The challenge of graduate education in the academic environment of today and tomorrow

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I accept the L. E. Casida Award on behalf of our entire program at West Virginia University (**WVU**). I do so with great humility and a clear appreciation of both the recognition it represents and the efforts by those who made it possible. I have been blessed by a work ethic instilled by my parents, by a quality education during my association with Dr. Casida, and by a singularly dedicated group of friends (my students and colleagues). The success of our program over the years has been due to hard work by those students and both constructive criticism and hard work by those colleagues. I am proud that one of our former students, Charlotte S. Farin, is presenting her work during this symposium.

This award was developed to recognize quality in graduate education. It was based in part on concepts outlined in a talk on graduate education that Dr. Casida presented to the American Society of Animal Science in 1965 (Casida, 1966). During the fall semester of 1965, he presented a seminar on the same subject at WVU. On that occasion, he was invited to review our proposal for an interdisciplinary doctoral program in reproductive physiology. Members of the proposed faculty of reproductive physiology were from seven departments, led by the group in Animal and Veterinary Sciences.[3] At that time, WVU was largely an undergraduate teaching institution. In the 5 years between my graduation in Dairy Science in 1959 and my return to the faculty from the University of Wisconsin in 1964, student enrollment had doubled, from 6,000 to 12,000.

I will never forget one thing that Dr. Casida told me during that visit. Near the end, I had asked, "What do you think?" He looked me squarely in the eyes and said, "The group you have here can do it, but Keith, you must always remember that you are playing with people's lives." The fact that we "are playing with people's lives" in graduate education (in fact, in all education) has not changed.

The model that Casida epitomized at Wisconsin was not his alone. The principles were gleaned from Casida's mentor, Dr. Fred McKenzie at Missouri, and from other great teachers of research in animal breeding and anatomy (Day, 1994). These principles were developed and nurtured six to seven decades ago in the then fledgling sciences of embryology, endocrinology, and reproductive physiology. Other universities contributed as well, but the University of Wisconsin was truly a leader in the development of the complete land grant philosophy.[4]

My life as a professional reproductive physiologist has been very rewarding. It was a great honor for me to have the privilege of working for 5 years with Dr. Casida and his colleagues in Madison. It was a distinct pleasure to be able to present the first of these awards in his name to Dr. Lester C. Ulberg in 1985 (Inskeep, 1986) and to see later awards presented to Drs. Allen Tucker, Harold Hafs, Bob Foote, Billy Day, Fuller Bazer, and Bill Thatcher. I have had the valuable opportunity to interact with each of these men in some manner over the years and the special privilege to hear and read their advice on graduate education (Ulberg, 1986; Tucker, 1988; Hafs, 1990; Foote, 1992; Day, 1994; Bazer, 1996; Thatcher, 1998). It would serve little purpose for me to reiterate those tenets and philosophies that they espoused. We all share most of them, and they have proved continually to be sound.

Therefore, I will take a different approach today. It seems important to try to put into context some of the changes that have occurred in the milieu in which we work and in our students. If we can understand and relate to those changes, perhaps we can develop the approaches needed to maintain and strengthen graduate education in our field of science in the decades ahead.

I have participated in graduate education for 35 years at a mid-sized, underfunded, land-grant institution, as a member of a graduate faculty in which, fortunately, quality has been emphasized over quantity. In addition, I have served on numerous committees and councils on graduate education at the institutional level and reviewed several other programs. My thoughts today come from experience as a participant, not as a pedagogical scholar of the process. My experience is probably most relevant to my generation, and some of the current trends that I find disturbing may be adjusted to more easily by colleagues from later generations. I am certainly not the first to observe these changes or to consider their impacts on science. Many of them were predicted by the Nobel Laureate Paul Weiss in a lecture in 1961 that is valuable reading yet today (Weiss, 1962).

Changes

To set the stage for an examination of current and future needs of quality graduate programs, let us consider what has changed during the last four decades. What was it like when I entered Dr. Casida's laboratory in 1959, compared to what is the case today in regard to several key factors that affect the conduct and outcome of graduate education? The choices of examples that I have made do not imply that these changes are "good" or "bad," but these changes do have significant implications for graduate education.

Then. Professors were respected by students, administrators, and clientele, and they had a mutual respect for the other groups. Most students and few professors were in the lab at night, and professors were usually present on weekends only if their help was needed for a special experiment.

Now. Many faculty and administrators do not respect or trust each other, and students show less respect for faculty, often calling them by first names, for example. More professors than students may be in the lab at night or on weekends.

Then. Department heads were elected by the faculty. Most administrators were trusted friends among the faculty who took their turns in those roles after successful academic careers. They seemed to view their task as one of supporting the scientist/teacher, making it possible for things to happen.

Now. University administrators are selected by national searches from among folks who want the position but who may not be familiar with the constraints under which the faculty members of the institution carry out their work. Administrators seem to operate in a *culture of fear*, with regulatory compliance and procedures to avoid lawsuits receiving more of their time than the promotion of academic excellence and maintenance of core academic programs and values.

Then. Dr. Casida's lab was well-funded; there were few demands for strict accountability to the individual project. I was later to state that "the average graduate student at Wisconsin has more purchasing power than the average full professor at West Virginia." Services to research were first-class, with dedicated secretaries, animal technicians, and farm workers in abundance.

Now. Accountability and justification of everything to everyone are placing tremendous time constraints on the efforts of professors to do research and to educate graduate students. Fiscal bottom lines, downsizing, and other concerns once relegated to business are now foremost in the purview of the academic business. Nine-month appointments for faculty members in agricultural experiment stations seriously limit their ability to direct graduate students. Secretarial and technical help for the faculty to carry out their duties may well be limited or nonexistent. Most of us have computers on our desks and do our own typing.

Then. All the graduate students in Dr. Casida's laboratory were males, all were excellent scholars, all were dedicated to careers in reproductive physiology, and most had grown up on farms. Almost all had played important roles within their families as they grew up, which pushed them into maturity. We worked on research and attended classes during the day. Studying was relegated to nights and weekends, but we still had time for fun. The average student had few outside interests.

Now. Graduate students come from several countries and cultures; most likely, more are females than males. Most American students did not grow up on farms, and fewer of them have any real experience in animal agriculture or even in handling animals. Most have had more privileges and fewer demands from their families to work, and some lack focus and dedication. Many are not sure what career they really want to pursue. Some will go to veterinary school, medical school, law school, or business school (MBA) after they have completed the M.S. or even a Ph.D. Many students expect more amenities to be provided. They have numerous outside interests and may consider conducting an experiment on weekends or collecting samples around the clock to be unreasonable demands.

Then. In Casida's laboratory, palpation of cows *per rectum*, bioassays of hormones in the pituitary, laparotomy, and analysis of variance were the four staple techniques in use. Progesterone in luteal tissue was extracted and measured in a spectrophotometer. Treatments of animals and most of the collection of data were done by the students and faculty, and we all helped each other as needed. Thus, we became familiar with the concepts and results in several species and areas of work. This knowledge helped young scientists learn how to "trick the animal" into revealing secrets of biology. Later we were to realize that great advances in understanding were made from knowledge of the contents and concentrations of hormones in endocrine glands, when the interpretations made were confirmed by assays of hormones in blood (Inskeep et al., 1982).

Now. Techniques in molecular biology and protein chemistry predominate in current studies. Culture of gametes and other in vitro manipulations take precedence over work with the whole animal. The advent of ultrasonography and other imaging technology has revolutionized in vivo studies, so that time-consuming surgery is used less frequently. More collaboration is required to obtain access to techniques needed, but the student may be working more often as an individual on an isolated project.

Then. Presentations at scientific meetings were oral. As pointed out by Day (1994), students practiced their papers extensively. Abstracts submitted were reviewed, and only those that were judged to have tested a hypothesis adequately were accepted. Members in the audience raised serious questions about experimental designs, analyses, and interpretations.

Now. Essentially all abstracts submitted are accepted. Often two or more abstracts on the same subject are submitted from one laboratory. Having accepted large numbers of papers, societies have been forced to devise alternatives to oral presentations. Most papers are presented as posters. Some students prefer not to face the large audience and state that they meet more people with a poster (perhaps without having made an oral presentation for comparison). When students present only posters, prospective employers have little basis on which to judge their skills in oral presentation.

Neither student nor mentor pride is apparent in many of the oral presentations. Because of a "kinder, gentler" approach, few people ask difficult questions or offer constructive criticisms after either oral or poster presentations. However, many people leave the session complaining to colleagues about the poor quality and lack of new findings in the presented papers.

The Current Situation

"Time to think" does not seem to exist for faculty members. The completion of forms and reports requires a major commitment of their time. As one example, applications for approval of projects by the Animal Care and Use Committee require more time *now* than grant proposals did *then* (Dailey, 1999). In addition, grant proposals today are more complex, detailed, and time-consuming. Promotion and tenure has

become a cumbersome process, with outside letters, boxes of documentation, and decisions being made at the provost's office rather than in the department.

In short, outsiders (who often have no education in science and represent special interests) are determining both our values and our priorities, and it seems that academic freedom is a lost concept. The core values of our institutions of higher learning (educating young people and adults, generating new and exciting information, and taking intellectual risk) are badly out of focus and endangered.

In the present context, many students come to the laboratory with considerable confidence that they know more than they really do, with less maturity, with less experience in accepting responsibility, and with a much different work ethic. Most did not grow up in families in which they were "needed" to play a responsible role in the family unit. This leads to a considerable conflict between the current students and some of you listening today who learned to work on diversified family farms. We benefited from the knowledge and work ethic of our parents and others around us who were members of the "World War II Generation," which Brokaw (1998) has called "The Greatest Generation." When I was in high school, I helped grow and harvest the crops as well as milk and care for 80 dairy cows. I got hands-on experience with turkeys, chickens, sheep, hogs, beef cows and calves, stocker cattle, corn, hay, and small grains. That the children were "needed" in the family unit was clearly shown by the fact that my father sold the dairy cows when my youngest brother left the farm for college. Current students are more apt to be like my cousin's daughter, who has her first job this summer after already completing her freshman year at a prestigious university.

We perceive that most of us went into science because of our curiosity, coupled with a desire to avoid some of the routine we had encountered in other work. In contrast, many in the current generation seem, at least to those in my generation, to have fame or fortune as goals, or no goal in particular. Because of their different experience and background, many of today's students must learn a work ethic, responsibility, honesty, and integrity. The problem has been recognized by the NIH, which now insists that postdoctoral programs include some formal education in research ethics. These needs are in addition to the scientific method and the ability to think in the field, intrinsic to the philosophy adhered to by Dr. Casida and those educated in his laboratory and the laboratories of previous recipients of this award. The time required of faculty members to accomplish these additional teaching needs of graduate students is significant, and this role is beyond the experience of many faculty members. These needs detract from the process of careful mentoring of the student's skills in research, communication, and invention.

Another formidable challenge facing the faculty member today is that the promotion and tenure bureaucracy is in conflict with a quality graduate education. For example, graduate students may lack communication skills. It is in their best interests to work through the numerous iterations of a manuscript required to make it publishable, yet the young professor may preempt the process and largely write and edit the manuscript, perhaps even taking senior authorship. These mistakes occur because the single most utilized operative criterion for tenure is that the faculty member must publish rapidly in the early years. If the professor does the writing, the student who began a graduate program in an immature status may fall further behind, and the postdoctoral program may become remedial graduate education. Although Bazer (1996) correctly pointed out that publication is a must for completion of the work, Ascoli (1989) has emphasized that quantity of publications is a poor measure and that we must pay more attention to quality. If the student is robbed of the opportunity to learn how to write for publication, the legacy of quality to the next generation of scientists has been compromised.

While on the subject of communication, although communication skills may not have changed, diversity of backgrounds and experiences is a challenge to communication and to congeniality in the laboratory. For example, males and females interpret the same words or actions differently. One person does not hear what the other person meant to convey and concludes, "I don't want to work with him (or her)" in the laboratory, without thinking through what that statement really means. Deborah Tannen's books, *That's Not What I Meant* (1987) and *You Just Don't Understand* (1990), have become valuable resources.

Dr. Casida believed in collaboration in research and graduate education. He emphasized the opportunity to learn from studies outside one's immediate field and to adapt concepts from other species. He participated with his students in seminars and journal clubs in three or four departments or programs each week. Each student made at least one presentation in each of those venues each and every semester. Thus, the students gained both breadth of knowledge across the field and skills in communication to deal with both people and ideas. When I came to work with Dr. Casida in Genetics and W. J. "Tip" Tyler in Dairy Science, Casida had other students in collaboration with Art Pope and Ed Hauser in Meat and Animal Science. I wonder whether Neal First would have been the successful and recognized researcher that he is today if he had not taken advantage of the opportunity to collaborate with Casida and A. B. Chapman when he first arrived at Wisconsin. I know that I received tremendous mentoring through collaboration with Roy Butcher, Alexander Kenny, Clyde Johnson, and Peter Hall during my early years at WVU, as well as from the guidance and advice of Nicholas Fugo, Edmund Flink, John Jones, and George McLaren.

Some current administrators tell newly hired faculty members that they must "develop an independent program of research" to earn tenure. This approach, if taken literally, may deprive them of the mentoring that one can receive from collaborators. Meanwhile, those same administrators ask established faculty to mentor new ones. Not only does assignment of mentors fail to take advantage of many natural collaborations, but also mentoring often is devoted more to preparing for the process of promotion and tenure than to building a truly professional academic career. As a result, too

many young faculty members may fail to understand that our role is to promote the professional development of the graduate students. Graduate students are not in the university to promote the professional development of the faculty.

Henry Prentice Armsby referred to the education of the beginning scientist and the roles of the scientist in the advancement of agriculture in his presidential remarks to the Society for the Promotion of Agriculture in 1907. He pointed out that "the genius in science is driven by an inner compulsion to search out the hidden things of nature. With this exceptional man the only question is how to make the conditions surrounding him such as to render his work most effective" (Armsby, 1907). In spite of changes that have occurred, our academic institutions have continued to develop excellent scientists, and faculty members have continued to be productive, but the capacity to compromise has been nearly exhausted.

Conclusions and Goals

The time has come when the conditions under which scientists and their students are working in academia must be reassessed. Conditions in the academic environment must be changed to promote rather than hinder the success of the prepared mind in both research and graduate education, which go hand in hand. In both aspects, the tenets of quality, the reduction of problems to testable hypotheses, testing these hypotheses with rigorous experimental designs, and the teaching of basic biological principles that brought success in the past must be retained. Research is exploration, and exploration involves risk; the system must be redesigned to encourage, rather than inhibit, risk-taking.[5]

Scientists must guard against inventing problems to utilize existing techniques and develop the in-depth thinking that will allow our students to invent techniques to solve the problems. In the last two decades, the importance of teaching has been diminished. Graduate education in the sciences, particularly in many of the schools that have grown in the rapid manner that I described earlier for WVU, has not been an intrinsic priority and has been overly dependent on soft monies. The concept that teaching is important must be restored, with excellent teaching as the core value of academia, in the classroom, in the research laboratory, and with the clientele in the real world.

To accomplish these goals, academic leaders will need to reduce their concentration on the processes of accountability and regulation, and instead increase their focus on the desired results. Faculty members will have to become more aware of social, societal, and demographic factors that influence the backgrounds and values of our students and portend conflicts among generations (for examples, see Sheehy, 1995). Students will need to attain a greater breadth and depth of knowledge, so that an understanding of the function of the whole animal and its place in the global production system may be restored.

Literature Cited

Armsby, H. P. 1907. Research as a career. Soc. Prom. Agric. Sci. 28:9-26.

Ascoli, M. 1989. Editorial: Quality versus quantity. Endocrinology 124:i-ii.

Bazer, F. W. 1996. Graduate education: Training and learning experiences of an animal scientist. J. Anim. Sci. 74(Suppl. 3):60-63.

Bell, J. M. 1996. Hoofprints to reprints: The history of the Department of Animal Husbandry, Animal Science and Animal and Poultry Science, University of Saskatchewan 1909-1989. College of Agric., Univ. Of Saskatchewan, Saskatoon. pp 5-6.

Brokaw, T. B. 1998. The Greatest Generation. Random House, New York.

Casida, L. E. 1966. Graduate training in animal science: Degree requirements and the involvement of the student in the research program. J. Anim. Sci. 25:1236-1239.

Dailey, R. A. 1999. Who is directing the research? Soc. for the Study of Reprod. Newsletter 16(1):8-9.

Day, B. N. 1994. Graduate education: One way. J. Anim. Sci. 72(Suppl. 3):55-57.

Foote, R. H. 1992. Animal scientists: Nature and nurture. J. Anim. Sci. 70(Suppl. 2):51-54.

Hafs, H. D. 1990. A philosophy of research and graduate training. J. Anim. Sci. 68(Suppl. 2):39-40.

House Committee on Science. 1998. Unlocking our future. Toward a new national science policy. A report to Congress. Available at: http://www.house.gov/science/science_policy_report.htm.

Inskeep, E. K. 1986. Presentation of the L. E. Casida award for excellence in graduate education and research. J. Anim. Sci. 62(Suppl. 2):106-107.

Inskeep, E. K. 1990. Annual report of the Animal Science Panel, CSRS, USDA.

Inskeep, E. K., R. A. Dailey, and R. C. Rhodes III. 1982. Some considerations on the value of hormonal assays and a knowledge of hormonal profiles to production of red meat animals. S. Afr. J. Anim. Sci. 12:85-101.

Sheehy, G. 1995. New Passages. Random House, New York.

Tannen, D. 1987. That's Not What I Meant. Ballantine Books, New York.

Tannen, D. 1990. You Just Don't Understand. Ballantine Books, New York.

Thatcher, W. W. 1998. Graduate education: Inherited, developed and acquired traits of a graduate student mentor. J. Anim. Sci. 76(Suppl. 3):76-79.

Ulberg, L. C. 1986. A philosophy of graduate education for animal science. J. Anim. Sci. 62(Suppl. 2):109-111.

Weiss, P. 1962. Experience and experiment in biology. Science (Wash DC) 136:468-471.

Notes

1. I thank Drs. Caird Rexroad and Paul Lewis for their time in nominating me for the Casida Award. Drs. Neal Schrick, Gary Anderson, Peter Hansen, Rick Barb, Jeff Armstrong, and Jim Tilton of the symposium committee were gracious in selecting me for this honor and providing the time to speak. Most important to this presentation, thanks to Drs. Bob Dailey, Ollie Ginther, Greg Lewis, Paul Lewis, and Phil Senger for valuable discussions and comments on the current status of graduate education in

the animal sciences and on the manuscript. Jean Dailey provided valuable and appreciated editorial suggestions.

2. Correspondence: G044 Agric. Sci. Bldg. (phone: 304-293-2406; fax: 304-293-2232; E-mail: einskeep@wvu.edu).
3. Because interdisciplinary programs of graduate education will become more prevalent, readers may be interested in the historical development of an interdisciplinary graduate program. Background on some of the early faculty of the reproductive physiology program at WVU may be helpful. Harold E. "Bill" Kidder had been teaching an undergraduate course in reproductive physiology in Animal Science since coming from Wisconsin in 1954. Bill was a Colorado native, inspired by a great teacher at Colorado State, H. H. Stonaker. He was already a great teacher himself, and it was his course and guidance that had inspired me to go to Wisconsin for graduate study and many other WVU students to pursue a graduate education. Nicholas Fugo, who had studied the effects of LH in the weaver finch with Emil Witschi at Iowa, was head of Obstetrics and Gynecology. Dr. Fugo was interested in how delay of ovulation, or intrafollicular aging, might contribute to congenital defects in human beings. In 1962, he had hired Roy Butcher, a West Virginian who earned his doctorate in Robert Melampy's laboratory at Iowa State University after he had completed an M.S. at WVU with Bob Dunbar (Ph.D. with C. R. Henderson at Cornell University) and Jim Welch (Ph.D. with Andy Nalbandov at the University of Illinois). Roy was developing a model for aging of the oocyte in rats, using John Everett's classic finding that injection of pentobarbital during a critical period on the afternoon of proestrus delayed the LH surge until the next afternoon. Charles Norman was doing research on extenders for room-temperature storage of bull semen in the Biology Department. One of his former doctoral students, Clyde Johnson, had joined Animal and Veterinary Science and, along with Don Horvath, was advancing room-temperature storage of boar semen. Gideon Louw, in Biology, had been educated in South Africa and brought a different perspective on pituitary function. Joginder Nath in Genetics, another Wisconsin graduate, was interested in freezing ram semen; John Thomas and Rich Cenedella in Pharmacology were studying androgen action in male accessory glands and sperm motility, respectively; Bob McCafferty in Anatomy was interested in the Harderian gland; and Walt Moran in Surgery was studying antidiuretic hormone.
4. When the University of Saskatchewan was established, President Walter Murray led a team to eastern Canada and to the United States in October and November of 1908 to study how to best manage degree level education in agriculture (Bell, 1996). They visited 11 schools and concluded that the University of Wisconsin model was to be recommended. The Minister of Agriculture, W. R. Motherwell, was not convinced and sent his deputy, W. J. Rutherford, to conduct an independent study. Rutherford confirmed the earlier conclusions and the University of Saskatchewan was organized with Agriculture as a full-fledged College.
5. It has been well recognized that peer review panels are very conservative. I emphasized the need to take risks in funding and the association of risk with innovation in a 1990 report to the National Research Initiative (USDA) after serving as Panel Manager for the Animal Reproduction Program (Inskeep, 1990). More recently, the House Committee on Science (1998) has made the point very strongly that young scientists must receive support for risky but innovative studies.