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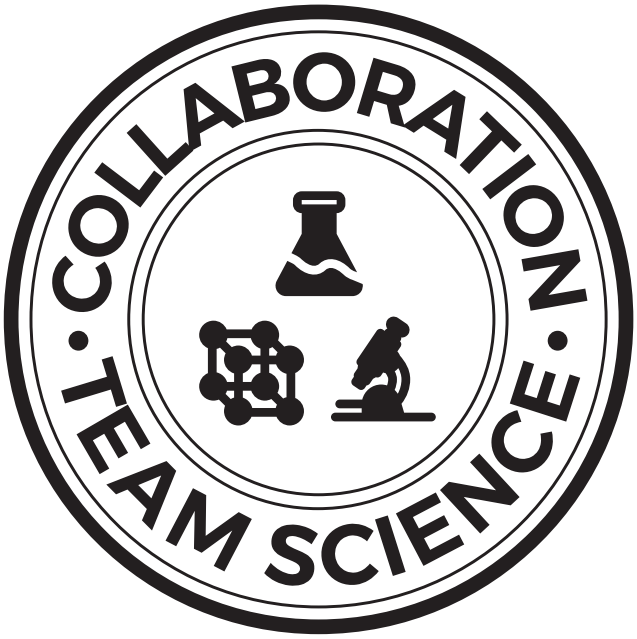

FIELD GUIDE

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U.S. Department of Health & Human Services | National Institutes of Health

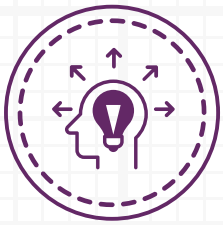
Top Ten
Take Aways

TRUST

It is almost impossible to imagine a successful collaboration without trust. Trust provides the foundation for a team. Without trust it is nearly impossible to sustain a collaboration.

VISION

A strong and captivating vision attracts people to the team and provides a foundation for achieving team goals. Shared vision provides a focal point around which a highly functioning team can coalesce.



SELF-AWARENESS AND EMOTIONAL INTELLIGENCE

Emotional Intelligence among team members contributes to the effective functioning of research teams. Self awareness gives people greater control over their own emotional reactions to others, improves the quality of their interactions, and helps build other-awareness.

LEADERSHIP

Strong collaborative leadership elicits and capitalizes on the team members' strengths and is a critical component of team success. Leadership can be demonstrated by every team member, not just the formal leader(s).

MENTORING

Mentoring is an indispensable aspect of successful collaboration. A mentor recognizes the strengths of each team member, identifies areas in which newer scientists have the greatest potential to grow, and can help coach people to attain their aspirations. With good mentoring, the development of scientists is synchronous with strengthening team dynamics.

TEAM EVOLUTION AND DYNAMICS

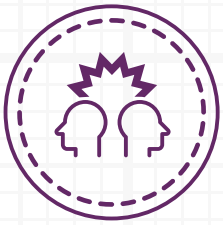
Research teams form and develop through critical stages to achieve their highest potential (Forming, Storming, Norming, Performing). A positive team dynamic sustains and further strengthens a research team, enabling it to achieve successful outcomes.

COMMUNICATION

Effective communication within and outside a research team contributes to effective group functioning. It depends on a safe environment where team members can openly share and discuss new scientific ideas and take research into new, previously unconsidered directions as well as ensure that difficult conversations can take place.

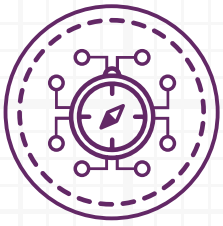
RECOGNITION AND SHARING SUCCESS

Individual contributions should be recognized, reviewed, and rewarded in the context of a collaboration. Recognition and reward of all team members should be done thoughtfully and fairly in the context of the team and the institution.



CONFLICT AND DISAGREEMENT

Conflict can be both a resource and a challenge—a resource because disagreement can expand thinking, add new knowledge to a complex scientific problem, and stimulate new directions for research. A challenge because if it is not handled skillfully, conflict impedes effective team functioning and stifles scientific advancement.



NAVIGATING AND LEVERAGING NETWORKS AND SYSTEMS

Highly collaborative teams can transcend different organizational structures, extending their reach across and beyond the organization. They often function within the context of multiple and sometimes interconnected systems, and they can help establish strong networks of researchers who together can accomplish more than they could as individuals.

Table of **Contents**

Introduction

Collaboration and Team Science: A Field Guide was first published in 2010. For nearly a decade, the ***Field Guide*** has served as a valuable resource for scientists participating in or leading a research team. It has also been used by those considering becoming involved in or building a research team. Graduate courses designed to focus on or integrate team science and interdisciplinary research into their learning have used it as a base text, and professional development offices have provided it to trainees to enhance their understanding of working collaboratively. Institutional leaders have used it to help guide change at an organizational level, shifting research culture from a primary investigator-initiated focus to one that embraces collaborative and efforts that cut across discipline-based departments.

The original research foundation for the ***Field Guide*** was conducted with scientific teams at the NIH. Since its publication, the authors have had opportunities to travel nationally and internationally to conduct workshops and give lectures, as well as work with and learn from individuals, teams, and organizations. The learning from these experiences is reflected in this second edition.

We were honored and humbled by the initial response to the Field Guide. That reaction enabled us to interact with and learn from others and continue collecting practical information as it pertains to collaboration and team science. As our learning expanded, it seemed time to update the Field Guide to provide additional information as well as to refine or enhance that which existed. We wish to thank Samantha Levine-Finley for her valuable contribution to the first edition of the Field Guide. We also want to thank Darlene Summers for careful editing of this version of the Field Guide. It is with appreciation for the opportunity to contribute that we have integrated several additional sections as well as resources into this new version.

This new version of the Field Guide, as well as the content in the appendixes, can be accessed at *http://teamscience.nih.gov*.

CHAPTER 01

Engaging in **Team Science**

Increased specialization of research expertise and methods has made interdependence, joint ownership, and collective responsibility between and among scientists near requirements. These features of team science may not suit everyone, but given these current trends, most researchers likely will find themselves asked to participate on or lead a research team at some point in their careers.

The early 2000's was met with a surge of interest and investment in multi- and inter-disciplinary team science programs from public agencies and private organizations alike. Today, with modern research methods becoming more specialized and pressing health issues being truly complex, collaborations among scientists trained in different fields have become essential. The field of inquiry termed the Science-of-Team-Science (SciTS) was coined in 2006. This field encompasses an amalgam of conceptual and methodological strategies aimed at understanding and enhancing the outcomes of large-scale collaborative research and training programs. In 2015, a report commissioned by the National Research Council presented an overview of what has been learned about "factors such as team dynamics, team management, and institutional structures and policies that affect large and small science teams." (Cooke and Hilton, editors, 2015).

There are many types of research teams, each one as dynamic as its team members. Research teams may comprise investigators from the same or different fields. Interdisciplinary teams have members trained in different disciplines bringing their unique expertise together to solve a problem or answer a question. Research teams vary by size, organizational complexity, and geographic scope, ranging from as few as two individuals working together to a vast network of interdependent researchers across many institutions and countries. Research teams have diverse goals spanning scientific discovery, training, clinical translation, public health, and health policy (Stokols, Hall et al. 2008).

Innovations and advances not possible within one laboratory are emerging from collaborations and research teams that have harnessed techniques, approaches, and perspectives from multiple scientific disciplines and therapeutic areas. Team science has been described as a collaborative and cross-disciplinary approach to scientific inquiry that draws researchers, who otherwise would work independently or as co-investigators on smaller-scale projects, into collaborative centers and groups.

As the figure on the next page illustrates, research teams vary across a continuum of interaction and integration. This continuum provides a basic framework for understanding how this ***Field Guide*** conceptualizes teams. On one end of the spectrum is investigator-initiated research, wherein scientists work individually and independently on their research. They may create a team-like environment within their laboratory but there is little or no interaction with others outside. Collaboration at the mid-level of interaction and integration reflects researchers working relatively independently on different aspects of a common scientific problem with some interaction that may lead to publishing the results together. After this experience, they may or may not work together again. At the opposite end of the spectrum are highly integrated research teams that display high interaction. They exhibit a number of characteristics including, but not limited to, high trust as evidenced by their ability to distribute leadership responsibility, and they share resources, data, and decision-making authority, as well as credit. Well-functioning teams display many of the characteristics described in the following modules. This ***Field Guide*** addresses a wide range of team science concepts, from low levels of interaction and integration to highly integrated.

First Collaboration

It can be extremely helpful to frame one's first projects, as an undergraduate or graduate student and in some cases a postdoctoral fellow, as collaborations. The collaborator in these instances is the investigator who hired the trainee to support his/her research program. If this relationship is treated as one between peers, based on trust and mutual respect, it will result in an outstanding training environment where the trainee will take on more responsibility, contribute to the research agenda, and accept accountability for experimental successes —and failures.

What Is a Scientific Research Team?

...think of it as a continuum...

LOW — **Level of Interaction and Integration** — HIGH

INVESTIGATOR-INITIATED RESEARCH	COLLABORATION	INTEGRATED RESEARCH TEAM
Investigator works largely independently on a research problem with his or her laboratory.	Each group member brings expertise to address the research problem. Group members work on separate parts of the research problem, which are later integrated. Data sharing or brainstorming among lead investigators varies from limited to frequent.	Each team member brings specific expertise to address the research problem. Teams meet regularly to discuss team goals, individuals' objectives, and next steps. Team shares leadership responsibilities, decision-making authority, data, and credit. Frequently, new leaders emerge to take on projects from new ideas sparked by the joint work.

Scientific teams vary in their duration. Some teams are put together for a very focused purpose and are not intended to have a life that extends beyond the accomplishment of a specific task. Others may be designed with the expectation of a long-term collaboration, exploring multiple facets of a set of problems that may only be resolved over a lengthy time frame.

As the focus on research teams sharpens, questions are emerging about how research teams can maximize their effectiveness and experiences. Effectiveness can be considered in the context of the overall functioning of the team and its success in its ability to achieve major research accomplishments. We can think of teams in two dimensions: the task dimension and the interpersonal dimension. Task refers to the interactions among group members related to the scientific assignment and interpersonal refers to the relationships among group members and the team as a whole (Fiore, Carter et al. 2015). It is generally believed that a team's chances of achieving its scientific goals is very strongly affected by its ability to establish effective working relationships among its members.

Not every team is successful – some never really get off the ground, others are able to achieve only some of their goals, and some never really maximize their full potential. Other teams are highly successful – reaching and often exceeding their recognized goals and creating positive experiences for team members and the institutions that support them. We acknowledge that a team can be successful with respect to its relationships yet not achieve the scientific success it sought.

Why do some research teams achieve a state of high functioning while others do not? What factors maximize a research team's productivity or effectiveness? How can research teams best be recognized, reviewed, and rewarded? ***Collaboration and Team Science: A Field Guide*** was developed to help answer these and other questions. For those of you who are thinking this is pretty obvious stuff...

THIS IS PRETTY OBVIOUS STUFF

In our experience, people sometimes characterize the principles, ideas, and concepts presented in this manual as pretty fundamental–they are common sense; they are obvious. Others may feel the concepts are difficult to get their head around, especially since there are no concrete data or experiments that can be performed to prove anything, and there is no one formula that assures success.

While much of this may seem obvious, a disconnect exists when we consider many people who are engaged in scientific and personal interactions. For example, while people intuitively know that trust is a strong foundation for collaboration, their behavior during everyday interactions with group members in the laboratory, during seminars, or when discussing data suggests lack of trust. The individual may self-assess as a very trusting person and someone who can easily build trust with others; however, real-life experiences indicate the exact opposite.

We devoted a module in this ***Field Guide*** to self-awareness because willingness not only to self-examine but to accept and act on feedback from others can greatly enhance one's ability to align his or her self-perception with reality, and even change one's behavior (see ***Chapter 02: Preparing Yourself for Team Science*** page 12).

Note to the Reader:

Just as every research team is unique, so too may be your approach to the Field Guide. You may read it in the order in which it is written, or may prefer to start with a topic that is most relevant to you at the current moment. Each module is devised to stand alone but also contains references to other modules because, not surprisingly, there are important connections among concepts. We have included **Take Aways** at the end of each module that provide the key elements from the section.

CHAPTER 02

Preparing Yourself **for Team Science**

Team science is rapidly becoming a primary mode of operation for biomedical researchers and clinicians working on complex questions involving human health. Making the most of the opportunities that team science has to offer may seem fraught with the challenges of adapting from a solo-investigator culture to one of collaboration. For example, each person often has a different perception and experience of what this “team science” stuff is all about. We included the scenarios below to help stimulate thoughts around some of the challenges you might face as you consider participating on or leading a team and to formulate questions so you can make the most of the opportunities team science presents.

IT'S WORKING: CASE STUDY 1

It's lunchtime and Dr. Welstrom is walking to the cafeteria with a colleague from another laboratory, Dr. Miller. Dr. Miller starts discussing a problem he is having with a specific team research project. He says he feels stuck; he has most of the expertise he needs but lacks it in one particular area that would allow him to truly advance his research. Dr. Welstrom tells him that she not only has the expertise and resources to help, but that she sees another line of inquiry that could be important to follow. Her contributions would help with the publication that Dr. Miller is trying to prepare, broaden its scope, and contribute globally to the research project. Dr. Welstrom invites him to provide her with the cell lines she would need to perform the experiments and says she'll provide him with any findings. Dr. Miller says that it is not how his laboratory does things. Instead, he wants to introduce Dr. Welstrom to the team leader who is always open to new skills and perspectives of other scientists that will help them get the data needed. The laboratory finds it more rewarding to work as a team to uncover the multiple facets that underlie complex scientific questions, rather than have people work in isolation and just contribute data. As Dr. Welstrom enters the cafeteria and approaches the colorful salad bar, where she sees all the different vegetables that will combine to become her lunch, she realizes that she has the opportunity to become part of an interdisciplinary team. What does she need to know as she starts this new venture?

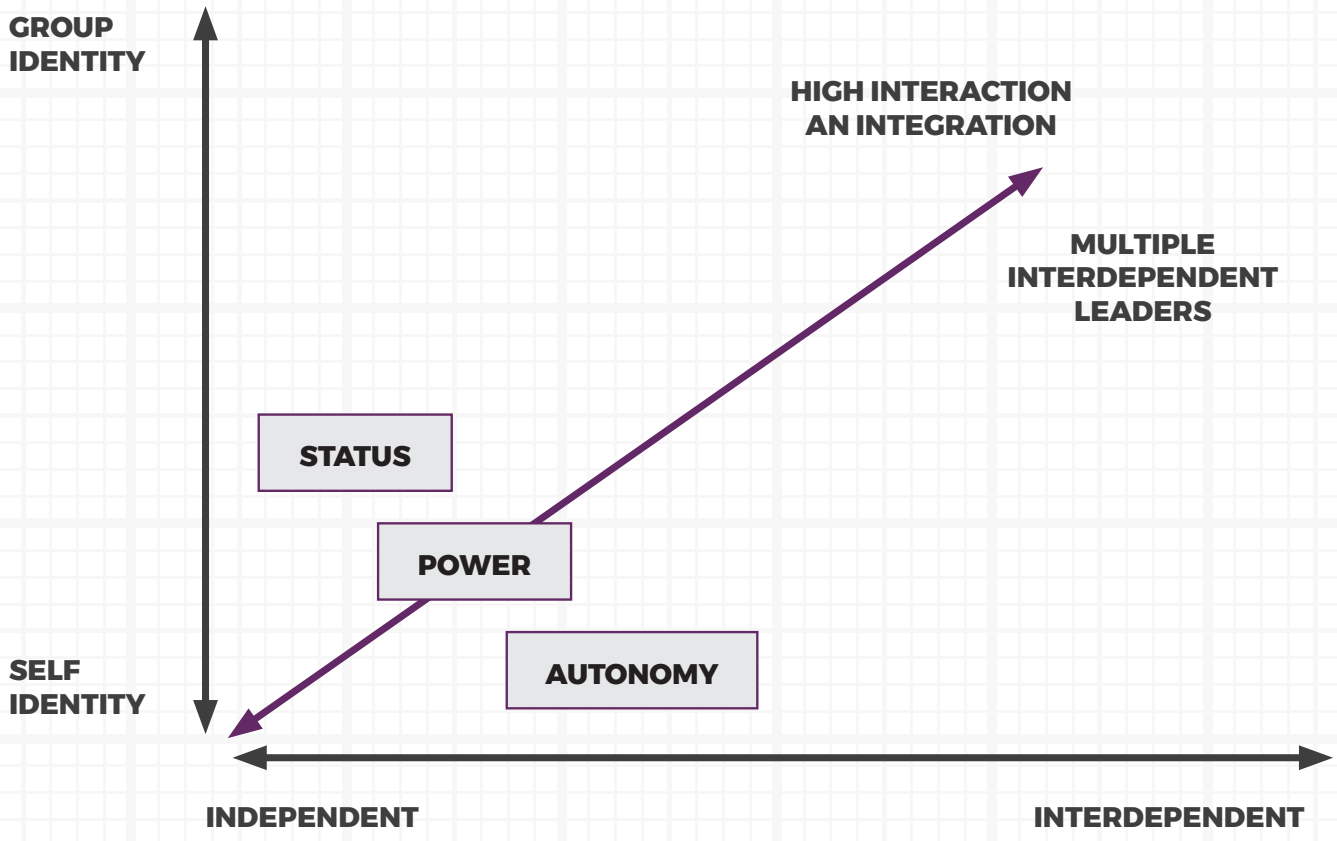
IT'S NOT WORKING: CASE STUDY 2

Dr. Antonelli has been running her own laboratory for a few years and things are going fairly well. She has had a couple of papers in high-impact journals and is feeling good about the contributions her group is making to her current projects. She has been formulating an idea for a much larger effort that would require her to bring together a number of experts in different fields. Dr. Antonelli is hesitant to try to pull the trigger on starting this initiative because she just can't put her finger on the problem. Dr. Antonelli has noticed that people in her laboratory don't offer much during weekly laboratory meetings and, when they do, they are reluctant to give details about their experiments. Sometimes they even make disrespectful comments to each other. She has been surprised when junior scientists have come to her with requests to work on projects that are irrelevant to the lab's mission. Most concerning, Dr. Antonelli finds herself having to stamp out often bitter arguments between laboratory members over authorship and reliability of data. Why are things going wrong, and what can Dr. Antonelli do about it? And if she does do something about it, can she apply what she has learned to that bigger, bolder project that is bubbling in her mind?

Some people naturally function as part of a research team, whereas others must develop and apply skills to enable them to successfully contribute to team efforts. The same can be said for the ability to lead teams. We have found that effective team members and team leaders possess skills that contribute positively to the overall functioning and success of the team. They must be able to contribute to building trust, communicating effectively, and both giving and receiving constructive feedback. In addition, they must embrace a collaborative spirit, meaning they are willing to share data, credit, and decision–making with other team members.

At this juncture, we want to point out that the notion of collaboration can also introduce threats. For investigators who have been trained to work independently, have been promoted based on individual accomplishment, and who are routinely rewarded for their singular contributions to science, a shift to an approach or culture that involves others as equals can be foreign. In the collaborative setting, there is a requirement for the leaders to share decision-making, power, knowledge, resources, and credit. Investigators may feel more comfortable to think about taking this step after tenure or otherwise secure in their position. Yet, even this can feel risky.

COLLABORATION INTRODUCES THREATS



Negative Impacts of Emotional Reactions

Everyone has emotions and emotional reactions to people and events. However, being unaware of your own strong emotional reactions may have negative consequences, including:

- Narrowing vision and creativity
- Stifling curiosity, openness, and playfulness of mind
- Hindering ability to recognize nuances
- Distorting perceptions
- Lowering team morale

THE VALUE OF SELF-REFLECTION

The strength of collaboration skills often depends on an individual's level of personal insight and self-awareness, ability to be in touch with his or her thoughts and feelings, level of consciousness of his or her impact on other people, and strengths and weaknesses. Self-awareness does not emerge without effort; usually it is the result of actively engaging in self-reflection and exploration.

The following tips may help establish a positive orientation toward participating in teams:

- Recognize that others may have a different understanding or perception.
- Ask questions to understand how others perceive an experience.
- Appreciate that different perspectives are what contributes to creativity, innovation, and problem solving.
- Remind yourself that different disciplines look at the world in distinct ways, use different methodologies and techniques, may have unfamiliar conceptual frameworks and even distinctive norms and values.

As a team leader or member, be aware of your emotional reactions and try to manage them the best you can. Emotional reactions can have strong and direct negative impact on the rest of the team (see Negative Impacts of Emotional Reactions box).

Whether you are a member or a leader, your contributions to the team can benefit from self-reflection. Although you may not think that the consideration of the finer points of interpersonal dynamics is relevant to biomedical research, there is more

of a connection between scientific thinking and self-reflection than appears at first glance. Both depend heavily on inferential reasoning—selectively focusing on observable data, drawing inferences about what the data might mean, and finding ways to test those inferences with additional observable data. Although the "data" of interpersonal relationships may not have the facticity of data in research studies, they are nonetheless available for observation, inference, and reflection.

Over the years, studies of interpersonal dynamics, group functioning, and individual cognitive and emotional processes have established that, through self-reflection and communication, people can become more aware of themselves, their behavior, and the impact they have on others. More importantly, such awareness can give people greater control over their own reactions to others and improve the quality and direction of their relationships.

For this reason, self-awareness among team members is crucial for the effective and satisfying functioning of research teams. As written by Cohen and Cohen in *Laboratory Dynamics (Cohen and Cohen 2012),* an excellent discussion of management skills for scientists, "... self-awareness allows you to exercise behavioral options and choose the behavior that will be most effective, rather than the one that may make you feel good for the moment, but that you will later regret."

However, to move toward self-awareness, a person must overcome what social psychologist Lee Ross (Ross 1996) has described as "naïve realism"—the belief that we see events as they really are. Each person believes that his or her attitudes and beliefs derive from an objective reaction to information and that other rational people will react in the same way if they are open to the same information. In this regard, scientists are like most other people.

Although there is no single approach that works for everyone, developing self-awareness by yourself may be a challenging task. You may find it helpful to start by looking within yourself to become more aware of the strengths and weaknesses you bring to a team and then seek out a mentor, coach, or other role model who can help you navigate the nuances of your research team.

Some institutions offer free professional development training and coaching sessions. Raising your self-awareness by discovering your personality type (see Myers-Briggs Type Indicator page 20) or your ***Why-It-Matters*** (why you are the

CASE STUDY 3

Two colleagues, Dr. Maxim and Dr. Lao, have just presented their research results at a conference. A question from the audience challenges the pair's conclusions. Dr. Maxim responds defensively because he "heard" and "experienced" the challenge as an attack. Dr. Lao jumps into the discussion with a very different attitude; she welcomes the challenge and is eager to debate the data and its interpretation that led to the conclusion. Instantly, each person in the room, including Dr. Maxim and Dr. Lao, draws conclusions and creates "stories" to explain the researchers' different reactions. Why do the two researchers bring a very different perspective when being asked the same question?

best at doing what you do) may well become a life-changing experience and it may be easier to seek out a professional trainer as part of your journey. Professional development experts have access to assessment tools, which may help you to draw a more complete picture of your personality and work style. In addition, these experts can help you develop strong leadership skills and provide feedback to help your professional development.

The following sections provide tools and resources that can help you explore and become more aware of how you see yourself and the world, which will provide useful insights into your contribution to the team dynamic. In addition, this exploration will help you understand better those around you.

UNDERSTANDING PERSONALITY TYPES

There are myriad ways to describe differences in psychological functioning. Among the most well-known approaches to describing differences in the ways people think and feel is the Myers-Briggs Type Indicator (MBTI), a questionnaire derived from the psychological theories of C. G. Jung. This psychometric test assesses people in terms of their preferred stance toward others—extroverted versus introverted—and their preferred modes of psychological functioning—judging versus perceiving, thinking versus feeling, and sensing versus intuition (see page 20).

The MBTI is commonly used to assess an individual's personality type by considering his or her attitude, functioning, and lifestyle. It can help you understand your own way of thinking and feeling and can also help you appreciate personality differences that exist among other people.

For example, becoming aware of something as "obvious" as the difference between extroversion and introversion can help you work with, adapt to, and accept—rather than react against—someone whose orientation is different from your own. You will likely find that people with different styles can complement each other and offer strengths where others are less skilled.

The MBTI is just one tool for beginning to think about personality types. You may find it useful to simply reflect on how you see yourself and how you think others see you. For example, you might ask, "How collaborative am I?" and "How collaborative do others think I am?" Other questions you might ask can focus on your style of interacting with others: "How argumentative am I?" and "How argumentative do others think I am?" Cohen and Cohen (2012) provide excellent examples of questions for self-reflection and tools that allow you to rate your style of interaction as well as how you think others perceive you.

Myers-Briggs Personality Types

ATTITUDE

- Do you prefer to focus on the outer world of people and things (extraversion [E]) or on your own inner world of ideas and images (introversion [I])?

FUNCTIONING

- Do you prefer to focus on the information you receive through your five senses (sensing [S]) or do you prefer to interpret and add meaning to the patterns and possibilities you see (intuition [N])?
- When making decisions, do you prefer to first consider objective logic and facts (thinking [T]) or do you prefer to consider people and feelings involved (feeling [F])?

LIFESTYLE

- In dealing with the outside world, do you prefer structure and boundaries (judging [J]) or do you prefer openness and adaptability (perceiving [P])?

There are 16 Myers-Briggs personality types that result from combinations of preferences in these areas. For example, someone who prefers to focus on the outer world, receive information through his/her five senses, make decisions based on logic and facts, and be in settings characterized by structure and boundaries has personality type ESTJ.

The MBTI conceptualizes personality type as similar to left- or right-handedness: individuals are either born with, or develop, certain preferred ways of thinking and acting. No one type is better or worse; however, individuals naturally prefer one overall combination of type differences. To take the MBTI or to learn more, visit *www.myersbriggs.org*.

VALUE OF ASSESSMENTS

Assessments are powerful ways of learning more about ourselves and, by extension, others. They are not a meant to be used to assign labels to yourself or others, nor are they meant to describe unchangeable personal characteristics. Rather, they capture preferred ways of acting and interacting that can be influenced by internal and external factors. This is especially true when people are angry, hungry, or tired since we tend to go to the style we are most comfortable with in these situations. One value of becoming aware of your predominant style is that it can help you experiment with different ways of handling challenging situations.

GIVING AND RECEIVING FEEDBACK

Even in conditions of high trust, it can be hard to give or receive honest feedback about behavior or the job being performed. This can be especially true for team leaders. If you are a team leader, your role will likely supersede your personal characteristics in the workplace, even in casual team environments where friendships exist. As team leader, your reaction to feedback—including your emotional response—is likely to have an impact on team members and "set the tone" for the team as a whole. For example, if you welcome feedback from all team members and thank them, they will learn by watching you. It is especially difficult for people with less power or in subordinate positions to provide candid feedback, especially if you, as team leader, have the ability to impact their careers. Ensuring they feel safe receiving and giving feedback is essential.

The single most important factor in encouraging candid feedback is establishing an atmosphere in which disagreement and constructive criticism are welcomed. To establish such an atmosphere of psychological safety, team members must have a positive experience when they voice disagreement with the team leader or other team members. If your response to another team member's expression of differences is defensiveness, rebuttal, ridicule, punishment, or exclusion—whether in private or public—team members will be unlikely to speak up, even when asked. However, if you meet team members' efforts to voice disagreement with both receptivity and appreciation, you will begin to build a base from which others can voice their opinions—both positive and negative—to improve overall team function. While it may be impossible to get to the point of absolute honesty and frankness, it is possible to move further in that direction.

There are a number of approaches for giving feedback, one of which is called the Situation, Behavior, Impact, Future (SBIF) model (see text box page 22). For receiving feedback, the rules are simple. Greet the input with a sincere "Thank-you" and if you do not fully understand the comments someone is making, ask some questions. Whatever you do, there is no need to respond defensively or to explain yourself. The "Thank-you" is adequate.

In recent years, "360-degree evaluations" have become a popular managerial and self–evaluation tool, particularly in circumstances where the ability to work well together is important. In a 360-degree evaluation, each person being evaluated receives feedback from peers, supervisors, and subordinates. To increase the likelihood of truthful responses, the feedback from peers and subordinates is kept anonymous.

GIVING FEEDBACK: THE SITUATION, BEHAVIOR, IMPACT, FUTURE (SBIF) MODEL

When giving positive or constructive feedback the goal is to be as specific as possible so the recipient knows exactly what they did well or can learn how to do better next time. The following approach can help you deliver specific feedback.

- **Situation** – describe the exact situation and location where the behavior occurred: "During our monthly team meeting yesterday, …"
- **Behavior** – describe the exact behavior that was observed: "…you repeatedly made bold statements arguing that my proposed approach will not work. …"
- **Impact** – describe the impact that behavior had: "…When you made those statements, it made me feel unsupported and it drained all my energy. …"
- **Future** – (if constructive in nature) describe what behavior you would like to observe in the future: "I would appreciate if instead of making such statements in front of the entire team, you could discuss your concerns regarding my scientific approach with me in person first. We could then take the discussion to the entire team for their input on the various possible approaches."

THE VALUE OF MENTORSHIP

Mentoring is an indispensable aspect of successful collaboration. When embarking on a collaborative effort for the first time, or as your collaboration evolves into a highly integrated and diverse team, being or having a good mentor can help. No matter how reflective you may be, there are limits to what you can achieve on your own. Having another person help with the process of self-reflection can be enormously important. In science, a mentor can play that role.

Being a Mentor

Leading a successful research team extends beyond supervising and managing. It extends to the role of mentors: being someone who recognizes the strengths of each team member and identifies areas in which newer scientists have the greatest potential to grow.

Mentors can exist at every career stage and help others learn the nuances of the science, unravel and handle the politics of the organization and/or the discipline, develop scientific and other skills in various areas, and create strategies for successful collaborative interactions. Great mentors can help you achieve success along your chosen career path through assisting with networking, identifying opportunities, and tackling complex scientific situations or questions by assembling the right resources and sharing the formative successes and failures they faced along the way.

Seeking a Mentor

Regardless of your career stage, mentors can serve as a sounding board as you work your way through a maze of issues, challenges, and opportunities. If you do not have a mentor, consider seeking out and identifying an individual who would be a strong mentor for you. Although your supervisor may or may not be a mentor to you, he or she can be a terrific resource for identifying others who can help guide you. Mentors do not even need to know they are serving as a mentor to you. Sometimes just by observing someone you respect and admire in a meeting or interacting with others, you can take away powerful lessons learned.

A GOOD MATCH IS IMPORTANT

Before you enter a mentoring relationship with someone else, take time to discuss the goals and expectations you both have. Try to figure out if it will be a good fit.

Questions for Mentors:

- What qualities in a mentee will bring out the best qualities in you as a mentor?
- What four characteristics define you best in the role of mentor?
- What kind of mentoring arrangement do you prefer?

Questions for Mentees:

- What do you want out of a mentoring relationship?
- What goals have you set for yourself? Short term? Long term?
- How do you learn best?
- How do you like to be challenged?
- What kind of mentoring arrangement do you prefer?

Ask Yourself: Am I Ready to Participate on a Research Team?

- Can I thrive as a member of a highly collaborative research team?
- To what extent? What would it take?
- What would I gain? What do I most hope to gain?
- Do I have anything to lose? What is my biggest worry about being on a team?
- Am I willing to share data and credit with team members?
- Am I willing to accept constructive feedback and training from team members?
- Am I willing to provide constructive feedback and training to team members?
- Can I openly discuss issues and concerns with team members?

CHAPTER 03

Leading **Research Teams**

Leading a research team requires more than finely honed research expertise and subject matter proficiency; it requires the development and application of multiple skills and thoughtful interaction with team members. As a team leader, you must be able to clearly and decisively communicate, share information, and articulate the team's shared vision. You must be prepared to model a collaborative approach to science and motivate other members to do so as well. You must also support and empower team members, assign roles and delegate responsibilities, and manage team members' expectations.

LEADERSHIP DIMENSIONS

Bringing together a talented group of researchers to work cooperatively to solve a problem takes time, commitment, passion, and a lot of hard work. Whereas everyone on the team plays an important role, typically one or two individuals steer the effort. As a leader, you can bring people together to brainstorm, discuss new ideas, develop strategies and timelines, and coordinate small contributions of individual resources that together can get a project off the ground. You can build both personal and scientific trust among the team members and provide a conduit to senior leadership in the organization. In addition, you can foster mutual respect, the desire to share data and credit, a willingness to continually challenge each other to advance the project while containing conflict, and develop a dynamic process that evolves over time.

The characteristics of successful research team leaders are as diverse as the teams they lead. There are a number of common strengths exemplified by leaders that contribute to the overall success of the team. Leaders of collaborative efforts, no matter what their personal style, seem to be effective at: energizing and supporting participation among team members; communicating across different areas of specialization; and finding ways to address difficult issues.

Leadership styles, like leadership characteristics, vary widely. Some leaders employ a style in which they both self-identify as the team leader and are seen clearly by others as heading the effort. They are in command and in charge. Others would be less inclined to describe themselves as leaders and could be thought of as driving from the back of the bus. That is a leadership approach that is less directive and provides many of the team members the opportunity to take on leadership roles in the context of the overall project.

Non-authoritarian leadership styles seem to be more common across successful team leaders. However, there are some leadership styles that can damage and derail a team effort, including:

Absentee leadership—unavailable or insufficiently involved

Inhibited leadership—conflict avoidant or averse and reluctant to handle difficult people or situations

Defensive leadership—resistant to feedback regarding systemic problems and projecting outward blame

Hostile leadership—actively promoting competition and conflict within the team

Strong scientific and interpersonal communication skills are critical and required to keep the group interacting, cohesive, and on course. Communication includes both the subjects for discussion as well as the logistical strategies for effective interactions. As a leader, you must ensure that the team outlines roles and responsibilities, commitment of resources, and how credit for participation in team efforts will be shared and assigned. Communication strategies may include teleconferencing, interactive Web-based collaboration tools, listservs, and e-mail. Workshops and retreats provide forums for face-to-face interaction as well as strengthening and broadening networks. In addition, the importance of learning each other's scientific languages cannot be understated (See ***Chapter 07: Communication***).

How people speak can play a role in the collaborative setting and can depend on the context. Leaders who are conferred high status by their followers and peers typically use powerful language (statements that are assertions without any qualification). In contrast, we typically do not associate strong leadership with the use of powerless language. Powerless language is characterized by the use

of hesitations, hedges, disclaimers, raising one's voice at the end of a sentence, and tag questions (e.g., "I think...," "it has been said that," "maybe I'm wrong but," and "don't you agree?"). Powerful language is devoid of such elements. A study was conducted to evaluate status conferral to individual leaders in the context of independent and interdependent work. Results demonstrated that in the context of highly interdependent work, that higher status was conferred to leaders who used powerless language. This was due in part to the perception that the leader was more strongly focused on the group as a whole than on his personal role within the group (Fragale 2006).

Other studies have found that women are much more likely to use powerless language than are men, which might be another factor to explain why having more women on a team leads to better functioning. When you qualify someone's assertions with an expression such as "perhaps I am mistaken, but...," you create a comfortable space in which someone else can safely offer her or his perspective. There is accumulating evidence that having women in leadership roles or on the team contributes positively to overall functioning and productivity (more in ***Chapter 09: Managing Difference*** section). Several studies have found that women speak less frequently and also are much less likely to interrupt other speakers in team meetings than are men. If we remember that the intent of a team is to direct multiple perspectives on a problem, then it makes sense that teams in which there is more even participation are likely to be more creative and make more progress than teams in which participation is monopolized by a few people.

STRENGTHS BASED LEADERSHIP

Leaders of collaborative teams are in the enviable position of being able to draw on the greatest talents of each member. All it requires is that the leader(s) can recognize and exploit those strengths for the benefit of the team and its research project. Some leaders have a talent for identifying the strengths of others quickly. Other leaders may take longer and can use multiple ways to identify an individual's strengths and how they contribute best to a team. Perhaps the simplest and most straightforward method is to ask everyone to share what they think their own strengths are. Another approach is to take advantage of the *StrengthsFinder* book or other assessments available online (Rath 2007). The results of these can be discussed in the group setting enabling individuals to share what resonates or not about their individual assessment results as well as allowing feedback and observations from team members. When people are contributing their greatest strengths to a project, they are typically energized by the process. When people are asked to contribute in ways that drain and tire them, it can be difficult to sustain motivation for the effort.

THERE IS NO FORMULA FOR THE PERFECT LEADER

Characteristics that Contribute to Successful Team Leadership include:

- Self-awareness
- Other awareness
- Shared responsibility for success
- Accountability for issues and problems
- Mentoring others
- Managing up and across
- Creating a safe environment
- Having difficult conversations
- Speaking up, challenging ideas
- Fairness in decisions and actions
- Giving your best everyday
- Serving as a role model

Note to the Reader:

Leaders sometimes forget they are being watched closely. Others will model the behavior they see, not the words they hear.

Ask Yourself: Am I Ready to Lead a Research Team?

- Am I able to clearly and decisively communicate and share information with team members?
- Am I prepared to clearly articulate my vision to team members?
- Am I prepared to model a collaborative process and inspire team members to achieve our shared goal?
- Am I willing to support team members at all levels and assign roles and responsibilities?
- Am I willing to manage team members' expectations?
- Am I prepared to select team members who will thrive in the team's culture?

IT'S WORKING: CASE STUDY 4

Dr. Bello and colleagues had been sharing ideas for many months around a possible new project. Some preliminary data from one of the team members resulted in a lot of excitement. The group started to coalesce around what felt like a promising direction for a new research project at the intersection of several disciplines. As the team became more excited about the project and generated enough data to submit a grant application, Dr. Bello started integrating time into their meeting agendas to ensure that the dynamics of the team were working well. Dr. Bello had extremely strong self-awareness as a result of taking advantage of professional and leadership development opportunities at work. Dr. Bello was able to help the group develop trust, surface tensions early, and openly challenge and question research results. In addition, team members took time to create a research plan that outlined roles and responsibilities and talked about how they would hold each other accountable to the commitments each of them made.

IT'S NOT WORKING: CASE STUDY 5

Drs. Spark and Rey had just completed a manuscript and submitted it for publication. Paper writing had gone pretty smoothly with each of them writing their respective sections based on the work they performed and merging the content. They were quite enthusiastic about the results they combined from similar sample sets and decided they should continue working together. They set up a meeting and asked Drs. Tan and Gagnon to join them. As they started developing ideas and performing initial experiments over the following months, the group members seemed more focused on their individual efforts as opposed to that of the group. In addition, Dr. Tan was not performing the promised experiments, instead making excuses about other priorities. As commitment continued to wane, other group members also found it difficult to find time to complete their assignments. Soon, Dr. Tan stopped attending meetings all together. Dr. Gagnon followed suit. Data generated were either left unpublished or found their way into their individual publications.

ASK YOURSELF IF IT'S WORKING

When It's Working:

- Leaders understand their strengths and weaknesses as well as those of the team members.
- Leaders hold themselves and their groups accountable.
- Leaders can detect when there is tension and effectively intervene to resolve it at the earliest stage possible.
- Leaders create environments where people feel safe sharing ideas about the science as well as bringing up interpersonal issues related to the team.
- Leaders engage others to take on tasks where they are less skilled or competent.
- Leaders are fully supportive of the people around them succeeding and taking on leadership roles.
- Leaders are fully present both physically and when interacting with team members.

When It's Not Working:

- Leaders have little or no self-awareness and as a result also have little awareness of the dynamics that surround them.
- Environments of trust and psychological safety are not created.
- People are hesitant to share concerns about others' scientific data.
- Interpersonal conflicts are avoided or work arounds are created.
- Members are more likely to blame and make excuses than take responsibility or act with accountability.
- Members are too busy to meet regularly.
- When in meetings, members are often checking email or engage in side conversations.

Take Aways:

The leader…

- Is self- and other-aware.
- Ensures leadership and management functions for the team are fulfilled, and may call on others to contribute to those roles.
- Knows what motivates and energizes the team members and tries to align their strengths with the work that needs to be done.
- Welcomes the contributions of all team members.
- Delegates responsibility to the lowest levels possible.
- Is willing to handle conflict and encourage disagreement.
- Understands he/she is being watched and team members will model his/her behavior.

CHAPTER 04

Building a **Research Team**

Whether you are leading or participating on a research team, it is critical to understand what contributes to successful team functioning and what can negatively impact the development of a productive group. As science becomes ever more specialized, researchers increasingly need the support, input, and expertise of scientists from several research fields to move their efforts forward. Yet, bringing together individuals from various disciplines or specialties, and at different stages in their careers, is a task that requires forethought and care. After all, people from different disciplines often bring expectations, norms, and ways of thinking that are unique to their field. It is crucially important that collaborators agree on expectations at the earliest point of a project as possible and reconcile any conflicting views. If handled well, the process of integrating scientists from diverse backgrounds can result in the formation of a highly functioning group. If done indiscriminately, the team may not endure.

LAUNCHING A TEAM

You can build a research team from the top down (by leaders in their respective fields and/or organizations) or from the bottom up (by junior and senior scientists at the grassroots level). Both approaches can result in the development of highly effective teams.

A well-known example of the top-down formation of a highly successful research team was the one established by the World Health Organization (WHO) in 2003 to solve the spreading SARS (Severe Acute Respiratory Syndrome) pandemic. WHO brought together 11 researchers from 9 countries to identify the pathogen responsible for SARS deaths. Once organized, the team quickly embraced several key principles of effective teams—frequent communication about data, results, and next steps; processes to share data and clinical samples; and a shared commitment to a concrete goal. As a result, a mere month later, the team determined that a previously unrecognized coronavirus was the causative agent of SARS (Peiris, Lai et al. 2003).

Bottom-up teams form when scientists identify a common interest and come together to tackle a problem or achieve an agreed-upon goal. Examples of bottom-up teams and collaborations can be found across the biomedical sciences, from simple collaborations to highly complex and interactive research teams. People will often be drawn together by a common interest and will self-assemble to collaboratively address a challenging question. With leadership support for their scientific endeavors, self-assembled multidisciplinary efforts can be highly successful.

When interviewing potential new team members:

- Develop interview questions that require the candidate to articulate his or her interest and experience in working on a research team.
- Ask for examples of how the candidate has successfully contributed to a team in the past, what challenges he or she encountered, and how they were resolved
- When checking a candidate's references, inquire about his or her capacity to collaborate and function as a supportive member of a team.

IT'S WORKING: CASE STUDY 6

Most of Dr. Wu's team members applied for their positions, knowing from the beginning that they would be working as part of a collaborative research team. During interviews, Dr. Wu was clear in communicating each team member's expected roles and responsibilities, processes for sharing data and credit, as well as the team's overall vision and goals. She even provided them with a "Welcome to My Team" letter that outlined what she expected and what could be expected of her in return. She then asked about each applicant's objectives and commitment to team science to determine compatibility. If the person indicated that he or she was more comfortable working as a solo investigator than as part of a team, Dr. Wu suggested that another laboratory or project might be a better fit. "It's a personality thing," she said. "You can really tell a lot about what kind of team member someone will be by asking the right questions and being open to their answers."

IT'S NOT WORKING: CASE STUDY 7

Dr. Anderson had come to the conclusion that several of his junior team members joined his team primarily because of the research funding he was able to offer. Once these team members had the resources they needed, they stopped attending team meetings and withdrew from interactions with members of the team. Other team members, especially senior researchers in leadership roles, continued participating in the team effort, but failed to share data openly or discuss research results. Team members often did not interact directly and were openly resistant to considering alternative ideas or perspectives offered by other team members. "On paper, we are a research team, but I get the feeling many team members are focusing on their own research," he said. "I guess they do not share my collaborative spirit."

Many lessons can be learned from these case studies and the interviews we conducted with scientists and researchers who are part of interdisciplinary scientific teams at NIH. In the world of biomedical science, tremendous value is placed on individual accomplishment; both the team leader and the participants need to be mindful of the balance between individual professional growth and the achievement of a scientific goal by the group. In the pages to follow, you will learn more about the importance of creating this balance, including strategies to carve out leadership roles for team members and to define success metrics for reviews and other evaluations to assure recognition and reward (see the sections ***How to Give Recognition and Share Credit*** and ***Recognition, Review, and Reward*** in ***Chapter 08: Credit and Sharing***).

Interviewing New Team Members

Interviewing is a key part of bringing new talent into an existing team or building a team from scratch. In addition to reviewing a candidate's CV, letters of reference, and research statement, it is informative to utilize different types of questions to be sure to gain insight into the individual's values and past performance as well as how he or she is likely to deal with everyday challenges. When conducting interviews, be sure to ask the potential team member to expand on his or her answers and give specific examples. In addition to listening attentively, watch for body language and visual cues that may provide additional insight.

Values-Based Interview Questions

Values-based interview questions can help you learn more about whether a potential team member's values are consistent with the principles that guide your team. The first step is to identify the characteristics of an ideal candidate. Next, develop interview questions that will help determine if the candidate has those values or characteristics. Sample values-based interview questions include:

- Describe three things you particularly liked about your past job(s). What were the key ingredients that made those situations so agreeable?
- What would you do if you realized you had made a mistake in your work?
- In working on a research team, you may encounter some people who are more challenging to work with than others. Describe your approach to working collaboratively.

Performance-Based Interview Questions

Performance-based interview questions can help you determine whether the candidate is capable of performing the job at stake (Hale 2002, Adler 2007). While a person's résumé says that he or she "led a team that successfully identified a gene that modifies disease susceptibility," performance-based questions encourage the candidate to describe how this achievement was accomplished. In addition, ask the candidate to speculate on how he or she would approach a particular situation. For example, you might say: "The successful candidate in this position will be responsible for developing a policy for data sharing and communicating research results for our laboratory. How might you approach such a task?" Deeper questions such as these can help you determine how an individual may actually perform in the position and provide insights as to the candidate's potential for success on the team. Sample performance-based interview questions include:

- Describe a project that you led that had a tight deadline and its outcome.
- One project of great importance to the team is [explain project]. How would you approach it?
- Tell me about a time when you have led a team and a time when you have been a participant on a team.

Behavioral-Based Interview Questions

Behavioral-based interview questions can help you understand how a candidate may behave or react under certain circumstances and what skills he or she would bring to specific situations (Fitzwater 2000). Behavioral interviews are based on the premise that you will have a better idea of how an individual may function on your team if there is past behavior to assess. It is usually most helpful to present a specific scenario and then ask the potential team member to describe how he or she would behave in the situation at hand. After the question is answered, you could then discuss the impact of his or her behavior. Sample behavior-based interview questions include:

- There is considerable disagreement within your team about what should be the next set of studies in your project. How would you handle this situation?
- Your team has adopted a new policy that you think is overly restrictive. How would you respond?
- A fellow team member tells you he is upset; he says you did not take his idea for a new research direction under serious consideration. How would you respond?

SETTING EXPECTATIONS

There are many ways to go about building a research team—some more effective than others. If you are charged with or are interested in building a research team, there are several considerations to keep in mind:

- Make sure each person understands his or her roles, responsibilities, and contributions to the team's goals.
- Establish expectations for working together; as a participant, understand your contribution to the end goal.
- Recognize that discussing team goals openly and honestly will be a dynamic process and will evolve over time.
- Be prepared for disagreements and even conflicts, especially in the early stages of team formation (see box ***Understanding Your Team's Evolution*** page 46).

- Agree on processes for sharing data, establishing and sharing credit, and managing authorship at the start and over the course of the project.
- Develop a process to regularly consider new scientific perspectives and ideas related to the research.

Several tools exist for setting expectations including:

- Collaborative agreements
- Welcome letters
- Institutional Agreements

A collaborative agreement can serve several purposes. First, it can explicitly and precisely state the goals of the project and describe how each of the collaborators will contribute to the project. Second, it can delineate how to handle communications, data sharing, differences of opinion, and other project management process issues. Third, it can address the administrative aspects of the collaboration—finances, accountability, staffing, etc. And finally, in the current scientific environment, it also can provide an opportunity to reflect on potential conflicts of interest.

The Welcome to My Team Letter can provide a scaffold for building deeper trust. It includes description of what team participants can expect of the team leader(s) and each other, what the leader(s) expect of the members, and can describe the process that will be followed if there is a disagreement. Team Letters can be written by the leader and shared with the team or they can be written collaboratively among team members. Ideally the letter would be reviewed at some regular interval to keep it up to date (Bennett, Maraia et al. 2014).

Institutional agreements such as offer letter, pre-tenure agreements, joint-appointments documents as well as promotion and tenure criteria can all play a role in the dynamic between individuals and teams relative to the larger organization. (More in ***Chapter 12: Navigating and Leveraging Networks and Systems***).

Documents for expectation setting can only provide the framework within which the collaboration will occur. Implementing the agreement requires translating these aspirations into practice, and this requires structuring the working relationships in a way that engenders trust among the collaborators (see ***Chapter 05: Trust***). Templates for developing these agreement types are located in the ***Appendix.***

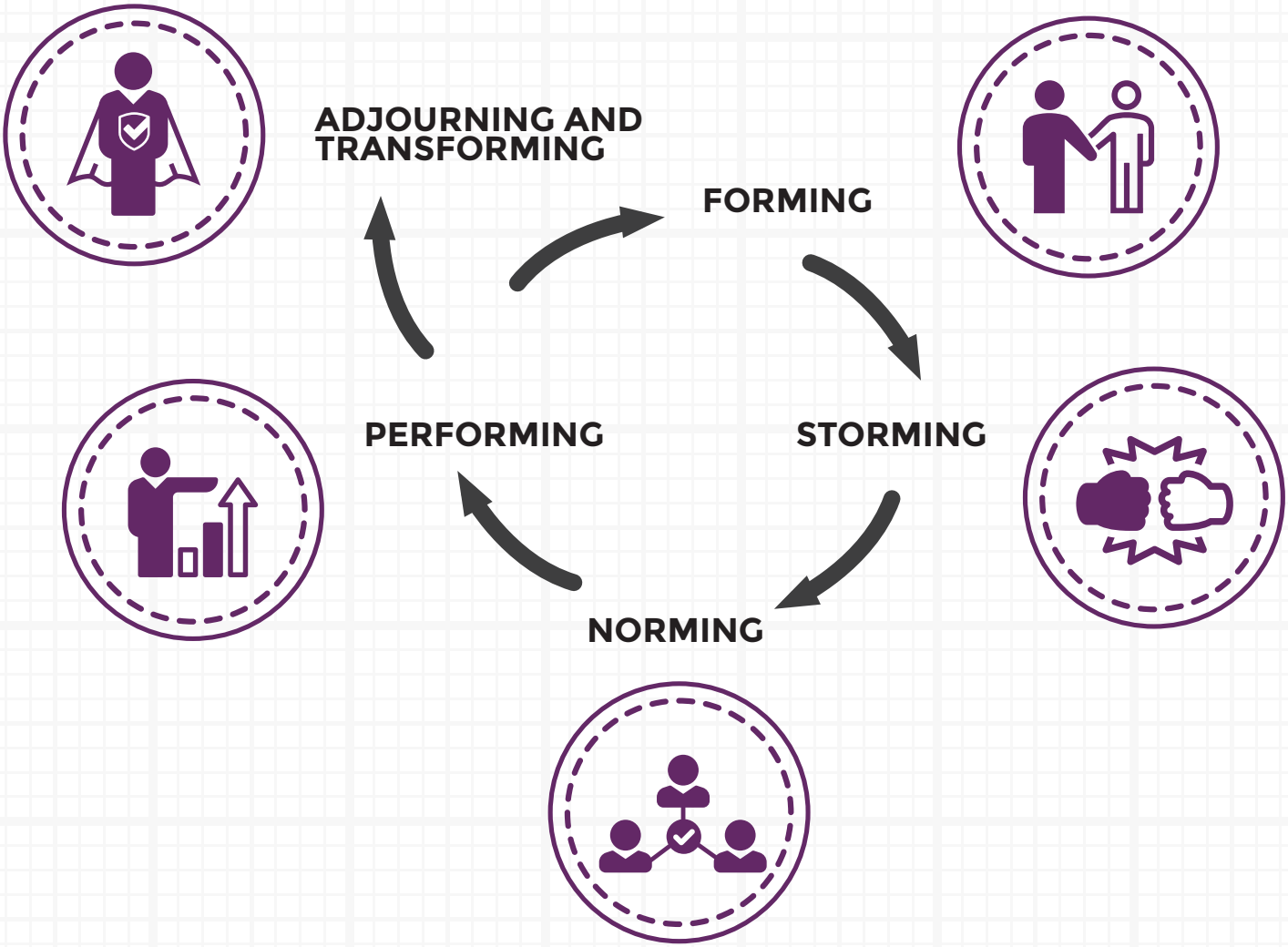
Understanding Your Team's Evolution

The Model of Group Development published by Bruce Tuckman in 1965 theorizes that research teams and other groups form and develop in critical stages to achieve their highest potential (Tuckman 1965, Tuckman and Jensen 1977). Over 50 years later, Tuckman's model is still cited and used within leadership courses and by organizational development experts. You may find it extremely helpful to note these stages, which include the four originally described by Tuckman and a fifth he added years later, as your team evolves.

1. **Forming:** The team is established using either a top-down or bottom-up approach.
2. **Storming:** Team members establish roles and responsibilities. This process may trigger disagreements or "turf battles" and reveal a reluctance to appreciate the perspectives and contributions of people from different disciplines or training. However, if collegial disagreement is supported and premature pressure to consensus is resisted, people will begin to open up to one another.
3. **Norming:** Team members begin to work together effectively and efficiently, start to develop trust and comfort with one another, and learn they can rely on each other.
4. **Performing:** The team works together seamlessly, focuses on a shared goal, and efficiently resolves issues or problems that emerge.
5. **Adjourning or Transforming:** Two things can happen when a team accomplishes its initial goal(s):
   - Teams may come to a natural end. The team's dissolution should be celebrated and the accomplishments recognized and rewarded.
   - The team may take on a new project with a new goal, applying its ability to work together to solve a new problem.

MODEL OF TEAM DEVELOPMENT

Bruce Tuckman, 1965, 1977



ASK YOURSELF IF IT'S WORKING

When It's Working:

- Team leaders recruit members whose strengths include being part of a research team.
- Team members reach out to leaders who can guide their professional growth and development in the context of the team.
- During interviews, candidates and potential collaborators are made aware of the team's culture and the expectations for working together and sharing data.
- If a person doesn't fit with the team, it is addressed directly and if there is no resolution, the individual either leaves of his/her own accord or is encouraged to find another project.
- Team members take advantage of tools such as Collaborative Agreements and Welcome Letters (Bennett, Maraia et al. 2014).

When It's Not Working:

- Members prioritize their own objectives before the overall team goal.
- Members lack a clear understanding of the overall vision for the team.
- The leader fails to provide clarity around roles, responsibilities, and expectations for each of the team members.
- Individual team members begin working for their own gain at the expense of the team.
- Working through scientific, experimental, or personal challenges openly and honestly becomes difficult and fraught with conflict.

Take Aways:

- Whether you are building a team or considering becoming part of a team, ask questions of potential team participants and be certain you understand their expectations of team functioning.
- Understand that teams evolve over time and go through periods of “storming” before reaching peak performance.
- Make sure team members’ roles and responsibilities are clear to everyone involved.
- Agree up front on how to achieve open and honest communication, share data, and evaluate scientific achievement and progress.
- As a group, agree on expectations, and how to respond if they are not met.

CHAPTER 05

Trust

Let us be honest: Working with others means relying on them, and relying on others always entails some level of risk. Taking that risk requires some level of trust. It is almost impossible to imagine a successful collaboration without trust. A lack of or the erosion of trust almost always leads to the collapse of collaboration.

Trust is not a simple, one-dimensional variable. It is based on an assessment we make of another person's or group's abilities, honesty, reliability, and intentions. To experience trust, research team members must have confidence in the abilities of their colleagues to do good work, do it on schedule, produce reliable results, and openly share and discuss interpretations of data collected. Team members must also feel confident that their colleagues are committed to the collaboration, that they care about the interests and needs of others on the team, and that they are invested in the success of the team as a whole. Finally, trust requires faith in the candor of one's colleagues—the belief that they will be truthful in their communications and in the conduct of their scientific research.

HOW TO FOSTER TRUST AMONG TEAM MEMBERS

- Hold weekly data meetings or case conferences—be sure that all team members have the opportunity to present data and receive feedback.
- Model and teach team members how to give feedback that is both complimentary and constructive.
- Encourage scientific debate and exchange—challenge ideas with the goal of making a decision or reaching a conclusion based on scientific information.
- Create an environment where every team member feels safe to share ideas and ask questions of other team members.
- Hold team members accountable for following through on their commitments.
- Encourage the sharing of knowledge and cross-training whenever practical among group members.
- Develop a process to handle disagreements over clinical issues or science or other laboratory issues, before conflict arises.

TYPES OF TRUST

While we often think of trust as deeply personal, that is not always the case. Driving on a highway, for instance, entails some degree of trust in the other drivers but not in a way that is personal. This type of trust is known as "calculus-based" trust—it is situation-specific and is contingent upon the assumption that people will conform to established norms or procedures. In other words, people do what they are supposed to do because the rewards outweigh the penalties and ensure a reasonable degree of reliability.

When someone says "trust," we typically think of "identification-based" trust. This kind of trust is built around a sense of compatibility of goals or values or an intellectual or emotional connection. With this sort of trust, each party is confident that the shared interests or strong connection mean they can act on behalf of each other. It is this trust that can endure and provide the platform for sustained collaboration and interactions. It is also critical for providing the foundation for effective communication, successful team building, and the sharing of data and credit (see ***Chapter 04: Building a Research Team***; see ***Chapter 07: Communication*** and ***Chapter 08: Credit and Sharing***).

Two other types of trust are frequently seen in the scientific setting: competence-based trust and swift trust. If you have ever known a scientific colleague with "golden hands" who can help you get any protocol or procedure working, you have experienced a relationship built on competence-based trust. You may not know the individual well, but you know you can count on her/him to help you get your method working.

When groups are formed quickly and for a short duration to accomplish a task, that is called teaming. These short-lived teams can be vital for solving a problem or overcoming a barrier yet are not meant to endure. Teaming relies on swift trust. In this situation, roles are defined, the goal is clear, deadlines are defined, and everyone gives each team member the benefit of the doubt, proceeding as if trust exists.

There are often connections between the forms of trust. For example, teams can start working together using calculus-based trust, using Collaborative Agreements or Welcome Letters, as the foundation. From here, trust can grow and expand. Scientists, for whom work is almost always more than just work, can develop deep relationships that are personal though not intimate.

Four Forms of Trust

- **Calculus-based trust** – built on calculations of the relative rewards for trusting or losses for not trusting
- **Identity-based trust** – built on an assumption of perceived compatibility of values, common goals, emotional/intellectual connection
- **Competence-based trust** – built on the confidence in people's skills and abilities, allowing them to make decisions and train others
- **Swift Trust** – built on giving all team members the benefit of the doubt that their intentions are good with clear goals and limited time

IT'S WORKING: CASE STUDY 8

Team members on an interdisciplinary, multi-institutional research project established a publication and data analysis committee. This committee was charged with ensuring the team adhered to the International Committee of Medical Journal Editors (ICMJE) fair authorship guidelines. It also provided a forum in which decisions on authorship and related issues were openly made by an assembly supported by all investigators. This committee was also empowered to review and approve data analysis plans and study-wide papers. The processes for submission were clearly defined by the committee. Over the course of several years, all issues that came before the committee were handled satisfactorily.

IT'S NOT WORKING: CASE STUDY 9

Dr. Salazar and Dr. Buchanan, two scientists from different institutions, were involved in a long- term collaboration. The two PIs did not develop a partnership agreement in advance and there were no explicitly agreed-upon guidelines for determining authorship. Dr. Salazar published a paper in a high-visibility journal using data that had been generated by postdocs in her laboratory as well as by postdocs in Dr. Buchanan's laboratory. Although Dr. Salazar acknowledged Dr. Buchanan's lab's contribution in the paper, none of the researchers from that laboratory were included as authors. Dr. Buchanan disagreed with the way the data from her laboratory were presented in the published paper and asked her to retract it. When Dr. Salazar failed to address the concerns raised, Dr. Buchanan contacted senior-level scientists in Dr. Salazar's organization to air her complaints. These leaders initiated a formal investigation into the charges. By this time, the two investigators no longer trusted one another and their collaboration came to a halt.

PSYCHOLOGICAL SAFETY

Psychological safety has a reciprocal relationship with trust, another key element in successful team functioning. Each supports the other. If people are reluctant to speak up and interact with their colleagues it will be difficult to develop trust with them and working well together without trust is almost impossible. For any team to function, its members need to feel free to speak up, share ideas, ask questions, and express disagreement. Without that, there is no team, just an assemblage of people working in parallel. The tragedy of the Columbia space shuttle is now the classic example of what can happen in an organizational climate where speaking out is not okay and people fear the consequences if they do. Amy Edmondson, who studied for over two years the 2003 explosion of the space shuttle, has identified four major "risks to image" that her research shows inhibit people from speaking up as shown in the table below (Bohmer, C. et al. 2004; see also *The Space Shuttle Columbia's Final Mission:* hbswk.hbs.edu/item/the-space-shuttle-columbia-s-final-mission).

Being Seen as…	Results in reluctance to…
Ignorant	…ask questions or seek information
Incompetent	…admit mistakes or ask for help
Negative	…disagree, express concerns, or offer criticism
Disruptive	…seek feedback or interrupt flow of work

It is important for team members to be conscious of the degree of psychological safety in their teams. Without psychological safety, teams cannot identify problems and errors, clarify misunderstandings, or work together toward team goals. Leaders in particular play a major role in creating, modeling, and supporting psychological safety within a team. Among the steps leaders can take to create the conditions for psychological safety are:

- Invite participation (and mean it)
- Admit mistakes and show fallibility
- Acknowledge gaps in knowledge—admit to not knowing something
- Be available to team members
- Be fair when holding people accountable
- Clearly convey what is acceptable

ASK YOURSELF IF IT'S WORKING

When It's Working:

- Trust provides a foundation for the team's success.
- There is frequently open communication, discussion, and even disagreement in a safe environment.
- The team encourages sharing opinions and is able to achieve consensus when appropriate.
- Data sharing is common and discussion of next steps is collegial and cooperative.
- Team members teach each other and support each other's work.
- Team members show confidence in each other's motives and commitment to the group's mission.

When It's Not Working:

- Team members remain focused on themselves and their own efforts.
- The group cannot openly discuss scientific projects or issues involving team dynamics out of fear.
- Individuals are suspicious of others' motives and are less inclined to share data or other information that might help others advance their efforts.
- The collective discusses issues only at the most superficial level.
- Team members are more likely to see others in the group as competitors rather than as collaborators.
- Team meetings are regularly followed by smaller meetings of sub-groups where discussion is more candid and free-flowing and people raise issues they were reluctant to discuss in the larger group.

Take Aways:

- Building and maintaining trust takes work; it is risky to place too much faith just in good interpersonal chemistry.
- There cannot be trust if collaborators are not explicit about what they expect from each other.
- Scientists need to attend to the quality of scientific and relational communications and interactions within their laboratories and among their collaborations.
- A written collaborative agreement can provide guidelines and processes for addressing every major issue that might arise in a collaboration.
- Trust is fragile—handle with care. If someone's trustworthiness becomes an issue it is addressed promptly.

CHAPTER 06

Vision

We have more choices of how to spend our time than we can accommodate. Researchers are pulled in many different directions and challenged to prioritize how they will spend their time. If the vision for a collaborative project is not compelling, it will be difficult for people to pull their attention away from something perceived as more pressing.

A strong and captivating vision serves as a magnet to attract people to participate and helps create the highly functioning team's foundation. It is not uncommon for team members to have a slightly different sense of the team's vision depending on their roles and responsibilities within the team or their stage of career development. What is most important is that each person understands the overall vision and goals of the project and how they contribute to the collective effort.

HOW TO DEVELOP A SHARED VISION

- Write a vision statement for your laboratory, collaboration, or team.
- Ensure that all team members can describe the team's goal, or the "big picture."
- Encourage all team members to articulate their own research goals and how these goals relate to the "big picture."
- Discuss each team member's accomplishments and challenges and how these relate to the team's overall mission.
- Instill in team members a sense of ownership of their contribution to the team's goals.
- Encourage team members to accept responsibility and be accountable for their accomplishments and failures—without blaming.

Team members at a very junior level of their career, such as high school students, may have a thorough understanding of their own project and a general understanding of the overall vision for the project. Yet they might not have the depth of knowledge to understand the intricacies of all the different components that come together to form the entire effort. As individuals advance in their scientific training and their level of responsibility increases, they tend to develop a greater

depth and breadth of overall understanding. They become more and more aware of what each team member is doing and how those concurrent efforts combine to support the mission of the team. Beyond this understanding, though, a hallmark of successful teams is that all members can articulate the feeling of being part of a larger whole and indicate that the work they are doing is helping to successfully achieve the vision.

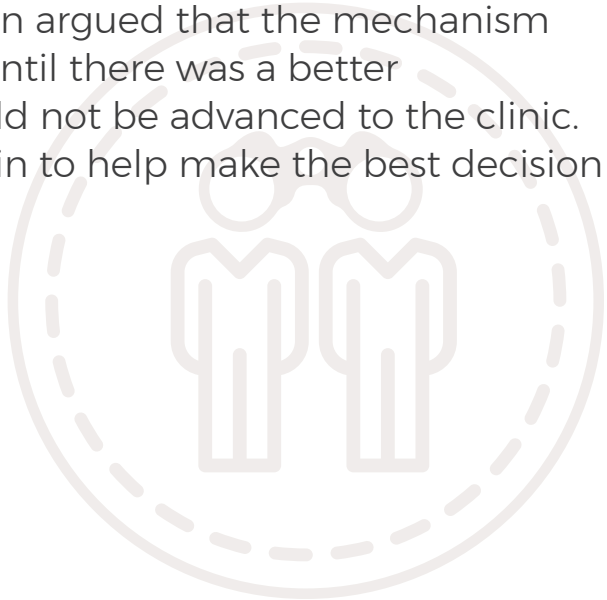
Our research uncovered the risks that emerge when team members do not share a common vision. Group cohesion is strained when individuals cannot articulate the overall vision for the project or describe how their individual efforts contribute to the larger effort. A researcher may express less commitment to an overarching effort than to his/her individual success. Without shared vision, group members are, in effect, not working on the same project. For this reason, they do not see themselves as being part of a "team." Consequently, they may show evidence of low trust, lack of willingness to share data with other group members, desire to keep all credit to themselves, and poor communication with team members. In extreme cases, they may even subvert one another's work. Needless to say, these elements can compromise the ability of a team to effectively and successfully function.

IT'S WORKING: CASE STUDY 10

Dr. Henry recently joined a research team. Dr. Torres, the team leader, has set clear and tangible short- and long-term scientific goals for her team. Dr. Henry and his fellow team members are able to articulate the goals and understand how their research results and other contributions will help achieve the team's overall vision. The team frequently discusses where it is going and how it wants to get there. In fact, once a quarter, Dr. Torres convenes the entire team to discuss the team's progress toward its goals and whether adjustments need to be made. At these meetings, each team member again articulates his or her research goals and the team discusses how the pieces fit into the bigger picture.

IT'S NOT WORKING: CASE STUDY 11

A PI, Dr. Cohen, and a branch chief, Dr. Millstrom, appeared to have a shared vision for the collaborative project in which they were involved. However, when it came to the implementation phase, it became clear they did not agree on how to achieve the vision. They were at odds about when to move the findings from the laboratory into the clinical setting. Dr. Millstrom argued that the preclinical results were sufficient. Dr. Cohen argued that the mechanism behind the preclinical data was unclear and until there was a better understanding of the results, the project should not be advanced to the clinic. Mediators and experts needed to be brought in to help make the best decision for the research project.



ASK YOURSELF IF IT'S WORKING

When It's Working:

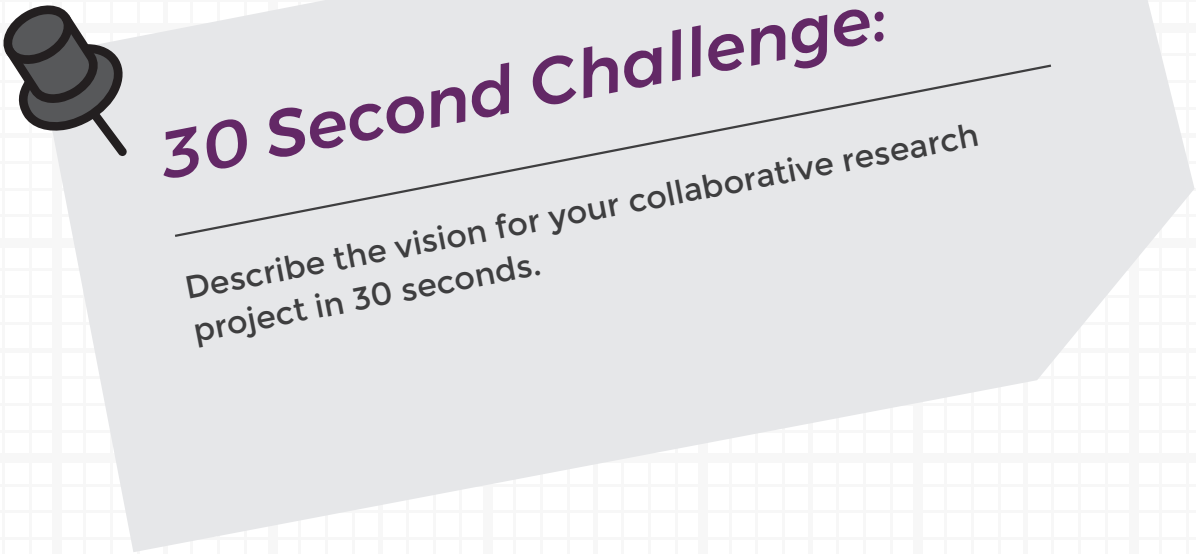
- Each team member knows what goals he or she is working toward and how they relate to the team's overall goals.
- Team members share a sense of purpose and ownership.
- There is a high level of commitment, responsibility, and accountability among all team members.
- Team members support—rather than compete with—one another.
- In achieving the shared vision, members are just as willing to share credit and criticism.
- There is a tendency for team members to stay at work even after the official work day has ended.

When It's Not Working:

- Team members have difficulty understanding how their individual goals relate to the big picture.
- Team members are focused on their own individual achievements above the overall focus of the group.
- Team members tend to compete with—rather than support—one another.
- Cohesiveness among team members is weak; individuals are focused on personal projects, sometimes at the expense of another scientist's work.
- Team members find it difficult to share data and credit, leading to conflict and tension within the group as a whole.
- There is a tendency for people to leave work early or as quickly as possible at the end of the official work day.

Take Aways:

- Whether you are leading or participating on a research team, you must be able to articulate and commit to the team's overall goals.
- Each team member's individual research goals should be clearly stated and their importance should be recognized in the context of the team's effort.
- A team's vision is dynamic and will change over time; regularly review and revise (as needed) the team's vision statement and that of each team member.



SWOT ANALYSIS

A SWOT (**S**trengths, **W**eaknessess, **O**pportunities, **T**hreats) analysis is a process for thinking strategically about a project and identify paths toward achieving the projects goals. It entails analyzing strengths and weakness within the team and opportunities and threats in the larger environment. It could be an instructive exercise for a team to have each member fill in this matrix and then for their entries to be posted and compared. To do so allows the team to become aware of differences in individual perceptions and experiences of the collaborative project.

Internal	**STRENGTHS**	**WEAKNESSES**
External	**OPPORTUNITIES**	**THREATS**

CHAPTER 07

Communication

One common communication challenge faced by interdisciplinary teams who begin a project together includes trying to understand what each other is saying. Different scientific disciplines have their own vocabularies, jargon, and phrasing that is not necessarily understood by others. Even more, it is not uncommon for disciplines to use words that might have one meaning in everyday plain language but another in the context of the science they are conducting. It takes time, patience, and even translation for groups to learn each other's languages or even recognize that the words they are using mean different things. When this becomes clear, you may find it helpful to stop action and take the time to make sure everyone has the needed vocabulary and understanding required to contribute fully to the discussions at hand.

Communicating with your team about science—everything from scientific discourse to the discussion of data and the implications of research results—may be an easier topic for some people to handle than others. As you work through this module, you will see that much of what we have learned about success in communicating about science relies upon trust (see ***Chapter 05: Trust***).

> Researchers of interdisciplinary teams have identified several common problems... in such collaborations: differences in epistemology and method, different ways of formulating research questions, and differences in communication styles between members... During meetings goals are defined, knowledge is shared, and new common perceptions of the problems at hand are developed. It is through the sequential meeting process that this group identifies and establishes a common "working" set of definitions, concepts, goals and knowledge practices (From Monteiro and Keating 2009).

HOW TO COMMUNICATE ABOUT SCIENCE

Among the scientific teams we studied and have worked with, those that were highly integrated had established a concrete schedule of activities that guided the work of the group. In general, they held weekly laboratory meetings to talk about data and results and had regular journal club meetings where relevant papers, methodologies, and/or scientific approaches were discussed; in addition, each group member presented a formal seminar at least once per year. Differences of opinion or alternative interpretations of presented data were addressed from a scientific perspective rather than considered personal affronts, and all members of the team, regardless of their career level, were invited and expected to contribute to all discussions. In other words, everyone had a voice. The groups intentionally revisited their goals and objectives on a regular basis and redefined them as needed to align with the most recent data and results. Strong communication about the science provided for a solid platform on which to move the science forward and clearly articulate the mission, goals, and objectives of the team.

Supporting Idea Generation and Creativity

- Embrace the notion that differing opinions may hold the seeds to creativity and important new ideas.
- Expect team members grounded in different disciplines to have different perspectives on scientific issues.
- Conduct regular meetings in which team members take turns presenting data and providing feedback.
- Ensure that all team members feel able to participate in discussions about data, methods, results, and other aspects of the science, as well as various issues affecting the group.
- Convene a journal club or other forum to discuss current topics and methodologies.
- Provide an environment and opportunities for team members to talk informally about their work.

Tending to Team Dynamics to Enhance Communication

- Establish ground rules for how people are expected to communicate with each other during meetings.
- Develop an expectation that data and results will be shared with all team members as well as procedures for doing so.
- Respectfully address and resolve debates over science or scientific results through literature reviews, experimentation, outside expert opinion, and other relevant methods.
- Help people translate when there are differences in concepts, methodologies, and frameworks.
- When disagreeing, be sure to disagree with the idea, not the person.
- Support the contribution of team members at all levels of seniority.

FRAMING: THE ART OF PERSUASION

As a team leader or team member, you will have to present projects, initiatives, requests, issues, or ideas to key stakeholders (leadership, potential collaborators, reviewers, etc.), and it is important to frame your presentation towards your audience. As Jay A. Conger writes in his book *The Necessary Art of Persuasion*, "There is just as much strategy in how you present your position as in the position itself. In fact, I'd say the strategy of presentation is the more critical. (Conger 2008)"

What is persuasion? It is the ability to present an issue, idea, or request in a convincing manner that leads stakeholders to willingly support it and act upon it.

According to Jay A. Conger, we should all be careful with the persuasion exercise most of us perform every day in our own heads. This is mainly a self-persuasion exercise and it is not intended to be framed towards any stakeholder's perspective. Instead, we all should use a more rational approach based on Conger's 4 C's strategy: **C**redibility, **C**ommon Ground, **C**ompelling Positions, and **C**onnection.

Credibility: First, you need to establish your credibility either through your expertise (knowledge/track record), your relationship (history/quality/trustworthiness/shared values), or your body language (voice tone/interaction/eye contact). You can also use credibility substitutes such as experts, supporting evidence, pilot study, ambassador, or network.

FRAMING: THE ART OF PERSUASION CONTINUES ON PAGE 68 >>

FRAMING: THE ART OF PERSUASION CONT.

Common Ground: Second, you need to frame your presentation to your stakeholder's view of the idea or issue, speaking about shared benefits, values, and beliefs. Custom frames need to be used for each different stakeholder.

Compelling Positions: Third, build your arguments to support your frame. Choose evidence and data from your stakeholders' perspectives and use vivid details to make them compelling. Do not hesitate to tackle the killer questions up front.

Connection: Finally, appeal to your stakeholders' identity and address their emotion. Support your solution with stories, values, illustrations with emotional appeal. Describe how individuals will be impacted personally.

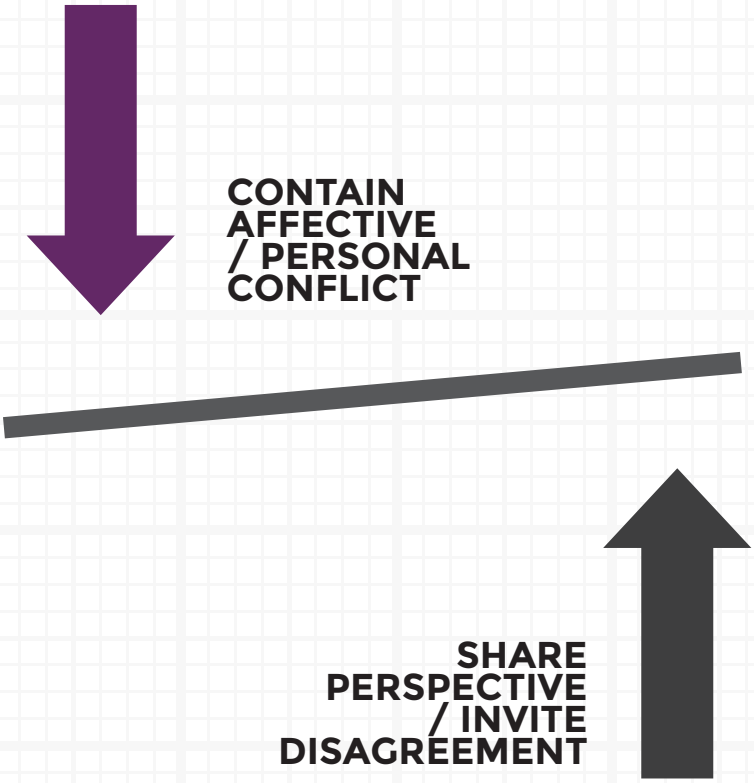
PROMOTING DISAGREEMENT

We find it useful to differentiate between (scientific) disagreement and (interpersonal) conflict. The paradoxical task of research teams is that they must become a place where, simultaneously, disagreement is freely expressed and personal conflict is contained and managed. Science thrives on disagreement; it is the motivator for scientific progress. Interpersonal conflict is an inevitable part of human interaction and, if not managed well, can be tremendously destructive. Of course, scientific disagreements sometimes segue into personal conflicts, especially when scientific disagreements become personalized. That is why it helps enormously to de-personalize scientific disagreements.

At the outset of any collaboration, a scientific team should decide how its members will address both scientific disagreements and interpersonal conflicts. Whereas interpersonal conflict can disrupt the effective working of a team, scientific disagreement, if handled properly, will not threaten the working relationship. However, it is helpful if a team agrees to structure regular opportunities for communication and establish shared attitudes and norms regarding both conflict and disagreement (See ***Chapter 10: Conflict Is Normal***). Teams can put aside time in which relevant scientific issues are discussed in a format where the only goal is to better understand the different conceptions and positions of the discussants.

Scientific disagreements are different from those in other areas—such as politics—which are generally addressed or "settled" by debates during which each side attempts to win by proving the other wrong. In debates, the initial positions of opposing parties remain fixed and one or the other side is declared a winner. Winning a debate usually means that the winning party made better arguments for the position they argued. In science, the process of addressing disagreement is more important than the initial positions in the disagreement. Often the initial positions are changed by the very process of dialogue.

PRODUCTIVE COLLISION



A line of scientific inquiry can begin with disagreement; the disagreement is then the basis for hypothesis formation and the first step towards a fact-based exploration for fundamental understanding. Although science can be incredibly competitive, it is not meant to be guided by either a primary concern for preserving relationships or a desire to win the argument regardless of the relevant facts. The Nobel Prize-winning behavioral scientist Daniel Kahneman has actually developed and employed a methodology of *adversarial collaboration* that attempts to exploit the strengths of both dialogue and debate and also elevates science above personal rivalry (Mellers, Hertwig et al. 2001). When we look at it from the broadest perspective, science is a form of adversarial collaboration in which people with competing perspectives work toward the solution of shared problems and puzzles.

IT'S WORKING: CASE STUDY 12

Dr. Andrews, a tenured scientist, was asked to join a scientific research team that was formed after a grassroots effort met early success and gained the favor of the Institute director. Her expertise in statistics would fill a gap for the research team, which was preparing to initiate a new clinical trial. The team leader explained to Dr. Andrews that the team was highly integrated and that they attributed the quick pace of the research progress to regular meetings at which results and next steps were discussed. When Dr. Andrews agreed to join the team, she received the meeting schedule, which included both data-sharing and strategic sessions; she then revised her own schedule to accommodate the new commitments. While attending these new meetings meant Dr. Andrews needed to resign from a committee on which she was proud to serve, she understood that a commitment to this new group was among her highest priorities. She quickly became accustomed to very dynamic group meetings during which everyone participated and challenged the presenters. When her turn came, she welcomed the discussion around her analyses and ideas, which enhanced her contributions to the ongoing experimental design of the protocol.

IT'S NOT WORKING: CASE STUDY 13

Dr. Polcyzk's branch conducts monthly meetings to discuss experimental data, interpretations, and next research steps. The meetings are largely perfunctory in nature. It is expected that they will occur, but minimal effort or enthusiasm is invested. At these meetings, the presenter is rarely asked to clarify his or her data and is seldom asked questions or for more information; the discussion is brief and everyone is eager to get back to his or her own work. When questions are asked, the presenter is usually defensive and guarded in what he or she will share with the broader group. There are rarely questions that challenge a presenter's interpretation of data.

ASK YOURSELF IF IT'S WORKING

When It's Working:

- Team members develop a common language for the project, eliminate or clearly define discipline-specific jargon, and translate across disciplines.
- Open discussion, differing opinions, and constructive criticism are encouraged and lead to healthy scientific dialogue.
- Team members become interested in learning more about the work of other team members from different disciplines.
- Over time, team members have the capacity to integrate the perspectives of others into their thinking and into hypothesis generation.
- The team works on projects in which everyone can see a path to clinical or scientific application.
- Interpersonal conflict is dealt with and addressed early before relationships are damaged.

When It's Not Working:

- Team members fear sharing an idea or challenging a result could damage their image or reputation.
- There are "turf wars" and other indicators that individuals are defensive and/or hoarding data, reagents, or other resources.
- There is less focus on the science and more on the personal aspects of the team's interactions.
- Separate "factions" emerge within the team, establishing artificial barriers to scientific discussion; the team may engage in "unhealthy agreement" to avoid conflict.
- Members approach scientific discussions as debates and may become combative or avoid discussion altogether.
- Group meetings feel more like debates than opportunities for dialogue.

Take Aways:

- Expect that all group members will participate in laboratory meetings, journal clubs, and other scientific discussion that facilitates the direction of the research project.
- Establish an infrastructure that guides behavior, helps the team become comfortable having dynamic scientific discussions and debates, and leads to strong collaborative relationships.
- Learn how and encourage others to disagree productively about the science as a component of professional growth and development.
- Remember that open scientific communication and consideration of new ideas and perspectives can result in more rapid achievement of accomplishments and take research into new, previously unconsidered directions.

Debate, Discussion, Dialogue

	Debate	Discussion	Dialogue
Communication	In debate, two sides oppose each other and attempt to prove each other wrong. Forceful assertion of one's position. Debate creates closed-minded attitude.	Exchange of information, opinions, experiences Little attention to identity, power, and status. Discussion tends to contribute to the formation of an abstract notion of community.	In dialogue, two or more sides work together toward common understanding. Understanding based on appreciation of differences and personal experience.
Self-Orientation	Debate defends one's own position as the best solution and excludes other solutions. Precludes revealing one's assumptions.	In discussion, one of the primary goals is to clarify and understand the issue, assuming that all are working with a stable reality. Orientation toward being right.	In dialogue, one submits one's best thinking, knowing that other peoples' reactions will help improve it rather than destroy it. In dialogue people reveal assumptions and personal values.
Other-Orientation	In debate, one looks for glaring differences in opinion. In debate, one listens to find flaws and weaknesses in the other position. Aim is to critique and defeat the other.	In discussion, one listens primarily to be able to insert one's own perspective. Little regard for participation of others.	In dialogue, one listens to the other side(s) in order to understand, find meaning and points of connection. One searches for strengths in the other positions. Dialogue oriented toward modifying one's perspective.

COMPARING DEBATE, DISCUSSION, DIALOGUE CONTINUES ON PAGE 76>>

Debate, Discussion, Dialogue

	Debate	Discussion	Dialogue
Emotions	In debate, one is not concerned with the feelings or emotions of the other. In debate, one does not consider how the debate will affect relationship with the other.	In discussion, emotional responses may be present but may be unwelcome. Strong focus on content rather than affect.	In dialogue, emotions help to deepen the understanding of personal and group relationship issues.
End State	In debate, winning is the goal.	In discussion, the more perspectives voiced, the better.	In dialogue, finding common ground is the goal.

Compiled and adapted by Ratnesh Nagda, Patricia Gurin, Jaclyn Rodriguez & Kelly Maxwell (2008), based on "Differentiating Dialogue from Discussion" a handout developed by Diana Kardia and Todd Sevig (1997) for the Program on Intergroup Relations, Conflict and Community (IGRC), University of Michigan; and, "Comparing Dialogue and Debate," a paper prepared by Shelley Berman, based on discussions of the Dialogue Group of the Boston Chapter of Educators for Social Responsibility (ESR). Other members included Lucile Burt, Dick Mayo-Smith, Lally Stowell, and Gene Thompson.

CHAPTER 08

Credit and Sharing

Of all the aspects of team science, sharing recognition and credit is among the most difficult to master. Professional recognition is important regardless of where a researcher is on his or her career path: it plays a role in tenure decisions, grant submissions, promotions, scientific awards, and acceptance to prestigious organizations, among other things. For decades, scientists have largely been recognized—and thus rewarded—for their individual accomplishments. However, support is increasing for the idea that individual contributions can be recognized and rewarded in the context of a collaboration. Recognition and reward of all team members should be done thoughtfully and fairly.

How credit is attributed can vary greatly from team to team, and the decision about how to share credit will impact all team members. The best time to make these decisions is either before work begins or as early as possible. Waiting until the paper is written and authorship discussed can jeopardize the work as well as relationships among team members. Sometimes it is not possible to determine order of authorship at the outset of a collaboration. In these circumstances, collaborators can agree in advance on the criteria that will be used for making authorship decisions and the process by which those decisions will be made.

HOW TO GIVE RECOGNITION AND SHARE CREDIT

- Build and maintain trust among team members (see the section ***How to Foster Trust Among Team Members*** in ***Chapter 05: Trust***).
- Unambiguously assign or negotiate roles and responsibilities for the various team members—this is especially important for team leaders.
- Establish as early as possible a process and criteria for determining how authorship and other forms of credit will be decided. This can be done in the form of Collaborative Agreements, Welcome Letters, or other types of documents (see ***Appendix***).
- Create a credible process by which team members can raise concerns about how credit is being or will be determined as soon as questions arise.

Proposed Framework for Evaluating Collaborative Academics

A recent publication puts forward a simple framework to appropriately recognize and review academic researchers participating in collaborative research or team science. Aligned with the pillars of the academic model, the framework combined qualitative and quantitative assessment in the areas of education and service, stature and accomplishment, and urges the collection of evaluative data. Assessment of the following scientific activities is suggested: design, implementation, analysis, and contributions to publications. In addition, the framework encourages assessment through other more creative approaches, including input from lead investigator collaborators, teaching, input into grant applications, and commitments such as journal clubs (Mazumdar, Messinger et al. 2015).

- Identify early on in your scientific relationship those who will be responsible for answering questions and responding to outside inquiries about various scientific aspects of the project.
- In public presentations, identify team members and explicitly acknowledge their contributions to the research endeavor.
- Appropriately attribute all people who contribute to writing, performing experiments, or provide intellectual input.

The formation of highly productive, integrative research teams has outpaced institutional mechanisms that support, review, recognize, and reward individuals who contribute to these collaborations. For research teams to flourish, there must be paradigm shifts for both scientists working in teams and the organizations that evaluate their work. Appropriate recognition and reward of team science is critical for promoting the success of existing teams as well as for nurturing new ones. At NIH, there are several examples of changes that have been made to help shift the perception that recognition and reward for team science projects are lacking. Most notably, in 2006, the NIH modified its intramural tenure evaluation guidelines to include recognition for participation in team science. The guidelines indicate that substantial impact of independent pursuits, as well as those characterized as team science, will qualify an individual for recognition for tenure. Another NIH effort recognizing the importance of collaboration in 2007 was permitting R01 applications to be submitted by multiple PIs.

IT'S WORKING: CASE STUDY 14

A collaborative research team set up a publications committee to actively address authorship issues from the very beginning of the project. The leader, Dr. Kamela, encouraged team members to generate and present to the group their proposals for potential experiments and get their ideas out into the open. Dr. Kamela also made explicit the expectation that the resulting data would be shared and discussed openly with the team. The team agreed on clear and specific authorship rules and how they would share credit. The publications policy was included as an appendix on every research plan.

IT'S NOT WORKING: CASE STUDY 15

Two fellows from different laboratories were working, at the direction of their supervisors, on a collaborative project. While the scientific question was clear and the work was distributed based on expertise, authorship had never been discussed as an aspect of the collaboration. When it was time to write the paper, both fellows assumed they would be first author. A heated and emotional dispute erupted when it became clear that neither one would give up his position of thinking he should be first author. Accusations of discrimination, poor-quality research, lack of intellectual contributions, among others, were made. Many hours of valuable time over many days were spent trying to come to a resolution. The supervisors continued their collaborations; the fellows, however, remained bitter and frustrated.

Leading medical and research associations are recognizing that there are research accomplishments that ought to be attributed to a scientific team. The American Association for Cancer Research, for example, has created the Team Science Award that recognizes interdisciplinary approaches to translational cancer research. Additionally, many journals now have explicit policies about how joint authorship is determined.

ORGANIZATIONAL RECOGNITION AND REWARD

Institutions have trouble giving an individual credit for a scientific accomplishment if credit for the achievement was shared among multiple people. There is a belief among some established researchers involved in team science or highly collaborative work that there comes a time in their careers when they should cede senior authorship on papers and pass speaking invitations to more junior members of the team so that the junior members can attain greater recognition, take a more prominent role, and further develop their careers. Review teams that value the individual investigator grapple mightily with how to deal with such situations. There can be the misperception that the senior investigator is no longer playing an important role; why otherwise would she or he give up the last author position or not give the talk? What happens when two team collaborators at roughly the same career development stage aspire to the same progression of promotions? While science is inherently competitive—and needs to remain so to assure the most robust research approaches and outcomes—does it make sense to promote just one of two equally outstanding scientists purely based on the premise that it has always been done that way and no mechanisms are in place to support the promotion of both? Culture shifts in how sharing and giving credit are perceived will be another critical element to assuring there is enthusiasm for participating in collaborative ventures.

Another shift in the culture of academic institutions is the implementation of a new role that is intended to support collaborative research. Although the titles, roles, and responsibilities of the individuals in these positions vary from institution to institution, we have become aware of a trend among some institutions to actively support collaboration and team science. Whether they are referred to as research development professionals, boundary spanners, or laboratory managers, the individuals in these positions play a critical role in making connections across the institutions, helping researchers find other scientists who could contribute to a

collaborative venture. In addition, they can help to identify funding opportunities, to provide a point of contact for the researchers in the open laboratory setting, or to structure a grant application to convey how team science will advance the research goals. As research becomes more and more collaborative, a greater need exists for individuals who can play a scientific coordination role in the context of the science itself or the scientific administration.

ASK YOURSELF IF IT'S WORKING

When It's Working:

- How credit and authorship will be attributed, including meeting abstracts, papers, and intellectual property, is decided at an early stage of the research project.
- All team members understand and accept the process and criteria for allocating authorship and acknowledgments.
- An environment of psychological safety is created and sustained which enables group members to willingly and openly discuss any issues or concerns that arise.
- Team members share data, discuss interpretation, and jointly plan next steps.
- Strategies for recognizing and rewarding individuals participating on teams is established.

When It's Not Working:

- Team members resent their supervisors and colleagues because they think they should have gotten credit when they did not.
- Team members are willing to accept credit and recognition, but unwilling to give it in return.
- Communications are troubled, and issues and concerns of team members are not openly discussed.
- Team members become reluctant to openly share their data.
- Members are unwilling to ask for agreements in the early stages of the scientific collaboration.
- Personal and professional relationships suffer.

Take Aways:

- Develop agreements for how credit for research accomplishments will be attributed.
- Have a clear understanding of authorship criteria and responsibilities early in the life of the project.
- Be mindful of team members' career development when developing agreements:
    1. For whom is the credit and recognition most critical?
    2. Are there any team members who can begin letting more junior members have greater recognition? This may take the form of authorship, corresponding authorship, and/or presentation of invited talks.
- When joining an organization, ask it to outline how your contributions to team science will be formally reviewed and recognized.

HOW TO APPROACH RECOGNITION AND REWARD

Unfortunately, there are still many tales of scientists and clinicians at prominent institutions who find out during a tenure review process or other evaluations that they are viewed as "not demonstrating the required independence" to make it to the next step in their career trajectory even though they heard that working with multiple colleagues on complex scientific problems is valued. In other words, promotion policies, institutional norms, and personal values of evaluation committee members are not always up to date with the messages being broadcasted by organizational leadership; this can have a strong negative impact on those participating in team science.

It is difficult for an early career scientist to contemplate the benefits of team science if s/he works in an institution that does not recognize or reward collaborative efforts or whose mentors suggest not engaging with others for fear of giving the impression that they are not completely independent. In addition, regardless of career stage individuals in disciplines that are inherently collaborative (such as bioinformaticians and statisticians) are often confronted with the challenge of demonstrating how they have made independent contributions in the context of the team even when publications would not have been possible at all without their expertise.

For this reason, the ability of a research team leader to engage positively with and gain the support of his or her organizational leadership cannot be understated. As a team leader, you can put into place specific processes, if only for your special circumstance. For example, you could negotiate to include appropriate review and recognition of collaborative research efforts in a new recruit's start-up package.

To correctly approach recognition and reward:

- Assure that processes and procedures are in place to robustly and rigorously review, recognize, and reward researchers involved in highly collaborative research teams.
- Communicate and demonstrate to those participating on and leading research teams that their efforts, if truly outstanding, will be appropriately rewarded.

RECOGNITION, REVIEW, AND REWARD

The development of institutional procedures, policies, and processes for assessing the accomplishments and contributions of scientific teams, as well as of the individual members who contribute to those efforts will send strong messages about the value of this approach. Routine team science criteria for review panels, metrics or milestones for the researcher involved in collaborative work, and policies and procedures to assure that young investigators are not punished for participating in collaborative teams are lacking. The creation of such mechanisms would signal institutional commitment to the community.

In 2017, the National Institutes of Health published a Funding Opportunity Announcement (FOA, PAR-17-340) for a RM1 grant entitled "Collaborative Program Grant for Multidisciplinary Teams." This FOA has been designed to support highly integrated research teams of three to six PIs to address ambitious and challenging research questions that are important for the mission of the National Institute of General Medical Sciences (NIGMS) and that are beyond the scope of one or two investigators. Teams have been encouraged to consider far-reaching objectives that will produce major advances in their fields. These objectives should require considerable synergy and should not be achievable with a collection of individual efforts or projects. Such a funding mechanism recognizing the effort of multiple PIs involved in highly integrated research teams should ultimately promote the advancement of their individual careers.

CATCH 22 FOR THE TENURE-TRACK SCIENTIST

One question surfaces in tenure committee meetings: "Has Scientist X demonstrated independence?" For tenure–track investigators to be awarded tenure, they need to do outstanding science and demonstrate their independence. As a result, early-career, energetic researchers are typically cautioned against collaboration and counseled to focus exclusively on independent efforts. After many years of research successes achieved through individual effort, they are, once tenured, allowed and perhaps even expected to collaborate and join with others to solve complex scientific problems. By this time, they may or may not be inclined to pursue such efforts.

Systems, policies, and criteria need to be put in place by institutions to assure early-career investigators that they can participate on collaborative research teams and that they will be appropriately reviewed and rewarded during the tenure process for doing outstanding science as part of collaborative interactions.

Various tools exist:

- Offer letter
- Pre-tenure agreement
- P&T criteria
- Joint appointment agreements

IT'S WORKING: CASE STUDY 16

Dr. Felix had worked largely as a solo investigator for many years until he accepted a senior position on a research team investigating epitope-driven vaccines. Dr. Felix was pleasantly surprised by how supportive the institute was of the team's efforts, and how this was clearly communicated and demonstrated. Leadership had recently revised certain policies that had not been "team science friendly" to encourage investigators to work collaboratively and ensure fair review at tenure meetings, annual performance evaluations, and other institutional venues. Mechanisms were put in place so that individuals would be regularly recognized for the outstanding research they were performing on their own as well as their contributions to meritorious team efforts. Dr. Felix's team leader had an excellent relationship with the institute's leadership, making the group, as a whole, feel supported in their efforts.

IT'S NOT WORKING: CASE STUDY 17

Dr. Amiel was recruited to a prestigious institute to begin her career as an independent investigator. She was recognized to be a creative thinker, had successfully challenged existing paradigms at the postdoctoral level, and had proposed a compelling line of research to pursue. In addition, her strong scientific contributions and leadership ability were clearly demonstrated in her work with a collaborative research team, an attribute the institutional leadership indicated was highly valued. Dr. Amiel quickly found her place at the new institution, initiated the independent research she proposed, and made substantive contributions as both a participant and a leader in collaborative research efforts. At her formal review three years later, Dr. Amiel was shocked at her overall assessment by the outside review team. She was praised for her independent research, but the review committee strongly suggested that she abandon her collaborative research projects because they "will not contribute to international reputation" and noted that "it is difficult to assess her independence" in the context of the collaborative work. The reviewers said the time Dr. Amiel was squandering on these efforts could be redirected to assure she attained tenure at her next review. Since there were no policies or criteria in place for the review of contributions to team research efforts, they were barely considered by the outside committee and provided no foundation for an appeal to the review.

ASK YOURSELF IF IT'S WORKING

When It's Working:

- Institutional messages about the importance of team science and collaboration are supported by policies, processes, and procedures.
- Departments have developed strategies to recognize individual accomplishment in the context of a team.
- Expectations around collaborative research are explicitly captured in offer letters or pre-tenure agreements.
- Team science is actively supported through the implementation of research and scientific administrative positions that work closely with the researchers in support of collaboration.
- More senior researchers sponsor more junior colleagues by giving them opportunities for senior authorship on papers, national/international speaking engagements, or take the lead on a new research direction.

When It's Not Working:

- Scientists participating in collaborative research efforts are skeptical that their efforts will be recognized and rewarded.
- Early career scientists are unwilling to participate in team efforts for fear that they will risk not being recognized as independent.
- Criteria for tenure are out of date and committees operate through a "***we know it when we see it***" or "***we've always done it this way***" approach.
- Agreements are all verbal and a collaborative investigator does not have anything in writing to confirm conversations about how they will be reviewed for their team efforts.

Take Aways:

- Institutions should align their messages about team science with their policies and procedures.
- Positions evolve over time to increasingly support the scientific and administrative needs of team science.
- Written agreements can help assure that both the researchers and the institutional leadership have clear expectations about:
    1. how team science will occur and
    2. how it will be recognized, reviewed, and rewarded

CHAPTER 09

Managing **Difference**

Team science is an exercise in diversity. The dimensions of differences that come together in inter- and trans-disciplinary research range from disciplinary, social, knowledge and skills, to personality and power, just to name a few. Although the rationale for team science is grounded in an appreciation of the potential benefits of disciplinary diversity, that diversity does not automatically blend into a harmonious, cooperative team of researchers exchanging information and moving in the same problem-solving direction.

At the most general level, many research studies show that as long as there is not great pressure within a group to conform and agree, heterogeneous groups outperform homogeneous groups in solving problems (Hong and Page 2004). Heterogeneous groups are often found to have more interpersonal and group process related problems than homogeneous groups. More specifically, demographic diversity negatively affects group process. However, such problems are not inevitable and they need not be insurmountable.

Differences are at the core of the research team's strength and at the same time serve as a challenge to their successful functioning: strength because the very purpose of a team is to bring multiple perspectives to bear on complex problems; and challenge because the more people involved the greater the likelihood of difficulties in communication, conflict, and coordination. Unless managed well, any type of diversity can become the basis for conflict and stereotyping or other problems in social integration and communication. You may have such diversity in your group; categories that are known to impact group performance and group process are shown in the text box page 91.

HOW TO HARNESS DIVERSITY IN TEAM SCIENCE

- Establish trust (see ***Chapter 05: Trust***)
- Create an environment of Psychological Safety (see ***Chapter 05: Trust***)
- Develop the skills to have difficult conversations (see ***Chapter 10: Conflict Is Normal***)
- Set expectations (see ***Chapter 04: Building a Research Team***)
- Recognize that different perspectives are essential for a better outcome
- Share and understand differences among group members
- Be curious and ask questions before making a decision
- Assume that every team member has something important to contribute

Categories and Types of Diversity

(Mannix and Neale 2005)

SOCIAL-CATEGORY DIFFERENCES

Race

Ethnicity

Gender

Age

Religion

Sexual Orientation

Physical Abilities

DIFFERENCES IN KNOWLEDGE OR SKILLS

Education

Functional Knowledge

Information or Expertise

Training

Experience

Abilities

DIFFERENCES IN VALUES OR BELIEFS

Cultural Background

Ideological Beliefs

PERSONALITY DIFFERENCES

Cognitive Style

Affective Disposition

Motivational Factors

ORGANIZATIONAL- OR COMMUNITY -STATUS DIFFERENCES

Tenure or Length of Service

Title

Special Relationship with Some Organizational Leaders

DIFFERENCES IN SOCIAL AND NETWORK TIES

Work-Related Ties

Friendship Ties

Community Ties

In-Group Memberships

There is a relationship between different types of diversity and their impact on group performance. Informational diversity corresponds to differences in individuals' knowledge, skills, and experience-related background. Research has shown that informational diversity is positively related to group performance. When informational diversity is present, scientific teams work better if there is at least a moderate level of conflict over science-related matters. As we have tried to emphasize in this guide, a research team should be a place where disagreement can flourish. Diversity, not just expertise, seems to make a difference in team performance. For example, it has been reported that "the greater the proportion of experts a team had, the more likely it was to disintegrate into nonproductive conflict or stalemate"(Gratton and Erickson 2007).

By comparison, the impact of social/category differences on group process and performance seems to depend on how well it is managed: in general, the less conflict, the better the group's performance. Visible differences can lend themselves to evocation of stereotypes and biases and be the basis for misunderstandings and failed communications. The effects of stereotypes and biases can be modulated by creating opportunities for team members to learn about each other explicitly rather than based assumptions and visible traits. Some studies have indicated that, when demographic diversity is viewed as a potential strength, then it is more likely to contribute to stronger team coherence. With the increase in team science and collaborations across institutions and even nations, demographic diversity in science is an ongoing feature of life. In this way, if team members become aware of differences related to demography, personality style, values, beliefs, and status, they are able to exploit those differences as a basis of establishing bonds with fellow team members.

Earlier, we wrote about the four phases of team development (see ***Chapter 04: Building a Research Team***) and the importance of psychological safety in building trust so that a group can progress from the storming to norming stage. Psychological safety and trust also can serve to bridge across differences. In fact, the relationship is reciprocal—bridging differences helps to build trust and establish psychological safety. *"If a team cannot create an environment that is tolerant of divergent perspectives and that reflects cooperative goal and interdependence, then the individuals who carry the burden of unique perspectives may be unwilling to pay the social and psychological costs necessary to share their viewpoints"* (Mannix and Neale 2005).

In the same way that self-awareness is essential for individuals to be able to interact effectively and cooperatively with colleagues (see ***Chapter 02: Preparing Yourself for Team Science***), teams must be aware of disciplinary differences that lead to conflicting scientific strategies, methodological approaches, tools for managing data, and preferences regarding research direction. For example, when researchers became aware of the methodological and conceptual differences they were experiencing, they were able to build a shared framework within which their discussions could be productive and their work could progress. Most often, that awareness develops in meetings that are structured to identify and clarify scientific misunderstandings. Although researchers typically are more interested in doing science than in attending to the fine points of group dynamics, spending time developing skills in communication, conflict management and decision making can have a beneficial effect on the scientific work itself. The Toolbox Dialogue Initiative is one tool focused on working with collaborative teams to guide them through a structured dialogue in order to achieve greater self-awareness and mutual understanding among team members (*Michael O'Rourke – The Toolbox Dialogue Initiative: toolbox-project.org/*).

IT'S WORKING: CASE STUDY 18

A group of scientists came together with an interest in developing a novel *in vitro* model system that could recapitulate the interplay of different cell types and how they changed during the disease process. During the first team meeting, one of the researchers, a materials science engineer, presented a concept for a matrix that could be used to support cells such that different cell types could be combined, as one would find them in the body, and their interactions studied. In the meeting room, three other disciplinary backgrounds were also represented among the group members. It became quickly apparent that the different members were not speaking the same language; in fact, their approaches and methodologies were quite distinct. Recognizing this, one of the group members interrupted the scientific discussion once it was clear that there were going to be some challenges and asked permission to talk about the discomfort and tension he noticed.

IT'S NOT WORKING: CASE STUDY 19

Dr. Chin, a new post-doc, recently joined Dr. Smith's laboratory. She has been working diligently on her project and has been very productive. She is well spoken and presents her data clearly at laboratory meetings but is generally very quiet and difficult to engage in casual conversations. Dr. Smith has been pleased with her work thus far but is disappointed that she fails to propose new directions for her project. Dr. Clark, the other post-doc in the laboratory, has been in the laboratory for several years and has become good friends with Dr. Smith. He is very self-assured and enthusiastic and often speaks up at laboratory meetings, contributing suggestions and new ideas that enhance the projects of the laboratory. He and Dr. Smith often eat lunch together and go out after work to discuss new ideas for his project. They also regularly leave the laboratory together to play tennis during the day. Dr. Chin's previous laboratory had a very strict hierarchy and her former PI dictated her entire project. She has had numerous ideas for her project but because she is only a junior post-doc she does not feel it is her place to present these suggestions to Dr. Smith.

The single most important factor in overcoming the challenges that diversity can introduce is the development of a strong team identity. As a team begins to work well, the growing sense of identity balances and integrates their disciplinary, institutional, and demographic identities. This shared identity is built around a sense of shared vision, growing trust, clear roles and responsibilities, as well as problem conceptualization. The more you and your team members think of their identity as being "a member of X team," the stronger the potential bonds within the team with shared messages such as: "we are in this together, we are pursuing the same goals, we must support one another." In addition, any differences in status will begin to minimize with the increasing cohesion.

ASK YOURSELF: IS IT WORKING

When It's Working:

- Groups are able to work together cooperatively and supportively across differences.
- Active listening and curiosity is used to uncover definitions and meanings that may be distinct to some team members.
- Psychological safety exists and team members participate actively in group discussions.
- Differences in power and status among team members begin to moderate as the team spends more time together.
- At team meetings people do not cluster only with people like themselves.
- Disagreement about scientific matters is expected and valued, and interpersonal conflict is diffused at the earliest stage possible.
- People are able to raise any identity-related concerns, either with leaders or the entire team.

When It's Not Working:

- There are high levels of inter-personal or inter-group tensions among team members.
- Rivalries develop among different groups within the team.
- At team meetings, people in same identity groupings cluster together.
- During team meetings, the fact that there are tensions among the group members is reflected in how people interact, either keeping silent or confronting others.
- Different identity groups discuss common concerns among themselves rather than raising them with the entire team or with leadership.
- When inter-group problems arise, people are too busy to attend to them.

Take Aways:

- Pay attention to the dynamics of interaction within a team and between diverse groups and be open to surfacing differences so they can be discussed openly.
- Diversity can be a strong asset to a scientific team when individual strengths are recognized and valued.
- Building a strong sense of team identity is essential for team functioning.
- A clear vision that is understood by all promotes team identity.

CHAPTER 10

Conflict **Is Normal**

Conflict is about differences; it exists when two or more parties disagree, compete, or perceive that their interests are incompatible. Conflict is both an inevitable and a necessary aspect of human interaction. It is impossible to imagine a collaborative venture in which conflict does not occur. But conflict does not automatically mean there is something wrong with a team. In fact, social cohesion emerges from engaging in and resolving conflicts.

Science is competitive by nature and this can generate conflict. Many people, including scientists, fear conflict and tend to avoid it. Many scientists are both competitive and conflict avoidant—a potentially counterproductive combination especially for members of a scientific team. Ignoring problems and avoiding conflicts can undermine the research endeavor. This is particularly the case if competitiveness leads to engaging others in ways that elicit conflicts. If you avoid acknowledging and addressing these conflicts, you cannot understand what led to them, which is necessary for resolution.

Team leaders and members should learn not to fear conflict even though they may never enjoy it. We have seen that surfacing differences and talking them through is the only way to manage the disagreement and, if handled well, can strengthen the team.

UNDERSTANDING CONFLICT

Earlier in the ***Field Guide***, we wrote about the importance of self-awareness and awareness of others (see ***Chapter 02: Preparing Yourself for Team Science***). One arena in which it is especially useful to be aware of your emotions and reactions is in the way you handle and respond to disagreements or other types of conflict. A well-known inventory of conflict styles, the Thomas-Kilmann Conflict Mode Instrument (Thomas and Kilmann 1974 updated in 2007), may help you identify your most natural style of resolving conflict as well as other conflict resolution styles that may be useful in different situations.

A particular conflict resolution style may be more effective in some circumstances and a liability in others. One example where an approach can be a liability follows. Imagine the head of a research laboratory whose preferred mode of handling conflict is avoidance, a common trait among scientists. If there is discord among the scientists in his laboratory and he is reluctant to address it, the conflict can fester, undermining the research endeavor and possibly derailing the project. Recognizing your conflict style preference(s) and understanding the ramifications of the other styles can be helpful in guiding the way you approach future conflicts.

The most successful team players and leaders do not hold themselves captive to their dominant conflict resolution style(s). Instead, they adapt their reaction to conflict according to the issues at hand, the styles of those with whom they disagree, and the ends they hope to achieve. They recognize and are adept at using all styles as appropriate for each situation.

HOW TO ENGAGE WITH CONFLICT

If you are leading or participating on a team, consider the following steps for managing and resolving conflict:

- **Understand the culture and the context of conflict**—seek out the meaning of the conflict for yourself and/or the other parties.
- **Actively listen**—assure others you have heard what they said and ask questions to confirm your understanding.
- **Acknowledge emotions**—they will likely be part of the conflict, but expressing them and hearing them can help lift barriers to resolution.
- **Look beneath the surface for hidden meaning**—hidden fears, needs, histories, or goals may be the underlying source of the problem.
- **Separate what matters from what is in the way**—get away from discussing who is right or wrong and focus more on how to satisfy mutual needs.
- **Learn from difficult behaviors**—let those experiences help you develop your skills in managing difficult situations and having empathy for and patience with others.
- **Solve problems creatively and negotiate collaboratively**—this also means committing to action.
- **Understand why others might be resistant to change**—the problem could be an unmet need.

Adapted from Cloke and Goldsmith, 2000

When dealing with conflict, it is important to recognize people's tendencies to overemphasize the importance of personal and interpersonal dimensions and underestimate the significance of organizational factors. Personal and interpersonal factors are usually quite visible and, in conflict situations, often quite dramatic. By contrast, organizational factors often operate outside of our immediate awareness. For example, if there were to be a conflict between two team members, your first instinct may be to consider the personalities of each person, citing the aggressiveness of one or the reclusiveness of the other. However, an alternative approach that may get to the root of the conflict would be to consider the competition that the two feel in vying for the team leader's favor. Not surprisingly, it is less common to identify the ways in which the leader may have inadvertently sparked the conflict by failing to ensure roles and responsibilities were clearly defined. The leader may have neglected to discuss how each team member's contributions integrate into the greater whole and are important for the overall vision of the team's research endeavor (see ***Chapter 06: Vision***).

Scientific teams are necessarily diverse. By itself, diversity of thought, opinion, approach, or identity is neither good nor bad; what matters is how it is handled. Critically examining the culture of a team can often provide insight into understanding why differences in personal attributes that could be an asset for a team instead develop into a source of conflict and disharmony.

CONFLICT RESOLUTION STYLES

When you encounter conflict, you may rely more heavily on one style than on others, whether because of temperament or practice. But everyone is capable of using all five conflict resolution styles. Think about how different styles could be used in different situations.

Competing: When competing, you use whatever power seems appropriate to win your own position. Competing can involve "standing up for your rights," defending a position you believe is correct, or simply trying to win.

Accommodating: When accommodating, you neglect your own concerns to satisfy the concerns of others. Accommodating might take the form of selflessness or yielding to another person's direction or point of view.

Avoiding: When avoiding, you sidestep the conflict altogether.

Collaborating: When collaborating, you attempt to work with the other person to find a solution that fully satisfies the concerns of both. It means digging into an issue to pinpoint the underlying needs and wants of the individuals.

Compromising: When compromising, you attempt to find an expedient and mutually acceptable solution that partially and even fully satisfies the concerns of all parties.

Adapted from Thomas-Kilmann, 2007

QUESTIONS TO EXPLORE WHEN FACING CONFLICT:

- Who is involved and what are their personalities, emotions, thoughts, motivations, values, ideologies, and/or identities?
- What are the interpersonal dynamics, including communication, intimacy, rivalry, competition, power, and hierarchy?
- How are the organizational structure and dynamics (such as roles and responsibilities, rules, policies and procedures, and organizational norms and values) contributing?

LISTENING: THE FIRST STEP TOWARD PROBLEM SOLVING

Skillful listening helps you to gather the information you need to reframe a conflict as a joint problem and build the rapport and trust that is necessary to begin a process of jointly solving the problem through the collaboration of the disputants.

When approached for help in resolving a conflict, the best place to start is by listening. Instead of immediately trying to solve the problem, interrogating people or prematurely analyzing the problem/situation, ask the person to explain to you what has happened and listen. If there are things you do not understand ask questions to gain more information. You may need to seek out others and ask them for their account of the situation as well, before you can come to a decision about what next steps to take.

True listening is a far more comprehensive endeavor than simply hearing someone talk. It is a multifaceted effort that includes attending to the speaker's words, tone of voice, and body language.

There are several components to effective listening.

Visibly "Tune-In"—Face others directly, adopt an open posture, make eye contact, and relax.

Active Listening—Focus exclusively on the person speaking, make efforts to connect, and be open to what others have to say.

LISTENING: THE FIRST STEP TOWARD PROBLEM SOLVING CONTINUES ON PAGE 106 >>

LISTENING: THE FIRST STEP TOWARD PROBLEM SOLVING

Accurate Listening—Paraphrase others' points to assure that you understand and, if something is unclear, ask for more information.

Listening for Meaning—Restate the issue or problem and request feedback on your understanding, and ask as many questions as needed for full understanding.

Adapted from Egan, 2001

PRINCIPLED NEGOTIATION

In a team setting, the assumption that conflict is bad or that two people in conflict are necessarily adversaries can be incredibly destructive. Rather, if all parties can see their conflict as a joint problem, they can entertain the idea of working together toward a joint solution where both people can benefit. The end goal is to negotiate in a principled way rather than in a manner that resembles fighting.

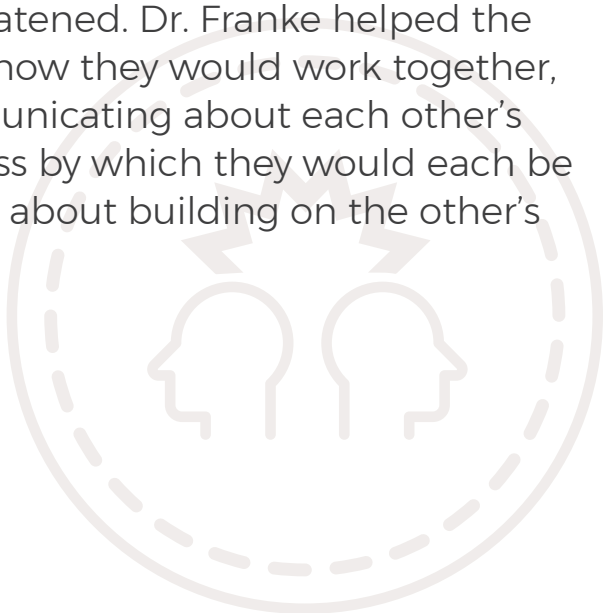
Principled negotiation has five steps:

- Separate the people from the problem.
- Focus on interests, not positions.
- Invent options for mutual gain.
- Insist on using objective criteria to evaluate options.
- Be focused on the future.

The aim of such negotiation is to find a solution that is attractive to all parties and leaves them feeling that they have achieved something. In addition, an ideal outcome is that all parties believe that their ability to manage and resolve conflict has been enhanced by the very way they have negotiated. Adapted from (Fisher, Ury et al. 1991)

IT'S WORKING: CASE STUDY 20

Dr. Willoughby, a postdoc, complained to her team leader, Dr. Franke, that a senior technician on the project, Dr. Tuma, was withholding data and was unwilling to keep her informed about the studies he was conducting. Dr. Tuma independently reported that Dr. Willoughby was treating him abusively and claiming his ideas for herself. Dr. Franke quickly realized it was important to tackle this conflict head on and invited both individuals to a neutral place for a discussion. After listening carefully to each of them, Dr. Franke became aware that Dr. Tuma was having difficulties managing boundaries and setting limits in his working relationship with Dr. Willoughby. A voraciously curious researcher with seemingly unlimited energy and a willingness to spend day and night in the laboratory, Dr. Willoughby would quickly design new experiments based on the studies and results of others on the research team. Other team participants were able to capitalize on her enthusiasm and work collaboratively with her. For reasons of personal history and style, Dr. Tuma experienced her curiosity as intrusiveness and saw her eagerness to build on the work of others as if she were taking ideas away from them; he felt that his contributions to the team were being threatened. Dr. Franke helped the two scientists negotiate an agreement about how they would work together, including rules about sharing data and communicating about each other's studies. The two then jointly designed a process by which they would each be expected to obtain agreement from the other about building on the other's work or collaborating.



IT'S NOT WORKING: CASE STUDY 21

Dr. Lewis, a team leader who recently assembled a new research group to address a thorny scientific issue, announces that she wants everyone to focus their energies on research and that she does not want to be bothered with petty personal disputes that arise among participants. "I expect you to work out among yourselves whatever differences may arise," she explains in her introductory discussion with every person who joins the team. After an initial period of harmonious interaction among members of the group, two postdocs with different supervisors begin to quarrel about access to the electron microscope and other team resources. Unable to resolve their differences, the two soon begin to have disagreements about cleaning the shared equipment after use and the usage and purchase of reagents. The tension between the two begins to negatively affect the overall group dynamic and functioning until one of the postdoctoral researchers approaches Dr. Lewis to inform her that he is leaving the team.

ASK YOURSELF: IS IT WORKING

When It's Working:

- All team members—from team leaders to trainees—are attuned to potential conflicts among team members, have established processes to address them, and are comfortable intervening should they arise.
- The team maintains high expectations of interpersonal civility (see ***Chapter 05: Trust*** and ***Chapter 11: Sustaining and Strengthening the Team***).
- Areas of scientific and methodological disagreement are not understood in personal terms.
- Once recognized, ambiguities over team members' roles and responsibilities are addressed proactively.
- The team leader conveys and demonstrates to team members that conflict can have a positive impact—from improving group cohesion and enhancing research to promoting team goals.
- Initial signs of conflict are addressed promptly.

When It's Not Working:

- There are undiscussed interpersonal conflict(s) and tensions within the team.
- Groups do not listen to concerns, engage in mediation between colleagues, nor seek out other third-party resources to serve as neutral intervenors.
- The team is unaware of or avoids acknowledging other team members' motivations and needs.
- The "deeper" meaning behind the conflict is not seen.
- There is a failure to listen carefully to team discussion.
- Group members interpret conflict as unhealthy when it is actually constructive.
- Individuals misread a lack of argument or challenge as agreement.
- Team leads overestimate team members' ability to work together as a team.

Take Aways:

- When handled skillfully, conflict can be productive and provide opportunities for creativity. If it is handled poorly, it can undermine a team's functioning.
- Ignoring conflict is a sure way to guarantee that it will remain alive and perhaps worsen.
- Resolving conflict requires individuals to take the time to understand what is driving it.
- Team leaders must develop strong listening skills to thoughtfully and fairly intervene in conflicts; they can then encourage and mentor team members to learn and use those same skills to listen to one another and begin to understand differing opinions and perspectives.
- Teams should be proactive and establish processes to handle conflicts, ambiguities, or other concerns when they arise.
- Taking the Thomas-Kilmann Conflict Mode Type Instrument can greatly benefit the team by helping everyone understand their (and others') conflict styles.

CHAPTER 11

Sustaining and **Strengthening the Team**

A scientific problem and how to approach it is what brings the team together. That is why the notion of having a strong vision is so critically important. However, if the team does not also attend to team dynamics, they run the risk of derailing. We find that many of the interdependent characteristics of successful teams are also at play in positive team dynamics, including good communication, effective conflict management, strong leadership, shared goals, recognition and reward for collaborative research, and the development of interpersonal trust (see the ***Table of Contents*** to locate modules on these topics).

Creativity and innovation are oftentimes mentioned as the benefits for bringing people together from different disciplines. The contributions from the various dimensions of difference can come together in new and original ways. However, this does not occur magically. Just as groups need to be mindful of how they are sharing data and information, they need to challenge themselves to not get too comfortable with their team mates.

In his book *The Wisdom of Crowds*, James Surowiecki identifies four characteristics that minimize the risk of group-think and support effective team functioning *(Surowiecki 2005):*

Diversity of opinion – a multiplicity of perspectives in the team;

Independence – individual members do not feel pressure to agree with others;

Decentralization – individual members have different specialized knowledge;

Aggregation – processes of mechanisms for integrating perspectives and making collective decisions.

Almost by definition scientific teams meet the criteria for elements 1 and 3. Attending to team dynamics enables the team to take fullest advantage of its diverse strengths. One important way to sustain a positive team dynamic is to create an atmosphere in which everyone feels free to participate in discussion.

For example, when discussing a particular research finding or an unexpected obstacle, it can be powerful to remind everyone that brainstorming is enriched by viewing every idea put forward is valuable. Not all ideas need to be implemented, but they can be shared such that the team can determine if they would be feasible. Many more ideas can be generated by adopting the approach of saying "thank-you" to every idea and then building on it by saying "and." This building of ideas can move a not so good idea to a great one through additions and iteration. Once many ideas are on the table then the group can begin to narrow the field to select the ones that are likely to have the greatest impact. Responding to someone else's idea by saying "yes, but," or "that's a dumb idea," or asking "how are you going to do that?" can have the effect of squashing the idea. Once the idea is dead, there is nothing to build on.

Another way to keep a group fresh or even accelerate productivity is to step back and ask what new expertise is needed on the team and invite new people to participate, which will cause the team to enter a storming cycle. While storming can be a challenge, it also ensures that the group mixes it up, considers new perspectives, and moves out of its comfort zone and back into an arena where creativity and innovation can flourish.

HOW TO STRENGTHEN TEAM DYNAMICS

- Monitor the group environment to ensure that the psychological safety remains intact—that it is collegial and nonthreatening.
- Identify, recognize, and leverage the strengths each team member brings to the group.
- Practice building on each other's ideas to spark innovation and cultivate creativity before narrowing possibilities down to identify a solution or path forward.
- Recognize that individual accomplishments contribute to overall successes for the team.

ONE BAD APPLE

Almost everyone has had the experience of being in a group where a single individual poisons the group's morale and undermines the group's performance. This happens even in teams with lots of "talented, very smart, and likeable people." In the same way that it is imperative to address conflicts as they occur—they do not go

The Five Dysfunctions of a Team

In thinking about team dynamics, it may be helpful for you to compare the characteristics of successful teams with the indicators of failed teams. In *The Five Dysfunctions of a Team*, Patrick Lencioni identifies five traits that characterize dysfunctional teams:

- Absence of trust
- Fear of conflict
- Lack of commitment
- Avoidance of accountability
- Inattention to results

Successful teams are alert to the signs of these dysfunctions and take steps to confront and overcome them. A small but consistent amount of attention to team dynamics can pay off tremendously in terms of improving team morale and performance (Adapted from Lencioni, 2002).

away on their own—it is important that a group deal with the bad apple and directly address the problems that person is creating. When we speak of the bad apple in a group, we are not talking merely about individual eccentricities, or ordinary non-conformity. Research has identified three types of people who fairly consistently present problems for teams or groups (Felps, Mitchell et al. 2006):

1. **The slacker** — a person who simply does not pull their weight, who almost always does less than they can, and often attends to matters that have nothing to do with the work of the team even when they are at work (e.g., talking on the phone, searching the web, taking long breaks).
2. **The miscreant** — a person who attacks and insults others and regularly violates "interpersonal norms of respect."
3. **The depressive pessimist** — a person who is continually negative in mood and attitude and often complaining about the work being unpleasant or expressing pessimism about the group's project coming to a successful end.

Studies consistently find that such individuals can do great damage to a team's spirit and performance. While there are no "cures" for bad apples, there are suggestions for how to address the problem. First, it is important to try not to hire such people in the first place. Careful reference and background checking can assist with that. Second, if such a person is hired and begins to cause problems, it is

important that the team and its leaders respond quickly. Bad apples do not change spontaneously. Using performance appraisals that take into account behavior as well as performance can be important for giving feedback, issuing warnings, initiating monitoring, taking disciplinary actions, and even firing when nothing else works.

As many can attest, dynamics are not necessarily tangible or easy to define; they can be more easily recognized when considering a team from a "few steps back." Taking time to examine how things are going and group process can make a big difference. The chart below is one example of a simple team or collaboration assessment form that can structure such an examination. Whether using a formal assessment tool or taking a more informal approach, teams can set a regular time for members to discuss how they are experiencing the team and to discuss what is functioning well and what needs to be addressed.

Evaluation for Scientific Collaborations: Relationship and Performance*

Indicators	Poor	Marginal	Satisfactory	Good	Excellent
Relationship Indicators					
Communication					
Process for Resolving Disputes					
Adequate Notice of Problems					
Responsiveness of Parties to Concerns Raised					
Level of Trust Among Participants					
Openness					
Ability to Work as a Team					
Performance Indicators					
Availability of Resources					
Keeping to Schedule					
Commitment of Participants (Individuals/Leaders)					
Attitude of Participants					
Expectations					
Barriers (Fewer Barriers = Higher Rating)					
Synergy					

* Adapted from a form used by the Office of the Ombudsman, Center for Conflict Resolution, NIH.

IT'S WORKING: CASE STUDY 22

A new initiative included team members who were steeped in tradition and knew how the system works, and others who were newer and willing to challenge the status quo. At the outset of their collaboration, they spent half a day outlining their expectations about how they would communicate, make decisions, and address any problems that might arise. In addition, they committed themselves to creating an atmosphere in which any member of the team could safely raise any scientific question they had. To that end, they established an informal set of ground rules to provide guidance for team discussions. Shortly after the collaboration began, they found that team members often chatted in the hallways in addition to participating in formal meetings. During idea generating sessions, they learned to build on each other's ideas instead of shooting them down or telling the group theirs was better. Judgement was suspended and all ideas provided a bridge to a better one. The combination of experiences and backgrounds contributed to a collegial atmosphere where everyone had a voice.

IT'S NOT WORKING: CASE STUDY 23

Dr. Donaldson, a junior scientist, was loyal to his former laboratory chief who hired him and not the current laboratory chief, Dr. Chu, who later became his supervisor. When Dr. Donaldson was unhappy about Dr. Chu, he turned to his previous boss. When Dr. Chu was unhappy with Dr. Donaldson, he turned to his laboratory manager asking him to monitor Dr. Donaldson. This made Dr. Donaldson feel anxious and insecure about his place on the team. He began to feel isolated and less committed to the team's research. He vented his frustrations to a fellow junior scientist, who in turn told a friend of his. This created an environment where everyone felt vulnerable to other team members' gossip and where social dynamics began to affect the lab's productivity and scientific achievements.

Emotional Intelligence

A positive mood supports a team's flexibility and resilience. "A team with a strong positive mood will be hopeful about the future and grateful for what is going well today," wrote facilitators Marcia Hughes and James Bradford Terrell in *Team Emotional and Social Intelligence* (2009). Team members and leaders must also be sure, of course, to reality-test their optimistic ideas or they run the risk of unchecked expectations, leading to burnout.

The authors list seven key ingredients that contribute to a positive team mood:

- Curiosity
- Perseverance
- Positive, can-do attitude
- Hopefulness
- Attitude of abundance
- Playfulness
- Zest

To promote a positive mood among your team, try gathering team members in pairs or small groups to answer the following questions; then discuss responses as a large group:

- How do you demonstrate a positive attitude as a team?
- How do you demonstrate a long-term view and keep things in perspective?
- Are playfulness and a sense of zest encouraged in your team? If so, how?

ASK YOURSELF: IS IT WORKING

When It's Working:

- Psychological safety is sustained over time, and team members regularly discuss issues and concerns.
- Team members are aware of each other's strengths and tap into them to move the project forward.
- Teams understand that if they are feeling too comfortable, it is probably time to infuse some new members into the team.
- Team members are engaged and feel they are valued and value others, creating an atmosphere of mutual support.
- The group uses "thank-you, and" when sharing ideas.
- Team members know that decisions are made fairly and there will be an opportunity for comment.

When It's Not Working:

- An unpredictable, uncertain atmosphere leads to feelings of anxiety, vulnerability, and threat.
- Team members are uncomfortable discussing difficult issues as a group, contributing to indirect communication.
- Little sense of personal recognition or value among team members dampens the sense of ownership of team goals.
- Team members have insufficient or unequal commitments to team performance.
- Team members feel disengaged, isolated, alienated, or defensive.
- Team members, including the team leader, do not provide candid feedback.
- Team members engage in gossip.

Take Aways:

Sustain and Strengthen Team Dynamics:

- Don't let the team get too comfortable, bring in new members as the project evolves.
- Treat every idea as valuable and nurture them with "thank-you, and..."
- Identify, recognize, and take advantage of each other's strengths.
- Check in with the full team from time to time to review what is working well and to make sure there are no hidden issues.

CHAPTER 12

Navigating and Leveraging **Networks and Systems**

Working across boundaries, even within the same scientific organization, can be challenging. This is especially true when an institution's culture values work that is done largely independently, in isolation, and procedures, policies, or processes are not in place to facilitate cross-organizational interactions. Collaborating with others beyond the confines of an organization presents additional challenges.

We visualize a research team as the intersection of organizational entities that may or may not have their own points of interconnection. The team benefits from the expertise contributed by each of the component parts and, together, the components constitute an overall network or system within which the team operates. A research laboratory could be considered as its own focused system within the context of a larger system—the department or division—that, in turn, sits within and/or is influenced by a larger, more powerful system.

A team can transcend different organizational levels and extend its reach within and beyond the organization. A more complex conceptualization would include various interactions among investigators within and among institutions that contribute to the overall project. A sketch of this might look similar to a network map, not unlike a molecular interaction map that is used to demonstrate the complexity of the system in which a gene or protein is functioning. Thus, we come to recognize that highly collaborative teams function within the context of multiple and sometimes interconnected systems, and they also help establish strong networks of researchers who together can accomplish more than they could as individuals.

If the community of researchers within an institution does not believe, or does not perceive, that team science is truly valued and rewarded at the same level as individual achievements, their motivation to participate on research teams will be diminished.

Can Architecture Support Team Science?

The University of Saskatchewan in Saskatoon, Saskatchewan, Canada, spearheaded an effort focused on integrating collaborative research and teaching approaches into its Health Sciences enterprise. The leadership envisioned that an interdisciplinary approach would strengthen success in securing research funding, maximize the research impact, augment clinical research, and expand opportunities for research trainees at all levels. The University embarked on a project to build an Academic Health Sciences Complex with interdisciplinary collaboration as its foundation. Multiple scientific disciplines would be included but not limited to medical, dental, veterinary, pharmacy, nutritional, clinical psychology, and public health. They would be brought together in buildings designed with open laboratory space, shared specialty facilities, and places designed for collisions such as open stairways, seating areas, coffee bars and snack rooms. In addition to promoting physical connections, glass was a strong feature throughout, permitting daylight to penetrate into the atriums and laboratories and to permit people to make visual contact at a high rate, to enhance safety as well as transparency. As the leadership strategically guided this vision forward, it kept in mind five interacting facets: people, space, operations, institutional leadership, and training (Bennett, Nelan et al. In press).

THE TEAM AS A SYSTEM: SOCIAL NETWORK ANALYSIS

The social structure of a team will impact how the group functions and how well it performs. Once teams have formed and begun working toward their goals, team members can map out their social network by performing a *social network analysis* (SNA). Merely creating an organizational chart and a listing of the job responsibilities of each of the members of a research team will not necessarily give you a good picture of how a team actually works, who interacts with whom, or the impact on the team of each of its members.

An SNA can help you and other team members understand the interactions that are or are not taking place within and outside of the team. Within this context, team members can identify areas of strength or weakness and assess how valuable resources are utilized. The ultimate goal of this approach is to implement strategies to improve the team's ability to create and share knowledge by looking at how people interact.

An SNA can help a team answer the following questions:

- What systems have we put in place?
- Can we use our internal or external systems to more effectively get work done?
- How can those systems be modified or enhanced to better support the team's mission?

To perform an SNA, consider four types of networks: knowledge, access, source receptive, and energy (see box page 125).

INDIVIDUAL NETWORK ANALYSIS

Your individual network can be leveraged in the context of team effort. Professional connections can result in a benefit to the whole team as they seek out additional experts to contribute to their effort. When people join a team, they are not only establishing a new network, they are also expanding everyone's interconnections and possibilities for interaction. They can chart their own existing network and within it, identify where ties can be strengthened or gaps filled to broaden one's reach within and beyond the walls of the institution.

System Network Analysis

Four types of networks are described below. Asking the questions provided in italics can help you gain a better understanding of the components that constitute each network.

Knowledge Network: Knowing who can answer questions or provide more information allows for more efficient functioning and points the team in the right direction to obtain the information it needs. Effective teams may build in some redundancy here so that the team does not come to a halt if a key person in the knowledge network suddenly becomes unavailable. *Ask: Who does or does not have the specific information I need?*

Access Network: You may know where to go for information, but a critical question is whether the person with the information will share it and be a resource for additional information. *Ask: I've identified who has the information, and will he or she share it now and in the future?*

Source Receptive Network: Within teams, the old adage "knowledge is power" sometimes points to an ugly reality: team members are not always collaborative. If there is personal enmity between two team members, or if trust is low, they might withhold data, materials, or technical assistance. *Ask: Will I be welcomed as a collaborator? Will he or she share with me the data and resources I'm looking for?*

Energy Network: The outcome of the above interactions may impact the energy of team members and the group as a whole. Energy can propel a team forward and support its functioning; likewise, drains on energy can sap momentum. Key people and interactions that infuse energy into the team or suck it away should be quickly identified. Not surprisingly, energized teams perform better when the group is focused on a positive goal and when the members are fully engaged, feel they are valued, and sense that they are contributing to the overall progress toward the stated objectives. Every team member—from team leader to junior scientist—plays an important role in a team's energy and team functioning. *Ask: How did my interactions with him or her feel? Did it give or take from the team's energy?*

ASK YOURSELF: IS IT WORKING

When It's Working:

- Team leaders are aware of immediate and overall institutional support and communicate that to team members.
- Team leaders and members work together to secure support and recognition of the team as a whole. Individual contributions to the team are also recognized.
- Teams thrive when there is top-down support and bottom-up vision and enthusiasm.
- Perceptions that the institution is unsupportive, while frustrating, do not stand in the way of the leader doing what he or she thinks is right.
- Teams cut across boundaries and have distinct patterns of communication, information exchange, informal influence, and trust.
- Teams establish formal and informal networks that facilitate research progress.
- Team leaders take the time to understand the social networks.

When It's Not Working:

- Junior scientists and clinicians are wary of entering into complex collaborations for fear that their institutions will not recognize their contributions during review.
- Team leaders and members are unsure whether their work on a team will help, or hinder, their careers.
- There is confusion over the team's place in the organizational structure.
- Organizational leaders do not consider teams as they develop strategic plans, budgets, and other institutional policies.
- The team is unable to establish connections as a group with key individuals or groups within the organization.
- The team encounters resistance, obstruction, or complacency when it interacts with other institutional bodies.
- Team members experience their organization's administration and leaders as oppositional.

Take Aways:

- All teams function within larger systems that have an impact on how they operate.
- Team leaders must have a holistic view of where the team sits within the institution and who the key players are influencing the team's functioning.
- Team leaders must seek institutional support for their efforts at the highest levels.

CHAPTER 13

Fun

How many times we have heard or even told students at a career fair, "If you do what you love, you will love what you do." It sounds so trite, so simplistic, and yet there is something about that phrase that people enjoy holding onto.

When thinking about this in the context of the laboratory and a great collaboration, what is the driving force behind this commitment to solve a research question together? This is where passion comes in. We have used the words *commitment*, *vision,* and *mentorship*—all of which are vitally important, and all derive from an inner passion and a relentless curiosity. What could be more fun and more satisfying than finding other people with similar passions and interests with whom to unravel complexities and make new discoveries?

It is not just successful scientific problem solving and discovery that lead scientists to work collaboratively. Although it is not often discussed, one of the most compelling aspects of collaborative work is that it is fun. Anyone who visits a highly cohesive laboratory quickly notices that people work well together, there is a welcoming and enthusiastic environment, and the laboratory members are clearly comfortable working with each other. In informal discussions with scientists, they often refer to having fun and point to the satisfaction that comes from being part of a team that works well together. Daniel Kahneman, the psychologist who won the Nobel Prize in economics, describes the delight he discovered in his collaboration with Amos Tversky:

"[W]e met in Jerusalem to look at the results and write a paper. The experience was magical. I had enjoyed collaborative work before, but this was different. Amos was often described by people who knew him as the smartest person they knew. He was also very funny, with an endless supply of jokes appropriate to every nuance of a situation. In his presence, I became funny as well, and the result was that we could spend hours of solid work in continuous mirth . . . [A]nd we were not just having fun. I quickly discovered that Amos had a remedy for everything I found

difficult about writing. With him movement was always forward . . . [A]s we were writing our first paper, I was conscious of how much better it was than the more hesitant piece I would have written by myself" (American Psychologist, 2003).

Kahneman's remarks point to many of the best things that research collaborations can offer: complementarity in styles and abilities, enhanced quality of the final product, a deeply satisfying connection to a colleague, and substantial doses of fun.

Interestingly, recent research in the relatively new area of positive psychology supports these informal observations. In a wide variety of settings, there are very strong correlations between people's happiness in their work and their commitment to that work, their relationships with colleagues, and productivity.

More broadly, there is also research demonstrating the adaptive value of positive affect. "Beyond their pleasant subjective feel, positive emotions, positive mood, and positive sentiments carry multiple, interrelated benefits" (Fredrickson & Losada, 2005). These benefits are both behavioral and physical. Among the noteworthy behavioral benefits of positive affect are an expanded scope of attention, increased creativity and intuition, and broadened behavioral repertoires.

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Appendix

A. COLLABORATIVE AGREEMENT TEMPLATE

Although each research project has unique features, certain core issues are common to most of them and can be addressed by collaborators posing the following questions:

Overall Goals

- What is the overall vision for the collaboration?
- What are the scientific issues, goals, and anticipated outcomes or products of the collaboration?
- When is the collaboration over?
- When is the project over?

Who Will Do What?

- What are the expected contributions of each participant?
- Who will write any progress reports and final reports?
- How and by whom will personnel decisions be made? How and by whom will personnel be supervised?
- How and by whom will data be managed? How will access to data be managed? How will you handle long-term storage and access to data after the project is complete?

Authorship, Credit

- What will be the criteria and the process for assigning authorship and credit?
- How will credit be attributed to each collaborator's institution for public presentations, abstracts, and written articles?
- How and by whom will public presentations be made?
- How and by whom will media inquiries be handled?
- When and how will you handle intellectual property and patent applications?

Contingencies and Communicating

- What will be your mechanism for routine communications among members of the research team (to ensure that all appropriate members of the team are kept fully informed of relevant issues)?

- How will you decide about redirecting the research agenda as discoveries are made?
- How will you negotiate the development of new collaborations and spin-off projects, if any?
- Should one of the principals of the research team move to another institution or leave the project, how will you handle data, specimens, laboratory books, and authorship and credit?

Conflict of Interest

- How will you identify potential conflicts of interest among collaborators?
- Could a collaborator or any close family members or associates benefit financially from the research?
- Is a collaborator receiving money from someone who could benefit financially from the research?

B. "WELCOME TO MY TEAM" TEMPLATE

The Letter can transmit important information about:

- Goal of research group/PI vision
- Fulfilling the mission and providing training
- Role of the PI or Team Leader(s) – what can be expected
- Expectations of laboratory or team members

Specific Topic Areas Could Include:
Laboratory/Team Interactions and Procedures

- Team meetings, Journal Clubs, Sharing space and reagents, Using specialized equipment
- Time and attendance, Vacations, Sick leave
- Networking, Attending outside meetings, Professional etiquette
- PI or Team Leader(s) Work habits, Expected work habits

Conduct of research

- Scientific integrity/research ethics, Notebooks, record keeping, sharing data
- Data presentations, Submission of Abstracts and Presentations
- Responsibility for data storage and retrieval

Communication
- Seminars and talks, Abstracts and manuscripts
- Logistics and agendas for routine meetings, Expectations for participation and/or contribution
- Process to follow if there is a disagreement

Authorship & Collaborations/Sharing Credit
- Criteria/process for deciding, Ongoing projects
- Process for regular review and revision, Acknowledgments

Career Development
- Training in science, Communication skills (oral, written)
- Personal Interactions - professionalism
- Career Planning, Promoting the careers of more junior members
- Opportunities to take on new leadership roles

Evaluation
- Form and Frequency
- Reference Letters

Scientific Administration & Leadership
- Manuscript review
- Grantsmanship

Mentoring
- Finding a mentor (or mentors)
- Mentoring, sponsoring, coaching others

Institutional and Local Resources
- Employee assistance program/counseling, Housing, Local information

C. LANGUAGE TO INSERT INTO AN OFFER LETTER OR PRE-TENURE AGREEMENT

Although every recruitment is unique, emphasis on interdisciplinary and multidisciplinary science is becoming quite common. Research institutions wanting to encourage collaborative research while promoting development of bright early career researchers need to establish well-defined guidelines for review and reward of those who engage in interdisciplinary science.

It is crucial that offer letters explicitly delineate what is expected of both the institution and the individual scientist. The template below identifies a set of questions the answers to which ought to be clear from either the offer letter or ancillary communications with the recruit.

Participating in or Leading an Interdisciplinary Research Project

Roles, Responsibilities, Expectations

1. What will be the role of the individual?
2. What will be expected of the early career scientist?
3. How will success be defined for those participating in interdisciplinary research? Leading an interdisciplinary team?
4. What will be the role of the department? Chair?
5. What will be expected of the department? Chair?

Review and Reward*

1. Success: What criteria will be used to assess the progress and success of the scientist for interdisciplinary work?
2. Sharing Credit and Data: How will data sharing, processes for access to data, authorship decisions be reviewed and assessed?

Mentoring

1. How will the early career scientist be mentored in interdisciplinary research? (Individual mentor, mentoring committee, etc.)
2. What will be expected of the scientist in mentoring his or her own lab/team members?
3. What training is expected and/or required of those participating in or leading interdisciplinary efforts?

Joint Appointments

For researchers appointed in more than one department the agreement will clearly:

1. Identify the departments/organizations involved in supporting the scientist
2. State that the departments/organizations are committed to the tenure-track scientist
3. State who will be responsible for the administration of the scientist (performance reviews, HR, budget tracking, etc.) and define administrative home
4. Which resources will be provided by which department/organization
5. Commit to annual review and define who will participate

6. Establish a procedure to follow in case of disagreement
7. Establish a procedure to follow should any party decide to withdraw or significantly alter the agreement

Possible criteria to include for reviewing an interdisciplinary researcher:

1. Clearly describe the researcher's role in driving the project(s) forward
2. What is the major effort that she/he is leading or to which she/he is making significant scientific contributions?
3. Is the contribution essential for the overall success of the project?
4. How did the contribution influence the overall outcome/direction of the project?
5. Was the contribution original rather than a reproduction of the work of others (e.g., was the software developed with novel, original features that will be used by others in the field, or did the scientist merely modify existing software to make it compatible with the workflow of the project)?
6. What accomplishments/achievements can be attributed to the PI in the context of the larger team?
7. For PIs whose research is mainly collaborative, how is the contribution of the individual PI regarded in the PI's field of research? What is the significance of the contributions?
8. What agreements were put in place to decide how authorship, data, and presentations would be shared? What processes were put in place in case of disagreement?

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