Developing a Culture of Safety in Biomedical Research

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NIGMS
Do You Know the Name Sheri Sangji?
Sheri Sangji’s Death Led to Criminal Charges against the PI and UCLA and to the Formation of the UC Center for Laboratory Safety

10 years after Sheri Sangji’s death, are academic labs any safer?

Chemists discuss their efforts

by Julian Kemery
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On Dec. 29, 2006, Sherinha “Sheri” Sangji was working on a chemical synthesis in a lab at the University of California, Los Angeles. One of the reagents she was using was lithium(nitromethyl) (nBuLi), which ignites spontaneously in air. It was likely only the second time she had handled such a hazardous substance. She had graduated from college a few months earlier and was working in the lab as a staff scientist while applying to law schools.

She was transferring a total of 160 mL of nBuLi solution using a 60 mL plastic syringe, according to her lab notebook. For unknown reasons, the plunger came out of the syringe barrel and the nBuLi was exposed to the atmosphere. The nBuLi ignited, along with Sangji’s clothes. She wore nitrite gloves, no lab coat, and possibly no eye protection. A lab mate attempted to use a lab coat to smother the fire, then started pouring water on Sangji from a nearby sink.

“She clothing from the waist up was largely burned off, and large blisters were forming on her abdomen and hands—the skin seemed to be separating from her hands,” the lab supervisor, chemistry professor Patrick Horan, later recalled for investigators. Sangji died from her injuries on Jan. 16, 2009. She was 23 years old.

The California Division of Occupational Safety and Health fined UCLA $31,875 for workplace safety violations leading to Sangji’s death. The Los Angeles County District Attorney charged the University of California system and Harvard for felony violations of California labor laws. Both cases settled.

The UC Center for Laboratory Safety (UCCLS) was created to improve the practice of laboratory safety through the performance of scientific research and implementation of best safety practices in the laboratory. The Center operates under the oversight of the UC Center for Laboratory Safety Advisory Board with technical support from the UCLA Office of Environment, Health and Safety.

The UC Center for Laboratory Safety White Paper can be viewed here.

CENTER NEWS

Workshop on Laboratory Safety
Our 2020 Workshop on Laboratory Safety will be hosted at UCLA, May 3-5. Visit our event page for more information.

A series of Lessons Learned have been published in the Journal of Chemical Health and Safety

- Lessons learned - Mercury thermometer incident. New
- Lessons learned - Organic peroxide incident. New
- Lessons learned - Vacuum pump fire. New

Proceedings of the 2016 workshop Safety by Design - Improving safety in research laboratories

E. Czornyj, D. Newcomer, J. Schroeder, N. Wayne, C.A. Meric, 2018, J Chem Health and Safety

The report summarizes the major outcomes of the 2016 Workshop on Laboratory Safety and describes specific actions to improve laboratory safety culture. Read more.

The UC Center for Laboratory Safety and Associate Vice Chancellor for Research Nancy Wayne received National Awards for Promoting Laboratory Safety

The UC Center for Laboratory Safety received the 2017 Innovation Award of Honor from the Campus Safety, Health and Environmental Management Association (CSHEMA) for promoting laboratory safety at UCLA. Nancy Wayne, an associate Vice Chancellor for Research, was honored with a 2017 Campus Leader Who Cares Award of Honor. Read more.

Accident Investigation UH Manoa

UCCLS conducted an investigation of the March 16, 2016 explosion in a laboratory at the University of Hawaii at Manoa. UCCLS reports on the accident were released by UH Manoa. View the report on the Technical Analysis of the Accident and Recommendations for Improvements in UH Laboratory Safety Programs. The results of the forensic tests can be viewed here.

Webinar on APLU Guidelines and Toolkit

UCCLS together with BioRAFT organized a webinar on how the APLU Guidelines and Toolkit can be implemented in academic institutions. View here.
2006 Liquid Nitrogen Tank Explosion at Texas A&M

- Liquid N$_2$ tank’s pressure release valves sealed at some point in the past
- Led to catastrophic failure in the middle of the night
- Destroyed the lab, blew out windows and door, blew hole in the floor, turned floor tiles into shrapnel, shot the tank into the mechanical room on the floor above
2016 University of Hawaii Explosion

- Bioenergy researchers growing bacteria under atmospheres containing H₂ and O₂
- Small detonation “sentinel event”
- In scaled up experiment, static electricity ignited gas mixture leading to tank explosion
- Postdoc lost arm and suffered other serious injury
Some Other Tragic Lab Accidents in Recent Years

- University of Chicago researcher working with attenuated strain of *Yersinia pestis* gets infected and dies
  - Strain was compromised in its ability to take up iron, but researcher had hemochromatosis
  - CDC investigation cited “inconsistent use of gloves” as a likely factor
- Yale student killed when hair became caught in lathe while working alone at night

“But UCCLS, which was founded at UC Los Angeles in the aftermath of the Sangji catastrophe, notes in the report that many other institutions also tolerate poor safety cultures and practices. It therefore fittingly intends its report to also “serve as a direct call to action for researchers, administrators and [Environmental Health and Safety Office] staff not only at the UH, but at all institutions of higher education that conduct research.”
Some Other Tragic Lab Accidents in Recent Years

Emilie Jaumain in 2010, the year she was exposed to prions during a lab accident. She died in 2019 at age 35. ARMEL HOUEL

France issues moratorium on prion research after fatal brain disease strikes two lab workers

By Barbara Casassus | Jul. 28, 2021, 4:35 AM
What to do?

Language in all NIGMS training FOAs, e.g.:

- **Program Considerations:** “Additionally, safety in research training should encompass (1) environments free from harassment and intimidation, in which everyone participating is treated in a respectful and supportive manner, (2) laboratory and clinical settings where individuals exercise the highest standards of practice for chemical, biological and physical safety, and (3) practices at the institutional leadership and research community levels that demonstrate core values and behaviors to emphasize safety over competing goals.”

- **Institutional Letter:** “ensures that the research and clinical facilities as well as the laboratory and clinical practices promote the safety of trainees…”

- **Review Criteria:** “Is the mechanism for ensuring that the trainees are learning the highest standards of practice in biomedical research (e.g., record keeping and safety) robust? Will the Participating Faculty teach laboratory safety throughout the didactic and mentored portions of the program? Is there a clear institutional commitment to develop and promote a culture in which the highest standards of safety, scientific rigor, reproducibility, and responsible conduct of research are advanced? Is there evidence that the research facilities and laboratory practices ensure the safety of trainees?”
What to do?

- Had a plenary presentation at the NIGMS Training, Workforce Development and Diversity Program Directors’ meeting about laboratory safety
  - Craig Merlic, Ph.D., UC Center for Laboratory Safety
  - Most highly rated session at the meeting!

- Providing administrative supplements to NIGMS training grants to develop new curricular activities related to safety
What to do?

- R25s for safety training modules
  - NOT-GM-20-047 (PAR-20-296)
- Create a clearinghouse on the NIGMS website for links to safety training materials
  - https://www.nigms.nih.gov/research-training/resources/laboratory-safety-and-guidelines
- Encourage programs to teach to industry standards
- Partner with professional societies?
ACS has been a leader on lab safety including new policies for its journals

ACS journals enact new safety policy

Authors to be required to address novel or significant hazards

By Jyllian Kemsley

American Chemical Society journals will have a new safety reporting requirement starting in 2017: Authors must “address and emphasize any unexpected, new, and/or significant hazards or risks associated with the reported work,” says an ACS Central Science editorial describing the change (2016, DOI: 10.1021/acscentsci.6b00341).

ACS Publications editors and staff took a closer look at how the journals addressed safety after a “confluence of events” that included high-profile accidents and a survey of safety policies of chemical journals (J. Chem. Health Saf. 2016, DOI: 10.1016/j.jchas.2015.10.001), says Sarah Tegen, vice president for global editorial and author services at ACS. ACS also publishes C&EN.
Use Our Bully Pulpit (and Our Policies and $$$)

New NIGMS Web Resource on Safety in the Lab and Other Training Environments

BY DR. JON LORSCH

© comments

The safety of trainees and other lab workers from accidents, violence, harassment, and inappropriate behavior is a high priority for NIGMS. Because the Institute has such a large training and workforce development portfolio, we feel that we should play a central role in promoting the development of a robust culture of safety in biomedical research training environments.

All new funding opportunity announcements (FOAs) for training programs supported by the National Institute of General Medical Sciences (NIGMS) contain the expectation that the programs will promote "salutary, safe, and supportive scientific and training environments. This is not content, the need for a safe, supportive learning environment is an implicit part of the FOA and our mission."

In the program, we focus on the lab work environment, with a great emphasis on training and research. We also mean that institutions should ensure that their campuses are as safe as possible so that individuals can focus on a productive learning environment. This includes a safe and healthy campus environment and a culture of respect and inclusion. In the program, we focus on the lab work environment, with an emphasis on training and research. We also mean that institutions should ensure that their campuses are as safe as possible so that individuals can focus on a productive learning environment. This includes a safe and healthy campus environment and a culture of respect and inclusion.

DEVELOPING A CULTURE OF SAFETY IN BIOLOGICAL RESEARCH TRAINING

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ABSTRACT: The National Institute of General Medical Sciences (NIGMS) at the U.S. National Institutes of Health (NIH) is committed to supporting the safety of the nation's biomedical research workforce. To foster a culture of safety, NIGMS has developed a series of policy changes and educational initiatives that have broad influence across all of NIH's institutes, resulting from good standing points for its initial efforts to promote the development and maintenance of robust cultures of safety at U.S. academic institutions. In this Perspective, we focus on laboratory safety, although many of the strategies we describe for improving laboratory safety are also applicable to other forms of safety including the prevention of harassment, intimidation, and discrimination. We frame the problem of laboratory safety using a number of recent examples of tragic accidents, highlight some of the lessons that have been learned from these and other events, discuss what NIGMS is doing to address problems related to laboratory safety, and outline steps that institutions can take to improve their safety culture.

RECENT LABORATORY ACCIDENTS: SOME TRAGIC EXAMPLES

In November 2004, a liquid nitrogen tank that had been improperly made to use its pressurized release (presumably because the vent had been damaged) exploded in the middle of the night at a lab at Texas A&M University in College Station. In Texas A&M University in College Station. Two employees died and 13 others were injured.

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Teach Students to Do Hazard Assessments as Part of Experimental Design

| Educate Yourself | Establish Experimental Protocol | Identify Safety Concerns | Create Standard Operating Procedures |
|------------------|--------------------------------|--------------------------|--------------------------------------|
| Participate in safety training (required and elective, lab-specific, online) | **Step 1**<br>a) Equipment<br>b) Reagents<br>c) Manipulations | Research the hazards:<br>- Accident and near-miss reports<br>- Safety Data Sheets<br>- EH&S bulletins<br>- Literature & web searches<br>Conduct “What If” analysis & brainstorming | Write out what to do *and what not to do* at each step of the protocol to minimize risks |
| Survey the research environment - identify hazards and the type & location of safety equipment | **Step 2**<br>a) Equipment<br>b) Reagents<br>c) Manipulations | Annotate protocol: hazards at each step | Develop contingency plans in case of an accident |
| Learn lab-specific safety procedures | | | Get feedback from experts |

**SAFETY FIRST**

Think Safe... Work Safe... Be Safe
Teach Students to Question Their Assumptions
Bring Core Facilities into the Teaching Mission of the Institution?

- Core facilities could be incorporated into lecture-based and active-learning courses
- Could teach best practices
- Could introduce students to the cores available for research, safety practices, SOPs, rigorous practices, etc. at the same time
- Allows cores to provide additional value to institution
Institutions
Values and behaviors emphasize safety and respect

- Inclusive, supportive environments free from harassment and intimidation
- Strong culture of safety in laboratory and clinical settings
  - Laboratory and clinical leadership exemplify and reinforce the culture of safety
  - Individuals practice the highest standards for safety
  - Collaborative working relationships among Health and Safety Officials, leadership, scientists, and clinicians
- Safety training and oversight permeate all aspects of the enterprise
  - Hazards assessments are routine and pervasive
  - Near miss accidents are widely reported, analyzed, and used to catalyze change

Training program funding announcements emphasize safety – required in the training plan and part of the scored review criteria

Supplements to training awards to develop a culture of safety and to create safe, supportive, and inclusive research training environments

Funding announcement to develop training modules freely available to the community

Promote safety through webpages, webinars, and meetings for training directors
Questions or Comments?