Team Science and Lessons from Kindergarten: Reflections on Collaborative Research

2021 Mitchell Center Sustainability Talk Series

Pips Veazey

Director, UMaine Portland Gateway

Kindergarten

1. Share everything.
2. Don't hit people.
3. Put things back where you found them.
4. Clean up your own mess.
5. Watch out for traffic, hold hands, and stick together.
6. Say you’re sorry when you hurt somebody.

Be aware of wonder.

Robert Fulghum, All I Really Need to Know I Learned in Kindergarten

Overview of presentation

- A little about Pips
- Team science
- Lessons learned from working with research teams
- Roles for future scientists
- UMaine Portland Gateway


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U. S. COAST GUARD

Alaska EPSCoR

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Alaska NSF EPSCoR is a partnership dedicated to growing Alaska's scientific research capacity, funded by the National Science Foundation and the State of Alaska.

Partners in the Sky

Tanana Chiefs Conference collaborates on aerial remote sensing

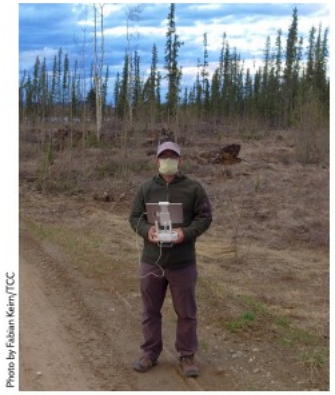


Photo by Fabian Keirn/TCC

Photo by Debra Lynne/TCC

Left: Tanana Chiefs Conference Forester Fabian Keirn gathers sUAS footage of a firebreak in the village of Tanacross, May 12, 2020. Right: Tanana Chiefs Conference Natural Cultural Resources Specialist Debra Lynne gathers sUAS footage of the Chena River outside Fairbanks in summer 2020.

TCC + sUAS = an exciting pair of research projects for Alaska NSF EPSCoR.

Researchers with the Tanana Chiefs Conference, the regional non-profit organization representing 42 Alaska Native tribes scattered across the Interior, are collaborating with the EPSCoR Boreal Fires team on two projects studying wildfire-related impacts using small unmanned aircraft systems (sUAS) or drones. One study examines vegetation regrowth in village firebreaks, and the other looks at how fires along rivers could influence salmon habitat and growth rates.

"They've got a better handle on what's important to their communities than we do," Boreal Fires researcher Todd Brinkman said of TCC. "I want us to co-produce research that helps TCC advocate for the interests of their communities and helps them make smart, timely, and adaptive decisions with regards to wildfire and to resilience to wildfire."

Firebreaks

In May 2020, TCC Forester Fabian Keirn traveled to the communities of Dot Lake, Tanacross and Tetlin, all of which had had preventative firebreaks put in at various times over the last 20 years. They are all "shaded fuelbreaks," in which crews had thinned stretches of woods rather than clear-cutting them. "That way when a fire is coming towards the community, the hope is that the

Continued on page 2

From the PI

Pips Veazey, Principal Investigator

Hello everyone,

It's mid-December, and it feels odd not to be at the temporary center of the science universe, the American Geophysical Union Fall Meeting. Instead of its usual San Francisco (or New Orleans or D.C.) venue, this year's event has been entirely virtual. Researchers from across EPSCoR have been presenting and exhibiting posters (here's a list) and discovering the ups and downs of the virtual format – the most significant downside probably being all the presentations scheduled for three a.m. Alaska time!

Speaking of virtual meetings, we held our first EPSCoR all-Zoom All-Hands Meeting November 4-5. The event went off without a hitch and more than 100 people attended to share in conversations and presentations

Continued on page 3

COVID Challenges

Coastal Margins researchers cope with coronavirus restrictions

As Brenda Konar sees it, the masks and the social distancing are the easy part.

The real challenges of conducting fieldwork during a pandemic, Konar says, lie in the endless stream of paperwork, the 12-hour drives from Fairbanks to Homer without being allowed to enter a building along the way, and - most onerous of all – the two weeks her research team has had to quarantine before every week-long research trip.

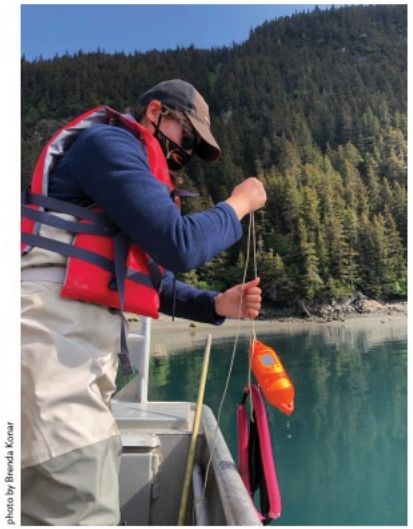


photo by Brenda Konar

Coastal Margins graduate student Lindsey Stadler checks readings on an aquatic sensor in Kachemak Bay.

"There are about seven days a month that I'm either not in the field or not in quarantine," said Konar, co-lead of the Coastal Margins component and head of intertidal and oceanic fieldwork in Kachemak Bay. "I feel like a true homebody right now."

Konar and her research team aren't the only Coastal Margins researchers who have had to drastically alter their research plans in the era of COVID. In Kachemak Bay and Lynn Canal, across river and estuary-based research projects, scientists have had to make significant changes in order to continue their five-year project of data collection in the Gulf of Alaska nearshore and the rivers that feed it.

ALASKA NSF EPSCoR

FIRE & ICE

2018-2023

Studying Student Stewards

UAF class charts young children's environmental engagement

How do children act as stewards of their environment?

That question was at the core of a recent UAF graduate course, "Children as Cultural Change Agents," which received support from an Alaska NSF EPSCoR Education and Outreach Seed Grant. Taught by UAF Associate Professor of Graduate Education and EPSCoR affiliate Dr. Carie Green, the class centered on participatory research projects engaging preschool, kindergarten, and high school students in the communities of Fairbanks, Kenai and Scammon Bay.

"The project is geared towards equipping educators to engage children in environmental stewardship," explained Green. "At each site they facilitated participatory research methods that honor children's voices and

photo courtesy Holly Williams

Scammon Bay kindergarten students take part in a playacting exercise as part of the "Children as Cultural Change Agents" course project.

PORTLAND GATEWAY

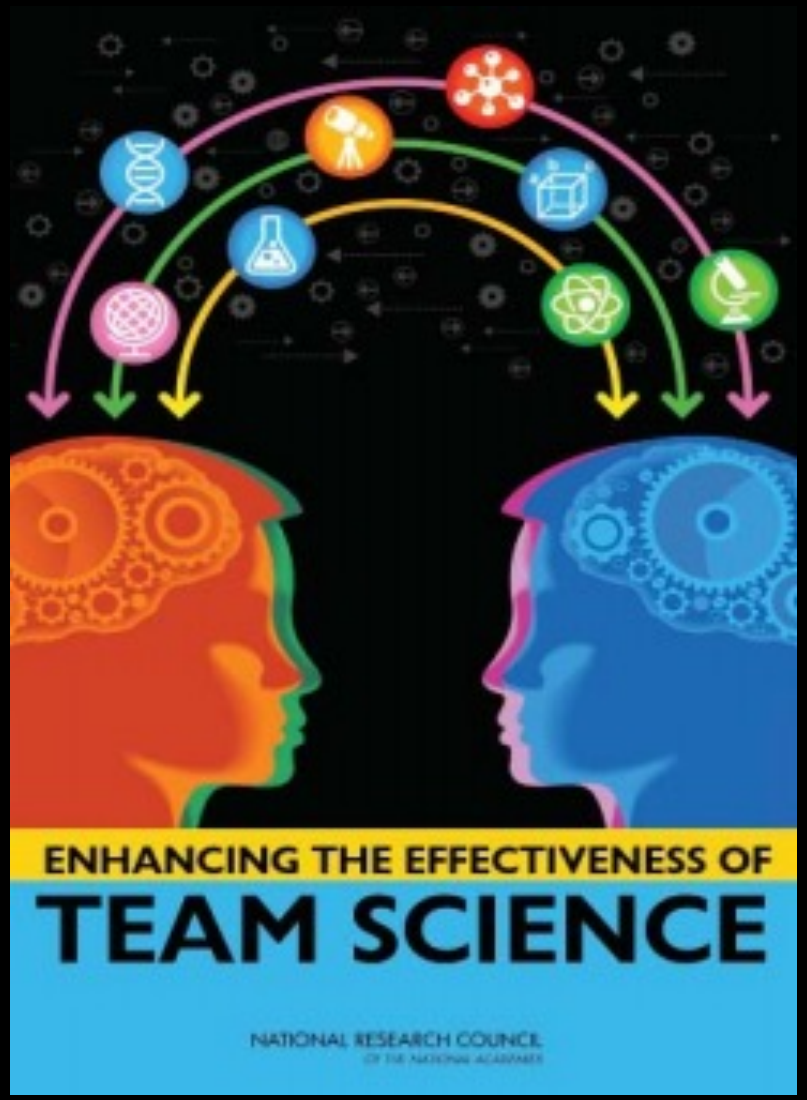
Creating Opportunities

"…the most [significant] barrier to successful translational research: the inability to create and sustain dynamic and innovative multidisciplinary research teams."

M. L. Disis, J. T. Slattery, The road we must take: Multidisciplinary team science. Sci. Transl. Med. 2, 22cm9 (2010)

WHAT IS TEAM SCIENCE?

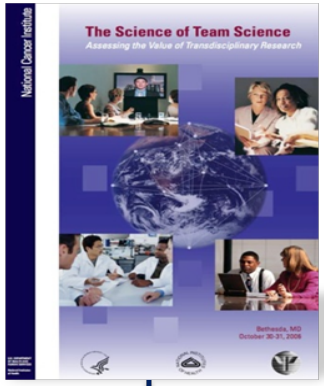
A collaborative effort to address a scientific challenge that leverages the strengths and expertise of professionals trained in different fields.



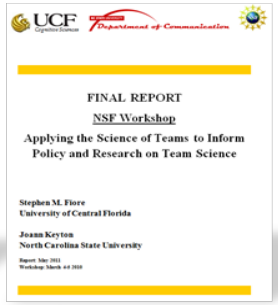
*National Research Council. 2015. Enhancing the Effectiveness of **Team Science**. Washington, DC: The National Academies Press. https://doi.org/10.17226/19007.*

Key Milestones in the SciTS Field

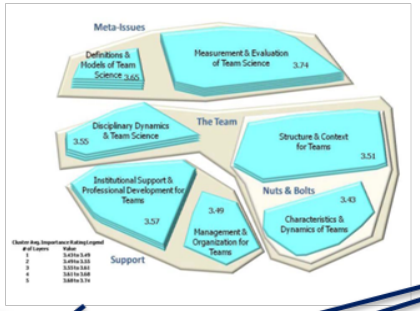
NCI Conference: The Science of Team Science: Assessing the Value of Transdisciplinary Research



Applying the Science of Teams to inform Policy & Research on Team Science



Mapping a Research Agenda for SciTS



Annual SciTS Conference

SciTS | Building the knowledge base for effective team science

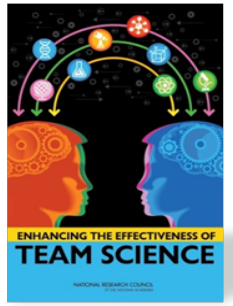
2006 2008 2010 2011 2012 2013 2014 2015 2016

SciTS Journal Supplement

Team Approaches to Science, Practice, & Policy in Health

Collaboration Science & Translational Medicine

National Academies Consensus Study

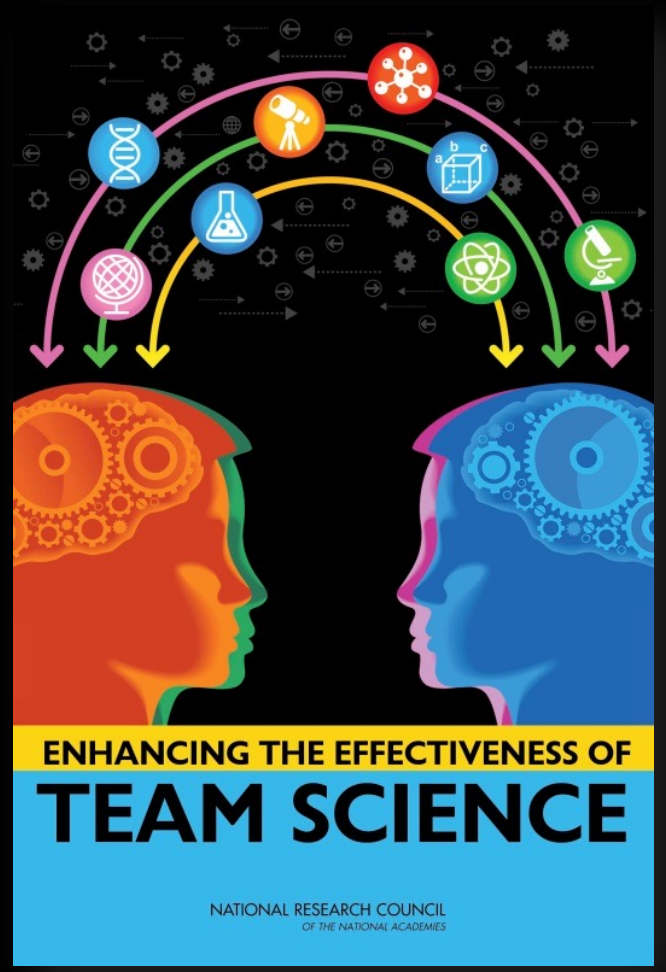


Hall, K. L., Stipelman, B. A., Vogel, A. L., & Stokols, D. (in press). Understanding cross-disciplinary team-based research: Concepts and conceptual models from the Science of Team Science. In Frodeman, R., Klein, J. T., & Mitcham, C. (Eds). *Oxford Handbook on Interdisciplinarity, 2nd Edition*. Oxford, UK: Oxford University Press.

Science of Team Science

The science points to interventions for:

- Assembling teams
- Collaboration planning
- Providing professional development and education opportunities
- Supporting leadership development opportunities
- Promotion and tenure credit for team-based work
- Study and measurement



*National Research Council. 2015. Enhancing the Effectiveness of **Team Science**. Washington, DC: The National Academies Press. https://doi.org/10.17226/19007.*

Features of Team Complexity

KEY FEATURES	LOW COMPLEXITY	HIGH COMPLEXITY
Size	Small (2)	Mega (1000s)
Task Interdependence	Low	High
Boundaries	Stable	Fluid
Goal Alignment	Aligned	Divergent or Misaligned
Integration	Unidisciplinary	Transdisciplinary
Diversity	Homogeneous	Heterogeneous
Proximity	Co-located	Geographically Distributed

*National Research Council. 2015. Enhancing the Effectiveness of **Team Science**. Washington, DC: The National Academies Press. https://doi.org/10.17226/19007.*

International Network of the Science of Team Science (INSciTS)

INSciTS
Building the knowledge base for effective team science
International Network for the Science of Team Science

INSciTS

Special Interest Groups

Which SIG is right for YOU?

https://www.inscits.org/sigs

Team Science Education and Training

Co-Chairs: Wayne McCormack and Liz Ryder

Create, Assess, Share, Disseminate

Team Incubation and Accleration

Co-Chairs: Ellen Fisher, Hannah Love, Alyssa Stephens

Build, Innovate, Generate, Inspire

Scientometrics and Data Analytics

Co-Chairs: Zaida Chinchilla-Rodriguez, Lin Zhang, and Yi Bu

Analysis, Networks, Data Visualization, Indicators

Fostering Team Science in Academia

Co-Chairs: Steve Crowley and Kathy Halvorsen

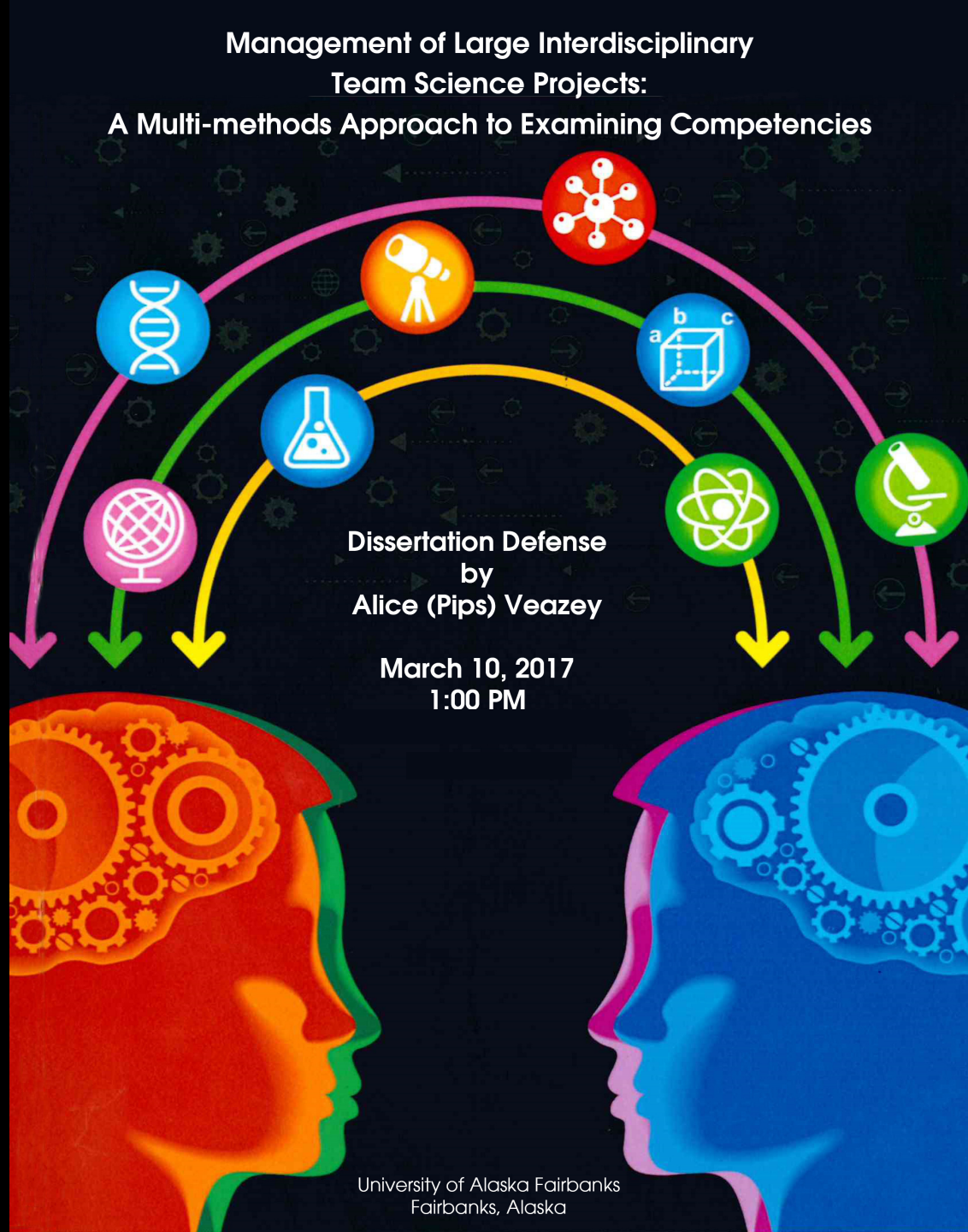
Recognize, Reward, Assess, Promote

Intereach

Co-Chairs: Kristine Glauber and Christine Hendren

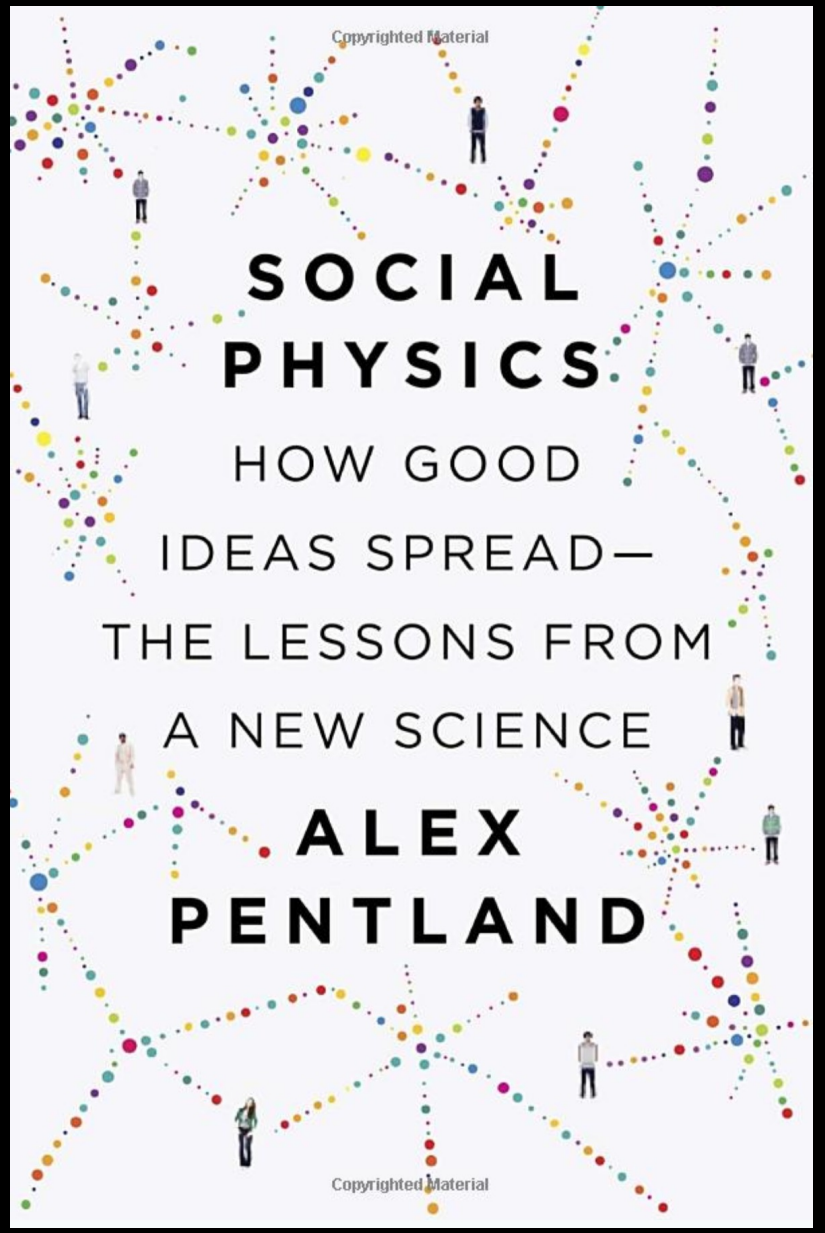
Professional Development and Developing the Profession

PhD, Interdisciplinary: Team Science Leadership



Sandy Pentland, MIT

Sociometers and team success

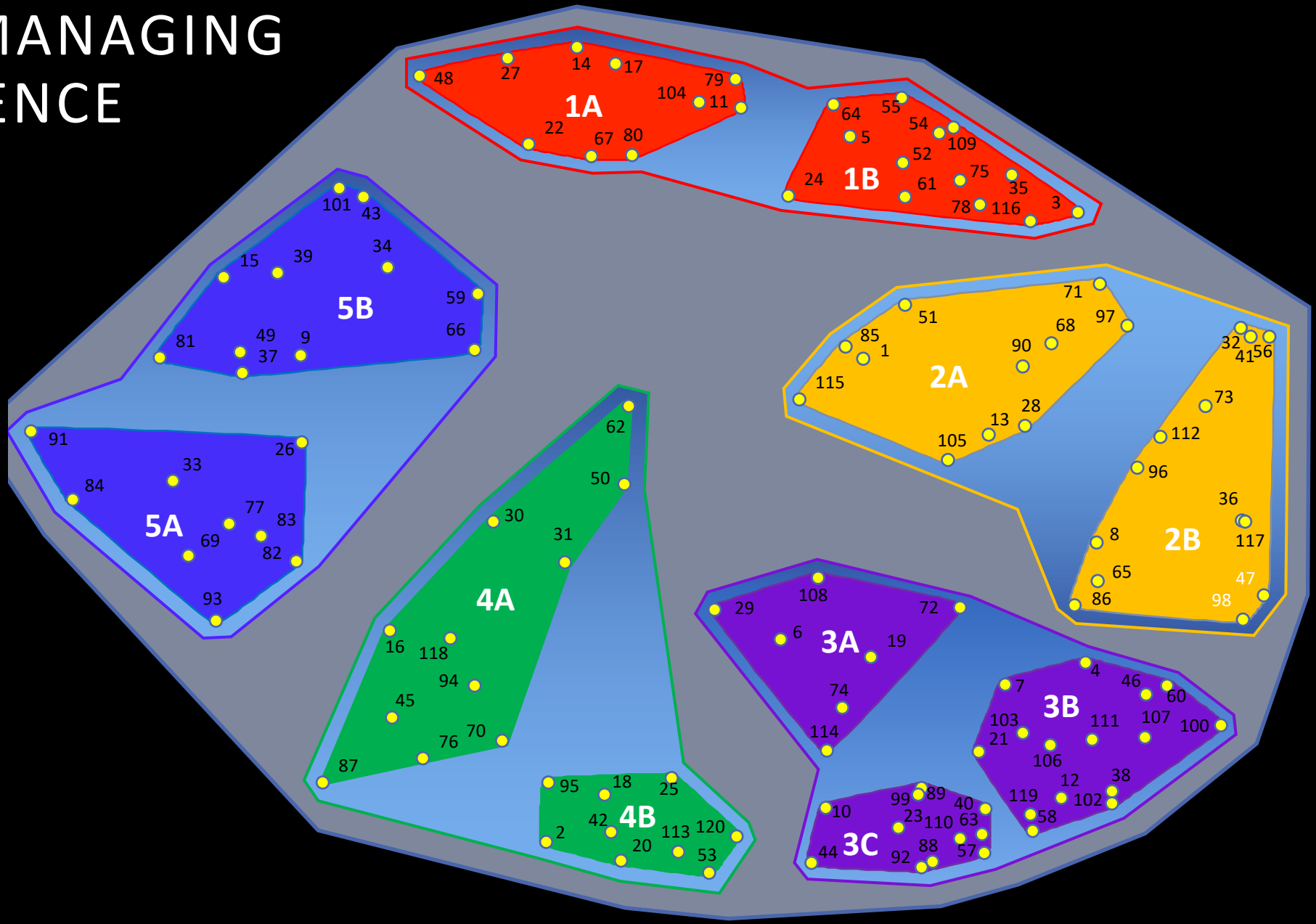


Team performance driven by 5 measurable factors:

1. Everyone in the group talks and listens in roughly equal measure, keeping contributions short
2. Members maintain high levels of eye contact, and their conversations and gestures and energetic
3. Members communicate directly with one another, not just with the team leader
4. Members carry on back-channel conversation or side conversations within the team
5. Members periodically break, go exploring outside the team, and bring information back to share with others

LEADING AND MANAGING TEAM SCIENCE

1. Project Management
   - A. Knowing
   - B. Doing
2. Shared Leadership
   - A. Organizational Management
   - B. Organizational Empowerment
3. Personal Competence
   - A. Team Management
   - B. Self-management
   - C. Self-awareness
4. Social Competence
   - A. Relationship Management
   - B. Social Awareness
5. Communication
   - A. Internal to team
   - B. External to team



http://search.proquest.com/openview/4077d8f594272097f4611dfa9dd479b8/1?pq-origsite=gscholar&cbl=18750&diss=y.

TEAM LEADERSHIP

Project Management

The application (*doing*) of knowledge, skills, tools (*knowing*), and techniques to project activities to meet the project requirements

Communication

Internal: communication within the team

External: **communication** between the team and the rest of the world

Sharing information…

Shared Leadership

A leadership style that broadly distributes leadership responsibility and can be formally appointed at the outset…or can emerge over time.

Organizational management**:** organizing, planning, leading and controlling resources

Organizational empowerment**:** empowering employees in an ongoing process of providing the tools, training, resources, encouragement and motivation people need to perform at the optimum level; enabling individuals to adopt new behaviors that further their individual and organizational aspirations

Social Competence

Ability to understand other people's moods, behaviors and motives in order to respond effectively

Relationship management: clear communication and effective handling of conflict; the bonds built with others over time; ability to see the benefit of connecting with many different people, even those who are difficult partners

Social awareness: carefully consideration of what people want, and a plan to communicate with them in a way that is intended to meet that need

Personal Competence

Ability to stay aware of your own emotions and manage your behavior and tendencies

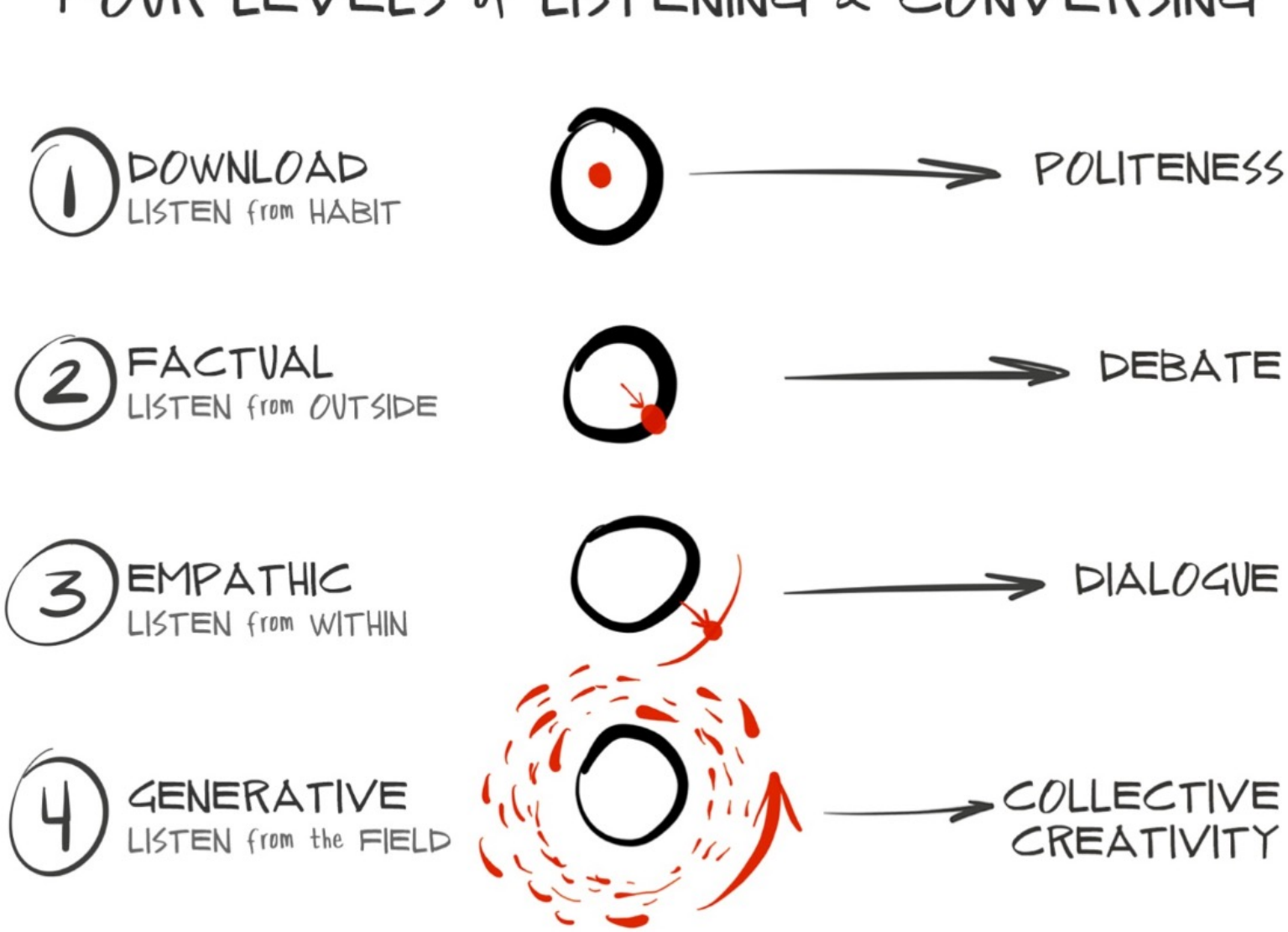
Team management*:* ability of an individual (or an organization) to administer and coordinate a group of individuals to perform a task

Self-awareness*:* ability to recognize your own emotions and their effects on yourself and other people

Self-management*:* builds on self-awareness, using self-control to ensure that emotions don't control you regardless of the situation

Research collaboration: some critical elements

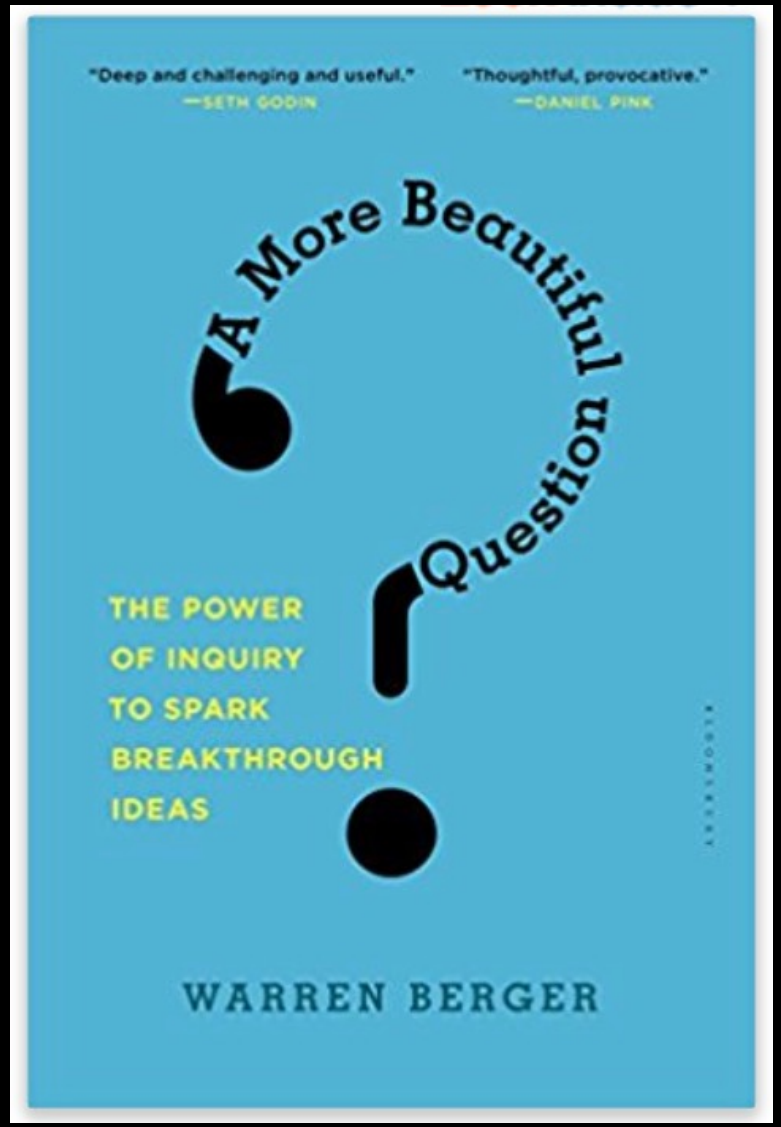
- Listening
- Questioning
- Visualizing
- Collaborating
- Suspending belief
- Facilitating and more



Four levels of LIstening, from Otto Scharmer.

Warren Berger

A beautiful question is an ambitious yet actionable question that can begin to shift the way we perceive or think about something – and that might serve to bring about change.



Interdisciplinary Research Teams

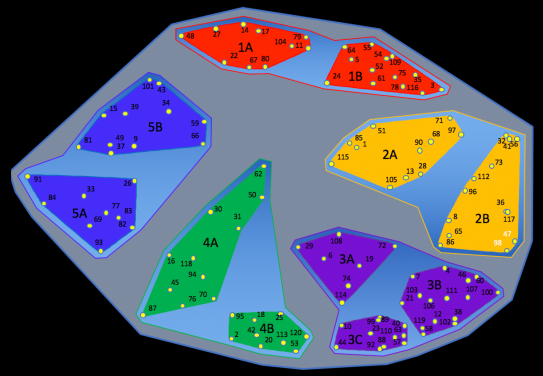
Alaska NSF EPSCoR (Established Program to Stimulate Competitive Research) builds Alaska's scientific capacity by engaging in research and education projects supported by the state of Alaska and the National Science Foundation.

The **Alaska Adapting to Changing Environments (ACE)** project examines the mechanisms by which communities adapt to environmental and social change. The six-year (2012-18) effort has focused on subsistence users in Northern Alaska, fisheries in Southcentral Alaska, and tourism businesses in Southeast Alaska.

Alaska Fire and Ice (F&I), 2018-23, uses remote sensing, fieldwork, laboratory experiments, and modeling methods to study climate-driven changes to two critical Alaskan systems: wildfire regimes in the Alaskan boreal forest, and the coastal ecosystems of the Gulf of Alaska.

Leadership Competencies

Project managers and leaders from the NSF EPSCoR community participated in a group concept mapping exercise, through which they developed a map of the competencies needed to effectively manage large and complex team science programs. While there is an existing body of knowledge pertaining to the field of "project management" within professional organizations and degree programs, participants found project management skills to be only one of five critical elements of effective team science management. They also identified four other conceptual groupings as important components of a competency framework: shared leadership, personal competence, social competence and communication.



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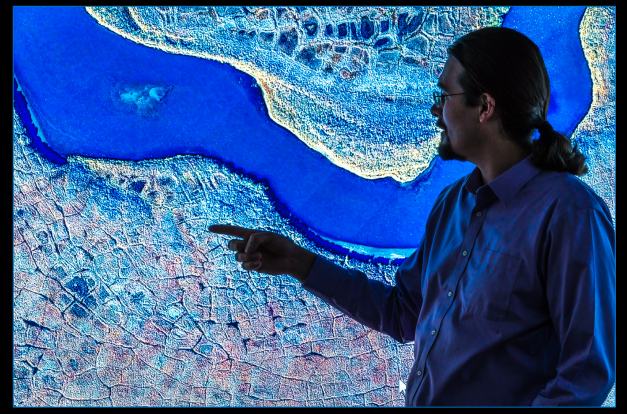
5. Communication
   A. Internal to Team B. External to Team

Visualization Space

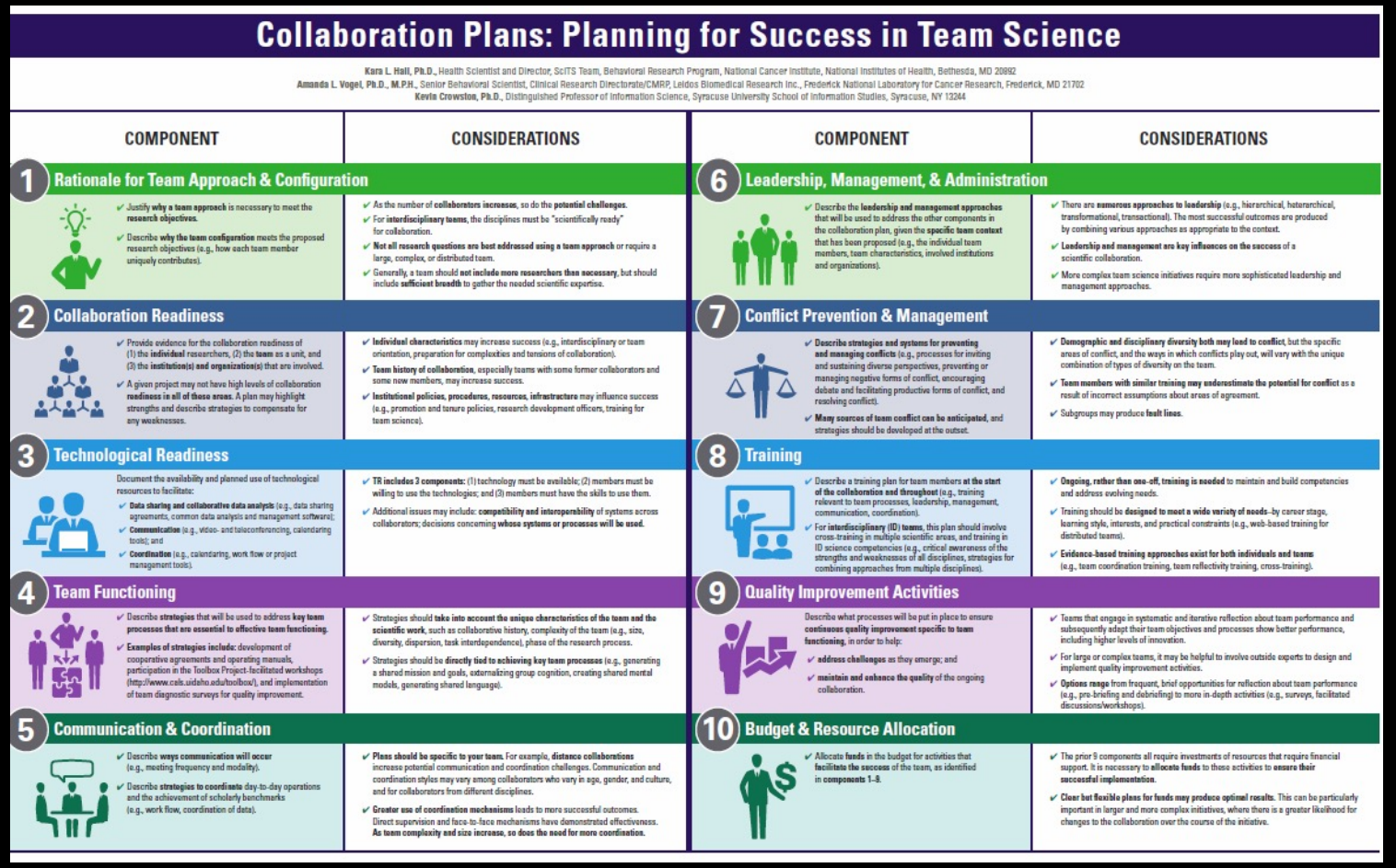
Built in 2016, Vis Space is an interactive, high-resolution visual environment designed to enable discussions and decision-making by policymakers, researchers, and industry leaders. There is a growing need for such environments stemming from advances in visualization technology; data sets of unprecedented size; an increasing need for team approaches to complex research and policy questions; and a growing acknowledgement of the importance of visual stimuli to fully engage the decision-making capacity of the human brain.



PREPARING FOR TEAM SCIENCE: TOOLS

COLLABORATION PLAN

Detailed plan that describes multi level ways the group will plan for and support effective collaboration



Collaboration Plans: Planning for Success in Team Science

Kara L. Hall, Ph.D., Health Scientist and Director, SciTS Team, Behavioral Research Program, National Cancer Institute, National Institutes of Health, Bethesda, MD 20892
Amanda L. Vogel, Ph.D., M.P.H., Senior Behavioral Scientist, Clinical Research Directorate/CMRP, Leidos Biomedical Research Inc., Frederick National Laboratory for Cancer Research, Frederick, MD 21702
Kevin Crowston, Ph.D., Distinguished Professor of Information Science, Syracuse University School of Information Studies, Syracuse, NY 13244

COMPONENT	CONSIDERATIONS
1 Rationale for Team Approach & Configuration	
✔ Justify **why a team approach** is necessary to meet the **research objectives.** ✔ Describe **why the team configuration** meets the proposed research objectives (e.g., how each team member uniquely contributes).	✔ As the number of **collaborators increases**, so do the **potential challenges.** ✔ For **interdisciplinary teams**, the disciplines must be "scientifically ready" for collaboration. ✔ **Not all research questions are best addressed using a team approach** or require a large, complex, or distributed team. ✔ Generally, a team should **not include more researchers than necessary**, but should include **sufficient breadth** to gather the needed scientific expertise.
2 Collaboration Readiness	
✔ Provide evidence for the collaboration readiness of (1) the **individual** researchers, (2) the **team** as a unit, and (3) the **institution(s) and organization(s)** that are involved. ✔ A given project may not have high levels of collaboration **readiness in all of these areas.** A plan may highlight strengths and describe strategies to compensate for any weaknesses.	✔ **Individual characteristics** may increase success (e.g., interdisciplinary or team orientation, preparation for complexities and tensions of collaboration). ✔ **Team history of collaboration**, especially teams with some former collaborators and some new members, may increase success. ✔ **Institutional policies, procedures, resources, infrastructure** may influence success (e.g., promotion and tenure policies, research development officers, training for team science).
3 Technological Readiness	
Document the availability and planned use of technological resources to facilitate: ✔ **Data sharing and collaborative data analysis** (e.g., data sharing agreements, common data analysis and management software); ✔ **Communication** (e.g., video- and teleconferencing, calendaring tools); and ✔ **Coordination** (e.g., calendaring, work flow or project management tools).	✔ **TR includes 3 components:** (1) technology must be available; (2) members must be willing to use the technologies; and (3) members must have the skills to use them. ✔ Additional issues may include: **compatibility and interoperability** of systems across collaborators; decisions concerning **whose systems or processes will be used.**
4 Team Functioning	
✔ Describe **strategies** that will be used to address **key team processes that are essential to effective team functioning.** ✔ **Examples of strategies include:** development of cooperative agreements and operating manuals, participation in the Toolbox Project-facilitated workshops (http://www.cals.uidaho.edu/toolbox/), and implementation of team diagnostic surveys for quality improvement.	✔ Strategies should **take into account the unique characteristics of the team and the scientific work**, such as collaborative history, complexity of the team (e.g., size, diversity, dispersion, task interdependence), phase of the research process. ✔ Strategies should be **directly tied to achieving key team processes** (e.g., generating a shared mission and goals, externalizing group cognition, creating shared mental models, generating shared language).
5 Communication & Coordination	
✔ Describe **ways communication will occur** (e.g., meeting frequency and modality). ✔ Describe **strategies to coordinate** day-to-day operations and the achievement of scholarly benchmarks (e.g., work flow, coordination of data).	✔ **Plans should be specific to your team.** For example, **distance collaborations** increase potential communication and coordination challenges. Communication and coordination styles may vary among collaborators who vary in age, gender, and culture, and for collaborators from different disciplines. ✔ **Greater use of coordination mechanisms** leads to more successful outcomes. Direct supervision and face-to-face mechanisms have demonstrated effectiveness. **As team complexity and size increase, so does the need for more coordination.**
6 Leadership, Management, & Administration	
✔ Describe the **leadership and management approaches** that will be used to address the other components in the collaboration plan, given the **specific team context** that has been proposed (e.g., the individual team members, team characteristics, involved institutions and organizations).	✔ There are **numerous approaches to leadership** (e.g., hierarchical, heterarchical, transformational, transactional). The most successful outcomes are produced by combining various approaches as appropriate to the context. ✔ **Leadership and management are key influences on the success** of a scientific collaboration. ✔ More complex team science initiatives require more sophisticated leadership and management approaches.
7 Conflict Prevention & Management	
✔ **Describe strategies and systems for preventing and managing conflicts** (e.g., processes for inviting and sustaining diverse perspectives, preventing or managing negative forms of conflict, encouraging debate and facilitating productive forms of conflict, and resolving conflict). ✔ **Many sources of team conflict can be anticipated**, and strategies should be developed at the outset.	✔ **Demographic and disciplinary diversity both may lead to conflict**, but the specific areas of conflict, and the ways in which conflicts play out, will vary with the unique combination of types of diversity on the team. ✔ **Team members with similar training may underestimate the potential for conflict** as a result of incorrect assumptions about areas of agreement. ✔ Subgroups may produce **fault lines.**
8 Training	
✔ Describe a training plan for team members **at the start of the collaboration and throughout** (e.g., training relevant to team processes, leadership, management, communication, coordination). ✔ For **interdisciplinary (ID) teams**, this plan should involve cross-training in multiple scientific areas, and training in ID science competencies (e.g., critical awareness of the strengths and weaknesses of all disciplines, strategies for combining approaches from multiple disciplines).	✔ **Ongoing, rather than one-off, training is needed** to maintain and build competencies and address evolving needs. ✔ Training should be **designed to meet a wide variety of needs**–by career stage, learning style, interests, and practical constraints (e.g., web-based training for distributed teams). ✔ **Evidence-based training approaches exist for both individuals and teams** (e.g., team coordination training, team reflectivity training, cross-training).
9 Quality Improvement Activities	
Describe what processes will be put in place to ensure **continuous quality improvement specific to team functioning**, in order to help: ✔ **address challenges** as they emerge; and ✔ **maintain and enhance the quality** of the ongoing collaboration.	✔ Teams that engage in systematic and iterative reflection about team performance and subsequently adapt their team objectives and processes show better performance, including higher levels of innovation. ✔ For large or complex teams, it may be helpful to involve outside experts to design and implement quality improvement activities. ✔ **Options range** from frequent, brief opportunities for reflection about team performance (e.g., pre-briefing and debriefing) to more in-depth activities (e.g., surveys, facilitated discussions/workshops).
10 Budget & Resource Allocation	
✔ Allocate **funds** in the budget for activities that **facilitate the success** of the team, as identified in **components 1–9.**	✔ The prior 9 components all require investments of resources that require financial support. It is necessary to **allocate funds** to these activities to **ensure their successful implementation.** ✔ **Clear but flexible plans for funds may produce optimal results.** This can be particularly important in larger and more complex initiatives, where there is a greater likelihood for changes to the collaboration over the course of the initiative.

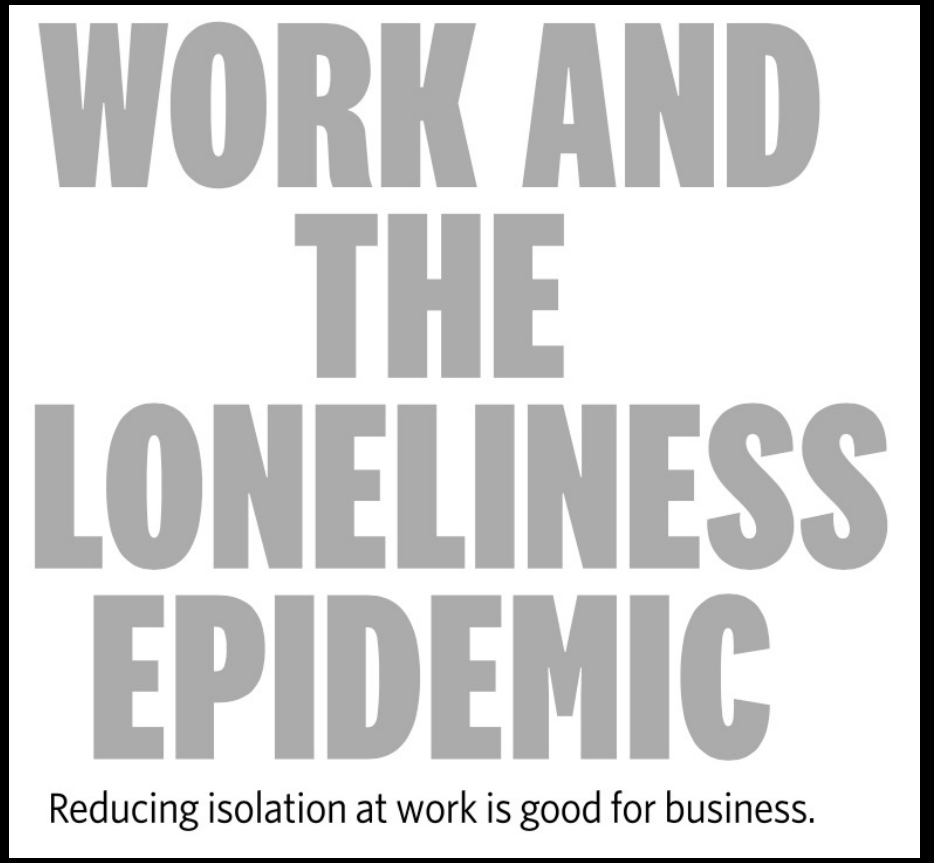
Bennett, L. M., Gadlin, H., & Levine-Finley, S. (2010). Collaboration & Team Science: A Field Guide. Bethesda, MD: NIH.

Abraham Lincoln

“I don’t like that man very much; I must get to know him better.”

Work today

Vivek Murthy, Surgeon General of the United States

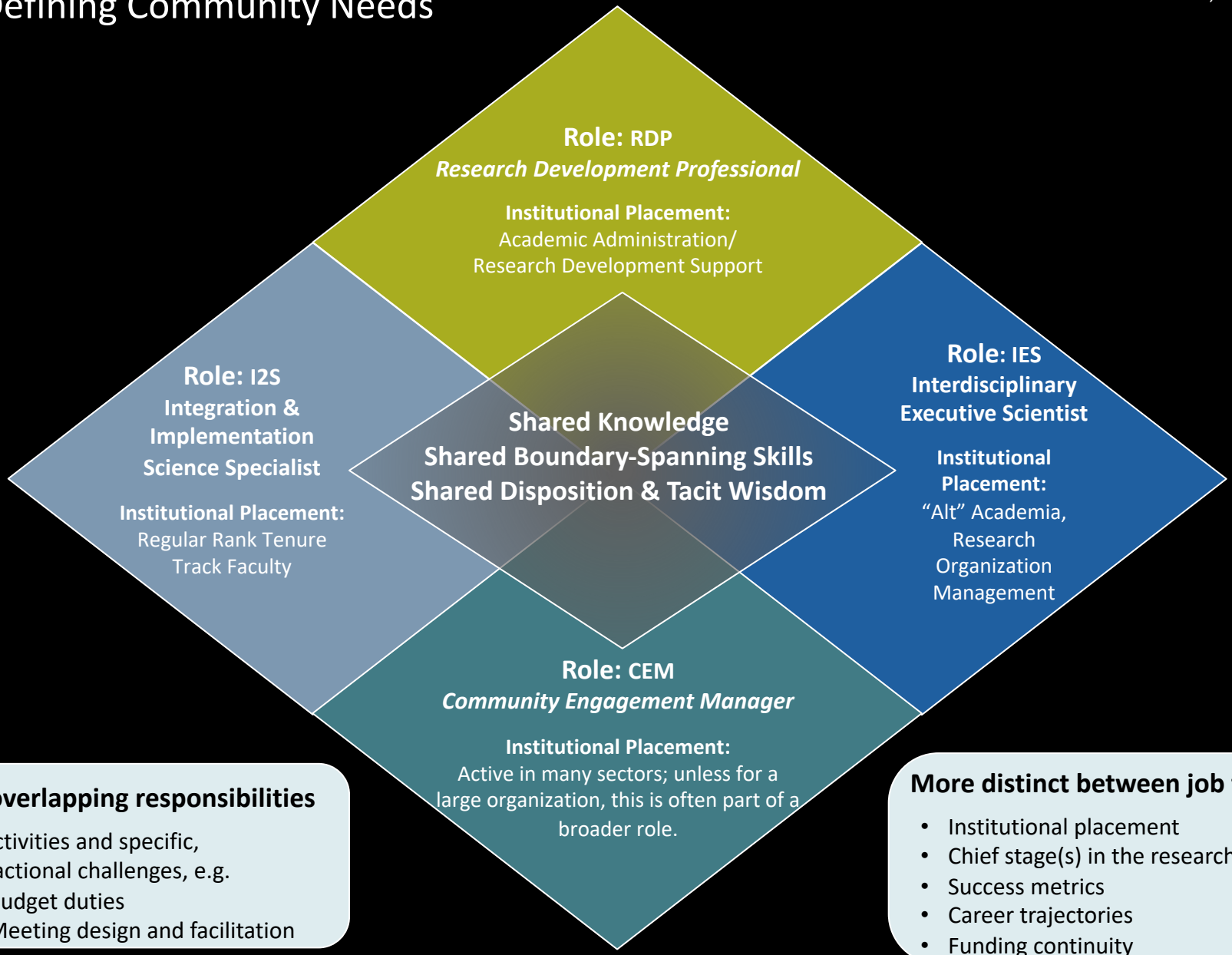


61% (from 40%) of Americans feel lonely

20% of Americans like their jobs

Overlaps & Distinctions in Practitioner Jobs:
Both Helpful in Defining Community Needs

Hendren et al., 2021, INTEREACH (Interdisciplinary Integration Research Careers Hub) Special Interest Group Panel, Science of Team Science Conference, International Network for the Science of Team Science, Virginia Tech University (virtual).



Many overlapping responsibilities

- Job activities and specific, transactional challenges, e.g.
  - Budget duties
  - Meeting design and facilitation

More distinct between job types

- Institutional placement
- Chief stage(s) in the research life cycle
- Success metrics
- Career trajectories
- Funding continuity

PORTLAND GATEWAY

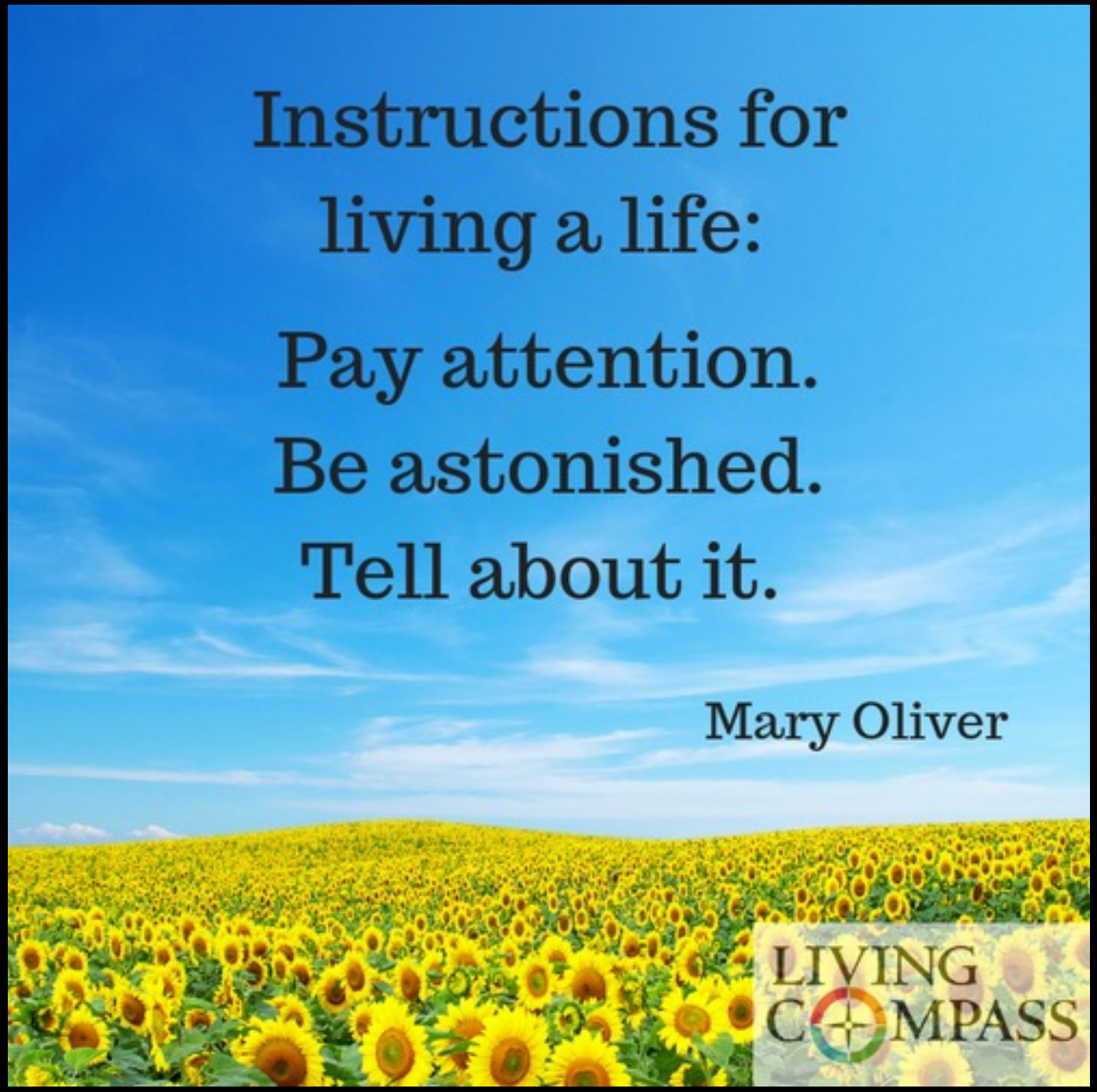
Creating Opportunities

One-Stop Connection to UMaine
Research, Education, and Outreach

gateway@maine.edu

UMaine research

Despite the daunting challenges caused by the pandemic, UMaine set another new record in the past fiscal year by generating **$133.6 million** in external funding, an all-time record high.


Instructions for
living a life:
Pay attention.
Be astonished.
Tell about it.
Mary Oliver
LIVING
COMPASS

Thank you.