

FEATURE

Make safety a habit!

Safety needs to be an integral part of every scientist's work. To really make safety a daily part of your work routine, it needs to become a habit. Charles Duhigg in *"The Power of Habit"* explains that habits account for a large portion of our decisions, and if we understand habits we can change bad habits and create new habits that will improve our lives (Duhigg, 2014).¹ Habits are the result of a "habit loop" where a "cue" clicks in your brain to automatically do something – the "routine", in order to receive a reward. We use habits in every facet of our daily lives – when we click our seat belts in place, when we brush our teeth, when we take our medicines – you get the picture. Individuals, organizations, and even societies have habits. This paper will discuss how to improve safety and safety cultures with the use and formation of safety habits by students, lab workers, researchers, Principal investigators, lab supervisors and managers.

Q2

Q1 **By Robert H. Hill Jr.**

PREFACE

In August 2017 I was honored to receive The Tillmanns-Skolnik Award from the Division of Chemical Safety and Health (CHAS) for service to the division. I did not know the person for whom the award was named and neither did others in CHAS. So I investigated to learn more about the namesake of this award which I discussed briefly at the award presentation. Emma June Tillmanns-Skolnik (1942–1984) was a CHAS leader and an active American Chemical Society (ACS) member when she died in 1984. She was a Research Scientist for Imperial Chemical Industries (ICI) Americas working in Industrial Toxicology within Health and Environmental Affairs. She was a member of the CHAS founding committee and within CHAS she served as Councilor, Awards Chair, and Liaison to the Committee on Chemical Safety (CCS). She was also an active member of the Delaware Section of the ACS where she served as Councilor, Chair (first woman chair), and Secretary. The Delaware Section also honored her by

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naming their service award, The Tillmanns-Skolnik Award – there are two service awards in her name! She also served in the Division of Chemical Information (CINF) as Program Chair, Assistant Secretary, and Chair of Committee on Membership. Her husband, Herman Skolnik, was a CINF leader and a technical achievement award is given in his name by CINF. I hope to learn more about her so if you know something or have a picture of her, it would be great to share that with our fellow CHAS members.

INTRODUCTION

Safety is an integral part of all aspects of chemistry and it needs to be considered every day in the work that we do in the chemical enterprise. If you are fortunate, you work in a strong safety culture where safety is treated with importance in its work and practices. Safety-conscious organizations and their leaders and managers do many things to promote safety and help ensure that your laboratory is equipped with proper safety equipment (PPE) and supplies. Some organizations are less safety conscious in that they may speak in terms of the importance of safety but their acts, leadership, and direction often emphasizes production over safety and focuses almost entirely on tasks to be done with little or no input about safety. Nevertheless when it comes down to daily practice, safety is mostly an individual sport – that is, it is up to you to conduct your work in the safest

possible manner, and insisting that safety comes first. In this paper the creation and use of safety habits will be discussed and proposed as part of one's daily efforts to keep you and your colleagues safe. I like to present a real incident to illustrate the need for a particular aspect of safety – so here is one that relates to safety habits.

INCIDENT — SAFETY GLASSES NOT USED^{2,3}

A first-year graduate student was preparing one gram of a diazonium perchlorate ($\text{RN}_2^+ \text{ClO}_4^-$) while working on an open bench. He was wearing regular prescription eyeglasses – not safety glasses. As he transferred the compound from a porcelain funnel using a metal spatula, it exploded. Shards from the funnel shattered the left lens of his glasses and became imbedded in his cornea and face. Surgery was required and fortunately he did not have any permanent injuries and was later able to return to the laboratory. The graduate student had received standard institutional safety training, personal protective equipment including safety glasses, and had been required to sign off as having read relevant standard operating procedures (SOPs). Because the injured student wore his own prescription safety glasses but not safety glasses, he probably had acquired a sense of protection that ordinary prescription glasses do not provide. As a result the university now pays the cost of prescription safety glasses. Also

noteworthy was the work was carried out on an open bench, seemingly without a safety shield. The SOP called for work with potentially explosive compounds (PECs) to be done in a hood and recommended a safety shield. The report⁵ focused on what went right, what should have been done, the direct cause, corrective actions taken, and measures to prevent other incidents like this one. Underlying causes were not addressed, but an interview with the Principal Investigator (PI), under whom the student worked, suggests that this was a systemic failure, and significant efforts subsequently went into improving safety efforts in this and other laboratories.² The PI, Professor Dean Toste, was quoted – “*It’s not to the student’s benefit if we restrict hypothesis- and curiosity-driven research. But we have to change the culture so that it’s second nature to always put on safety glasses and other PPE and to check the SOP.*” The PI seemed to be saying that we need to make safety a habit! In the remaining part of this paper, we will discuss habits, how they are formed, and how we might use habits to make safety “second nature”, especially in laboratory-based work, including research.

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THE HABIT LOOP

In his amazing book, *The Power of Habit*, Charles Duhigg presents an interesting and useful guide to understanding habits and how they might be influenced or created.¹ He defines habits as deliberate choices that we make at some point but then we stop thinking about them and continue to

do these automatically on a daily or more often basis. Thus brushing your teeth, combing your hair, driving your car, making coffee, or other routines are done without thinking because they have become habits. Researchers showed that more than 40% of our actions are not really decisions but habits.⁴ Habits depend upon “The Habit Loop” (Figure 1) that includes (1) a cue; (2) a routine; and (3) a reward. A habit is elicited by a trigger or “a cue” which tells the brain to go into automatic mode. A cue could be visual, thought sequences, or an emotion – something like a particular time of day, or when you climb into your car, or when you get in front of the mirror in your own bathroom first thing in the morning. The routine could be simple or complex – putting toothpaste on your toothbrush, brushing your teeth, and rinsing. Going to your car will be more complex – getting in, adjusting things like the seat or mirrors, starting the car, getting out of your parking place, looking on the road for the correct lane, observing traffic signals, and watching out for other drivers and pedestrians. The rewards can be physical or emotional stimulations – “clean teeth” and “getting safely to your destination”.

Your brain does a lot of work so it uses habits because it wants to reduce some of its efforts. It seeks to make any routine into a habit! You might think of habits as “brain” shortcuts to ease its burdens. But here is the rub, the habit can be good or bad, the brain does not judge this – it only wants to reduce its thinking efforts. You can also create new habits by finding the right cue and routine that brings the desired reward. The more you do a routine the stronger

the habit. It turns out that habits never go away, but they can be changed or modified by changing the routine. But be warned, some habits are really tough to change. You really have to work at it – think about all those smokers who have tried to stop smoking or those overweight people who have earnestly tried to lose weight. Now you have a little information about habits (to learn more read Charles Duhigg’s book¹), let’s think about how we can use habits to make us and others safer in the world of the chemistry laboratory.

DEVELOPING YOUR OWN SAFETY HABITS

In teaching labs, students learn safety habits because there are strict rules that must be followed. The “cue” is entry into and start of the lab. The “routines” involve actions such as always wearing safety goggles, closed-toed shoes, no shorts or short skirts, no bare mid-drifts, long hair tied up, etc. The “rewards” are: you are allowed to work in the lab; you are allowed to complete a lab exercise and get a grade; and you are not injured. Not following these rules will likely eliminate the “rewards”, so students really want to do these things. Furthermore these “habits” if repeated over and over again can become safety behaviors.

The downside of “rules” is that some people do not like to follow them, especially when no one is watching. So it is important that as we set rules that we explain “why” we have those rules. In future advanced laboratory work, students become more independent, and when conducting advanced

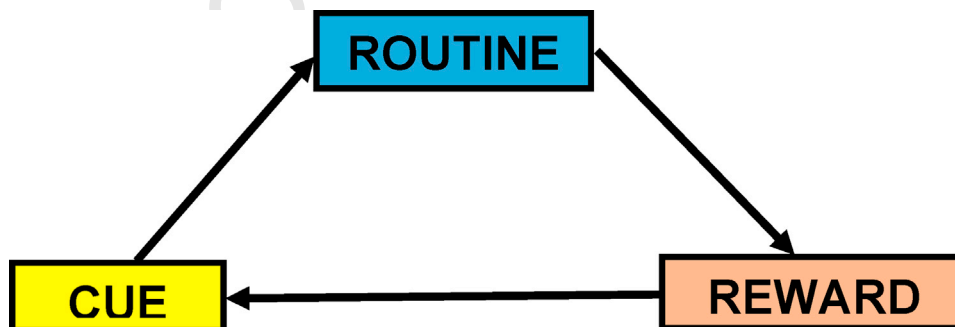


Figure 1. The habit loop.

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