

# NSF Broader Impacts: Tips from a Former NSF Program Director

April 14, 2020  
University of Colorado Boulder



Research & Innovation Office  
UNIVERSITY OF COLORADO BOULDER

## **NSF Broader Impacts: Tips from a Former NSF Program Director**

Tuesday, April 14, 2020 | 12-1:30pm

University of Colorado Boulder

12:00-12:05: Welcome Remarks, Mikhaila Redovian, RIO

12:05-12:15: Broader Impacts from a Leadership Perspective, Dr. Massimo Ruzzene, CEAS

12:15-12:55 Lightning Talks

- 1 Anderson Language and Technology Center (ALTEC), Rebecca Allison
- 2 Biological Sciences Initiative (BSI), Dr. Julie Graf
- 3 BOLD Center, Dr. Tanya Ennis
- 4 Colorado Diversity Initiative, Barbara Kraus
- 5 CU Office for Outreach and Engagement, Dr. Jenny Briggs
- 6 CU Science Discovery, Dr. Alex Rose
- 7 CU Venture Partners, Dipika Singh
- 8 Fiske Planetarium, Dr. John Keller
- 9 Laboratory for Interdisciplinary Statistics (LISA), Dr. Eric Vance
- 10 Science and Technology Center on Real-Time Functional Imaging (STROBE), Dr. Ellen Keister
- 11 CIRES Education and Outreach, Dr. Anne Gold
- 12 CIRES Evaluation and Educational Research, Dr. Anne Gold

12:55-1:15: Faculty Panel Discussion, Dr. Alison Cool and Dr. Zachory Berta-Thompson

1:15-1:30: Question & Answers with Dr. Ruzzene, Broader Impacts Partners, Dr. Cool, and Dr. Berta-Thompson



# Broader Impacts Network (BIN)



**Anderson Language and Technology Center  
(ALTEC)**

ALTEC supports the language learning community at the University of Colorado Boulder and in the state of Colorado.



**ATLAS**

ATLAS promotes rigorous, curiosity-driven investigation in a thriving academic community that is supportive, energetic and playful.



**Biological Sciences Initiative**

The Biological Sciences Initiative supports undergraduates to pursue bioscience-related research.



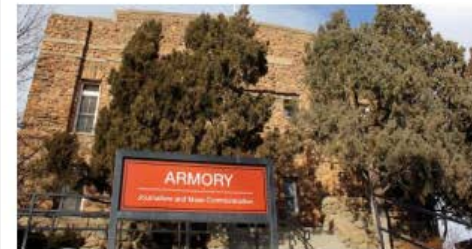
**BOLD**

The BOLD Center provides a place for engineering outreach, focusing on minorities.



**Center for Communication and Democratic  
Engagement**

The Center for Communication and Democratic Engagement supports broader impacts by encouraging, facilitating, networking and studying public participation practices.



**Center for Environmental Journalism**

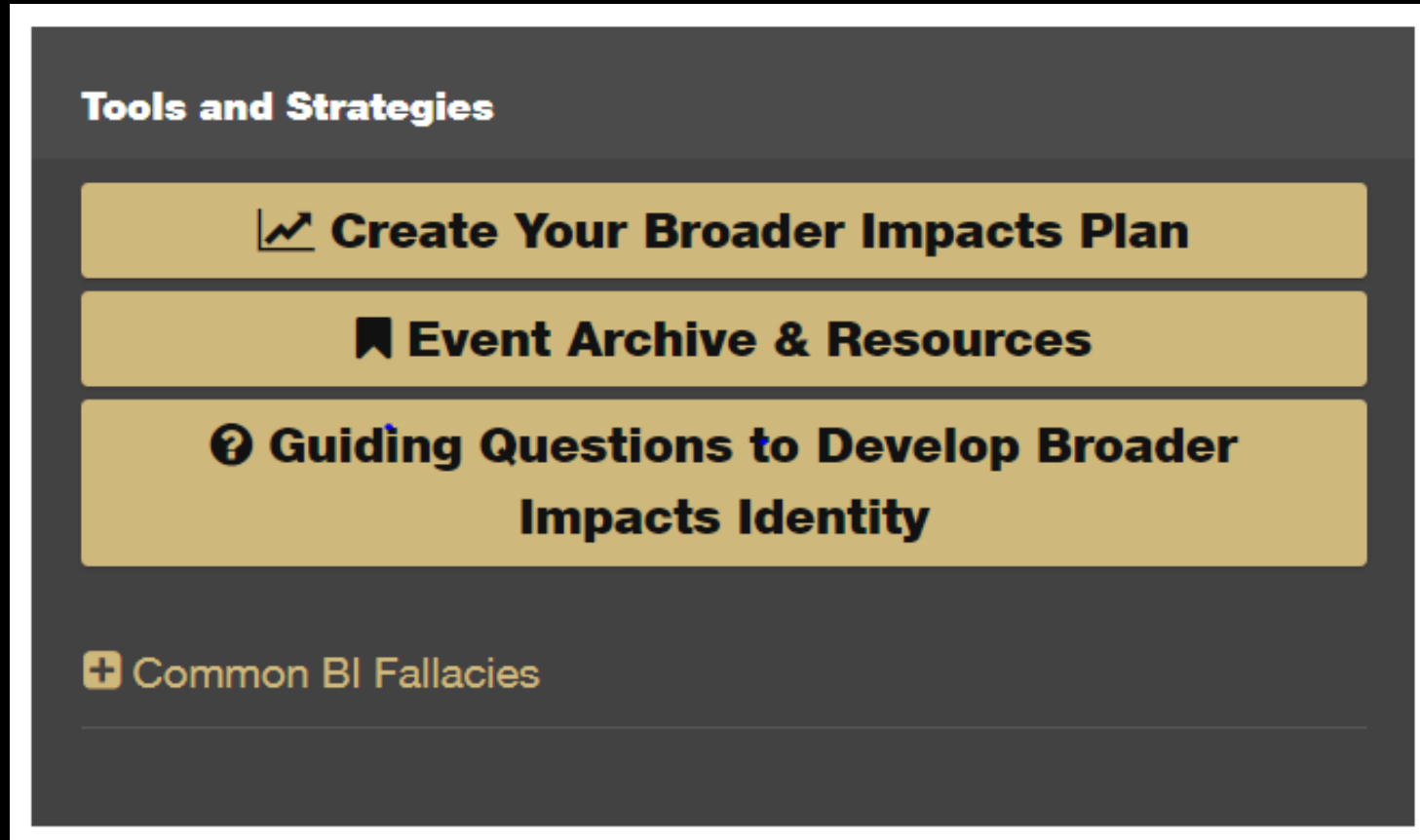
The Center for Environmental Journalism was created to enrich public understanding of environmental issues.



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[tinyurl.com/cuboulderBIN](https://tinyurl.com/cuboulderBIN)

# Broader Impacts Network (BIN)





# Dr. Massimo Ruzzene

Associate Dean for Research,  
College of Engineering and  
Applied Science

NSF Program Director (2014-  
2016)



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# Broader Impact Workshop

**Massimo Ruzzene**

Associate Dean for Research

College of Engineering and Applied Science



# About me

- Professor and Associate Dean, College of Engineering and Applied Science, CU Boulder
  - August 2019-Present
- Program Director, Dynamics Control and System Diagnostics, The National Science Foundation
  - 2014-2016
- Professor, School of Aerospace Engineering, Georgia Institute of Technology
  - 2002-2019

# NSF Merit Review

- Three Merit Review *Principles*
- Two Merit Review *Criteria*



# Merit Review *Criteria*

- Intellectual Merit
  - The Intellectual Merit criterion encompasses the potential to advance knowledge
- Broader Impact
  - The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes

Is IM or BI More Important?

“[B]oth criteria are important and should be given full consideration during the review and decision-making processes; each criterion is necessary but neither is sufficient.”

*National Science Foundation Merit Review Criteria: Review and Revisions, National Science Board, NSB/MR-11-22, Dec 2011*

# Which BI Activities Are Required?

“... contribute to the achievement of *specific, desired societal outcomes*.”

- NSF **does not require** specific activities.
- The *proposal* identifies specific outcomes.
- The *proposal* explains why they are desired.



# Some piece of advice....

- Get engaged early in BI activities...it shows interest and track record
- Focus on BI activities that are compelling, i.e. that are exciting for you
- Avoid check-lists.....focus on a signature activity
- Leverage campus resources...but you need to contribute ideas of your own
- Make sure that proposed activities are commensurate to resources available
- Make the conceiving of BI activities part of the proposal creative process
- Avoid BI activities that overlap with regular faculty duties



# Anderson Language and Technology Center

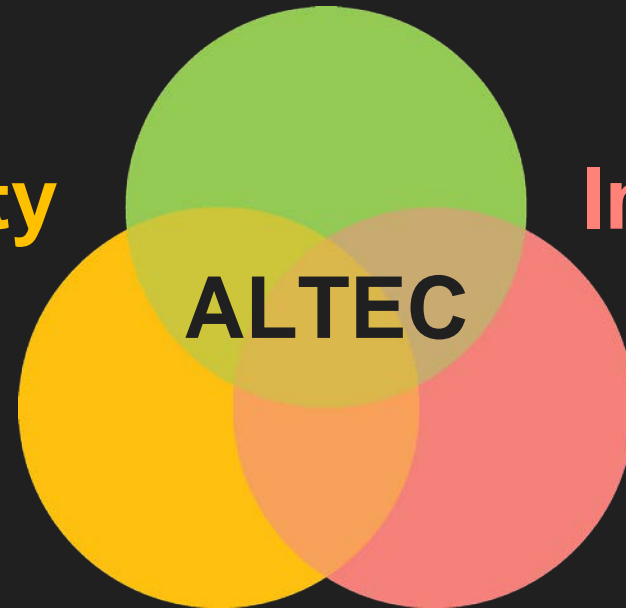
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Learning & Teaching

Community

Innovation





# Broader Impacts

- Portugueses de Papel
- Establishing a Southeast Asian Track in the Asian Studies BA
- Chinese Language Instruction in the Digital Age





# Anderson Language and Technology Center

UNIVERSITY OF COLORADO **BOULDER**



Susanna P. Pàmies, Director  
Rebecca Allison, Program Manager

The HIVE @ALTEC (Hellems  
159)  
[altec.colorado.edu](http://altec.colorado.edu)



## Broader Impacts Opportunities in the *Life Sciences*

Increase:

Access  
Diversity  
Scientific  
Literacy







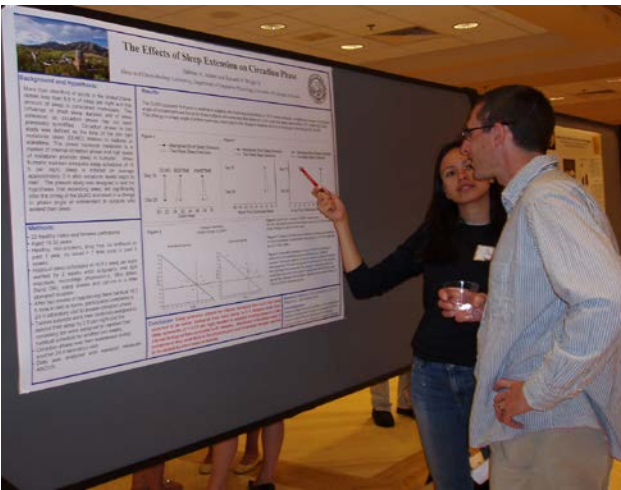
## Undergraduate Research

### BSI STEM Scholars

Apprentice-based

Mentored

Professional Development







## CUREs

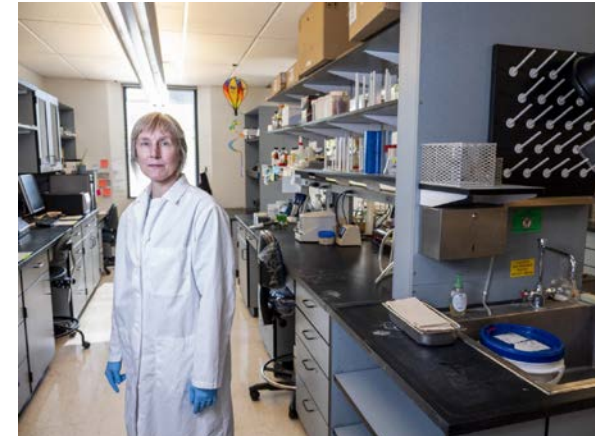
Course-based **U**ndergraduate **R**esearch **E**xperiences  
Introductory laboratory courses based on Faculty Research

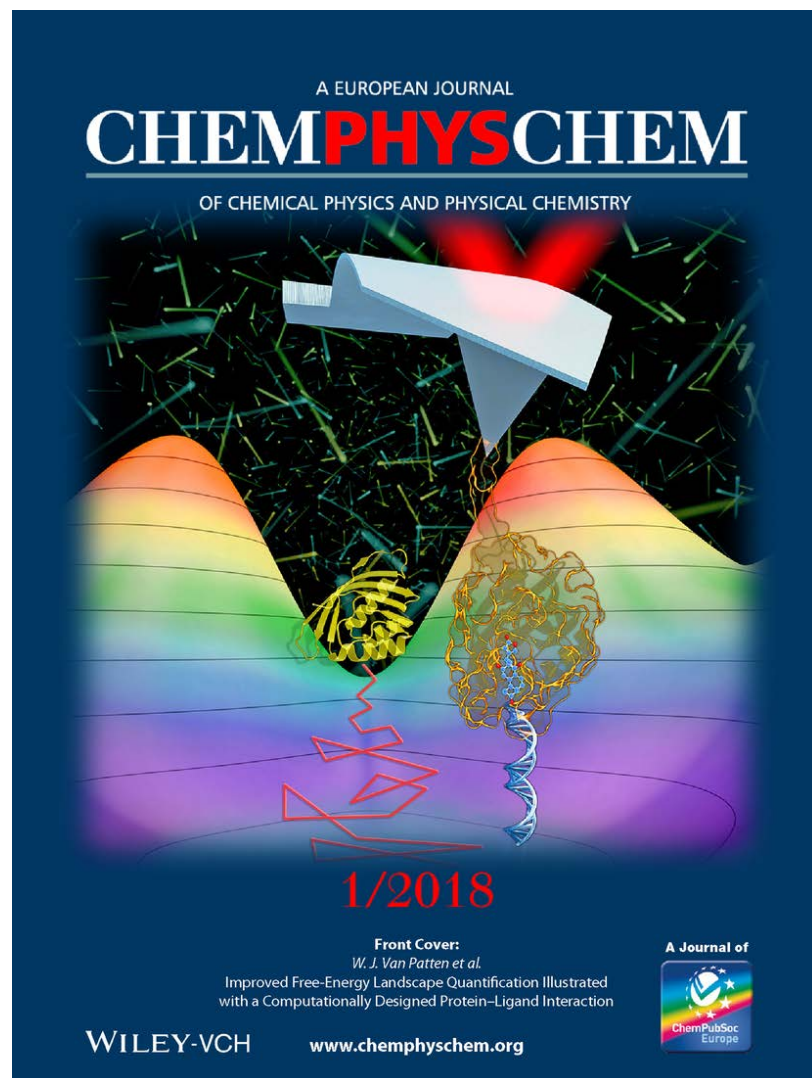
*Chemotherapy Discovery Lab*  
**Tin Tin Su**, MCDB Professor  
MCDB 2171



*Biological Probiotic Discovery Lab*  
**Christopher Lowry**, IPHY Professor  
IPHY 1181

*Antibiotic Discovery Lab*  
**Corrie Detweiler**, MCDB Assoc. Professor  
MCDB 1171





## Broader Impacts

### *Retention & Graduation:*

**96% graduate; 95% URM**

### *Undergraduate Co-authorship*

**nearly 500 undergrad co-authors  
in peer-reviewed journals**

### *Advanced Degrees*

**66% completed Masters or PhDs**

# NSF Broader Impacts: Tips from a former NSF Program Director BOLD Center Presentation

Tanya Ennis

BOLD Center Director

[Tanya.ennis@Colorado.edu](mailto:Tanya.ennis@Colorado.edu)

(303) 492-6473

March 11, 2020

[www.colorado.edu/engineering/bold](http://www.colorado.edu/engineering/bold)



# Broadening Opportunity through Leadership & Diversity

Tanya Ennis, Director





**The BOLD Center vision** is to foster a socially just and equitable educational experience in engineering and applied sciences.

## **BOLD Mission: What Sets Us Apart?**

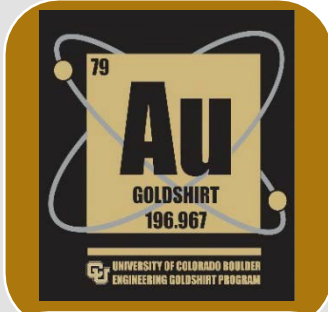
We dismantle oppressive systems and remove barriers that limit access to resources for historically minoritized, underserved, and underestimated populations including, but not limited to, the following populations:

Native American/American Indian/Indigenous		Latinx
Asian Pacific Islander Desi American (APIDA)		Hawaiian
Women	LGBTQIA	Black/African-American
Gender-Diverse	First-Generation	Low-Income
Undocumented	Disabled	

# BOLD Center: Multifaceted Student Support

## Engineering GoldShirt Program

Alternative pathway to direct admission  
High touch program in the first and second years



Supports motivate and talented student who need additional academic support

Participants include, but are not limited to, first-generation students, women, underrepresented minority students, and English-language learners



# Broader Impacts and Faculty Participation

- Examples of faculty participation:
  - Dr. Alireza Doostan CAREER Grant (Research presentation/faculty mentoring)
  - Dr. Jana Milford: NSF S-STEM Grant for Redshirting in Engineering Consortium
  - Dr. Beverly Louie and Dr. Virginia Ferguson – YOU'RE@ CU research program
  - Dr. Shelly Miller – CUImpact (Support for women in engineering)
  - Former BOLD Faculty Fellows (Dean Emeritus Rob Davis, Dr. Shelly Miller, Dr. Jana Milford, Dr. Melinda Piket-May, Dr. Mark Hernandez, Shaun Kane, Daniel Appelö)
  - Partnership with ITLL (student employees) and Engineering Plus Faculty (curriculum instructors)
- Please refrain from making statements and claims that BOLD is partnering with you without a formal agreement.
- Participate in our current programming to get to know staff and students; it's easier to support faculty when we understand faculty interests and engagement with BOLD Center students.

# COLORADO DIVERSITY INITIATIVE



**Focus: Diversity in STEM PhD Education**

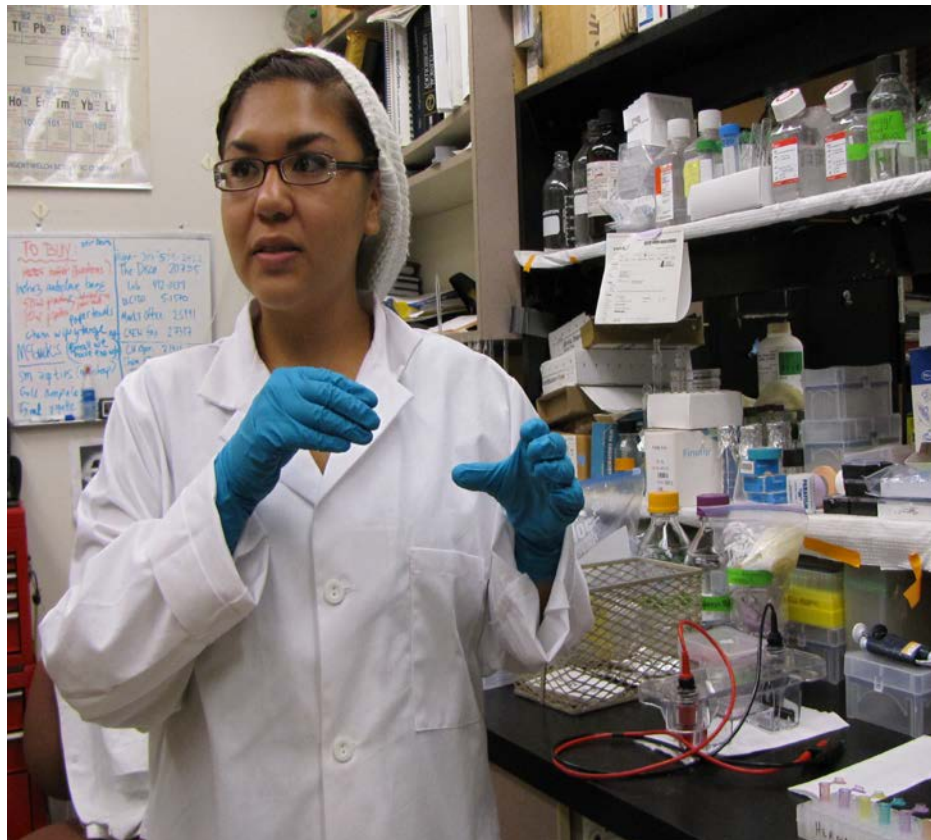
**Programs to recruit and retain diverse PhD students**

**Grant Proposal Prep: Data and text to support diversity**

**ODECE: Office of Diversity, Equity and Community Engagement**



# COLORADO DIVERSITY INITIATIVE



## SMART Program Colorado Advantage Diversity Fellowships

**Contact: Barbara Kraus**  
**Barbara.Kraus@Colorado.edu**  
**303-492-5779**

**ODECE: Office of Diversity, Equity and Community Engagement**



# Office for Outreach and Engagement

UNIVERSITY OF COLORADO **BOULDER**

Jenny Briggs, Community Outreach Program Manager  
Broader Impacts Design (BID) project team member  
March 11, 2020



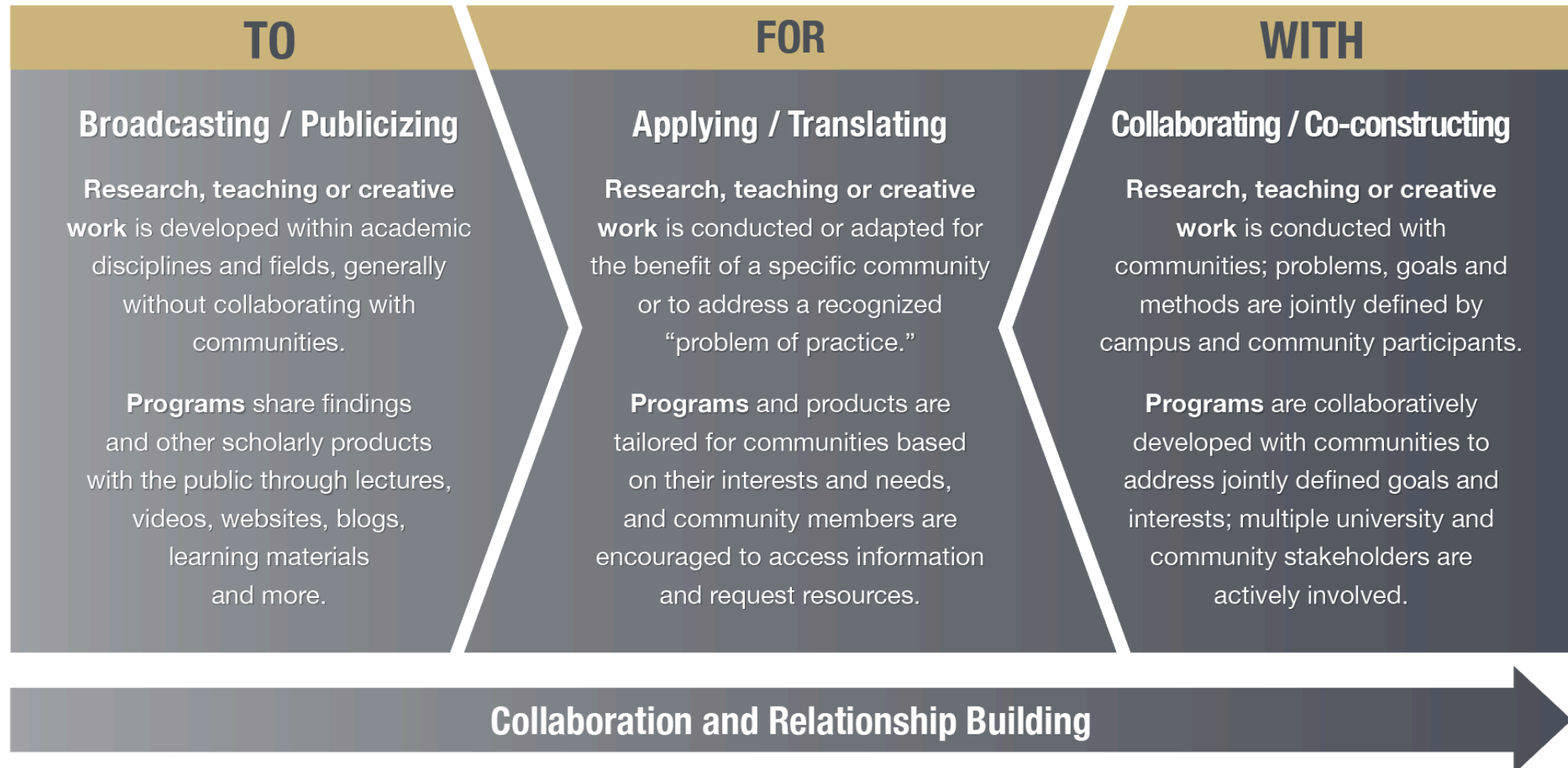
# Mission

## Outreach and Engagement Campus Definition

At CU Boulder, we define outreach and engagement as **the ways faculty, staff and students collaborate with external groups in mutually beneficial partnerships** that are grounded in scholarship and consistent with our role and mission as a comprehensive, public research university.

*Endorsed by the CU Boulder Council of Deans, February 16, 2010*

# Continuum of Engaged Scholarship





# Connections beyond campus

**CU**  
ON THE  
WEEKEND

## Learning to Live With Megafires

**PRESENTED BY**  
**Michael Kodas**  
Instructor  
College of Media,  
Communication  
and Information

**WHERE & WHEN**  
**January 26 • 1–3 p.m.**  
Jennie Smoly Caruthers  
Biotechnology Building  
CU Boulder East Campus  
3415 Colorado Avenue

**FREE & OPEN  
to the  
PUBLIC**

**Be Boulder.**  
@CUOutreach

Office for Outreach and Engagement  
UNIVERSITY OF COLORADO BOULDER  
[colorado.edu/outreach/oe/cu-weekend-weekend@colorado.edu](https://colorado.edu/outreach/oe/cu-weekend-weekend@colorado.edu) · 303-492-4561





# Collaboration - and “pilot” funding



**Micro Grants**

**Community Impact Grants**

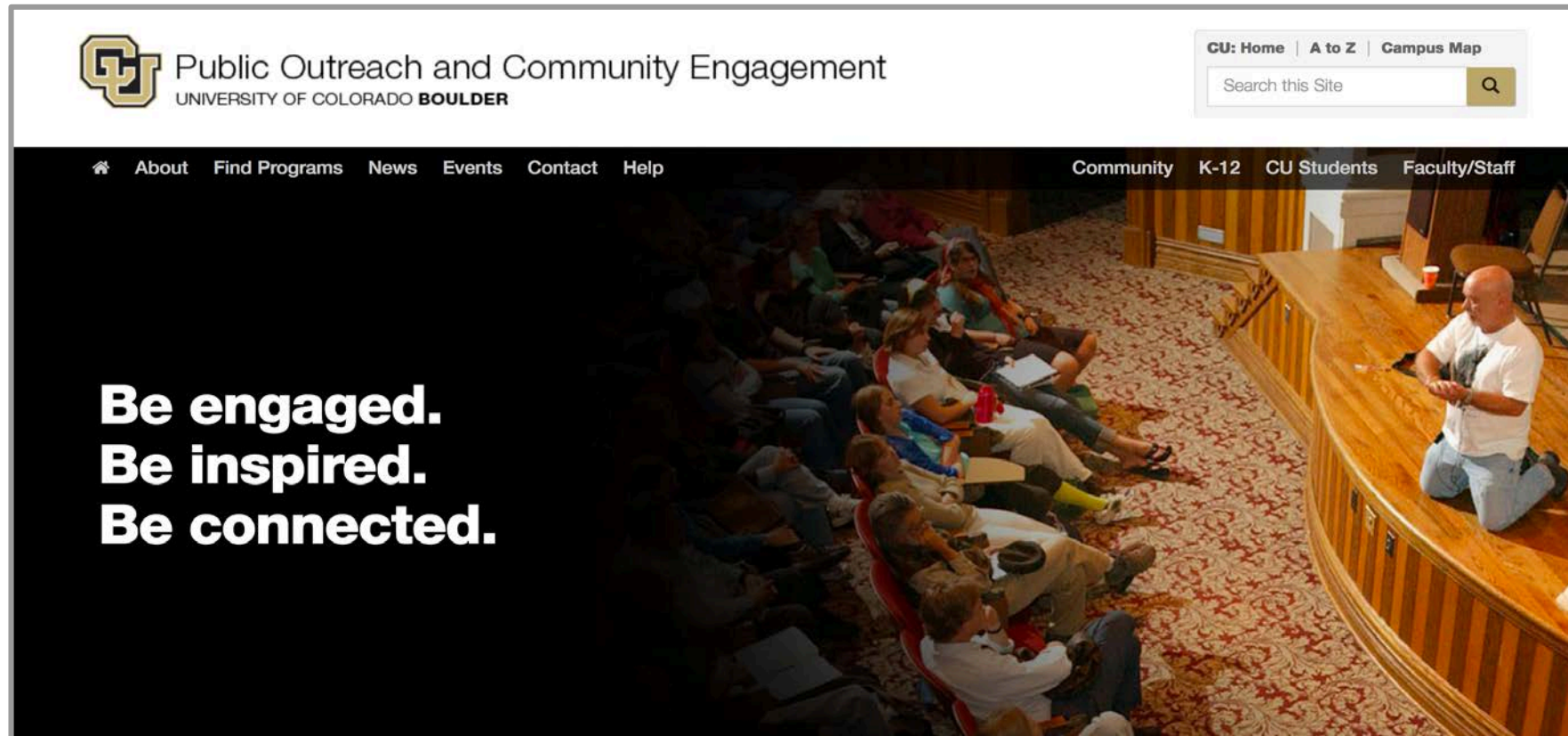
**CU Boulder Outreach Awards**

**Consulting & facilitating!**

**[colorado.edu/outreach/ooe/outreach-funding](https://colorado.edu/outreach/ooe/outreach-funding)**



# Public Outreach and Community Engagement website



**Project examples: [outreach.colorado.edu](https://outreach.colorado.edu)**  
**Contact us: [outreach@colorado.edu](mailto:outreach@colorado.edu)**



Science Discovery  
UNIVERSITY OF COLORADO **BOULDER**



# How we can help with your Broader Impacts

**Alexandra Rose**, Broader Impacts Liaison  
**Stacey Forsyth**, Director





# Who are We?



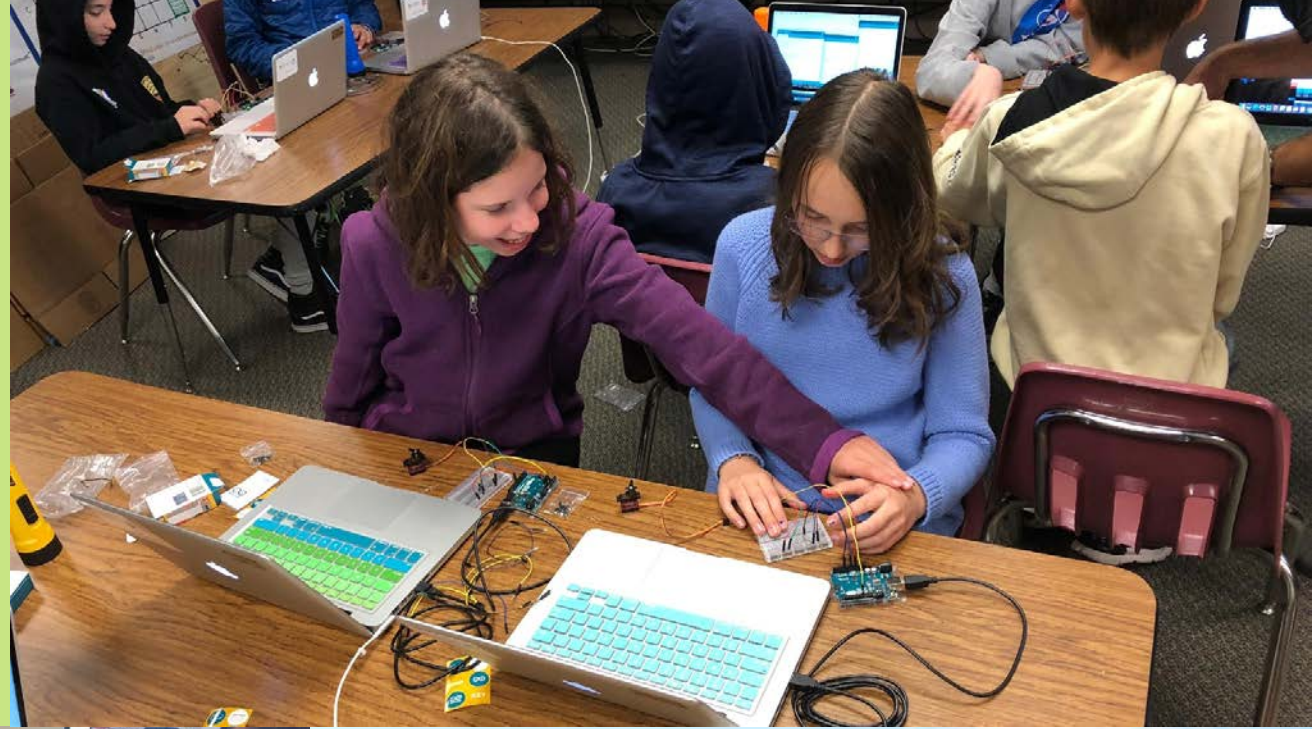


# Summer Camps





# After-school Homeschool In-school







# Teacher Professional Development





# Community Outreach Events... and more!







Science Discovery  
UNIVERSITY OF COLORADO **BOULDER**



In 2018-2019:

- 25 NSF proposals from 13 different departments

We can help with:

- BI budgets
- Activities development, implementation, and evaluation
- We love partnering with other BI providers

Contact us soon!



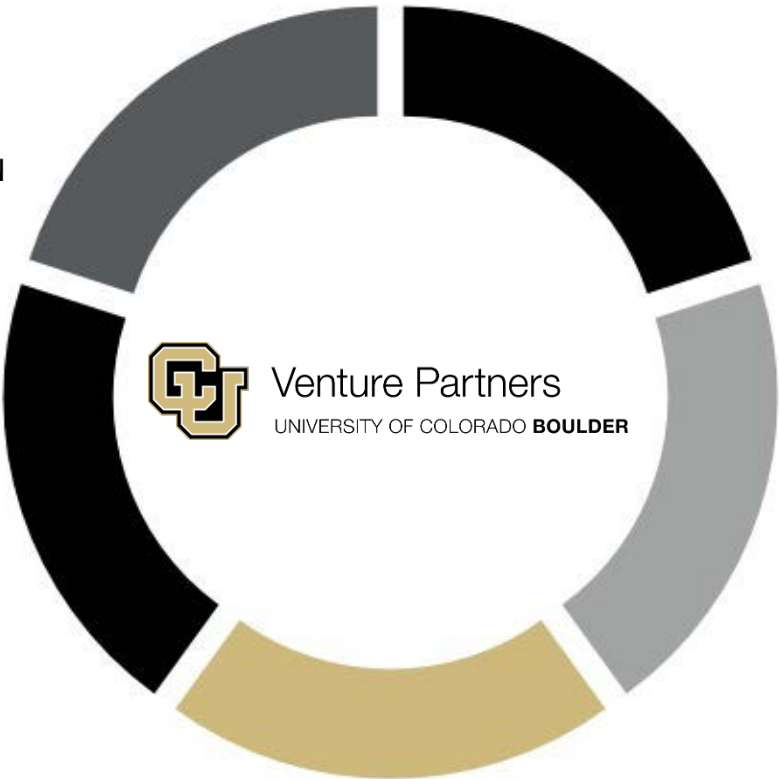
# Venture Partners

UNIVERSITY OF COLORADO **BOULDER**

Dipika Singh  
Senior Licensing Manager  
March 11, 2020



# Mindset

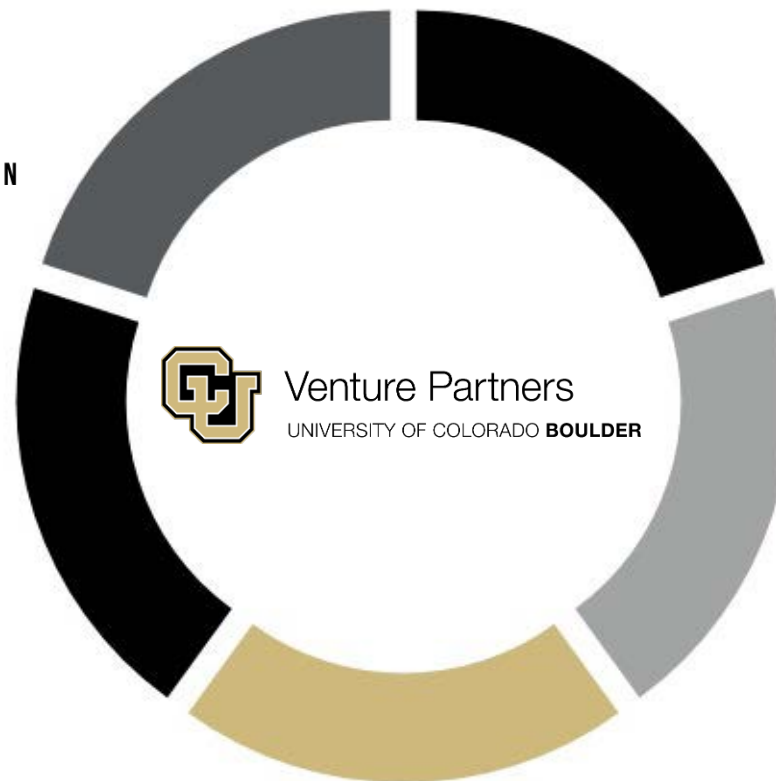




# Mindset



# Managing IP







# Mindset



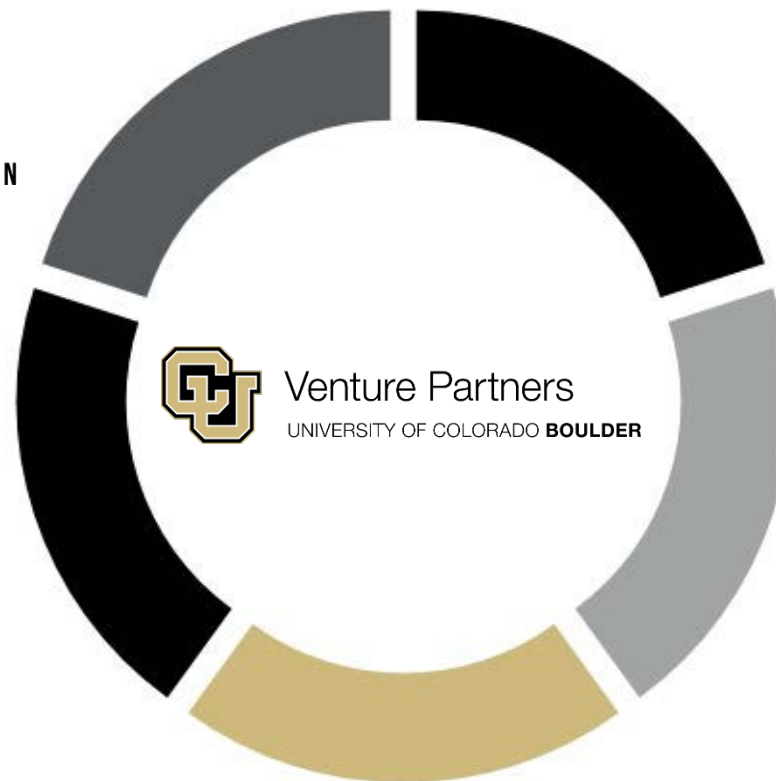
# Managing IP



# Mentorship



# Money





# Mindset



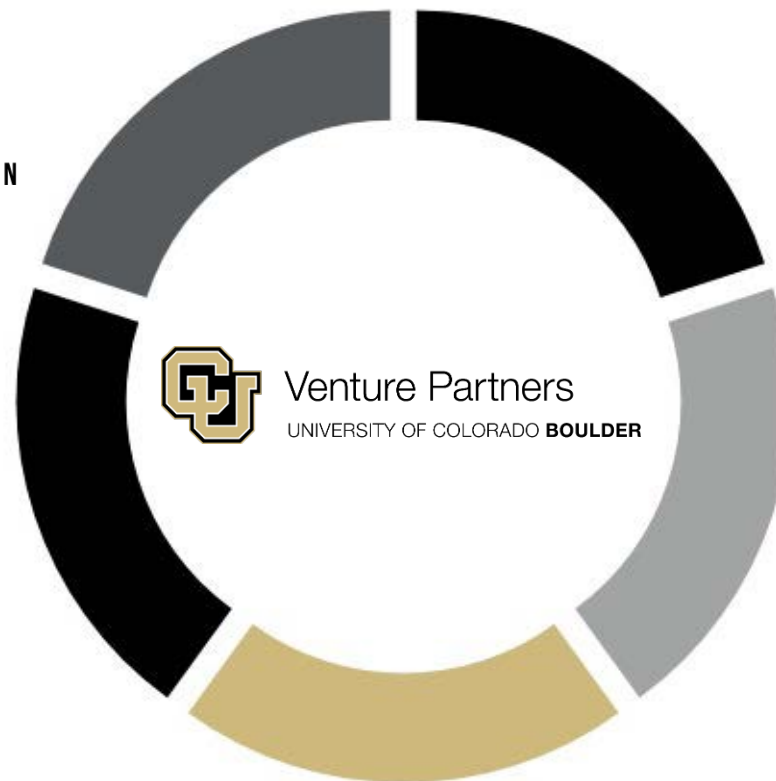
# Managing IP



# Mentorship



# Money





Mindset



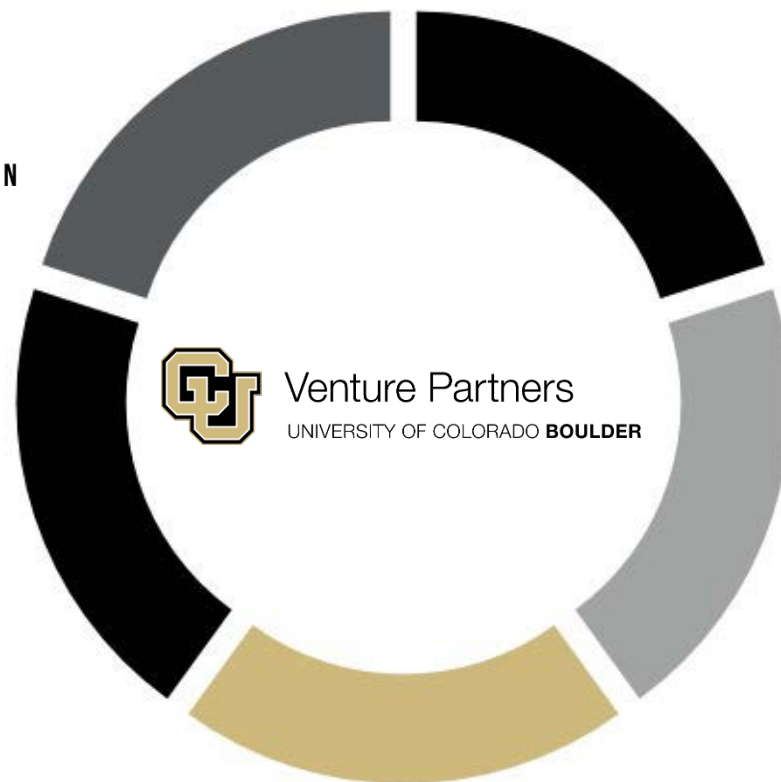
Managing IP



Matching



Mentorship



Money





# Venture Partners

UNIVERSITY OF COLORADO **BOULDER**

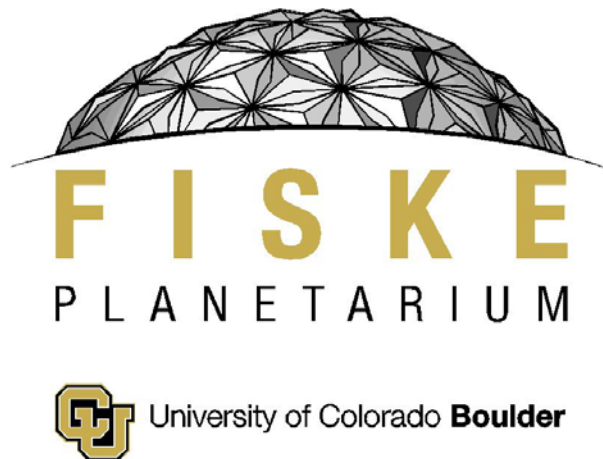
<https://www.colorado.edu/venturepartners/>

Dipika Singh

dipika.singh@colorado.edu

303-735-1109





**John Keller, PhD**

**Director, Fiske Planetarium**

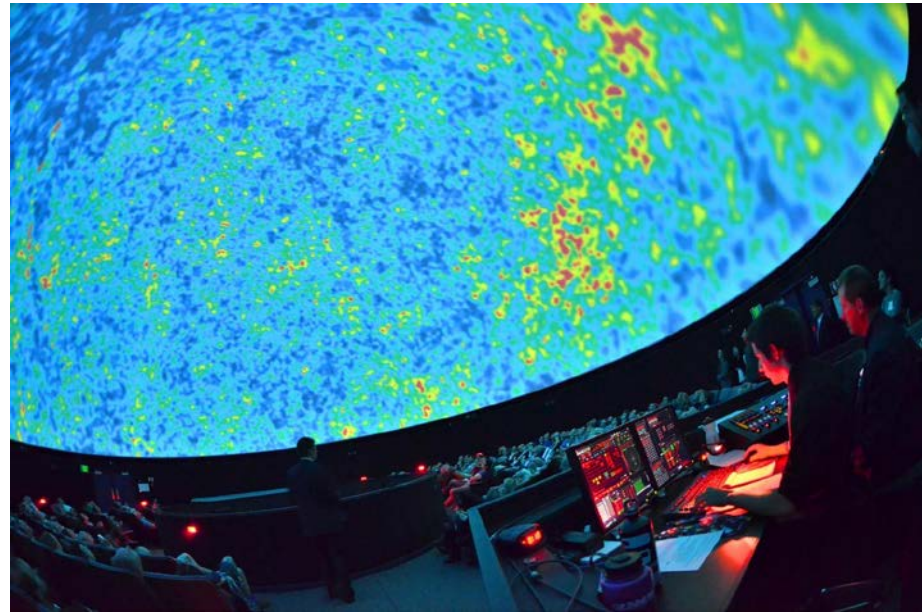
**Astrophysical and Planetary Sciences**

**[john.m.keller@colorado.edu](mailto:john.m.keller@colorado.edu)**

**<https://www.colorado.edu/fiske>**

# Fiske Planetarium

- Largest Dome btw Chicago and Los Angeles (65-foot diameter seats 206)
- State-of-the-Art Digital Projection System (8Kx8K full dome at 60 fps)
- Plus MegaStar Projector (10 million stars and Milky Way)
- Lounge with Science on a Sphere and Solar Physics Exhibits
- Eight fulltime staff and ~40 student staff (education, production, events)

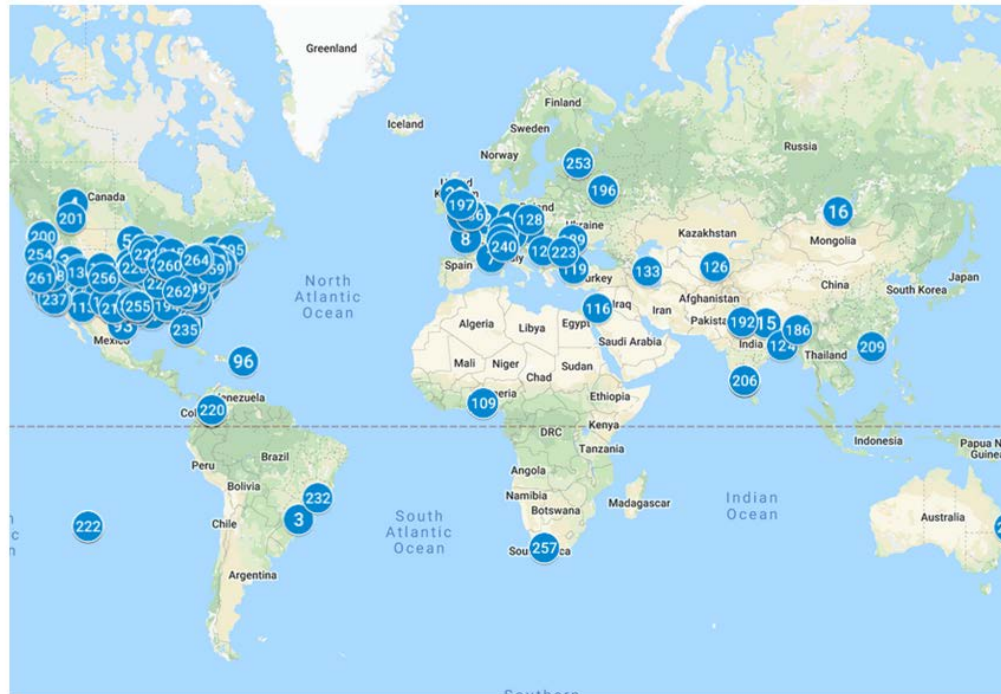




# Broader Impacts Examples

- NASA Explorations Award – 5-minute fulldome short films
- NASA Lunar Explorations Film – 25-minute fulldome film
- NASA Drive Center Award – Science on a Sphere vs. fulldome visualizations
- NSF MOSAIC Mission – Three 25-minute fulldome films from Arctic
- VOYAGERS! Musical – Live fulldome musical production opening March 13

As of June 2019, videos produced at Fiske under a NASA grant  
are being shown in at least 264 planetariums worldwide!



# **Be Immersed. Be Engaged. Be Inspired.**

## **FISKE PLANETARIUM**

Looking forward to partnering with you!!

john.m.keller@colorado.edu

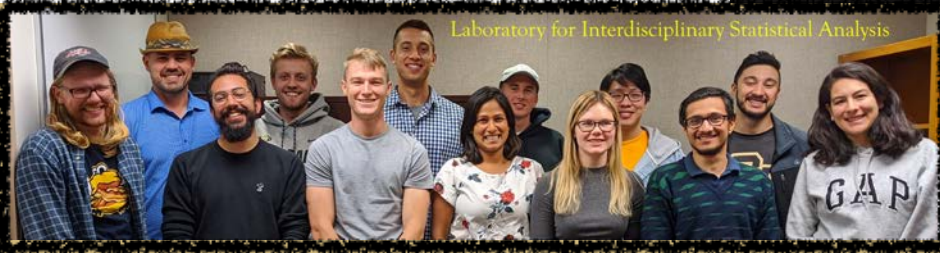
<https://www.colorado.edu/fiske>







# Laboratory for Interdisciplinary Statistical Analysis



## LISA helps CU researchers benefit from applying **Statistics + Data Science**

- Designing Experiments or Surveys •
- Visualizing and Modeling Data •
- Interpreting Results • Writing Manuscripts •
- Using Software •

## Collaboration

Request a meeting for personalized statistical  
advice: [www.colorado.edu/lab/lisa](http://www.colorado.edu/lab/lisa)

For best results ... *Meet with LISA **before** collecting your data.*

All services are **FREE** for CU researchers. We assist with research—not class projects or homework.

## Short Courses

Designed to help grad students apply  
statistics in their research. Open to all.

### “Statistics in Python Short Course Series”

**10AM-noon in Norlin E206**

Jan 22: “Python Data Wrangling”

Jan 29: “Intro to Machine Learning with Scikit-learn”

Feb 5: “Building Neural Networks with Keras”

### “Coding in R Workshop Series” with CRDDS

**10AM-noon in Norlin E206**

Feb 12: “R, Level 0”

Feb 19: “Intro to R”

Feb 26: “Data Visualization in R”

Mar 4: “Statistical Analysis in R”

Mar 11: “Geospatial Analysis in R”

Mar 18: “Text Analysis in R”

Apr 1: “Social Network Analysis in R”

Apr 8: “Parallel Computing with R”

## Walk-in

LISA Statistics Walk-in Hours held every Tues &  
Thurs from 12-2PM in Norlin Library E206



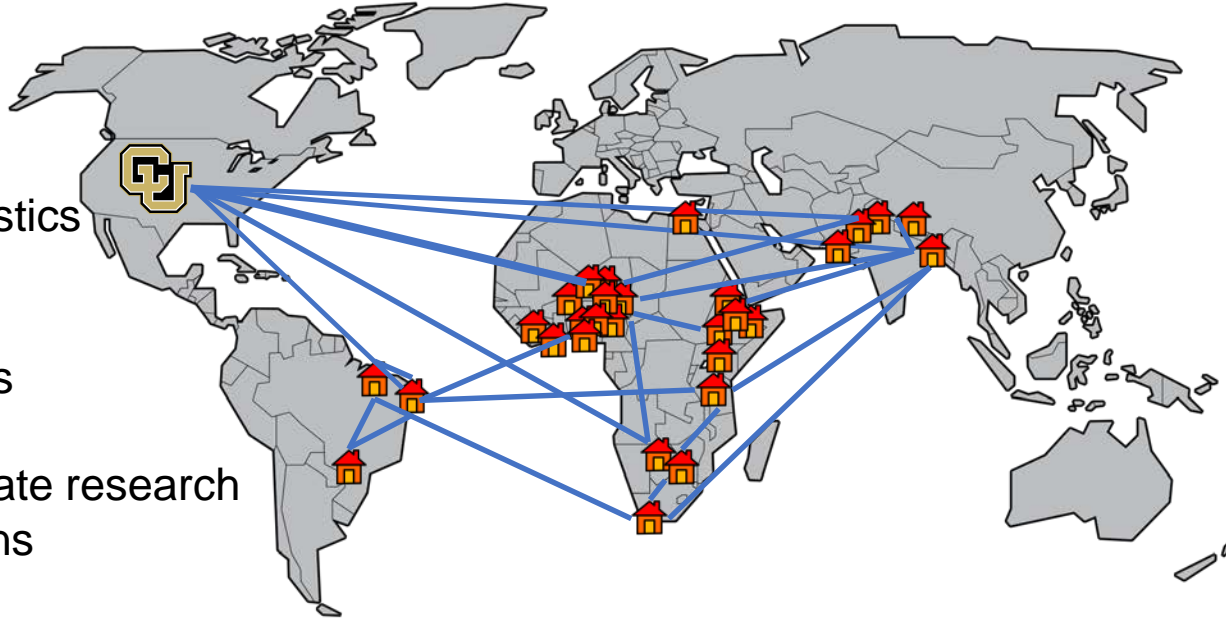
University of Colorado **Boulder**

[www.colorado.edu/lab/lisa](http://www.colorado.edu/lab/lisa)

# LISA 2020 is a Global Network of >18 Stat Labs

## Broader Impacts

- On-the-ground, local statistics and data science capacity
- Student/faculty exchanges
- Infrastructure to disseminate research findings in developing regions
- Short courses and workshops

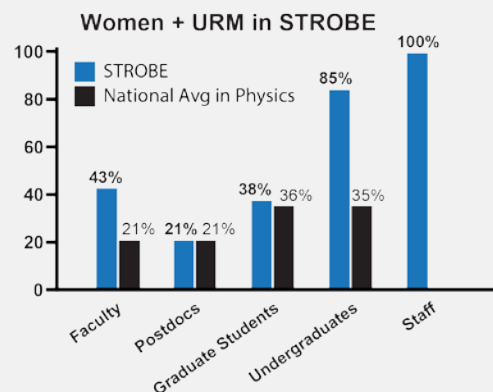


Please join us for a World Statistics Day celebration of the  
Year of Women in Statistics and Data Science and  
the LISA 2020 Network on October 20, 2020

## Building and sustaining a diverse STROBE community



- Best practices for recruitment and persistence
- Role models
- Professional development for long-term STEM career success
- Social and academic integration



## Integrated Education and Research



- Diverse leadership team
- Team-oriented projects
- New transdisciplinary curricula
- Inclusion of trainees in all programming and activities



## Pathways



- Expert informed K-12 outreach
- NGSS teacher training
- Student exchanges between multiple nodes
- Mentoring training







Program  
Evaluator

Informal  
Educator

1 PhD level  
Cognitive  
Psychologist

3 PhD level  
scientist



K-12 Educator

University  
Instructor

Environmental  
Designer

Science Writer

Social Media  
Expert

## **CIRES - Cooperative Institute for Research in Environmental Sciences Education & Outreach Program**



**Contact:**

[Anne.U.Gold@Colorado.edu](mailto:Anne.U.Gold@Colorado.edu)

<http://cires.colorado.edu/outreach/>

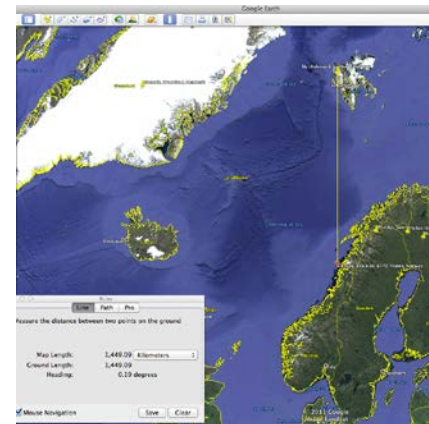
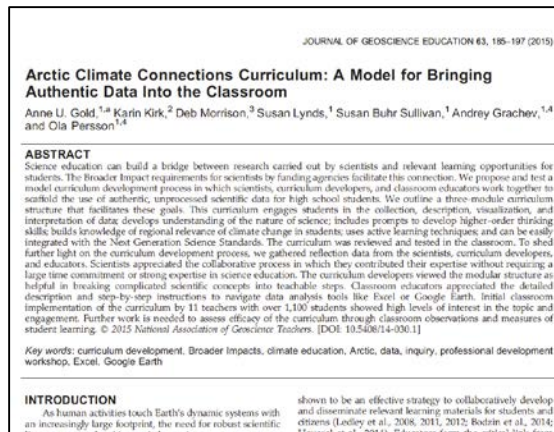




# NSF Broader Impact



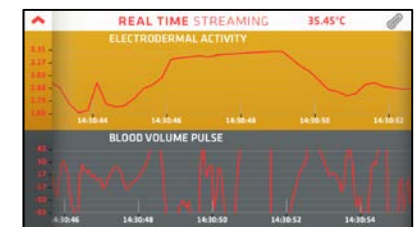
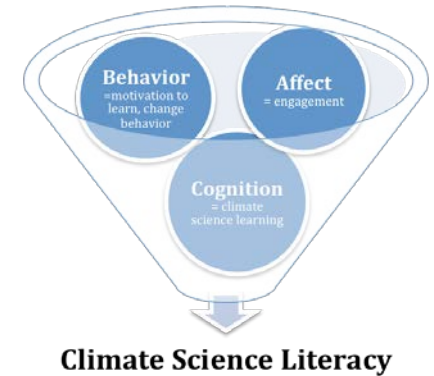
- Educator workshop
- Curriculum using authentic data
- Journal publication, Presentations
- MOOCs





# NSF CAREER Education Component

- Educational videos & curriculum
- Educational research
- Opportunity for grad students





**Evaluation** is a “systematic investigation of the worth or merit of an object.”

*NSF evaluation handbook*

## Why?

- Monitor quality
- Gather evidence on impact
- Document results
- Provide publishable data





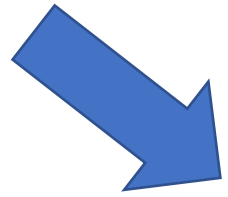
**Front-End  
Evaluation**



**Formative  
Evaluation**







**Front-End  
Evaluation**



**Formative  
Evaluation**

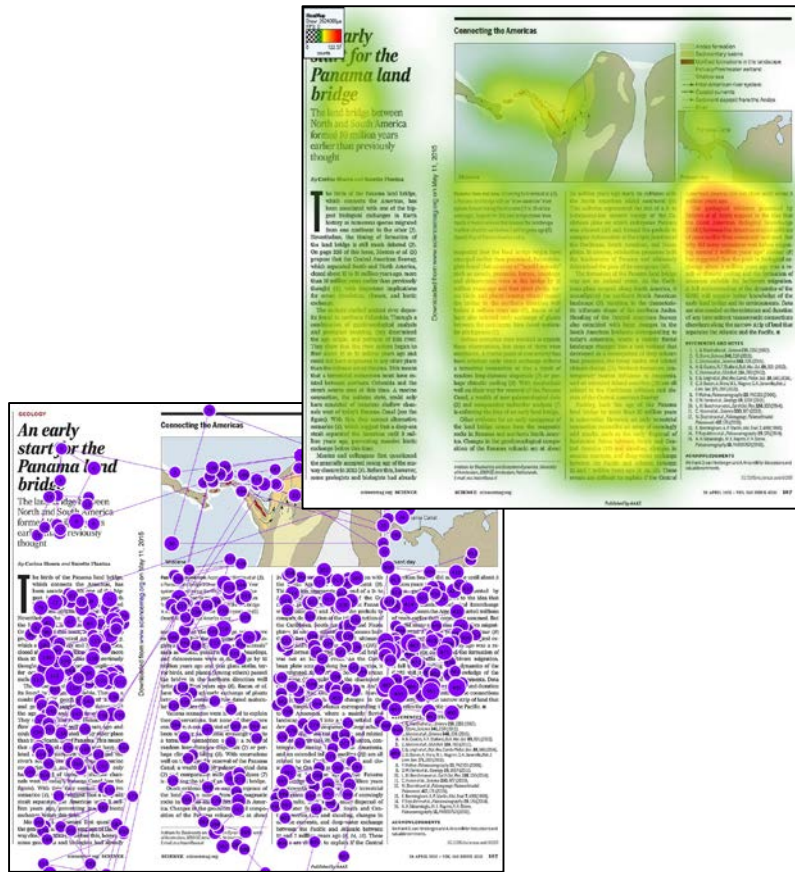



**Summative  
Evaluation**






# Website Evaluation



**Climate.gov**  
science & information for a climate-smart nation



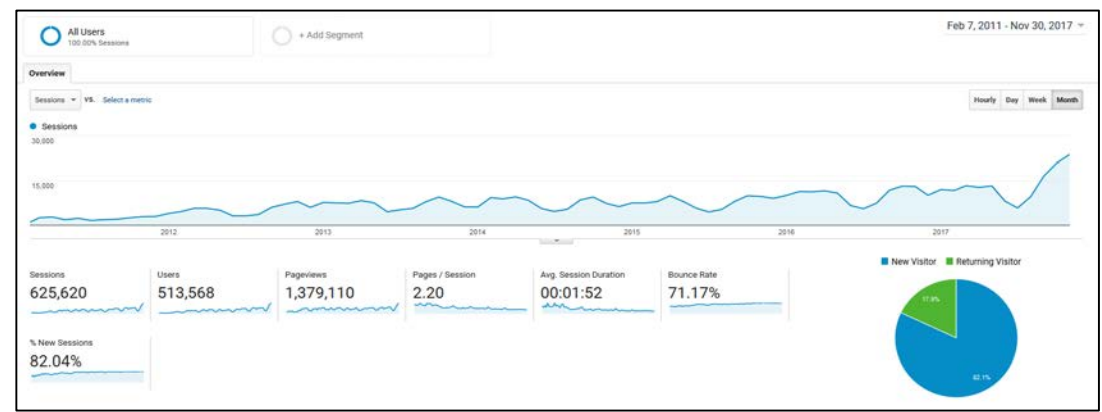
**We want your feedback!**

Thank you for visiting the NOAA Climate.gov website. You have been randomly chosen to take part in a brief survey to let us know what we are doing well and where we can improve. The feedback obtained from this survey will help us enhance our website. Please take a moment to tell us about your experience.

This survey is conducted by an independent company, CFI Group. Your participation is voluntary and your response is anonymous; we are not collecting or storing any personal data.

CONTINUE >>

NO THANKS X



# Interested in evaluation for your BI component or educational research?

**Contact:**

anne.u.gold@colorado.edu





# Faculty Panel Discussion



Research & Innovation Office  
UNIVERSITY OF COLORADO **BOULDER**



# Dr. Alison Cool

Assistant Professor

Anthropology



Research & Innovation Office  
UNIVERSITY OF COLORADO **BOULDER**



# Dr. Zachory Berta-Thompson

Assistant Professor

Astrophysical and Planetary  
Sciences



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**Dr. Alison Cool**



**Dr. Zachory Berta-  
Thompson**

# Questions?



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