



The paths our lives and careers take us on are full of interesting bends and unexpected developments.

An Interview With Dr. Dan Brown

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Dan Brown, associate professor in Animal Science, shares his story, where the scope of his work takes him across borders, across species, and across academic areas of interest. Following his research from Ithaca to Haiti, and from nutrition to toxicology, one can see just how far the breadth and scope of animal science reaches.

Your academic pedigree includes degrees from both coasts. How did your educative path unfold?

I actually grew up near Davis, California and in 1976, received my Bachelor of Science degree in Animal Science from UC-Davis. I also earned high school teaching credentials for biology and agricultural sciences at UCD in 1977 and then obtained a PhD at Cornell University in Nutritional Sciences with minors in Biochemistry and Food Science in 1981. While my PhD is in Nutrition, I did the work in the Animal Science department with Doug Hogue as my major professor. In those days, there was a much closer relationship between the Division of Nutrition and the Animal Science department and it was common for livestock nutrition students to get their PhDs in Nutrition rather than Animal Science.

Then, I went to Maseno, (a village in Western Kenya) and worked for Winrock International on the Small Ruminant Collaborative Research Support Program, after which I joined the faculty at UC-Davis for 11 yrs to work on the control of body nutrient reserves in a variety of species, in vivo body composition measures, measurements of Net Energy as well as evaluating by-products and how animals responded to them.

From nutrient reserve control to toxicology...explain how this development occurred.

In Kenya, I was reminded that one of the functions that animals have is bringing nutrients and wealth from the time of year when there are plenty of feed resources to the time of year when there are not. That involves putting away body resources – fat, protein and so on, which are withdrawn during either periods of less feed resources or periods of high levels of production like pregnancy or lactation. However, I also continued to be interested in limited resource systems, such as in the case of the small farmers we worked with in Kenya, where we were looking at possible new feeds and feed resources for them. That is when I began to take an interest in nutritional toxicology. The humid tropics are a very permissive environment; there are green plants everywhere and you would not think there would be any problem in feeding animals. Unfortunately, a permissive environment

for forage plants also allows large populations of insects, herbivores, fungi and so on, to prosper and attack the plants. So plants tend to have secondary plant compounds that limit the utilization of the feed by the organisms. Therefore, one of the things you sort out when you are improving feed resources in the tropics is how to overcome those secondary compounds.

Your research is not tied to a particular species. Explain why you work with the variety of species that you do.

At Davis, I was hired to be a dairy nutritionist and did some of that with cattle, but the basics of that work applied to most other species. I worked largely in the basic biology of nutrient reserve control, so I worked with principally goats and dairy cattle at first, but then branched out to lactating sheep. As I got deeper into the in vivo body composition work and looking at new ways of measuring Net Energy, I ended up working with quite a variety of species – sheep, cattle, goats, rabbits, pigs, and even humans for nutrient reserves, and poultry for toxicology work. So I came away with the philosophy of not really being tied so much to a particular species as much as an area of interest.



Photo: 1 Dan Brown - harvesting peanuts

You mentioned your current work in Haiti with the human ‘animal.’ Enlighten us as to how you proceeded from a 4-H extension position to International Agricultural Research in the Caribbean.

In 1994, I came to Cornell to be the 4-H specialist half time and to do research half time. That was fun – we made a lot of progress injecting a lot more science into the livestock youth programs. After awhile though, I wanted to get back into the international work so I interviewed for a job at ILRI, the International Livestock Research Institute. I ended up with a research appointment at Cornell half time and a half time position with ILRI for about two and a half years until it then folded back to me being here in a full time teaching and research position.

Meanwhile, I taught Nutritional Toxicology for about eight years and then, after returning to Cornell full time, I developed a course for non-majors (An Sci 110, now known as 112). Most recently, I’ve become part of the team teaching for An Sci 1160, the new freshman course and I also teach the Comparative Nutrition and Toxicology course.

While I was teaching the Nutritional Toxicology class in 1995, we started requiring students to create a professional webpage about toxins of their choice. Over the years, we incorporated some of the better class webpages into the poisonous plants webpage we had started when I was in extension. (www.ansci.cornell.edu/plants) A number of

students over the years made their pages on aflatoxins or other mycotoxins, which eventually prompted an email from a pediatrician in St. Louis by the name of Pat Wolf. Wolf works for Meds and Food for Kids in Cap-Haitien, the second largest city in Haiti, curing severe malnutrition in children. Now, Haiti is by far the most difficult place I've ever worked in terms of chronic malnutrition of children – it's a tougher environment than Kenya, Ethiopia and so on. However, Wolf found that RUTF (ready to use therapeutic food) really works. RUTF is a mixture of peanut butter, milk powder, sugar, oil, and a trace mineral/vitamin mix that has low water activity and is shelf stable. Using RUTF, Medicine Food for Kids is able to take kids, typically between six months and five years of age, who are 2 or 3 standard deviations below the mean for weight and height, and put them back on the growth curve in about 6 weeks. It's the first thing that has been effective in doing that and it is all done outside the hospital. So Wolf had seen the webpage and sent me an email about the peanuts they use in Haiti, concerned about the aflatoxin content. She said, "Do you think they have aflatoxins in the peanuts here?" I said, "Well of course they do - they do everywhere." So she sent some samples and we analyzed them, and they were sky high – 1500 ppb aflatoxin! You can't legally feed an American dairy cow more than 20 ppb of aflatoxin so this is way above what you should be feeding to babies.

So, I flew down to Cap-Haitien in January of 2007 and set up a series of very quick, very intense experiments on how to sort, treat and separate good peanuts from bad peanuts. We established a laboratory there so they could screen the peanuts and since then, they have created - with local people, local materials and local efforts - a very high quality, food control lab for their RUTF making operation.



Photo: 2 - Shelling sorted peanuts

Meanwhile, I was also able to get some grants to study the metabolism of aflatoxin. One of the things that animals and people do with aflatoxin is convert it from aflatoxin B1 to M1, first found in milk. Everyone who eats aflatoxin makes that conversion. The idea with M1 is that it is more water soluble, so it goes off in the urine before it can damage DNA. So, one of the things we want to know is how malnutrition, and HIV status, would affect the ability of people to get rid of aflatoxin by this sort of detoxifying conversion. We look at the aflatoxin that is in the urine of children as they come into the malnutrition project as well as the urine of people who go to the HIV clinic in Port-Au-Prince, Haiti. From the urine, we can look at different catabolites and see how successful people are being in defending themselves from the aflatoxin. If they are not eating aflatoxin, they won't have any of these catabolites. If they are eating aflatoxin and are successfully defending themselves, they will have conjugated glucuronides or sulfonated aflatoxin and M1 coming out in the urine. If they are losing the battle, they will have aflatoxin guanine adducts where aflatoxin had been attached to the DNA, been excised, and ends up in the urine, which means the DNA in the liver and other parts of the body may have been repaired, but not successfully defended on the front end. The hypothesis is that if you

have good nutritional status, the aflatoxin will shift towards being water soluble whereas if you have HIV or are in a state of malnutrition, you might end up with more of the catabolite that is evidence of DNA damage. Aflatoxin attacks DNA, causing liver damage and accentuating malnutrition and it also acts as an immune suppressant. In a country with so much malnutrition, as well as HIV and AIDS, the last thing they need is a food that is doing all this damage.

What's to Come...at what point are you right now in the project?



Photo: 3 Researcher measuring child

Right now, the Haitian lab is pretty well stabilized and set up so that they can make clean RUTF. We have some urine samples and we have a grant to buy the equipment so we can do the HPLC analysis as well as begin the tandem Mass Spectrometry work for the guanine adducts here in Ithaca.

In addition, the other area I work with is limited resource livestock systems because ultimately we would like to prevent malnutrition. One of the Stateside projects we're working on is in Finger Lakes National Forest, a small national forest

just west of here that leases pastures for grazing. They have had a terrible time with invasive species. Part of the reason they are having the problem is they are continuously grazing with cattle only – no rotational grazing or mixed species grazing – so each year they get more of the undesirable invasive species and less good grass. Therefore, this summer we got the go-ahead to go in with sheep and possibly goats and clean up some of this pasture while investigating multiple species grazing.

So this summer in addition to looking at the intermediary metabolism of aflatoxin in Haiti, I'll be involved with grazing and attacking invasive species with sheep. We offer a variety of experiences for students and we are looking for interested undergraduates to help out in the summer, especially those interested in working with pastures and sheep!