



Commentary

A personal view on traits useful for success in science: Daniel S. Lehrman Award Lecture

Jeffrey D. Blaustein

Department of Psychological and Brain Sciences, Center for Neuroendocrine Studies, University of Massachusetts, Amherst, MA 01003, USA

A B S T R A C T

As the 2018 recipient of the Daniel S. Lehrman Lifetime Achievement Award from the Society for Behavioral Neuroendocrinology, I was asked to give a short lecture in the Young Investigator Symposium of the combined Society for Behavioral Neuroendocrinology/International Congress on Neuroendocrinology meeting in Toronto. This lecture focused on one person's thoughts on what it takes to be successful in an academic science career. In this paper, I elaborate on success, on traits that may be useful for success in science, and on where the field of Behavioral Neuroendocrinology may be going.

As the 2018 recipient of the Daniel S. Lehrman Lifetime Achievement Award, I gave a short lecture in the Young Investigator Symposium at the combined Society for Behavioral Neuroendocrinology/International Congress on Neuroendocrinology meeting in Toronto (<http://www.icn2018.org/>). I was asked to write an article elaborating on that lecture. Because of the venue and the fact that many members of the symposium audience attended in order to hear the Society for Behavioral Neuroendocrinology's Young Investigators, I organized my presentation around what qualities I believe are important to be successful in science. I am not an expert on this topic, but after four decades as a professor in this field, I have gained some insight, at least about being an academic scientist and professor, that I am happy to share.

During my training as a behavioral neuroendocrinologist, I worked with three advisors at three institutions before achieving independence. After my first semester at Rutgers, New Brunswick, I made the risky, but well thought-out, decision to change graduate schools and advisors, returning to the University of Massachusetts, where I had received my Bachelor's Degree. After receiving my Ph.D. at the University of Massachusetts, I spent two years doing postdoctoral work at the Institute of Animal Behavior of Rutgers University, Newark. I then spent four years as an assistant professor in the Zoology Department at Iowa State University before returning to the University of Massachusetts, where I spent the rest of my career. Although I learned from my advisors, I learned far more from my peers and subsequently from my colleagues at each of my faculty positions and in my field. In my experience, peers and especially near-peers (those a bit more advanced than yourself) are most helpful in teaching the culture of research.

1. How to define success?

Quite simply, success in science should be measured by excelling at teaching and/or research. Being respected by our colleagues for doing excellent, ethical research and/or for being a well-respected and effective educator should be the goals. Administrators who engage in unselfish behavior that facilitates or enhances the careers of their peers are also worthy of our respect. Success can be defined generally as having the respect of one's colleagues and trainees.

2. What is not success?

I do not measure success solely by papers published in journals with an impact factor of five or above, as some do or by one's H index. Although journals with high impact factors publish some excellent work, important work is also published in journals with lower impact factors. Likewise, weak papers and papers that are ultimately retracted for ethical violations are published in both classes of journals. I also do not measure success by a colleague's total number of journal articles published. Finally, landing a prize position at a top research university is also not necessarily success, *unless this is the goal that you set for yourself in your career.*

3. Traits that are useful for success in science

I will now discuss the traits that I, and many of my colleagues believe, may help scientists achieve success. A modicum of intelligence is essential, but without motivation and curiosity, intelligence can be wasted talent. To be motivated, you have to enjoy what you are doing. Science should be so much fun that you do not mind the long hours that are often required. And why would anybody want the life of a scientist

E-mail address: jblaustein@umass.edu.

<https://doi.org/10.1016/j.yhbeh.2018.12.005>

Received 29 October 2018; Received in revised form 27 November 2018; Accepted 11 December 2018

Available online 22 December 2018

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without possessing in the first place the curiosity to try to understand how things work?

Scientists analyze a lot of data, so having an analytical mind and being able to synthesize are useful traits. Creativity is also useful; looking at data and seeing a relationship that somebody else did not see can be exhilarating. Scientists write numerous papers, so logic is absolutely necessary, or at least a time-saver in organizing presentations of data. You must be able to bring the reader from A to B to C in a logical manner in order for others to follow your argument and for you to be able to effectively lead them to your conclusions. In working on manuscripts with trainees, the most difficult to edit are those lacking logical organization; correcting grammar is relatively easy.

Being critical of your own work, as well as that of others, is essential. As scientists, we and our data are constantly being critiqued – our manuscripts, our grants, our presentations, and our teaching. If we are our own harshest critics, that will leave less for others to critique. We must also accept the criticism of our colleagues, reviewers, and students. They are often, maybe even usually, correct. This criticism never ends, at least not until you submit your final grant, your final paper, or your final annual performance report to your institution. Given the constant assessment, science is certainly not for those with a thin skin.

Parenthetically, when you criticize your colleagues, whether anonymously in reviews of manuscripts or grants, as well as in assessments for promotion and tenure decisions, do it in a positive, but honest, way. Your colleagues and your trainees will *usually* appreciate your honesty.

Good time management skills and multi-tasking abilities are essential to balance work and family or personal life. The ability to multi-task is essential in order to simultaneously do research, write papers, work on a grant, serve on department and institutional committees, as well as review papers and grants, maybe even serve on a grant review panel. Balancing work and family is possible, but not without good time management skills. Because not all potential advisors may subscribe to this view, if your goal is balance in your life, then by all means determine the priorities of your advisor before you sign on to a particular research group. Do the same with regard to your life partner; it helps to go through life and your career with an individual supportive of your career.

If you are not collaborative, learn how to be. We have much to learn from each other, and we cannot be expected to know everything.

It has become more and more important to be able to explain your research to non-scientists, and to provide the reasons that it is important. Legislators and tax-payers have to understand why they should care, and therefore fund, our research. The budgets of the federal funding agencies are dependent on our ability to convince non-scientists of the importance of our work.

Find time to accept service positions for which you do not think you have the time. New experiences beget other new experiences. As one example, when I was asked to become an associate editor of *Endocrinology*, I could not have predicted that it would lead to my becoming Editor-in-Chief five years later. Nor could I have imagined that there were people who would need the experience and expertise that I gained as editor-in-chief of a major society journal. Each of those resulting experiences has provided professional opportunities that I had never imagined.

Related to this, get involved with your professional societies. Involvement provides the opportunity to contribute your talents to benefit the societies and ultimately science. You are also likely to meet individuals who can help you later on in your career.

Network when you attend conferences. Your colleagues have to know who you are. A now-deceased colleague, a previous Lehrman awardee, used to tell his trainees that they had to return to their institution with the names of five new acquaintances who would remember them after the meeting.

Self-promotion seems to be in vogue nowadays, although it was not during the development of my own career. We were taught modesty; “If you build it, they will come.” That is, we were told that if we publish

good work, others will read it. It was considered improper to advertise our own work other than to a few close colleagues. This has changed. As a senior member of our scientific organization, I now understand the need for helping colleagues to find the trees in the huge forest of publications. However, I would urge you to promote your work with class and grace. Perhaps a bit of shameless self-promotion, but maybe avoid braggadocio.

Failure happens, and failure is not so bad. Every successful individual has had numerous failures. What distinguishes those with successful careers from others is often just tenacity and resilience. Recently, a high-profile publication of a “failure CV” made the news (Haushofer, 2016; Swanson, 2016). Johannes Haushofer, a professor at Princeton University, published a listing of the programs that did not accept him, grants he did not receive, and publications that were rejected. Success comes with failure. I am not going to list my own, extensive list of failures, but for every grant I received during my four decades in the business, I had at least one rejection. Although I never actually counted, for every position that I was offered, I was rejected by around a dozen. Yet, I think I had a successful career by my personal criteria. I do in fact possess both, tenacity and resilience. When knocked down by rejection, get up and try again. Nobody bats 1000, and few get close to it.

Although this should not need to be articulated, respect your peers, your trainees, and your students, regardless of their race, gender identity, sex, religion, nationality, sexual orientation, etc. Neither discriminate, nor use your position for sex. The “me too” movement has many leaders in all careers understandably scared. Discrimination and sexual misconduct in all of its forms happen in academia, as they do in other professions. Those in power over others have gotten away with a great deal of unwanted advances and worse, but thanks to the “me too” movement, many of those individuals are finally being held accountable for their inappropriate actions. I hope that this will lead to a decline in the incidence.

The final trait to be discussed is collegiality, which is appreciated by all. To put it very bluntly... don't be a jerk. Try to be the kid with whom others want to hang out with in the sandbox. Your colleagues will be more likely to want to help you out when you need technical help or professional advice from your colleagues. They are also more likely to want to write letters of recommendation for jobs and awards for you.

4. Traits that are antithetical to success in science

The worst trait that I believe you can have in science is willingness to engage in unethical behavior. Unethical behavior may result in short-term gains, possibly grants, and maybe even awards, but it does not lead to true success as defined earlier. Ethical behavior is absolutely critical; quite simply, to be successful, do not cheat. Do not plagiarize, do not fabricate, do not massage, trim or adjust data, do not steal, and always credit others who did work before you (Blaustein, 2010). In order to acknowledge those who came before you, it is essential to read the literature, even from long ago. This is being both fair and scholarly.

While I believe that science is truth, I have known scientists who have been guilty of at least one of these ethical transgressions. While people sometimes get away with it for a while, colleagues will realize eventually that something is amiss. In all likelihood, individuals who do this are defamed. They lose grants, jobs, and of course the respect of their colleagues. I hesitate to say that the system always works to self-correct errant scientists, because I do know of individuals who have not been “brought down” yet. A good adage to remember is one that does not only apply to science: If it looks too good to be true, it probably is not true. When a scientist is guilty of unethical behavior, even minor alterations of data, it undermines all of science and feeds into the disbelief of science that some members of the general public have.

5. Dogma

Do not accept dogma (Blaustein, 2004), and do not defend it against all attackers. Because my own career was shaped by my challenge of dogma, I have given dogma its own section.

When I was proposing my doctoral work, it was widely held that progesterone inhibited the expression of sexual behavior in guinea pigs, hamsters, and mice, but not in rats. This did not seem likely to me. Although, as my good friend, Per Sodersten, continues to point out, there is still a question of whether it is of physiological significance during the estrous cycle of rats, there is no question that systemic treatment with progesterone has the same facilitating and inhibiting effect on sexual behavior in rats, as it does in other model rodent species (Blaustein and Wade, 1977a, 1977b).

While working on my dissertation, we knew that there were estrogen receptors and progestin receptors in the uterus and oviduct; however, the dogma was that the brain had only estrogen receptors, not progestin receptors. Progesterone was thought to function through a mysterious, non-receptor mechanism. In my doctoral work, we provided preliminary evidence for the existence of progestin receptors in the brain (Blaustein and Wade, 1978). Following the protocol developed by Neil MacLusky (MacLusky and McEwen, 1978), in my post-doctoral work (Blaustein and Feder, 1979a, 1979b, 1980) we demonstrated their involvement in the mechanism of action of progesterone on sexual behavior.

It was widely held that, unlike females, male rats and guinea pigs did not respond to sequential treatment with estradiol and progesterone with the expression of lordosis. That is, the male brain was believed to be unresponsive to estrogens and progestins for the induction of female sexual behavior. Deborah Olster and I confirmed and extended the work of Sodersten and colleagues (Sodersten, 1976) that pulsatile injection of estradiol followed by progesterone induces female sexual behavior in males (Olster and Blaustein, 1988), a finding at odds with most models of sexual differentiation of the brain.

Although unoccupied estrogen receptors were believed to reside in the cytoplasm of cells, two papers published by different research groups in 1984 changed that, and a paradigm shift occurred (Blaustein, 2004), such that the new dogma was accepted that *all* estrogen receptors were present in cell nuclei (King and Greene, 1984; Welshons et al., 1984). When we discovered with our newly developed, immunocytochemical technique (Blaustein et al., 1988; Blaustein et al., 1992) that the unbound receptors could be found in distal dendrites and axon terminals within the hypothalamus of guinea pigs, our unconventional results were politely challenged, as was appropriate, by some colleagues. Some colleagues believed that our finding estrogen receptors outside of cell nuclei, including dendrites and axon terminals, was an artifact of the technique. Nevertheless, we persisted in further challenging our results, and this finding was then confirmed by other groups in other brain areas (McEwen et al., 2001).

Another dogmatic belief, overturned by members of Bert O'Malley's group, was that steroid receptors were ligand-activated proteins that only functioned when the receptor was bound to ligand. Shaila Mani demonstrated that dopamine, among other factors, could activate progestin receptors in the brain and consequently lordosis, by a ligand-independent mechanism (Mani et al., 1994). I was fortunate to be invited to collaborate on this work, and my group later went on to demonstrate the involvement of this novel mechanism in the facilitation of sexual behavior in female rats by genitosensory stimulation by male rats (Auger et al., 1997). Oddly, despite the fact that numerous compounds can activate steroid receptors by this mechanism, the Nuclear Receptor Signaling Atlas (NURSA; <https://nursa.org/nursa/index.jsf>) still continues this dogma by defining the progestin receptor as “a progestin-activated steroid receptor member of the nuclear receptor superfamily of transcription factors.”

To summarize, dogma can and should be challenged. When you obtain results that do not fit with the dogma of the day, do not assume

your data are the problem; often the dogma is at fault and in need of change.

6. Failure to replicate

We sometimes fail to replicate earlier work, even from our own lab. Although failures of replication have been getting a lot of attention in particular areas of science, mainly social science (Camerer et al., 2016), it is a fact of life in all of science. Without going into detail about our many failures to self-replicate, I will just say that there's nothing wrong with failing to replicate yourself. What is important is how you handle those failures. In each case that we failed to replicate our own work, we, like others with similar experiences (Sorge et al., 2014), learned something new about the environmental influences on a procedure or about hormones, brain and behavior (e.g., (Laroche et al., 2009a, 2009b)).

7. Benefits of an academic career in science

There are numerous benefits of a career in science and in Behavioral Neuroendocrinology in particular. Although I believe that a career in any aspect of science, be it industry, education, public policy, law, or any other career path that uses scientific knowledge, can be exceptionally rewarding, I know first-hand the benefits of academic careers.

For starters, an academic scientist can study what he/she wants if he/she can convince the government or other agencies that the research is worthwhile. Although this is more difficult than in the past, there are numerous examples of researchers who are being funded by federal agencies to study what they want to study, not what somebody else (e.g., management) wants them to study.

As an academic scientist, we have the privilege of interacting with amazing, intelligent, fun, and critical individuals, who know that science is real. Sadly, many members of the general public do not believe this, at least with respect to particular scientific findings (Beck, 2015). We also have the privilege of working with bright, fun trainees. Unfortunately, no matter what we tell people, we often get credit for their work, until colleagues realize it really is the trainee's work. Nevertheless, it is incumbent upon us to promote the careers of our trainees, and their success in turn reflects on our own effectiveness as mentors.

We are fortunate to have the opportunity to travel to a wide variety of interesting places and meet interesting colleagues, and often, somebody else pays. If/when we retire from being a faculty member, we often become an emeritus/emera professor. Although emeritus/emera faculty will usually not be paid, we retain many of the benefits of being a faculty member without any of the responsibilities.

As scientists in Neuroendocrinology, we can use what we learn to help the public. After almost four decades, I closed my lab in 2017, but I now write about the effects of estrogens on brain function and mental health for women with breast cancer (who are interested) and their oncologists (who in my experience tend to be less interested).

Finally, if we work hard, stay in the business for a long time, and don't irritate too many people, sometimes we get awards, like the Daniel S. Lehrman Lifetime Achievement Award that I was delighted to receive.

8. Where is our field going?

I was asked to comment on the future of Behavioral Neuroendocrinology, but I do not feel qualified to do this. I have no authority over funding decisions of the federal agencies. Nevertheless, I will make some comments regarding what I believe will be important.

Basic research will continue to be required to inform clinical science. Whether we work with animal models or cells, in order to obtain federal funding, it is likely that it will continue to be important to do work that in some way informs our understanding of the human

condition. Solid clinical trials are costly, and because it is difficult to obtain sufficient sample size, and they are difficult to control, they are often of limited value. Although understanding basic mechanisms will always be important, the work that is most likely to be funded is the work that will help in making decisions about health care in humans. It will also require the expertise of individuals, who are skilled at advocating for the use of animal models and *in vitro* systems to predict clinical outcomes. An example that has been important to me: Are estrogens good or bad for postmenopausal women (Blaustein, 2016)? Can they be both, depending on any number of conditions?

I also believe that work that aims to understand the influence of our changing climate and of the environment on the neuroendocrine system and behavior will be important. How do changes in ocean temperatures influence reproduction, an issue of great importance to our food supply and the balance of nature? How do plastics, their components, and their break-down products influence animals living in our oceans, upon which we depend? Do the microparticles that we ingest from the fish we eat influence our brains and mental health? Are the plastics and contaminants in our own environment likely to influence our brains, mental health and physiology? How does the increasing stress in our urban environments influence our brains, mental health, and physiology? How do environmental factors of any type influence the sexual differentiation of our brains?

An interesting example that has recently received attention is that China is planning to launch an artificial moon to provide illumination over cities in place of street lights (Meixler, 2018). Neuroendocrinologists should be involved in the discussion of the influence of illumination at night on our endocrine systems and mental health. Neuroendocrinologists understand the influence of dim light at night on mental health (e.g., (Bedrosian et al., 2011)).

None of our scientific findings will be of value to society, and it will become more and difficult to make the case for their importance, until those uniformed leaders change their attitudes toward science. Vaccines do not cause autism. Evolution is real. Our planet's climate is in fact changing, and it is due to humans. Despite nearly unanimous agreement among scientists for each of these and more, our fellow Americans (and possibly citizens of other countries) and many of our leaders still do not trust science. It is essential that all scientists learn how and to advocate effectively and constructively in our teaching and in our writing for the public as well as in our interactions with legislators that science is real. Scientific facts are just that, not just opinions. While it is true that dogma is sometimes confused with fact, there are scientific facts about which all or nearly all legitimate scientists agree. It is our job as scientists to find ways to convince those who do not possess our training, that "Science is real" and of benefit to society.

Acknowledgments

I thank all of the trainees who have passed through my lab in four decades and my colleagues, all of whom I have learned so much over the years. There are too many individuals who I have learned from and who have helped me in my career to name all of these individuals, but I want to single out a few critical individuals. Dr. Neil Carlson, with whom I took a course in 1970 and in whose lab I worked on my Senior Honors Thesis at UMass, sparked my initial interest in the brain and behavior. I want to acknowledge Dr. Paula Davis, one of my first graduate school lab-mates, who helped me make a critical decision in my career to change doctoral programs in 1974. I thank two of my first graduate school lab-mates, Dr. Thomas Gentry and Dr. Edward Roy, who taught me a great deal about hormones and the culture of science. I thank my first doctoral student, Dr. Theodore Brown, who helped me in my first attempt at learning how to be a supportive mentor. I thank my former graduate student, and now colleague and friend, Dr. Marc Tetel, for his critical, yet supportive, comments on an earlier version of this manuscript, and I thank Dr. Randy Nelson, who first gave me the idea for this manuscript when he asked colleagues via Facebook to list traits

useful for success in science. I am grateful to the Society for Behavioral Neuroendocrinology for presenting me with the Lehrman Award. I acknowledge the National Institutes of Health, the National Institute of Mental Health, and the National Science Foundation for funding my research throughout my career, and I thank the administrators at the University of Massachusetts, who supported my career. Finally, I thank my wife, Marilyn Hecht Blaustein and sons, Jeremy and Seth, for their support and understanding of my life as an academic scientist and professor.

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