

Responsibility as a Foundation of Safety Culture

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ABSTRACT

When researchers strive to do the right thing, rather than just the required thing, a safety culture which embraces personal and communal responsibility emerges. In our experience, building a culture based on responsibility within a research group can complement and enhance institutional safety training.

KEYWORDS

Laboratory safety, liability, responsibility, culture

MAIN TEXT

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A Commentary is, by definition, the opinion of the authors, but the simple act of including a disclaimer introduces a legalistic tone that shifts the readers' perception. A similar shift in perception can occur in chemistry laboratories when a researcher becomes aware of liability risks lurking in the shadows of academic research.

Liability is used here in the legal sense, where the law assigns responsibility to a person or entity. Many chemists had not thought about such liability in the lab, at least not concretely, until the Los Angeles District Attorney's office brought felony charges against Professor Patrick Harran following the death of Sheri Sangji in 2011. That tragic incident has undoubtedly led to significant improvements in academic laboratory safety. Some of the changes surely respond to a sense of wanting to protect the health and safety of researchers, while other changes may well be responses to the specter of liability.

The notion of liability can be uncomfortable or inscrutable for administrators, faculty, and early career researchers alike. Of these, it is the early career researchers who are working in the laboratory space on a daily basis, at the front lines of laboratory safety. Could a graduate student's mistake lead to disruptions due to legal actions against an advisor? Or could a graduate student face legal action themselves? These are scary thoughts, and it is easy to imagine negative impacts when researchers begin worrying about liability.

We experienced one form of liability concern in launching *The Safety Net*, a web resource dedicated to sharing safe operating procedures (SOPs) and other information on safe laboratory practices with the synthetic chemistry community (<http://safetynet.web.unc.edu>). In the

development stages, some faculty suggested that the endeavor was inviting a lawsuit. Some groups were hesitant to post their own group's SOPs on the site for this reason. Other groups suggested that trying to help ensure the safety of researchers should not be a crime. *The Safety Net* eventually launched with the mission of helping chemists work more safely, but also with a lengthy disclaimer.

We have taken an important lesson from this experience with the legal side of chemistry research. When researchers strive to do the right thing — not just the legally or institutionally required thing — a safety culture which embraces personal and communal *responsibility* emerges. While institutionally required safety trainings and infrastructure are essential, in our experience building a culture of responsibility requires additional investment at the research group level. This culture can help scientists spend less time worrying about liability and more time focusing on better safety outcomes.

If we are going to focus on *responsibility* in building team safety cultures, we must first understand what that means. Responsibility in this sense captures the moral obligation to act for the good of others and the community. While liability concerns center on individual legal consequences and accountability, shifting the focus to responsibility highlights a communal safety mindset. Scientists who feel a deep responsibility for working safely are not only more likely to follow the institutional rules; they are also more likely to build a strong safety culture focused on doing the right thing.

In our lab, we have implemented a range of activities to help build a culture where each researcher feels a keen sense of responsibility to ensure the safety of the group. We organize these into three

themes here: communication, teamwork, and defining roles and expectations, each with a few examples of how these themes have evolved in our group.

Communication. Strong communication among researchers is one of the core philosophies we have adopted in nurturing our group safety culture and sense of shared responsibility. To this end, our lab has created and maintains SOPs with instructions, safety notes, and tips for topics such as handling pyrophoric reagents, performing vacuum transfers, and working with carbon monoxide. These are meant to be used in conjunction with training from more experienced labmates and serve as a point of reference with rich historical knowledge for common lab techniques. Communicating this information within our group is an important facet of how we train researchers, and we provide many of these SOPs on *The Safety Net* to aid other scientists in their safety education.

Training is a vital aspect of communication. The group initially envisioned a formalized training flowchart for new students in which there were three chronological steps: (1) watching an experienced research mentor perform a technique, (2) performing the technique under the supervision of that mentor, and (3) explaining the newly learned technique to an expert. The goal of this exercise was to develop proficiency in new skills, but also to foster communication between older and younger students and instill good teaching techniques in all lab members. While formally signing “certificates” of completion for techniques did not gain traction in our lab, a more informal version of the “see—do—teach” teaching/learning philosophy has yielded positive results for trainees.

Additionally, we set aside designated time to discuss safety at our weekly group meetings. Researchers rotate giving an interactive presentation on a safety topic of their choice, guiding the group in a focused safety discussion. Previous topics covered have included specific hazards (e.g. formaldehyde), shipping procedures, chemical spill response, lab security, and glove breakthrough times, among many others. These discussions engage the entire group and invite their input on developing protocols, nurturing the communication around safety that we view as integral to our safety culture.

Teamwork. Teamwork is another tactic important to building a culture of responsibility. It is vital that roles assumed by lab members highlight a fundamental sense of cooperation. This also extends to interactions beyond the group, such as building and maintaining a strong partnership with local environment, health, and safety representatives so that these entities can work together as a team with well-defined roles and responsibilities.

Particularly within lab groups, we would like to highlight the negative effects of the global pandemic on lab teamwork. With shift scheduling to ensure lower lab population density, we went entire months without direct, in-person communication with some colleagues. In conjunction with this, decreased in-lab time compressed the timeline for research goals, creating a sense of urgency which made it difficult to prioritize tasks which would benefit the entire lab community instead of individual projects. We list below two approaches we took to combat these effects of the COVID-19 pandemic and support more teamwork among labmates.

One way that we have encouraged teamwork in the lab is by adopting a “lab tidying” routine where we all set aside an hour per week to work on things that benefit the entire lab. During that time, everyone is working on something to make the lab a more pleasant, functional, and safer environment. Safety tasks such as testing old regulators or doing vacuum pump maintenance become easier when working alongside fellow labmates; taking on tasks as a team helps build camaraderie and cultivates teamwork.

To continue fostering a team environment, this year our lab held a group retreat. Removing ourselves from the daily hubbub provided an opportunity to evaluate what was (or wasn’t!) working within the group. A key goal of the retreat was kindling best practices in team science. We grappled with some hard (but important) questions together: What is the best way for people to communicate with you? What difficult situations have arisen in lab when confronting labmates about safety issues? What tactics are most effective in navigating awkward conversations in lab? Stepping away from the physical lab space helped us come together to think about how we work best as a team.

Clear Roles and Expectations. Defining individual roles and responsibilities has helped strengthen our group’s communal safety efforts. Individual research pressures can easily overshadow community responsibility, so we have found that it takes extra effort to foster a climate of moral responsibility and teamwork that thrives in the midst of competing priorities.

Setting expectations is essential. The “Miller Group Laboratory Manual” was written as a group and is read carefully upon joining the group. One important goal of this document is to establish

expectations, including our commitment to safety and team science. We hope that defining expectations at the start of a researcher's career will form good habits and cultivate a deep sense of the identity to which our research group aspires.

To uphold our expectations, we define roles and responsibilities. For example, in-house documentation on the use of our inert atmosphere gloveboxes contains detailed information on the responsibilities of individual users and the researchers who manage each box. This addresses questions such as whose job it is to replace communal supplies when they run low, train new users, and spearhead equipment repairs. Talking about roles and responsibilities in this formal document helps lay the groundwork for researchers growing responsibility outside of their immediate research goals.

Through initiatives promoting communication, championing teamwork, and defining roles and expectations, we have sought to establish a sense of responsibility for individuals and the broader group. Given that safety considerations infuse everything we do in the group, this responsibility inherently (and explicitly) extends to our safety culture. While each group is different and will find its own useful methods to reinforce the importance of safety responsibility, we argue that developing a culture of responsibility has numerous benefits over a culture driven by fear of liability.

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