplies; selecting data collection sites; developing and implementing data collection protocols; establishing how research is documented; scheduling the use of space or

equipment; and obtaining necessary approvals for research involving human or animal subjects (Wickner, Dunlap, & Trumpower, n.d.; World Health Organization, 2009; Nickols & Nickols, 2007). When training (and re-training) group members, leaders should review SOPs (see #5).

A helpful resource for developing SOPs is “The Art of Writing and Implementing Standard Operating Procedures (SOPs) for Laboratories in Low-Resource Settings: Review of Guidelines and Best Practices” (Barbé, et al., 2016). Included are recommendations for creating templates, using clear language, making SOPs accessible to everyone in the research group, and reviewing them regularly, as well as considerations for writing SOPs in culturally diverse settings. Leaders should check with their institution’s Environmental Health & Safety or Research Office for local guidance and templates.

7. Develop and Implement a Data Management Plan

Time and resources devoted to data management are a critical investment for a group. Each member of a research group needs to be able to locate, use, trust, and build on data collected and analyzed by others. This is especially true of the leader, who will rely on the group’s data to shape the research agenda going forward. It is therefore critical that a leader articulate clear expectations for data management, including developing a data management plan (DMP).

A DMP is more than a required component of a research grant proposal: it is a valuable tool that can help keep the group’s data and analyses searchable, accessible, and usable into the future. A DMP describes: how group members will handle data during the lifetime of a project; what will happen to the data when the project is completed; and, the specific steps to be taken to thoughtfully organize, sufficiently document, securely store, responsibly share, and properly dispose of or preserve the data.

Some components of the DMP may require written SOPs (see #6). Components of a thorough DMP include:

- conventions for file and folder naming, folder structure, and version control
- best practices for research notebooks and for organizing/labeling data in spreadsheets and models
- locations for securely storing data, and responsibility and workflows for back-up
- standardized metadata templates and norms for including related documentation and code
- clarification of data ownership and stewardship
- policies/procedures for sharing data within and beyond the group
- plans for data retention and/or submission to external repositories for long-term access and preservation.

Staff at your institution’s library or research office may offer valuable help crafting a DMP; see also *Ten Simple Rules for Creating a Good Data Management Plan* (Michener, 2015).

Some research groups need to manage physical samples, and maintain links to the associated data. Adequate data management plans should consider how samples are maintained.

The group's DMP should be a living document. The group should review the plan regularly to make sure it still addresses their needs, and update or add to it as necessary (e.g., when a project changes or a new one begins). Leaders should train personnel on how (and why) to implement the plan, including discussing the impact of effective data management on the integrity of research and long-term usability of results.

8. Encourage Mentorship

The leader of a research group should mentor everyone in the group, at all levels. Leaders should also themselves seek mentoring from more experienced colleagues. Neglecting mentoring can be costly, whether in lost time, wasted research, or emotional investment. Mentoring the next generation of scholars is among the most significant contributions one can make to an institution or a field of study. Excellent mentorship enhances the professional reputation of the mentor, the mentee, and the research group, and strengthens a group's research by attracting strong, highly motivated people who become increasingly productive and independent group members.

The inherent challenge of effective mentoring is heightened by the place of mentoring in current research/academic culture: it is often taken for granted. There is little explicit training in how to do it effectively, and little formal acknowledgement of the time and energy it takes to be a good mentor (Van Noorden, 2018).

As a starting point, leaders need to recognize that mentoring will take substantial time and energy. They should begin by discussing individual goals and expectations – both those of the mentor, and those of the mentee, being honest about what the mentor can offer, and setting clear expectations (see #5 and #6). It is the mentor's job to foster a mentee's personal and professional development in the context of their professional relationship (not to serve as a best friend, therapist, or surrogate parent). A good mentoring relationship fosters growth and change on both sides, and being able to recognize and adjust to those shifts is part of the job.

9. Develop Authorship Guidelines

Discussing the criteria by which authorship will be assigned is an essential part of setting up a research group. Whenever possible, leaders should ensure that authorship roles and expectations are clearly outlined and communicated at the outset of each project (Albert & Wager, 2004). Ambiguity about authorship roles and expectations can lead to problems ranging from degraded relationships among group members, to serious research integrity issues such as "gift," "honorary," or "ghost" authorship (Albert & Wager, 2004; Louis, Holdsworth, Anderson, & Campbell, 2008).

Authorship inclusion and order (i.e., who is listed as first, second, lead, or junior author) can have serious implications in an increasingly competitive environment, and the importance of authorship order may vary with academic rank (graduate student, postdoc, pre- or post-tenure professor). Developing clear authorship expectations and discussing the relative contributions of each potential author is an important element of mentorship (see #8). Most publishers have guidelines and criteria outlining the scope of work that warrants authorship in their journals

(The Committee on Publication Ethics, 2014). Authors are typically defined as those who make a substantial contribution to the scholarly work (Albert & Wager, 2004; Louis, Holdsworth, Anderson, & Campbell, 2008). However, it may be difficult to assess the level of contribution, and potential co-authors may disagree about which contributions, at what level, deserve authorship credit. Quantitative metrics have been suggested as one possible way to reduce ambiguity and subjectivity in gauging author contributions (e.g., Clement, 2014).

Because individuals, roles, or relative contributions may change over the course of research projects, leaders should ensure that groups or project teams regularly revisit authorship expectations.

10. Just ask!

For leaders, starting a research group means stepping from a familiar environment into a new place where they feel like they should know their way around and how everything works – but they don't. Every leader, no matter their experience, has had a clueless first day on the job - and they probably remember it vividly. Asking questions, even ones that seem foolish, is essential for success. The answer “yes” is only possible if a question is asked. Group leaders should seek out staff and administrators at their institution with the expertise they need to get research up and running. Further, they should identify colleagues who understand the local culture and who can help them navigate it effectively. Leaders will quickly find out who's helpful.

In addition, group leaders should empower students, advisees, and new employees (see #5) to come to them or senior group members for advice and guidance. Group leaders who encourage questions help promote the development of members' independence, as well as innovative research. Questions help to open the door to valuable dialogue, knowledge sharing, clarification of expectations, and identification of issues and possible solutions.

Conclusion

This simple guide is intended to help launch a collaborative research group that is both successful and mindful of principles of responsible conduct of research. Because research disciplines and institutions vary widely, and every group is unique, this list is not exhaustive; rather, we hope it will be broadly useful to new leaders who seek to weave research integrity into the practices and ethos of their research team from the very beginning.

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