



Future of Publishing

The social biology professor: Effective strategies for social media engagement

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Abstract

Evolutionary biology and ecology have always been collaborative enterprises, benefitting enormously from active communication of ideas among traditional academic networks of peers. The Internet age, with its thriving online social networks, offers new tools that can help our current generation of biologists to collaborate, and communicate with the public, more effectively. Having a dynamic web presence, being part of an active blogging, Facebook, or Google+ community, and being a strategic tweeter can help your research, teaching, and service programs. Below we outline how to be a strategically savvy and active social media scientist, and discuss some of the pitfalls to avoid wasting time. We highlight some ecologists and evolutionary biologists who are active in social media to help you understand the many ways social media can help you in your academic life.

Key Words: Social media, Twitter, tweet, blogging, Internet, communicating science

Introduction

Biologists like Charles Darwin and Alfred Russel Wallace relied heavily on mail to communicate their findings. They left behind a rich collection of letters that offer us glimpses and insights into their thought and discovery processes and the nature of collaboration in the 19th century (archives at: <http://wallaceletters.info/> and <http://www.darwinproject.ac.uk/>). Indeed, it was

Wallace's letter to Darwin that laid the foundation for modern biology through their joint presentation of the theory of evolution by natural selection to the Linnean Society. Darwin and Wallace were also public intellectuals who communicated their research findings with both their peers and the broader public. What might Darwin or Wallace have accomplished in the 21st century age of the Internet and online social networking? It is easy to imagine them both as bloggers enthusiastically sharing their discoveries on a regular basis. Over a century and a half after their European academic social networks brought Darwin and Wallace together, evolutionary biology and ecology are ever more dependent on global networks of collaboration and communication, as well as public enthusiasm and support. Big data and collaboration are two major characteristics of how biologists work these days—and both of these can benefit enormously through effective use of online social networking tools.

Bik and Goldstein (2013) review the benefits biologists can reap from building a strong social media presence. They broadly discuss how a well-curated dynamic online profile can help make science communication efforts more effective, broaden the impact of research, enhance abilities to translate research into policy action, and even help find jobs and get tenure. They also discuss some of the immediate benefits, such as how a dynamic online profile can help strengthen research networks by connecting new collaborators, find datasets, engage the public in citizen science, and find and recruit students and postdocs for future research projects.

Here we extend Bik and Goldstein's (2013) work by highlighting strategies to ensure effective use of social

media in everyday academic life. Social media is about communicating (many to many)—not just broadcasting (one to many) (Rheingold 2012). To effectively network on social media, academics must go where people are gathered and engage with them by offering something that adds value. Opt in, rather than intrude, by being dynamic. Academics must participate in online discussion groups and take the time to read other people’s posts and answer questions if they have the expertise (Wilcox 2011). To communicate effectively and to get something back for your efforts, it is important to (1) determine your goals, (2) integrate social media into your daily routine, and (3) build a following. If you keep these strategies at the forefront, you can quickly reap the benefits of social media. Below, we discuss these strategies, and then describe some of the research and teaching benefits associated with academics taking the time to engage in social media. Just in case we haven’t convinced you of the inherent value in social media for evolutionary and ecological researchers, we then reiterate why active participation in social media can be beneficial, and worthy of the challenge.

Set your goals

A key step to ensuring effective use of social media is to determine your goals. Do you want to increase the number of scientists reading and citing your research? Find research collaborators? Find a community of people with whom to brainstorm ideas about teaching? Broaden research ideas? Become informed about new publications as they get released? Write more effectively? Enhance interactions among students in your courses? Increase traffic to your website? Attract more/better students or postdocs? Increase your own chances of landing an academic job? Make your science more accessible to the general public? Being conscious of your goals helps you effectively target your audience(s) and waste less time (Pearson 2012).

Integrate social media into your daily routine

Commit to spending at least 15 minutes a day on Twitter (Canady 2010), which is perhaps the most efficient of the available options for rapid communication. Set up a research-based Twitter account and post at least one new and interesting thing every day. Below we outline what Twitter is and how to effectively incorporate it into your teaching and research programs. Here, for example, are some of the different types of tweets we see in our Twitter feeds:

- Links to new publications with brief descriptions about why they are interesting or controversial
- Requests for reprints of published papers (hashtag #ICanHazPDF; read below if you don’t know what a hashtag is)

- Requests for opinions on teaching, research, or statistical methodologies
- Requests for datasets to address larger-scale questions in ecology and evolutionary biology
- New research, teaching, or mentoring blogs with descriptions about why they are insightful (Mollett et al. 2011, Wihbey 2012)
- Upcoming opportunities including paid positions, invited talks, presentations at conferences, and volunteer opportunities for your students
- Upcoming events including public seminars and science cafes
- Recent achievements of past and present students from the tweeter’s lab
- Links to videos, podcasts, and photos that might interest ecologists and evolutionary biologists
- Links to online lab notebooks with descriptions about why they are interesting or controversial
- Links (via e.g., Figshare <http://figshare.com/>) to unpublishable theses or other products with negative or null data and descriptions about why they are interesting or controversial. Note: Figshare is citable
- Live tweets from conferences such as the Ecological Society of America’s annual meetings using conference specific hashtags (e.g. #ESA2012 was used for the 2012 ESA meeting in Portland, Oregon)
- Participation in conversations and discussions about science.

You can also commit some time to other social network options like Facebook and Google+ that offer more threaded discussions around specific topics, whereas LinkedIn seems particularly useful for the job market. Alternative networks like Academia (<http://academia.edu>) and ResearchGate (<http://researchgate.net/>) offer specific features for academics including the ability to list and share reprints of your papers, helping you keep your online profile current. They also provide metrics of people searching for and finding your name or keywords relevant to your work, which could be useful in gauging your broader impact. The downside of such niche networks is that they replicate the ivory tower seclusion rather than opening up broader access to academic networks.

RSS feeds allow you to stay informed about things that interest you by continually updating content from websites, newspapers, blogs, audio shows, and videos you are most interested in. Other sites like Reddit (<http://www.reddit.com/>), Digg (<http://www.digg.com/>), and StumbleUpon (<http://www.stumbleupon.com/>) serve well for discovery, offering ways to share and find links to interesting things (new papers, news items, blog posts) on the internet, and have good science sections. A few minutes scanning these sites and your RSS feeds

(similar to reading the newspaper over your morning coffee or scanning journals over lunch) can be rewarding and help you keep up with developments relevant to your research. If you can afford more time, Reddit has very active discussion forums, often around controversial topics, which allow scientists to engage directly with their readers and the public. Reddit also features special “Ask Me Anything” sessions, an intriguing option for engaging with the public, where scientists can offer themselves up to questions from anyone about any topic relevant to their work. One must also be wary of Reddit’s dark side, however, because that network has been prone to rampant misogyny and climate change denialism. In general, it helps to have allies who are savvier about these networks in order to reap the most benefit from such exposure, especially if you want to communicate about research that is potentially controversial yet also highly relevant to the public. Quora (<http://www.quora.com/>), a social network dedicated to asking and answering questions, is another forum where you can fruitfully share your particular expertise with the general public.

Of course, the internet offers many such options (with new ones springing up regularly), with the potential to distract as much as to inform, so the key is to find a few that work for your goals, and commit the time necessary to start reaping the rewards. In this paper, we focus on blogs and Twitter as particularly useful and flexible social media engagement tools, but much of the advice we offer for effective practices applies across the different social networks.

Build a following

Regardless of whether you blog, tweet, use Facebook or Google+, you should consider the costs and benefits of cultivating a following (Shipman 2012a) and “grow” your academic footprint. Join (‘friend’, ‘subscribe’ or ‘like’ on Facebook, ‘follow’ on Twitter, ‘add to circle’ on Google+) thoughtful communities (people and journals that are interesting) that share your interests and provide relevant links and reviews. Ensure you are findable by including your preferred social media profile (Linked In, Twitter, Facebook, Google+, ResearchGate, Academia) page and blog contact information on your laboratory’s website, your department’s website, on your blog, and even on your business card. This will allow non-experts to find you and identify you as an expert.

With many journals now building social sharing buttons and toolbars into their websites, it is trivial to share your papers across many social networks. That is, of course, only the first step in science promotion. Your actual reach will depend on the strength of your social network, and how well you can leverage connections with key influencers (e.g., bloggers like those at

Scientific American’s blog network or National Geographic’s new Phenomena blog) that maximize the spread of links to your publications. Thinking back to the 19th century again, we wonder about the course of the history of evolutionary biology if Charles Darwin had been less plugged into the social networks of his day, or if those networks had picked up more on Gregor Mendel’s work. While some researchers might argue that self-promotion is the only reason to use social media, others would argue that social media should be focused on promoting the science, not the person. This results in a gradient from ‘self promotion’ to ‘promotion of the science’. It is helpful to be aware that this gradient exists so you can actively decide where you want to place yourself.

Twitter

Tweets are 140-character (maximum) text-based messages that can include links to websites or media (photos, video, sounds) that are broadcast to your followers. While tweets are targeted toward your followers, any recent tweet can be searched for by any Twitter user and then be replied to or retweeted by that user, regardless of whether they are one of your followers. Because of the broadcasting nature, Twitter is inherently social and can be dynamic and powerful, especially if you have a strong social community of followers. When people “follow” you on Twitter, they receive all of your tweets (among all tweets of everyone else they follow). Provided you only follow people whose tweets you are interested in, you can create a message filter for the type of information you desire.

Twitter has numerous uses for ecological and evolutionary biologists. “Twitter allows us to grapple with new information and ideas in real time, collectively verifying, supplementing, and testing ideas with those who can’t be in the room, or even in the same country. Science progresses by challenging, testing and refining existing ideas, and social media allows this to happen more rapidly than traditional discourse restricted to peer-reviewed journals. Twitter’s greatest value is not in the speed, but in opening up so many more opportunities to have these conversations” (Neeley 2012).

You have to decide what functions you want Twitter to perform for you. We use it to publish content by linking to articles or blogs by others that we find interesting, and to get people interested in things we have written about, or captured in photos or videos. We tweet to ask and answer questions to get and give help/feedback on science-related issues. We monitor news, updates, and trends in subject areas that interest us. We mentor people on Twitter, both those whom we know and those who are new to us. While we ensure our ratio of professional:personal tweets is heavily biased towards professional, we also occasionally tweet about

some of the fun and light-hearted sides of life as biologists, including difficulties associated with balancing priorities, families, and our active lives. By including a personal side to some of our tweets, we hope to make biologists seem more ‘real and accessible’ to non-academics.

We also live tweet from meetings, seminars, or lectures as they happen. Tweeting at conferences can draw conversations about science out of the backchannels and into the open (Neeley 2012, Parr 2012). Conference tweeting helps in note taking, quoting presenters, and notifying followers of key concepts and new findings. Conference tweeting can also add richness and depth, as audience members can pose questions as they arise from the talk, as well as answer them in real time. Conference tweeting allows individuals to attend the conference virtually (i.e. offsite), and still share insights and ideas (Fox 2013, Katti 2012). Tweeting also enables the presenters to look at what was tweeted about their talk, address questions, and start offline conversations. “Twitter has become an increasingly important method for making the backchannel that has always existed in conference settings more public. Responding to speakers in real-time takes some practice, but it creates a participatory, learning environment where you can share your thoughts with more than the person next to you. Even people not at your conference can become involved when you use your conference’s hashtag within your tweets. If you’re not using Twitter, you might be missing half of the conference” (Coxall 2009). As a presenter, you can expand your audience (both in the room and outside) in several ways: advertise your talk by tweeting about it, tweet links to your abstract and/or full presentation (e.g., on Figshare or Slideshare), and, respond to questions coming in via Twitter. It is even possible (using Twitter clients like Hootsuite that allow you to schedule tweets in advance) to tweet out key messages from your talk as you deliver it live. Importantly, talks with many enthusiastic tweets can draw interest from reporters and press officers to turn into news stories.

Your Twitter stream, especially if you follow a lot of people or a very active conference hashtag, can turn into a torrent that can drown you in tweets. Storify (<http://storify.com/>) provides a very useful tool for capturing and archiving a set of tweets that form a conversation (along with elements from other social networks such as Facebook updates and comments, Flickr images, or YouTube videos). You can then share your story as a record of the conversation, embed it into a blog post, or use it as a skeleton around which to build a longer manuscript. Storify allows you to archive important conversations—conversations that will otherwise be lost if you wait too long because of Twitter’s limited search functionality and short database of past tweets.

We find Twitter to be one of the most useful tools associated with social media, and have time-saving

advice for ecologists and evolutionary biologists who are just getting started: (1) use hashtags (word or acronym that begins with #) to ‘categorize’ a tweet and make it more easily searchable; (2) provide a link when discussing a publication, blog, or photo, so others can easily access it; (3) use a URL shortener to convert long links to short ones (URL shorteners like bit.ly shorten the link and provide statistics on the number of clicks your link receives); (4) retweet (‘RT’) is the core of what makes twitter so powerful. When retweeting, include RT and the original tweeter’s handle to give them credit and make it clear you are retweeting their ideas, not your own. Make it easy to be retweeted by ensuring there is enough room for RT @yourhandle so you can be easily retweeted with credit; (5) time your tweets by broadcasting and rebroadcasting them during peak times (e.g., when individuals arrive at work (8-10am) in Europe and East/West coast United States/Canada). Twitter recently integrated the application Buffer to help with this. Buffer makes it easy to schedule future tweets and retweets to occur on dates, times, and frequencies of your choosing; (6) Twitter lists enable you to group subsets of people you follow into discrete categories to optimize your time. Alternatively, many biologists use a variety of Twitter clients (e.g., HootSuite, TweetDeck, Twitterfeed, to name a few) to make lists of people or topics they want to follow without the lists being publicly visible. There are many places where biologists new to Twitter can gain valuable insights (e.g., <http://www.blogtips.org/blog/ing-tips-tutorial-how-to-use-twitter/>).

Teaching with Twitter

Some of our colleagues use Twitter in their teaching. Twitter can help enhance communication inside and outside the classroom, foster discussion about course subjects, and build a community amongst students. Sample (2010) and Hedge (2012) provide practical advice for teaching with Twitter. They discuss, among other things, the need to ensure the course has a clear and visible hashtag for students to use and follow. A specific course hashtag means only course-related tweets will be visible to you. Hedge (2012) discusses using Twitter to stimulate conversations among students. Her students tweet questions during videos, lectures, and peer-presentations. By giving a few minutes during each lecture to respond to questions that students have posed on Twitter, Hedge promotes and validates appropriate Twitter use in her classroom (Hedge 2012).

Another key to teaching with Twitter is providing explicit instructions for what activities are appropriate and expected (Sample 2010). Do you expect student’s tweets to “push the conversation forward ... provide something new, something of value, even if it’s only an

unanswered question” (Sample 2010)? Do you want them posting course-related news, sharing course-related resources, asking questions, providing clarification, or answering questions with their tweets? Do you want students tweeting during class, as part of one assignment only, or throughout the entire term? Tweeting during class can create a background discussion about what is going on in class as it happens. Tweeting can also “turn ongoing distractions into classroom-focused activities,” especially because Twitter is meant for throwing thoughts out there into the ether and creating a back-and-forth discussion; this discussion can go on in class as well as after the class has ended (Hedge 2012). Further, Twitter can help shy students who don’t want to speak up in class have their voice heard (Hedge 2012).

If you incorporate Twitter into your teaching, you will want to create a permanent Twitter archive (Tweet Archivist tracks specified hashtags <http://www.tweetarchivist.com/>). This will allow you to go back and review tweets. It can also help in grading if you want to provide participation marks for Twitter activity. You can also teach students to Storify tweets around particular topics which can serve as notes to help them study better.

An example of effective use of Twitter in the ‘classroom’ is Chris Buddle’s Natural History course, which he offers through McGill University, Canada. During the autumn 2012 course, Buddle had students work in small groups to write about a species of choice. Each group then tweeted facts, observations, and ideas about their research using the course hashtag (#ENVB222). “This is another informative, collaborative and fun way to seek input into their projects, and ... to bring what they have learned out to the broader community of biologists” (Buddle 2012). Buddle wrote about his experiences with teaching using Twitter as it was happening on his blog, and many people followed the course hashtag, including scientists from other universities. In one instance, Graham Scott from the University of Hull, United Kingdom, who was using Twitter in his field biology course (#58279hull) had his students connect with the McGill students, tweeting back and forth across continents (Figure 1).



Figure 1. An example of how students can make connections across continents using Twitter in the classroom.

Facebook

After starting out as a social network for college students, Facebook has become the dominant social network worldwide, and is therefore a useful channel for communicating science, especially because it seems to attract a different (and larger) population of users than does Twitter. Facebook shares key similarities with Twitter, which make it easier to broadcast your ideas and readings (‘mindcast’) to a broader network of people: status updates are akin to tweets; it is easy to share thoughts as well as links and images. In contrast to Twitter’s essentially stripped-down approach with tweets limited to 140 characters, Facebook also offers a richer (or noisier, some people find) array of communication options. Here are some key features of Facebook, and some advice on effective ways to use them: 1) status updates can be much longer than 140 characters making it easier to comment at some length on content you want to share, or expand on your observations and thoughts. It is possible to share mini blog-posts or essays, although we advocate establishing a real blog (see below) if you find yourself writing at length often. 2) Unlike Twitter, which is a very effective one-to-many medium for asymmetric communication, Facebook’s primary metaphor is of “friends” having conversations, giving you basic approval over who can be your friend. As such, conversations can be richer and deeper than on Twitter. That said, you can also allow people to simply “follow” you without your having to become “friends” with them and having their updates show up in your feed too. 3) Comments remain threaded under each particular post, making it easier to build and follow conversations without needing hashtags. 4) It is possible to share selectively with subsets of people (groups) by restricting who can see and comment upon particular updates or images. This requires some effort in curating your list of friends to create appropriate groups. This is particularly important if you want to use Facebook for both personal and professional networking. 4) You can also create topic-specific Facebook Groups, where you can share posts with others who need not be your personal friends. You can, for example, create a group for your lab or department, allowing sharing with colleagues and students. The Society for the Study of Evolution maintains an open group (<https://www.facebook.com/groups/21306713056/>) for conversations about evolution. Groups provide a way to have moderated conversations, but require some effort to ensure they remain active and useful. 5) A more effective way to engage with a broader audience is through Facebook Pages, which can be “liked” by anyone, allowing them to see everything shared there. Pages can be set up for a variety of purposes: a) for specific topics (such as your current research field) much like groups,

but requiring less moderation; b) for your public persona if your profile is high enough for too many people to want to friend/follow you. A good example is Frans de Waal's Public Page (<https://www.facebook.com/pages/Frans-de-Waal-Public-Page/99206759699>) where he regularly shares links and commentary on animal behavior, and images conveying the wonders of nature and science; and c) for your organization (department, college, professional society). Universities and many departments now recognize the importance of maintaining a Facebook presence in order to attract students and share information about their programs and activities. The Ecological Society of America (<https://www.facebook.com/esa.org>), Animal Behavior Society (https://www.facebook.com/animalbehavior_society), and other societies have also embraced Facebook, and maintain active pages for their outreach efforts. Katti maintains Pages for several organizations including the Central Valley Café Scientifique (<https://www.facebook.com/valleycafesci>) and Fresno Bird Count (<https://www.facebook.com/FresnoBirdCount>). 6) To share information about conferences or seminars, you can create "Events" to which you can invite potential participants, use the built in calendar functions to set up reminders, and share other information relevant to the event.

Facebook facilitates direct engagement with many people (friends, colleagues, strangers) in many-to-many conversations as well as one-to-many broadcasts. This also implies both a lower threshold for interaction as well as a greater investment of time in building meaningful conversations. Given the complex platform—with an often changing interface—and the numerous ways of sharing information, Facebook also raises a number of privacy concerns, making many academics wary of using it for professional purposes. Nevertheless, there is a lot to be gained from using Facebook if you keep a close eye on your privacy settings, and set up friends groups (and Pages) to separate personal from professional updates. If your goal is to engage a really wide audience in conversations about your research, it makes sense to go to Facebook because it has become the preferred network for most people.

Google+

A relatively new entrant among social networks, Google+, attempts to offer elements from both Twitter and Facebook in a relatively simple interface that also integrates with your other Google accounts (if you have any). Like Twitter, Google+ allows asymmetric interactions where anyone can follow you without your having to "friend" them back. Like Facebook, on the other hand, Google+ also allows you to post longer updates and essays, and comments remain threaded to build conversations. You can also add and manage events

(with integration with Google Calendar), and create profiles for organizations and institutions. Managing privacy to separate personal and professional content in your stream is easier on Google+ because friends must be added to one or more "Circles" by default, and when sharing anything, one must choose a circle. A unique feature of Google+ is "Hangout," which allows you to start and participate in live video chats with many people at once, for free. This can be used for conference calls among collaborators. More importantly, hangouts can be used for communicating live about ongoing events, such as a conference, a solar eclipse, or even a biological event like the emergence of cicadas or a turtle arribada around which a live chat may be organized for sharing the excitement with a broad public. While the possibilities are exciting, Google+ has been slow in accumulating users, although many ecologists and evolutionary biologists are beginning to join the network.

Blogs

"Blogging ... is a great way to build knowledge of your work, to grow readership of useful articles and research reports, to build up citations, and to foster debate across academia, government, civil society and the public in general" (Dunleavy and Gilson 2012). When you blog, you can show attitude and humor and hone your writing skills (Costello 2012).

We struggled with how to categorize the wide variety of ecological and evolutionary blogs that exist. Whatever categories we came up with were not adequate because many blogs fit into multiple categories. Bloggers sometimes provide up-to-date news about ecology and evolution, and other times discuss the many issues with which we struggle, ranging from publishing and grant writing, to teaching and mentoring, service, to work-life balance. Given there is no easy way to categorize ecology and evolutionary biology blog types, we subdivided them by author type: popular science writers and academics.

Popular science writers write for outreach and often provide detailed coverage of recent news issues, break down complicated topics into easier to understand concepts, or repackage recently published research findings to make them more accessible. High profile examples of popular science writers are National Geographic's Phenomena blog, featuring Carl Zimmer (The Loom <http://phenomena.nationalgeographic.com/blog/the-loom/>), Ed Yong (Not Exactly Rocket Science <http://phenomena.nationalgeographic.com/blog/not-exactly-rocket-science/>), Brian Switek (Laelaps <http://phenomena.nationalgeographic.com/blog/laelaps/>), and Virginia Hughes (Only Human <http://phenomena.nationalgeographic.com/blog/only-human/>). The Scientific American blog network (<http://blogs.scientific>

[american.com/](http://www.scientificamerican.com/)) features several ecology and evolution bloggers, along with the editor Bora Zivkovic (@BoraZ on Twitter). Note that Bora Zivkovic regularly publishes guest posts by academics, which can help increase their blog's visibility.

There are several academic blogs worth noting. Dynamic Ecology (<http://dynamicecology.wordpress.com/>), authored by Jeremy Fox, Brian McGill and Meaghan Duffy, covers broad issues in population, community, and evolutionary-ecology. The EEB & Flow (<http://evol-eco.blogspot.com/>) is a multi-authored blog that covers most topics in ecology and evolutionary biology. The Nature of Cities (www.thenatureofcities.com; where Katti is an author) brings together a broad international community of urban ecologists and shares developments in the field with a broad public. Early Career Ecologists (<http://earlycareerecologists.wordpress.com/author/earlycareerecologists/>) is written by graduate students and postdocs and focuses on topics about ecology, finding a job, communicating science, and collaborating. Deep Sea News (<http://deepseanews.com/>) is a primary source of information and discussion about marine biology, oceanography, and conservation issues due to its core of dynamic bloggers who are all academics at a variety of career stages.

There are also several great solo-authored academic blogs worthy of note. Prof-like Substance provides advice on everything from teaching to grant writing in The Spandrels Shop (<http://scientopia.org/blogs/proflike/substance/>). Terry McGlynn writes Small Pond Science (<http://smallpondscience.com/>) about the experiences and challenges of conducting research at a teaching institution. Joan Strassman writes prolifically about all aspects of academia in her blog Sociobiology (<http://sociobiology.wordpress.com/2013/02/>). Danielle Lee blogs about urban ecology, evolutionary biology, animal behavior, and diversity issues in The Urban Scientist (<http://blogs.scientificamerican.com/urban-scientist/>).

A handful of ecological and evolutionary academics are striving for more openness in science using their blogs. Rosemary Redfield and Carl Boettiger have been conducting their research in the open for years on their websites RRRresearch (<http://rrresearch.fieldofscience.com/>) and carlboettiger (<http://carlboettiger.info/index.html>). Redfield is an evolutionary microbiologist and Boettiger is a theoretical ecology and evolutionary biologist. Both write about their research as it happens, problems they are facing, statistics they are using, conclusions they are drawing, papers they are reading, and Redfield even posts submitted grant proposals.

If you are interested in blogging, read the aforementioned blogs to learn about the numerous styles and approaches. Also, consider producing some guest posts for an established blogger or network (e.g., the Scientific American blogs) or joining a multi-authored blog.

Before you start be sure to read www.scienceofblogging.com for detailed advice (Carrington 2008, Dunleavy and Gilson 2012, Podolak 2013). We highlight ten points to help ensure your effectiveness as a blogger:

- 1) Read before you write so you are aware about what others have already written about the subject.
- 2) Write about what interests you most.
- 3) Your title should tell a story.
- 4) Communicate the big message early on.
- 5) Ensure your writing is focused.
- 6) Include your own views and ideas to help your readers connect with you.
- 7) Link to research and other blogs on the subject and comment/interact with those people (Carrington 2008).
- 8) Include images and tag them as search engines look through photo tags when indexing blogs.
- 9) Ask questions—it is a sure-fire way to generate discussion.
- 10) Encourage comments and respond to all comments in a timely manner. Blogs can rapidly lose readership if the author(s) ignore comments.

Readers get annoyed by commenters that post inflammatory, derogatory, or inappropriate comments ('trolls'), so either monitor comments before they get posted or immediately delete inappropriate posts that sneak through.

If you decide to blog about peer-reviewed research (i.e., your own or others' papers), the Research Blogging (<http://researchblogging.org/>) and the Science Seeker (<http://scienceseeker.org/>) platforms provide powerful tagging and syndication tools to broaden the reach of your post, and find others' posts about published papers. Nature's SciTable has a Conference Cast blog (<http://www.nature.com/scitable/blog/conferencecast/>), which welcomes contributions that summarize or provide an overview of conferences from participating bloggers (e.g., Katti 2012).

Teaching With Blogs:

An effective way to challenge students to improve their written communication skills, and to increase interaction and collaborative peer-learning within and outside the classroom is to create a class blog. Blogging provides a more distributed mechanism for written communication and learning than traditional written essay assignments that are typically only read by the instructor. Of particular significance for science majors is the opportunity blogging provides to experience peer-review from fellow students reading and commenting on blog posts instead of just the instructor grading their writing. While some of us are using standard open blogging platforms (e.g., Blogger <https://blogger.com>, Wordpress <https://wordpress.com/>) for class blogs, dedicated digital

classroom management systems (e.g., Blackboard, Moodle) are also building blogs into their platforms, allowing for easier integration with tools for grading and monitoring participation. Given the importance many of us place on developing student writing skills, and the many benefits of doing so through blogging, we expect class blogs to soon become a standard part of ecology and evolution courses, especially in upper division undergraduate and graduate classes. Instructors can also benefit by sharing and seeking feedback on lesson plans, lectures, slides, videos, labs, protocols, experiments, and any other innovative approaches for teaching in the field and lab through blogs and other social networks.

Class blogs can come in a variety of forms to support the particular learning outcomes desired for each class. Undergraduate students in writing intensive courses may be asked to submit their writings to a class blog. For example, Katti (who has been using class blogs since 2008) requires each student in his upper division Evolution course (<http://blog.darwinsbulldogs.com/>) to submit several 500-word critical reviews of published papers during the semester, and encourages shorter posts on relevant topics for extra credit. Jonathan Eisen researches the phylogenomics of novelty in microbes. He has his undergraduate research students write posts about their research, which Eisen reads and comments on (<http://phylogenomics.wordpress.com/>). Students may also use blogs to share notes and reflections on classroom, laboratory, and field activities. Ecology students in particular can benefit from contributing to an online field journal based on field notes, where they can share ecological observations including sketches, photographs, and audio-video recordings in blog posts, and help each other solve problems in taxonomic identification and managing field experiments.

At the graduate level, Katti asks students in seminar classes to submit summaries of weekly readings, classroom discussions and any additional reflections to class blogs (<http://blog.reconciliationecology.org/>; see the earliest posts, tagged with “student”). Students can also use blog posts to develop research ideas and receive valuable feedback to help develop their thesis proposals. Sharing research ideas and preliminary results as they develop their projects can help students establish the primacy of their ideas and data (blog posts have a date and time stamp), and also draw upon a potentially much larger pool of feedback from colleagues than just their thesis committees. Graduate students can thus learn valuable skills in written communication and social networking, which are increasingly crucial for their long-term academic success. Some other examples of effective use of blogs in the classroom include:

- Mind the Science Gap (<http://www.mindthesciencegap.org/>): A Masters in Public Health course that requires every graduate student to write a blog post

each week, translating complex science into something easily understandable

- Physiologizing (<http://www.physiologizing.blogspot.com/>): Students in Emily Taylor’s BIO 502 class at California Polytechnic State University have been required to post on this blog for the last few years.
- Dezene Huber at University of Northern British Columbia has had a blog for his Animal Behavior class since at least 2010 and gets students to post to it (<https://blogs.unbc.ca/biol420-w13/>). He gets students to “explore broad subjects within scope of the course and then tell us all about what you’ve learned” and to “[f]ind peer reviewed articles or science news items that relate in some way to the weekly topic, and see if you can take things a bit further. Feel free to speculate, to think out loud, to make interesting linkages”.

Obstacles to adopting social media in the classroom may include privacy issues associated with student writings and university policies associated with placing course work in the public domain. We encourage faculty members to inquire about this with their home institution. One way Chris Buddle has avoided worry about privacy issues is to use group blogs and Twitter accounts (e.g., without student names associated with them).

Challenges of Social Media

Faculty, postdocs, and graduate students are often told to avoid social media because it wastes time. Yes, it has a tremendous power to distract and can, therefore, waste time, but it doesn’t have to. As NYU communications professor Jay Rosen put it, your tweets and status updates can come in two forms: life-casting (which fits the caricature of tweeting what you ate for breakfast) and mind-casting (where you share ideas, thoughts, readings that occupy your mind) (Wilkerson 2010). As scientists, you can opt for mind-casting posts, and follow those who do the same, so that you don’t have to sift through numerous life-casting posts on trivia to find a few gems. Here are some tips to help you be mindful (Rheingold 2012):

- Social media refers to communication platforms; platforms do not control content, you do (Shipman 2012b). Regularly manage your time by ‘unfollowing’ or ‘blocking’ people who clutter your feed with non-informative posts. If you don’t like what people are posting, stop following them. This is the only way to ensure your feed is filled with gems.
- Don’t try to keep up—sample instead. Websites, blogs, tweets, Facebook, Google+, etc. change too

often to attempt to keep up in the little time you have available.

- Set up an RSS reader to organize your information sources and ensure that the information being gathered is from like-minded individuals. A well-organized set of social media feeds can be a very effective personalized filter for the torrent of information on the web. It can also save you from continually checking blogs that you frequent for updates, as you will be informed about them all at the same time on through your RSS reader.

There are other obstacles besides time that may limit ecologists and evolutionary biologists from adopting social media tools in their research and teaching. These include lack of incentives, lack of support, concern about embargoes and confidentiality clauses, imposter syndromes, and ethical issues. Wilcox (2011) blogs about some of these research related issues and Bik and Goldstein (2013) discuss some of these issues in their section on long-term needs and outlook.

Conclusions

Social media can be very useful in finding and collating large global datasets to solve some of the larger-scale problems in evolutionary biology, ecology, and conservation. Online social networks also provide the social glue necessary to sustain networks of collaborators scattered across all the different time zones and continents. Full disclosure: while writing this paper, the authors were on different continents, and relied heavily on Twitter to brainstorm ideas, share feedback, and find and share key references.

Social media provide us with a growing set of tools to improve pedagogy and increase our effectiveness as teachers. The present decade is also seeing unprecedented levels of public participation in science, through a range of citizen science projects, crowdsourcing of data and ideas, and even crowd-funding to support research. Communicating our science openly in the public square and seeking support directly from the public assume even greater importance during recessionary periods for conventional funding sources, and when public suspicion of science is fostered by vested interests. Online social networking—especially Twitter and Facebook—have played key roles, for example, in mobilizing public support to push back against legislative measures advocating the teaching of creationism or global warming denialism in some states in the US. One very effective way to combat such regressive forces is for us biologists to use social media to share the awe and wonder inherent in our research, through images, sounds, and words, one blog post and tweet and status update at a time. As Darwin and Wallace would likely have done had they been exploring the world in the 21st century.

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