Communicating Plant Science in the Digital Age

One plant narrative

10,000 years of agriculture has transformed our world. Several thousand years after farming became widespread, people started using papyrus to write on to record information and communicate. Papyrus was displaced by paper and eventually large parts of human endeavor were all communicated on bleached plant fibers; great paintings, doodles and the written to-do list were invented, literacy spread. Even in our increasingly digital world, paper notebooks remain popular and useful for anyone who wants to use them to document their minds, including scientists.

All of it stemmed from growing plants for food and other civilization-related purposes. Paper was the path to The Internet– the literal plans for it were likely on paper first. The history of plants is as much a part of us as the history of the universe and crucial to study. This might appear to be an obvious story, but it's one I'll bet most people don't think of when they're sitting at their computers or taking notes or even appreciating a plant in their home, garden or in nature.

Plants and the social web.

Does plant science have the prominence it deserves (could be asked for science generally too)? Based on social media presence– a great way to engage people– reaching them where they are– perhaps not so much. The most-followed science twitter accounts have nothing to do with plants. In an era of tight research budgets and public audiences that could easily be more scientifically literate– especially in what sounds to many like obscure research like plant biology– increasing scientists' engagement with the public on platforms like Twitter will make a difference.

Of course scientists are already online– there are fantastic tools there that enhance our work. When it comes to social media, interactions with other scientists can expand networks, create collaborations and spark new research ideas. I am often more comfortable networking and talking to other scientists on Twitter than I am in real life– and those Twitter interactions can turn into real life meetings.

Social media also allows a glimpse of scientists as humans – not everyone knows a scientist and the stereotypical image of the personality-less white lab coat persists. My tweeting is not purely

professional; I talk about some of the everyday things I go through too. Search#OverlyHonestMethods on Twitter for a great look at how scientists portray themselves as definitively human.

Beyond internal communications, however, scientists can also capitalize on social media to share the stories of science more broadly with non-scientists. A person's first encounter with a scientific idea might well be via Facebook or Twitter. Though more science than ever is being more communicated than ever on The Internet, there is a lot of room for growth. Most fields of science are represented online, but physicists, engineers and NASA seem to dominate.

Any solid science communication advertises all science at some level– no matter how big or small. The fact that physicists, astronomers, NASA and engineers seem to attain broad cultural presence/popularity relative to other fields of science suggests they have some awareness of what works. Could the show 'The Big Bang Theory' be about any other field of science? The physics/engineering aspect is pretty key to the show's success I think. A lot of scientists I know aren't fans of "The Big Bang Theory", but the fact that there's a popular show with somewhat realistic scientists as central characters (we've all met a Sheldon Cooper in our science careers) is worth celebrating.

Recently, the reboot of 'Cosmos' is airing on a network television and being broadcast worldwide; there is an appetite for science amongst the public. The second episode addresses evolution and features photosynthesizing organisms, particularly the oxygenation of the atmosphere when the Earth was ~2 billion years old. Dr. Tyson also uses the metaphor of the tree of life literally by standing in front of an oak tree and using it to demonstrate how life shares common ancestry. Plants have made several other appearances in the show as well which is good to see for a show that would appear to be centered on physics. Showing the interconnectedness of fields of science is good to see, though having people within a field add to the narrative that 'Cosmos' starts is a possible next step in telling more specific stories of science. Plant scientists have to be there to add to the story.

The most popular plant science oriented person with over 100,000 followers is the food author Michael Pollan (see table). Combined, the botanical gardens, The ASPB, plant journals, Monstanto, The Danofrth Center, and the rest don't get close to him (again, see table). Plant scientists already know why science– plants specifically– are inherently interesting and important. There are plant scientists writing about plant science and engaging on Twitter like Pam Ronald, Mary Williams, Kevin Folta and *Anne Osterrieder et al*. (see table). As far as I know, however, there is not a Dr. Neil deGrasse Tyson of the plant world.

The most famous plant scientist nearly everyone knows is not widely known for his work on plants: Charles Darwin (to be sure, it's good he's best known for natural selection). There are plant scientists like Norman Borlaug and Barbara McClintock that the scientific community might know well, but very few members of Congress or a large majority of the public could name or talk about what they discovered. There is not an organization promoting purely plant science (public or private) that has a large following (greater than 100,000). Popularizing science and plant science particularly is challenging, but certainly is a core part of scientists' and ASPB's mission; educating students is great and also necessary, but adults need to learn things too (perhaps it's even more important in the short term for adults to be scientifically literate).

What can Plant scientists learn from the great science communicators?

Can the plant science community learn from Neil Tyson, Bill Nye, and NASA? What's made them successful? Partly, they are all rather expert in what I recently learned from a post doc working for NASA on a polar regions project they call Education, Public Outreach (EPO). NASA landing astronauts on The Moon inspired a generation (landing a plant on the moon might be cool, but likely wouldn't have the same impact). Both Neil Tyson and Bill Nye (and before them Carl Sagan) are associated with NASA in some way. As Neil Tyson likes to say, NASA gives us The Universe – a different, cosmic perspective, of ourselves. The Mars Curiosity Rover and Cassini missions have sent back some of the most incredible pictures ever captured. All of NASA's missions have their own social media accounts, including the 36-year-old Voyager missions. They actively promote their work.

Saying you're smashing small particles together at the CERN Large Hadron Collider to create other small particles or you're building a telescope to look up at the sky isn't exactly inspiring…nor does it seem like there's much of a point (does it affect our day-to-day life? Yes, but most would say not obviously or immediately so). Showing that we got the world wide web because of CERN and that we can all carry around CCD based cameras in our pockets because of that telescope does help bring the significance message home; and physicists and NASA engineers seem to do this very well. Even stories like the episode of 'Cosmos' telling Clair Patterson's story; trying to determine the age of the Earth lead to the removal of lead from gasoline and other industrial uses (today, it's unimaginable that someone would be against having less lead in the environment).

Practical products and clean air aside, there's something else NASA and other effective science communicators hit upon that's deeper. In Neil Tyson's recent interview on 'Fresh Air' he talks

about NASA being an inspiration engine, a critical part of creating a national (even worldwide) learning environment where curiosity is celebrated, inquisitiveness and innovation are defining cultural characteristics. When Commander Chris Hadfield started tweeting from the International Space Station (ISS), people connected with him in a big way. He started small, but it grew into a huge following that's been passed to other astronautsoccupying the ISS.

There is an appetite out there for learning about the natural world, scientists just have to do a better job bringing it to light.

NASA & astronomer's success is a combination of producing great pictures, presenting their results in interesting ways, showing the human side of their work and telling stories that resonate with people. EPO seems to work best when it's coming from a specific person to the right audience, not the institution as a whole, but the organization can provide important context and lend credibility to an individual connecting with others.

Even with all their success, there's a sense in the scientific community that in the US at least, people are still divorced from the science that impacts their lives every day and aren't necessarily inspired by it (as they are by the other part of the creative fields: entertainment). It's as if scientists are acting like photosynthesizing organisms, absorbing a lot of light for our selves, allowing only some of it to be seen by others. The Internet was a product of basic research and now to get the word out, scientists are competing with everyone else to get our ideas heard. On the Skeptic's Guide to The Universe Podcast's new year's episode, they talked about the top Google searches of the year; none of them directly science related. Smartphones made the list, but likely not because of the science and engineering behind them but because they're the hot new gadget to own (I love my smartphone too).

Beyond his obvious charisma and hard work to figure out how to communicate science well, Neil Tyson does some very smart things like pairing with comedians in his conversations. When he appears on 'The Daily Show', 'The Colbert Report', or does his 'Startalk Radio' show/podcast, he's paired with a professional comedian to bring levity to what many still consider a serious topic, namely science. Comedians are a form of communication specialist and many are very smart in their own right and ask very good, if somewhat unexpected, questions that Dr. Tyson then responds to. It's not the most structured way of answering specific questions, but it demonstrates that science is more than a list of facts and is, like entertainment, a creative endeavor; crossing those streams is a good thing. Dr. Tyson aided and abetted the demotion of

Pluto from planet status and does a great job justifying it to a public that was rather upset that something seemingly constant changed.

The relatively large community of astronomers, physicists and engineers that work individually, yet together, to tell the big and small stories of the universe is one key to their success as is long tradition (Galileo might well be considered an early science communicator). They produce amazing data and are able to get the message out in engaging ways through both traditional and social media. None of this was built overnight, but with ASPB and members working together to create a portal for plant science facilitating member interactions while also sharing our research stories with the world, plant science will be more accessible to fellow plant scientists and a curious public. The current Digital Futures Initiative being undertaken by ASPB is just such an effort that I hope the membership finds useful both for connecting with other plant scientists and creating a platform for connecting plant science to non-plant scientists.