From Chemistry to Campus: Advancing Safety Culture Throughout the University

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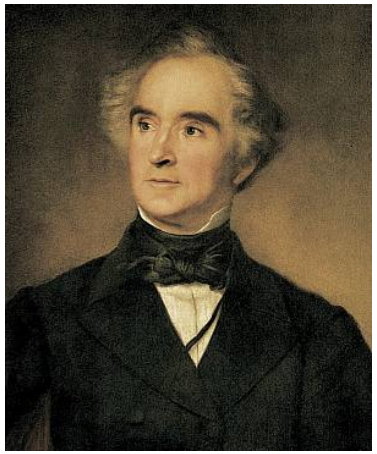
Safety as an Institutional Core Value

- Click to view video

https://www.youtube.com/watch?v=y5K3PEgwjsc

19th Century Cultural Wisdom in Chemistry Through the Ages

"If you want to become a chemist, you will have to ruin your health. If you don't ruin your health studying, you won't accomplish anything these days in chemistry."



Justus Von Liebig
(1803-1873)

Liebig's advice to Kekulé.

Quoted in *Berichle der Deutschen Chemishen Gesellschaft*, **23**, 1890. Trans. W. H. Brock.

F. August Kekulé
(1829-1896)

1980's-1990's Movement on Lab Safety Culture

The "Good Old Days"

- Heroic (kamikaze) attitude of martyrdom for the sake of science.
- Unlimited academic freedom from interference with laboratory operations
- "...accidents are really educational."
- "…a little horseplay is good for morale."
- Disposal: "down the sink, up the stack, or in the trash."

The New "Culture of Safety"

From the first laboratory experience, emphasize and enforce:

- Safety first!!!
- Responsibility for self, neighbors, and environment.
- Accountability to institution and greater society through local, state and national regulatory agencies.
- Line of responsibility from top down and from individual up.

Edward M Arnett, Duke University
Chair, National Research Council Committee
on *Prudent Practices in the Laboratory:*
Handling and disposal of chemicals. 1995

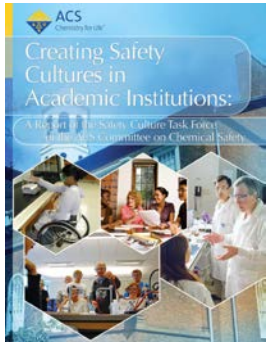
Academic Research Laboratory Safety

Over past 9 years: High consequence incidents (low probability?)

- UCLA (Sheri Sanji: fatality)
- Texas Tech (Preston Brown: loss of 3 fingers, eye perforation)
- Univ of Hawaii (Thea Ekins-Coward; loss of arm)
- Others?

- Reviews by agencies with focus on research laboratory organizations (Cal/OSHA, CSB, UCCLS) - focus primarily on causal analysis of incidents

- Professional society recommendations for organizational and programmatic approaches for enhancement of lab safety culture in academic research (NRC-NAS, ACS, APLU)



Background and Motivation

- Scale of laboratory research activity
  - ~700 Faculty/PIs with ~2500 wet labs across four schools)
  - ~4000 post-docs and professional grad students in academic research labs

- University Committee on Health and Safety focused discussion on lab safety culture issues. Belief that Stanford's research and academic excellence should be mirrored in safety culture excellence

Charge: University Committee on Health and Safety, in collaboration with the VP/Dean of Research, convened a Task Force:

- To evaluate and report on the status of the existing laboratory safety culture at Stanford; and,
- To provide recommendations to advance a strong, positive culture of safety within academic research laboratories at Stanford.

Safety Culture: What is it?

"Culture is manifested in the daily habits, patterns of behavior, traditions and rituals that both reflect a common set of values and provide a means of passing those values down to the next generation."

Safety is important to all of us, but is it richly reflected in our everyday activities?

A "Culture of Excellence" pervades the Stanford academic experience.

The Laboratory Safety Culture Spectrum

Generative
Safety is built into the way we work and think

Proactive
We work on problems that we will find

Calculative
We have systems in place to manage all hazards

Reactive
Safety is important; we do lots of it after every accident

Pathological
Who cares if we aren't caught

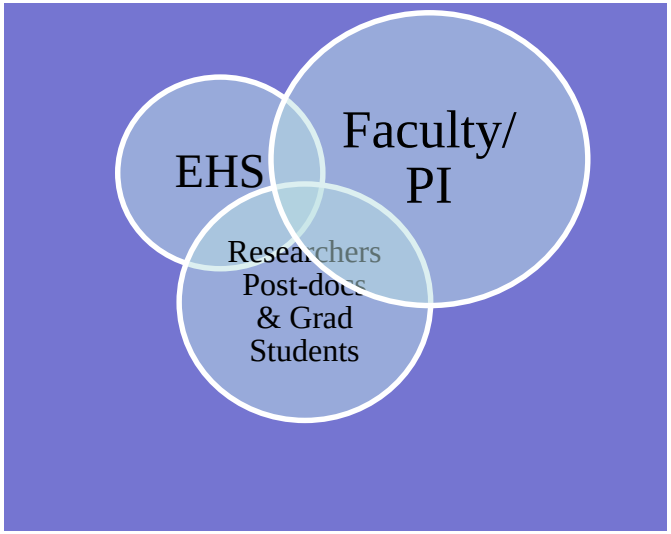
Increasingly informed lab groups with increasing trust and accountability

If not managed and maintained, lab safety culture can move the wrong way

Gibbs: Adapted from Hudson, P. Safety Management and Safety Culture: The Long, Hard and Winding Road (2001)

Areas Needing More Focus to Advance Lab Safety Culture in Academic Research

- Ability to evaluate/measure lab safety climate/culture.
- Better understanding of dynamics within the academic research laboratory – at the bench and within the research working group.
- Interactions between P.I. / Lab Researchers / EH&S.

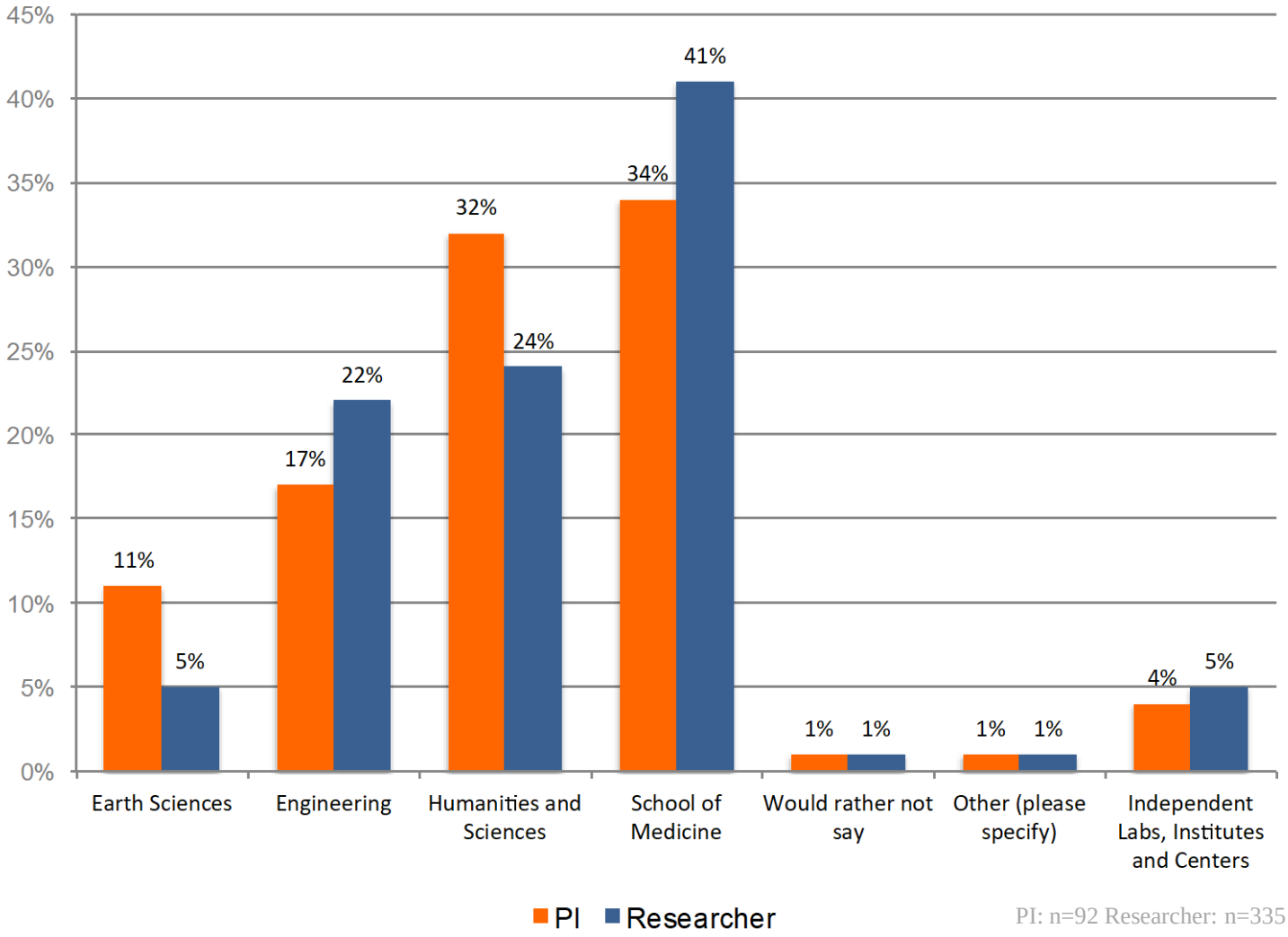


Task Force: Members, Activities, Outreach and Input

- Task Force: 13 members with broad, diverse representation
  - Three faculty co-leaders from chemistry, materials science and medicine
- Task Force meetings (7 meetings over 6 months)
- Stakeholder meetings (8 town hall-style meetings over 4 month period)
  - Bench Researchers
  - EH&S and University Safety Partners
  - Faculty-Principal Investigators
- Task Force Website for online submittals (anonymous, if desired)

- Laboratory Safety Culture Surveys/Palo Alto Research Center (PARC)
  - Principal Investigators (n=97)
  - Researchers (n=364)
- Ethnography review & in-depth, detailed interviews with > 40 PIs and grad students/post-docs from research laboratories (PARC)

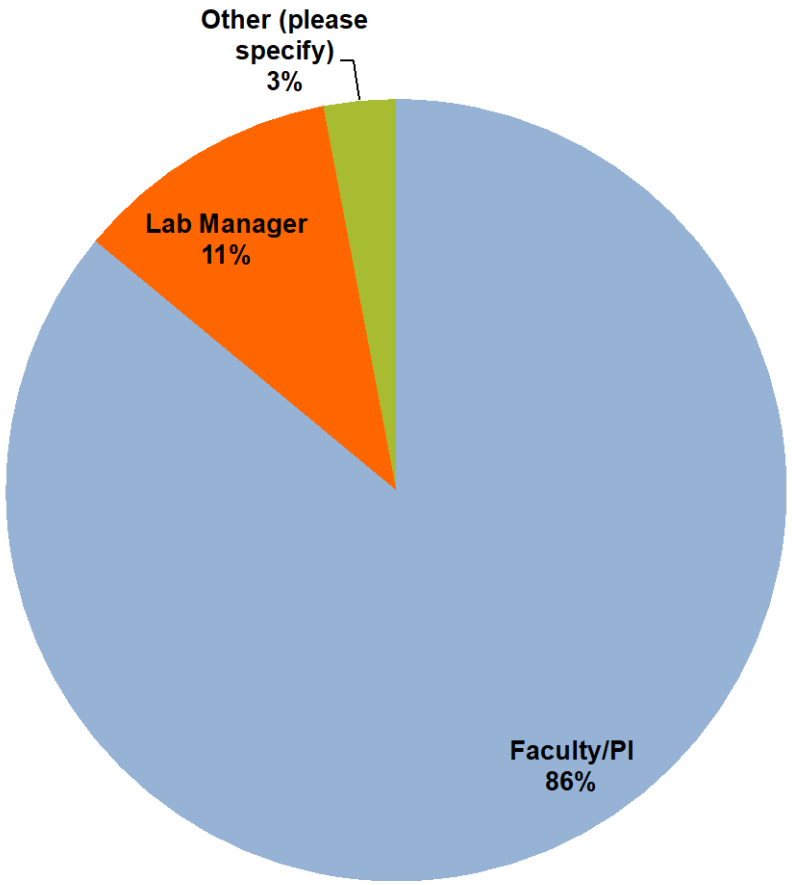
Respondent profile: by lab research school



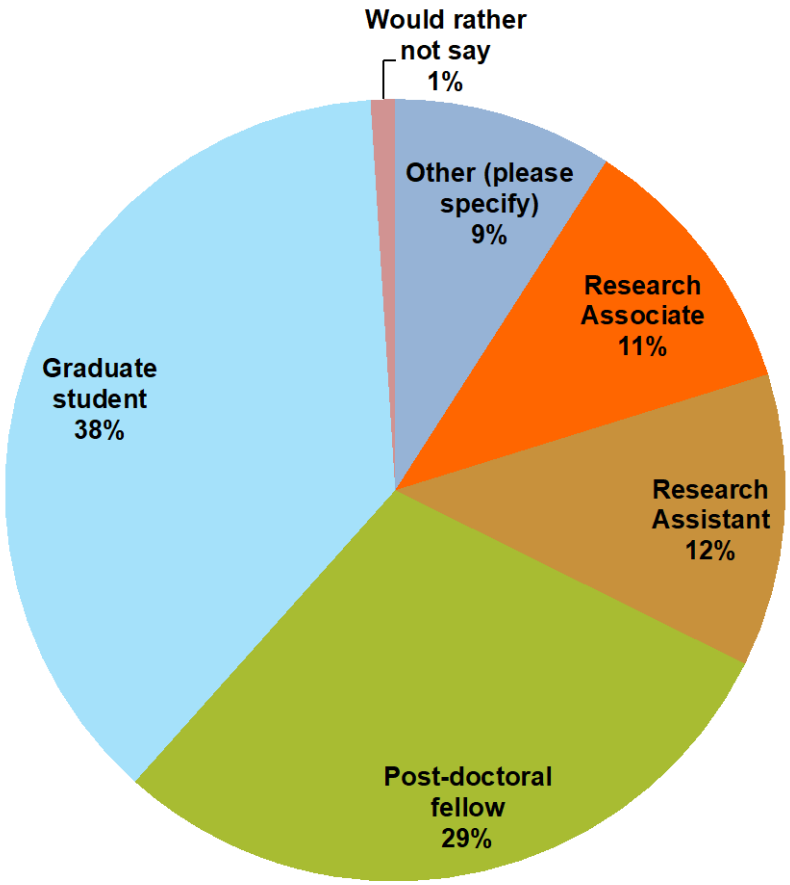
PI: n=92 Researcher: n=335

Q: In what school do you work? (If more than one, select primary)

Respondent profile: research role



PI survey

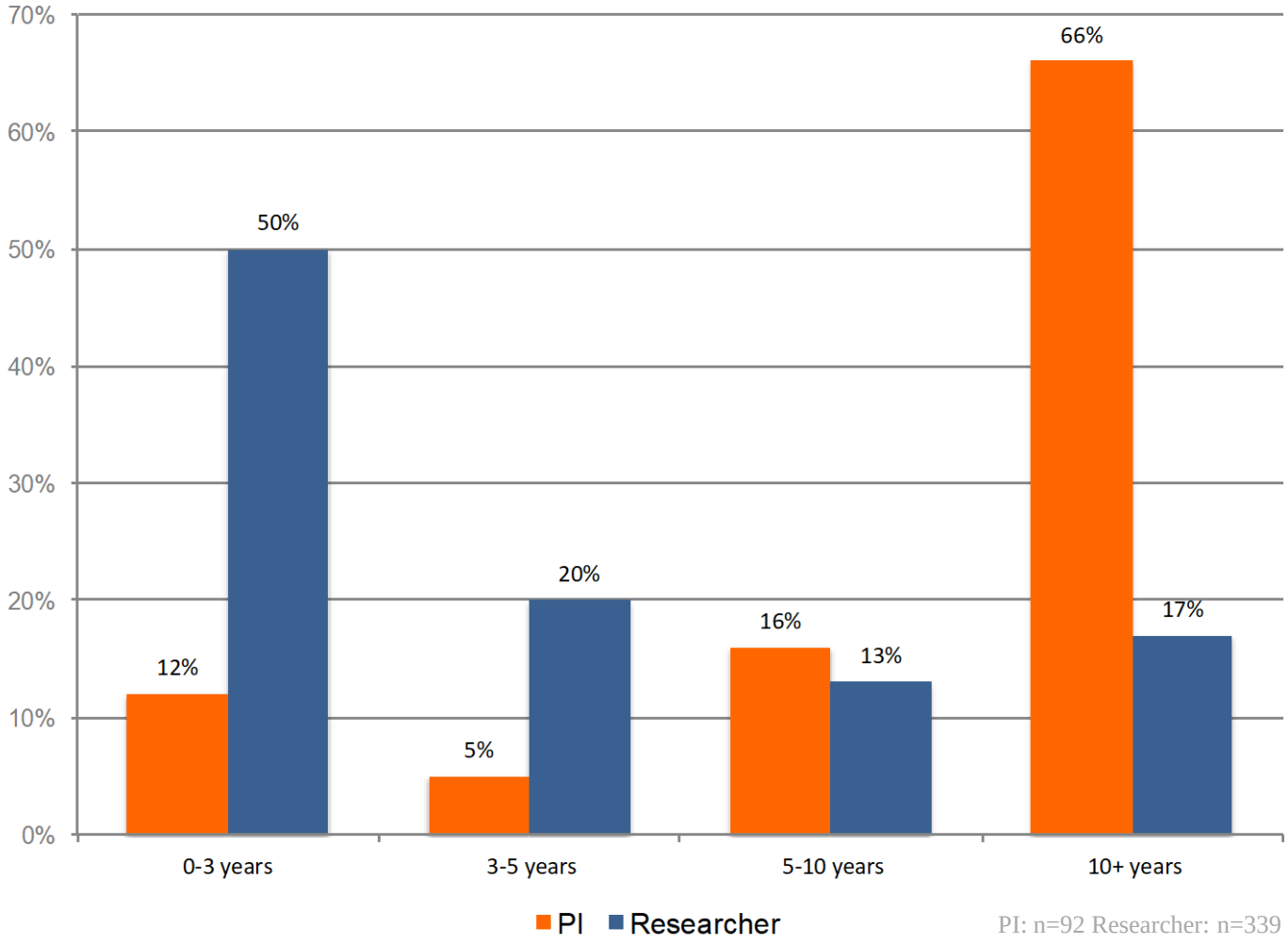


Researcher survey

Q: What is your role?

PI: n=91 Researcher: n=340

Respondent profile: years at Stanford



PI: n=92 Researcher: n=339

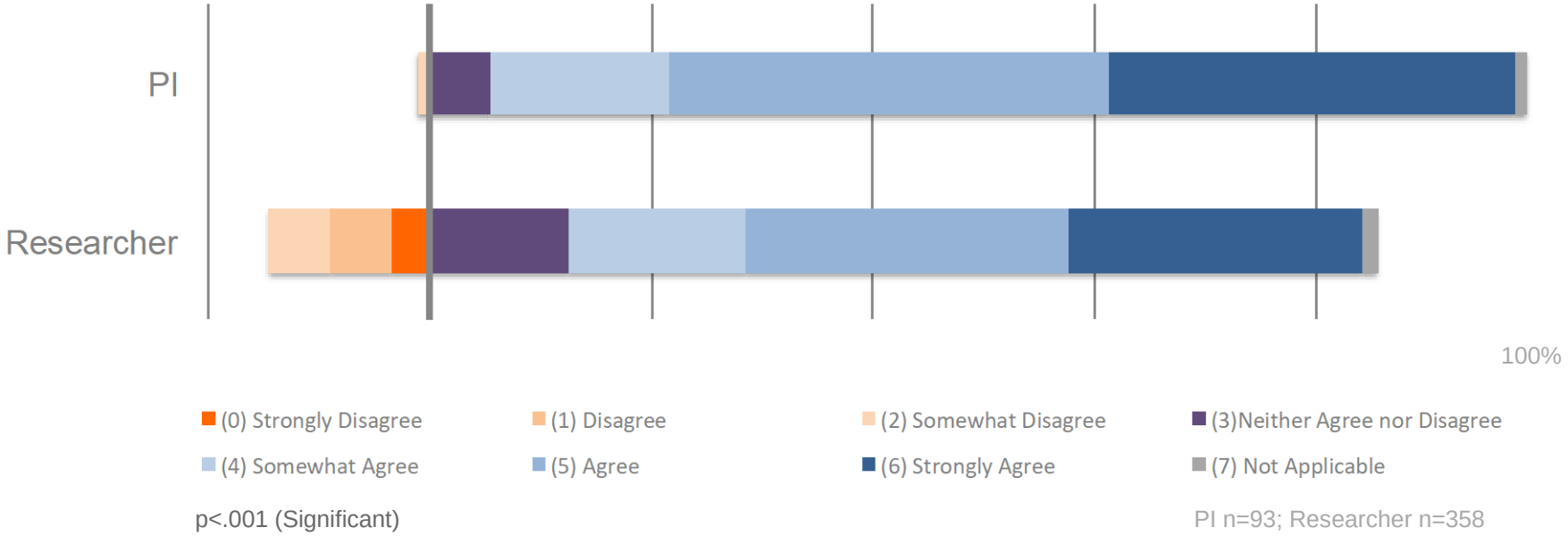
Q: How many years have you been at Stanford?

Lab Safety Culture Survey: Major Findings

Respondents (PIs and researchers) generally feel that they work safely and that their laboratory environment is safe. However:

- Approximately 5-10% of researchers did not agree with the statement that safety procedures in their labs are adequate and that their PIs are concerned about safety.
- 28% of researchers disagreed with the statement “In our lab, safety is the highest priority” compared to <5% of PIs.
- A proportionally small, but significant number of researchers say there is pressure to finish a project even though safety may be compromised.

28% of bench researchers did not agree that safety is not the highest priority in



p<.001 (Significant)

PI n=93; Researcher n=358

Analysis: The question was phrased exactly the same for both groups, and there is statistically significant difference between the two groups. While mostly positive, it should give us pause that 28% of the researchers do not "agree" with this statement, but answer neutral or disagree.

Q; In our lab, safety is the highest priority

PI and Lab Researcher Ethnography Review: Findings

- PIs receive no education on “how to run a safe group”; most perpetuate practices from the lab culture where they learned.
- Even PIs who make safety a priority in their lab often do not enforce safety on a daily basis, and lab practices can be far from optimal.
- Laboratories with permanent research staff (often lab managers) have an easier time managing day-to-day safe laboratory practices.
- In most groups, researchers work with great autonomy and do not call each other out on safety violations when observed.
- While EH&S is seen by many as helpful, it does not regularly enforce safe practices locally or determine laboratory safety culture.
- Infrastructure—layout, space, desk/bench space location—has an undeniable impact on the safety practices in a building; in many newer buildings safety in design seems to have been an afterthought.
- The EH&S website is widely viewed as in need of major overhaul!

Identification of Lab Safety Culture Attributes

Good practices supporting a strong, positive lab safety culture

1. Laboratory research group organizational dynamics
2. Working behavior within the laboratory
3. Communication about safety within the laboratory
4. Environmental health and safety programs
5. Institutional and organizational attitudes about laboratory safety

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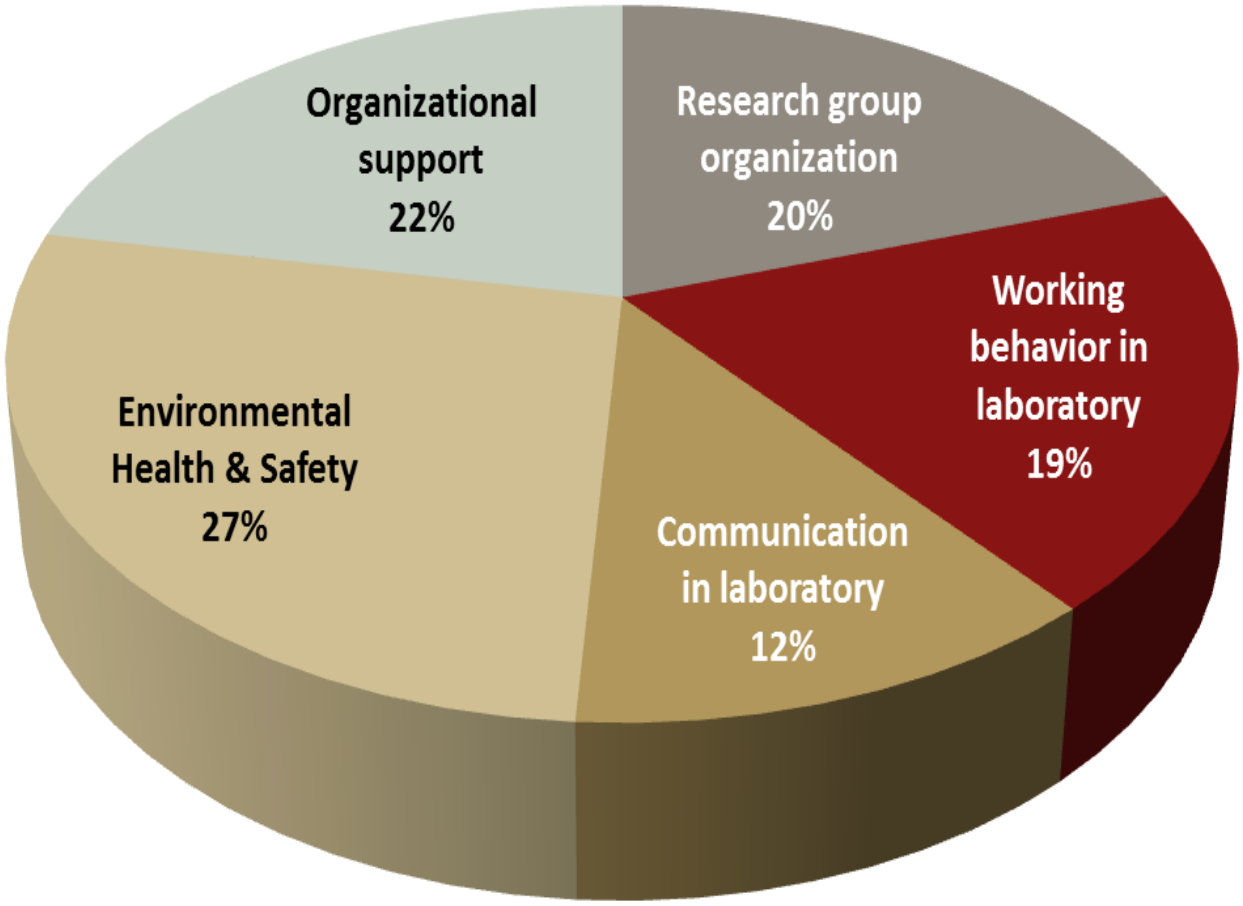
Information and input review mapped to attributes

Distribution of town hall and online submittal comments aligned by Laboratory Safety Culture Attribute category (N=383)



Task Force Recommendations

22 task force recommendations also aligned within the 5 general safety culture attribute areas:

1. **Laboratory research group organizational dynamics (3)**
2. **Working behavior within the laboratory (7)**
3. **Communication about Safety within the laboratory (5)**
4. **Environmental Health and Safety Programs (4)**
5. **Institutional and organizational attitudes about laboratory safety (3)**

Task Force Report Summary

Stanford is a world leader in scientific research. This culture of excellence is not as evident in the habits and behaviors that define Stanford's Lab Safety Culture.

Safety is critical in the responsible conduct of research

- Education – next generation of thought leaders
- Faculty – robust safety culture keeps minor incidents minor
- Institutionally – accidents are not common, but can be devastating

"This will be an ongoing effort – this report is solely the start of a conversation!"

Robert Waymouth, Task Force Co-Chair

Task Force Report to Stanford Faculty Senate

Fostering a Safety Culture within Stanford Labs

- Click to view video

https://www.youtube.com/watch?v=v5agbBf360I

Lab Safety Culture Advancement: Next Steps

- EHS Modern Website Development/ Stanford Safety Portal Resource – development completed
- Faculty/PI onboarding and support - involvement with Provost's office of faculty development
- Lab Safety Coordinator Support and Recognition Program
- Enhancing technical support capability for research laboratories
  - EH&S personnel that understand both the research topic and EHS
  - goal to integrate/automate hazard and risk analysis and safety into the research process
- Produce a better institutional product; graduates and post-docs better prepared to manage labs safely

Examples of programs addressing Task Force Recommendations

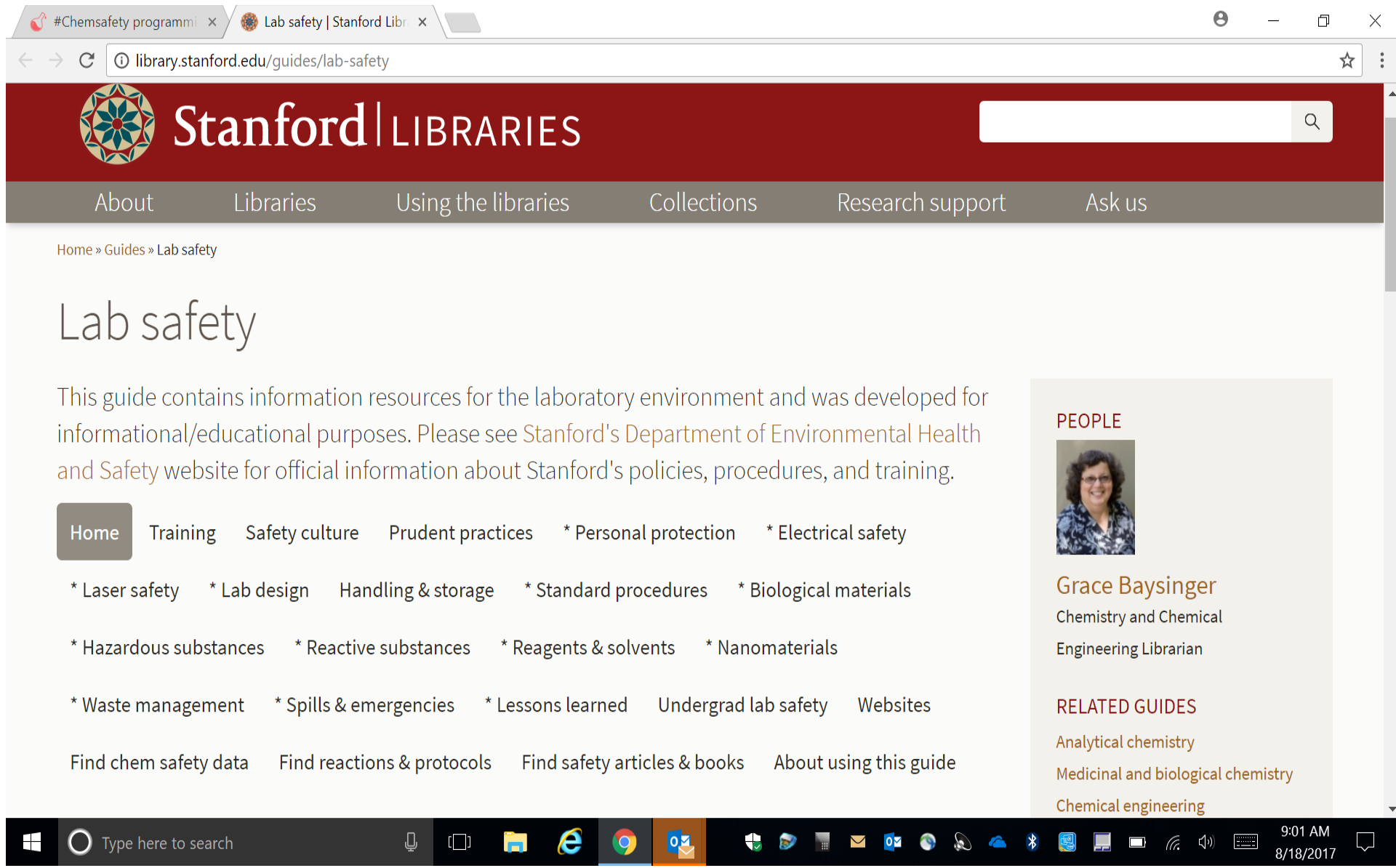
Task Force Recommendations*

Safety Culture Initiatives	*Lab group dynamics*			*Lab Working behavior*							*Safety Communication in Lab*					*EH&S Programs*				*Organizational Attitudes*				
	safety culture developed and supported by PI	safety culture outreach/information for current and new PIs	PIs show safety is a top priority	researchers conduct risk assessments	onboarding process for new researchers	training for short-term/transient researchers	LSCs designated	EH&S support for LSCs	revised PPE program	reviewed/updated research lab design	PIs facilitate open safety communication	EH&S develop safety communication best practices	explore new/hands-on forms of safety outreach & training	non-punitive incident and near-miss reporting	examine and update online and classroom training	redesign the EH&S website	laboratory safety inspection tools	more personal contact with bench researchers	training that supports lab safety culture	leadership promotes and reinforces health & safety policy	promote safety roles, responsibilities, and authorities	centralized funding support for safety (esp. PPE)	customer service and research mission support	reduces administrative burden
9. Revised PPE Program				●	●	●			●												●		●	
10. Risk Assessment Tools				●	●														●				●	
11. Standard Operating Procedures (SOPs)				●	●	●						●				●					●		●	
12. Incident Response and "Lessons Learned"														●									●	
13. Updated Lab Standards and Design Guide										●														
14. Lab Specific Training Templates			●		●	●			●										●		●		●	●
15. Safety Manual Revisions	●	●				●															●		●	
16. Local Biosafety Plans				●	●	●																		
17. Assignment of Laboratory Safety Tasks		●		●																				
18. SWEEPS																		●					●	
19. Surplus Chemical Program																							●	●
20. Lab Cleanout Program																							●	●
21. ProtectSU																							●	●
22. Risk and Hazard Mitigation Fund																						●		●
23. Lab Coat Program (Cintas)									●													●	●	
24. Safety Eyewear Program									●													●	●	
25. EHS Office Hours in Independent Labs																		●					●	

Integrating Safety as an Institutional Core Value?

- Explicit Institutional Policy – President\Provost offices
  - "…safety is a core value at Stanford University…"
  - Clear roles and responsibilities related to role of principal investigators for safety
  - University Provost and Vice Provost for Research – video
- Human Resources
  - Job Description Work Standard: "Promote culture of safety - Demonstrates commitment to personal responsibility and value for safety; communicates safety concerns; uses and promotes safe behaviors based on training and lessons learned."
  - Performance evaluation standard: "Promote culture of safety"
- Institutional Internal Audit Function
  - Management audits of research/laboratory departments includes review of management program elements for laboratory safety in sampling of labs
    - Chemical/lab safety plan developed
    - PPE risk assessment for the lab completed
- Departmental safety committees – active
- EH&S Strategic Plan – focus on research safety as priority
- Stanford Libraries - Section dedicated to Laboratory Safety

Stanford Libraries Section on Lab Safety



Safety Culture to Campus: Case study

Dining Services (by the numbers)	Student Housing	Auxiliary Services
~750 faculty and staff on meal plan	Five million square feet of campus residential space	Stanford Guest House@SLAC
~9,000 graduate and undergraduate students on meal plan	360 different housing facilities	Campus Catering
~18,000 meals provided at 22 dining locations daily	Serves ~11,000 students and their families every year	Campus eateries

CY2012

- Injury incidence – 18% of SU total
- Workers' compensation (WC) direct losses – 26% of SU total
- Highest lost time case rate

Proposal to collaborate on integrating a robust safety culture as part of "Culture of Excellence" vision

SU Organization	Percentage of cases w/ ≥ 5 lost work days
Residential and Dining Enterprises *Stanford Dining* *Student Housing* *Hospitality and Auxiliaries*	40%
Department A	36%
Department B	25%
Department C	29%
Stanford University	24%

Residential & Dining Enterprises
STANFORD UNIVERSITY
Creating a Culture of Excellence

Injury Type	% of total R&DE Injuries
Strain Injury	39%
Slip, Trip, Or Fall	19%
Cuts	10%
Burns	8%
All others	24%
Total	100%

Focused Safety Risk Reduction Efforts – 2013/2015

- R&DE-wide
  - Development of Safety Task Force
  - Focus groups to assess local safety culture
  - Scheduling of "safety week" in early 2014
    - Communicate and focus on safety as core value
- Within operational units
  - Formulation of operational safety rules
  - PPE programs (slip-resistant shoes and cut gloves)
  - Safety suggestion boxes
  - Ergonomic evaluations of higher-risk activities
- EH&S safety assessment of Dining units, Housing Units, and Maintenance Shops
  - Each unit provided action plan of corrective measures
  - Enhanced supervisor training
  - Development of supervisory tools (e.g. disciplinary notices re: safety PPE)

R&DE Safety Risk Reduction Framework – CY 2014

Engage all levels of staff on safety involvement:
- Training
- Adherence to safe work practices and procedures
- Prompt incident reporting and follow-up
- Local safety communication

Survey individual work units:
- Verify safe practices/procedures in place
- ID opportunities to improve safety management
- Set timelines for implementing identified corrective actions

- CY2014 R&DE-wide WC claims - ⇩22% from CY 2013
- WC direct costs - ⇩57%
- Lost time claims - ⇩38%
  - Claims with ≥5 lost days - ⇩39%
- Injury types - Decreases in all injury categories, most notably in strains and cuts

Stakeholder Collaboration is Critical in Moving Forward

- EHS staff
- Faculty/Principal Investigators
- Lab Managers
- Lab Safety Coordinators
- University Safety Partners
- Senior University Leaders (Deans, Dept Chairs, etc.)

Safety Culture at Stanford

Vision:

- World leader in scientific research and lab safety culture.
- Safety promoted as a core value from the day students and researchers arrive.
- Better prepared researchers able to influence others throughout their professional careers.

Opportunity:

"For Stanford to advance lab safety culture to parallel achievements in other campus endeavors and make Stanford safer --- and a model for others."

ACS-DCHAS Award Program Review and Validation Team

DCHAS members Stephanie Gangano and Stephen Hemperly site visit to review and validate Stanford's nomination and programs

Areas of Award Program Evaluation

1. Institutional Safety Policy
2. Chemical hygiene plans for instructional laboratories
3. Evidence of incorporation of safety concepts and sources of information into the curriculum:
   a. Student rules
   b. examinations safety course offerings
   c. Seminars on safety topics
   d. Results of safety research
   e. Other
4. Chemical waste guidelines, documents and statistics
5. Storage: written policies and description of procedures
6. Prep room: chemical hygiene plan, general policy and procedures.
7. Waste minimization: policy, practice, incorporation into curriculum
8. Faculty development: seminars, workshops, production of videotapes, slides, etc.
9. Laboratories and chemical use areas: conditions
   a. Ventilation
   b. Housekeeping
   c. Supervision
   d. Security
   e. Emergency Equipment
   f. Personal Protective Equipment
10. Accident reports: maintenance, analysis, use

Thank you

With gratitude and appreciation to the many Stanford collaborators and contributors:

- Russell Furr, Director of Research Safety and Deputy Director for EH&S
- Mary Dougherty, EH&S Manager for Laboratory Safety
- Bob Waymouth, Professor of Chemistry and co-chair of Lab Safety Culture Task Force
- P.J. Utz, MD, Professor of Medicine and co-chair of Lab Safety Culture Task Force
- Bruce Clemens, Professor of Materials Science and co-chair of Lab Safety Culture Task Force