



Dr. Samantha Brooks

“I was a pre-vet student that discovered I liked research”

By Melanie Soberon
06/01/2009

A recent addition to the faculty of Animal Science, Samantha Brooks, hails from the University of Kentucky, where she obtained her doctorate degree and completed a two year post-doctorate. She has just completed her first year as assistant professor in the Department of Animal Science at Cornell University, where she taught the Horse course and set up a lab to perform research in equine genetics.

Brooks did not originally plan for graduate school, or even animal science. As an undergraduate student at the University of Kentucky, she first pursued a degree in biology. During her junior year, she switched into the field of animal science by choosing a newly created major in Agricultural Biotechnology, which mixed her interest in genetics and agriculture.

“I was a horse person and everyone kept telling me you can’t do science on horses,” said Brooks. “Horses are my interest, but science was what I’m good at.”

Fortunately for Brooks, she crossed paths with a graduate student whose mentor worked on horse genetics, proving to her that science and horses do, in fact, mix. Although she had originally planned on veterinary school, Brooks discovered a unique opportunity in her very own University of Kentucky too good to pass up – the chance to work with someone specializing in horse genetics. Other than Kentucky, only around four other schools in the country could boast this claim.

“I was a pre-vet student that discovered I liked research,” said Brooks. “I started as a masters student and my research got very interesting so I ended up pursuing a PhD.”

After her PhD, Brooks was awarded a competitive fellowship to work as a post-doctorate for two years at the University of Kentucky.

When asked how she developed her interests in horse genetics, Brooks explained that “where I grew up (Kentucky), horses were a part of the culture.” The horse ‘bug’ bit her early and she made every effort to get horse experience, even if it meant mucking stalls for her first job at age 10. Meanwhile, she also cultivated a strong interest in biology and life sciences.

“It seems to me that everything in biology breaks down to genes,” Brooks said. “So I like to go right down to the genes, the text for life– we can’t always read that text but technology is advancing fast in the field of genetics. As a result, geneticists have to be more rapidly evolving than you might in other fields in biology.”

To keep up, Brooks works to continually learn new approaches. Her goal in research is to “bridge that gap between the applied techniques and the more abstract, quantitative approach to genetics.”

For instance, while Brooks performs a lot of gene mapping, she also looks at gene regulation and function. She claims this approach has a lot to do with her animal science background because “we tend to look at applied science more than just science for the sake of science.”

“We’ve been gushing about the genome for about two years now,” said Brooks. “It was one of those things we never expected to happen.”

The decision of the National Human Genome Research Institute (NHGRI) to sequence the horse genome among several other selected mammals for a comparative project was a landmark event for not only horse geneticists, but the horse industry. Brooks said that the economic impact of the horse industry is actually larger than that of the film industry, although no one expects that because the ‘products’ of the horse industry are ‘downstream’ of the industry – jobs, feed purchased, etc.

As to why the horse genome was one of the lucky few selected, Brooks explained that the genome in both horses and humans consists of about 3 billion bases. Of those bases, only about three percent are what geneticists call coding sequence, the part that describes the order of amino acids in a protein.

“The other 97 percent was thought to be junk, but as it turns out there is more to a gene and a protein than its amino acid sequence,” Brooks said. “There are complexes that tell the ‘how’ and ‘when’ things will be used and those sequences are very hard to decipher. In order to understand those regulatory sequences, NHGRI decided they needed to sequence a number of mammals to compare similar sequences among them and find out which ones are the same from mammal to mammal, (conserved regions). These conserved regions may be directing the usages of nearby genes.”

In Brooks’ own research, she has looked at the genes that control specific coat colors in horses.

“It’s of great interest to horse owners,” she said. “For example, there are about 1 million horses in the American Paint Horse Association. An average foal may sell for \$2,000 but a spotted foal is worth twice as much. If a genetic test costs \$40, it economically makes good sense to make educated crosses rather than leaving it to chance.”

Another important aspect of her research is that some of the coat colors, like Overo, are associated with a disease. Horses with Overo that have just one copy of the gene are healthy but horses with two copies exhibit both a white coat and an intestinal disease that always leads to premature death.

Brooks has also found certain coat colors, like Sabino, can function for geneticists as models of different gene regulations and functions.



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“We originally thought there must be 100,000 genes in a genome but as it turns out, there really are only about 18,000 to 20,000,” said Brooks. “So, how does this number of genes makes 100,000 different types of proteins with different functions?”

Brooks explains that the genome is made more efficient by using regulatory mechanisms like alternative splicing.

“It’s a way to alter a gene in order to allow it to accomplish multiple tasks,” Brooks says. “You can think of it like a club sandwich. If

you take out the turkey and roast beef, you still have the ham sandwich.”

One particular example of alternative splicing found in the horse, *Sabino 1*, is an especially valuable model because it is rarely found in mice models. While it was interesting to biologists because it was a unique case, horse owners found it useful because they could test for it in order to improve their production of spotted foals.

Another research project Brooks is engaged in correlates diseases in horses with genetic tendencies.

“We want to learn where in the genome the mutation responsible for a particular disease is located,” Brooks said. “We look for groups of horses that all have the disease and then we look for a marker that they have in common – wherever it is located, that is where the mutation is likely to be.”

Cornell undergraduates celebrated the return of the Horse course this past fall as Dr. Brooks taught the course to a full class of no less than 64 students. She anticipates that number of students again this upcoming fall. Undergraduates can look forward to “a closer look at science and a bit less of horse management.” While Brooks reassures that the basics of horse management will be covered such as leading, grooming, and caring for the horses, students will also have opportunity to delve into immunology and infectious diseases, genetics, nutrition and basic physiology of the horse.

In the future, Brooks plans to teach a Comparative Genomics Course as well.

With a number of fascinating research projects and a well-attended course, Brooks is off to a great start as the new equine geneticist in the Animal Science department.