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## The Past, Present, and Future of Equine Science

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## Review Article

## The Past, Present, and Future of Equine Science

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## ABSTRACT

A core group of 27 equine nutritionists and physiologists joined together in the late 1960s to formally address and enhance the direction of equine research, creating the Equine Nutrition and Physiology Society. In 2003, that growing society transformed into the Equine Science Society, which now serves as the preeminent, internationally recognized scientific equine organization. In recent years, it has been appreciated that equine science encompasses a wide range of focus areas, including exercise science, nutrition, genetics, reproductive physiology, teaching and extension, production and management, and mix of other specialties, qualified as biosciences. Additionally, trainees are highly valued in the society, with the clear understanding that young people are the future of equine science. Amongst tightening budgets, equine researchers must focus on timely dissemination of high-quality research studies and development of strong, interdisciplinary, cross-species, and multi-institutional collaborations to ensure sustainability of academic research programs. With a little creativity, equine science will continue to thrive for the betterment of the horse and all involved in the equine industry.

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## 1. The Past

The past is the past. Knowing the history of an organization can help that organization move forward. How could that core group of researchers involved in equine research in the late 1960s have had the vision that has served those in equine science so well? The review of the first 25 Equine Science Society (ESS) symposia relayed that vision spelled out in the society objectives: (1) to conduct quality research related to equine nutrition and physiology; (2) to establish effective communication among researchers, teachers, extension, and production personnel regarding nutrition and physiology; (3) to conduct periodic symposia; and (4) to cooperate with other organizations having similar or related interests [1]. It is from that past associated with the Equine Nutrition and Physiology Society (ENPS), now ESS, that has allowed the society to grow and make a difference in how horses are fed, bred, worked, housed, and cared for. It has also aided horse owners in their relationship with their horse as they use and enjoy them.

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The society started simply with a small meeting in 1968 with 27 people discussing 23 research presentations. The proceedings came after the meeting so as to not limit participation [1]. From the humble beginnings, the society grew with more and more attendees. This growth was also a reflection of how equine research was changing and growing at universities and other organizations. In the review by Nielsen, Coleman [1], one can see how the numbers of participants grew along with institutions represented.

In 1989, Dr. H.D. Stowe, who had served as the chair of the first meeting, organized an index of the papers presented at all of the symposia up to and including 1987. In this index, there is a section for authors and subject matter. This was a daunting task as all of this material would have existed as hard copy only. With any society, how records are stored now is very different than at the time ENPS was getting started. No e-mail; all relied on the postal system and someone having space to store all the documents, which was extensive considering proceedings included full papers, not the shortened abstracts with which most are familiar today. When one reviews the index of subject matter, topics are wide ranging and cover all areas of research. This document is an excellent source of historical information on the society as to where it started and how far it had come till it became ESS. The index also shows how the objectives of the society were being fulfilled [2].

While it is noteworthy that the science was being done and people were meeting to discuss the work, what impact was it hav-

**Table 1**  
Number of posters presented from 1987–2003.

Year	Location	Number of Posters
1987	Colorado	29
1989	Oklahoma	16
1991	Calgary	23
1995	California	24
1997	Texas	44
1999	North Carolina	45
2001	Kentucky	42
2003	Michigan	38

ing? In a cursory review of the literature cited portion of the 1989 NRC Nutrient Requirements of Horses, some interesting numbers came to light. In the references for energy, 26.3% of the citations came from ENPS proceedings while under the protein listing, 31.6% of the citations came from the ENPS proceedings. In addition, another 20 citations covered topics related to minerals, vitamins and other related nutritional topics. This might seem to be inconsequential but remember, this information came from the proceedings that, at the time, were not available on PubMed or other such search engine. In many cases, if someone noted a citation that was from a proceeding, they may have had to contact the author or the society itself to acquire the reference.

To address the objective of organizations with related interests, the society incorporated invited speakers into the biennial conference. These speakers came from other parts of the equine world or other areas of science that would benefit the membership. The first speakers were part of the symposium in 1991 in Calgary, Alberta, Canada. The speakers were incorporated in the program in a manner that all symposium attendees would have the opportunity to hear them [1]. The concern over making choices when attending the symposium was always considered, especially when new areas of subject matter were introduced. As was common with many attendees who were extension or teaching faculty, the need and desire to catch all the topics presented was always a challenge.

The interest in equine research, teaching, and extension continued to grow and as such, so did attendance at the symposium. With this increase in interest came an increase in presentations. Time became a limiting factor to accommodating all of the submitted papers. To aid in management of the submissions, a poster session was developed and, in 1987 in Colorado, the first session was offered with 29 posters from all sections being presented. The poster sessions have remained a strong part of the symposium as can be seen in Table 1.

While the addition of the poster sessions has given many an opportunity to present their work, the issue of making all the abstracts fit into the limited time for the symposium has continued. As the posters have increased in popularity, sessions are divided within the program to allow all the opportunity to view and discuss the work being presented. While it was mentioned previously, much of the information presented at the symposia has made its way into various other publications, including the current 2007 NRC Nutrient Requirements of Horses along with numerous textbooks for students of the horse.

But how can ESS connect with the end user: the horse owner? There have been many conversations about what to do and how to do it. In 1981, at the seventh Equine Nutrition and Physiology Symposium, a producer session was incorporated into one evening of the symposium. This program along with one in Kentucky at the eighth Symposium featured three topics presented to the local horse community. After an absence, the 12th Symposium in 1991 brought the program for horse owners back with a Horseman's seminar similar to the previous two programs. The topics and speakers are found in Table 2.

In order to reach a different group but one that has a strong related interest in equine research, the 15th symposium had an evening program that was dedicated to the practicing veterinarian. The program topics are in Table 3.

That group of researchers who started the society in the late 1960s had what was a vision for the future. While the early focus was on nutrition and physiology, it has allowed the society to grow and incorporate much more that is reflective of the science of the equine. The objectives of quality science and effective communication has allowed the society to grow. The incorporation of both graduate student (beginning in 1985) and undergraduate student (beginning in 2007) competitions fosters new members of the society. That desire to bring in new members started in 1977 when invitations were made to encourage students and those new to equine research to participate (Coleman, personal communications).

Has one topic or presentation made a difference in how many deal with the horse and the horse owner? One specific paper comes to mind. The paper was "A Condition Score Relationship to Body Fat Content of Mares During Gestation and Lactation" in 1981 authored by Dr. Henneke et al. [3]. This was in the seventh Proceedings of the Equine Nutrition and Physiology Symposium in Warrenton, Virginia. For many at the symposium, it was the first introduction to the Body Condition Scoring system, the system that today is often referred to as the Henneke system.

Like this research, there are many others that may be pivotal to how equine research is conducted and how equine courses are taught which may have been developed from efforts stemming from ENPS, now ESS. The vision from the past has been and continues to be a sound basis for the present and the future of equine science. Those four objectives were sound concepts of what was needed then and hold true today; they just have a broader interpretation.

## 2. The Present

The present becomes the past immediately yet shapes the future forever. Describing the present therefore must refer to the past and inform the future, making a careful evaluation of the utmost importance. The present society, ESS, was born in 2003 of this very process and of the ENPS described before. That past informed the future, our present, to develop the ESS of today. This society that is established as one of the preeminent, internationally recognized scientific equine organizations is at another point of reflection. Strength is in numbers and data from the past two decades reflects growth of the Society, not only in symposia abstracts and registrants, but in membership, both graduate student and professional (Fig. 1). Our successes have drawn us in many directions. It has grown beyond nutrition and physiology to be more deliberate and inclusive. Now nutrition, reproductive physiology, production and management, teaching and extension, genetics, exercise science, and equine bioscience are all elements that make up this scientific society. The research has changed, the teaching and extension have changed.

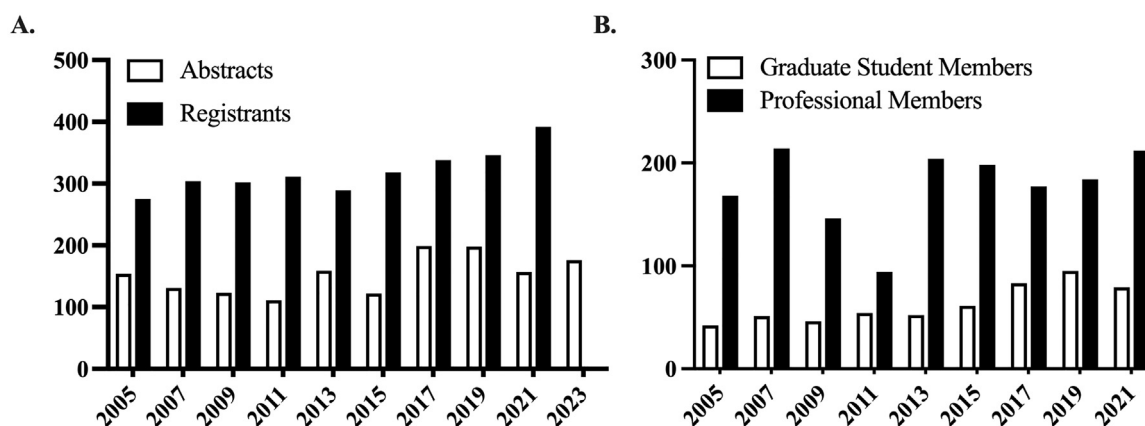
From beasts of burden to symbols of wealth and freedom, horses have been part of the human society for eons, yet a true understanding of their care evaded us. ENPS set out to remedy this. Research goals were clearly if not broadly understood. The Equine Science Society has many of those answers. The NRC (last updated in 2007) remains amongst the most valuable tools in caring for the equine partner and is the demonstrable result of work studied and reported through this society. Detailed and incremental gains continue as nutrient requirements and metabolic inferences are studied and published (reviewed by Harris, Ellis [4]). Many of the mysteries of reproduction have been solved, as well. In May 2003, Idaho Gem (the first equine clone) was born, al-

**Table 2**  
Applied research review sessions incorporated with ENPS/ESS symposia.

Symposium	Year	Location	Topic	Speaker
Seventh	1981	Warrenton Virginia	Equine reproductive physiology	J. Warren Evans
			Equine nutrition	H. F. Hintz
			Learning behavior of horses	G. D. Potter
Eighth	1983	Lexington Kentucky	Advances in equine reproduction	E.L. Squires
			Horse feeding in the 80s	H.F. Hintz
12th	1991	Calgary Alberta	Nutrition research	M. Russell
			What has it provided for Horsemen	
			Advances in reproduction	K. Malinowski
			Applications in exercise Physiology	C. Wood
			Assessing fitness in performance horses	

**Table 3**  
What is new in equine science for the practicing veterinarian. 1997 15th equine nutrition and physiology society symposium.

Topic	Speaker
New techniques for shipping cooled semen	E. I. Squires and S.P. Brinsko
Feeding broodmares to achieve high reproduction rates	G. D. Potter
Nutrition of the young growing horse for optimal bone development	E. A. Ott
A scientific approach to nutritional supplementation of performance horses	L. M. Lawrence



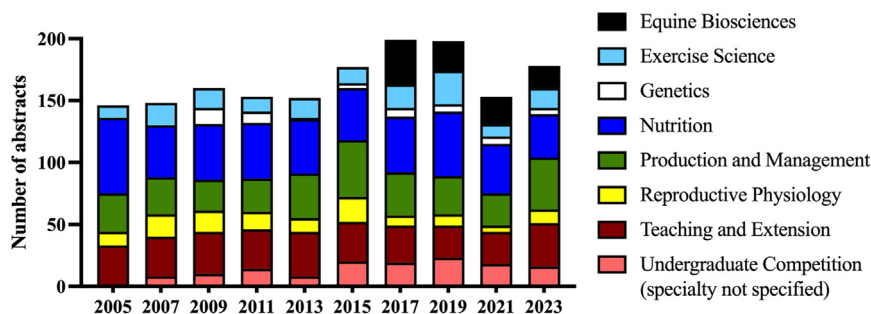
**Fig. 1.** The data collected from each Equine Science Society Symposium since 2005 demonstrate the relative health of the society. (A) Abstracts accepted and presented and (B) professional and graduate student membership have all remained constant with some tendencies to increase. The registration and attendance at the symposia have increased.

though only ½ horse [5], followed 20 days later by Prometea the first horse that happened to be carried by her donor [6]. Now commonplace, cloned horses continue to make the news. Adolfo Cambiolo rode 6 clones (Cuartera 01–06) of his favorite mare to win one the most prestigious polo matches in Argentina (2016). Genetics and possibly a species have been restored, when the San Diego Zoo contracted a Texas veterinarian and former invited ESS speaker (Murfreesboro, TN 2011) to create Kurt, an endangered Prezwalski foal, from stored genetic material. Even the mystery to in vitro fertilization was solved [7]. Equine geneticists have mapped the entire genome [8] twice over [9]. The primary genome has been updated three times (EquCab 3.0). They have solved and resolved the Equus evolution mystery [10]. A multitude of diseases are now of known genetic causes (reviewed by Finno and Bannasch [11]) and pooled resources from these researchers has resulted in impressive genotyping arrays [12]. The genetic knowledge does not stop at the horse. In fact, the present understanding of the microbiota grows almost daily. Equine Science Society scientists study and describe the microbiota in the gut (reviewed by Garber and Hastie [13]) and the reproductive tract (reviewed by Poole & Soffa [14]) in hopes of further understanding its role in the health of the horse. Exercise physiologists continue to study and gain insight into the equine musculoskeletal system. Exercise-induced pathologies and micro damages are the focus of many. ESS has members

branching out further yet, where they study the relationship between horses and humans. They can demonstrate the true value in having horses involved in therapies of many kinds [15]. Others relate common diseases and nutrition to training and musculoskeletal repair (reviewed by Peat and Kawcak [16]). Too numerous to mention are the overlapping projects where genetics predict disease or control metabolism. Disease induces exercise changes. Nutrition regulates reproduction and post fetal metabolism. These are but a very few examples of the present research findings.

This society is the epicenter for modern teaching and extension. One need not look further than the 2021 ESS Symposium. This was a virtual meeting where educators embraced the challenges and presented data on online courses [17] and how COVID affects care access [18] or the equine industry itself [19]. The student presentations continued, and the students thrived. Workshops provided in real-time allowed for great participation, maybe even by those who may never have had the ability to travel. It was here too that described the balance or difference between technology and hands-on learning [20].

These spectacular advancements have drawn in new scientists and allowed us all to reach for answers and collaborations with others. The quality of the work is recognized by individuals, philanthropic foundations, industry and even federal agencies. ESS



**Fig. 2.** Number of abstracts in each specialty section presented at ESS symposia from 2005 to 2023. Numbers include posters, student competition papers, and regular section oral presentations. The Undergraduate Competition was introduced in 2007, Equine Biosciences was introduced in 2017, and 2021 was held in a virtual format due to the COVID19 pandemic.

members are funded by the American Quarter Horse Foundation, Grayson-Jockey Club, Waltham, Gates Foundation, Morris Animal Health, the United States Department of Interior Bureau of Land Management, the United States Department of Agriculture (USDA), and a multitude of industry partners and ESS sponsors. Their findings are recognized worldwide and as such, our members are drawn to meetings far and wide. The Equine Science Society is a safe and friendly training grounds, a place to focus on the horse and the people that care for them. At present, ESS is a society that impacts the industry, strengthens our ability to care for and understand the horse. This society is ready, capable and adaptive.

### 3. The Future

*“Keep on the lookout for novel ideas that others have used successfully. Your idea has to be original only in its adaptation to the problem you’re working on.”* Thomas Edison

What is the future of equine science and equine research programs? While this section will focus on university research programs, it is important to remember that universities are not the sole location where equine research is conducted. In fact, many nutrition companies employ well-trained, highly qualified equine researchers to test the effectiveness and impacts of various dietary ingredients on the horse. However, these studies must be related to marketable products and, thus, may be limited in their scope, focused on applicable outcomes as opposed to further understanding of basic physiologic mechanisms. One advantage of the academic research environment is that a researcher is limited only by his ability to generate new ideas....and his ability to get those ideas funded.

There has been a shift in academic research programs especially following the “Great Recession” in the late 2000s. During this time, state and federal budgets declined significantly, leading many universities to downsize support staff and other general researcher support. This included administrative assistants, laboratory technicians, financial support of graduate students, 12-month appointments, and more. As such, researchers (in general, but specifically equine) have struggled to maintain robust research programs where they can let their imaginations guide them while still paying the bills. A positive outcome of this tightening of budgets has been innovation. Innovation in novel areas of research, including those discussed previously such as human-equine interaction and the numerous benefits horses may have on human health. Innovation in teaching and extension methodologies to vastly enhance student learning and stakeholder engagement. Innovation in the use of horses as models for other species, such as aging humans [21–23]. Innovation in the application of cutting-edge technologies utilized in other species/models that are now being brought into equine research, profoundly expanding the questions equine researchers are able to ask and, hopefully, answer.

This shift in funding has somewhat been reflected in the numbers of abstracts in each specialty section at ESS symposia over the last two decades (Fig. 2). While Nutrition has remained a strong area of study, there has been exponential growth in the Equine Biosciences section, though the section only debuted in 2017. However, this section has offered an outlet for work that did not traditionally “fit” in the other sections, including topics like *in vitro* work, -omics, behavior, and circadian fluxes. Perhaps these are giving us a glimpse into the direction of future equine studies.

Most equine researchers derive funding from a few routine sources, which may also shape the research being conducted: (1) corporations interested in having their products tested by an unbiased team and which may not possess the resources necessary to carry out said testing; (2) private foundations created to advance specific facets of equine research; or (3) federal competitive grants. Each of these has its pros and cons, and none are guaranteed. Universities tend to favor federal grants, as these have higher limits of allowed indirect costs than most corporations and foundations. However, similar to other livestock industries, funding decisions may be “guided” by personal relationships, putting younger faculty with novel, sometimes risky, ideas at a disadvantage. Additionally, some foundations require “intervention-ready” outcomes, which may not be possible for a project with a minimal budget in an area that still requires foundational knowledge before interventions can be effectively developed. These larger scale, basic science-type projects fit well within federal opportunities but then a second set of issues may arise. (1) Horses proverbially walk a fine line between livestock and companion animals. Often, researchers find it difficult to convince production animal reviewers that horses should also be valued as agriculturally relevant and, better, significant species which should be funded. (2) The adage, “It’s not what you know, but who you know” holds true even in funding decisions. Understandably, reviewers are more willing to fund investigators whom they feel confident can perform the research and effectively disseminate results with the public in a timely manner. This confidence could come from a documented history of success, typically measured in scientific publications, or from a personal relationship. Regarding publications, equine researchers need to begin to prioritize submission of high-quality manuscripts. As of March 1, 2023, of the 151 abstracts presented at the 2021 ESS Symposium, approximately 28% have been published, 6% are under review, 65% have not yet been submitted, and less than 1% were converted to Extension publications. Certainly, there are many reasons for the delay, not the least of which is that, often, abstracts are a portion of a graduate student’s thesis or dissertation, and that student may graduate shortly after the summer symposia. With the PI’s limited time to now dedicate to getting the paper out, it lives (and potentially dies) on a list on a white board. A suggestion/consideration would be to require students to submit their manuscript for publication prior

to being cleared to graduate. Of course, there are extenuating circumstances, but this idea may help equine researchers more efficiently share their quality data in a way in which universities and funding agencies give credit. Finally, (3) Equine researchers are often not trained in a National Institutes of Health, USDA, or National Science Foundation (NSF)-funded laboratory and, thus, have not been exposed to the rigor or breadth of scientific studies, or the intricacies of successful grantsmanship for these larger federal opportunities.

So how do equine researchers find funding success in the federal realm? Firstly, investigators may have to specialize in a focused area rather than on a specific species. As many know, horses are unique, especially regarding their gastrointestinal physiology and their exceptional athleticism. However, they are not \*that\* unique. Equine skeletal muscle physiology is quite similar to most other mammals (save mice and a few others that contain myosin heavy chain type IIb fibers). Nutritionists have the added bonus of getting to work with a monogastric and a modified ruminant all in one! Consider the possibilities of becoming incredibly proficient in a certain area—skeletal muscle physiology, reproductive physiology, inflammation and disease—but using those skills in other species which may be more likely to get funded. This now gives a program some breathing room, allowing larger projects to fund graduate students and perhaps smaller grants to fund a horse study. But why not just get a large horse grant? This is achievable but is reliant on one simple fact: we must collaborate. Gone are the days of being able to carry a program by oneself. With the speed at which research progresses, it is impossible to be good at everything. And why should we be? Researchers should be allowed to become incredibly proficient at a specific focused area and rely on others for expertise in their specific areas. This is the future of equine research.

Moving forward, we must work together. For equine researchers at different schools, this might look like coordinating projects together to ensure proper sample collection, storage, and shipping so more can be gained from a single project. Within a university, this may be venturing outside of the walls of Animal Science (or whichever department in which you are housed). There are incredible kinesiologists, nutritionists, bioengineers, veterinarians, etc. with whom exciting new ideas could be generated or pathways known in the other species but never investigated in the horse could be tested. Perhaps the horse could be used as a model for other species or for investigations into the basic physiological mechanisms that sustain life (NSF Physiological and Structural Systems (PSS) Cluster, for example). A highlight of the biennial ESS symposium is the networking opportunities and the camaraderie of a group of passionate equine scientists sharing their love of bettering the horse. The future of equine science lies in the continuation and expansion of these brilliant relationships.

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