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 Keaveny
DECEMBER 28, 2020 | APPEARED IN VOLUME 97, ISSUE 1

On Dec. 28, 2008, Sherin Ababneh “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 tert-butyllithium (tBuLi), 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 school.

She was transferring a total of 160 mL of tBuLi 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 tBuLi was exposed to the atmosphere. The tBuLi ignited, along with Sangji’s clothes. She wore nitrile 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.

“Her 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 Horan for felony violations of California labor laws. Both cases settled.
2006 Liquid Nitrogen Tank Explosion at Texas A&M

- Liquid N\textsubscript{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

Émilie Jaumain in 2010, the year she was exposed to prions during a lab accident. She died in 2019 at age 33. 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
- 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

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.

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Developing a culture of safety in biomedical 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. Ensuring the safety of trainees is our top priority. NIGMS has a broad influence across its parent institutes, rolling from good starting points for our 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.
Teach Students to Do Hazard Assessments as Part of Experimental Design

Educate Yourself
- Participate in safety training (required and elective, lab-specific, online)
- Survey the research environment - identify hazards and the type & location of safety equipment
- Learn lab-specific safety procedures

Establish Experimental Protocol
- **Step 1**
  - a) Equipment
  - b) Reagents
  - c) Manipulations
- **Step 2**
  - a) Equipment
  - b) Reagents
  - c) Manipulations
  - ...
  - ...

Identify Safety Concerns
- Research the hazards:
  - Accident and near-miss reports
  - Safety Data Sheets
  - EH&S bulletins
  - Literature & web searches
  - Conduct “What If” analysis & brainstorming
- Annotate protocol: hazards at each step

Create Standard Operating Procedures
- Write out what to do *and what not to do* at each step of the protocol to minimize risks
- Develop contingency plans in case of an accident
- Get feedback from experts
- Test, review, revise

**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?