

Let's Talk About Safety: Open Communication for Safer Laboratories

A growing chorus is calling for a change in the way we approach chemical safety in academia. At the national level, a committee of leading academic and industrial researchers, formed in 2014 by the National Research Council of the National Academies of Science, concluded that a strong, positive safety culture is critical for academic laboratories.¹ Similarly, the American Chemical Society formed a Task Force for Safety Education Guidelines in 2012 and has published new guidelines for safety in academic settings.²

Many of the recommendations for instilling a reinvigorated safety culture revolve around communication—between academic and industrial laboratories, between researchers and health and safety officials, and between research groups. A variety of venues that promote dialogue about safe practices are available, including American Chemical Society initiatives such as *Chemical and Engineering News'* **Safety Letters** and **Safety Zone** blog and online resources for researchers such as **NotVoodoo**. Now is a critical time for the community to build upon—and amplify—these efforts toward continuous improvement of best practices.

None of the above recommendations can be implemented effectively by edict or decree. A bottom-up approach is needed, as the committee reports have recognized and emphasized. It is therefore past time for all academic scientists—faculty, postdoctoral scholars, and students—to join the conversation. A pioneering example comes from the University of Minnesota departments of Chemistry and of Chemical Engineering & Materials Science, which have established a student-run Joint Safety Team aimed at building a collaborative, communicative safety culture from the bottom up.³

In an effort to broaden the discussion on safety within the academic community and beyond, we have created an online resource called The Safety Net (<http://safetynet.web.unc.edu>) (Figure 1). Our goal is to provide a platform for scientists to more openly discuss laboratory safety, by building lines of communication for sharing laboratory procedures between different laboratories. We envision the site as a place to learn about techniques, connect research groups with complementary expertise, and spark conversations about safe practices. We believe these interactions can form an important component of a strong safety culture in individual groups, within departments, between institutions, and across the academic–industrial aisle. In fact, many academic–industrial collaborations already organically result in additional safety training and dialogue for students and individual research groups.

The Safety Net public site has focused on a curated collection of standard operating procedures (SOPs) from the Miller group at the University of North Carolina at Chapel Hill, and the Tonks group at the University of Minnesota, Twin Cities. Topics range from how to keep a lab notebook to how to approach purifying organometallic complexes and how to work with high-pressure reactions. We want to emphasize that being transparent about how we carry out research is a critical factor in our continued effort to improve academic lab safety.

For example, by posting our SOPs and eliciting feedback, we envision that we can iterate and innovate, improving as a research community. An online form is available for anyone to submit a SOP, and we wish to encourage the broader community to contribute to this resource. Additional safety resources include laboratory signage, links to synthetic procedures that address prior safety concerns, and links to collections of physical properties. Long-term goals for The Safety Net include more outside participation to generate a larger library of SOPs, new content driven by researchers in other areas of chemistry, and a public forum for dialogue on best practices.

Graduate students and postdoctoral scholars create most of the material on The Safety Net site, and the material is vetted by internal peer review. We believe that lasting changes in safety culture need buy-in and leadership from students and postdocs, in addition to strong support from departmental and environmental health and safety leadership.

So where did the inspiration for The Safety Net come from? Our interest in improving lab safety culture goes back to the beginnings of our own scientific careers in the Bercaw group at Caltech. As the group safety officer at the time, Alex felt responsible for ensuring the health and safety of his friends. It was during this time that we learned of Sheri Sangji's death after a laboratory accident at UCLA.⁴ This was a sad and difficult time for many graduate students, and one of our responses after being “on the ground” during this moment of shock for the field was to think more critically about safety in the Bercaw group and beyond.⁵

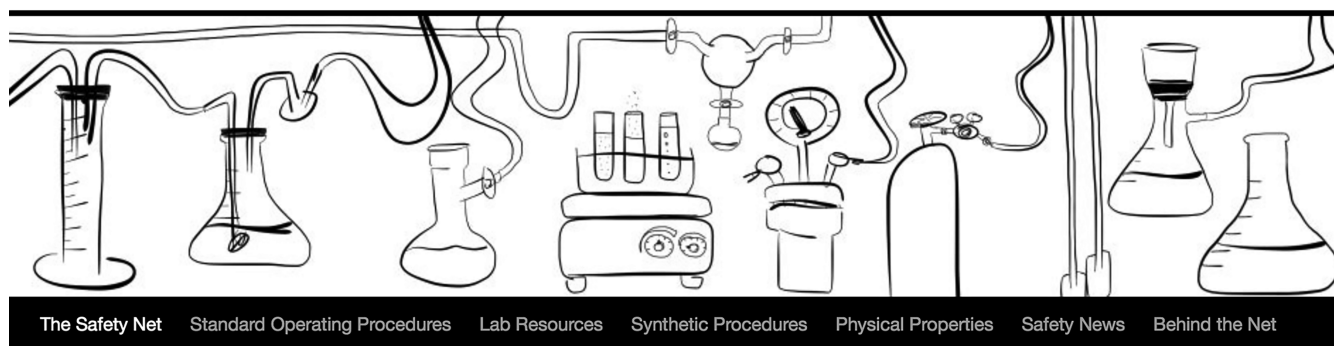
Not long after we started postdoctoral research positions, Ian was involved in a scary lab accident of his own,⁶ bringing the potential risks and hazards in the field to the forefront again. It is heartbreaking to watch a friend extract glass shards from his face and arms. Proper safety training and a deeply ingrained habit of wearing the appropriate protective gear helped prevent a more disastrous result. On the other hand, it became clear that poor communication on the dangers of the reaction within the community was partly to blame for the accident; after the fact, other researchers around the globe related anecdotes about hazardous complications preparing the same compound. If those near-misses and concerns had been shared more widely via a caution statement in a journal publication (as ACS author guidelines encourage), a *C&EN* safety letter, or some other accessible venue, Ian may have chosen a different procedure and avoided an accident.

As a result of these foundational experiences, we were both thinking about how to foster the right safety culture within our groups as a primary objective when we were each starting our independent research laboratories in 2012–2013. Starting a lab provides a unique opportunity to really think carefully about safety, protocol, and culture and set the right tone from day one. However, we realized that there is not an obvious resource to help academics get started when it comes to safe practices.

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The Safety Net

Safety knows no season.



The Safety Net Standard Operating Procedures Lab Resources Synthetic Procedures Physical Properties Safety News Behind the Net

Figure 1. Banner of The Safety Net showing the different sections and resources available. Accessed <http://safety.net.web.unc.edu> on July 5, 2018.

For us, it was helpful to talk with people, bouncing ideas around with friends and colleagues and having open discussions with our research groups. This informal communication was a great way to share ideas. For example, Ian related the successful implementation of Safe Operating Cards (SOCs) at Minnesota to Alex, which inspired Alex to pilot the use of these reusable information cards in his group and eventually share the model across UNC (Figure 2).⁷

Safety Starts with U Reaction: _____	
Contact: _____	Intended Conditions: T: _____ P: _____ Stirring: _____ Other: _____
Hazards <input type="checkbox"/> Acid <input type="checkbox"/> Base <input type="checkbox"/> Oxidizer <input type="checkbox"/> Flammable <input type="checkbox"/> Mercury or Heavy Metal <input type="checkbox"/> Reactive Air, Water, Shock, Light, Heat, halogens, <input type="checkbox"/> Inhalation Hazard <input type="checkbox"/> Toxic	<input type="checkbox"/> Low Hazard <input type="checkbox"/> Biohazard <input type="checkbox"/> Radioactive <input type="checkbox"/> Temp Hi/Lo <input type="checkbox"/> Pressure Hi/Lo
Emergency Shut Down: _____ _____ _____ _____ _____ _____	
<small>Safe operating card http://storage.dow.com.edgesuite.net/safety-dow-com/External-SOC-Form_v060612.pdf UNIVERSITY OF MINNESOTA Driven to Discover™ <small>© 2012 DOW Chemical Company</small></small>	

Figure 2. Example of a Safe Operating Card (SOC) from the University of Minnesota, Twin Cities.

Reflecting on the process of starting our laboratories, we felt there was an opportunity to build a widely accessible resource that could improve communication across academia and strengthen the culture of safe practices in the laboratory. It was in this context that the idea for The Safety Net was hatched. Support for the construction and maintenance of the site comes from the National Science Foundation as part of the educational plan of Alex's CAREER award (CHE-1553802).

The current site is the result of our initial efforts, and it is an invitation for others to join us in the conversation. When we started, we both followed our instincts on doing what we thought was right and what we felt was best. We have come to appreciate that laboratory safety underpins all of the chemistry research, training, and community outreach activities at institutions of higher learning and to recognize that our safety culture grows stronger the more we communicate, bring in

new ideas, and embrace innovation. We don't have all of the answers, but we're happy to talk about safety.



Alex Miller (left) and Ian Tonks (right).

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Notes

Views expressed in this editorial are those of the authors and not necessarily the views of the ACS.

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