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PERSPECTIVE

BECOME A SPOKESPERSON FOR SCIENCE



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THE IMPORTANCE OF OUTREACH: WHY DO IT?

The National Science Education Standards defines scientific literacy to include a “greater knowledge and understanding of science subject matter” and “the role of science in society and personal life (1).” It is important for all members of society to understand the importance of science in our lives as they will be voting on issues, making purchases, and making health choices that involve scientific understanding. Often these decisions directly impact the various industries and organizations we serve as scientists.

There is a public perception that science is difficult and is typically done by Albert Einstein stereotypes in a laboratory with chemicals and strange looking glassware. This has been proven many times in classrooms where students have been asked to draw a scientist, and although there is some variation around the world, they typically depict a male with glasses or goggles and erratic hair (2). It is our responsibility as scientists to help change that perception and broaden the view of what scientists are. We also need to be prepared and able to respond when we see or hear stories that contain scientific inaccuracies being shared between friends, posted to social media or covered by various mainstream media outlets so that we can better stop the spread of misinformation. Let’s explore a couple of examples.

Biotechnology, also known as genetically modified organisms (GMOs), has been a target for both media outlets and marketing campaigns using scare tactics to try to influence consumers to purchase organic or non-GMO products. These campaigns and stories do not focus on the science, but rather imply that organic food products are healthier and non-GMO products are safer. Despite the agreement of many esteemed scientists regarding the benefits of GM crops, and 121 Nobel Laureates who signed a letter calling upon governments around the world to not only approve but accelerate the access of farmers to the improved seed technology (3), some consumers at the grocery store continue to be

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unwilling to trust the scientific experts when selecting food purchases.

We see the same mistrust of scientists regarding the use of vaccines. The number of parents immunizing their children has decreased to about 60 percent in the U.S. (4). One of the contributing factors to this decline is recent negative media coverage, perpetuating the idea that the vaccines may cause autism or other side-effects. This leaves vulnerable members of the population at higher risk for diseases like measles that were once nearly eradicated. These kinds of stories make headlines but they are harmful to science and contribute to a decline in the general impression and trust the public has regarding science and scientists.

As scientists, we can change the impact of the public's overall impression of science and we can serve as a knowledgeable and reliable resource to answer questions. Trust is an important part of this scenario. As scientists, we know the scientific process continues to ask questions on topics and the continuous testing of theories or hypotheses prove or disprove our current understanding, making the science self-correcting in this respect. We might not have all the answers but given the body of evidence provided we draw logical conclusions about our field of study. But how do we help the public understand this and trust this process?

You can start building trust and breaking down certain stereotypes about scientists by becoming involved in community outreach. If scientists from various backgrounds serve as mentors, we can illustrate the diversity of those working in the sciences and the variety of topics we study. We do not all fit a single mold of a middle-aged male in a lab that is still too commonly thought of today (2). Our research may take us anywhere—from the far reaches of the world to our very own backyard. Showing the public that some scientists study geology in Antarctica, others might collect house fly populations from dairy farms in Australia, while some may take water and soil samples

from our local rivers and pastures. Illustrating the range of jobs in the scientific community and sharing stories about how this work leads to technology that can improve people's day-to-day life will help begin to broaden the public's overall understanding of the positive impact the scientific community makes to the world. It's important to be willing to share our stories.

Students are one of the most important groups for scientists to focus on. In my opinion, one of the most rewarding experiences of doing outreach is when a student comes up to you and says you changed the course of their studies or influenced their career choice. As role models for future generations of scientists it's important to note the need for growing the number of students pursuing science degrees. The U.S. Bureau of Labor Statistics projects that there will be 9 million more STEM jobs available between 2012 and 2022 (5). The President's Council of Advisors on Science and Technology (PCAST) states that 1 million more STEM college graduates will be needed over the next decade (6). In addition, PCAST estimates that "fewer than 40% of students who enter college intending to major in a STEM field complete a STEM degree" (6). By being role models for science you can contribute to improving the retention rate of students majoring in STEM degrees.

Giving back to the community helps me see how one person can have such an impact on another. Bringing scientific enrichment opportunities to those who may have none is something that has been a passion of mine. For the last several years, I have worked with the Indianapolis School on Wheels, an organization that provides tutoring and educational enrichment to students experiencing homelessness. At the School on Wheels locations, colleagues and I present a variety of hands-on science demonstrations for this group of students. These hands-on activities were created by Dow AgroSciences' volunteers—known as the Science Ambassadors.

Another personal experience was when I was a graduate student and worked with local educators to provide interactive hands-on activities presented by undergraduate mentors for their classes. Students and classroom supervisors were

motivated to learn new subject material and new ways to present or experience science in their classroom. We can all give back to our communities and serve as scientific mentors at any age or level of education.

IMPACT ON DEVELOPING YOUR SKILLS AS A SCIENTIST: WHAT DO YOU GAIN?

One of the best ways to illustrate your competency in a subject is to be able to effectively communicate it to others. Learning to tailor messages to your audience is key. Explaining what you do to a group of third graders is different than explaining your job to a group of college students—despite the general ideas of the subject matter being discussed is the same. Regardless of age, if the person you are trying to reach is outside of your specific scientific field of study, scientific jargon can easily make them feel like an outsider in the discussion. One way to keep people involved is to consider everyone a learner; try to understand what information will be new and how best to present that, explaining critical vocabulary words.

Creativity in delivering your message can also be a way to help engage the audience during your outreach talks and activities, but it is often one of the hardest. I personally find this to be one of the most challenging aspects of science outreach. How can I create an experience for someone during my outreach interactions so they will connect with the subject? I do not merely want them to see the subject demonstrated; I want them to interact with it so that they will care about the subject longer than the one-time presentation.

My undergraduate courses in education and communication have helped me in this regard.

Communication can come in a variety of forms: public presentations, written papers, social media, etc. My personal preference is to have face to face interactions, because it is easier to see how my message is coming across and know if I need to further explain topics based on the instant feedback of my audience's body language and engagement—or lack thereof—in conversation. For example, I sometimes use Skype to connect with students located in different parts of the country. Snapchat, Facebook, Twitter, blogs, and other social media channels all have uses in communicating science to the public because this is where the public is easily accessible. The mode of communication you should choose comes down to what you are most comfortable with and good at. Some people are better performing live demonstrations, while others have made a name for themselves doing scientific outreach through blogs and YouTube videos. The main objective is to communicate your science in a relatable way, this helps support all sciences because it helps the public build trust and puts science and scientists in a positive light.

Outreach activities also require you to demonstrate many of the soft skills that

employers desire in job candidates. There is the leadership you show by getting involved and planning an outreach event or activity. Building your organization, creativity, and ability to communicate your science in an understandable way are skills that are important to career success in the scientific world. Scientists volunteering to do outreach activities also develop time management skills as almost all outreach is performed beyond the traditional course curriculum or work hours.

Outreach also forces you to think about your own research differently, from another person's perspective. The confidence you have in yourself and your research hits a high when you see someone else understand your research through outreach. I had a student at a Science Day look at my vinegaroon, (a whip scorpion that I use for entomology

discussions), from afar. It was obvious that she was clearly nervous but also curious. I started asking her questions about why she was nervous and assured her that he didn't bite, pinch, or sting and that he had some interesting characteristics. We continued to talk about the fact that the only way he defended himself was to spray acetic acid. I followed that up by telling her that acetic acid is vinegar which she's probably had on her salad. By the end of a few minutes of conversation she had approached the table and was reaching out to pet the creature that she initially feared. She even said he was kind of cute. This small breakthrough for this one person I believe will have an impact the next time she sees a "scary" looking arthropod, which in turn will impact how she sees the study of these creatures.

BUILDING YOUR NETWORK

You've probably already heard how important networking is in the job search and in professional development. Outreach not only allows you to practice talking to people and explaining your work, but it automatically expands your network. Depending on the type of activities you get involved in you will be working with members of your department, across departments within your university, and your field of study across universities. The professors you work with on outreach events can be great resources for future letters of recommendation for graduate school or job applications. Or, if your outreach program takes you across many different universities, you might find a faculty member with which you would like to pursue graduate studies.

If the event is sponsored by an external organization, it is likely you will meet others doing public outreach for other institutions or companies. These contacts can provide

mentorship and possibly introduce you to job opportunities. My job at Dow AgroSciences came about this way. I was involved in outreach in graduate school and attended the Entomological Society of America meeting. There was a symposium on outreach that I attended and several the speakers were industry representatives. After the talks, I asked the organizer if she could explain how she as an industry professional was involved in outreach, and why. She explained that it was important for industry scientists to be talking to the community about the work we do in agricultural sciences. During that same conversation, she asked me when I was graduating and I pulled out my CV—noting that I still needed to finish school that spring. The next thing I knew I received a phone call asking me to fly to their global headquarters for an interview, and now I have been an employee at Dow AgroSciences for 8 years.

If you choose to participate in science outreach programs, you will also be interacting and networking with the community participating in your event. This could include students, teachers, parents, the public, media, and scientists in other fields. Community events give you a significant platform to reach a large audience, but it is good to prepare before the

event so you can clearly communicate your message and explain why you are there and what you are demonstrating. You want to sound confident and at ease with your subject, not nervous and unsure. The best way to overcome that is to be prepared and practice frequently. Having your answer ready if you get asked will help you sound like the expert that you are.

SCIENCE OUTREACH: I'M INTERESTED BUT HOW DO I DO IT?

The easiest way to get involved is with an event that has already started. For example Earth Day would be a great time to do a special activity in the community. If you're a chemist, the American Chemical Society sponsors National Chemistry Week each year. In the Indianapolis area, there is a large Celebrate Science Indiana event held each October. Investigate what the various clubs and organizations on campus are doing. Many universities offer summer camps for children where you could volunteer. If you're still having trouble finding an event, talk to faculty or others doing science outreach and see what suggestions they have to offer. I'm happy to help you get something started in your local area if you need help.

If you want to take it a step further, demonstrate your leadership and passion for a particular area and start your own event. There's nothing like the feeling of starting an event that becomes so popular that it remains long after you have graduated and moved on. As a graduate student, I had the opportunity to work with faculty at Cornell University to develop the first ever Insectapalooza, a one day open house event in the Entomology Department (7). This event is now in its thirteenth year and continues to grow!

Insectapalooza highlights the diversity of insects and entomology research. Activities have included everything from insects in the movies to roach races to citizen science projects to insect physiology. The entire department is engaged, which allows undergraduates, graduate students, and faculty to work together to develop the materials and activities for the event. The day of the event everyone interacts with the public. Undergraduates from other disciplines also participate. We've partnered with the art department to showcase insects and have communications students doing interviews for stories in the university newspaper.

Another option is to be a guest speaker for local schools. As an undergraduate I would often go back and talk to students at my former elementary school and high school. Contact someone at your elementary, middle, or high school and see if you can come speak to a class or organize a larger assembly and bring some of your college colleagues to each do activities. If you have moved away from your hometown for college, get to know some of the teachers near your university. Many teachers are eager to have students come in to talk about science. You provide a role model for students to aspire to and help the teacher with knowledge they might not have.

CONCLUSIONS

Scientific outreach is an important endeavor that is often overlooked in the day to day aspect of coursework and research. Work in this area impacts our community's opinions and understanding of science. Personal impacts include a sense of pride in the work you do, giving back to the community, building upon skills, and making connections with others. There's freedom and creativity in expressing

your chosen scientific field and connecting that with others. Overall it's rewarding and fulfilling to set aside a day or even an hour to talk about something you have invested your time and talents into studying. If you are looking for ways to get involved in scientific outreach talk to others with a similar interest and start or contribute to an event in your area. As Nike so famously put it— "Just Do It!"

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