

Statement on Teaching, Research and Service - Seth C. Murray, Ph.D.

My objective as a plant breeder is to improve the quality and sustainability (both environmental and economic) of life on Earth by developing plants that fit better into the natural world and produce more with less. This is not a task that any individual can undertake alone or that will ever be finished, as new challenges and opportunities constantly arise. Towards my objective I work with partners with diverse skill sets, interests, and backgrounds. Among my most important partners, leading to some of my most significant and longest lasting impacts, are students, whom I learn from and also teach.

Teacher, mentor and role model – The last few years have been an exciting time for plant breeders. Many PhD graduates are being hired by industry six months or more before they graduate at close to six figure salaries. This demonstrates strong demand for these students. As I educate more students to work in industry, my teaching goals, philosophies, and strategies, have continuously evolved. Furthermore, new technologies, tools and findings are rapidly changing how plant breeding is conducted. Currently I play two primary official roles as a teacher (in the class room, as an adviser); however, I also have two “unofficial” teaching roles as a mentor, and as a role model in my daily activities and in developing my programs research focus.

One of my official roles is in class room teaching. My current primary teaching responsibility is the final plant breeding class for PhD students. This class allows liberty to explore student interests but comes with great responsibility to ensure that they have the knowledge and skills to be modern breeders. The goals of this class are best summarized in the learning objective topics of the syllabus: A) *Thinking and analysis* (6 learning objectives), B) *Professionalism and leadership* (3 learning objectives), C) *Science/ knowledge* (2 learning objectives), and D) *Data analysis, simulations and software* (3 learning objectives). My teaching philosophy is reflected in these learning objectives as the number relating to teaching ‘knowledge’ per se is small. Instead I want students to learn how to think independently, to ask good questions – and question everything, to be lifelong learners, to be able to deal with complexity, to work well with others of diverse backgrounds, to communicate well, and to be exemplary professionals in their field. This is in the context of the latest technologies, techniques and scientific findings that link the two often disparate disciplines of plant breeding and molecular quantitative genetics. I survey my students before class to learn what they want to learn and afterwards to understand what they think they learned. I have found that the barrier to most students understanding is quickly overcome once they can first identify what they do not understand and this is best done through their writing. In my undergraduate teaching (guest lectures and study abroad), I communicate the excitement and opportunities I feel for the subject and make sure students are aware it is their responsibility to ask questions and be learners. Another philosophy, based on my undergraduate and graduate experiences, is that students often learn more from their peers than from their teachers. I believe it is the teacher’s job to help facilitate peer to peer interaction, especially with introverted students. It is for that reason I strongly encourage group projects, and difficult homework that requires group interaction to complete rather than individual tests.

Although I believe that I am effective in the classroom as a teacher, I feel I am even more effective when students can informally ask questions and I can interact with them on a one by one basis. I interact with students on an individual basis in my official teaching role as an advisor at the graduate level (my own students, committee students) and at the undergraduate level (student workers and interns in both my own and my colleagues programs). My overarching philosophy in graduate student training is in the answer to a question my graduate advisor used to ask his students “If I ask you to paint this box red, and you do, do you deserve a degree?” A

Statement on Teaching, Research and Service - Seth C. Murray, Ph.D.

degree is awarded for individual thinking, philosophy and scholarship, not memorization and routine application. In practice, students in my program (where possible) design their own projects and are therefore primarily responsible for their own successes. My role is to guide the process as much as possible by asking them questions, providing resources, rigorously developing their written communication, and preventing major failures. I feel that there is also a role for minor failures and all of my students have two or three projects to ensure any failure is a learning experience and not a barrier to graduation. This helps them to learn skills such as time management, prioritizing, leadership, and asking good biological questions.

Finally, I have the “unofficial” (harder to quantify) teaching roles as a mentor and a role model in the department and in my discipline. I attempt to mentor students in making career and life decisions or point them to other resources (faculty, students, or readings) that can empower them to do so. I was made aware of being a role model after being introduced at multiple presentations as someone who went from PhD to faculty member and that the students should learn from this. I do serve as a role model in the capacity that I am of a more similar age to many students. I charted a career path beginning in high school and try to demonstrate that hard work and perseverance pay off. Likewise, I try to demonstrate that there is a time to joke (which I believe improves moral and reduces stress) and there are times to act professionally. Professionalism includes being prepared during teaching activities, dressing appropriately when teaching or giving talks, responding to all emails (or trying to), and making everyone feel valued. Finally, I try to be a role model through leadership in volunteering for service work, taking the lead in difficult and unpopular projects that need to get done, asking tough questions and giving science based perspectives in seminars and other professional events.

Researcher, plant breeder and scholar – In addition to having an ability to teach, I choose to work in academia so that I could pursue long-term meaningful questions that others have not addressed. It is my philosophy that academics have the unique opportunity and obligation to investigate long-term, high-risk, big picture questions that transcend the necessarily short-term views of shareholders (industry) and politics (federal government). Again my main objective as a plant breeder is to improve the quality and sustainability (both environmental and economic) of life on Earth. I believe to meet the worlds growing needs in a sustainable way we will need a major agricultural paradigm shifts such as developing high-yielding perennial polyculture systems that mimic highly productive natural systems like the prairie. This is a testable hypothesis and creating materials to test this is a specific long-term career goal of mine but it is far too large for a single funded project or even a single individual’s career. Even short-term commercial cultivar improvement is not a technology that can be improved within a year. Therefore, to be prepared for a changing world, I incorporate long-term and mid-term research projects in my program. However, a majority of my current research, is focused on projects with short term deliverables to improve systems that currently exist and allow graduate students to complete them. These projects can be divided into two main areas: 1) applied plant breeding, and 2) development of new technologies and innovations that assist cultivar improvement.

In plant breeding, the end goal is to improve a cultivar which can be planted and grown adding value to a grower or to society. This process is largely about design, much like being an architect or engineer except that 99.5% of what was created is thrown away because it was later found not to be an improvement over what is currently available. My short-term breeding goals are the result of stakeholder input, primarily the Texas Corn Producers Board, a Texas growers commodity group. These goals include yield improvement, aflatoxin resistance, and drought tolerance. I inherited a very large and unique collection of maize germplasm bred in Texas for

Statement on Teaching, Research and Service - Seth C. Murray, Ph.D.

unique traits and conditions. Therefore, I am building on my predecessors and colleagues successes by testing this material in new ways and identifying how to get these in growers hands. I am challenged by the fact that my materials appear to compete with private industry, which is much better funded and has a market, but currently fails to meet the needs of Texas growers. Every day I ask myself if I am doing the best job in being relevant to the growers in the state of Texas and how can I get my improved hybrids into their hands.

There is a strong need, as evidenced by funding, in the public sector to develop new technologies and innovations to assist plant breeders in creating better cultivars faster and with less expense. The skill sets and tools I use center around conventional phenotypic plant breeding and molecular quantitative genetics but within these, an extremely diverse knowledge and skill base is needed. As Mark Sorrells, the Plant Breeding and Genetics Department Chair at Cornell used to say “being a plant breeder means being a jack of all trades and a master of none”. In the context of the my basic science research program there is specialization but to have success in plant breeding and genetics it is about putting concepts and disciplines together which necessitates a wide range of collaborators. Nearly every one of my current funded projects is collaborative with plant pathologists, extension agents, molecular biologists, food scientists or colleagues whose interests complement my own. Research and service often overlap in my program with the large number of projects I plant for people within Texas A&M and across the country. The ability to evaluate material in additional environments is important for identifying stability and unique traits. I believe it is my duty to help to provide testing locations to the best of my abilities. Each of these collaborations has led to new opportunities.

As discussed under teaching, many of my short term research goals are set by graduate students’ interests, finding answers to questions that they ask and no one else is addressing. In summary I balance my portfolio of projects between applied breeding (cultivars that will be released to companies and growers), and more basic science and molecular quantitative genetic projects (genetic mapping, simulation studies). I also balance between short-term projects (led by graduate students for rapid publication), medium term projects (the breeding program as a whole), and long term projects (perennialism, bioenergy, colored corns, improved nutrition).

Servicing professional organizations and stakeholders – I find I have the greatest opportunity to interact with current colleagues and stakeholders as well as meeting new ones through service activities; these are often the most interactive part of my job. Additionally, I have benefited greatly from service put in by others and I want to give back. My goals for service work are to: 1) build communities to facilitate interaction (National Association of Plant Breeders – NAPB, Judging at TAMU Student Research Week); 2) Contribute professionally to my discipline (Associate Editor, journal reviewer, ASTA program chair, NAPB meeting co-organizer); 3) Contribute professionally to the University community and my department (Curriculum review committee, Graduate Teaching Academy, attending seminars); and importantly 4) Communicate research work from myself and others (presentations to growers, field days, guest presentations, answer stakeholders questions when asked).

My philosophy on service is that it is my obligation to volunteer for what is important and will otherwise not get done, areas that I could add unique perspectives and value, or activities that will increase my interaction with colleagues and/ or further my professional reputation. Previously I accepted nearly all of the opportunities presented and just worked harder (or longer) to complete them all. This approach became unsustainable and I have learned to refocus on maintaining important activities I have committed to and replacing activities instead of adding.