Conference Program

SciTS 2017

Building the knowledge base for effective team science

June 12-14, 2017
Hyatt Regency Clearwater Beach Resort & Spa
Clearwater Beach, FL
www.scienceofteamscience.org

Science of Team Science (SciTS) 2017 Conference

Day 1: Monday, June 12, 2017

8:00 am	Registration *Gallery, 2nd Floor*		
8:00 am	Continental Breakfast *Belleair Room*		
9:00–12:00 pm Morning Workshop Sessions "Techniques and Training for SciTS"	Workshop 1: Taking the Pulse of the Science of Team Science with the Toolbox Dialogue Initiative *Sand Key*	Workshop 2: Improvisation for Leadership and Critical Communication with sideCoach *Longboat Key*	Workshop 3: Enhancing Team Science Effectiveness through Team Training *Aqualea Ballroom AB*
12:00–1:30 pm	Complimentary Lunch Buffet *Belleair Room*		
1:30–4:30 pm Afternoon Workshop Sessions "Processes and Technologies in Support of SciTS"	Workshop 4: Self-Identifying that Knowledge, Skills, and Dispositional Attributes that Define the Intereach Community *Sand Key*	Workshop 5: Network Perspectives to Understand and Enable Team Science *Longboat Key*	Workshop 6: Collaborative Technologies: Facilitating How We Conduct Research Together *Aqualea Ballroom C*
4:30-5:00 pm	Networking Break *Gallery and Siesta Key*		
5:00-5:15 pm	Welcome and Introduction *Aqualea Ballroom AB*		
5:15-6:00 pm	Opening Featured Speaker: Heidi Gardner, Harvard University *Aqualea Ballroom AB*		
6:00-6:45 pm	Poster Session and Happy Hour *Gallery and Siesta Key*		
6:45-8:00 pm	Networking Reception with Substantial Hors d'oeuvres *16th Floor Sky Terrace*		

Day 2: Tuesday, June 13, 2017

8:00 am	Registration *Gallery, 2nd Floor*			
8:00 am	Continental Breakfast *Belleair Room*			
8:55–9:00 am	Welcome & Introduction *Aqualea Ballroom AB*			
9:00–10:00 am	Featured Speaker: Jakob Zinsstag-Klopfenstein, Swiss Tropical and Public Health Institute *Aqualea Ballroom AB*			
10:00–10:45 am	SciTS Recognition Award *Aqualea Ballroom AB*			
10:45–11:00 am	Networking Break *Gallery and Siesta Key*			
11:00–12:00 pm Thematic Paper Sessions and Panels (submitted)	Papers: Multi-Site Health Research Collaborations *Sand Key*	Papers: Team Science Training for Graduate Students and Postdocs *Longboat Key*	Papers: Conceptual and Theoretical Frameworks for Understanding Team Science *Madeira*	Papers: Centers and Institutes to Promote Team Science - What Leads to Success? *Aqualea Ballroom C*
12:00–1:30 pm	Complimentary Lunch Buffet and Featured Speaker: Suzanne Bell, DePaul University *Aqualea Ballroom AB*			
1:30–3:00 pm Thematic Paper Sessions and Panels (submitted)	Panel: Reward and Recognition across the Spectrum *Aqualea Ballroom C*	Papers: Training for Team Science — Developing Team Science Competencies *Madeira*	Papers: Evaluating and Enhancing Team Processes *Longboat Key*	Papers: Collaborations across Academia, Industry, and Government *Sand Key*
3:00–3:15 pm	Networking Break *Gallery and Siesta Key*			

3:15–4:45 pm Thematic Paper Sessions and Panels (submitted)	Panel: Seeding and Watering New Cross-Disciplinary Collaborations *Aqualea Ballroom C*	Papers: New Technologies and Evaluation Approaches *Madeira*	Papers: Insights through Network Analysis *Sand Key*	Papers: Translational Health Research *Longboat Key*
4:45–5:00 pm	Networking Break *Gallery and Siesta Key*			
5:00–6:00 pm Thematic Paper Sessions and Panels (submitted)	Papers: Ethics and Integrity in Team Science *Aqualea Ballroom C*	Papers: International, Large-Scale Distributed Teams *Longboat Key*	Papers: New Findings on What Leads to Innovation *Sand Key*	Papers: Gender and Diversity in Teams *Madeira*

Day 3: Wednesday, June 14, 2017

8:00 am	Registration *Gallery, 2nd Floor*	
8:00 am	Continental Breakfast *Belleair Room*	
9:00–9:05 am	Welcome & Introduction *Aqualea Ballroom AB*	
9:05–10:30 am	Featured Panel: Humanities, Arts, Science, and Technology Alliance and Collaboratory *Aqualea Ballroom AB*	
10:30–10:45 am	Networking Break *Gallery and Siesta Key*	
10:45 –11:30 am	Featured Speaker: William "Brandon" Vessey, NASA International Space Station Medical Project at Johnson Space Center *Aqualea Ballroom AB*	
11:30-12:45 pm	Complimentary Lunch Buffet *Belleair Room*	Emerging Scholars Luncheon *Sand Key*

12:45-1:30 pm	Keynote Speaker: James Olds, National Science Foundation *Aqualea Ballroom AB*			
1:30–3:00 pm Thematic Paper Sessions and Panels (submitted)	Panel: Beyond the Ivory Tower *Longboat Key*	Panel: Interdisciplinary Integration Exercises *Aqualea Ballroom C*	Papers: Approaches to Foster New Innovative Collaborations *Madeira*	Papers: Creating an Institutional Culture for Team Science *Sand Key*
3:00-3:30 pm	Networking Break *Gallery and Siesta Key*			
3:30-5:00 pm Thematic Paper Sessions and Panels (submitted)	Panel: Before, During, and After - Using Social Network Analysis as a Tool to Identify Potential Research Sites *Longboat Key*	Panel: Community Management in Scientific Teams and Communities *Aqualea Ballroom C*	Papers: Dialogue Approaches to Build Bridges across Disciplines and Perspectives *Sand Key*	Papers: Team Formation and Cohesion *Madeira*
5:00-5:30 pm	Closing Session *Aqualea Ballroom AB*			

Table of Contents

Special Thanks to this Year's Sponsors!

Sapphire Sponsors

UCF | Institute for Simulation and Training
UNIVERSITY OF CENTRAL FLORIDA

JOHN TEMPLETON FOUNDATION

Platinum Sponsors

UCF Faculty Cluster Initiative
UNIVERSITY OF CENTRAL FLORIDA

UF Clinical and Translational Science Institute
UNIVERSITY of FLORIDA

NIH National Institutes of Health
Turning Discovery Into Health

Gold Sponsors

SCHOOL OF VISUAL ARTS & DESIGN
SVAD
UNIVERSITY OF CENTRAL FLORIDA

Trellis | AAAS

Silver Sponsors

UCF Cognitive Sciences Laboratory
UNIVERSITY OF CENTRAL FLORIDA

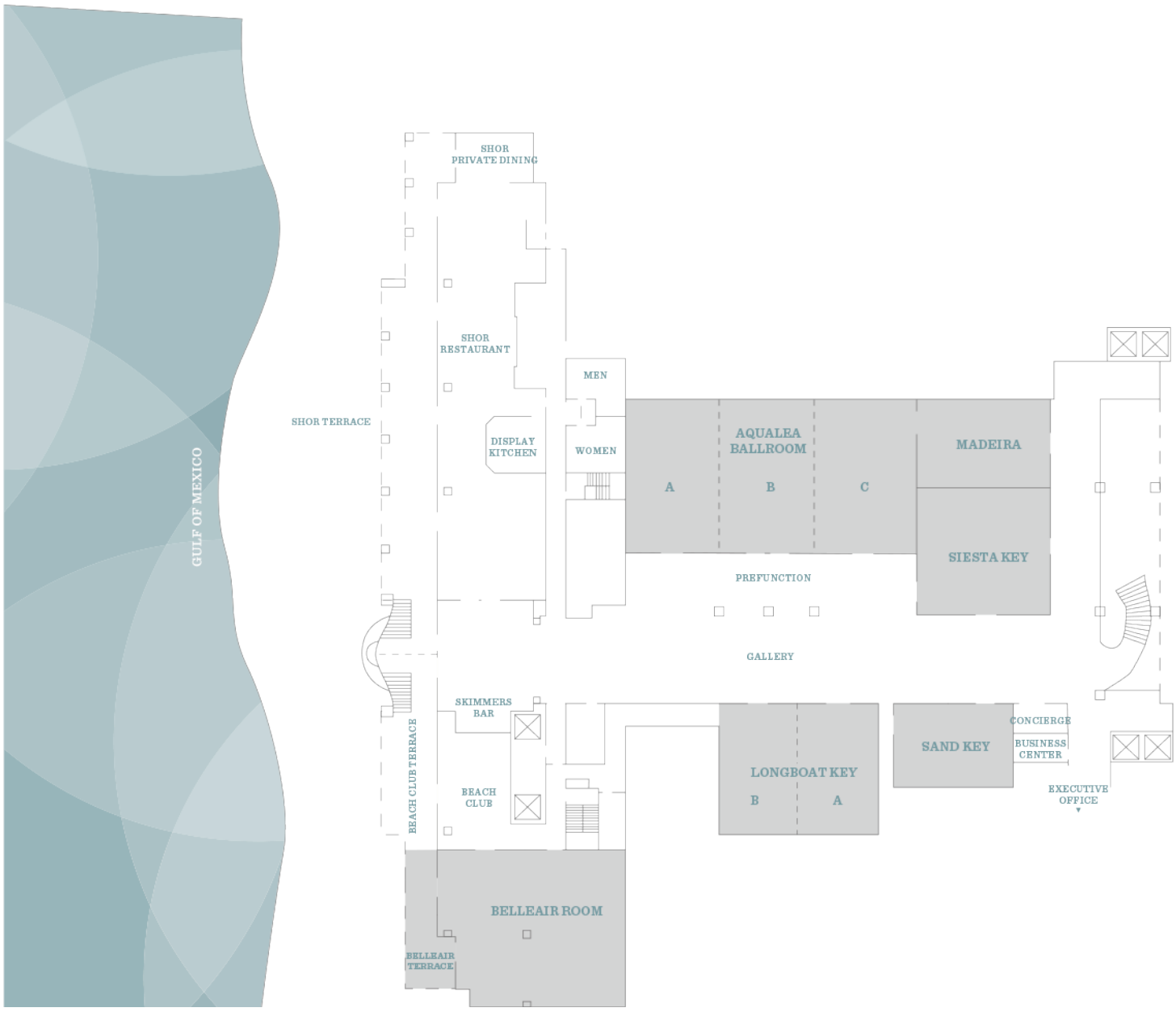
Westat

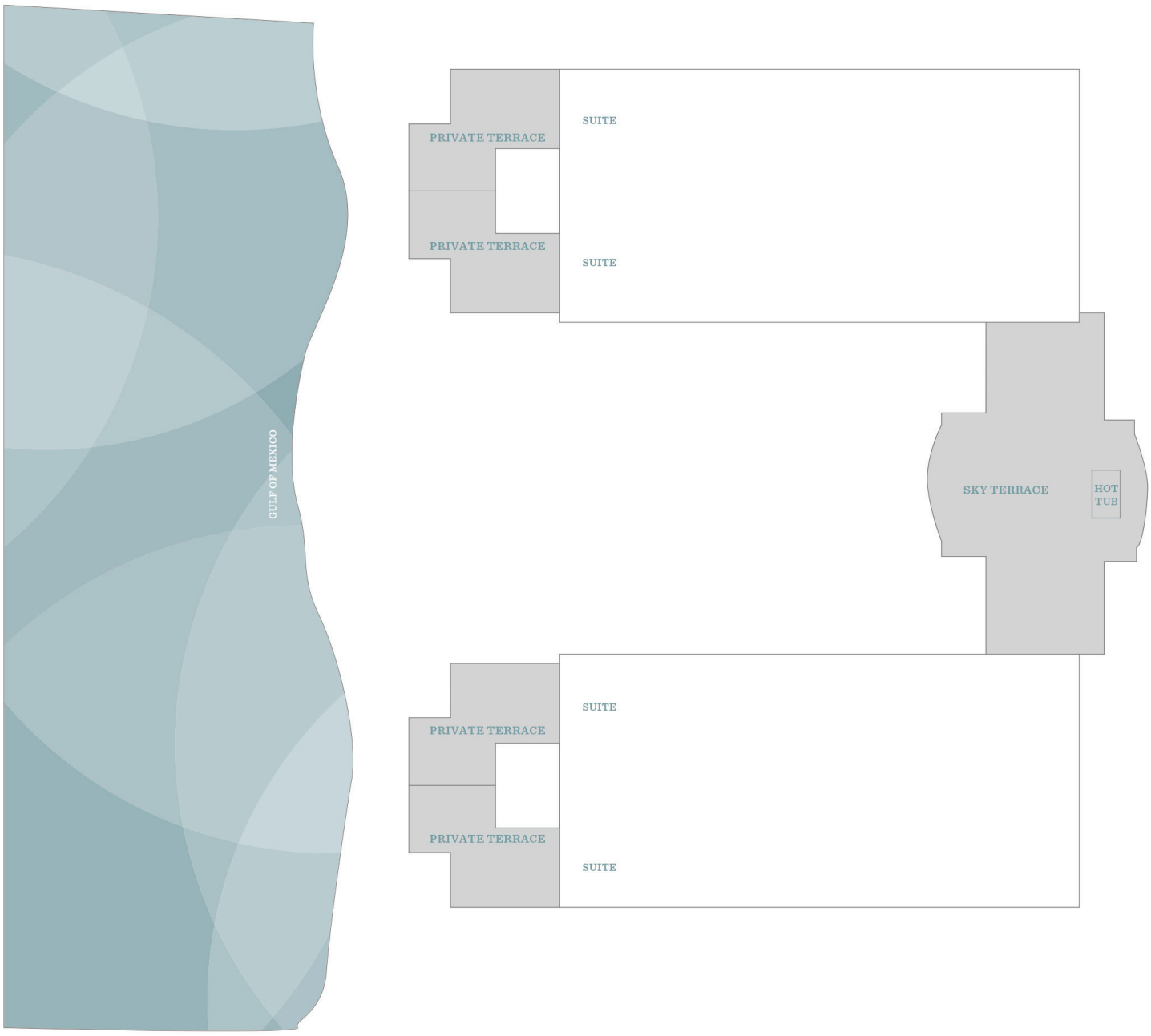
Bond Life Sciences Center
University of Missouri

The opening and closing sessions, along with all featured speaker talks, will be held in the Aqualea Ballroom. Concurrent sessions will be held in Aqualea Ballroom C, Sand Key, Longboat Key, and Madeira. The Monday evening poster session will be held in the Poster Gallery followed by the Networking Reception on the 16th Floor Sky Terrace.

Conference rooms are indicated on the following maps of the Hyatt Regency Clearwater Beach Resort & Spa by the dark gray boxes.

FLOOR PLAN
Second Floor




GULF OF MEXICO
PRIVATE TERRACE
SUITE
PRIVATE TERRACE
SUITE
SKY TERRACE
HOT TUB
PRIVATE TERRACE
SUITE
PRIVATE TERRACE
SUITE

SciTS 2017 Conference Planning Committee and Support

Conference Chair

Stephen M. Fiore, Ph.D.
Director, Cognitive Sciences Laboratory
Cognitive Sciences, Department of Philosophy and Institute for Simulation and Training
University of Central Florida

Conference Co-Chair

Kara L. Hall, Ph.D.
Director, Science of Team Science Team
Behavioral Research Program
National Cancer Institute

Program Chair

Maritza Salazar, Ph.D.
Assistant Professor of Organization and Management
University of California, Irvine

Program Co-Chair

Gaetano R. Lotrecchiano, EdD, Ph.D.
Associate Professor of Clinical Research and Leadership and Pediatrics at The George Washington University School of Medicine and Health Sciences

Conference Planning Committee

Gabriele Bammer, Ph.D.
Professor, National Centre for Epidemiology & Population Health
Australian National University

Heather Billings, Ph.D.
Director, Faculty Development
Center for Clinical & Translational Sciences (CCaTS)
Mayo Clinic

Stephen Crowley, Ph.D.
Associate Professor
Department of Philosophy
Boise State University

Holly J. Falk-Krzesinski, Ph.D.
Vice President
Global Academics & Research Relations
Elsevier

Scott Leischow, Ph.D.
Professor of Health Services Research
Office of Health Disparities Research
Mayo Clinic

Janet Okamoto, Ph.D.
Research Associate
Office of Health Disparities Research
Mayo Clinic

Michael O'Rourke, Ph.D.
Professor of Philosophy, AgBioResearch
Michigan State University

Daniel Stokols, Ph.D.
Research Professor and Chancellor's Professor Emeritus
University of California, Irvine

Julie Thompson Klein, Ph.D.
Professor of Humanities Emerita, Faculty Fellow for Interdisciplinary Development in Division of Research
Wayne State University

Amanda L. Vogel, Ph.D.
Senior Behavioral Scientist
National Cancer Institute

Kevin Wooten, Ph.D.
Chair and Professor of Management and Human Resource Management
University of Houston, Clear Lake

Conference Event Planner

Christi Rich
Strategic Event Specialist

Assistant for Conference Administration (University of Central Florida)

Melisa Grzanich
Coordinator, Research Program/ Services
Institute for Simulation & Training
University of Central Florida

On behalf of the SciTS 2017 Conference Planning Committee, welcome to Clearwater Beach, Florida and the Science of Team Science (SciTS) 2017 Conference!

As with our prior conferences, we continue our efforts in building the foundational knowledge supporting effective team science. Although conferences are well recognized as important venues for knowledge sharing, as a young community, they are particularly important for SciTS. We face the challenge of being both a rapidly growing area of scientific inquiry as well as a field of practice needing immediate guidance and assistance. The conference committee takes this challenge very seriously. As such, we have pursued a two-pronged effort to meet these needs.

First, we open the conference with a set of workshops designed to meet the needs of our diverse stakeholder groups. This includes workshops on training for team science as well as technology for collaboration. We also include workshops on methods for studying science teams as complex networks and a variety of approaches designed to understand and improve communication and collaboration in science teams as well as with stakeholder groups. In this way, we are supporting the science and practice of team science – what we see as an important complementary relationship necessary to advance scientific collaboration.

Second, the committee has assembled an integrated set of speakers and panels along with papers and posters, to share with you the latest conceptual and empirical advances in our understanding of team-based science. Further, our invited speakers were specifically assembled to provide insights and unique perspectives from those experienced in "doing" team science as well as those "studying" team science and collaboration. We additionally broaden the conceptual space of fields involved in scientific collaboration. This includes assembling a panel that consists of experts who have been working in collaborations that draw from the humanities as well as the social and computational sciences. We have also accepted a number of submissions that represent the cutting edge in theoretical, empirical, and practical work in scientific collaborations. And we are very happy to see a healthy combination of new participants to the conference as well as sustained interest by those who continue to do important work for SciTS.

Our Monday evening session will open with our first featured speaker, Dr. Heidi Gardner, from Harvard University. Dr. Gardner will share with us her insights gleaned from years of studying leadership and teamwork in organizations and discuss with us her new book, "Smart Collaboration: How Professionals and Their Firms Succeed by Breaking Down Silos." We'll then enjoy a happy hour poster session – our idea here is to have an informal social gathering where we can discuss ideas around the posters while enjoying refreshments with colleagues. We'll close out the evening with a networking reception. Here we get to enjoy the spectacular view of the beautiful Gulf of Mexico at sunset from the Sky Terrace on the 16th floor of the Hyatt. This venue will be a relaxing environment where we serve up conversation with colleagues along with drinks and hors d'oeuvres.

As with last year, we've organized the conference so that mornings feature sessions that give a broad overview of SciTS topics relevant to all attendees, while afternoons allow attendees to focus more deeply on topics of particular interest to them. Highlights include:

- Tuesday morning's featured speaker is Dr. Jakob Zinsstag-Klopfenstein of the Swiss Tropical and Public Health Institute. Dr. Zinsstag-Klopfenstein is past-president of the International Association for Ecology and Health and president of the scientific board of the Transdisciplinary Network of the Swiss Academies. He is a pioneer in the field of "One Health," a complex collaborative research effort requiring coordination amongst scientists,

medical practitioners, stakeholders and citizens, in order to improve human and animal health. We'll then have our SciTS Recognition Award, our annual event acknowledging significant contributions to the field. This year, we're pleased to recognize the years of passion and dedication of Dr. Kara Hall from the National Cancer Institute. Our lunch on Tuesday will feature the research of Dr. Suzanne Bell, with DePaul University. Dr. Bell is an internationally renowned expert in team composition and building team human capital via the selection, placement, training, and development of team members.

- We open Wednesday with an exciting featured panel on the "Humanities, Arts, Science, and Technology Alliance and Collaboratory." Our goal with this panel is to introduce the SciTS community to the important work being done in the cross-disciplinary field of Digital Humanities to establish a framework for collaborative research and education that bridges humanities and technology. This panel features Dr. Bruce Janz and Dr. Scot French, of the University of Central Florida, Dr. Julian Chambliss from Rollins College, and Dr. Julie Thompson Klein, of Wayne State University. Additionally, we have Dr. William "Brandon" Vessey, of the NASA International Space Station Medical Project at Johnson Space Center. Dr. Vessey will discuss his efforts to lead NASA's research on ground-based spaceflight analog studies as well as his work on teams and leadership focusing on teamwork over long duration space missions. We are also excited to have for our closing keynote address, Dr. James Olds, Assistant Director of the Directorate for Biological Sciences (BIO) with the National Science Foundation, where he is responsible for helping to conceptualize and fund a variety of complex team science initiatives. The international Decade of the Mind project was begun under Dr. Olds leadership, and this helped shape former President Obama's BRAIN Initiative.

This year's host organization, the University of Central Florida, has been a pioneer in developing and supporting collaborative research, and they've been very pleased to provide guidance and oversight to ensure a successful conference. We hope you will enjoy the community and collaboration we've created for this year. We anticipate that the dialogue fostered by this year's conference—among administrators who influence policies in academia, researchers who engage in team-based research, and scholars who study team science—will enrich the quality of the scientific enterprise. After your exciting days with colleagues at the SciTS 2017 Conference, we also hope you have the opportunity to enjoy the spectacular setting of Clearwater Beach, Florida, and enjoy the beauty that is the Gulf of Mexico.

Enjoy the 2017 SciTS Conference!

Stephen M. Fiore, Ph.D.
University of Central Florida
SciTS 2017 Conference Chair

Maritza Salazar, Ph.D.
University of California, Irvine
SciTS 2017 Program Chair

Kara L. Hall, Ph.D.
National Cancer Institute
SciTS 2017 Conference Co-Chair

Gaetano R. Lotrecchiano, Ed.D.,Ph.D.
The George Washington University
SciTS 2017 Program Co-Chair

Moderators

We would like to extend special thanks to our moderators for facilitating discussion at the conference:

Wayne McCormack

Shalini Misra

Julie Thompson Klein

Hannah Love

Gaetano R. Lotrecchiano

Kevin Wooten

Deborah DiazGranados

Lou Woodley

Amanda L. Vogel

Pips Veazey

Teresa Lant

Martiza Salazar

Michael O'Rourke

Suzanne Bell

Ryan Watkins

Holly Falk-Krzesinski

Elina Mäkinen

Christine Hendren

Bonnie Spring

Stephen Crowley

Mason Matthews

Jennifer Davison

Bruce Janz

Bethany Laursen

SciTS 2017 | Building the knowledge base for effective team science

SciTS Recognition Award

2017 Recipient: Dr. Kara L. Hall

To recognize her vision, dedication, and leadership in helping to establish and continue to advance the Science of Team Science field.

Dr. Kara L. Hall is program director and health scientist in the Behavioral Research Program of the Division of Cancer Control and Population Sciences at the National Cancer Institute (NCI) of the National Institutes of Health (NIH). She also serves as NCI's Director of the Science of Team Science (SciTS), and Director of NCI's Theories Initiative. During her career, Dr. Hall has led a variety of interdisciplinary clinical and research endeavors. For over a decade now, Dr. Hall has been a recognized leader in the development of the SciTS field. Her contributions to SciTS span a wide range of work, including some of the first empirical studies of transdisciplinary team science and its measurement, as well as theoretical and conceptual work that helped form a strong foundation for the field. She has also produced special journal issues, been a driving force for the annual SciTS conference, and contributed to internationally visible reports on SciTS. Her work is designed to help build an evidence base for effective team science approaches and support the translation and dissemination of emerging knowledge and best practices into practical tools and resources. As recognition of her accomplishments, she was nominated to serve as a member of The National

Academies Committee on the Science of Team Science (2012-2015). As a study committee member, she helped co-author the resulting study report, *Enhancing the Effectiveness of Team Science*. As evidence of the importance of the topic, this document was the third most downloaded National Academies Press report in 2015. In addition to her stewardship of the Science of Team Science, Dr. Hall has focused on advancing dissemination and implementation research and promoting the use, testing, and development of health behavior theory in cancer control research. Dr. Hall champions areas including systems science approaches and teams/groups in health and healthcare. Prior to arriving at NCI, Dr. Hall's program of research included the development of behavioral science methodologies such as the design of survey protocols, meta-analytic techniques for health behavior theory testing, as well as on applications of health behavior theory to multiple content areas and the development of computerized tailored interventions to foster health promotion and disease prevention behaviors. Dr. Hall earned her Masters and Doctoral degrees at the University of Rhode Island in Psychology with specializations in clinical psychology, neuropsychology, and behavioral science.

James Olds,Ph.D., Closing Keynote Speaker
Assistant Director of the Directorate for Biological Sciences (BIO)
National Science Foundation, Arlington, VA

Our keynote for this year's conference will be Dr. James Olds, Assistant Director of the Directorate for Biological Sciences (BIO) with the National Science Foundation. In this position, Dr. Olds is responsible for helping to conceptualize and fund a variety of complex team science initiatives. Dr. Olds is also director and chief academic unit officer at the Krasnow Institute for Advanced Study at George Mason University, a position he has held for 15 years. He is also the Shelley Krasnow University Professor of Molecular Neuroscience. The international Decade of the Mind project was begun under his leadership at Krasnow, a project that helped shape former President Obama's BRAIN Initiative.

Heidi K. Gardner, Ph.D.
Distinguished Fellow in the Center on the Legal Profession
Harvard Law School, Cambridge, MA

Dr. Heidi K. Gardner, is a Distinguished Fellow in the Center on the Legal Profession at Harvard Law School. She also serves as a Lecturer on Law and the Faculty Chair of the school's Accelerated Leadership Program executive course. Dr. Gardner's research focuses on leadership and collaboration and her book, *Smart Collaboration: How Professionals and Their Firms Succeed by Breaking Down Silos* was just published by Harvard Business Press in January 2017 (http://amzn.to/2n8zEvS). Her research has also been published in the *Academy of Management Journal, Administrative Science Quarterly, and Harvard Business Review* and her work was awarded the Academy of Management's prize for Outstanding Practical Paper with Implications for Management. She has degrees in organizational behavior from the London Business School, and she has been a Fulbright Scholar and an International Research Fellow at Oxford University.

Jakob Zinsstag-Klopfenstein, Ph.D.
Deputy Head of the Department of Epidemiology and Public Health
Swiss Tropical and Public Health Institute (TPH), Basel, Switzerland

Dr. Jakob Zinsstag-Klopfenstein is a veterinarian in tropical animal health. He is past-president of the International Association for Ecology and Health and president of the scientific board of the Transdisciplinary Network of the Swiss Academies. Since 1998 he has headed a research group on human and animal health at the Swiss Tropical and Public Health Institute. Since 2011 he has also been deputy head of department of Epidemiology and Public Health at Swiss TPH. He focuses on the control of zoonoses in developing countries and the provision of health care to mobile pastoralists. He has helped to develop the "One Health" approach to research and practice and is co-editor of the book *One Health: The Theory and Practice of Integrated Health Approaches* (http://amzn.to/2ly0lOe). One Health is complex collaborative research effort requiring coordination amongst scientists, medical practitioners, stakeholders and citizens, in order to improve human and animal health.

Dr. Suzanne Bell, Ph.D.
Associate Professor, Industrial & Organizational Psychology
DePaul University, Chicago, IL

Dr. Bell is faculty with the Industrial & Organizational Psychology program at DePaul University. Dr. Bell is an internationally renowned expert in team composition and building team human capital via the selection, placement, training, and development of team members. She has published on a variety of topics including conducting actionable research on extreme teams, composing cohesive teams, as well as the relationship between personality and cognition and coordination in teams.

William "Brandon" Vessey, Ph.D.
Deputy Element Scientist for Flight Analogs with NASA's ISS Medical Project
Johnson Space Center, Houston TX

Dr. William "Brandon" Vessey is currently the Deputy Element Scientist for Flight Analogs with NASA's ISS Medical Project at the Johnson Space Center, providing scientific oversight for ground-based spaceflight analog studies. His primary research interests fall into the broad categories of teams, leadership, and creativity, with specific focus on teamwork over long duration space missions, team leadership, and collective leadership. He is co-editor of a recent scholarly volume, *Team Cohesion: Advances in Psychological Theory, Methods and Practice*, that discusses cutting edge developments in research on the attitudinal factors in teams driving successful performance (http://bit.ly/2mvnTCu).

Panel: Humanities, Arts, Science, and Technology Alliance and Collaboratory
Panelists: Bruce Janz, Chair, University of Central Florida; Julie T Klein, Wayne State University; Scot French, University of Central Florida; Julian Chambliss, Rollins College

Bruce Janz, Ph.D.
Professor of Humanities in the Department of Philosophy
University of Central Florida, Orlando, FL

Bruce Janz is a Professor of Humanities in the Department of Philosophy, core faculty member of the Texts and Technology Ph.D. Program, and co-director of the Center for Humanities and Digital Research at the University of Central Florida in Orlando Florida. His Ph.D. is in Philosophy from the University of Waterloo. He has taught in Canada, the US, Kenya and South Africa. He is author of *Philosophy in an African Place*, co-author of *A Neurophenomenology of Awe and Wonder: Toward a Non-Reductionist Cognitive Science*, and editor of *Place, Space and Hermeneutics*, as well as many articles and chapters on contemporary African philosophy, space and place, contemporary European philosophy, digital humanities, and interdisciplinarity. He is the chair of the organizing committee for HASTAC 17, the annual conference for the Humanities, Arts, Science, and Technology Alliance and Collaboratory, to be held in Orlando in November 2017.

Julie Thompson Klein, Ph.D.
Professor of Humanities Emerita in the English Department
Wayne State University, Detroit, MI

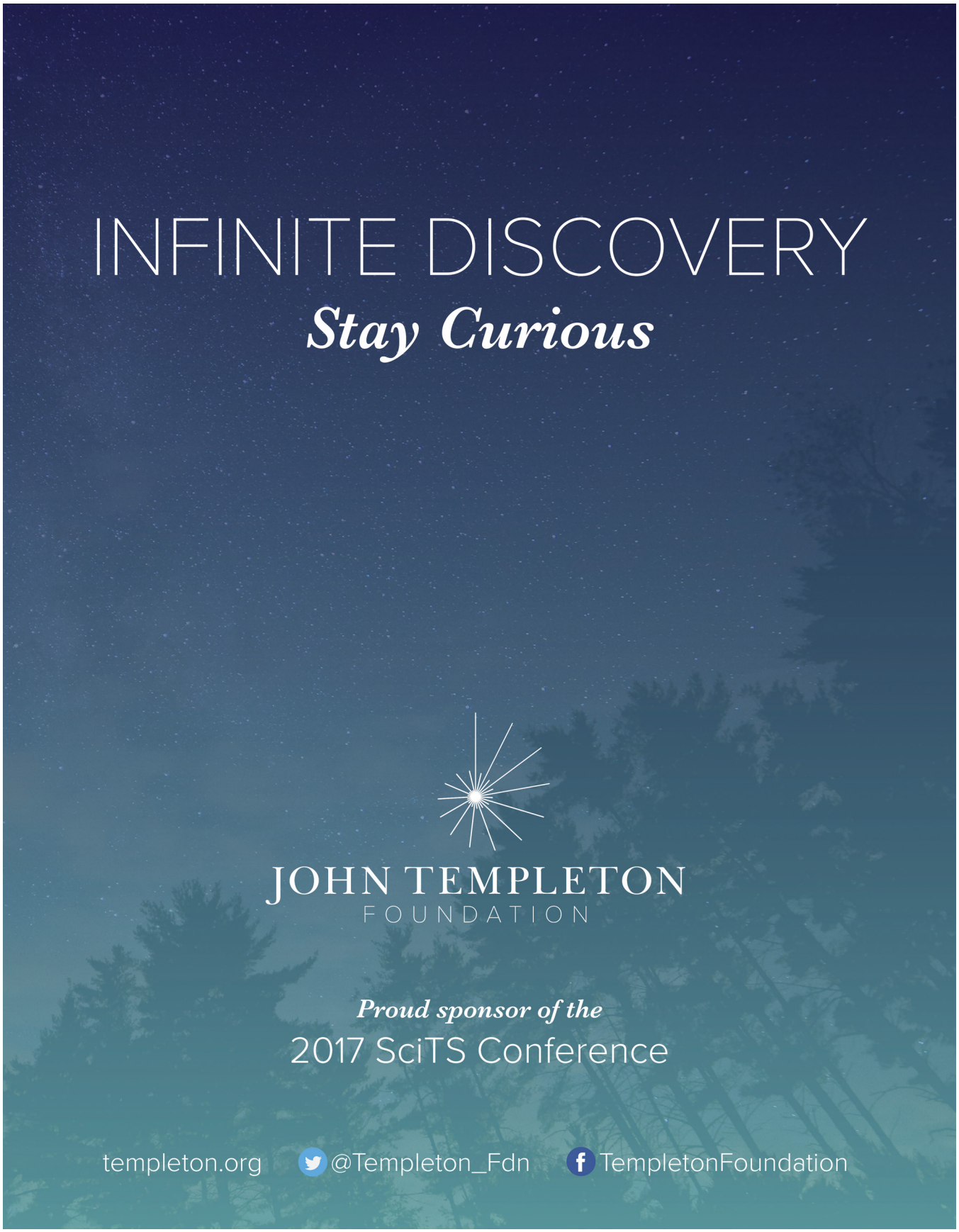
Julie Thompson Klein is Professor of Humanities Emerita in the English Department at Wayne State University and an Affiliate of the TdLab at the ETH-Zurich university for science and technology. Her authored and co/edited books include *Interdisciplinarity* (l990), *Crossing Boundaries* (1996), *Transdisciplinarity* (2001), *Humanities, Culture, and Interdisciplinarity* (2005), *Creating Interdisciplinary Campus Cultures* (2010), and *Interdisciplining Digital Humanities* (2015). She is past president of the Association of Interdisciplinary Studies, Associate Editor of *The Oxford Handbook on Interdisciplinarity* (2010, 2017), and co-editor of the University of Michigan Press series Digital Humanities@digitalculturebooks. She has served on numerous national task forces on interdisciplinarity and is on boards of the Science of Team Science network and HASTAC. Klein has also been Visiting Foreign Professor in Japan, Fulbright professor in Nepal, Foundation Visitor at the University of Auckland, Mellon Fellow in Digital Humanities at the University of Michigan, and Distinguished Women's Scholar at the University of Victoria.

Scot French, Ph.D.
Professor and Chair of the Department of History and Coordinator of the Africa and African-American Studies Program
University of Central Florida, Orlando, FL

Scot French is an Associate Professor of Digital History, Director of Public History, and a core faculty member of the Texts and Technology Ph.D. program at the University of Central Florida. He is the former director of the Virginia Center for Digital History (2006-2010) and the founding chair of the Florida Digital Humanities Consortium (2015-present), a collective of twelve institutions in the State of Florida that seeks to promote an understanding of the humanities in light of digital technologies and research. (FLDH is hosting the HASTAC17 conference and a companion workshop, "Information Analysis: The Role of Visualization Tools and Cloud Storage Platforms in Collaborative Research and Teaching," to be held in Orlando this Fall.) As digital editor of the *Florida Historical Quarterly*, French directed a broadly collaborative, multi-institutional research project, "Visual Historiography: Visualizing 'The Literature of a Field," and co-authored an e-poster, with Ohio State historian David Staley and U.Va. visualization specialist Bill Ferster, that appeared in the *Journal of Digital Humanities* (Spring 2014). French is the author of *The Rebellious Slave: Nat Turner in American Memory* (Houghton Mifflin, 2004) and numerous essays on the legacy of race and slavery in American memory.

Julian C. Chambliss, Ph.D.
Associate Professor of Digital History, Director of Public History
Rollins College, Winter Park, FL

Julian C. Chambliss is Professor and Chair of the Department of History and Coordinator of the Africa and African-American Studies Program at Rollins College in Winter Park, Florida. His research and teaching interests focus on urban culture and development in the United States. His articles have appeared in journals such as Rhetoric Review, Florida Historical Quarterly and Studies in American. An interdisciplinary scholar he has designed museum exhibitions, curated art shows and created public digital history projects that trace community, identity, and power in the American South. He is co-recipient of an Associated Colleges of the South (ACS) & Research 1 University Mellon Foundation Collaborative Project grant to explore the creation of digital collaborative ventures to enhance undergraduate engagement with diaspora topics and texts. He is co-recipient of an ACS Mellon Foundation Faculty Renewal Grant for Project Mosaic: Zora Neale Hurston -- A Multidisciplinary Exploration of African-American Culture, a digital project exploring African-American experience. Dr. Chambliss also has an ACS Faculty Advancement Grant on the topic of Urban Dreams and Urban Disruptions: Transforming Travel Study and Undergraduate Archival Research with Collaborative Interdisciplinary Digital Tools. He is co-editor and contributor for *Ages of Heroes, Eras of Men: Superheroes and the American Experience*, a collection examining the relationship between superheroes and the American Experience (2013). His forthcoming edited collection, *Assemble!: Essays on the Modern Marvel Cinematic Universe* will be published in 2017. A public intellectual he has published opinion and commentary in popular forums such as the *Los Angeles Times, The Orlando Sentinel, The Christian Science Monitor, and National Public Radio* (NPR).


INFINITE DISCOVERY
Stay Curious
JOHN TEMPLETON
FOUNDATION
Proud sponsor of the
2017 SciTS Conference
templeton.org
@Templeton_Fdn
TempletonFoundation

Monday, June 12, 2017

8:00 am
Registration

Gallery, 2nd Floor

8:00 am
Continental Breakfast

Belleair Room

9:00–12:00 pm
Workshop 1: Taking the Pulse of the Science of Team Science (SciTS) with the Toolbox Dialogue Initiative (TDI)

Sand Key

Stephanie E. Vasko, Ph.D.
AgBioResearch
Department of Philosophy
Michigan State University

Stephen Crowley, Ph.D.
Associate Professor
Department of Philosophy
Boise State University

The Toolbox Dialogue Initiative (TDI, formerly the "Toolbox Project") is a philosophically-grounded, dialogue-based approach to enhancing communication and collaboration within teams and communities. For this year's SciTS conference, TDI is aiming to support community-wide reflection by the SciTS community on aspects of the science of team science. Following an introduction to the TDI method and its use in the SciTS community the workshop will utilize an instrument tailored to allow participants to directly create knowledge based on interdisciplinary dialogue.

Workshop 2: Improvisation for Leadership and Critical Communication with sideCoach

Longboat Key

Boyd Branch, M.F.A.
Visiting Assistant Professor, Performing Arts
Arizona State University

This workshop is devised to help train future leaders to utilize performance and improvisation tools to develop personal, dynamic, data-driven techniques to build consensus, encourage excellence in teammates, and make outcome-independent requests of stakeholders.

Workshop 3: Enhancing Team Science Effectiveness through Team Training

Aqualea Ballroom AB

Maritza Salazar, Ph.D.
Assistant Professor of Organization and Management
The Paul Merage School of Business
University of California, Irvine

Deborah DiazGranados, Ph.D.
Assistant Professor
Virginia Commonwealth University

Theresa Lant, Ph.D.
Professor
Director, Arts and Entertainment Management Program
Pace University

Gaetano R. Lotrecchiano, Ed.D, Ph.D.
Associate Professor
Clinical Research and Leadership and Pediatrics
George Washington University

Kevin Wooten, Ph.D.
Faculty Chair and Professor of Management
College of Business
University of Houston

Although interdisciplinary scientific collaboration has many success stories, evidence suggests that, in many cases, teams do not always achieve the goal of successfully integrating knowledge. To improve the ability of interdisciplinary teams to generate novel solutions to complex problems, effective teamwork and team training has been identified as a critical means to enhance performance. Drawing on decades of research on team training, this workshop will present participants with evidence-based approaches to the design, development, and implementation of successful team training programs

---

12:00-1:30 pm

Complimentary Lunch Buffet

Belleair Room

1:30-4:30 pm

Workshop 4: Self-Identifying the Knowledge, Skills, and Dispositional Attributes the Define the Intereach Community

Sand Key

Christine Ogilvie Hendren, Ph.D.
Executive Director,
Center for the Environmental Implications of NanoTechnology
Duke University

Holly J. Falk-Krzesinski, Ph.D.
Vice President
Global Academics & Research Relations
Elsevier, Northwestern University

Gabriele Bammer, Ph.D.
Professor, National Centre for Epidemiology &
Population Health
Australian National University

This workshop addresses a new but growing SciTS-generated community of practice and research: Intereach (Interdisciplinary Integration Research Careers Hub). The Intereach community has evolved around a broadly shared need for new types of roles to be defined, recognized, institutionally supported and trained in order to optimize the success of interdisciplinary scientific endeavors. We will cover the new forms of expertise needed to address complex problems and effectively engage diverse knowledge bases and work at the interfaces between disciplines to help facilitate, optimize, and translate research outcomes.

Workshop 5: Network Perspectives to Understand and Enable Team Science

Longboat Key

Noshir Contractor, Ph.D.
Professor of Behavioral Science
Northwestern University

In this workshop, attendees will be introduced to the basics of social network theories, methods, and tools. They will come away with an improved understanding of the various forms of networks necessary for effective scientific collaborations. This workshop is organized into three distinct parts. (1) The first part provides an historical overview of the motivations to view team science from a social networks perspective. This first part will conclude with a brief introduction to the concepts of social networks, cognitive social networks, knowledge networks, cognitive knowledge networks and their relevance to team science. (2) The second part focuses on using network metrics to describe team science. This part begins by defining various concepts used in network analysis: actors and attributes of actors, relations and properties of relations as well as two-mode networks. Next it describes various how these concepts influence strategies for the collection of network data. The session then defines and describes how various common network metrics are computed and interpreted at the actor, dyadic, triadic, sub-group, and component level. (3) The third part of the workshop addresses using network models to understand and enable team science. Here, a multi-theoretical multilevel (MTML) model is outlined to help stakeholders understand the dynamics for creating, maintaining, dissolving, and reconstituting social and knowledge networks in scientific communities. The session will provide a high level overview of statistical techniques to test MTML models of team science. Research exemplars are presented to illustrate the potential of the MTML framework to understand and enable team science. The session concludes with a demonstration of how these insights are being used to develop recommender systems for assembling effective scientific teams.

Workshop 6: Collaborative Technologies: Facilitating How We Conduct Research Together

Aqualea Ballroom C

Ryan Watkins, Ph.D.
Professor
Educational Leadership
George Washington University

Megan Potterbusch, MLIS
National Digital Stewardship Resident
Open Science Framework

Anne Marino
Senior Program Director
National Academy of Sciences

This workshop is devised to discuss the wide variety of technologies used to facilitate collaborative team science. Whether you are working in the same building, or collaborating with researchers around the world, today's research teams can benefit from numerous technologies. In this workshop we review how to effectively use the varied features of these technologies that support team science.

4:30-5:00 pm

Networking Break

Gallery and Siesta Key

5:00-5:15 pm

Welcome and Introduction

Aqualea Ballroom AB

5:15-6:00 pm

Opening Featured Speaker

Aqualea Ballroom AB

Heidi K. Gardner, Ph.D.
Distinguished Fellow in the Center on the Legal Profession
Harvard Law School, Cambridge, MA

6:00-6:45pm

Poster Session and Happy Hour

Gallery and Siesta Key

6:45-8:00 pm

Networking Reception with Heavy Hors d'oeuvres

16th Floor Sky Terrace

Tuesday, June 13, 2017

8:00 am
Registration

Gallery, 2nd Floor

8:00 am
Continental Breakfast

Belleair Room

8:55–9:00 am
Welcome and Introduction

Aqualea Ballroom AB

Stephen M. Fiore, Ph.D.
Director, Cognitive Sciences Laboratory
Cognitive Sciences, Department of Philosophy and
Institute for Simulation and Training
University of Central Florida

Kara L. Hall, Ph.D.
Director, Science of Team
Science Team
Behavioral Research Program
National Cancer Institute

9:00–10:00 am
Featured Speaker:

Aqualea Ballroom AB

Jakob Zinsstag-Klopfenstein, Ph.D.
Deputy Head of the Department of Epidemiology and Public Health
Swiss Tropical and Public Health Institute

10:00-10:45 am

SciTS Recognition Award

Aqualea Ballroom AB

10:45-11:00 am

Networking Break

Gallery and Siesta Key

11:00-12:00 pm

Thematic Paper Sessions and Panels (submitted)

Thematic Paper Session: Multi-Site Health Research Collaborations

Sand Key

Moderator: Wayne McCormack

Paper 1: Implementing team science to promote transdisciplinary research in NIH's ECHO Program

Authors: Christina Park, Catherine Monk, Bray Patrick-Lake and Matthew Gillman

Paper 2: A 23-year Experiment in Sustainable Team Science: The Health Care Systems Research Network

Authors: Sarah Greene

Paper 3: Network Analytics to Assess Team Science

Authors: Radhakrishnan Nagarajan

Thematic Paper Session: Team Science Training For Graduate Students And Postdocs

Longboat Key

Moderator: Shalini Misra

Paper 1: Effects of an Interdisciplinary Postdoctoral Program on Interdisciplinary Science

Authors: Christine Bachrach, Sheaba Daniel, James Moody, Lindsey Realmuto, Laura Sheble and Linda Weiss

Paper 2: If We Expect Future Scientists To Work in Teams, They Should Be Trained in Teams: Team Training for Clinical & Translational Ph.D. Students

Authors: Wayne T. McCormack

Paper 3: Training Future Team Scientists: Reflections from Translational Course

Authors: Huda Sarraj, Mark Hellmich, Celia Chao, Judy Aronson, Christina Cestone, Kevin Wooten and Allan Brasier

---

Thematic Paper Session: Conceptual And Theoretical Frameworks For Understanding Team Science

Madeira

Moderator: Julie Thompson Klein

Paper 1: The Use of Paradox to Study, Understand, and Develop Scientific Teams

Authors: Kevin Wooten

Paper 2: Differing views on interdisciplinarity in the human and social sciences

Authors: Kristine Lund and Daniel Frandji

Paper 3: What is collaborative, interdisciplinary reasoning? The heart of interdisciplinary team science

Authors: Bethany Laursen

Thematic Paper Session: Centers And Institutes To Promote Team Science - What Leads To Success?

Aqualea Ballroom C

Moderator: Hannah Love

Paper 1: Can cross-university collaboration be facilitated by establishing institutes to promote team science?

Authors: Griffin Weber, Noshir Contractor, Shuba Gopal, Alina Lungeanu and Yulia Tyshchuk

Paper 2: Team science failure: the problem of interdisciplinarity in academia

Authors: Jack Schultz

Paper 3: Cultural Computing: building a collaborative research team across the arts, humanities, sciences and engineering.

Authors: Stephen Beck

12:00-1:30 pm

Complimentary Lunch Buffet with Featured Speaker

Aqualea Ballroom AB

Dr. Suzanne Bell, Ph.D.
Associate Professor, Industrial & Organizational Psychology
DePaul University, Chicago, IL

1:30-3:00 pm

Thematic Paper Sessions and Panels (submitted)

Panel: Reward and Recognition Across the Spectrum: Attending to the Needs of Multiple Collaboration Stakeholders in the Professions and Learning

Aqualea Ballroom C

Moderator: Gaetano R. Lotrecchiano

Authors: Gaetano R. Lotrecchiano, Holly J. Falk-Krzesinksi and Michael O'Rourke

Thematic Paper Session: Training For Team Science - Developing Team Science Competencies

Madeira

Moderator: Kevin Wooten

Paper 1: The Impact of Team Skills Training on the Expression of Intrapersonal Collaboration Readiness Factors

Authors: Katherine Campbell and Katherine Stackpoole

Paper 2: Reflecting on Global Development: A Toolbox for Development Teams

Authors: Anna Malavisi, Marisa Rinkus and Michael O'Rourke

Paper 3: The Role(s) of Personal Skills Development in Developing a Collaboration Plan

Authors: Stephanie Vasko

Paper 4: Effectiveness of the Coalesce Online Learning Modules for Team Science Training

Authors: Bonnie Spring, H. Gene McFadden, Katya Klyachko, Philip Rak, Frank Vernon, Donald Hedeker, Juned Siddique and Angela Pfammatter

---

Thematic Paper Session: Evaluating And Enhancing Team Processes

Longboat Key

Moderator: Deborah DiazGranados

Paper 1: Profile Analytics as a Mechanism for Understanding Engineering Design Teams

Authors: Marissa Shuffler, William Kramer, Michelle Flynn, Apurva Patel and Joshua Summers

Paper 2: Connecting Research Methods and Successful Teams

Authors: Hannah Love and Jeni Cross

Paper 3: What makes a team?: An Evaluation of an Interdisciplinary Team Development Program Teams

Authors: Jennifer Cross and Hannah Love

Paper 4: 21st Century Techniques for Achieving Collaboration Despite the Hidden Curriculum

Authors: Derek Wade

Paper 5: "That's a good point": Collaboration & Idea Development at Datathons

Authors: Teis M. Kristensen and Matthew Weber

Thematic Paper Session: Collaborations Across Academia, Industry, And Government

Sand Key

Moderator: Lou Woodley

Paper 1: Communicating Across Organizational Boundaries in the Context of Biopharmaceutical Research and Development

Authors: David J Mcbee

Paper 2: The Role of Intermediate Network Organizations in Creating Collaboration Networks: Exploratory Analysis of an International Professional Association as a Heuristic Device

Authors: Bei Wen, Edwin Horlings, Marielle van der Zouwen, Wim van Vierssen and Peter Van Den Besselaar

Paper 3: Motivations behind cross-boundary collaboration

Authors: Bei Wen, Wim van Vierssen, Marielle van der Zouwen, Edwin Horlings and Peter Van Den Besselaar

Paper 4: Establishing a Statewide Research Initiative: Lessons from Developing a Knowledge Network

Authors: Amber Caulkins

3:00-3:15 pm

Networking Break

Gallery and Siesta Key

3:15-4:45 pm

Thematic Paper Sessions and Panels (submitted)

Panel: Seeding and Watering New Cross-Disciplinary Collaborations: Approaches from Funders and Universities

Aqualea Ballroom C

Authors: Amanda Vogel, Kara Hall, Anne Heberger Marino, Suzanne Christen and Damayanthi Ranwala

Moderator: Amanda Vogel

Thematic Paper Session: New Technologies And Evaluation Approaches

Madeira

Moderator: Pips Veazey

Paper 1: Use of Theoretic Frameworks and Models to Inform Design of Health Information Technology to Support Treatment of Heart Failure in VA Primary Care

Authors: Jennifer H. Garvin, Michael W Smith, Charnetta Brown, Salim Virani, Charlene R Weir and Laura A. Petersen

Paper 2: The Use of Digital Trace Data to Examine Scientific Teams

Authors: Laura Anderson and Cheryl Kieliszewski

Paper 3: A Self-Scoring Mechanism for the Motivation Assessment for Team Readiness, Integration, and Collaboration (MATRICx)

Authors: Gaetano R. Lotrecchiano, Trudy Mallinson, Alexandra Rosenberg, Holly J. Falk-Krzesinski, Lisa Schwartz and John Liu

---

Thematic Paper Session: Insights Through Network Analysis

Sand Key

Moderator: Teresa Lant

Paper 1: Author connectivity within disciplines: how big is your world?

Authors: Daniel Acuna and Elizabeth Novoa

Paper 2: Comparing Bibliographic Maps with Researcher Networks in Educational Research

Authors: Heisawn Jeong, Kristine Lund, Sebastian Grauwin and Pablo Jensen

Paper 3: The Effect of a Clinical and Translational Science Award Institute on the Ego Networks of Investigators at a Large Research University

Authors: Felichism Kabo and George Mashour

Paper 4: The Associations between Social Networks, Sense of Community, and Co-Location Among Healthcare Policy Scientists

Authors: Felichism Kabo

Thematic Paper Session: Translational Health Research

Longboat Key

Moderator: Martiza Salazar

Paper 1: Team Science as a Strategic Research Priority at Academic Medical Centers

Authors: Rand Haley

Paper 2: Creating a Culture of Collaboration at George Washington University (C3@GWU): University Seminar Think Tanks and Aims

Authors: Gaetano R. Lotrecchiano, Sean Cleary, Paige L McDonald, Shalini Misra, Julia Storberg-Walker and Ryan Watkins

Paper 3: Citizen Science- The Ultimate Team Science: A Look at Public Participation in Biomedical Research

Authors: Katrina Theisz

4:45-5:00 pm

Networking Break

Poster Gallery

5:00-6:00 pm

Thematic Paper Sessions and Panels (submitted)

Thematic Paper Session: Ethics And Integrity In Team Science

Aqualea Ballroom C

Moderator: Michael O'Rourke

Paper 1: Ethical Foundations in Team Science Settings

Authors: Jonathan Beever and Mark Hannah

Paper 2: Holding it all together: Promoting Integrity in Science Multiteam Systems

Authors: Samantha Dubrow, Richard Klimoski, Laura Fletcher and Stephen Zaccaro

Paper 3: Division of Labor and Scientific Misconduct

Authors: John Walsh, You-Na Lee and Li Tang

Thematic Paper Session: International, Large-Scale Distributed Teams

Longboat Key

Moderator: Suzanne Bell

Paper 1: Collaborative, multi-geography interdisciplinary research: early lessons from the trenches

Authors: Lucia Scodanibbio

Paper 2: A Dynamic Ecology of Teams in an International Virtual Research Organization: What Makes Teams Productive?

Authors: Iftekhar Ahmed, Ashley Trudeau, Elizabeth Simpson, Natalie Lambert and Marshall Scott Poole

Paper 3: Examination of processes that contributed to the success of a research partnership in Canada through three key moments in its development

Authors: Saint-Jacques Marie-Christine, Robitaille Caroline, Saint-Amand Annick and Turcotte Daniel

---

Thematic Paper Session: New Findings On What Leads To Innovation

Sand Key

Moderator: Ryan Watkins

Paper 1: Small Teams Generate New Directions in Science and Technology

Authors: Lingfei Wu, Dashun Wang and James Evans

Paper 2: Research versus Development Teams: The Delicate Balance between Freedom and Focus

Authors: Jeff Tsao and Venkatesh Narayanamurti

Paper 3: The Dual Frontier: Patentable Inventions and Prior Scientific Advance

Authors: Mohammad Ahmadpoor and Benjamin Jones

Thematic Paper Session: Gender And Diversity In Teams

Madeira

Moderator: Holly Falk-Krzesinski

Paper 1: The Role of Diversity in the Scientific and Engineering Workforce and its Impact on Innovation: A Review of Quantitative Research

Authors: Vanessa Pena and Asha Balakrishnan

Paper 2: Collaboration between men and women in science: a bibliometric analysis of scientific activity by gender and co-authorship between men and women

Authors: Grégoire Côté

Paper 3: Social network analysis of grant membership of university researchers: gender and network centralities

Authors: Eriko Fukumoto

Wednesday, June 14, 2017

8:00 am
Registration

Gallery, 2nd Floor

8:00 am
Continental Breakfast

Belleair Room

9:00 - 9:05 am
Welcome and Introduction

Aqualea Ballroom AB

Stephen M. Fiore, Ph.D.
Director, Cognitive Sciences Laboratory
Cognitive Sciences, Department of Philosophy and
Institute for Simulation and Training
University of Central Florida

Kara L. Hall, Ph.D.
Director, Science of Team
Science Team
Behavioral Research Program
National Cancer Institute

9:05-10:30 am

Featured Panel: Humanities, Arts, Science, and Technology Alliance and Collaboratory

Aqualea Ballroom AB

Bruce Janz, Ph.D.
Professor of Humanities
Department of Philosophy
University of Central Florida

Julie T Klein, Ph.D.
Professor of Humanities Emerita
English Department
Wayne State University

Scot French, Ph.D.
Professor and Chair of the Department of History and
Coordinator of the Africa and African-American Studies
Program
University of Central Florida

Julian Chambliss, Ph.D.
Associate Professor of Digital History
Director of Public History
Rollins College

10:30-10:45 am

Networking Break

Gallery and Siesta Key

10:45-11:30 am

Featured Speaker:

Aqualea Ballroom AB

William "Brandon" Vessey, Ph.D.
Deputy Element Scientist for Flight Analogs with NASA's ISS Medical Project
NASA International Space Station Medical Project at Johnson Space Center

---

11:30-12:45 pm

Complimentary Lunch Buffet

Belleair Room

11:30-12:45 pm

Emerging Scholars Luncheon

Sand Key

Shanlini Misra, Ph.D.
Assistant Professor
Virginia Tech University

Deborah DiazGranados , Ph.D.
Assistant Professor
Virginia Commonwealth University

12:45-1:30 am

Keynote Speaker:

Aqualea Ballroom AB

Dr. James Olds
Assistant Director of the Directorate for Biological Sciences (BIO)
National Science Foundation, Arlington, VA

1:30 - 3:00 pm

Thematic Paper Sessions and Panels (submitted)

Panel: Beyond The Ivory Tower: Knowledge Production Between Academic And Non-Academic Science

Longboat Key

Moderator: Elina Mäkinen

Authors: Elina Mäkinen, Benjamin Keep, Charles Gomez and Sebastian Muñoz-Najar Galvez

Panel: Interdisciplinary Integration Exercises: Practitioners share meeting design, facilitation methods, successes and failures

Aqualea Ballroom C

Moderator: Christine Hendren

Authors: Christine Hendren, Jack Schultz, Pips Veazey and Amber Caulkins

---

Thematic Paper Session: Approaches To Foster New Innovative Collaborations

Madeira

Moderator: Bonnie Spring

Paper 1: Team science in agriculture: Perspectives on the Ohio State University agricultural experiment station's SEEDS competitive grant program

Authors: Julie Aldridge, Keith Smith and Graham Cochran

Paper 2: A framework for analyzing funded and non-funded teams through each phase of a research grant competition

Authors: Griffin Weber, Noshir Contractor, Alina Lungeanu and Yulia Tyshchuk

Paper 3: MCubed: Token-Based Seed Funding Distribution for Formation of Interdisciplinary Teams

Authors: Mark Burns and Valerie Johnson

Paper 4: Professional Development for Team Science: Training for Effective Teaming

Authors: Meghan Suter and Ellen Fisher

Thematic Paper Session: Creating An Institutional Culture For Team Science

Sand Key

Moderator: Stephen Crowley

Paper 1: Creating a Culture of Collaboration at George Washington University (C3@GWU) Utilizing the Open Science Framework (OSF)

Authors: Gaetano R. Lotrecchiano and Megan Potterbusch

Paper 2: US DOE Energy Frontier Research Centers: A Case Study of Team Science in the Physical Sciences

Authors: Robin Hayes

Paper 3: Recognizing Team Science in the Tenure and Promotion Process: Developing a Common Tool for Evaluating Faculty Achievement

Authors: Therese Kennelly Okraku and Christopher McCarty

Paper 4: Fundamental Challenges to Transdisciplinary Research in Higher Education

Authors: Valerie Imbruce

3:00-3:30 pm

Networking Break

Gallery and Siesta Key

3:30 - 5:00 pm

Thematic Paper Sessions and Panels (submitted)

Panel: Before, During, and After – Using Social Network Analysis as a Tool to Identify Potential Research Sites & Partners and to Monitor & Evaluate Interdisciplinary Team Science Collaboration over Time

Longboat Key

Moderator: Mason Matthews

Authors: Mason Mathews, Wendy-Lin Bartels and Christopher McCarty

---

Panel: Community Management in Scientific Teams and Communities: An Emerging Discipline to Effect Collaboration

Aqualea Ballroom C

Moderator: Jennifer Davison

Authors: Jennifer Davison, Andreas Leidolf, Lou Woodley, Elisha Wood-Charlson and Malin Sandstrom

---

Thematic Paper Session: Dialogue Approaches To Build Bridges Across Disciplines And Perspectives

Sand Key

Moderator: Bruce Janz

Paper 1: On the interaction of affect and information transfer in cross-disciplinary dialogue

Authors: Graham Hubbs, Stephen Crowley, Chad Gonnerman, Kara Hall, Troy Hall, Anna Malavisi, Michael O'Rourke, Marisa Rinkus, Brian Robinson and Stephanie Vasko

Paper 2: Development of Interdisciplinary Attitudes and Knowledge at the NExSS Winter School

Authors: Michael Burnam-Fink, C.J. Huff and Steve Desch

Paper 3: Enhancing Integrative Capability among Team Science Participants

Authors: Maritza Salazar and Theresa Lant

Paper 4: The Integral Place of Dialogue in Social Entrepreneurial Ventures

Authors: Chitvan Trivedi and Shalini Misra

Thematic Paper Session: Team Formation And Cohesion

Madeira

Moderator: Bethany Laursen

Paper 1: Perturbations of interdependent (science) teams reveal perfect and dysfunctional teams

Authors: Bill Lawless

Paper 2: Ecosystem factor influencing the victor in team vs. team competitions

Authors: Satyam Mukherjee, Yun Huang, Brian Uzzi and Noshir Contractor

Paper 3: Applying Lessons from Intentional Living Communities to Team Science

Authors: Amy Wilstermann and Rachael Baker

5:00-5:30 pm

Closing Session

Aqualea Ballroom AB

Stephen M. Fiore, Ph.D.
Director, Cognitive Sciences Laboratory
Cognitive Sciences, Department of Philosophy and
Institute for Simulation and Training
University of Central Florida

Kara L. Hall, Ph.D.
Director, Science of Team
Science Team
Behavioral Research Program
National Cancer Institute

Kevin Wooten, Ph.D.
Chair and Professor of Management and Human Resource Management
University of Houston, Clear Lake

Submitted Abstracts

We would like to extend special thanks to our abstract reviewers:

Gabriele Bammer

Nicholas Berente

Roger D. Blandford

Stephen Crowley

Deborah Diaz-Granados

Holly J. Falk-Krzesinski

Stephen Fiore

Kara Hall

Julie Thompson Klein

Teresa Lant

Gaetano R. Lotrecchiano

Wayne J. Lutters

Justin Nash

Linda Nebeling

Michael O'Rourke

Janet Okamoto

Deanna Pennington

Reitman-Olson

Maritza Salazar

Jack Schultz

Daniel Stokols

Amanda L. Vogel

Tuesday, June 13, 2017

Thematic Session 1

Multi-Site Health Research Collaborations 11:00-12:00 pm

Paper 1: Implementing team science to promote transdisciplinary research in NIH's ECHO Program

Authors: Christina Park, Catherine Monk, Bray Patrick-Lake and Matthew Gillman

The National Institutes of Health launched the Environmental influences on Child Health Outcomes (ECHO) program in 2016, to enhance the health of our nation's children. It supports multiple longitudinal studies of children as well as 17 clinical sites for intervention studies among rural and underserved children. Its goal includes instituting best practices for team science to promote transdisciplinary research.

We began evaluating a team science approach at ECHO's first two in-person meetings involving >100 members. At these meetings, we administered the same brief questionnaire on: networking opportunities, communication, common language, collaboration facilitation, and engagement. Together these serve as a baseline for subsequent intervention and evaluation.

During the second meeting, an NIH expert presented principles of team science. We then had a team exercise involving 11 teams to address: 1) what do you see as the most challenging task for ECHO?; 2) how can team science tackle this challenging task?; and 3) what novel ideas can ECHO pilot to successfully complete this task? We summarized the results into 5 areas: vision sharing, setting expectations, collaboration facilitation, communication, and other. The results reinforced the need for ECHO to clarify processes where possible and to be transparent about complexities that require further investigator leadership. Concrete actions resulting were a glossary to clarify potentially confusing terms, FAQ documents, educational webinars, and a small investigator-led group to address informed consent needs of cohorts before the data collection protocol is completed. Ideas for pilots included: virtual town halls for those not in attendance of in-person meetings, and storyboards on cohorts/science displayed at in-person meetings.

The meeting evaluation showed that 77% of respondents agreed that the team exercise produced concrete ideas to enhance transdisciplinary science, suggesting that we can continue to benefit from implementing team science approaches and ongoing evaluation of them to improve the ECHO program.

Paper 2: A 23-year Experiment in Sustainable Team Science: The Health Care Systems Research Network

Authors: Sarah Greene

Real-world health care delivery systems provide unique advantages for conducting research on how to improve health of individuals and populations. These systems offer assets including: automated data from electronic health records and health care claims; a stable population base that can be observed in both across time and care settings; and the ability to study the impact of myriad changes in how care is organized, financed, and delivered. The Health Care Systems Research Network (HCSRN) was conceived in 1994 by leaders from six research centers embedded in delivery systems including Kaiser Permanente and many others. Since then, the HCSRN has grown to include 20 health systems with ability to conduct multi-site clinical trials, epidemiologic studies, and comparative studies of health care services. Many features of the HCSRN have contributed to

its success, and also provide instructive guidance for other research initiatives. This presentation will examine the factors that have contributed to the HCSRN's longevity, as well as potential risks to the team-based multi-site collaborative model.

Governance: The HCSRN has a representative governance structure, wherein each member has a designate on the Board of Governors. The Board provides leadership, pursues strategic imperatives, stewards the network assets, and collectively advises its members on scientific priorities. In 2016, the HCSRN hired an inaugural Executive Director recognizing the need for a full-time position empowered to lead the network, ensure visibility, and provide stability as Board members come and go. The Board sets the tone for the Network, creating the organizational ethos. As such, it strives for a balanced and ecumenical approach to sharing opportunities, such as the opportunity to lead large research projects.

Research Funding: The HCSRN has been productive with respect to securing research dollars from federal and other sources, and in its ability to inform and influence care. In particular, the HCSRN spawned several condition-specific multi-site research networks in cancer, diabetes, mental health, aging, pharmacoepidemiology, and cardiovascular disease. In 2012 alone, HCSRN member research centers received $340 million in federal funding, as well as funding from other sources. An initial focus on a Cancer Research Network (CRN), funded by the National Cancer Institute, was the cornerstone initiative that allowed the HCSRN to develop a robust collaborative infrastructure that enabled studies ranging from cancer prevention to survivorship and end-of-life care. Central to this infrastructure was the discovery that cancer studies were frequently reusing the same research data elements (patient demographics, variables characterizing diagnosis and treatment, utilization, etc.). Hence, CRN leaders elected to build a federated data warehouse that could be re-used for multiple projects without re-work.

Data: A common data model is the backbone of the HCSRN's Virtual Data Warehouse (VDW). It is virtual in that local health system data remain in place at a local data warehouse, using standardized processes for improving data quality and validity, and governance of data sharing. Each HCSRN site incorporates information from EHRs and other clinical and administrative sources into a set of VDW data tables with standardized variable names, labels, definitions, and coding. Again, given that diverse studies have a relatively unified set of data needs, with perhaps 80% being common from study to study and 20% being de novo data collection, the VDW frees individual projects to develop new variables to address specific scientific questions. Thus, both the content and organization of the VDW continue to evolve, as does the HCSRN's sophistication and knowledge base about using its data.

Culture of collaboration: The importance of a network comprised of peers cannot be understated. HCSRN sites provide one another with complementary domain and disciplinary expertise (e.g., some sites have a deep "bench" of biostatisticians or health economists who can collaborate with sites that lack this expertise). Shared learning is a shared value, and an annual research conference enables collaborators to come together in a common venue to learn not only research results, but methods and approaches that are uniquely pertinent to delivery system research.

Securing the Future: Given a growing focus on the "triple aim" in health care of better outcomes, better experience, and lower cost, the HCSRN is a vital cog in the wheel of comparative effectiveness research. Identifying ways to sustain the network in an uncertain funding climate is our next great challenge, but leveraging our culture, data, and infrastructure are central to evidence-based care.

Paper 3: Network Analytics to Assess Team Science

Authors: Radhakrishnan Nagarajan

Recent studies have clearly demonstrated an increasing shift towards team science potentially attributed to growing interdisciplinary, multidisciplinary and transdisciplinary research. Grants from federal agencies (e.g. Clinical Translational Science Awards, NCATS) have especially emphasized the importance of translational research that in turn demand team science approaches. Our recent studies have successfully used network analytics of grant collaborations to objectively quantify and assess team science in translational settings in an evidence-based/data-driven manner (Nagarajan R et al., J. Biomedical Informatics 2013; Nagarajan R et al. Clinical Translational Science 2015). Collaborative grants are often the culminating point or outcome of successful and sustained research collaborations. Grant collaboration data sets are accessible and curated diligently with minimal errors making them a useful resource for investigating team science efforts. Grant collaboration networks (GCNs) provide a convenient abstraction of collaborations that can be studied in a controlled and cost-effective manner in-silico. In this presentation we show that GCNs can provide insights into inherent non-trivial community structures, cross-talk between communities and their temporal evolution. The strength of these communities as a function of time is also investigated by using synthetic surrogate network models (e.g. random graphs) as internal controls. Understanding the temporal evolution of these communities and their deviation from random graphs can especially be useful in evaluation in pre-/post-intervention settings and has the potential to serve as evaluation metrics. Inherent community structures and cross-talk between communities in the GCN can also assist in targeted resource allocation that can impact policy. However, GCNs are open-systems and prone to external perturbations and confounders that demand careful interpretation of the results. Forecasting of the GCNs can also be challenging as the nodes as well as the edges are not conserved as a function of time. Universality of the findings presented will demand repeating the exercise across diverse settings.

Thematic Session 2

Team Science Training For Graduate Students And Postdocs 11:00-12:00 pm

Paper 1: Effects of an Interdisciplinary Postdoctoral Program on Interdisciplinary Science

Authors: Christine Bachrach, Sheaba Daniel, James Moody, Lindsey Realmuto, Laura Sheble and Linda Weiss

Between 2003 and 2016, the Robert Wood Johnson Foundation's Health & Society Scholars (HSS) program trained 187 early-career scholars to investigate how determinants of health at the biologic, genetic, behavioral, social, and environmental levels combined to influence the population's health. A key goal of the program was to develop interdisciplinary scientists. Last year, the program began an evaluation of the program that compared career accomplishments among a sample of program alumni and a closely matched control group drawn from finalists for the program. This presentation will discuss the effects of the program on research interdisciplinarity.

Interdisciplinarity was assessed using network measures that revealed the extent to which scientists reached across disciplines in published research identified through Web of Science. All study participants applied to the program during 2003-2007;

published research was observed during 2011-2015. We report results from two approaches to defining interdisciplinary reach. The first approach uses network clustering algorithms to identify disciplines and examines the extent to which there is disciplinary diversity within references cited in a person's published research. The second uses network distances directly and measures the median distance (weighted) in the network among all pairs of references in a paper.

Our results show that those who participated in the HSS program scored higher on virtually all measures of interdisciplinarity in their published work. The results suggest that programs specifically designed to produce interdisciplinary scientists can be impactful in developing cross-disciplinary researchers.

The presentation will address:

• The approach to interdisciplinary training used in HSS;

• The design of the evaluation, including evidence for a close match between program participants and controls;

• Results from univariate analysis and multivariate analyses controlling on potential confounders and mediators;

• Discussion of study implications, strengths, and weaknesses.

Paper 2: If We Expect Future Scientists To Work in Teams, They Should Be Trained in Teams: Team Training for Clinical & Translational Ph.D. Students

Authors: Wayne T. McCormack

The UF Clinical & Translational Science (CTS) Ph.D. program is based on the premises that team science training enhances research effectiveness, and that researchers must be prepared for academic and nonacademic career pathways. Essential elements include a curriculum based on team science and team-based research training. A CTS Ph.D. co-major is available to students in over 40 partner Ph.D. programs in eleven colleges. Core courses strengthen research skills through experiential work requiring collaboration, e.g., "Translational Research & Therapeutics: Bench, Bedside, Community, & Policy", in which multidisciplinary teams identify an unmet medical need, experience multimodal instruction including team-based learning (TBL), and develop research proposals at T0-T4 stages of translational research to address their unmet medical need, and "Team Science", in which teams practice skills for team assembly, management, and performance monitoring. Mentored dissertation research includes clinical/translational specific aims, and an extensive program for career and professional development supports academic and nonacademic career interests. A unique feature of our CTS program is a team-based model for research training in which Ph.D. candidates perform collaborative research, with direct support via a TL1 training grant. "TL1 Teams" include two or more Ph.D. students from different degree programs in at least two colleges. Team members collaborate to develop new team specific aims that expand the scope of individual research projects related to human health. TL1 Teams have a common research interest, e.g., a particular human disease being investigated at different levels (molecular to population), with different experimental approaches, and/or at different parts of the T0-T4 continuum. Teams identify ways in which research projects of team members will inform each other, provide alternative experimental approaches or data analysis methods, assist with data collection or analysis, etc. The science of team science can transform doctoral training, and we welcome opportunities to expand this training model across institutions.

Paper 3: Training Future Team Scientists: Reflections from Translational Course

Authors: Huda Sarraj, Mark Hellmich, Celia Chao, Judy Aronson, Christina Cestone, Kevin Wooten and Allan Brasier

Problem Statement

The importance of Interprofessional and Multidisciplinary (IPMD) collaborations between scientists and clinicians to translational research is well documented. However, there remains a paucity of formal training to prepare biomedical scientists and physicians to take part in IPMD collaborations.

Method

We developed an eight-week IPMD course, in which biomedical graduate students (n=6) were teamed with medical students (n=10) to design a translational research project that addresses a significant gap in the detection, treatment, or prevention of human disease. The capstone project for each team (n=5 teams) was an NIH-style translational research proposal. At the end of the course, students completed a reflective writing assignment discussing the impact of the exercise on their perceptions and attitudes about IPMD team science. Students' responses were mapped to the eight team science competencies outlined in the NIH document "Collaboration in Team Science: A Field Guide."

Results

While students were not explicitly asked to identify team science competencies, students on average identified two competencies from the field guide in their essays (mean = 2.3 0.3). The number of competencies mentioned per student ranged from 0 to 5. Developing Shared Vision was the most commonly identified, with 9 of 16 students citing examples where this competency was practiced within their team. Two of the team competencies (Sharing Credit and Leveraging Network) were not recognized by any of the students.

Significance

A major objective of our course was to create an authentic translational research experience to introduce and develop IPMD team science competencies in our students. Preliminary evidence suggests that most students successfully recognized and contextualized at least two team science competencies into their IPMD grant writing experience. In the future we plan to modify the curriculum to improve the acquisition of competencies/student and to assess the durability of the learning in this initial cohort.

Thematic Session 3

Conceptual And Theoretical Frameworks For Understanding Team Science 11:00-12:00 pm

Paper 1: The Use of Paradox to Study, Understand, and Develop Scientific Teams

Authors: Kevin Wooten

Objective: Over the last 25 years, paradox has been a successful framework to the study of all levels of organization phenomena (Cameron & Quinn, 1988; Smith & Lewis, 2001; Lewis, 2000; Schad, Lewis, Raish, & Smith, 2016), including teams. Paradox can be seen as "contradictory yet interrelated elements – elements that seem logical in isolation but absurd and irrational when appearing simultaneously" (Lewis, 2000, p. 760). The purpose of this paper is to apply the frameworks established to study paradox to scientific teams, specifically types of paradox and contextual factors. Because team science involves collaboration and integration across different individuals, disciplines, ideologies, and methodologies, the use of paradoxical analysis is appropriate.

Methods and Findings: Based on the typology developed by Schad, Lewis, Raish, and Smith (2016), team science illustrations relating to common types of learning, organizing, belonging, and performing paradoxes are shown in Table 1. Schad, Lewis, Raish,

and Smith also have purported the environmental conditions of plurality vs. competition, change vs. innovation, and scarcity vs. resource abundance, and these can be seen in team science, along with the team science specific conditions such as degree of disciplinary integration (Rosenfield, 1992) and stage of transdisciplinary team progress (Hall, Voegel, Stipleman, & Stokols, 2011). Qualitative and mixed research methods to study paradox in scientific teams should be used to help develop a more extensive and explanatory base. Paradox theory can also be used as a diagnostic framework for team development to discover needed individual and team based change strategies (i.e., working through the paradox) that are positive in nature (Cameron, 2008).

Table 1. Types of Paradox and Team Science Illustrations

Type Team Science Illustrations

Learning

- Exploration vs. exploitation
- Scientific discovery vs. commercialization
- Stability vs. change
- Methodological familiarity vs. adoption or development of new methods
- Short-term vs. long-term
- Incremental scientific progress vs. scientific breakthrough

Organizing

- Alignment vs. flexibility
- Business model vs. scientific method
- Control vs. autonomy/empowerment
- Management science vs. science

Belonging

- Competing identities Researcher vs. mentor/educator
- Individual vs. collective
- Team leader vs. team member/follower

Performing

- Cooperation vs. competition
- Research agenda of network vs. principle aims of team
- Multiple objectives and stakeholders
- Scientific objectives vs. patient/community objectives

Adapted from: Schad J, Lewis MW, Raish S, Smith WK. Paradox research in management science: Looking back to move forward. Acad Manag A. 2016; 1-60.

Advancement of SciTS Field: The field of team science is currently without a common framework to explain or predict team based conflicts and tensions. Use of a contextually derived theory of paradox to illustrate how and when team science tensions are likely to occur is instrumental to both general theory as well as theory in practice.

Paper 2: Differing views on interdisciplinarity in the human and social sciences

Authors: Kristine Lund and Daniel Frandji

Interdisciplinarity in human and social sciences is not yet well understood, to the extent of the plurality and the heterogeneity of the meanings covered by this notion. If researchers work together from disciplines that are seen as close together by outsiders, their interdisciplinarity is often not acknowledged by institutions. "Real" interdisciplinarity — a curious term — is often seen as occurring between disciplines that are very far apart in theories, methods, goals, and object of study. But what is "real" interdisciplinarity? How can science that is founded on multiple disciplines be "close" or "far apart"? We aim to clarify these notions by questioning what they cover in sciences that are interested in educational phenomena. Our argument, founded on the analysis of a corpus of research projects and their evaluations, aims to show that only using disciplines to categorize interdisciplinarity does not suffice in order to make significant progress involving these questions. Over and above disciplinary

boundaries, the key questions concern transversal dimensions that are more fundamental to knowledge and are focused rather on mobilized social ontologies and the knowledge interests (Habermas, 1973) they suppose.

The new French interdisciplinary laboratory of education at the Ecole Normale Supérieure in Lyon funded two calls for projects in 2016 involving local researchers mainly from sociology, history, political science, educational science, and language sciences. Our analyses of submissions show that the epistemological and ontological assumptions that researchers use to both present and evaluate interdisciplinarity do not fall so clearly fall into disciplinary boundaries. Our results help advance the field of the Science of Team Science in that we show how assumptions about interdisciplinarity is not solely explained by the discipline with which one identifies, both from a researcher and evaluator perspective.

Paper 3: What is collaborative, interdisciplinary reasoning? The heart of interdisciplinary team science

Authors: Bethany Laursen

Collaborative, interdisciplinary research has grown dramatically in recent decades—both in prevalence as well as promise. This growth has occurred in spite of the fact that this form of research poses its own special challenges. These challenges have sparked meta-research on collaborative, interdisciplinary processes, a literature to which this paper contributes. Underrated in this meta-research is a clear understanding of perhaps the most basic task of these research teams: collaborative, interdisciplinary reasoning (CIR). This paper presents an analysis of CIR centered on the co-application, co-creation, and co-repair of intersubjective values and standards among teammates.

This view of CIR takes its departure from a Habermasian understanding of rational discourse (1) and further refines it with work by Wright (2, 3) and Campolo (4, 5) on the necessary conditions of "reasoning together." Wright and Campolo emphasize that collaborative reasoning is pursued for the sake of continuing a discourse that was interrupted, perhaps by new evidence, circumstances, interlocutors, or misunderstandings. In CIR, these interruptions manifest as "research questions" that instigate a collaborative research project. Together with Habermas, Wright and Campolo point out that resuming a discourse rationally requires that interlocutors share values so that they can mutually evaluate reasons given by their conversation partners. In interdisciplinary team settings, these values are packaged in the methods, standards, frameworks, and concepts of the various participating disciplines. Intersubjective integration of these values is typically required for interdisciplinary reasoning to succeed.

Thematic Session 4

Centers And Institutes To Promote Team Science - What Leads To Success? 11:00-12:00 pm

Paper 1: Can cross-university collaboration be facilitated by establishing institutes to promote team science?

Authors: Griffin Weber, Noshir Contractor, Shuba Gopal, Alina Lungeanu and Yulia Tyshchuk

Accelerating high impact, collaborative scientific endeavors is a priority for many in the biomedical research community. A recent Nature Index Collaborations report noted "of the 100 strongest partnerships between two institutions around the world, nearly half are between pairs of research organizations in the same city or metro area." However, the report cautions that "proximity is just one factor driving collaboration". In particular, it suggests that part of the reason why Harvard University and the Massachusetts Institute of Technology (MIT) have the

highest collaborative index of any pair of institutions across the world is a joint venture called the Broad Institute of MIT and Harvard. We sought to test this hypothesis through a bibliometric analysis of publications from Broad and the nearby Whitehead Institute for Genome Research. Both were founded to promote a deeply collaborative approach in the area of genome research, and they both support collaborations that span Harvard and MIT. We found that when controlling for year, Broad and Whitehead publications show similar impact, with 117.3 and 114.6 citations respectively per article. However, even when institutions are organized to promote collaborations, the structure of the resulting teams can differ. When controlling for field, publications with Broad involvement have more than double the citation count of Harvard or MIT publications without Broad involvement. Broad publications also have more collaborators than Whitehead publications (17.43 authors vs 8.85), and typically have collaborators from a much wider cross-section of other institutions. Further, Broad publications tend toward a clinical focus, partnering more often with faculty from Harvard's affiliated hospitals. We will share our findings on what may contribute to the unique impact these institutes have, as well as what distinguishes each. We will highlight key features that other organizations can adopt to accelerate their own collaborative endeavors.

Paper 2: Team science failure: the problem of interdisciplinarity in academia

Authors: Jack Schultz

Most research-intensive universities claim to appreciate the value of interdisciplinarity and scientific collaboration. They also appreciate the fondness funding agencies have for these concepts, and many are following up by developing interdisciplinary centers or programs of one sort or another. In a few cases such centers or programs have been populated primarily with new hires focused on common themes and teamwork. But much of the time efforts to encourage team science among university researchers proceeds with little regard for whether or not the available researchers actually have reason to work together. This creates a situation in which team-building has to happen post hoc, involving researchers who weren't thinking about it at the start.

I will use an example of such an 'undesigned' center to identify the widespread institutional barriers to successful development of interdisciplinary collaborative programs and centers. These range from contrary reward systems to a lack of a management structure for follow-through, as well as poor communication and individual vision and attitudes.

Successful interdisciplinary, collaborative research centers and programs do exist, so there must be ways to cope with institutional barriers. These include establishing a priori goals and themes, devising a personnel plan to determine and modify membership, working to influence reward structures, establishing influence in the institution's management, selecting a particular kind of leader, and identifying one or more individual "champions" who see that all the pieces come together appropriately. Negotiating with faculty researchers to get them willing to commit to team building can be one of the biggest hurdles, and there are ways to accomplish this. I will provide an outline of optimal approaches to overcoming institutional and individual barriers to interdisciplinary collaboration on university campuses.

Paper 3: Cultural Computing: building a collaborative research team across the arts, humanities, sciences and engineering.

Authors: Stephen Beck

This presentation is a case-study on how a transdisciplinary research collaboration was created to explore computational applications in the arts and humanities. The group's struggles and successes provide a road map for others looking to overcome the significant structural, cultural and administrative barriers inherent in most research universities.

In 2003, our university invested $9 million in recurring state funds to establish and support an interdisciplinary research center in computational science. In addition to traditional computational disciplines (materials science, fluid dynamics, astrophysics), the governing council for the center authorized the establishment of a research group in digital media, recognizing the nascent strengths at the university and the opportunity for research and economic development in this area.

Challenges were plenty in establishing this new group. Money for joint faculty hires was in the originating budget, but departments and colleges were reluctant to share time and resources to support such faculty. University promotion & tenure policies did not address keys issues relating to joint appointments, and its F&A policies did not provide sufficient incentives for departmental participation in joint research projects. We overcame these barriers by identifying common goals and values, requiring financial buy-in from departments, and sharing the benefits (financial and intellectual) among all participating units.

We will present two instances where faculty co-location, shared values and random coffee meetings led to significant scientific and artistic breakthroughs. Projects in tangible interaction and music-over-networks will illustrate the transdisciplinary nature of the research. And we will focus on how research teams were identified, assembled and incentivized to address complex artistic problems that cross the arts, humanities, science and engineering.

Thematic Session 1

Panel: Reward and Recognition Across the Spectrum: Attending to the Needs of Multiple Collaboration Stakeholders in the Professions and Learning. 1:30 pm

Authors: Gaetano R. Lotrecchiano, Holly J. Falk-Krzesinksi and Michael O'Rourke

Problem. Proper recognition and reward for collaborative activities are critically important for learners and professional scholars given the nature of academe. As collaborative principles and cross-disciplinary engagements continue to gain importance in complex problem solving, concerns about recognition and reward structures at the individual, team, and organizational levels require specific attention to ensure that individuals are appropriately credited to support career advancement. Researchers are motivated by increased recognition and visibility (Beaver, 2001; Beaver & Rosen, 1979), and personal recognition can increase the visibility of the work produced through the multiple contacts and networks formed out of collaborations (Katz & Martin, 1997; Laberge, Albert, & Hodges, 2009). Researchers anxious about receiving adequate recognition for their work may shy away from interdisciplinary, collaborative work (Wray, 2006), and loss of identity and increased risk through collaboration are dominant concerns (Fox & Faver, 1984; Georghiou, 1988; Hackett, 2005; Sonnenwald, 2007).

Historically, promotion and tenure practices and policies appear to support individual and disciplinary achievements rather than interdisciplinary work, although there does appear to be a shift in recent years (Falk-Krzesinski, 2013). Therefore, interdisciplinary research can be considered risky in terms of career progression (Carayol & Thi, 2005; Coberly & Gray, 2010; Harris, Lyon, & Clarke, 2009; Horlick-Jones & Sime, 2004; Maglaughlin & Sonnenwald, 2005; Rhoten & Parker, 2004; Zucker, 2012). Academic rank and status can negatively affect the allocation of recognition in interdisciplinary and collaborative projects, and much of the literature suggests that this risk is especially true for early career researchers, who must often delay collaborative work until tenure has

been achieved (Boden, Borrego, & Newswander, 2011; Carayol & Thi, 2005; Maglaughlin & Sonnenwald, 2005; Younglove-Webb, Gray, Abdalla, & Thurow, 1999).

For students, participating in scientific collaborations is a sign of recognition and acceptance by the greater scientific community (Hara, Solomon, Kim, & Sonnenwald, 2003). However, the skills required to achieve this are often acquired post-training as early career professionals engage with more senior scholars. There remains lack of attention to two important considerations: (a) the recognition and reward structures required in educational settings to promote collaboration, and (b) how best to evaluate individual mastery while simultaneously encouraging robust collaborative practices.

Method. The panel discussion will explore three main areas of concern for recognition and reward of collaborative research and scholarly efforts: Learning strategies that reward collaborative and cross-disciplinary engagement (Dr. O'Rourke), motivations that drive stakeholders to collaborate (Dr. Lotrecchiano), and structures and policies that encourage and recognize collaboration (Dr. Falk-Krzesinski). Participants will be introduced to emerging thought in these areas and be engaged in discussion around specific concerns and strategies that can be employed in their professional environments.

SciTS Advancement. As collaboration priorities become more commonplace amongst professionals as a means to accomplishing greater cross-disciplinary integration and complex problem-solving, structures and policies that define how this is accomplished remain disparate and often not clearly defined. By taking a multilayer approach that targets learner, professional, and organizational dynamics, this cross-topical conversation can advance the way that team scientists consider the relationship between developing collaborative skills, maintaining collaborative engagement, and advocating for appropriate infrastructures and policies that further recognition and reward on each level of engagement.

Thematic Session 2

Training For Team Science - Developing Team Science Competencies 1:30 pm

Paper 1: The Impact of Team Skills Training on the Expression of Intrapersonal Collaboration Readiness Factors

Authors: Katherine Campbell and Katherine Stackpoole

Scientists are not traditionally trained to engage in collaborative research. Consequently, team skills training may be useful for an organization interested in increasing the competencies of researchers engaging in collaboration. As effective scientific teams share a number of competencies, including self-and-others awareness, communication, and team processes such as role clarification, these would be logical to include as part of an evidence-based team skills training program. Additionally, it has been stated that team member expression of intrapersonal collaboration readiness factors (CRFs), such as methodological flexibility, cooperative spirit, inclusiveness, and a positive attitude towards collaboration, can influence the outcome of collaborative research. However, there are no currently published data on the impact of training on expression of intrapersonal CRFs. Therefore, the purpose of this study was to explore the impact of a team skills training workshop on participant expression of CRFs.

Sixteen biomedical researchers who regularly participate in collaborative research at the Research

Institute at Nationwide Children's Hospital were enrolled in a five-hour team skills training workshop focusing on self-and-others awareness, communication, and team processes. Participants were given a pre-workshop survey designed to measure expression of the four intrapersonal CRFs mentioned above. Immediately following completion of the workshop, participants were administered an identical post-workshop survey. A paired t-test was used to analyze changes between pre-and-post workshop survey responses. The data showed a statistically significant increase ($p=0.03$) in the expression of at least one CRF by participants following the workshop. Unexpectedly, the study also identified a population of researchers who expressed a high-level of collaboration readiness prior to training.

Understanding this exciting population of researchers primed to engage in collaborative research is of importance for the SciTS field. Additional research to study the frequency and potential impact of this significant population is recommended.

Paper 2: Reflecting on Global Development: A Toolbox for Development Teams

Authors: Anna Malavisi, Marisa Rinkus and Michael O'Rourke

In a small rural village in Bolivia stood a brand new rehabilitation center for malnourished children. It was empty, unstaffed, and inaccessible by public transport. Funded by an international Non-Government Organization (NGO) through a local, national NGO, this project reflects an absence of critical reflection and dialogue about the purpose and the real impact of their work. The failure of development projects like this is attributable in part to the lack of communication among the various teams involved, leading to a lack of mutual understanding. Questions that may arise from global development include: do members of development teams have a shared understanding of the concept of development, or the concept of sustainability? How much thought goes into the impact of decisions on the communities where development organizations focus their work? How much should it be? We submit that structured dialogue about these and other issues that undermine deep, mutual understanding within development teams can improve the effectiveness of international development efforts.

Within development organizations, and particularly development teams, there is a need to generate a space for critical reflection and dialogue about the values and beliefs that influence decisions. This dialogue can support identification of potentially damaging differences and enhance communication by enabling colleagues to see the development landscape through each other's eyes. The Toolbox Dialogue Initiative (http://toolbox-project.org) offers an innovative, concrete, and tangible approach to critical dialogue that can help in two ways. First, it can generate a space for critical dialogue within development teams about issues that matter to them; second, it can enable discussion and analysis of specific concerns such that afflict development teams, such as conflicting assumptions, power dynamics, implicit biases, ethical issues, and epistemic injustice. We propose modifying this approach to address the communication challenges that confront global development.We also argue that the analysis presented here can also be applied to teams working in humanitarian aid and academic research in a global context.

Paper 3: The Role(s) of Personal Skills Development in Developing a Collaboration Plan

Authors: Stephanie Vasko

Hall, Crowston, and Vogel's 2014 working draft of "How to Write a Collaboration Plan" is an important first step in codifying a step-by-step approach to developing a research team. As Hall et al. state, "Collaboration plans should address a range of issues relevant to laying the foundation for the collaboration, as well as implementing and managing the collaboration, and engaging in quality improvement activities specific to collaborative interactions." "How to Write a Collaboration Plan" is an excellent resource for teams, addressing issues including rationale for team

approach and team configuration, collaboration readiness, technological readiness, team functioning, communication & coordination, leadership/management/administration, conflict prevention and management, training, quality improvement activities, and budget/resource allocation.

In this talk, I will discuss expanding "How to Write a Collaboration Plan" and the potential impact of focusing on personal development and skills-building on team collaboration. Specifically, I will focus on the roles of skills including flexibility, resilience, and accountability in participating in and managing team science (Vasko, 2017). These skills bridge several sections of a potential collaboration plan, including (but not limited to) individual collaboration readiness, communication & coordination, conflict prevention and management, and training. I will discuss the role (and potential obligation) of the institution (both academic and funding) in training individuals in these skill sets for collaboration.

I will present how the Toolbox Dialogue Initiative (TDI) is working within the Michigan State University (MSU) community to identify key individual skills for team science and how TDI is working among the different levels within MSU to inform and influence on-campus opportunities. I will also discuss the possibility of handling personal skills-building by bringing in specialists who posses these skill sets and could handle internal trainings, like those from the integration and implementation scientist (I2S), interdisciplinary executive scientist (IES), research development professional (RDP), and community engagement communities.

Paper 4: Effectiveness of the Coalesce Online Learning Modules for Team Science Training

Authors: Bonnie Spring, H. Gene McFadden, Katya Klyachko, Philip Rak, Frank Vernon, Donald Hedeker, Juned Siddique and Angela Pfammatter

Background: The four Coalesce online learning modules at teamscience.net are an open-access resource developed to support cross-disciplinary team science training. Launched in 2011 with CTSA support, the first module (Team Science 101) introduces team science experts who present foundational concepts and findings in the science of Team Science (TS). Interactive modules 2, 3, and 4 enable learners to work through simulated team science challenges in behavioral, clinical, and basic biomedical science while acting in the roles of early stage investigator, senior scientist, or research development officer, respectively.

Objectives: To characterize users of the site and evaluate the effects of the modules on team science knowledge, attitudes, and self-efficacy.

Methods: Generalized linear models were applied to evaluate pre-post changes in performance among users with biomedical versus other disciplinary background from the first generation of users (2011-2016).

Results: From 2011 through 2016, teamscience.net was visited by more than 80,000 unique individuals, of whom 2,103 voluntarily registered and provided demographic information. Of that number, 66.8% were female; 72.7% worked in academia; 46.4% were trained in biomedical science; 46.6% had a doctorate; and 66.8% expressed primary interest in learning about the practice (rather than the science) of team science. Those who completed both module pre- and post-tests showed significant improvement in team science knowledge, attitudes, and self-efficacy for all modules ($p<.001$) except module 1, for which improvement in knowledge and attitudes were nonsignificant. Those trained in biomedical versus other disciplines (e.g., social, physical, engineering sciences) showed no performance differences on any module, except module 4 on biomedical science, for which those trained in biomedical science showed greater pre-post improvement than other disciplines ($p<.05$).

Conclusions: Coalesce remains the first and only open-access, online training in team science for the health professions. Data from the first generation of users indicate that teamscience.net is widely accessed by diverse users from the biomedical, social, and

physical sciences who express primary interest in the practice rather than the science of team science. The modules were all effective in improving team science knowledge, attitudes, and self-efficacy, except for the more didactic, less structured module 1, which some users reportedly found overwhelming. No major differences were seen in the benefit that biomedical and other scientists derived from the modules. We discuss planned technological improvements for Coalesce and expansion of its content to demonstrate application of team science principles to community engaged research.

Thematic Session 3

Evaluating And Enhancing Team Processes

1:30 pm

Paper 1: Profile Analytics as a Mechanism for Understanding Engineering Design Teams

Authors: Marissa Shuffler, William Kramer, Michelle Flynn, Apurva Patel and Joshua Summers

With the increased use of teams in organizational contexts, researchers are challenged with approaching team measurement in a rigorous manner, especially in understanding the dynamics of interdisciplinary teams such as in engineering design. Indeed, many studies fail to approach the measurement of teams dynamically (Kozlowski, 2015). The present research aims to address this issue by moving beyond a variable centric approach to introduce the use of teamwork profiles in current assessments of teams. Specifically, we introduce team science researchers and practitioners to the concept of profiles, providing an example of application in the context of engineering design teamwork processes via the Marks, Mathieu, & Zaccaro (2001) framework. The structure of teamwork state profiles involves a shift in mindset from individual variables (i.e., variable centric) to patterns or multiplexes of variables (i.e., team centric, O'Neill, et al., 2015). The team-centric paradigm proposes that teams can have the tendency to exhibit particular, qualitatively meaningful patterns, and that these patterns can predict future interactions and outcomes (O'Neill, et al., 2016). As these profiles represent where a team stands at a given point in time for a set of emergent states and processes, we consider them to be state profiles, since they can change over time. The present research aims to test the presence of teamwork state profiles in the prominent team process framework proposed by Marks, Mathieu, and Zaccaro (2001). From this perspective, teams experience transition processes (e.g., planning), action processes (e.g., completing goals), and interpersonal processes (e.g., conflict resolution) that interact to create effective teams. Drawing from a sample of mechanical engineering student design teams engaged in a semester-long project, we demonstrate teamwork factors that may be relevant in dynamic teamwork profiles, and provide examples of potential teamwork profiles along with discussing appropriate methodologies and analyses (e.g., latent profile analysis, transitional analysis).

Paper 2: Connecting Research Methods and Successful Teams

Authors: Hannah Love and Jeni Cross

What makes a successful team? What is 'success?" Often we look at metrics like publications, grants, or invention patents to determine if a team was successful. These are important measures of success and certainly help us know if a team is successful by most research and institutional standards. However, metrics like these may take years to gather. What if you only have six months to know if a team is 'successful?' What if you need to know if the team is engaging in a meaningful way to have a longer-term impact?

To solve this problem, Wooten et al. proposed three different types of evaluations: outcome, process, and developmental (2014). Most evaluations are outcome

evaluations where metrics like publications and grants and collected. For two-years we followed eight transdisciplinary research teams and gathered meso-level data and for a process evaluation. According to Wooten et al, process evaluation study how the team interacts, team meetings, and engagement (2014). More specifically, we have used social network analysis, participant observation, coding meetings, conducting focus groups, studying historical publication data, and interviewing members of teams.

In this paper, we will provide an overview our mixed methods meso-level data collection highlighting three research methods: social network analysis, coding for evening-turn taking, and participant observation. We will provide results which demonstrate how mixed-methods meso-level data is used in a process evaluation of teams. Further, we will explain how positive results in a process evaluation have larger and longer-term macro-level and outcome evaluation impacts.

Finally, our refined methods in our process evaluation has helped our institutions coach, identify, and support successful teams earlier in the teaming process. Allowing us to maximize budgets and institutional support for our teams to develop new and innovative science.

Paper 3: What makes a team?: An Evaluation of an Interdisciplinary Team Development Program

Authors: Jennifer Cross and Hannah Love

The objective of this research was to assess how ten transdisciplinary teams developed over time with seed funding from a university sponsored program. The Vice President for Research (VPR) issued a call for applications and awarded several teams $200,000 of seed money to support the formation of new interdisciplinary research teams, with the goal of achieving a 10X on investment from the original seed funding. This longitudinal study used mixed methods to conduct a process and developmental evaluation of ten research teams over two years. Research methods included observation of various types of team meetings, informal interviews with team members, and social network surveys. During team meetings our observations were focused on capturing: number of speaking turns by each participant, type of knowledge shared between participants, and the idioculture of each team. In addition, we conducted social network analysis of each team based on social network surveys and team observations. The surveys were administered three times, at the beginning of the program, after one year, and at the end of the second year. We found there are at least three distinct types of successful transdisciplinary teams: small teams, large teams, and teams of teams. The characteristics that distinguish the most successful from the least successful teams included: types of team interaction, proportion of women, clarity of team vision, and collaborative history between members, as well as relationships between the scientific team and external partners, either industry, practitioner, or community organizations. These findings have specific implications for the SciTS field, including necessary professional development for teams (regarding team building and mission definition), the importance of external partners in informing the research goal, as well as how seed funding can most effectively accelerate productive collaboration in teams of different sizes and scopes of research.

Paper 4: 21st Century Techniques for Achieving Collaboration Despite the Hidden Curriculum

Authors: Derek Wade

In her Science of Team Science 2014 keynote, Carole Goble noted "Open Research Practice is increasingly like Open Source Software Practice." This is one example of a co-informing between Interdisciplinary Research (IDR) and Interdisciplinary Product Development (IPD). Another example is adherence to practices and paradigms that fail to advance the team's agenda – "because that's the way we have always done it."

Both domains are characterized by differentiated roles and specialized knowledge; task interdependence;

dynamic workflows adapting to changing contexts; and the interplay of tacit and explicit knowledge. In IPD these characteristics have historically given rise to team coordination and communication challenges, time and budget overruns, and failures at the points of integration.

Some IPD team practices could offer insight into effective practices for Interdisciplinary Research teams. However, many IPD practices -- while well established and still widely used -- have their roots in 1970's-era projects. Such practices are based on a "project management" paradigm: centralized, role-based management of project team members' communication, coordination, and integration activities.

Today, this paradigm achieves only mediocre results in mitigating the issues it was intended to address, especially at scale. The differences between the intended and actual outcomes of this project management paradigm result from the hidden curriculum of Interdisciplinary Product Development, and includes such symptoms as:

-- Over-focus on inputs (e.g. large-scale up-front plans or team "kickoff" events), which builds additional delay into projects and fails to noticeably improve team mental models. What value that is created by these initial activities tends to decay rapidly as it becomes out-of-date.

-- Enforcement of team compliance to procedures and standards that restrict cross-discipline innovation, reinforce existing social silos, and create cumbersome decision-making hierarchies. These hierarchies decouple information, decision points, and action, which adds further cost, delay, and risk.

-- The Project Manager role, intended to be a "communication hub," suffers from information overload. Their responsibility for the management of explicit information about task-work, status, time and budget is impeded by the hidden curriculum of IPD team-work, accountability without authority, and a geometrically scaling network of interpersonal communication and social interactions.

Near the beginning of the 21st century, IPD best practices underwent a paradigm shift which could inform effective collaboration on IDR projects. These practices are based on a paradigm of decentralized coordination, work-state signaling, and team focus.

IPD adoption of these practices is growing rapidly due to their demonstrated ability to avoid historical project management problems, even on complex projects. Several of this paradigm's most successful project team coordination techniques are revealed, including:

1. Workflow visualization as a means of offloading Project Manager and team member cognition;

2. Bounded work to reduce multitasking, increase productivity, facilitate formation of team shared mental models, and manage time/cost; and

3. Feedback loops/cadence for better visibility and responsiveness, both amongst the team members and from outside the project.

Guidance in applying these techniques, gained from 20 years of IPD field experience, is provided for avoiding common pitfalls such as "tool overload," disruption of existing standards/procedures, and misapplication of predefined process frameworks.

Paper 5: "That's a good point": Collaboration & Idea Development at Datathons

Authors: Teis M. Kristensen and Matthew Weber

The engagement with complex problems often requires collaboration between individuals with diverse expertise. This study takes a mixed method approach to examine the relationship between interactions perceived to facilitate creativity, creative outcomes, and organizational members' traits. The content of creativity facilitating interactions was additionally explored. Data were collected using surveys, interviews, and observations at two datathon events. Each event was focused on the generation of new analyses and

software by researcher from multiple disciplines. Surveys were used to collect network data on the participants' communication patterns. The survey data were analyzed using exponential random graph modeling. Observations and interviews were collected at the datathon events and were analyzed using a grounded theory approach. The results find that a relationship exists between creativity facilitating interactions and creative outcomes. Organizational members' traits, such as openness to experience and intrinsic motivation, had a limited impact on the formation of creativity facilitating interactions. Trust and a feeling of safety were identified as important for the formation of interactions that facilitated creativity. Participants saw on interactions with others as an opportunity to receive idea feedback, technical know-how, and gage relevance from different knowledge domains.

Thematic Session 4

Collaborations Across Academia, Industry, And Government

1:30 pm

Paper 1: Communicating Across Organizational Boundaries in the Context of Biopharmaceutical Research and Development

Authors: David J Mcbee

Research into the innovative process often stress the contribution of boundary-spanning network ties. By allowing access to new knowledge, social networks facilitate creativity. But problems arise; innovative areas are often characterized by high failure rates and uncertainty. Biopharmaceutical research and development is no exception – only about 2% of projects reach the marketplace. Even successful projects experience serious scientific challenges. To cope with these challenges, biopharmaceutical companies utilize teams of Ph.D.s from a range of disciplines. Even so, some obstacles require communicating and coordinating with university faculty, key opinion leaders, or industry consultants located beyond the boundaries of the focal teams or organization. To understand how these collaborations between different organizational types operate, I conducted 39 in-depth interviews with 34 industrial biopharmaceutical scientists, project managers and project leaders. Using theories of social capital, team science, and fields; I examine how the context of the biopharmaceutical industry shapes scientists' ability to become aware, evaluate, and access much-needed expertise across organizational boundaries in a knowledge-intensive field. Whereas, scientists contribute their social capital in the form of personal network contacts, firms contribute economic capital, legal guidance, and consulting contracts in order to locate, utilize, and protect these sources of diverse knowledge. While these biopharmaceutical firms own the intellectual property they do not end up "owning" these social network ties created through pragmatic problem-solving. Because knowledge of others' expertise often remains tacit and because many boundary-spanning network ties stem from team affiliations that predate the problem-at-hand, individual scientists exert greater control over these informal networks.

Paper 2: The role of intermediate network organizations in creating collaboration networks: Exploratory analysis of an international professional association as a heuristic device

Authors: Bei Wen, Edwin Horlings, Marielle van der Zouwen, Wim van Vierssen and Peter Van Den Besselaar

Understanding professional networks in a global context is important for the development of a collaborative knowledge infrastructure. Little is known about the role of professional associations and network organizations in the organization of interactions

between industry, science, and government and even less is known about the ways in which individuals search for and establish interactions. Most existing studies are built up on the scholarly co-authorship networks out of bibliometric databases. In contrast to this approach, we use attendance data (conference, specialist groups, and thematic programs) from the International Water Association (IWA) to explore heterogeneous network formation. This is done by analyzing the co-attendance behavior among the various groups professionals in the water domain.

Paper 3: Motivations behind cross-boundary collaboration

Authors: Bei Wen, Wim van Vierssen, Marielle van der Zouwen, Edwin Horlings and Peter Van Den Besselaar

If cross-boundary collaboration is necessary to tackle today's grand challenges, the question becomes what motivations make researchers and practitioners to engage in cross-discipline and cross-sectoral collaboration. Previous research focused mainly on collaboration between researchers, and this study adds to this the understanding of collaboration between a variety of professionals other than only researchers. From this we may understand better the conditions for efficient cross-boundary collaboration.

Paper 4: Establishing a Statewide Research Initiative: Lessons from Developing a Knowledge Network

Authors: Amber Caulkins

The State of Rhode Island faces complex challenges across multiple areas. These challenges are dynamic and complex, requiring diverse skills, knowledge, and perspectives to determine solutions. Rhode Island, with its small geographic size, and 11 public and private colleges and universities, offers a unique opportunity to develop knowledge networks that leverage academic research to address state specific policy challenges.

Developed in 2013, The College & University Research Collaborative (The Collaborative) is a partnership between all 11 institutions of higher education in the state and offers a promising model for coordinating knowledge resources to improve connections between academic research and public policy. To date, The Collaborative has developed 39 research projects, working with 65 researchers from across disciplines and campuses, including 11 multi-campus interdisciplinary teams. Research projects have explored issues related to healthcare, energy, workforce, manufacturing, regional competitiveness, arts and culture, social services, municipal services, criminal justice, and education.

Using a unique process, The Collaborative seeks input from state government leaders to determine consensus-based questions related to pressing, state-level policy challenges. The Collaborative then works with faculty within Rhode Island to develop research approaches that best address these questions, including cross-campus, interdisciplinary teams. The Collaborative provides faculty with strategic support throughout research project development, including editorial and data visualization resources that help to clarify complex information for audiences outside of academia.

This presentation will share findings from an evaluation using both quantitative and qualitative measures that was completed in the third year of implementation (2016). The evaluation assesses the pilot phase of the program and its' impact on the research community and policymakers. Lessons learned from this evaluation, and recommendations for the next phase of the project, will provide valuable insights for developing statewide knowledge networks and meaningful collaborations that include stakeholders, researchers, and interdisciplinary teams.

Thematic Session 1

Panel: Seeding And Watering New Cross-Disciplinary Collaborations: Approaches From Funders And Universities 3:15-4:45 pm

Authors: Amanda Vogel, Kara Hall, Anne Heberger Marino, Suzanne Christen and Damayanthi Ranwala

There is strong interest in approaches to stimulate the creation of new boundary-crossing science teams and help these teams develop, launch, and sustain innovative collaborative research initiatives. This panel highlights how a diverse set of public and private funders and universities, with varying levels of resources, have successfully applied a range of approaches to advance these goals. Panelists will describe sandpits, conferences, preconference tutorials, speed networking, and funding approaches. They will highlight transferable strategies for success, lessons learned, and evaluation approaches.

Dr. Amanda L. Vogel of Leidos Biomed will provide an overview of key goals and challenges in seeding, watering, and growing cross-disciplinary science teams, and introduce the panel, highlighting the varied approaches used by their institutions to launch innovative cross-cutting collaborations.

Dr. Anne Heberger Marin, of the National Academies of Sciences Keck Futures Initiative will describe its 13 year initiative bringing together over 2000 scholars and professionals from across fields and disciplines in conferences, pre-conference tutorials, and seed grants to advance high-risk, high-reward science.

Suzanne Christen, JD, of the Institute for Advanced Study (IAS) will describe a recent collaboration between Stand Up to Cancer and IAS to stimulate and fund cross-disciplinary Convergence Science teams to advance clinical cancer research. This talk will highlight approaches used to bridge disciplines.

Dr. Damayanthi Ranwala of the Medical University of South Carolina will describe how the University's CTSA has stimulated new interdisciplinary research collaborations through theme-based scientific retreats, speed-networking, and pilot project awards, and will share evaluation approaches and findings.

Dr. Kara Hall of the US National Cancer Institute (NCI) will highlight innovative approaches used by the NCI and Cancer Research United Kingdom to generate new teams and novel research projects. This talk will highlight how mental models and network metrics are used to advance collaborations and scientific initiatives, and evaluate success.

Thematic Session 2

New Technologies And Evaluation Approaches 3:15-4:45 pm

Paper 1: Use of Theoretic Frameworks and Models to Inform Design of Health Information Technology to Support Treatment of Heart Failure in VA Primary Care

Authors: Jennifer H. Garvin, Michael W Smith, Charnetta Brown, Salim Virani, Charlene R Weir and Laura A. Petersen

Our multi-disciplinary team, of cardiologists, primary care providers, informatics and human factors researchers, designed a communication mechanism for primary care teams to improve beta blocker titration for patients with heart failure.

We used theoretic frameworks and models to inform our work. The Cabana model identifies clinician knowledge, attitudes, and behavior constraints. The socio-technical model for health information technology addresses factors including clinical content, workflow, and organizational culture. The Promoting Action on Research in Health Services (PARiHS) framework identifies the role of evidence, context, and facilitation in clinical practice.

We were primarily a distributed, virtual team using the Department of Veterans Affairs (VA) resources to complete our work. We used the theoretic frameworks to inform Cognitive Task Analysis (CTA) interviews and subsequent usability assessments (UA) with primary care providers, clinical pharmacists, and nurses.

The theoretic frameworks contributed to our team interactions. For example, the Cabana model provided a frame of reference for clinicians and human factors researchers to communicate about provider's information needs. The socio-technical model facilitated communication about workflow and clinical content among the informatics, clinical, and human factors specialists. The PARiHS framework helped different team members jointly conceptualize barriers and facilitators of the adoption of beta blocker titration practices.

Due to the frameworks and the interactions they supported, we were able to identify challenges facing care teams, and to develop and assess a prototype decision support tool to assist them.

Our work illustrates the use of constructs from theoretic frameworks, in a transdisciplinary approach, focused our work on clinical content and communication to support provider's clinical needs and workflow.

This research was supported by the VA, HSRD CRE 12-037 funding. Views expressed are of the authors and are not necessarily the views of the VA, their academic affiliates, or the U.S. Government.

Paper 2: The Use of Digital Trace Data to Examine Scientific Teams

Authors: Laura Anderson and Cheryl Kieliszewski

Discovery, the gaining of new insight or understanding, often is an important objective and achievement for scientific teams. Our research goal is to develop metrics that allow us to identify and measure the pace of discovery through the analysis of the digital trace data created by scientific teams. Our hypothesis is that the analysis of digital trace data from the direct and indirect products of scientific work practices provides insight into team activity and the emergence of discovery (Figure 1). Digital trace data sources include transcribed meeting conversations, written communication and social exchanges, tools and technology usage logs, and shared artifacts such as papers and presentations. We use multiple methods in our studies to analyze the digital trace data from the direct work of science teams including: trace ethnography of meeting transcripts and computing system logs; social networking analysis of communication channels such as email or Slack; and textual and thematic analyses of structured and unstructured text within project artifacts, with a focus on vocabulary and changes in topics. Our findings include varying patterns of social interaction and conversation across project phases, emergence of new vocabulary around discovery events, and observable changes in computer application usage related to discovery activity. Results of the analytical output can benefit the scientific teams by providing reflective feedback to enhance and augment their understanding of their collective activity. These approaches provide methods to gather empirical data of science teams as they work, and could be used to augment the science of team science evaluation methods.

Paper 3: A Self-Scoring Mechanism for the Motivation Assessment for Team Readiness, Integration, and Collaboration (MATRICx)

Authors: Gaetano R. Lotrecchiano, Trudy Mallinson, Alexandra Rosenberg, Holly J. Falk-Krzesinski, Lisa Schwartz and John Liu

Objective. To develop a translational self-scoring sheet for the Motivation Assessment for Team Readiness, Integration, and Collaboration (MATRICx) instrument for individuals and teams to be able to use the tool in team reflection and maintenance.

Methods. A review of the team science literature was used to compile a list of motivators and deterrents to collaboration that were developed into 6 domains of collaborative functioning in health and biomedical teams (Lotrecchiano et al., 2016). This list informed the development of 55 indicators representing a hierarchical spectrum of collaboration. Rasch analysis was used to investigate the rating scale structure, unidimensionality, and person-item fit of responses from 150 participants. Items were analyzed applying a 1-parameter Rasch model using Winsteps® 3.80.1 (Linacre, 2013). Pilot data analysis provided a hierarchy of motivators and threats which make up the MATRICx framework (Mallinson et al., 2016).

Results. Several iterations have contributed to the development of a self-scoring scale that maps individual participant motivators for collaboration against degree of collaborative experience and along the domains of collaborative functioning in a graphical context usable by individuals and teams to establish the degrees and depth of collaborative motivation.

Summary of findings. The self-scoring sheet provides the basis for technological advancement of the MATRICx tool to be designed and promoted as a mobile application for use by teams and to collect data for further research. The self-scoring graphical framework will be used as part of the technical development of the MATRICx mobile application.

Statement of how the research advances the SciTS field. The development of a self-scoring sheet for this assessment is the next phase of providing team scientists with usable tool for understanding motivations related to collaboration in knowledge producing teams. In addition, this practical tool will allow for strategies to be developed for team building useful to developing and assembling teams. Lastly, the scoring sheet is the bases for a digital platform (in development) that will serve as a mobile access point for the MATRICx as well as portal in which to continue the collection of data associated with the MATRICx project.

Thematic Session 3

Insights Through Network Analysis

3:15-4:45 pm

Paper 1: Author connectivity within disciplines: how big is your world?

Authors: Daniel Acuna and Elizabeth Novoa

Collaboration in science is important for improving the productivity, quality, and reproducibility of research. Often, new research projects start when scientists make connections among their advisors, mentors, and co-authors. Understanding the connectivity (e.g., distance) between two scientists is therefore important for starting new collaborative projects. However, we do not know how well scientists are connected within disciplines because access to datasets have been limited. Recent releases of datasets open the door to explore these answers.

Previous researchers have examined how disciplines differ in collaboration patterns. Newman (2001, 2004)

found that scientific collaborations in Biomedical Research, Physics, and Computer Science exhibit a "small world" pattern, where two scientists are connected by a short path. Finardi and Buratti (2016) found strong patterns of collaboration across BRICS countries and Coccia and Wang (2016) found stronger collaborations between applied and basic sciences in the course of decades. However, these studies have been relatively small in scale.

The purpose of this work is to understand author connectivity differences across disciplines. Our hypothesis is that scientists are closely connected but with significant differences across fields. To answer this question, we analyzed the Microsoft Academic Graph (Sinha et al., 2015), matched to the Web of Science discipline classification, containing 16.9 million authors and 25 million articles. We analyzed 19 fields (Fig. 1 A and B) and computed the most frequent field of publication per author. We found that the Multidisciplinary field, with a small share of only 2.2% of the authors (Fig. 1A), has the shortest average distance (3.41, Fig 1B) whereas Engineering has the highest (6.75). Similar to previous studies (Newman, 2001), we confirm that there is a significant correlation between the log of the number of authors and the log of the number of papers with the average distance within fields ($r(18) = 0.52$, $p = 0.02$, and $r(18) = 0.52$, $p = 0.02$, respectively). Our results coincide with previous findings that the sciences have relatively high minimum distance (compare Agricultural and Biological Sciences = 6.45 with Physics and Astronomy = 5.2). We will explore ideas for future work where we can create systems to automatically suggest collaborators based on fields of study. These results shed light on how teams of scientists may be formed based on connections among them.

Paper 2: Comparing Bibliographic Maps with Researcher Networks in Educational Research

Authors: Heisawn Jeong, Kristine Lund, Sebastian Grauwin and Pablo Jensen

Bibliographic analyses based on citation data are commonly used to understand the shape of research practices in science (Grauwin & Jensen, 2011). Citation is a human practice subject to human practices such as professional membership (Longino, 2013). In this study, we examined the extent that bibliographic maps formed by shared citations map into human research communities. We first performed bibliographic coupling on 36,715 articles in Scopus published from 2000-2004 in educational research, which resulted in a network of 18 clusters (Lund, Jeong, Grauwin & Jensen, 2015). We then compared this map with researcher networks captured in the 2005 annual meeting of American Educational Research Association (AERA) with 12 Divisions and 155 SIGs (Significant Interest Groups). We looked at how authors/participants for a given AERA Division/SIG sponsored sessions were distributed between different clusters, taking into account the relative size (in terms of authors) of each of these clusters. Strong matches were found between some of the clusters and AERA Division/SIGs, suggesting that bibliographic clusters are relevant to researcher networks. The match was not as strong in other cases, which is likely to be due to the limited scope of the data as five years of cluster authorship was compared to one year of conference participation. In addition, AERA, while large, does not fully represent the global educational research community. Both strong and weak matches together indicate that while disciplinary associations may prompt and guide researchers to cite specific references, publish in certain journals, and join particular professional organizations, researchers are also agents of knowledge dissemination, citing, presenting, and publishing their research across cluster boundaries. The relationship between bibliographic networks and researcher networks is not straightforward, and we need to continue to reflect on how citation may influence and be influenced by research networks of the fields.

Paper 3: The Effect of a Clinical and Translational Science Award Institute on the Ego Networks of Investigators at a Large Research University

Authors: Felichism Kabo and George Mashour

The goal of our study was to examine differences between investigators' ego networks based on whether they consulted with the CTSA institute. Our study sample was investigators who submitted research proposals to external sponsors in the year 2006 (N = 2,161). We collected grant submissions data for the period 2002-2012 where the treatment was consultation with the CTSA institute in 2006. We created investigator networks based on grant proposal co-submissions and generated the ego network measure two-step reach (TSR) – number of nodes that can be reached within two steps, which assesses the importance of 'weak' ties (friends of friends) with respect to information and knowledge flows. The study sample had two groups: Group A (N = 176) interacted with the CTSA, and Group B (N = 1,985) had no interaction with the CTSA. We ran independent sample one-tailed t-tests to examine the hypothesis that Group A would have a greater increase in TSR over time. With 2005 as the baseline (pre-treatment), we analyzed change in TSR in the post-treatment years 2008, 2010, and 2012. In 2008 there was no significant difference between Group A and Group B (meanA – meanB = -4.50, $p = .707$). In 2010 Group A had a significantly larger increase in TSR (meanA – meanB = 23.33, $p = .019$). In 2012 Group A had a significantly much larger increase in TSR (meanA – meanB = 145.68 $p < .001$). The difference in TRS score between the two groups increased with time, suggesting the CTSA institute has significant medium- and long-term positive impacts on investigators' ego networks. This has major implications for how collaboration patterns change at the individual and institutional levels. It also indicates potentially unidentified mechanisms by which the CTSA can have an impact on investigators' research productivity, namely, through enlarging and enriching individuals' grant-seeking ego networks.

Paper 4: The Associations between Social Networks, Sense of Community, and Co-Location Among Healthcare Policy Scientists

Authors: Felichism Kabo

The goal of our exploratory study was to analyze the association of social networks with sense of community (SOC) and spatial co-location. Our study sample was scientists at an institute for healthcare policy formed in 2011 by bringing together scientists from more than 20 different university units. In 2012, around 40% of the institute was co-located at a large research complex. We administered a two-part survey in late 2014 to the institute's 390 scientists (125 co-located) plus 21 employees of non-university affiliates. Part 1 focused on interactions with colleagues, and Part 2 focused on socio-physical perceptions of the workplace. The overall response rate was 39% (N=152) and 53% for co-located scientists (N=66). We symmetrized the Part 1 item on interaction frequency and generated a network that was used to create three dependent variables (DVs): degree or number of nodes directly connected to a given individual; two-step reach or number of distinct individuals within two steps of a specific individual; and betweenness or how often a given individual falls on the shortest paths between other pairs of individuals. The independent variables (IVs) were a Part 2 item on the sense of community (SOC) in an individual's unit, and co-location. For each DV we ran linear regressions controlling for organizational affiliation. To account for building layouts potentially impacting networks or sense of community, we clustered the standard errors by building. SOC was significantly correlated with degree ($\beta = 0.00862$, $p < .01$) and betweenness ($\beta = 0.00206$, $p < .05$). Co-located scientists had higher degree ($\beta = 0.0339$, $p < .01$) and two-step reach ($\beta = 0.153$, $p < .001$). Betweenness is only significantly correlated with SOC implying that individuals can be central in the institute's network despite lack of co-location. The study demonstrates associations between spatial co-location, SOC, and social networks.

Thematic Session 4

Translational Health Research 3:15-4:45 pm

Paper 1: Team Science as a Strategic Research Priority at Academic Medical Centers

Authors: Rand Haley

Institutional focus on, and investment in, team science—within academic medical centers (AMCs) and research-intensive schools of medicine—are important and increasing. But team science is just one of many elements within a complex array of other strategic research enterprise priorities. This presentation will share a recently-published framework for thinking about research strategies and priorities at AMCs, a framework developed from a review of research strategic plans and the authors' related experiences. While highlighting the places where team science emerges in AMC research strategic plans, the presentation will help to advance the SciTS field by providing the audience with a holistic context for considering other institutional priorities that may align or compete with team science for organizational attention and financial resources.

With an eye toward team science, the presentation will introduce a "research strategy DNA" framework developed to help leadership and faculty toward a shared understanding of their current position and help inform their future strategic priorities. Six common strategic elements are outlined in the framework: (1) research faculty, (2) research infrastructure and space, (3) research organizations, (4) research focus areas, (5) research teams, and (6) research partnerships. AMC thinking along these elements is guided by two strands: (1) pursuit of excellence, and (2) strategic stewardship. Additional areas of emerging strategic attention (yet underrepresented in current research strategies) are also introduced: research business models, translational organizational structures, and philanthropic agility.

Paper 2: Creating a Culture of Collaboration at George Washington University (C3@GWU): University Seminar Think Tanks and Aims

Authors: Gaetano R. Lotrecchiano, Sean Cleary, Paige L McDonald, Shalini Misra, Julia Storberg-Walker and Ryan Watkins

Creating a Culture of Collaboration at George Washington University (C3@GWU) is a University Seminar that convenes a cross-disciplinary community of expert faculty interested in issues related to scientific collaboration and connects them with regional and national partners and experts to explore and address topics that foster collaborative science. C3@GWU knowledge communities ("think tanks") represent GWU, regional institutes, and federal government stakeholders. C3@GWU will generate short and long term agendas and discussions that emphasize the mechanisms of scientific collaboration at GW about:

- Developing and educating team scientists
- Measuring team effectiveness
- Technologies for collaboration and scholarship informetrics
- Required organizational supports for team science and collaboration
- Faculty reward and recognition for collaborative activities,
- Issues related to crossing cultural, ethnic, and gender boundaries in science.

C3@GWU Seminar Objectives:

1. Assemble knowledge communities ("think tanks") of key contributors and stakeholders from throughout and beyond GWU to foster cross-disciplinary discourse and generate agendas for action in creating a collaborative culture at GWU.

2. Explore key topical areas critical to scientific

collaboration within and beyond the GWU scholarly community.

3. Examine critical areas of academic and organizational collaborative functioning that will strengthen a growing culture of collaboration at GWU.

4. Propose collaborative and team protocols, policies, and activities to university leadership and decision-makers responsible for empowering GWU collaborative science.

5. Disseminate key products and create knowledge-sharing events that will enhance collaborative activity at the GW department, school, and university levels.

Paper 3: Citizen Science- The Ultimate Team Science: A Look at Public Participation in Biomedical Research

Authors: Katrina Theisz

This presentation will serve as a state-of-the-science overview on the use of citizen science, crowdsourcing, and other methods of open innovation in biomedical research, with an emphasis on how the National Institutes of Health (NIH) supports open innovation methods. The NIH Citizen Science Working Group, a research interest group comprised of over 50 program officers from across the NIH, defines citizen science as a complex set of methods a collaborative approach to research involving the public, not just as subjects of the research or advisors to the research but as direct collaborators and partners in the research process itself. Over the years these methods have been used prolifically in disciplines such as ornithology, ecology, oceanography, meteorology, and astronomy. Their use in biomedical research is far more recent.

This presentation will examine the benefits and barriers specific to incorporating open innovation methods into biomedical research from a federal perspective, and how NIH has implemented public feedback into its approaches. Some examples of benefits include the acquisition of more insight and data than would have been possible using conventional approaches and harnessing the creativity of the public to solve problems, and a few examples of barriers include protecting the security and privacy of personal health data and bureaucratic delays to implementation. The presentation will conclude with links to free resources and open funding opportunities.

Citizen science involves individuals working together to identify and solve scientific quandaries, not only from across scientific disciplines but often individuals whose expertise and training lies outside of the realms of science. In this way, citizen science can easily be defined as the ultimate team science with the greatest discipline diversity across teams. The impact of citizen science on the study of SciTS has the potential to be great and will need to continue to be assessed as these methods develop and change.

Thematic Session 1

Ethics And Integrity In Team Science

5:00-6:00 pm

Paper 1: Ethical Foundations in Team Science Settings

Authors: Jonathan Beever and Mark Hannah

Ethical decision-making, (i.e. the cognitive and affective components of understanding and acting in situations of complex moral salience), is especially challenging for team science due to the communicative, methodological, and foundational differences among disparate science cultures. And yet ethics is an understudied component of team science. In this presentation, we outline a novel research strategy by which to better understand the nature and role of ethics in team science.

Much previous work in ethics has analyzed effective strategies of cultivating ethical decision-making at the individual level. Those projects leaned on Kohlbergian-based instruments of individual psychological moral development to assess ethical development. While

this approach enhanced researchers' understanding of ethical decision-making at the individual level, central questions arose as to how and to what extent ethical decision-making differed amongst groups collaborating in STEM disciplines and what impact these variations had on team science. This is a significant gap, given the increasing importance of team-based science.

In response, we have developed a multidisciplinary team research strategy to study the ways that ethical decision-making may differ across disciplines and at stages of individual formation within disciplines. As an alternative to what has become a standard rationalistic and individualistic model of ethical decision-making, we propose drawing on character-based work of moral foundationalists who argue that the individuals' ethical character is orientated, implicitly, to particular norms or values, and that these values are reflectively shaped by the cultures and contexts of group settings.

To pursue this work, we pose two related hypotheses. First, we think that disciplinary enculturation exacerbates differences in individual value perspectives and decreases researchers' abilities to collaborate effectively in team or group science settings. Second, we propose that foundational normative differences exist between disciplines precisely because of the ways in which members of disciplines are enculturated. Further, these differences play a role in the effectiveness of communication and decision-making within teams. In this presentation, we'll develop these hypotheses and the theories that guide them and outline a research plan to study them.

This research has significance for the science of team science both in drawing attention to the role of ethics in team science but also to the ways in which disciplinary enculturation effects individual values and actions.

Paper 2: Holding it all together: Promoting Integrity in Science Multiteam Systems

Authors: Samantha Dubrow, Richard Klimoski, Laura Fletcher and Stephen Zaccaro

Concerns around research integrity have grown exponentially in the last ten years. The issues have begun to extend beyond examples of data fabrication and plagiarism to include more nuanced ones, including failure to perform as promised, disputed claims to intellectual property ownership, and the inability to replicate findings or statistical standards for research quality. These issues are often faced by scientists participating in multidisciplinary teams (e.g., Edwards & Roy, 2017; Martensson, Fors, Wallin, Zander, & Nilsson, 2016). These issues will be exacerbated in scientific collective research where scientists are part of multiteam systems (MTSs), which are groups of teams, often interdisciplinary in nature, that are brought together to solve problems that are significant in scale and scope (Zaccaro, Marks, & DeChurch, 2012). Scientific MTSs may give rise to unique ethical challenges. First, when multiple teams come together, differentiation between component teams can lead to disparities in perceived research practices and potentially in ethical standards (Lotrecchiano, 2013; Luciano, DeChurch, & Mathieu, 2015). Different disciplines may have different norms for the scientific publication processes, such as the level of validity necessary to assert a given conclusion. Thus, MTS-level ethical leadership is a necessary precursor to between-team commonality in ethical norms and practices. Second, each team often has its own leader who is focused mostly on their team's mission, without necessarily keeping the MTS mission in mind. A laissez-faire leadership structure for the MTS can arise, causing a failure in communication of moral issues for the MTS and down to each component teams (Trevino & Brown, 2004). Due to these potential issues of integrity that may arise in science MTSs, we aim to discuss how the assembly process and MTS governance--including boundary management, ethical leadership, norm setting, and issues of free agency--can be structured to promote scientific integrity in such collectives.

Paper 3: Division of Labor and Scientific Misconduct

Authors: John Walsh, You-Na Lee and Li Tang

Science is increasingly a team activity, and the size of the teams has been growing. At the same time, there has been an increase in the rate of retractions of published findings. We argue that the increase in division of labor that is associated with larger team size may be a key factor contributing to scientific misconduct and the associated retractions. While larger team size may reduce retraction likelihood due to more people monitoring and checking the results, greater division of labor reduces the ability of team members to monitor each other's work, increases coordination and communication problems and may lead to goal displacement, and therefore should increase the probability of retraction, net of team size. Based on a matched sample of 263 retracted and 506 paired papers that were not retracted, we develop indicators of the division of labor in the team that produced a paper and find that the rate of retractions is higher as the division of labor increases (net of team size), even though team size has a negative effect on retractions. We conclude with a discussion of the implications of these findings for science policy, in particular for organizing team science projects.

Thematic Session 2

International, Large-Scale Distributed Teams

5:00-6:00 pm

Paper 1: Collaborative, multi-geography interdisciplinary research: early lessons from the trenches

Authors: Lucia Scodanibbio

An increasing number of large multi-partner, geographically distributed, inter-disciplinary research consortia are being funded to address wicked problems in the socio-ecological realm, such as around climate change and sustainable development. While some call these projects transdisciplinary and others compare them to communities of practice, there is no clear framework as yet to describe them, or to help harvest the lessons that are emerging in the complex process of implementing projects such as these. Some argue that this collaborative research model holds the potential to yield unique insights that can be applied to multiple regions and reflect a more systemic and integrated understanding of the issues. However, working collaboratively across several time zones, different institutional and personal capacities, and opposed disciplines and local contexts, also entails large transaction costs and a challenging integration process. The purpose of this paper is to explore the learning that has emerged halfway through the Adaptation at Scale in Semi-Arid Regions (ASSAR) project; a five-year multi-country, multi-disciplinary research project that seeks to explore some of the main barriers and enablers to effective, widespread and sustained adaptation to climate change in semi-arid regions of Africa and Asia. The paper starts by mapping ASSAR onto different frameworks that are often used to describe such boundary-spanning research consortia, such as transdisciplinary and interdisciplinary collaborations, communities of practice, and frameworks emerging from science of team science scholars. It then moves on to discuss the learning that emerged from a range of ASSAR researchers and staff members that were surveyed in late 2016, halfway through ASSAR's duration. It ends by highlighting emerging lessons to date and provides preliminary recommendations around issues that need to be taken into consideration when designing and implementing large multi-site interdisciplinary research collaborations.

Paper 2: A Dynamic Ecology of Teams in an International Virtual Research Organization: What Makes Teams Productive?

Authors: Iftekhar Ahmed, Ashley Trudeau, Elizabeth Simpson, Natalie Lambert and Marshall Poole

Traditional research on organizational teams primarily focuses on the interactions among team experience, task, and team-organization alignment (Tannenbaum, Mathieu, Salas, & Cohen, 2012) where membership, leadership, purposes, and boundaries are well defined and effectiveness criteria are somewhat clear (Wageman, Gardner, & Mortensen, 2012). However, the nature of teams, team environment, and collaboration has been rapidly changing and geographic dispersion and multiple team membership became significant factors in understanding teams and team effectiveness (Wageman, Gardner, & Mortensen, 2012; Tannenbaum, Mathieu, Salas, & Cohen, 2012). Considering knowledge-intensive work in multinational organizations, research shows that, "at the team level, performance is higher for teams whose members allocate a greater proportion of their time to the focal team, but surprisingly, performance is also higher for teams whose members allocate time to a greater number of other teams concurrently" (Cummings & Haas, 2012, p. 316). The scenario calls for innovative methodology to understand the effects of multiple team membership over time (O'Leary, Mortensen, & Woolley, 2011).

A network based approach could significantly contribute to our understanding of teams in this changing environment. Although D'Innocenzo, Mathieu, and Kukenberger (2016) argue for the "relative value of employing social network theories and measures as compared to aggregate theories and measures of shared leadership" (p.1), there is a need to study dynamics and changes in networks and team structures over time to fully realize this value.

This case study looks into project development, participants, and productivity of research and development teams in the Joint Lab for Extreme Scale Computing (JLESC), an International Virtual Research Organization that has generated seventy nine projects from 2010 to 2016 that includes 217 participants with 46 different institutional affiliations across four continents. We track the composition, project focus and productivity of the teams over time. Using content analysis, interviews, and network analysis, we generate data that enables us to test three hypotheses related to productivity in the teams: (1) Teams with members who are more central in the participation network are more productive; (2) Teams that persist over time are more productive; and (3) The more linkages a team has to other teams, the productive it is. The results have the potential to shed light on the paradox raised by the Cummings and Hass findings and also to illuminate the role of networks among teams on scientific and engineering productivity.

Paper 3: Examination of processes that contributed to the success of a research partnership in Canada through three key moments in its development

Authors: Saint-Jacques Marie-Christine, Robitaille Caroline, Saint-Amand Annick and Turcotte Daniel

Based on our experience establishing and managing a large, interdisciplinary research partnership—"Team Science"—dedicated to parental separation and stepfamilies, this presentation highlights the processes that facilitated this undertaking, as well as those that hindered it. These processes, brought to light by our assessments, will be examined with emphasis on three key moments in our team's development: its origin, its implementation and its continuation over time.

Starting in 2008, the analysis that led to establishing this team helped to create a consensus regarding the themes and issues to prioritize. It also led to the development of a participatory research strategy promoting action and the co-creation of knowledge, a major undercurrent in the world of research (Gibbons et al., 1994). This way of working, combined with a research context in Quebec and Canada that favours research partnership with community organizations and a strong commitment by partners, is seen as having fostered development of this project. Partner organizations are asked to participate in intellectual leadership and to provide expertise.

Moreover, if seeking a balance between critical distance and physical proximity (Lapointe, 2008) is essential,

it includes challenges that can hinder the smooth operation of a partnership. In our case, establishing procedures for research production, governance and mobilization of knowledge that allow members to learn to work together and develop a shared vision of the situation of these families helped to overcome this challenge. The presentation will also outline strategies used to foster evolution of the team over time. Continuation of winning strategies, combined with the creation of a project of a different nature supported by all, seem to have contributed to this transition.

Thematic Session 3

New Findings On What Leads To Innovation

5:00-6:00 pm

Paper 1: Small Teams Generate New Directions in Science and Technology

Authors: Lingfei Wu, Dashun Wang and James Evans

Recent evidence that large teams are eclipsing small teams in the production of high impact science and technology raises questions about whether and how size influences the ideas, designs and products teams generate. We argue that larger teams are better designed to solve existing problems and develop existing technologies, while smaller teams are built to generate them. Analyzing teamwork represented by tens of millions of research articles, patents, and software products, we find remarkably consistent evidence that individuals and small teams are more likely to produce articles, patents and software that disrupt the system by drawing inspiration from older and less popular ideas, while larger teams build on, solve and refine important ideas from the immediate past. As a result, attention to articles, patents and software produced by large teams is more immediate, while the work of small teams comes further in the future, if at all. We show that part of this difference may be attributable to the economy of science and technology, as more intensely funded areas of science amplify the difference between small and large teams, leading large team leaders (and members) to minimize the risks of R&D by solving prominent problems where a stable market of attention already exists. We suggest that the decline of small teams may pose challenges for the long-term vitality of science and technology.

Paper 2: Research versus Development Teams: The Delicate Balance between Freedom and Focus

Authors: Jeff Tsao and Venkatesh Narayanamurti

On the continuum of research to development, research is the end that is most unpredictable and uncertain, in both the timescale and intellectual content of its outcomes. Our experience in the trenches of research and research teams in the physical sciences and engineering has been that the focus such teams bring to their tasks must be balanced by a considerable amount of freedom. Two important examples of such freedom are illustrated in the accompanying graphic, both related to the SciTS concept of "permeability."

• In the example on the left, a researcher gains new knowledge that suggests that his or her contribution might be better maximized by switching from one research team to another. The researcher's freedom to make that switch is critical to the impact of his or her research contribution, but may have detrimental consequences to the research team he or she has abandoned.

• In the example on the right, a research team gains new knowledge that suggests that it should change intellectual direction and that it should add or subtract researchers to better align with that new intellectual direction. The research team's freedom to make these additions or subtractions is critical to the success of its research, but may have detrimental consequences to the researchers who have been added or subtracted.

In this talk, we advance the thesis that, for teams towards the research end of the continuum, primacy must be given to the properties of the research ecosystem that facilitate the freedom of researchers and research teams (e.g., the permeability just mentioned). For teams towards the development end of the continuum, knowledge spaces are narrowed purposely to reduce uncertainty, teams are more stable in composition and intellectual direction, and primacy can be shifted to the inner workings of the team itself.

Paper 3: The Dual Frontier: Patentable Inventions and Prior Scientific Advance

Authors: Mohammad Ahmadpoor and Benjamin Jones

We build a new knowledge map, linking 4.8 million U.S. patents to 32 million research articles in the Web of Science, to determine the minimum citation distance between patentable inventions and prior scientific advances. The distance metric provides a new typology of impact to characterize fields, funders, institutions, and individuals. The metric can also inform long-standing ideas about the nature of scientific and technological progress. We find that the integrated citation network encompasses the majority of both patents and papers. Yet the linkages are typically indirect, peaking 3 degrees (papers) and 2 degrees (patents) from the patent-paper boundary, and fields vary enormously. The findings of majority connectivity, indirect connectivity, and the prevalence of university-to-firm linkages across the paper-patent boundary are consistent with some core conceptions of the "linear model" of science. However, consistent with more recent theories of scientific and technological progress, the same individual often bridges the patent-paper boundary, and advances along the patent-paper boundary appear strikingly more impactful within their respective domains.

Thematic Session 4

Gender And Diversity In Teams

5:00-6:00 pm

Paper 1: The Role of Diversity in the Scientific and Engineering Workforce and its Impact on Innovation: A Review of Quantitative Research

Authors: Vanessa Pena and Asha Balakrishnan

We reviewed the body of literature related to science, technology engineering, and mathematics (STEM) workforce diversity and innovation to better understand the evidence of diversity's impact on innovation. Workforce diversity and its role in organizational performance and innovation have been studied since the 1950s. The relationship between workforce diversity and innovation is tenuous and complex, interacting with many contextual variables, such as the nature of the team, tasks, industry, societal and organizational cultures and norms, among other factors. STPI staff conducted this literature review to shed light on the direct and indirect linkages surrounding the processes of when, how, and why workforce diversity affects innovation as understood from a collection of empirical studies to date.

We adopted wide-ranging definitions of diversity and innovation. Specifically, the workforce literature denoted three types of diversity—

1. Social, which included demographic characteristics (e.g., age, gender, and race/ethnicity),

2. Informational, such as characteristics related to skills (e.g., education, tenure in teams and organizations, experience (across industries), collaboration networks, and disciplines, and

3. Value, which described differences in personalities, attitudes, and beliefs.

We collected over 1,000 measures across the 63 studies describing statistical relationships between workforce

diversity and innovation. We identified studies broader than the STEM workforce and compared the STEM-specific workforce findings with those from other industries, such as business and finance. We analyzed the direction of the impacts (positive or negative) and described the quantitative measures based on frequency counts and statistical significance.

Of the 63 studies, we identified 25 articles (40 percent) related to STEM. The STEM studies analyzed some diversity variables not previously studied in non-STEM contexts—experience, collaboration network, and disciplinary diversity—which may indicate attributes that are more prevalent or important for the STEM workforce. Some of these findings are based on a small number of reported measures (<10). We did not observe other notable differences across STEM and non-STEM studies other than the existence of more measures and studies in non-STEM contexts. Further research specific to the STEM workforce could provide insight on the generalizability of non-STEM findings for the STEM workforce and vice versa.

Based on the frequency of the collected measures, the majority of the diversity attributes showed no effect or the findings were mixed. However, context is crucial to understand the nuances in the relationship between workforce diversity and innovation. The significant findings in the literature review also indicated that workforce diversity can positively or negatively impact innovation and performance depending on the presence of certain conditions. Context and a diversity measure's interaction with other factors, such as task complexity, type of leadership, human resource practices, and industry, among others, changed the significance level and direction of the relationship to innovation. Based on our findings, we provide considerations for managing workforce diversity in STEM contexts.

Paper 2: Collaboration between men and women in science: a bibliometric analysis of scientific activity by gender and co-authorship between men and women

Authors: Grégoire Côté

Leading research nations are recognizing gender issues and acting to improve gender balance throughout the research ecosystem. Although important gains have been made in gender equality in research—such as increases in the number of women enrolling in and completing STEM education, and in the professional engagement of women in STEM occupations—gender disparities persist in the research ecosystem. These disparities are more acute the higher one looks in the professional hierarchy.

Reliance on bibliometric statistics for promotions and in grant competitions is rising worldwide. If women are at a disadvantage relative to their male counterparts in terms of research output, then women might very well get stuck in a vicious circle: having lower scores for bibliometric indicators reduces the chance of being funded and/or reduces the actual amount of funding secured, which in turn can reduce capacity to increase research output and scientific impact.

The current understanding of gender dimensions in research output and impact is undeveloped. Science-Metrix is working on the development of new gender-disaggregated indicators on scientific publications.

This presentation will first outline some preliminary results on the participation of women in scientific publications. Men-women co-authorship will then be examined and compared to same-gender collaboration. The presentation will highlight differences in regard to team multidisciplinarity and scientific impacts, and discuss potential implications for team science.

Paper 3: Social network analysis of grant membership of university researchers: gender and network centralities

Authors: Eriko Fukumoto

Studies of the patterns of research collaborations often examine the co-authorship of research papers within and across institutes. The planned research is an exploratory and proof-of-concept social network analysis to investigate the relationship between gender and the centralities of researchers' positioning within

the networks of research grant membership within one institute. The primary question is- do women researchers occupy less advantaged network positions compared to male researchers? The primary data is the grant data of 806 projects in an engineering school at one large public research university in the U.S., which allow the identification of principal investigator (PI), co-investigator, and NSF discipline ID of each grant. The attributional data of the 259 individual researchers at the engineering school allow identification of the following characteristics: tenured and tenure-track faculty, rank, age, gender, and race/ethnicity. Among the 259 individuals, 208 individuals had at least one grant and work in 806 projects in total. As a social network analysis, this study operationalizes the ties of researchers as the co-appearance of the researchers' names on the same grant. The primary analysis identifies their network structures and examines a set of centrality measures including the degree centrality, closeness centrality, and eigenvector centrality. The latter phase of the analysis considers related factors such as gender, the positions of PIs and co-investigators. While collaborations of researchers often span across multiple institutes, the network structures of researchers within one school at one university help us understand the collaborative patterns and teams at the organizational level. The examination of the relationship between researchers' gender and positioning will provide insights for the further study of the collaboration patterns and interactions of researchers within the organizational context, which is important in understanding the gender impacts on the teams, activities and career trajectories of researchers too.

Wednesday, June 14, 2017

Thematic Session 1

Feature Panel: Humanities, Arts, Science, and Technology Alliance and Collaboratory

9:05 - 10:30 pm

Authors: Bruce Janz, Scot French, Julie Klein, and Julian Chambliss

This panel will define and demonstrate collaborative research and education in the cross-disciplinary field of Digital Humanities. It will establish a framework for collaborative research and education that bridges humanities and technology. The framework crosses three levels: individual teams, a state-wide consortium, and inter/national networks. As a prelude to the November 2017 conference of HASTAC, hosted by the Florida Digital Humanities Consortium, it will focus on projects within the state. HASTAC is the international network Humanities, Arts, Science, and Technology and Alliance and Consortium. The panel will feature presentations and discussion of three overriding questions with the audience: (1) What similarities exist between collaboration in humanities and in science, medicine, and health? (2) What differences exist? (3) How might SciTS and HASTAC as well as other Digital Humanities networks exchange insights and resources to extend understanding of the "science" of team science to include its "art" and "craft"?

Thematic Session 2

Panel: Beyond The Ivory Tower: Knowledge Production Between Academic And Non-Academic Science

1:30 pm

Authors: Elina Mäkinen, Benjamin Keep, Charles Gomez and Sebastian Muñoz-Najar Galvez

This panel examines an emerging trend in the global scientific enterprise: knowledge production between academic and non-academic science. It is widely agreed that science, technology, and innovation are critical drivers for economic growth and national well-being. Yet, innovative science is partly districted by who is allowed to participate in academic knowledge production. The three papers in this panel explore the ways in which academic knowledge production is becoming integrated with non-academic science. The panel discussion will address questions such as: What types of boundary interfaces are being created between academic and non-academic science? How do they facilitate or hinder knowledge production? How can society benefit from knowledge production that occurs between academic and non-academic science?

The first paper by Elina I. Mäkinen (University of Tampere) describes the evolution of a collaboration in the field of medicine between experts from academic and non-academic research environments. The second paper by Benjamin E. Keep (Stanford University) describes a case where volunteers and professional scientists collaborated using a problem-solving environment and cloud lab to solve open scientific problems in RNA design. Finally, in the third paper, Sebastian Muñoz-Najar Galvez (Stanford University) and Charles J. Gomez (The University of California, Berkeley) analyze usage data from SciHub, an illegal online repository that made published research papers available to anyone from around the world.

These three papers provide insight into different types of boundary interfaces—transdisciplinary meetings, a problem-solving environment, a cloud lab, and a "shadow library"—that allow for exchange of information and collaboration between academic and non-academic scientists. They also shed light on how different types of boundary objects (visual representations of data, a problem-solving environment, cloud lab, and download requests) facilitate knowledge production.

Thematic Session 3

Panel: Interdisciplinary Integration Exercises: Practitioners share meeting design, facilitation methods, successes and failures

1:30 pm

Authors: Christine Hendren, Jack Schultz, Pips Veazey and Amber Caulkins

For many people working in interdisciplinary roles, job responsibilities include connecting and communicating across boundaries of disciplinary expertise, sector, or other division that results in differences in culture, language and knowledge base. These practitioners are bought into concepts of interdisciplinarity and spend significant time and effort serving as the link between different moving parts of the team. However, to be truly effective at linking across boundaries in a manner that generates combined, transformational understanding, practitioners also need methods to shift the ownership of cross-pollinating and integrating ideas to the subject matter experts themselves. In this panel, team science practitioners will present their experiences with a variety of integrative exercises in which team members from a diverse array of knowledge domains participated in some type of programmatic event designed to facilitate the sharing and combining of their expertise in service of a common goal. Each panelist will describe the purpose, method, participant audience, and logistics of the exercise along with event outcomes, highlighting successes, failures and lessons learned. Interactive discussion will take place following all four presentations.

We will structure the first portion of this discussion by allowing each presenter to describe their approach and identify any specific feedback and critique they'd like to solicit from session attendees that may be useful to incorporate in future iterations of the exercises. After all four panelsts have presented, there will be an open-ended panel-wide question and answer session. Potential questions to seed the discussion will include consideration of applying the presented methods to different scenarios or disciplines, or patterns that may emerge across the different exercises in terms of common successes or challenges. Attendees will come away having learned of four example exercises within the context of particular communities and goals, as well as having participated in an interactive evaluative discussion that may spark ideas for new applications of presented methods, or entirely new ideas for exercises in their organizations.

Thematic Session 4

Approaches To Foster New Innovative Collaborations 1:30-3:00 pm

Paper 1: Team science in agriculture: Perspectives on the Ohio State University agricultural experiment station's SEEDS competitive grant program

Authors: Julie Aldridge, Keith Smith and Graham Cochran

The Ohio State University's agriculture experiment station, the OARDC, is the largest public and privately funded research organization in Ohio and the largest agbioscience research facility in the U.S. Agbioscience integrates scientific disciplines to focus on finding solutions to societal problems including food security, safety and health, environmental sustainability, and bio-based energy. The goal of SEEDS: The OARDC Competitive Grants Program is to encourage new research in agbioscience. SEEDS scientists work closely with researchers in 6 other OSU colleges plus OSU Extension. To date, there has been little measurement of the scientific productivity of the research output resulting from SEEDS grant funding.

The purpose of this study is to investigate the level of scientific productivity of the SEEDS grant program by bibliometric analysis. Objectives include:

1. calculate the h-index
2. calculate the average citations per item
3. compare the productivity of the grant with US universities and agricultural science programs
4. examine the productivity of the grant's subcategories

Scientific productivity can be measured through bibliometric analysis in any field that produces publications. The basic idea of bibliometrics is to evaluate the attention publications receive within the scientific community by counting formal citations in the literature. Citation reports were generated using Thomson Reuter's Web of Science (WoS). SEEDS output in WoS includes papers, conference proceedings, book chapters, patents, and doctoral dissertations.

Findings include the h-index and average citations per item of the SEEDS program with several of its subcategories above or well above average when compared to agricultural sciences and U.S universities. The research findings will inform OARDC practice and policy decisions regarding SEED's future.

This research contributes to SciTS because it evaluates the outcome of a team science initiative in agbioscience, a discipline underrepresented in the field.

Paper 2: A framework for analyzing funded and non-funded teams through each phase of a research grant competition

Authors: Griffin Weber, Noshir Contractor, Alina Lungeanu and Yulia Tyshchuk

In this presentation we describe our approach towards evaluating teams participating in an internal funding competition for $50,000 research pilot grants, conducted within Harvard in 2009 by its Clinical and Translational Science Institute. Of 37,266 eligible faculty, 1,469 formed 458 teams that submitted proposals. Peer-review narrowed this to 99 teams that were invited to in-person interviews, and 65 were awarded funding. We developed a Multi-Theoretical Multilevel (MTML) model to create an integrated explanatory framework to understand collaboration at multiple levels: (1) Individual (actor) level, such as academic rank and gender of each faculty member; (2) Relational (dyad) level, such as prior collaboration between team members; and (3) Higher Order (ecosystem) levels, such as connections between teams. Using the MTML model, we were able to study three distinct phases of the pilot grant process: (1) In the Team Assembly Phase we looked at which investigators chose to collaborate on a proposal and whether new collaborations formed; (2) in the Peer Review Phase, we looked for characteristics of the teams that were awarded funding; and, (3) in the Post-Award Phase, we followed all teams for five years to determine both the impact of funding on the awarded teams and the impact of applying on the non-funded teams. We developed a two-part analytical approach: (1) "Random Teams" compared actual teams that applied for funding to matched virtual teams consisting of randomly selected faculty who did not apply; and (2) "Random Networks" used exponential random graph models (ERGM) to study the applicants and awarded teams. Our findings include: (1) most teams consisted of a small core of prior collaborators joined by several new faculty, (2) faculty of the same gender were more likely to collaborate on proposals, and (3) non-funded teams continued to collaborate almost as much as funded teams.

Paper 3: MCubed: Token-Based Seed Funding Distribution for Formation of Interdisciplinary Teams

Authors: Mark Burns and Valerie Johnson

Through an efficient and unique peer-to-peer review system, MCubed distributes real-time seed funding to stimulate innovative research and scholarship among multi-unit, faculty-led teams at the University of Michigan. Housed within the University of Michigan Office of Research (UMOR), MCubed is part of the Third Century Initiative established by the offices of the President and Provost. The program has run for six years, distributing approximately $30M to over 400 faculty/student teams in all nineteen schools and colleges at Michigan. The program fosters interdisciplinary research by requiring each team or "cube" to involve faculty from at least two different colleges. And the development of a unconventional peer review system involving an interactive website and token-based funding distribution allows the creativity of the faculty and students to be released. To date, MCubed has been featured in venues such as Science (website), The Washington Post, and The Chronicle of Higher Education, and Reuters recognized the University of Michigan system as the seventh most innovative university in the world for 2016, in part due to the MCubed program. In this presentation, we will discuss the core innovations in the program's design, the strategies for its implementation, and its impact on Michigan.

Paper 4: Professional Development for Team Science: Training for Effective Teaming

Authors: Meghan Suter and Ellen Fisher

The goal of this work was to create an integrated professional development program designed to assist the formation and effectiveness of interdisciplinary research teams. Through the "Catalyst for Innovative Partnerships program" (CIP) sponsored by the Vice President for Research, new interdisciplinary research teams were formed and provided with significant funding for a two-year period. During the first year, teams were offered a range of professional development activities that were accessed by some, but not all of the teams. After the first year, a new program was launched to create teams primed to apply for the second CIP cohort, the PreCIP program. PreCIP

provided a variety of workshops on team building, communication skills; mission, value proposition, and brand definition; validation of the research objectives through communication with stakeholders; and engagement with industry and philanthropic partners and sponsors. We found several key elements associated with successful professional development for emerging teams. These include: aligning workshops to the unique challenges of academic research; promoting intra-team learning through the sharing of challenges, ideas, and feedback; and providing teams the opportunity to apply and practice the skills within their team in the workshop setting. We found that those teams that participated in the professional development workshops formed closer social networks and were more successful according to their respective programmatic metrics. Success for CIP teams is defined by securing significant extramural funds for collaborative research, new collaborative publications and presentations, and continued collaboration beyond the CIP funding period. Success for PreCIP teams is defined by completion of professional development workshops, submission of a proposal to the CIP and selection for funding, and similar metrics to those used to evaluate CIP teams. These findings contribute to the SciTS field by demonstrating how intentional professional development activities designed for interdisciplinary teams can potentially accelerate productive collaboration.

Thematic Session 5

Creating An Institutional Culture For Team Science

1:30-3:00 pm

Paper 1: Creating a Culture of Collaboration at George Washington University (C3@GWU) Utilizing the Open Science Framework (OSF)

Gaetano R. Lotrecchiano and Megan Potterbusch

Problem. In an effort to promote collaboration in research teams tackling complex problems, many new initiatives exist on local, regional, and national levels. Many of these stem from responses to executive and federal recommendations from agencies like the National Academies of Science (NAS), the National Institutes of Health (NIH), the National Science Foundation (NSF), and executive orders that encourage greater collaboration within and across disciplines requiring more team-oriented scientific approaches (Bennet, Gadlin, & Levine-Finley, 2010; National Academy of Science, 2015; Obama, 2015). Our response to this charge was to develop the Creating a Culture of Collaboration at George Washington University (C3@GWU) University Seminar that convenes a cross-disciplinary community of expert faculty interested in issues related to scientific collaboration and connects them with regional and national partners and experts to explore and address topics that foster collaborative science. Its main goal is to raise awareness and scholarship around key topical areas important to collaboration and team science.

In addition to encouraging individuals to interface in scholarly conversation across disciplines, schools, and institutions, which this seminar ensures, the seminar addresses a variety of organizational issues about needed mechanisms, which in the absence of informed knowledge, policies, and common understanding, can serve as barriers to achieving team scholarship goals. This university seminar addresses and builds a GW agenda of scholarly conversation around a few of these critical mechanisms:

- Being a Team Scientist: Being Prepared, Knowing Your Resources, and Using Available Tools.
- The-Science-of-Team-Science: Measuring Team Effectiveness
- Collaborative Technologies and Informetrics
- Educating Team and Interprofessional Scientists

• Trust, Vision, Recognition and Scholarly Credit

• Crossing Gender, Ethnic, and Cultural Boundaries in Science and Research

This university seminar compiles, disseminates, and archives, through university events and products, key "think tank" outcomes, which will bring together thinkers and practitioners in these areas. Ultimately, this project will allow faculty and staff to contribute to developing activities and products that are delivered to the university community. To manage this undertaking, we explored the Open Science Framework (OSF) as a platform for engaging disparate and diverse stakeholders with different levels of engagement. By leveraging the OSF's flexible structure and features, each think tank team can organize their OSF project to best suit their needs while also facilitating future public access to some or all of their work. This in turn will allow others to build on this work and thereby further develop scholarship in the field of collaborative science by making the process as well as the products public.

Method. The presenters plan to provide an overview of the C3@GWU program and its three year strategic plan as an example of how to promote team science awareness and values, and its potential impact in a university setting. In addition, we will demonstrate how the technologies such as the Open Science Framework were introduced, incorporated, and served as infrastructure for the successful execution of the seminar's multiple phases.

SciTS Advancement. The C3@GWU university seminar provides a low cost, high impact model for expanding discourse, scholarship, and service in a university setting. Through sharing of the program and resources, we hope to encourage others to fashion similar programs as a means to increase awareness and scholarship in the area of team and collaborative science.

Paper 2: US DOE Energy Frontier Research Centers: A Case Study of Team Science in the Physical Sciences

Authors: Robin Hayes

In 2009, the U.S. Department of Energy's (DOE) Office of Basic Energy Sciences (BES) established the Energy Frontier Research Center (EFRC) program (https://science.energy.gov/bes/efrc/) to further grand challenge science and create the scientific foundation for advanced technologies that support the Department's missions in energy, environment, and national security. The intent of the EFRCs is to bring together creative, multidisciplinary scientific teams from universities, government laboratories, non-profits, and industry to perform energy-relevant basic research with a complexity beyond the scope of single-investigator projects. They also train the next-generation scientific workforce by attracting talented students and postdocs interested in energy science. Since 2009, DOE has invested $1.087B in 60 EFRCs, of which 36 are active, in 40 states at about 150 institutions. Each center is funded at $2-$5M/year for a 4 or 5 year renewable award period and involves, on average, 18 Sr. Investigators and 50 students, postdocs, and staff.

One major challenge has been creating a culture of team science rather than traditional pairwise collaborations. BES has explored multiple mechanisms to promote synergy including: a management review and program manager visit within the first year; a mid-term peer review; monthly phone calls within thematic teams; periodic Director's meetings; biennial Principal Investigators' Meetings that include students and postdocs; communication contests; a quarterly newsletter run by junior EFRC members; and an Early Career Network that organizes in-person and virtual events. Ideas to foster team science have been captured in a Good Practices document and shared with all the centers. Preliminary analyses of co-authorship publication networks over time and self-reported impacts seek to identify the myriad ways that structure and process can promote team science. Two BES Committees of Visitors and a Secretary of Energy Advisory Board Task Force have found the EFRC program to be highly successful in meeting its goals.

Paper 3: Recognizing Team Science in the Tenure and Promotion Process: Developing a Common Tool for Evaluating Faculty Achievement

Authors: Therese Kennelly Okraku and Christopher McCarty

The tenure and promotion (T&P) process at colleges and universities aims to evaluate faculty's work and reward faculty for high quality research, teaching, and service. This evaluation system was created in a context when most research was completed by individual researchers and labs. However, contemporary research often requires researchers and labs to work in teams both within and across disciplines. This paper examines how T&P committees evaluate team science by analyzing data from text and network analysis of college level annual evaluation and T&P criteria, interviews with faculty, and a survey of researchers at a large public American university. Our study found that the current annual evaluation and T&P criteria does not sufficiently recognize team science and that faculty believe that collaborative research efforts should be rewarded. We suggest that universities provide additional mentorship to junior faculty members on how to showcase their collaborations within the existing T&P process and add additional evaluation criteria to recognize and reward team science.

Paper 4: Fundamental Challenges to Transdisciplinary Research in Higher Education

Authors: Valerie Imbruce

Transdisciplinary research is more commonly understood as a set of goals than processes of how to achieve them. Transdisciplinary efforts that seek to bridge departments, colleges and schools within a university face entrenched structural, intellectual, and inter-personal barriers. This paper uses this three-part characterization to consider the processes being developed at Binghamton University, a highly selective public research university in the State University of New York system, to foster a university wide, coordinated approach to transdisciplinary research. In its fourth year of operation, the Transdisciplinary Areas of Excellence represent five broad areas of research. Each area has a modest budget from the Provost's Office for seed grants and other kinds of programming that are self-defined by a steering committee of voluntary faculty appointees. To date, about thirty percent of all faculty at Binghamton self-affiliate with the TAE, and a modest investment of just over a half a million dollars in internal seed grants have generated at least $5M in external awards. Furthermore, about 90% of the inter-departmental research projects across the University in 2015-16 have at least one TAE affiliate, showing that this structure has captured the attention of those faculty interested in collaborating outside of their departments in research. However, a self-study shows that while there have been rapid gains and interest developed in this structure, obstacles keep this effort on the margins. This paper will use Binghamton's experience to better understand how fundamental aspects of academic life and higher education institutions challenge transdisciplinary, collaborative work.

Thematic Session 1

Panel: Before, During, and After – Using Social Network Analysis as a Tool to Identify Potential Research Sites & Partners and to Monitor & Evaluate Interdisciplinary Team Science Collaboration over Time 3:30 pm

Authors: Mason Mathews, Wendy-Lin Bartels and Christopher McCarty

Enhancing the capacity for interdisciplinary collaboration among scientists who participate in large-scale projects is an emerging theme within the scholarship of team science. Social network analysis presents novel ways to map and examine the factors that facilitate and constrain interactions among scientists. In this panel we present three research projects that each used social network analysis methods to enhance interdisciplinary team science. The first presentation illustrates how a co-author analysis of publications related to hydroelectric development in Brazil was used to not only identify existing clusters of academic collaboration, but also to analyze the relationships between the authors and the dams they study. The second presentation demonstrates how a scale of relationship intensity was adapted for use with social network analysis methods to measure collaboration among scientists to inform changes to the organization of the project during implementation. The third presentation will demonstrate a method to identify stable collaborative communities over time and explore the potential to use these communities as the basis for an intervention to strengthen core communities and bridge loosely connected communities.

Thematic Session 2

Panel: Community Management in Scientific Teams and Communities: An Emerging Discipline to Effect Collaboration 3:30 pm

Authors: Jennifer Davison, Andreas Leidolf, Lou Woodley, Elisha Wood-Charlson and Malin Sandstrom

Community management in science is an emerging role that provides critical support for research teams as well as scientific communities looking to engage their members. However, the role has yet to be formally defined by its practitioners and stakeholders.

The American Association for the Advancement of Science's inaugural Community Engagement Fellowship Program (CEFP) is working to develop a conceptual framework that could help define key characteristics of this nascent profession. The goals of this panel--composed of CEFP participants and leaders--are to 1) provide an overview of science community management as an emerging discipline and introduce CEFP as a mechanism for supporting and enhancing its development; 2) share examples of science community management by showcasing the diversity and commonalities of the roles and contexts within which members of the CEFP cohort work; and 3) explore the challenges and next steps required for functional validation of what we believe is a key role in team science and science communities broadly.

Panelists will share the results of a AAAS survey of scientific community managers, as well as preliminary

observations from follow-up research conducted on the CEFP cohort itself, through examination of job descriptions, organizational charts, network maps, time budgets, skills self-assessment, and needs analyses. Following the presentations we will further explore with attendees issues around the community manager role, including required skill sets, common challenges, and emerging best practices to support team science and community goals. We will also examine points of connection and synergy with other efforts, including those within the Science of Team Science's Intereach community and the Integration and Implementation Science community. Framing questions include:

• Where is the profession of Science Community Manager headed over the course of the next 2-5 years? Does this role need formalization, for example in the form of an accredited profession? How do we demonstrate and measure value? How can we support each other in performing our multiple roles and collectively grow in our professional development?

• How does the Science Community Manager role overlap or complement that of the Interdisciplinary Integrative Specialist, or other nascent roles? What are commonalities and differences in underlying foundation, vision, scope, approach, and methodologies?

Thematic Session 3

Dialogue Approaches To Build Bridges Across Disciplines And Perspectives 3:30 pm

Paper 1: On the interaction of affect and information transfer in cross-disciplinary dialogue

Authors: Graham Hubbs, Stephen Crowley, Chad Gonnerman, Kara Hall, Troy Hall, Anna Malavisi, Michael O'Rourke, Marisa Rinkus, Brian Robinson and Stephanie Vasko

Collaborative research distributes the effort of understanding the world across a team, which makes communication among collaborators critical. In this talk, a familiar distinction between relational and transactional communication [1]—i.e., between the affective character of communication and its informational character—guides our inquiry into two key aspects of communication within research teams. First, on the relational side, a research team benefits when its emotional context encourages open communication [2]. Second, on the transactional side, a team benefits when the claims exchanged by team members can be criticized, improving their accuracy and increasing the amount of information generated (cf. [3]).

These two aspects are in tension. Efforts to encourage openness can be interpreted as discouraging criticism, whereas feedback perceived as critical can be silencing. This tension is exacerbated in research contexts where new ways of understanding can challenge existing standards of accuracy, making it difficult to adjudicate critical exchanges in ways that preserve openness. And to further complicate matters, research in cross-disciplinary contexts puts in play distinct and possibly incompatible standards of accuracy.

The competing needs of openness and criticism must be managed to maximize innovation and insight, but successful management requires an understanding of how they are related to one another. In this talk, we examine the hypothesis that within the context of cross-disciplinary collaborative research the quality of emotional context (positive/negative) is directly correlated with the quality of information transfer within communicative episodes.

Our investigation involves close examination of structured, 1-2 hour "Toolbox" dialogues involving

conversation among cross-disciplinary scientific teammates about the beliefs and values that shape their approach to science and their common project. Six of these dialogues involving cross-disciplinary research teams have been divided into 102 threads comprising thematically related speaking turns, and each of these turns is coded for both conversational function (e.g., new information, question) and impact (e.g., increase self-awareness, increase team-awareness). Based on the codes, the threads have been judged exemplary, middle, or failed for the quality of their contribution to mutual understanding.

In investigating our hypothesis, we assess the quality of information transfer within a communication episode using expert codes of transcripts. To provide an assessment of emotional context of conversations we use the IBM Tone Analyzer [4] to yield a construct that we call the "emotional valence" of the conversational thread. After describing the development and testing of our methodology, we evaluate the relationships among thread quality and emotional valence. Our evaluation also includes assessment of dependencies between thread quality and certain demographic variables that may influence the affective character of communication, e.g., gender and career stage.

Paper 2: Development of Interdisciplinary Attitudes and Knowledge at the NExSS Winter School

Authors: Michael Burnam-Fink, C.J. Huff and Steve Desch

This paper studies the development and merging of interdisciplinary attitudes and knowledge acquisition over a week-long exercise to build bridges between disciplines. Astrobiology is the interdisciplinary search for life on planets other than Earth. The Nexus for Exoplanet System Science (NExSS) is a NASA research coordination network that investigates possible conditions for life on exoplanets, and how detectable signals of those conditions relate to trajectories of solar system evolution. As part of the NExSS mission to synthesize the multiple scientific perspectives involved in the search for life in the universe, a group of NExSS researchers held a week-long Winter School for junior researchers.

A survey of attendee's favorability on open questions in astrobiology revealed the existence of a split between reductionist and holistic approaches matching prior disciplinary divides between astrophysics, geochemistry, and planetary science. Pre and post surveys reveal that this divide lessened over the course of the workshop, indicating the development increased understanding between the disciplines. Furthermore, all participants demonstrated improvements in knowledge of each others' disciplines. Mutual respect and a common knowledge base is a key component of successful team science between disciplines (Cooke et al, 2015), and the NExSS Winter School demonstrates the successful application of a model for creating and measuring impactful interventions in scientific training (Davis & Scalice, 2014).

Paper 3: Enhancing Integrative Capability among Team Science Participants

Authors: Maritza Salazar and Theresa Lant

Prior research suggests that interdisciplinary teams that develop an integrative capacity, a capability that is sustained through an interactive system linking social, psychological, and cognitive processes, will be more likely to achieve their goals of knowledge integration and innovation. Cognitive and social integration among team members is a precursor to developing an integrative capacity. Thus, they are indicators of collaboration readiness. In this National Science Foundation supported study, we test the impact of communication training on cognitive and social integrative behaviors of team members. Establishing the effectiveness of training on behaviors that facilitate integration is the first step in improving the conditions for success for interdisciplinary teams.

Respondents were individuals currently engaged in interdisciplinary science teams within seven major medical centers around the US. We use a pre-post

design to test the impact of training. Team members completed surveys comprised of scales developed to assess cognitive and social integration behaviors, which have been demonstrated to have good psychometric properties. We test for differences pre and post training, comparing individuals who received communication training to those who did not. Our results suggest that the participants in the team science communication training showed significant improvement in terms of their propensity to suggest new ideas and to engage in team reflexivity.

Thus, the presentation of this research advances the science of team science by investigating a means of enhancing the collaboration readiness of individual scientists. If training increases the demonstration of cognitive and social integrative behaviors, teams will be more likely to develop an integrative capacity that will help them achieve their goals of knowledge integration and innovation.

Paper 4: The Integral Place of Dialogue in Social Entrepreneurial Ventures

Authors: Chitvan Trivedi and Shalini Misra

This article focuses on the integral significance of dialogue in the creation of cross-institutional knowledge networks in the context of Social Entrepreneurial Ventures (SEVs). SEVs are collaborative and participatory organizational forms whose goals are to address social problems and facilitate sustained positive social change (Trivedi & Stokols, 2011). This research scrutinizes the process of inter-sectoral and inter-organizational knowledge network creation, collaborative capacity building, and local empowerment in SEVs. Qualitative data from seven urban SEVs in India and the US were analyzed to reveal the centrality of communication in the collaborative space of social enterprises and understand the critical role it plays promoting social change.

Dialogue, conceptualized as a continuous inquiry into the assumptions and certainties that constitute everyday life (Isaacs, 1993), is key to developing a shared understanding of the social problem to be addressed; and coordinating and integrating the efforts of many different actors across diverse knowledge domains. We find that since knowledge of complex (social) systems is often gained iteratively and progressively, it is critical to transfer and translate member experiences and informal understandings through written rules, oral transmission, and systems of formal and informal apprenticeships. Effective SEVs invest in creating learning organizations through the creation of organizational routines and structures that provide opportunities for dialogue among and between diverse actors. Sustained dialogue encourages the sharing of experiences and when used with effective metaphorical language, enables members to suspend their assumptions, articulate their perspectives and express feelings, thereby revealing tacit knowledge that is otherwise difficult to communicate. Organizational knowledge creation through this dialogic process amplifies individual-level knowledge and crystallizes it as a part of the knowledge network of an organization, allowing the discovery of insights not attainable individually. However, the effectiveness of dialogue as organizational knowledge creation tool is limited by the nature and boundaries of the organizational context. Organizational structures that promote social interaction; encourage decisional autonomy and personal responsibility; focus on group performance; combined with strong leadership are necessary conditions for fostering dialogue.

This research advances the SciTS field by offering new insights on collaborative, participatory, and communicative processes in a comparatively less researched organizational form, social enterprises.

Thematic Session 4

Team Formation And Cohesion 3:30 pm

Paper 1: Perturbations of interdependent (science) teams reveal perfect and dysfunctional teams

Authors: Bill Lawless

Cooke & Hilton (2015) reported interdependence statistically associated with the best science teams, but not theoretically, with an unknown effect on team size. With our goal a metrics of team performance derived from a theory of interdependence, we have established that a team's performance cannot be determined by its membership (Lawless, 2017); that scientifically evaluating teams with self-reports or interviews cannot perfect or fix dysfunctional teams, or predict team performance (e.g., winners of sport competitions, political contests, or jury decisions); but that competitions (perturbations) among teams improves science and social welfare.

Team size is a fundamental barrier to a complete theory of teams: How to aggregate the contributions of team members? Cummings (2015) found that the worst performing scientific teams were the most interdisciplinary, but by removing interdisciplinarity, that the best scientific teams were highly interdependent, implying that forced interdisciplinarity adds redundancy to teams, impeding teams by reducing interdependence. From a traditional social science perspective, Centola & Macy (2007, p. 716) speculated that redundancy improves a team's efficiency. However, Lawless (2017) found support for Cummings by comparing oil firms as teams operating under a dictatorship, where they were highly redundant, versus oil firms as teams operating in a democracy, where they were highly interdependent; e.g., compare Sinopec's 124.6 employees/M BBL of oil to Exxon's production with 15.5 to see that redundancy creates inefficiency and serves as a source of corruption.

With Fourier pairs from Cohen (1995), our theory of interdependence for two factors or competing teams is:

$$[A,B]=iC \rightarrow \sigma_A \sigma_B \geq 1/2 \qquad (1)$$

From Equation (1), the exact knowledge of the standard deviation for factor A (σ_A) precludes simultaneously the exact knowledge of factor B, leading to several matches of theory and observation; e.g., from Arrow (1951/1963), aggregating preferences of three or more individuals is impossible without a vote (viz., the majority rule in a democracy) or a unilateral decision (e.g., a dictatorship). Thus, a team of interdependent members does not aggregate summarily. If aggregation occurs with degrees of freedom, then, without adjustment, $\sum n_{individuals} = dof$. But if the perfect team acts as a single unit, then $\sum dof_{team} = 1$.

Assuming the best available individuals fill the roles of a team and $\log (dof_{team})$ equals to its entropy gives

$$\log(dof_{(perfect\ team)}) \leq \log(dof_{(dysfunctional\ team)}) \qquad (2)$$

With this model from theory, team fit is crucial; interdisciplinarity is functional only if it improves team fitness; as a team's dof increase, due to redundancy, role conflict, lack of communication, etc., team performance deteriorates, allowing us to revise Eq. (1) to the standard deviation of entropy produced by team structure (least entropy production, or LEP) times that for performance (maximum entropy production, or MEP):

$$\sigma_{LEP}\, \sigma_{MEP} \geq 1/2 \qquad (3)$$

From Eq. (3), as $\sigma_{LEP} \rightarrow 0$, in the limit $\sigma_{MEP} \rightarrow \infty$; thus, the best performing (science) teams expend the least effort on team structure, generating MEP for a team's mission. In contrast, when a team becomes dysfunctional, illuminated by a perturbation, say a team divorce, Eq. (3) is reversed: as $\sigma_{LEP} \rightarrow \infty$, in the limit $\sigma_{MEP} \rightarrow 0$; i.e., a dysfunctional team expends entropy to tear its structure apart. Concluding, with further

research, ceteris paribus, we expect to find that larger team structures generate more entropy than smaller ones (i.e., more arrangements are possible), requiring more energy (revenue); that the perfect team operates emotionally in a state similar to a ground state, the dysfunctional team at a perturbed, excited state; and that the perfect team's generation of information to itself and outsiders is subadditive (Von Neumann information) while a dysfunctional team's information generation is additive (Shannon information), the two forming a metric for a team's performance, whether the teammates are humans, machines or robots, a key step for the science teams of tomorrow.

Paper 2: Ecosystem factor influencing the victor in team vs. team competitions

Authors: Satyam Mukherjee, Yun Huang, Brian Uzzi and Noshir Contractor

In this work, we advance the existing literature on multi-team membership and coopetition and introduce the concept of ecosystem factor for investigating how past experience of cooperation among individuals impacts the performance of a team during a contest. While multi-team membership has been studied within the premises of an individual's task in multiple teams, little contribution has been done in the situation where teams in multi-team membership are competing against each other. We focus on the little explored idea of team interaction: the ecosystem factor and its impact on the outcome of a competition between two teams. In the context of scientific fields, ecosystem is defined as members belonging to overlapping teams. In the context of competing teams, the overlapping members refer to rivals who were former teammates. For example, if team A and team B are competing in a match, and nA players from A and nB players from B are former teammates, then ecosystem factor is defined as difference of nA and nB. The current study on role of ecosystem factor is motivated by instances from politics, business firms and sports, where we have witnessed how relations between former allies worsen and lead to rivalry. Intuitively one could imagine that knowledge of former teammates, colleagues, or collaborators play a substantial role in a competitive setting. However, the precise role of ecosystem factor on outcome of a competition still remains unexplored.

Indian Premier League (IPL) exemplifies a setting in which the ecosystem factor naturally emerges – two players who played with each other in the past for the same team, starts playing for different franchises. We empirically address the question: What is the impact of ecosystem factor on match outcome? How robust and significant is the effect of ecosystem factor once we control for strength of a team and within team prior interactions? Our research draws on longitudinal data collected from proceedings of every match played in all the five seasons of the IPL between 2012 and 2016. We proceed as follows. First, we perform a conventional OLS model to predict the explanatory power of ecosystem factor on outcome of a game. To deal with dyadic autocorrelation arising in dyadic data and subsequent interdependence across observations, we perform MRQAP regression, a technique widely used in dyadic data.

Our empirical analysis demonstrates that ecosystem factor significantly impacts the outcome a game in all seasons of Indian Premier League. Our results are not influenced by any idiosyncratic characteristic of Cricket games in IPL and could well be extended to other domains involving teams. From the perspective of Science of Team Science, our research provides novel insights into the art of team building, wherein ecosystem factor serve as a stronger determinant of success of an organization.

Paper 3: Applying Lessons from Intentional Living Communities to Team Science

Authors: Amy Wilstermann and Rachael Baker

Many potential benefits of team science have been identified, including enhanced capacity to achieve goals, increased productivity and reach, and improved outcomes for individual team members. However, several factors that hinder attainment of these

benefits, such as high task interdependence and goal misalignment, have also been identified. The success of a team science initiative is therefore, in part, dependent upon implementing strategies that mitigate these factors. Philosophers of science suggest that a researcher's approach to doing science is informed by the context in which they conduct science. As faculty engaged in research at a faith-based undergraduate institution, we wondered what the culture, values, and practices of our tradition could add to our approach to team science. Through visits and discussions with faith-based intentional living communities across the United States and the United Kingdom, we discovered that team science and community living share many of the same disruptive factors. We also identified principles and practices that reduce the effects of these factors in intentional living communities and may serve to enhance the long-term success and thriving of collaborative research projects. Specific principles include shared vision and mission, recognition of unique talents, and commitment to community. Specific practices include cooperative learning, growth-centered and scaffolded mentoring, and celebration of events and achievements. The lessons and insights gained from intentional living communities are shaping the way that we structure, implement, and design assessment strategies for a new team-based research initiative at our institution.

Submitted Posters

Day 1: Monday, June 12, 2017

Science of Team Science 2017 – Poster Session 6:00 – 6:45 pm

Gallery and Siesta Key

WEB-BASED TECHNOLOGIES FOR THE SCITS COMMUNITY	
POSTER 1 *Amanda Vogel, Kara Hall, David Garner and Elliot Grant*	The Team Science Toolkit: An Online Knowledge Sharing Hub for the SciTS Community
POSTER 2 *Holly J. Falk-Krzesinski*	The Mendeley Science of Team Science (SciTS) Library: An Essential Team Science Resource
POSTER 3 *Li Guo*	Therapoid: a new online platform for scientific collaboration around biotechnologies (Poster Presentation)
POLICY LEVEL PERSPECTIVES	
POSTER 4 *Takehito Kamata*	Advancing international research collaborations: A comparative study of public research funding policies in Japan and the United States
POSTER 5 *Teis M. Kristensen, Matthew Weber, and Itzak Yanovitzky*	When Scientific Evidence Really Matters: Policy Windows Surrounding Childhood Obesity
POSTER 6 *Igor Kuzmin, Leah Hubbard, Julia Artnold, Andrew Hruszkewycz, Steven Nothwehr, Melissa Antman and Peter Ujhazy*	Program Project Grant Mechanisms (P01 and P50/SPOREs) Outperform R01 Research Project Grants in Citation Productivity
POSTER 7 *Marie-Christine, Saint-Jacques, Caroline Robitaille, Annick, S-Amand, and Dainel Turcotte*	Examination of processes that contributed to the success of a research partnership in Canada through three key moments in its development
CREATING SHARED GOALS AND TRUST	
POSTER 8 *Tierini Hodges-Murad*	Collaboration in the Loosely Coupled Academy
POSTER 9 *Kennan Salinero, Kimberley Brown Magnan and Mery Miguez*	Theory U Applied to Science: What's Possible?
POSTER 10 *Robin Straub*	How to Capture Transdisciplinary Cooperation and Integration in Teacher Education? Introducing a Questionnaire for Accompanying Research on Transdisciplinary Teamwork at the ZZL-Network

POSTER 11 *Margarita Paras and Fernando Lopez*	Geomatics and society: transdisciplinary prototypes for effective team science
POSTER 12 *Alexandra Rosenberg, Gaetano R. Lotrecchiano, and Trudy Mallinson*	Developing a Self-Scoring Mechanism for the Motivation Assessment for Team Readiness, Integration, and Collaboration (MATRICx)
CURRICULUM AND TRAINING	
POSTER 13 *Erica Watson-Currie*	Curriculum + Community Enterprise for Restoration Science (CCERS)
POSTER 14 *Kevin Wooten, Eduardo Salas, Theresa Lant, Maritza Salazar, Huda Sarraj, Allan Brasier and Lori Wiseman*	An Evidence Based Competency Model for Team Science Training
POSTER 15 *Pei Xu*	Incorporating Team-based Service Learning in the Teaching of An Agribusiness Application Course: A Case Study from Fresno, CA
POSTER 16 *Jonathan Beever*	Ethics and the Science of Team Science
DESIGN, COMMUNICATION, AND COORDINATION	
POSTER 17 *Monica Vandenberg*	Measuring Proposal Needs and Allocating Sufficient Research Support
POSTER 18 *Amelia Drake, Carrie Heike, Daniela Luquetti, Scott Bartlett, Daniela Vivaldi, Laura Stueckle, Marina Rampazzo, Mark Urata, Craig Birgfeld, Alexis Johns and Babette Saltzman*	Team science and the FACIAL network: facilitating clinical research in craniofacial microsomia
POSTER 19 *Maeve Donohue*	Co-design models for addressing complex societal challenges
POSTER 20 *Marie Smith and Kathryn Steckowych*	Primary care team workflow analysis to improve medication reconciliation communication and coordination
POSTER 21 *Tyler Quiring and Bridie McGreavy*	Sustaining team science: Dynamic Design Planning as a collaborative ecology

Poster 1

The Team Science Toolkit: An Online Knowledge Sharing Hub for the SciTS Community

Authors: Amanda L. Vogel (Leidos Biomedical Research, Inc.), Kara L. Hall (National Cancer Institute), David Garner (Westat, Inc.), Elliot T. Grant (Westat, Inc.), and the Team Science Toolkit Editorial Board

Are you an investigator who works in teams or leads teams? Are you an academic administrator or organizational leader who would like to create an organizational climate that fosters success in team science? Are you a funder who would like to better support or facilitate team science? Do you need measures or instruments for SciTS research, or to use in quality improvement oriented evaluation? The Team Science Toolkit has practical resources to help you achieve your goals. The Team Science Toolkit (www.teamsciencetoolkit.cancer.gov) is an online one-stop-shop for resources to help you engage in, lead, facilitate, support, evaluate or study team science. It contains a user-generated knowledge base of resources and information that leverages the collective knowledge and resources of all members of the SciTS community. Anyone can upload or download Toolkit resources, creating a continuously evolving knowledge store that represents the current "state of the science" in the SciTS field. The Toolkit was created by the National Cancer Institute, and debuted at the Annual International SciTS Conference in the spring of 2011. New content and functionality are continually being added. The Toolkit currently includes over 2600 resources. The Toolkit offers three main types of resources: (1) practical tools to help engage in, facilitate, or support team science; (2) measures to study or evaluate team science; and (3) a bibliography that integrates resources from the wide range of disciplines generating scholarship relevant to success in team science. The Toolkit also includes a popular expert blog featuring knowledgeable perspectives relevant to maximizing the success of team science, and a vibrant linked listserv (SciTSlist). This poster highlights practical tools for team science that are available on the Toolkit, to help with formation, team functioning, team training, quality improvement oriented evaluation, and recognition and rewards for team science. The Toolkit's practical tools have been generated by investigators, administrators, funding agencies, and SciTS scholars. The poster also highlights the very population blog feature on the Toolkit. Recent blog posts have addressed such wide-ranging issues as: data sharing and reuse, training undergraduates in team science, crowdsourcing to support harmonization of measures to enable meta-analysis and integrative data analysis, and interdisciplinary collaboration. Authors are hand-selected experts who are using team science in the field, teaching team science, or studying team science. Overall, the Toolkit aims to integrate and unify the diverse and growing knowledge about effective practices for team science, and to make this knowledge broadly available to the wide range of stakeholders interested in team science. By doing so, the Toolkit can reduce unnecessary replication of practical tools for team science as well as SciTS research, stimulate new directions for team science practice and research, and ultimately help to maximize the quality of the science produced by teams.

Poster 2

The Mendeley Science of Team Science (SciTS) Library: An Essential Team Science Resource

Authors: Holly J. Falk-Krzesinski, Vice President, Strategic Alliances, Elsevier

Team science initiatives are characterized by cross-disciplinary collaboration focused on complex problem-, project-, or product-oriented research. Over the last decade, academia has generated an upsurge in team science initiatives, while external funding agencies in the United States and around the globe have made more collaborative and team-based science funding opportunities available. Studies on research centers funded by the National Science Foundation (NSF) and National Institutes of Health (NIH) have demonstrated that team science initiatives entail significant coordination costs. As a result, team science takes more time, at least proximally, than individual research; however, studies have also demonstrated a distal payoff in terms of research acceleration. Consequently, it is imperative that team science leaders and practitioners can easily draw from the growing science of team science literature as an evidence base for the most effective praxis of team science. The Mendeley Science of Team Science (SciTS) Library–https://www.mendeley.com/community/science-of-team-science-(scits)/–is the most comprehensive and authoritative source of empirical literature on team science and scientific collaboration in the world. It is a free, public group available via the web and through the free Mendeley Desktop software providing over 2,000 references, most curated and organized into over three dozen practice-oriented folders. As a public group, any member of the community can directly add references to the library in a crowdsourcing fashion, including creating new folders, and anyone with a basic Mendeley profile can access the library in its entirety. The Mendeley Science of Team Science (SciTS) Library is the source of references for the NIH's Team Science Toolkit, was used by the National Research Council of the National Academy of Science to conduct their consensus report on the science of team science, "Enhancing the Effectiveness of Team Science," and the Academy of Medical Sciences team science report, "Improving Recognition of Team Science Contributions in Biomedical Research Careers," and constitutes the primary reference library for the Canadian Academy of Health Science Team Science Panel.

Poster 3

Therapoid: a new online platform for scientific collaboration around biotechnologies

Authors: Li Guo, Open Therapeutics

The pharmaceutical industry faces a host of worsening problems: Multibillion-dollar expenses and decade-long development times to bring new drugs to market, high failure rates for new drug candidates, and a patent system that is both expensive and uncertain. Similarly, academic scientists face issues such as reduced funding; broken peer review system; replication crisis and communication barriers; etc. Scientific collaboration should have no borders. Open access, open data, open source, and other open scholarship practices are growing in popularity and necessity. However, widespread adoption of these practices has not yet been achieved. To create a transparent platform for the free flow of scientific research, Open Therapeutics is building Therapoid as an online crowdsourcing platform that allows stakeholders from across the drug and therapeutic development community to come together, share knowledge and access technologies that will drive the next generation of pharmaceutical, healthcare and therapeutic innovation. Therapoid provides open licensed biotechnologies freely to the global community. Once a biotechnology is on-boarded, free of cost, the global community can collaborate and advance the science in an open way. Therapoid integrates open biotechnologies, funding, manuscript development prePeer Review, prePrint Server, open access, open data, artificial intelligence, and blockchain into a unified crowdsourcing ecosystem. The Therapoid web portal enables international scientists to share research easily, while it also opens a path to develop dormant technologies. Simple to use tools enable more effective collaboration. The combination of collaboration and biotechnologies will lead to better therapeutics for patients in every country.

Poster 4

Advancing international research collaborations: A comparative study of public research funding policies in Japan and the United States

Authors: Takehito Kamata, University of Minnesota

(1) Objective, problem under investigation, hypothesis or research goal: This study examines and compares the research funding policies of the national and federal government agencies to promote international research collaborations and advance international cooperation in science. The responsibilities and roles of the public research funding systems are critical to allocate resources and promote international research collaborations. In Japan and the United States, the national and federal government agencies have important roles to advance research by providing primary research funding to researchers and research facilities to conduct basic, applied, translational, clinical, and other research. (2) Description of research methods: This study is primarily based on examining the existing public research funding policies of the four independent government agencies in Japan and the United States. The purposes of this study are to analyze the government agencies' policies and identify potential challenges in international research collaborations. The data and policies are collected from publicly available sources. This study applies the organizational analysis criteria: 1) policies on international research collaborations, 2) funding opportunities on international research collaborations, and 3) guidelines and regulations on international research collaborations. (3) Summary of findings and Statement of how the research advances the SciTS field: Some policies define detailed guidelines and set specific objectives to promote international research collaborations. By the time of the conference, I will have more specific research findings. The public research funding policies are crucial to advance science; however, the absence of consistent public key infrastructure or polices to support international research collaborations could be potential challenges for researchers to conduct international research. In addition, the inequality to access research resources would yield gaps among researchers to participate in international research collaborations. This study will contribute to the studies addressing the needs of understanding public research funding policies across nations.

Poster 5

When Scientific Evidence Really Matters: Policy Windows Surrounding Childhood Obesity

Authors: Teis M. Kristensen, Matthew Weber, and Itzak Yanovitzky, Rutgers University

When challenges arise that require knowledge from multiple domains of expertise, organizations increasingly rely on diverse teams to address the resulting challenges of knowledge coordination. This study looks at the challenges facing Congressional members working to address complex policy issues pertaining to increasing childhood obesity rates, and the resulting social and economic impacts. In turn, this research uses data on congressional bills from 2001 to 2014 on the topic of childhood obesity to understand how evidence shapes and is utilized in policy processes. Understanding how evidence is used in policy processes can help narrow the gap between policy interventions and scientific based evidence. Congressional bills were retrieved and coded by researchers to identify policy sponsors and their use of evidence. Additionally, news databases were queried to gather the degree to which the news media covered the topic of childhood obesity, while third-party databases

were used to gather the number of government research reports available to legislators. The relationships between global characteristics of the sponsorship networks, use of research evidence, news media coverage, and available government research were examined within and across years. Analysis suggests that policy windows are formed around changes in political power but that a preexisting body of evidence is central for policy windows to be acted upon, and further points to the importance of environmental context as a key factor impacting the functioning of diverse teams in policy contexts.

Poster 6

Program Project Grant Mechanisms (P01 and P50/SPOREs) Outperform R01 Research Project Grants in Citation Productivity

Authors: Igor Kuzmin, Leah Hubbard, Julia Artnold, Andrew Hruszkewycz, Steven Nothwehr, Melissa Antman and Peter Ujhazy, National Cancer Institute

Prolonged stagnation of the available biomedical research budgets accentuated the need to support the most productive and promising scientific areas through cost effective funding mechanisms. Bibliometric approaches have become an increasingly important objective component in the assessment of scientific policies and programs. Here, we report a comparative bibliometric analysis of translational cancer research projects supported through R01, P01, or P50/SPORE (Specialized Programs of Research Excellence) grant activities by the NCI in fiscal years 2009, 2010 and 2011. Initial data were collected from IMPAC II databases using QVR. The initial dataset included the total cost incurred for each grant activity in 2009, 2010, or 2011, and the cumulative number of citations attributed to publications supported by a specific grant activity in a given grant year. For each of the three years, we then calculated the activity-specific citation cost index (CCI) representing the number of citations produced per $100,000 total cost invested in the targeted group of R01, P01, or P50/SPORE awards. Among different types of translational awards, the P50/SPOREs featured the highest CCI (mean 32.9, SD=12.2) followed by the P01 program project grants that included at least one translational project (mean 15.2, SD=3.3). Translational R01 grants were the least productive with the mean CCI of 11.7 (SD=2.9). The CCIs in translational subsets of R01 and P01 activities were slightly lower as compared to those for "alal funded" R01s (mean 14.4, SD=4.4) and "all funded" P01s (mean 17.8, SD=6.5). The data point to superior cost effectiveness of the P50/SPOREs as determined by the CCI in relation to other similar NCI-supported types of activities associated with translational research awards.

Poster 7

Examination of processes that contributed to the success of a research partnership in Canada through three key moments in its development

Authors: Marie-Christine, Saint-Jacques, Caroline Robitaille, Annick, S-Amand, and Dainel Turcotte

Based on our experience establishing and managing a large, interdisciplinary research partnership—"Team Science"—dedicated to parental separation and stepfamilies, this presentation highlights the processes that facilitated this undertaking, as well as those that hindered it. These processes, brought to light by our assessments,

will be examined with emphasis on three key moments in our team's development: its origin, its implementation and its continuation over time. Starting in 2008, the analysis that led to establishing this team helped to create a consensus regarding the themes and issues to prioritize. It also led to the development of a participatory research strategy promoting action and the co-creation of knowledge, a major undercurrent in the world of research (Gibbons et al., 1994). This way of working, combined with a research context in Quebec and Canada that favours research partnership with community organizations and a strong commitment by partners, is seen as having fostered development of this project. Partner organizations are asked to participate in intellectual leadership and to provide expertise. Moreover, if seeking a balance between critical distance and physical proximity (Lapointe, 2008) is essential, it includes challenges that can hinder the smooth operation of a partnership. In our case, establishing procedures for research production, governance and mobilization of knowledge that allow members to learn to work together and develop a shared vision of the situation of these families helped to overcome this challenge. The presentation will also outline strategies used to foster evolution of the team over time. Continuation of winning strategies, combined with the creation of a project of a different nature supported by all, seem to have contributed to this transition.

Poster 8

Collaboration in the Loosely Coupled Academy

Authors: Tierini D. Hodges-Murad, Higher Education Leadership

This research examines how loosely coupled university units collaborate in the achievement of institutional wide goals. Today's higher education institutions are being asked to do more with less as resources have decreased and regulatory procedures have increased. Collaboration is being touted as a means to improve student learning, avoid redundant efforts and protect access and affordability. When considering that the future of higher education is noted to rely heavily on institutions' ability to foster collaboration amongst its many components, it is vital that more data is collected that explains how collaboration happens at a loosely coupled university. To examine this phenomenon, this study utilized a qualitative case study methodology to explore the collaborative efforts of the faculty, staff, and administrators at a large state university during their acquisition of a grant which required the institution to infuse entrepreneurial principles throughout the institution. The data collected for this study was derived from individual interviews, direct observation of the campus, documents and archival records. The data collected for this study revealed that when considering how loosely coupled university units employ concerted action, five elements proved significant in the achievement of institutional goals. The processes and performance of the units, the collaborative processes of the group, the commitment of the units to the institutional goal, the presence and management of conflict, and the presence of a superordinate goal delineate what constitutes collaborative goal attainment at this large, loosely coupled research university. The significance of these themes was determined by their congruence to the evidence gathered from reviews of the literature outlining group dynamics and collaboration in higher education. The findings of this study provide data that can aid institutions in engaging their loosely coupled units in collaborative action in the achievement of institution- wide goals.

Poster 9

Theory U Applied to Science: What's Possible?

Authors: Kennan Salinero, Kimberley Brown Magnan and Mery Miguez, ReImagine Science

We wish to prototype the building of teams that have built a shared goal and developed trust-based relationships sufficient to take on challenging, complex projects effectively and sustainably. Theory U, developed by Otto Scharmer at the MIT Sloan School of Management, is philosophically rooted in systems dynamics thinking (Jay Forrester). According to Jaime Lester, co-author (with Adrianna Kezar) of 'Organizing Higher Education for Collaboration,' what we value matters, what we believe matters, and how we structure work matters. Learning Journeys that create shared values and allow work structures to organize based on self-management have displayed high capacity for impact. Mery Miguez, trained in social presencing theater, and Kimberley Brown Magnan, a trainer for self-managed teams and leadership, are exploring new ways to activate shared vision, generate deep trust, and maintain effective working relationships in service to goals that matter to the scientists striving to achieve them.

Poster 10

How to Capture Transdisciplinary Cooperation and Integration in Teacher Education? Introducing a Questionnaire for Accompanying Research on Transdisciplinary Teamwork at the ZZL-Network

Authors: Robin Straub, ZZL-Network / Methodology Center

The project ZZL-Network at the center for teacher education, Leuphana University Lüneburg, Germany, is dedicated to achieve a better integration of the consecutive teacher education system by bringing together various groups of actors from the university as well as local schools, teacher training seminars and extra-school partners. A particular challenge for the accompanying research of the ZZL-Network is to assess the project's self-proclaimed aim of establishing a 'third space' (Bhabha, 1996; Zeichner, 2010) where these actor groups interact within a culture of togetherness and on equal footing. In order to conduct accompanying research on these transdisciplinary teams a questionnaire was developed which is particularly designed to capture the notion of 'third space'. The conceptual framework of the questionnaire is inspired by the dimensions of integration developed by Jahn, Bergmann, and Keil (2012) and Felt's (2009) concept of epistemic living space. Its core dimensions comprise the epistemic, the social and the organizational. Established scales have been adapted to operationalize these dimensions. They cover aspects such as knowledge integration, team learning, social cohesion, perceived trustworthiness, cooperative behavior, collective goal orientation and teamwork satisfaction. In addition, an ego-centric network analysis allows the reconstruction of patterns of cooperative interaction between the occupational groups involved. These interactions patters provide additional insights regarding the degree of transdisciplinary integration within the development teams. The questionnaire will be conducted at the beginning of the summer term 2017 comprising up to approximately 80 - 90 participants. Preliminary results will be sketched out and discussed. The questionnaire outlined above contributes to the science of team science by offering an assessment instrument dedicated particularly to analyze teamwork context within a jointly shaped.

'third space'. Although it is developed and applied within the context of teacher education it is considered to be transferable to other transdisciplinary teamwork settings.

Poster 11

Geomatics and society: transdisciplinary prototypes for effective team science

Authors: Margarita Paras and Fernando Lopez, CentroGeo –CONACYT

Geomatics and society is a transdisciplinary framework developed during the past twenty years at CentroGeo-CONACYT, Mexico. It´s main achievement has been on innovative methods and tools advanced for the study of socio-economic-ecological systems in the territory, emphasizing space-time dimensions. It is precisely in the frontiers of the disciplines that it became necessary to conceptualize a broader science that would integrate different sources of knowledge, meaning, representation and communication of the processes involved, while incorporating continuous technological developments in the acquisition, processing and management of geographic information. Objective: The paper emphasises the building blocks that gear the model of Sci teams´ knowledge and geospatial information management, for the design and development of prototypes and geomatic solutions: (1) Territory and spatial analysis; (2) Complex systems thinking and principles for management; (3) Cybernetics; (4) ICT and geo-technology. Through a qualitative inter and transdisciplinary framework the Sci team develops conceptual and technological prototypes to address social demands related to local, regional or global problems, such as climate change, energy, water, resources management, health, education, food systems, urban environment, etc. In our design and modeling process, is at the territorial level that we can identify and ponder the problems addressed in research / planning and the potentialities of their solutions. At that level of enquiry we reveal the complexity of the context and its spatial functionality, Methodology: Social stakeholders are convened to participate in a collaborative teamwork for learning, discussion, consensus and scenario building. The clue is to consider tacit and explicit knowledge from the social actors compromised in the problem and in the possible solution. The spatial approach and geo-technology used to represent and communicate their knowledge and information, act as a bridge between the scientific framework put forward and the policy and decision tools that have to be mobilize. The achievements -over sixty prototypes- of this line of research give us the opportunity to share some of the most valuable lessons learned to document effective Sci of team science.

Poster 12

Developing a Self-Scoring Mechanism for the Motivation Assessment for Team Readiness, Integration, and Collaboration (MATRICx)

Authors: Alexandra Rosenberg, Gaetano R. Lotrecchiano, and Trudy Mallinson, George Washington University, Holly J. Falk-Krzesinski, Elsevier, Lisa Schwartz, John Liu, George Washington University

The objective of the work is to develop a translational self-scoring sheet for the Motivation Assessment for Team Readiness, Integration, and Collaboration (MATRICx) instrument for individuals and teams to be able to use the tool in team reflection and maintenance. Methods. A review of the team science literature was used to compile a list of motivators and deterrents to collaboration that were developed into 6 domains of collaborative functioning

in health and biomedical teams (Lotrecchiano et al., 2016). This list informed the development of 55 indicators representing a hierarchical spectrum of collaboration. Rasch analysis was used to investigate the rating scale structure, unidimensionality, and person-item fit of responses from 150 participants. Items were analyzed applying a 1-parameter Rasch model using Winsteps® 3.80.1 (Linacre, 2013). Pilot data analysis provided a hierarchy of motivators and threats which make up the MATRICx framework (Mallinson et al., 2016). Results. Several iterations have contributed to the development of a self-scoring scale that maps individual participant motivators for collaboration against degree of collaborative experience and along the domains of collaborative functioning in a graphical context usable by individuals and teams to establish the degrees and depth of collaborative motivation. Summary of findings. The self-scoring sheet provides the basis for technological advancement of the MATRICx tool to be designed and promoted as a mobile application for use by teams and to collect data for further research. The self-scoring graphical framework will be used as part of the technical development of the MATRICx mobile application. Statement of how the research advances the SciTS field. The development of a self-scoring sheet for this assessment is the next phase of providing team scientists with usable tool for understanding motivations related to collaboration in knowledge producing teams. In addition, this practical tool will allow for strategies to be developed for team building useful to developing and assembling teams. Lastly, the scoring sheet is the bases for a digital platform (in development) that will serve as a mobile access point for the MATRICx as well as portal in which to continue the collection of data associated with the MATRICx project.

Poster 13

Curriculum + Community Enterprise for Restoration Science (CCERS)

Authors: Erica Watson-Currie, SmartStart Evaluation & Research

Watson-Currie (2016) discussed the CCERS partnership, a three-year education research project. New data illustrates impact these ten organizations are having working together to develop a curriculum to enhance STEM-C education in public middle schools. The lessons engage students and teachers in long term restoration ecology and environmental monitoring projects in collaboration with peers, citizen scientists, STEM professionals, and community groups. The educational model is envisioned as a set of five programmatic pillars in which partners collaborate to create and implement complementary lessons, activities, and exhibits focused on restoration science. Now, an additional Smart & Connected Communities (SCC) grant has been obtained to improve the digital platform, and incorporate new partners from other disciplines (e.g., law & policy).

Objectives:

- Increase quality and effectiveness of STEM+C teaching and learning
- Increase teachers' knowledge and instructional skill
- Increase students' knowledge of and interest in STEM+C
- Develop a replicable model for other restoration projects as suited to local environmental conditions.

Description of research methods:

- External evaluators used a quasi-experimental design to assess the implementation, effectiveness, and impact of the CCERS project on educators and students.

- Researchers created composite items from the evaluation questionnaires, and used the corresponding datasets to compare findings in different pillars.
- As data for 2016-17 becomes available researchers will investigate the collective impact of the educational model, as well as the contribution of each component.

Summary of findings:

- Pillar 1: Teacher Development – Cohort 1 teachers' content knowledge increased, greatest increases in environmental justice and ability to facilitate experimental scenarios; Instruction skills increased as indicated by self-reported usage of Bybee's 5E methods.
- Pillar 2: Student Learning - Students of Cohort 1 teachers receiving CCERS curriculum achieved higher post-test scores on knowledge test than control group; Also, their self-reported confidence in science ability improved, whereas control students did not report increased confidence.
- Pillar 3: Digital Platform – Ongoing increase in capabilities, resources, and usage: Students and citizen scientists test water quality, monitor site conditions, and collect other measurements, then upload data to a collective database. Online dashboard enables students to analyze data from all sites, and create charts for science reports to be presented at annual symposium.
- Pillar 4: Out-of-School (OST) Mentoring – Students' knowledge and self-ratings for confidence science abilities increased relative to control group; however, increases were more modest than Pillar 2 as same evaluation instruments were used although fewer lessons and resources were provided.
- Pillar 5: Community Exhibits – Year 1, prior to receiving any CCERS lessons or activities, students of Cohort 1 teachers began taking field trips with interactive exhibits designed to complement developing curriculum. Brief exit surveys indicated their scores on knowledge items increased each semester (an indirect indicator of improvement as their teachers' knowledge increased. Spring 2016, students of Cohort 2 teachers scores on knowledge items were greater than knowledge scores for students in control group.

Poster 14

An Evidence Based Competency Model for Team Science Training

Authors: Kevin C. Wooten, University of Houston Clear Lake, Eduardo Salas, Rice University, Theresa K. Lant, Pace University, Maritza R. Salazar, University of California Irvine, Huda Sarraj, Allan R. Brasier, University of Texas Medical Branch, Lori A. Wiseman, University of Texas Medical Branch

The purpose of this poster is to describe the development of a competency model designed specifically to provide evidence based guidance for the development of training programs for leaders and members of scientific teams. There are numerous models available depicting team based knowledge, skills, and abilities (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995), specific attitudes, behaviors, and cognitions (Salas, Rosen, Burke, & Goodwin, 2009), major team factors (Salas, Sims, & Burke, 2005), teamwork skills (Rousseau, Aubé, & Savole, 2006), virtual team skills (Hertel, Konradt, & Voss, 2006), as well as interdisciplinary team health research competencies (Gebbie et al., 2008). The available evidence suggest that team performance can be increased through team training (Delise, Gorman, Brooks, Rentsch, & Steele-Johnson, 2010; Salas et al., 2008). However, the National Research Council (Cooke & Hilton, 2015) has called for more efforts to develop authentic team science training, and thus

team science specific competency models are needed. Figure 1 depicts our overall model and the different sets of competencies, and Figure 2 depicts the three competencies within each competency set. This model is built from evidence provided by both general team literature as well as relevant team science literature. For example, the competency involving Awareness and Exchange involves: 1) Sharing Unique Information/Promotive Voice (Liang, Farh, & Farh, 2012; Salazar, Lant, Fiore, & Salas, 2012); 2) Inquiring and Probing (Huber & Lewis, 2010; Marks, Mathieu, & Zaccaro, 2001); and 3) Reframing and Integrating (Van der Vegt, & Bunderson, 2005; Klein, 2005). This competency model provides for numerous behavioral markers for each distinct competency, which can be used as either developmental or evaluative rubrics. Advancement of SciTS Field: The proposed recursive and interrelated model is unique in that it can be used to guide the general development of nascent scientific teams, or can be used to make an intervention into mature teams requiring situation-specific assistance.

Poster 15

Incorporating Team-based Service Learning in the Teaching of An Agribusiness Application Course: A Case Study from Fresno, CA

Authors: Pei Xu, California State University Fresno

Fresno State agribusiness department is among the first to incorporate service learning as a required team project into its teaching of an advanced agribusiness application course. The study aims to gather and analyze students' feedback on this team project in order to identify means to improve agribusiness teaching and enhance students' collaborative networks. Problems under investigation includes: 1) will students understand course contents better when the contents are related to a real life situation, to be assigned to a team? 2) What factors will affect the team's involvement in community service? And 3) will the service aspect of the team project be considered helpful in assisting students in proposing new ways to solve agribusiness problems? Anonymous face-to-face survey was conducted in spring 2017 from 86 agribusiness students taking the advanced agribusiness application course. Preliminary statistics and results from a conditional logit model are presented. The results show: 1) A majority of students (89%) believed that they understand the course contents better when the contents are related to a real life situation and when the contents are learned in a team; 2) years of work experience as well as years in school positively affect the team's involvement in community service; 3) almost all respondents (94%) reported that the service aspect of the team project help them propose ways to solve real world agribusiness problems. This research advances the SciTS field to provide to peer educators, especially those in agricultural education, new understanding about the impact of team-based service learning on expanding students' learning of agribusiness principles and contents.

Poster 16

Ethics and the Science of Team Science

Authors: Jonathan Beever, University of Central Florida

Ethics has been largely overlooked in the science of team science. Yet ethics and ethical decision-making have been central concerns in research seeking to better understand how individual STEM researchers analyze ethical

relevant issues and formulate normatively-appropriate actions. This disconnect evidences at least two problems for the science of team science: (1) what is ethical decision-making for collaborative STEM research?, and (2) how does ethical decision-making apply in team science? This presentation lays out the complexity of ethical decision-making through a scaffolded approach of scale, scope, and skill and then outlines how this individualistic model applies to research teams. Questions of scope in ethical decision-making address at what level of analysis ethical inquiry applies. At one level, academic integrity or regulatory ethics concern institutional and contextual issues. (Note that at least one study has argued that team-based learning can offer gains in ethical decision-making, over traditional RCR practices (McCormack and Garvin 2014.) At another level, broader impacts of research address societal implications. Finally, a third level of scope focuses on the ways in which normative/value-driven commitments are embedded in research questions and contexts. Questions of scale compare personal morals with societal and professional ethical standards. Professional standards, evidenced for example by codes of ethics, do not necessarily align with personal values or societal norms. Considering scale brings these potential conflicts into relief. Questions of skill push beyond ethical reasoning to consider how one becomes sensitive to an issue as ethical in the first place, and then how reasoning translates into action through motivation. Sensitivity, reasoning, and motivation form an integrated triad of skills necessary for ethical decision-making. The complexity of ethical decision-making demands collaborative approaches within the disciplines and scaffolding within the curriculum. Conceptual coherence of ethical decision-making is a necessary precursor to data-driven analysis of its components.

Poster 17

Measuring Proposal Needs and Allocating Sufficient Research Support

Authors: Monica Vandenberg

Research staff capacity should not be a hindrance to a successful grant application. Unfortunately, a lack of up-front planning and forgoing the establishment of expectations and roles can lead to a deadline day that involves pointing fingers and frustration. In order to set roles, expectations, and research office staff time needed for each proposal, the University of West Florida Office of Research and Sponsored Programs is testing the following systems: (1) Initial Proposal Meeting Checklist indicating the PIs desired research office services: This meeting and checklist alleviates a last-minute request for research office services that require research staff to work into the night hours to meet deadlines. Additionally, use of the checklist allows the research office to allocate sufficient staff time to meet the service needs; (2) Proposal Checklists with role assignments: Once the research office services are determined, the PI and research staff determine the individuals who are responsible for meeting the proposal tasks. Each task is listed on the checklist with a deadline and the responsible party; (3) The adaptation of the Kanban Method and an agile project management software system: A key component of agile systems is to evolve solutions through a collaborative effort. Additionally, this system increases the pace of solutions and easily tracks progress to completion. The entire research office work capacity can easily be assessed so that a research staff member and/or supervisor can easily determine his/her capacity to take on new proposals. The above systems are a response to assist research offices with workloads that stretch their capacity and clearly communicate and document the steps to a successful proposal.

Poster 18

Team science and the FACIAL network: facilitating clinical research in craniofacial macrosomia

Authors: Amelia F. Drake, University of North Carolina, Chapel Hill, Scott Bartlett, Children's Hospital of Philadelphia, Philadelphia, Craig Birgfeld, Carrie Heike, University of Washington, Alessia Johns, Children's Hospital Los Angeles, Lauren A. Kilpatrick, University of North Carolina, Daniela Luquetti, University of Washington, Seattle, Marina Rampazzo, University of North Carolina, Babette Saltzman, University of Washington, Laura Stueckle, University of Washington, Mark Urata, Children's Hospital Los Angeles, Daniela Vivaldi, University of North Carolina

Objective: Multidisciplinary clinical care is an intuitive concept among craniofacial teams that provide coordinated, longitudinal care for children with congenital and acquired conditions of the head and neck. However, the concept of team science is relatively new to craniofacial teams in the US. The objective of this study is to assess the progress of building and expanding a research network among such teams through evaluation of the Facial Asymmetry Collaborative for Interdisciplinary Assessment and Learning (FACIAL) network. Methods: Craniofacial microsomia (CFM) is a congenital condition with a prevalence of 1:5,600 live births and involves underdevelopment of the facial structures, most commonly the ear and mandible. Children with CFM often undergo multiple surgeries, yet few outcome studies are available and consensus on standards of care does not exist. In 2009, we launched FACIAL network to study CFM. Our founding multi-institutional research team included experts from the following disciplines: Biostatistics, Clinical Study Management, Epidemiology, Dental, Genetics, Oral and Maxillofacial Surgery, Otolaryngology, Pediatrics, Plastic and Reconstructive Surgery. Summary of Findings: We have received continuous NIH funding to support this research, and have enrolled over 600 study participants, including cases, controls, and parents. We completed 14 institutional and state IRB applications, and developed data collection tools, databases, manuals of operating procedures, a series of study protocols, and incorporated existing resources (e.g. team science toolkit, PhenX common data elements, etc) whenever possible. We conduct regular teleconference meetings, and in person meetings, and continue to develop methods for shared recognition in authorship and scholarship. Conclusions: The FACIAL network provides a unique model for team science to further research in craniofacial conditions. Through this collaboration, we have gained insights into methods for accruing complex data sets on a relatively small number of participants with rare conditions, and developed a strong collaboration among a very diverse team.

Poster 19

Co-design models for addressing complex societal challenges

Authors: Maeve Donohue, Northeastern University

Over the past few decades the role of design has grown in both industry and practice. Designers are being increasingly called upon to join and lead interdisciplinary teams that are tasked with understanding and solving very large societal issues often referred to as 'wicked problems'. "Wicked problems are difficult or impossible to solve because of incomplete, contradictory and changing requirements that are often difficult to recognize. Moreover, because of complex interdependencies, the effort to solve one aspect of a wicked problem may reveal or create other problems" (Rittel and Webber 1973). The process of defining a problem and identifying possible

solutions cannot be separated into distinct linear phases. In order to comprehend and formulate solutions for these types of problems, creativity is needed to design new approaches. However, an individual stakeholder, regardless of intellect or creativity, cannot fully comprehend or solve problems of this scope on their own. An interdisciplinary team approach is required to merge multiple perspectives and approaches into a more comprehensive understanding of the context surrounding an issue in order to identify possible solutions. The design process has evolved in response to these complex problems. The user-centered approach where experts design for individuals traditionally referred to as 'users' has begun to shift into a participatory co-design approach that strives to actively involve all stakeholders of an issue in the design process from research to implementation. In a participatory design process it is necessary to define the approach, context and the goal, engage the relevant people and find the suitable method, techniques and tools to reach that goal. This poster will model different methods and approaches to involving interdisciplinary stakeholders in the design process from research to implementation in order to better understand how co-design can be a valuable approach to solving complex societal issues.

Poster 20

Primary care team workflow analysis to improve medication reconciliation communication and coordination

Authors: Marie Smith, Kathryn Steckowych, Andrew Stevens, University of Connecticut

Pilot project to: (1) examine primary care team member workflows and communications for medication reconciliation (MR) in primary care (PC), (2) identify workflow gaps and deviations, and (3) recommend collaborative opportunities for PC team members to improve medication use and safety.

Methods:

The MR process was observed within a PC office. A data collection form with 60 data elements for the MR process was pilot-tested and revised using video simulations and 4 hours of pilot observations in the PC office. Observations were conducted across PC teams over 6 weeks for 20 observation hours. Ideal-state and observed workflow maps were created and compared to detect team workflow communication gaps and deviations among PC team members.

Findings:

<u>Communication gaps</u>

1. Data Collection
   - Close-ended questions were used in the MR process (77%)
   - Patient allergies (20%) or pharmacy preferences (28%) were not recorded.
2. Data Verification:
   - Community pharmacies/prescribers were not contacted during MR process to verify medication use (100%)
   - Patient self-reported information was documented without further verification (62%)

- Discontinued meds were deleted from EHR without verification from prescriber/pharmacy (10%)

Workflow deviations

1. Problem with MR documentation system or insufficient time for completion (31%).
2. MR completed after patient intake phase of visit (10%).
3. MR not completed by one medical assistant when the patients' medication list contains >10 medications or if the patient sees multiple providers/specialists.

Opportunities for Improved Team Communication and Coordination

1. Expand "team members" to integrate community pharmacists/other prescribers to improve medication quality/safety and workflow efficiency.
2. Implement team training programs to improve use of open-ended questions in the MR data collection process.
3. Re-design MR workflow to optimize interdisciplinary roles in a community-health team model (PC teams + community pharmacists, social agencies, home health services).
4. Conduct further research on team dynamics to improve coordination of MR workflow.

Poster 21

Sustaining team science: Dynamic Design Planning as a collaborative ecology

Authors: Tyler Quiring, Bridie McGreavy, University of Maine

Sustainability science aims to provide solutions to pressing and complex socioecological issues, and as a result the teams conducting this science must practice unprecedented levels of collaboration and knowledge integration across a range of disciplines. As these diverse teams strive to balance key research objectives with the goal of making their science accessible and applicable to stakeholders, they increasingly seek ways to develop timely and flexible strategies for sharing information and making collective decisions about practical concerns such as data integration and stakeholder engagement. These needs also reveal tensions of organizational difference around matters such as group leadership, identity, and purpose. As members of the tristate New England Sustainability Consortium seeking to provide relevant scientific tools to support public decision making about dams, we have encountered these tensions through the communication research we conduct with our interdisciplinary collaborators. In this poster presentation, we share an ecological model of team communication that draws on insights from a longterm and ongoing ethnography of our collaborative organization. This effort is part of a larger teamwide strategy called "Dynamic Design Planning" through which insights from our ethnography are rapidly tracked, provided to our team, and integrated with other emergent forms of information sharing and decisionmaking that help us "take the pulse" of our collaboration and reshape our team science as needed. We are currently expanding this ethnography by developing a public team blog that provides a digital space to cultivate both shared and diverse forms of meaningmaking through science communication. Drawing on the concept of "integrated transmedia storymaking," or the synergistic and dynamic use of multiple media to tell a range of stories across a single online platform, we are finding that collaborative blogging allows our team to cultivate and practice a commitment to science that is both robust and readily useful.

UCF

INSTITUTE for SIMULATION & TRAINING®

Founded in 1982 as a research unit of the University of Central Florida, the institute of simulation (IST) provides a wide range of research and information services for the modeling, simulation and training community. IST is internationally recognized for its focus on advancing human-centered modeling and simulation technology and increasing our understanding of simulation's role in training and education.