Continuing our Zebras or Horses journey on how a false sense of security can lead to lab accidents (see Part I in the Mar 2024 issue), keep in mind that it's easy to judge others' actions in hindsight. This series aims to help us improve our lab safety preparedness. Our research often exposes us to both expected (horses) and unexpected (zebras) risks. Consequently, it is vital that we establish and properly use safety barriers—policies, operating procedures, supervision, and equipment—to mitigate these risks. The following describes an incident where such barriers were not in place.

In Jan. 2010, a Texas Tech University (TTU) chemistry lab experienced a catastrophic incident that would become a hallmark example of poor safety protocols, inadequate lab management, and severely lacking communication.\(^1\) Operating under the “Awareness and Localization of Explosive Related Threats” (ALERT) program funded by the U.S. Department of Homeland Security (DHS), the TTU lab was researching a novel, potentially shock sensitive nickel hydrazine perchlorate (NHP) derivative. Initially, 5th-year graduate student, Preston Brown, was preparing batches of 50-300 mg. But to avoid batch inconsistencies during testing, he decided to scale up the synthesis to 10 g. Aiming to eliminate chunks in the reaction product, Brown placed 5 g of the NHP derivative in a mortar with hexane and stirred with a pestle. Leaving and returning some minutes later without his safety goggles, Brown gave the sample one last stir. The sample detonated unexpectedly, causing Brown to lose three fingers and suffer an eye injury and burns to his face and hands.

Brown's previous research had not been on energetic materials; thus, to him, this work was a zebra. However, one's zebra might be another's horse—you should always seek out knowledgeable sources throughout your work. For Brown, his principal investigators (PIs) should have been those invaluable sources. Yet, they failed to provide him with adequate training, even with the entirely new lab techniques. Instead, Brown was simply instructed to complete an independent literature review of the energetic materials.

In addition, Brown's lab did not perform hazard assessments before synthesizing new compounds or performing new lab techniques, had no documented policies that required researchers to consult with a PI before changing experimental parameters, and had no written operating procedures or rules for working with energetic materials. The PIs relied on verbal communications with the senior graduate students, who in turn were expected to share the information with other group members. Lab activities were poorly documented in lab notebooks (e.g., the amounts of reactants used for each synthesis were not always recorded and entries were not dated). Wearing PPE was made a personal choice based on how dangerous researchers perceived an activity to be. And this list goes on.

As evidenced by the above, the lack of safety awareness in the lab was not limited to the researchers directly involved in this incident. An over-relaxed attitude toward safety extended throughout the lab, pointing to safety oversights that encompassed the administrative levels of the lab, department, and university. The ALERT program also did not require pre-approval of experimental procedures, intending to provide researchers with maximum scientific freedom. Tragically, their lack of supervision was detrimental to the TTU researchers' safety.

This event prompted major changes in how many institutions handle laboratory safety. Strict safety policies have since been implemented, and most now include protocols for establishing accountability in response to safety defects. By engaging in self-reflection and taking corrective actions, we grow in our ability to prevent our zebras from becoming lab accidents.

So, are there things that you, your lab, and your institution could be doing better to prevent your zebras from becoming the next major laboratory incident? For the U.S. Chemical Safety and Hazard Investigation Board's full incident report\(^1\), its consequences and a 10 years later retrospective\(^2\), and a summary of TTU's institutional changes\(^3\), refer to the cited sources.

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2. Eighmy, T., et al. (2020). https://doi.org/10.1021/acs.chas.0c00027
PhD Chemistry candidate Danielle Gomes Rodrigues was initially assigned the role of Lab Safety Officer because she was the sole graduate student in the Meisel Group. Five years later, she has truly made the role her own. Dani is credited with both effectively establishing a culture of safety within her research group and transforming safety practices throughout the GW Chemistry Department. Read the interview transcript to learn about Dani and her role as Safety Officer:

Q: “What do you do as the Safety Officer of your lab?”
A: “It’s my job to be on top of safety data sheets (SDS). I also ensure that all of our safety features are in place, such as by testing eye wash stations, and work with our inventory person to put good safety practices in place.”

Q: “What do you think of this role?”
A: “One thing I appreciate about this role is that we can always continue to improve the safety culture here. I actually carried over a safety feature from my undergraduate research known as an Overnight Reaction Form which is used extensively in our lab and other labs in the department.”

Q: What is the Overnight Reaction Form?
A: “In my undergrad, we had a form that had to be left up whenever a reaction was running. The idea wasn’t mine, it’s pretty standard for most labs. When I got here and we started having other graduate students, if they weren’t in lab and a reaction was running, I had no idea what was in there and no idea what to do if something went wrong. My number would be contacted if something went wrong overnight so I needed to know.”

Q: “What is the most important part of your job?”
A: “The most important part is figuring out a balance where you can talk openly and challenge people in the lab when something unsafe is going on without causing a big problem. The question is always ‘How do you build a good social culture and a good safety culture at the same time?’ I’ve had to stop people from running reactions before and I’ve learned that you have to go about safety stuff very gently. Safety is for everyone’s well-being, and mistakes shouldn’t be punished. We should be emphasizing confidence and safety to raise new, confident generations of chemists.”

Q: “What have you learned as a safety officer? Has this role informed your work as a researcher or changed your practices in the lab? If so, how?”
A: “I’ve personally learned a lot about communication. You turn out to be an example in this role. It puts you in a position where you are a role model to other graduate students and undergrads. I also never realized how regulated things are by outside organizations. At the end of the day, I’m just enforcing what the law requires. Lab safety is all about learning to tolerate these rules, comply with them, and continually educate yourself. It’s okay to not be super pumped about lab safety, but you do have to know it, do it, and create a culture of safety.”

Q: “You said you’ve learned a lot about communication. How do you effectively communicate with your lab mates about best safety practices?”
A: “One thing that I really like about my PI is that he is very safety oriented. It makes my job easier because I’m not always the bad guy. Safety culture has to stem from the PI first and foremost to set the tone for the semester. In my lab, we have a meeting at the beginning of every semester about lab safety which is something I think every lab should do. From then on, you have conversations on a lower level by incorporating safety into everyday discussions. When something is wrong, I typically write an email to let everyone know. I also make sure that safety discussions are happening at every level, whether that be at weekly group meetings or in the lab. The most important thing is to have these discussions without creating attention or placing blame as it is important for everyone’s well-being and people can make mistakes.”

**Additional Resources & Training**
- GW Environmental Health & Safety Trainings: https://safety.gwu.edu/training
- GW Office of Research Safety Trainings: https://researchsafety.gwu.edu/training

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