

*The Kentucky
Agricultural Experiment Station*

129th

Annual Report
2016

To His Excellency
The Honorable Matt Bevin
Governor of Kentucky

I herewith submit the one hundred and twenty-ninth annual report of the Kentucky Agricultural Experiment Station for the period ending December 31, 2016. This is done in accordance with an act of Congress, approved March 2, 1887, titled "An act to establish Agricultural Experiment Stations, in connection with the Agricultural Colleges established in the several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," and also the act of the Kentucky State Legislature, approved February 20, 1888, accepting the provisions of the act of Congress.

Very respectfully,

A handwritten signature in blue ink that reads "Rick Bennett". The signature is written in a cursive style with a large, sweeping initial "R".

Rick Bennett
Associate Dean for Research
Director, Agricultural Experiment Station

Lexington, Kentucky

June 30, 2019

Experiment Station–Affiliated Departments and Centers

Agricultural Economics
Animal and Food Sciences
Biosystems and Agricultural Engineering
Community and Leadership Development
Dietetics and Human Nutrition
Entomology
Family Sciences
Forestry and Natural Resources
Horticulture
Kentucky Tobacco Research and Development Center
Landscape Architecture
Plant and Soil Sciences
Plant Pathology
Regulatory Services
Retailing and Tourism Management
Robinson Center for Appalachian Resource Sustainability
UK Ag Equine Programs
UK Research and Education Center at Princeton
UK Veterinary Diagnostic Laboratory
USDA Agricultural Research Service Forage Animal Production Research Unit
Veterinary Science

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Purpose of the Kentucky Agricultural Experiment Station

The University of Kentucky, the state's flagship land-grant institution, is responsible for serving the people of the Commonwealth of Kentucky. The College of Agriculture, with its research, teaching, and extension activities, has developed a structure and organization to provide the mandated land-grant services in agriculture and related areas.

As the research arm of the College of Agriculture, the Kentucky Agricultural Experiment Station has been providing research results to farmers and rural residents for more than 130 years. The continued progress of Kentucky agriculture attests to the benefits of applying new knowledge and technology. College researchers also have successfully addressed problems of agribusiness, consumers, international trade, food processing,

nutrition, community development, soil and water resources, bioenergy, and the environment.

Experiment station research spans both basic and applied sciences. The ability of Kentucky producers to be competitive in domestic and world markets requires an expanded base of knowledge in emerging areas of research applicable to agriculture, food, and natural resources. This annual report lists experiment station research projects and publications completed during 2016. The research programs of the Kentucky Agricultural Experiment Station have benefited Kentucky's agriculture over the past century, and the results of present and future research will continue to serve Kentucky's primary industry.

Statewide Research

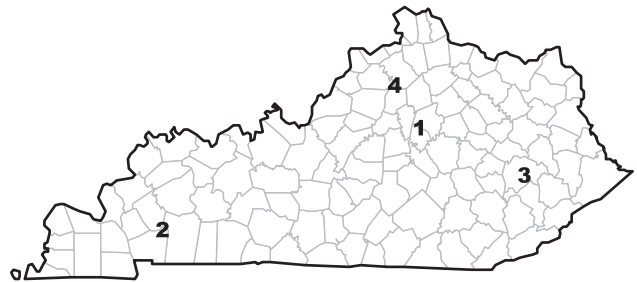
In 2016, research activities of the Kentucky Agricultural Experiment Station were conducted at Lexington, Princeton, Quicksand, and Owenton and in counties throughout the state. Efforts are constantly made to ensure that the research studies have application to the problems of all Kentucky farmers and other clientele groups. Locations of the experimental facilities provide conditions representative of most sections of the state.

Map Position 1

- **Campus**—Laboratories and specialized equipment for all research program areas
- **Coldstream—Maine Chance—Spindletop Farms**—Dairy cattle, poultry, and horses; forages and grain crops, tobacco, hemp, and turf
- **Horticulture Research Farm**—Fruits, vegetables, and ornamentals, including organic production
- **UK Animal Research Center** (Woodford County)—Purchased in late 1991 as a location for development of state-of-the-art food animal (beef cattle, sheep, and swine) research programs

Map Position 2

- The **Research and Education Center** facilities and the **West Kentucky Substation Farm** (Caldwell County) are devoted to research on grain crops, beef cattle, fruits, ornamentals and vegetables, forages, and tobacco.



Map Position 3

- At Quicksand (Breathitt County), the **Robinson Center for Appalachian Resource Sustainability** is the location of research on fruits and vegetables, ornamentals, forages, grain crops, tobacco, and wood utilization. Quicksand is also the headquarters of Robinson Forest, which spreads over parts of Breathitt, Perry, and Knott counties and is the site of forestry and watershed management research.

Map Position 4

- At the **Eden Shale Farm** (Owen County near Owenton), run as a public-private partnership with the Kentucky Cattleman's Association, demonstration studies are conducted on beef management.

Kentucky Tobacco Research and Development Center

The mission of the Kentucky Tobacco Research and Development Center (KTRDC) is to utilize plant-based technologies to benefit Kentucky agriculture. The focus is on the use of science, including molecular biology, genomics, plant genetic engineering, plant breeding/field research, and other advanced technologies to improve agricultural production for the benefit of Kentucky farmers. The program focuses on applied research in support of Kentucky tobacco production, the enhancement of tobacco and other *Nicotiana* species as a production system for plant-based products (including pharmaceuticals and industrial materials), and discovering new plant natural products having potential for commercialization. This includes resources devoted to research on industrial hemp including variety evaluation and production research.

KTRDC research facilities include field plots, laboratories, greenhouses, and contained growth facilities for plant breeding, plant analysis, disease screening and genetic engineering research. The goal is to utilize these resources to preserve and strengthen agriculture in Kentucky and, in particular, tobacco agriculture. The KTRDC program emphasizes applications-oriented research designed to facilitate the development of new crop-based businesses and technologies for Kentucky agriculture.

Research Program

The KTRDC research program is comprised of eight fully supported in-house research programs and six research programs that are housed in the KTRDC building and receive partial KTRDC support. Within KTRDC, there is expertise on plant breeding, the development of molecular markers, applied field research, plant genomics, plant genetic engineering and tobacco analytical research. KTRDC supported 29 research projects/programs. In addition, KTRDC offers a competitive grants program which encourages/supports research collaborations. Fourteen research projects were funded through this program. Progress reports and re-

search results for each of these projects/programs can be found in the KTRDC annual report for 2015–2016.

KTRDC has considerable resources and infrastructure dedicated to analyzing tobacco and tobacco products. Much of the support for this research effort comes from two Cooperative Agreements between KTRDC and the FDA, Center for Tobacco Products totaling over \$15 million. These funds have been utilized to establish the Center for Tobacco Reference Products (CTRP) within KTRDC. The CTRP provides reference tobacco products as standards for tobacco and tobacco product analyses. CTRP research focuses on constituent measurement and method development. The reference products are a necessary tool for measuring and reporting constituents as required by the Family Smoking Prevention and Tobacco Control Act and are sold to the tobacco research community throughout the world. As part of our research program, the CTRP has initiated a proficiency testing program to validate constituent measurement by laboratories and help establish accepted methods for measuring physical and chemical properties of tobacco and tobacco products.

The KTRDC/CTRP laboratory analyzed 6,920 tobacco samples, 1,386 fescue samples, and 258 industrial hemp samples in support of various research projects. In addition, the proficiency testing program conducted three proficiency testing rounds with participation by 87 labs from around the world. The proficiency testing included:

- A) Proficiency Test for TPM, Nicotine, CO, Water, NFDPM (Tar), Puff count and basic Physical parameters.
- B) Proficiency Test for NNK (4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone, NNN (N-nitrosoanornicotine), NAT (N-nitrosoanatabine), NAB (N-nitrosoanabasine), and BaP (Benzo[α]pyrene), TPM, Puff count and Physical parameters.
- C) Proficiency Test for Ammonia, Acrylonitrile, Isoprene, Benzene, Toluene, 1, 3 Butadiene, TPM, puff count, and physical parameters.

Research Activities

KTRDC Projects

- Production and Development of High Converter Burley Tobacco Seed
- Production and Development of High Converter Dark Tobacco Seed
- Production of Foundation Seed and Maintenance of LC Standards
- Genetics of Blue Mold Resistance in *Nicotiana Langsdorffii*
- Development of Recombinant Inbred Lines (RILS) Population to Identify Molecular Markers in Marker-Assisted Selection (MAS) for Tobacco Breeding
- KTRDC Analytical Laboratory—Research Support and Method Development
- Molecular Genetics and Genomics of *Nicotiana Benthamiana*
- Enhancing Capability of KTRDC in Performing Analysis of Chemical Constituents in Raw Tobacco, Cigarette Filler and Mainstream Smoke
- Effects of the Systemic Suckercide, Maleic Hydrazide on Tobacco Gene Expression
- The Effects of Cytokinin Application on the Accumulation of Tobacco-Specific Nitrosamines
- Sample Preparation for TSNA Analysis
- KTRDC Field Research Program: Tobacco, Industrial Hemp and Sumac

Faculty Research Support

- Hormone and Stress Regulation of Tobacco Growth

Summit and Externally Funded Projects

- Burley Tobacco Sucker Control by the Branching Inhibitory Hormone Strigolactone: a Feasibility Study
- Evaluation and Control of Ground Sucker Formation in Burley Tobacco Varieties
- Develop a Greenhouse Screening for Resistance to Fusarium Wilt in Tobacco
- Controlling Endophyte Colonization to Reduce TSNA in Tobacco Leaves
- Reduction of Heavy Metals in Tobacco by “Clean” Technology
- Alternative Strategies to Induce Early Flowering in Tobacco
- Interaction between Algae and Pythium Root Rot in the Tobacco Transplant Greenhouse

- Tobacco Response to Burndown Herbicides at Various Pretransplant Intervals
- Enhancing Burley Tobacco Production Labor Efficiency
- Optimizing the Integration of Annual Forages into Tobacco Systems
- Evaluation of the Efficacy of HP400 in Reducing TSNAs
- The Effects of Pre-Harvest Quercetin Application on the Accumulation of Tobacco-Specific Nitrosamines
- The Effect of Farm Machinery Exhaust Emissions on TSNA
- Development of Tobacco Plants with Ultralow Alkaloid Content by Targeted Mutation of Structural Genes Involving Nicotine Biosynthesis
- Genetic Manipulation of BL and LS Genes to Control Sucker Formation in Tobacco
- Varieties and Production Practices to Maximize Nicotine to be Utilized in Emerging Tobacco Products
- Addition of Blue Mold Resistance to KTTII Burley Tobacco Varieties
- Accumulation of Benzo- α -Pyrene and TSNAs During Fire-Curing
- Development of Gene-Specific Co-dominant Molecular Markers for Nic1
- The DNA Sequence of the Burley Tobacco Genome
- Fungal Disease Control of Burley Tobacco by the Plant Metabolite Trans-Cinnamic Acid
- Development Of User-Friendly Markers With High Throughput Technologies for the Nic2 Gene
- Development of User-Friendly Markers for Potato Virus Y (PVY) in Burley Tobacco
- Marker Design Based on Genotyping by Sequencing for Blue Mold Resistance in Tobacco
- Development of User-Friendly Markers for Resistance to Black Root Rot in Tobacco
- Evaluation of Six Varieties of Hemp for Dual Purpose: Both Grain and Fiber Production
- Evaluation of Seven Varieties of Hemp for Grain Production
- Evaluation of the use of Chemical Desiccants to Improve Mechanical Hemp Grain Harvesting
- Evaluation of Three Seeding Rates of Kenaf for Fiber Production
- Investigation of *R. Glabra* (Smooth Sumac) as a New Agronomic Crop for Kentucky Farmers

Regulatory Services

The Division of Regulatory Services is committed to consumer protection and service to Kentucky citizens, businesses, and industries. Our regulatory programs monitor and analyze feed, fertilizer, milk and seed products, and our milk, seed and soil service programs are all administered using a cooperative, science-based approach.

The division administers four state laws pertaining to ingredients, manufacturing, processing, labeling, and marketing of feed, fertilizer, seed and raw milk. Our primary objectives are to protect consumers of these products from poor-quality, mislabeled or misrepresented products, and to protect businesses marketing these products from unfair competition.

Feed, fertilizer, and seed are monitored from ingredients through manufacturing and retail channels for compliance. Label review, and product and facility inspections as well as product sampling by our inspectors and analysis in our laboratories are important steps in this process. Raw milk is monitored during marketing to (1) ensure accurate and equitable exchange between dairy producers and processors; and (2) ensure integrity of milk from farm to processor.

Eight regulatory inspectors and one auditor cover the state collecting samples, inspecting facilities, reviewing labels, and auditing records. Audits of sales and fee

payments are conducted on feed, fertilizer, seed, and milk firms in Kentucky to verify reports, records, and fee payments. One additional inspector is dedicated to the milk program for auditing payment records and monitoring activities of sampler-weighers, handlers, lab personnel, and lab facilities.

The activities in the division are performed by a dedicated and professional staff that conduct laboratory analyses, provide administrative and computer support, process data, and compile reports in addition to various other duties necessary to carry out and administer effective programs.

Feed Regulatory Program

The feed regulatory program provides consumer protection for livestock feed and pet food according to provisions of the Kentucky Commercial Feed Law. The program ensures safety, suitability and quality of animal feed in producing meat, milk, and eggs for human consumption and products for companion animals. The program provides standards of quality, safety, efficacy, and labeling for feed products. A statewide inspection, sampling, and laboratory analysis program monitors feed ingredients and feed products. Feed labels are evaluated to identify purpose of feed, guaranteed composition, ingredient list, feeding directions, and the need for any warning or caution statements.

The feed program participates in food safety efforts that promote consumer confidence in the nation's food supply. We work cooperatively with the U.S. Food and Drug Administration (FDA) in assessing compliance with the ruminant-to-ruminant feeding ban to prevent any establishment or amplification of bovine spongiform encephalopathy (BSE, or "mad cow disease"). In September 2016, Kentucky became one of 21 states fully participating in the Animal Feed Regulatory Program Standards (AFRPS) initiative, a joint effort by the American Association of Feed Control Officials (AAFCO) and the FDA to help build a more robust integrated food safety system by concentrating on regulation of animal feed production. This cooperative agreement will bring \$3,000,000 into the division and the university over the next 5 years.

Highlights

- Performed 1,251 official inspections at Kentucky feed manufacturers and dealers.
- Collected 3,191 official (with guarantees) and 232 unofficial samples that resulted in 31,645 total lab analyses.
- Samples collected included 1,445 pet food samples for analysis.
- Under our contract with FDA for the 2015–2016 fiscal year, inspectors conducted a total of 79 inspections for

compliance with the ruminant to ruminant feed ban including 28 inspections of medicated feed mills for compliance with current Good Manufacturing Practices.

- At the end of 2016, there were over 23,500 feed products registered for sale in Kentucky with 2,635 new products submitted in 2016.
- In 2016, there were 1,333 registered feed manufacturers offering feed products for sale in the state.
- Analyzed and reported 25 feed samples from quality control programs.
- Used 45 different approved analytical methods in providing results.

Income from inspection fees and product registration received during the period of July 1, 2015 to June 30, 2016 was \$1,280,919.96. Inspection fees are assessed at \$0.35/ton, and annual registration of \$50.00 is collected for products sold exclusively in 10 pound or smaller packages.

Fertilizer Regulatory Program

The fertilizer regulatory program ensures Kentucky farmers and urban consumers of quality fertilizer while promoting fair and equitable competition among fertilizer manufacturers and dealers through inspection and analysis of products found in the marketplace. The division, which administers and implements the Kentucky Fertilizer Law, promotes compliance through facility inspections, sampling and analysis of fertilizer offered for sale. The law requires proper labeling of fertilizer which includes the grade and guaranteed analysis of nutrients. The division is also responsible for maintaining registration of fertilizer products.

Highlights

- Conducted 1,179 visits to perform inspections and to sample agricultural, lawn, turf, and garden fertilizer at Kentucky processing, wholesale and retail locations.
- Administered actions on 2,744 official and 12 unofficial samples of fertilizer involving over 7,350 chemical tests.
- The official samples represented about 51,796 tons out of the approximately 846,811 tons of fertilizer distributed in Kentucky during 2016, or about 5.48 percent.

- Reviewed labels and registered over 4,850 products from 419 firms and issued licenses to 190 companies that manufactured custom-blended fertilizers.
- Analyzed laboratory check sample materials from Magruder®, UAN, and AFPC.
- Provided support for 15 different analytical methods that yield results for 28 analytes and contaminants.

Substantiated cash receivables from fertilizer reports. The income from registration fees, inspection fees and licenses received from July 1, 2015, to June 30, 2016, was \$781,597. Fertilizer products are assessed an inspection fee of 50 cents/ton.

Milk Regulatory Program

The mission of the milk regulatory program is to ensure raw farm milk produced and marketed in Kentucky is bought and sold using accurate weights and tests. The program's primary function is to monitor milk handling systems from the time a producer's milk is sampled and weighed, through delivery and laboratory testing, until producer payments are calculated. The program provides support to the producers and processors of Kentucky's dairy industry. Industry participants are trained, licensed and subsequently monitored to maintain compliance with the law.

In addition to regulatory functions, the milk program cooperates with other agencies in educational projects to provide a variety of services to Kentucky dairy producers, processors and allied industries. The milk program also operates a laboratory that is available for Kentucky producer, processor and handler service testing.

Highlights

- Reviewed applications and issued licenses to 1 transfer station, 19 milk handlers, 16 laboratories, 76 technicians, and 330 sampler-weighers (milk-haulers, receivers and samplers).
- Collaborated with Kentucky Cabinet for Health Services Milk Safety Branch to train sampler-weighers and processor receiving personnel. Trained and examined 57 sampler-weighers and 19 technicians.

- Conducted 7 pay-record and 13 raw milk receiving audits.
- Conducted 34 milk laboratory inspections.
- Conducted 292 sampler-weigher inspections and analyzed milk samples from 1,865 dairy herds to evaluate sampler-weigher performance and ensure accurate producer payments.
- Administered a monthly milk lab quality control check sample program through the distribution of samples to the 16 licensed laboratories and 2 other labs to ensure accurate component-analysis procedures.
- Provided analyses for Kentucky small processor cheese makers (55 samples).
- Analyzed milk samples from 63 cows in conjunction with cattle judging at North American International Livestock Exposition in Louisville.
- The income from fees and licenses received from July 1, 2015 to June 30, 2016 was \$161,832.92. Milk handlers and producers are assessed at the rate of one-half cent (\$0.005) per hundred-weight of milk.

Seed Regulatory Program

The seed regulatory program ensures Kentucky farmers and urban consumers of quality seed while promoting fair and equitable competition among seed dealers and labelers through inspection and analysis of products found in the marketplace. The division, which administers and implements the Kentucky Seed Law, promotes compliance through facility inspections, sampling and analysis of seed offered for sale. The law requires proper labeling of seed which includes kind, variety and lot designation, purity percentages, noxious weeds, origin, test date and a germination guarantee. The division is also responsible for maintaining registration of seed labelers, seed conditioners, and seed dealers in the state.

Highlights

- Conducted 1,019 visits to perform inspections and to sample agricultural, lawn, turf, and garden seeds at Kentucky seed processing, wholesale and retail locations.
- Collected and tested 1,951 official seed samples.
- Issued stop-sale orders on 267 official seed samples and 178 violative seed

lots at seed dealer and seed processor locations.

- Cooperated with the USDA-Seed Branch regarding shipments of seed into the state that was in violation of the Federal Seed Act.
- Reviewed and issued 216 permits to label agricultural seed and 57 permits to label vegetable and flower seed.
- Registered 633 seed dealers and 34 non-certified custom seed conditioners.
- Provided training to firms on labeling requirements, retail sales procedures, stop sale release procedures, and record keeping requirements.
- Substantiated cash receivables from seed reports. The income from fees, permits and licenses received from July 1, 2015 to June 30, 2016 was \$555,760. Seed products are assessed at 8–24 cents per unit.

Seed Testing Laboratory

The division maintains the only certified seed testing facility in Kentucky. This facility handles all official samples collected by inspectors and provides service testing for seed producers, dealers, retailers, research projects and homeowners for a fee. More than 90 percent of the service samples accepted into the laboratory were submitted by Kentucky firms or individuals.

The laboratory analyzes seed for purity, identifies weed and crop seed, conducts germination, counts seed, determines test weight, performs accelerated aging, conducts fluorescence testing on ryegrass, determines moisture content, conducts tetrazolium analysis, assesses herbicide tolerance, determines presence of endophyte, and conducts many other analyses. Our analysts keep abreast of changes through participation in regional and national referee testing with the Association of Official Seed Analysts (AOSA) and the USDA Federal Seed Laboratory and by attending special scheduled and regular workshops at the AOSA annual meeting.

Highlights

- Analyzed 3,155 service samples.
- Collaborated with researchers to analyze 80 seed samples.
- Collaborated with AOSA to analyze 7 referee seed samples.
- Supported the equine and livestock pasture management programs in analyzing 217 plant samples for endophytes.
- Analyzed 39 hemp samples in accordance with new KDA hemp program.
- Analyzed 45 seed samples under the provision that allows one free sample for testing each year from Kentucky residents.
- Income derived from service samples from July 1, 2015 to June 30, 2016 was \$54,214.

Soil Testing Laboratory

Soil testing provides farmers, homeowners, greenhouse operators, and others with scientific information about the fertility status of their soils or greenhouse media. In partnership with the Cooperative Extension Service, it also provides lime and fertilizer recommendations based on laboratory results. We also offer analyses of animal wastes, nutrient solutions, and special research solutions. A new activity began in fall 2016 with sampling and testing agricultural limestone for the Kentucky Agricultural Limestone Law under a cooperative agreement with Kentucky Department of Agriculture. The program received \$279,363 in income for service testing during the period July 1, 2015 to June 30, 2016.

The soil test web site is at soils.rs.uky.edu. The number of samples analyzed in 2016 with the percent change from 2015 is shown below.

Type	Number	% change
Agriculture	32,806	6
Home lawn and garden	9,247	11
Commercial horticulture	871	5
Greenhouse media	53	-43
Research	6,266	4
Atrazine residue in soil	19	217
Animal waste	392	45
Nutrient solution	85	18
Soil nitrate	225	127
Ag Lime	77	
TOTAL	50,041	8

Robinson Center for Appalachian Resource Sustainability

Extension Activities

- Hardwood tree grade training for U.S. Forest Service and state agency Forest Inventory Crews and Quality Control personnel
- National silviculture training for certification of U.S. Forest Service National Forest System silviculturists
- Best Management Practice (BMP) training for Kentucky Division of Forestry County Ranger Technicians
- Kentucky Master Woodland Stewards School for forest management and silviculture
- University of Kentucky's Department of Forestry and Natural Resources at the Robinson Center partners with the Division of Forestry in creating and maintaining a Wood Industries Direc-

tory of all the wood product companies in the state.

- Woodland Owners Short Courses (WOSC): The WOSC was designed to assist Kentucky's woodland owners in the care and management of their woodland resource and has been conducted on a regional basis with full Saturday programs in the East, Central, and West regions of the state. The regional programs were developed by local planning committees with local needs in mind and cover a wide variety of subjects. The WOSC offered two programming tracks: green for woodland owners just getting started and gold for those already actively managing their woodlands. The WOSC has been one of the best woodland owner

educational opportunities available in the state. Short courses were conducted on 7/16/, 7/30, and 8/13 in New Castle, Quicksand, and Princeton.

- Cutting Board, Lazy Susan, Shaker box, Bird Houses, and Bird feeder Workshop Series in cooperation with RCARS (held at the UK Wood Utilization Center on 3/3/16, 5/3/16, 5/13/16, 5/17/16, 7/12/16, 7/12/16, 7/16/16, 7/30/16, 8/15/16, 8/13/16, 9/6/16, 9/20/16, 10/25/16, and 11/7/16). Each participant made their own product and was able to customize it with lettering using the laser engraver. During the workshop we explained why these species of woods were chosen to produce these products and discussed/provided general information pertain-

ing to forestry practices in Kentucky including the Forest Conservation Act and its impact on our forest and the economic impact the Forest Products Industry has on Kentucky's economy. The bird house and bird feeders workshops included a wildlife presentation. These were hands-on workshops and each participant had the opportunity to router, sand, laser engrave, and finish their own products.

- The Center for Wood and Forest Certification (CFWC): The CFWC is a partnership for developing solutions to forest and wood certification and was developed to facilitate certification in the Central Hardwood and Southern Appalachian regions. The center is a hub for certification projects and functions as both a certification incubator assisting forest industry and forestry consultants grow their certification efforts as well as providing certification options for forest and small woodlands certification. The CFWC coordinates these efforts to ensure effective and sustainable development of certified forests and wood. The center works by coordinating, developing, and administering these projects. The center

encompasses a network of partners which are necessary for achieving success in sustainable forest and wood certification. A number of forest industries, consultants, woodland owners, and organizations are currently involved with projects administered under the center. The coordinated and strategically designed projects provide direct assistance to forest industries, foresters, and woodland owners as well as explore avenues to enhance certification efforts.

- Win with Wood Youth Event in cooperation with RCARS: This event was designed to acquaint/familiarize Kentucky youth with forestry/natural resources industries and potential career opportunities. This one day event encompassed nine individual and one team competition in forestry and wood technology for youth in the junior and senior 4-H age groups. The winner of the program received a \$500 scholarship to attend the UK College of Agriculture. Conducted 10/11/16. 217 youth competed in the event. Including support staff, judges, and teachers 300 people attended/supported the event.
- Master Logger Program conducted. November.

- Military Family Early Childhood Adventure at Robinson Forest. June.
- SOAR—Analysis of the Forest Industry's Potential in Eastern Kentucky.

Teaching Activities Conducted at Robinson Forest

- 4-H Natural Resource and Environmental Sciences Academy in cooperation with RCARS. A three-year program for seventh and eighth graders based on their academic achievements and teacher recommendations. Students study water, forestry and wildlife resources at the Robinson Forest.

Courses Taught

- NRE 320 Natural Resource and Environmental Analysis
- FOR 356 Forest Soils and Hydrology
- FOR 357 Inventory and Measurements
- FOR 358 Silvicultural Practices
- FOR 359 Forest Operations and Utilization
- FOR 365 Wildlife Assessment
- ENEC 698 Environmental Science Senior Capstone (UNC-Chapel Hill). Barton co-taught course and a week-long field study trip was conducted at Robinson Forest.

UK Ag Equine Programs

UK Ag Equine Programs is an interdisciplinary program encompassing all three areas of the land-grant mission: teaching, research, and outreach. A brief review of 2016 activities in each area follows.

Leadership and Organization

Three new members joined the organization in 2016. Dr. Camie Heleski and Dr. Jackie Wahrmund both joined as lecturers. Dr. Heleski is teaching within ESMA and Dr. Wahrmund is teaching ASC 101, a requirement for ESMA students. Both are also advising. Additionally, UK Ag Equine Programs hired a new director at the end of 2016. Dr. Mick Peterson began his term as director of the program in January 2017. He will be academically based out of Biosystems and Agricultural Engineering.

The office welcomed new student intern Maddie Regis in 2016.

A five-year strategic plan was completed at the end of 2015 and finalized beginning in 2016.

Teaching

The Equine Science and Management (ESMA) undergraduate degree was officially instituted in 2009, but even before that, 42 students were enrolled in "individualized studies," pending official approval of the program. In fall 2016, enrollment had climbed to 304 students (down a bit from fall 2015's 322). About 25 percent of these students are in state. Females account for 88 percent of students currently enrolled. The enrollment graph shows the continued high enrollment.

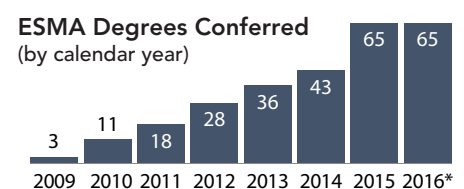
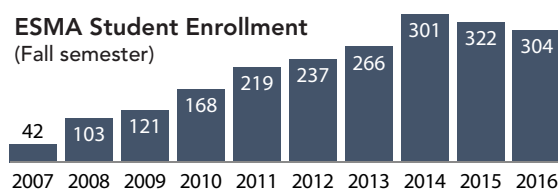
Internship Program

ESMA students completed 70 internships in 2016. Of the 2016 internships, 59 were in Kentucky, three in Ohio, two in Pennsylvania, and one each in Georgia, Florida, Maryland, Michigan, New York, and Virginia.

Alumni

The ESMA program has conferred degrees to 269 graduates to date. Number of degrees conferred by calendar year is illustrated in the following chart.

The employment of ESMA alums is as varied as the equine industry into which they are graduating. For a snapshot of employment of alums as of the end of 2016, see the alumni activity chart.



Research

Currently, 20 EP affiliates, along with their approximately 40 graduate students, are involved in equine-related research within the UK Ag Equine Programs.

Areas of research represented within the UK Ag Equine Programs include:

- Economics
- Entomology
- Environmental stewardship
- Genetics and genomics
- Horse-human connection
- Immunology
- Infectious diseases
- Musculoskeletal science
- Nutrition
- Parasitology
- Pasture management
- Reproductive health

Outreach

UK Ag Equine Programs offers a rich set of outreach programs, including both adult and youth extension programming as well as a variety of other programs.

Adult Extension Programs

- Horse College
- Asbury Draft Horse Field Day, held in partnership with Asbury University

Youth Extension Programs

The Kentucky 4-H Horse Program delivers educational programs to youth and adult leaders and volunteers across the state. There are 5,000 total youth registered in the Kentucky 4-H Horse Program. Some of the activities include:

- State 4-H Horse Show
- State 4-H Horse Program Contest
- Leader certification program

In addition to extension programming, UK's Ag Equine Programs offers a variety of other outreach programs, including:

- Horse Pasture Evaluation
- Pastures Please
- UK Equine Research Showcase and UK Breeders' Short Course

- Department of Veterinary Science Equine Diagnostic and Research Seminar Series consists of monthly seminars attracting internal and external participants; recorded by The Horse and made available internationally.

Diagnostic Services

UK's Veterinary Diagnostic Laboratory (UKVDL). The VDL offers testing and consulting in the following fields:

- Microbiology
- Molecular biology
- Histopathology
- Clinical pathology
- Serology/immunology
- Toxicology
- Virology
- Epidemiology

Budget

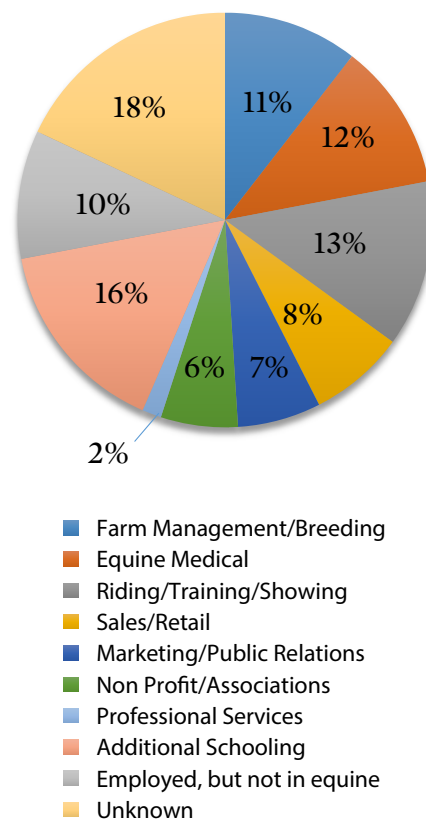
The Equine Programs operated on \$50,000 in-state funds. These funds support communications, the internship program, academic programs activities, office overhead, the office intern, and travel. Those funds were supplemented by \$9,500 in federal funds and \$4,000 TIIIF funds. The college contributed over \$300,000 to salaries of EP faculty and staff in 2016. Development of the EP budget is supplemented by cash and in-kind gifts. Much of these gifts directly support research efforts.

Communications

A dozen equine-related news releases were produced by EP Communications or the College of Agriculture, Food and Environment. In addition, communications support was provided to the 18 EP hosted or attended events. The program remains active on Facebook (pages include Equine Programs, ESMA alumni, horse pasture evaluation and Gluck), and Twitter (Equine Programs and Gluck).

Two monthly online newsletters are produced within the Equine Programs office, including the Bluegrass Equine

Snapshot of Alumni Activity



Digest, with more than 35,000 subscribers from 50 states and 110 countries and click-through/open rates around 40 percent, consistently the highest of The Horse's e-newsletters. The Wildcat Canter, a student- and program-based e-newsletter, also continues to grow.

Other equine-related newsletters in the college include Equine Disease Quarterly, Equine Research and Service Report, and Board Bits from the Gluck Center.

Clubs and Teams

Equine clubs and teams continue to be popular. UK's Ag Equine Programs offers a Dressage and Eventing Team, Equestrian Team (western and hunt seat), Horse Racing Club, Polo Team, Research in Equine and Agricultural Disciplines Club, Rodeo Team, and Saddle Seat Team.

UK Research and Education Center at Princeton

The University of Kentucky Research and Education Center (UKREC) is an integral part of the Kentucky Agricultural Experiment Station and the Kentucky Cooperative Extension Service. The faculty and staff of the UKREC are dedicated to sustaining the long heritage of meaningful impact and achievement by addressing the rapidly changing issues and challenges associated with Kentucky agriculture and rural communities. The center's goal is to be recognized at the local, state, and national levels for excellence in agricultural research, education, leadership, and service to the Commonwealth.

Established in 1925, the West Kentucky Substation at Princeton has functioned as a center of agricultural activities in western Kentucky. Great advancements have been made in Kentucky's leading industry—agriculture—with considerable progress being made in improving use and conservation resources, increasing yields of crops and livestock, better management of capital and labor, expanding markets, and finding solutions for problems facing rural people and communities. Increased returns to Kentucky farmers and livestock producers total millions of dollars annually just from the use of new production technologies resulting from research findings and educational programs of the College of Agriculture.

The University of Kentucky Research and Education Center is fundamentally interdisciplinary, applying the biological and social sciences to challenges in agricultural, food, and environmental systems. Our scholarship encompasses human and natural resources and their interaction.

As part of the University of Kentucky, the center:

- Facilitates life-long learning, informed by scholarship and research
- Expands knowledge through creative research and discovery
- Serves Kentucky communities by disseminating, sharing, and applying knowledge

The UKREC is the headquarters for more than 50 faculty and staff members representing seven different academic departments (Agricultural Economics, Animal and Food Sciences, Biosystems

and Agricultural Engineering, Entomology, Horticulture, Plant and Soil Sciences, and Plant Pathology) and three units (Ag Communications Services, Research and Education Center, and Regulatory Services) in the College. Its faculty and staff conduct research, provide diagnostic testing services, and develop educational programs on topics of concern to Kentucky farmers, livestock producers, agribusinesses, and families.

The UKREC Experiment Station Farm consists of almost 1,300 acres, including soils of both sandstone and limestone origins that are characteristic of soil types throughout the state. Researchers conduct approximately 100 different research/demonstration projects each year at the Experiment Station Farm or on farms in western Kentucky. Information derived from these projects or research conducted elsewhere is delivered to farmers, livestock producers, and the general public through county offices of the Cooperative Extension Service. Extension specialists located at the center have expertise in a wide variety of food and agriculture topics.

Crops such as corn, wheat, soybeans, tobacco, fruit, vegetables, and ornamentals are studied for ways to increase yields, disease resistance and profitability, improve handling and storage, protect the environment, and address other problems farmers may have. Research, demonstrations, and educational programs are also conducted in the areas of beef and swine production. Agricultural engineering specialists conduct research and educational programs related to both crop and livestock production.

Service laboratories located at the center provide information needed to make management decisions in the following areas:

- Soil testing enables farmers to develop nutrient management plans for growing crops.
- The plant disease diagnostic laboratory helps identify plant health problems and provides recommendations for disease prevention and control. Once insect and plant pests are identified, specialists can give advice on integrated pest management strategies to control them.

The following additional learning opportunities and resources are provided through the UKREC:

- The Rottering-Kuegel Agricultural Research and Extension Building is available to large and small groups for classes and meetings in agriculture, home economics, and 4-H. It is also used for a wide variety of meetings by government agencies, industry, and the general public. Each year there are approximately 450 different meetings held in this building, attended by about 14,000 people, many from other states and countries.
- Commodity-specific and joint commodity field days showcase the work of the UKREC and attract about 3,000 people annually. Visitors observe research, educational displays, and demonstrations representing work conducted at the center and throughout the state.
- Individuals and small groups are welcome to visit throughout the year to observe specific projects and talk with specialists.

Activities

Agricultural Economics

- Completed 2014 Farm Bill education to help farmers with their ARC vs. PLC decision
- Provided market situation and outlook to help farmers understand market conditions
- Improved understanding of crop insurance and price risk management tools

Animal and Food Sciences—Beef Cattle

- Form of selenium on progesterone levels in cycling cows
- Long-term effects of form of selenium on multigenerational physiological capacity
- Regulation of controllers of EAAC1 to enable efficient nutrient metabolism
- Year-round mineral intake in beef cattle

Biosystems and Agricultural Engineering

- Improving energy efficiency on Kentucky farms
- Evaluation of a wood pellet heating system for broiler houses
- Energy assessments for grain and livestock farms

- Energy assessments for solar PV installations
- Nationwide study on packing factors for six different grains
- Providing food security in Nigeria by reducing post-harvest grain losses during storage at the farm and small-holder (warehouse) level
- Assessment of needed research and extension programs in Ghana to reduce post-harvest grain losses along the value chain
- Revising the *Midwest Plan Service Handbook on Grain Drying, Handling and Storage*

Entomology

- Spotted wing drosophila survey in small fruit
- Survey of exotic insects in soybean, orchards, vineyards and nurseries
- Using insect pheromone traps to predict outbreaks
- Survey of kudzu bugs in soybeans and kudzu plants
- Survey of aphids and barley yellow dwarf virus in wheat (collaborating with Carl Bradley)
- Efficacy tests for soybean seed treatments
- Studies of soil mites under different poultry and swine manure soil amendments in wheat and corn (collaborating with Edwin Ritchey and an international scholar)
- Identifying ambrosia beetles on nurseries ((collaborating with Winston Dunwell)
- Training of an international visitor scholar from Pakistan

Forages

- Alfalfa variety test
- Red clover variety test
- Tall fescue variety test
- Orchardgrass variety test

Grain Crops

- Applying late-season nitrogen to soybean with pivot irrigation systems in Western Kentucky
- Late season nitrogen to dryland soybean production
- Sulfur trials in winter wheat
- Evaluation of N and P enhancement products
- Phosphorus response trials – how does spatial scale influence plant response?
- Barley variety trial

- Double-crop soybean trial
- Evaluating the effect of controlled drainage on soybean yields in Western Kentucky
- Hulless barley variety trial
- Soybean and wheat seed company tours
- Soybean variety trials
- Barley, malting barley, rye and cereal rye agronomic production studies
- Agronomic Studies to reduce vomitoxin accumulation in wheat
- Agronomic studies to increase double-crop soybean yield and profitability
- Wheat vernalization and plant development trial
- Evaluation and selection of early generation wheat breeding material
- Wheat variety trial
- Wheat vernalization and plant development trial
- No-till wheat management
- Corn variety trial
- Testing of wheat breeding lines
- Wheat fusarium head blight nursery

Horticulture

Sustainable Nursery/Landscape Research

- Integrated pest management (IPM) monitoring (Ambrosia Beetle)
- PlantPoint™ moisture sensor irrigation controller evaluation
- Maintaining water quality and efficient irrigation of nursery crops
- Landscape plant evaluations
- Landscape plant establishment based on production container
- Plant container evaluation for sustainable production
- Efficient fertilization of nursery crops
- Kentucky native plant evaluation, production protocols, and use
- Development and maintenance of Kentucky provenance stock plants
- Container nursery runoff remediation

Fruit

- NC-140 Rootstock trials: apple and peach
- Cultivar trials: peach and blackberry
- Sweet cherry rootstock observation and UFO training system demonstration trial
- Small fruit demonstration plots
- Pecan variety demonstration
- Blueberry fruit production in above-ground containers with moisture sensor irrigation and fertility monitoring and control.

Vegetables

- Broccoli vegetable production variety trials

Manure Management and Use

- The use of gypsum and/or poultry litter to increase rooting depths in fragipan soils
- Poultry litter, biosolids, and composted swine manure used for winter wheat and corn production
- Poultry litter use for corn and soybean production
- Investigation of the potential of poultry litter to contain viable weed seed

Plant Disease Diagnostic Laboratory

- The laboratory diagnosed 765 routine plant specimens

Plant Pathology

- Soybean fungicide efficacy testing
- Corn fungicide efficacy testing
- Wheat fungicide efficacy testing
- Monitoring for diseases of grain crops
- Effect of poultry litter on soybean cyst nematode populations

Soil Science

- Remediation of the fragipan to increase soil productivity: Greenhouse trials with ryegrass + soybean rotation; wheat + soybean rotation; ryegrass + sodium fluoride; ryegrass variety evaluation; ryegrass + KCl; ryegrass + KCl + NaCl; ryegrass + NaNO₃; ryegrass + corn rotation; ryegrass + humate
- Remediation of the fragipan to increase soil productivity: Field trials with chicken litter; fly ash; gypsum; calcium carbonate lime; calcium silicate lime; sodium nitrate; calcium nitrate; potassium nitrate; ryegrass cover crop; ryegrass + sodium fluoride; wheat; humate with and without ryegrass

Soil Test Laboratory

- The laboratory tested 20,720 soil samples for growers, precision agriculture consultants or companies and UK extension/research personnel.

Tobacco

- Tobacco transplant production – plastic tray evaluation
- Dark fire-cured commercial variety test
- Dark air-cured commercial variety test
- Burley commercial variety test
- Burley regional quality trial

- Insecticide performance for tobacco hornworm, budworm, flea beetle and aphid control
- Regional sucker control trials for burley and dark tobacco
- Comparison of potassium sulfate and potassium chloride sources for dark air-cured tobacco
- Dynamics of benzo- α -pyrene and nitrosamine accumulation during fire-curing
- CORESTA Dark fire-cured and dark air-cured tobacco pesticide residue tests
- Evaluation of biofungicides on control of target spot and frogeye leafspot in tobacco
- Evaluation of bacteriacides for angular leaf spot control in dark tobacco
- Evaluation of plant-back intervals for dark tobacco following 2,4-D and saflufenacil applications
- No-till and strip-till tobacco production demonstrations
- Feasibility of chemical topping in burley tobacco
- Effect of foliar calcium addition in tobacco where Ca is deficient according to tissue tests

UK Veterinary Diagnostic Laboratory

The University of Kentucky Veterinary Diagnostic Laboratory (UKVDL) continues to strive to be one of the premier veterinary diagnostic laboratories in the United States, providing timely and accurate services in support of the practicing veterinary profession, livestock agriculture, the signature equine industries, the poultry industry and backyard flock operations, companion animals, wildlife, and zoo animals.

As the state's flagship veterinary diagnostic laboratory, the UKVDL's primary goal is to develop, apply, and utilize validated, state-of-the-art veterinary diagnostic testing methods and scientific knowledge to improve animal health and marketability, preserve the human-animal bond, and help protect and improve public health through the early and accurate identification and surveillance of zoonotic diseases. The UKVDL laboratory is fully accredited to the ISO 17025 standard by the American Association of Veterinary Laboratory Diagnosticians (AAVLD) and is a member of the USDA National Animal Health Laboratory Network (NAHLN) and the FDA Veterinary Laboratory Investigation Response Network (Vet-LIRN).

In addition to its clinical diagnostic role, the UKVDL provides surveillance and regulatory testing for emerging and endemic diseases such as equine infectious anemia (EIA), equine viral arteritis, equine piroplasmiasis, West Nile virus, chronic wasting disease of deer, contagious equine metritis, and bovine spongiform encephalitis (Mad Cow Disease) to assure that animals can move freely in the markets, sale barns, and events/shows. Furthermore, the laboratory conducts ongoing proficiency testing to be prepared to confirm the presence monitors for foreign

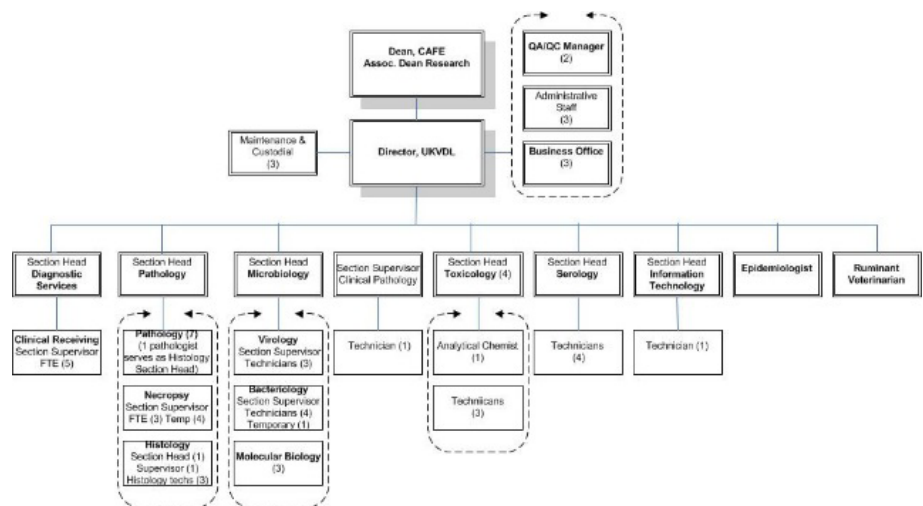
animal diseases (FADs) such as foot and mouth disease, high path avian influenza, and classical swine fever. Finally, UKVDL hosts a rich continuing education and outreach program for our clients and the public every year.

Farmers and animal owners use the UKVDL's services primarily through their practicing veterinarians. These professionals have expertise in selecting, preparing, shipping, and submitting the proper specimens for testing when needed to assist in making a clinical diagnosis. Laboratory findings are reported back to the submitting veterinarians, who then consult with their clients to implement treatment protocols or prevention/management solutions to disease problems on the farm. A state-of-the-art laboratory information management system (LIMS) enables UKVDL to provide the most professional, accurate and timely accessioning, order entry, results capture, and clinical case reporting for our clients.

UKVDL faculty, scientists, and technical staff are specialists in several diagnos-

tic medical disciplines directly related to animal health, including bacteriology, clinical pathology, epidemiology, extension, molecular biology, pathology, serology, toxicology, virology, and informatics. The laboratory is exploring the potential of supporting the Kentucky aquaculture industries, food safety, stem cell therapy, and other emerging animal health technologies. As part of the cooperative agreement with the Lincoln Memorial University College of Veterinary Medicine, the Center for Animal Health in Appalachia (CAHA) was launched in 2015. Director, Dr. Craig Carter, serves on the advisory board.

Disease diagnostic efforts are coordinated and handled by specialists in the appropriate disciplines. Complex clinical cases involving multiple sections are monitored by trained case coordinators. During surge testing periods and disease outbreaks, cross-trained technicians are redistributed across sections to assure that the surge in workload can be managed in a timely and accurate fashion.



The organization of UKVDL's sixteen sections

The UKVDL received 14,082 clinical diagnostic cases (+4.4% over calendar year 2015) and 20,682 regulatory cases (down -34.4% over calendar year 2015). The decreasing trend in regulatory cases is due primarily to changes in state, federal, and international requirements and the establishment of new labs that can perform the testing (i.e. increased competition). The necropsy caseload increased by approximately 1.6 percent in calendar year 2016. The diagnostic and necropsy accession caseload fluctuates based on seasonal and natural epidemiologic conditions and events such as new emerging diseases. Total tests run in each laboratory section are listed in the individual section reports.

Vision

The Veterinary Diagnostic Laboratory strives to be one of the premier veterinary diagnostic laboratories in the United States, providing the very best and timely services in support of the practicing veterinary profession, Kentucky animal agriculture, the signature equine industries, companion animals, and public health.

The Veterinary Diagnostic Laboratory (UKVDL) is a full-service laboratory and an administrative unit in the College of Agriculture, Food and the Environment (CAFE) at the University of Kentucky.

The UKVDL was established in 1970 by the State Legislature of Kentucky and is charged with safeguarding the health of animal agriculture in Kentucky via veterinary diagnostic testing and disease identification/confirmation.

The UKVDL confirms infectious diseases, parasitic diseases, chemical and biological intoxicants, and other toxic contaminants that may harm animals or humans. In addition, the laboratory conducts regulatory testing which allows for the movement of animals domestically and internationally in the export markets. The laboratory provides an early warning system for impending epidemics. Emphasis is placed on quality assurance and control for all diagnostic and regulatory testing, including new testing methods in accordance with the ISO 17025 standard. Each employee of the UKVDL focuses on performance of all tasks according to protocol with a total commitment to quality.

Mission

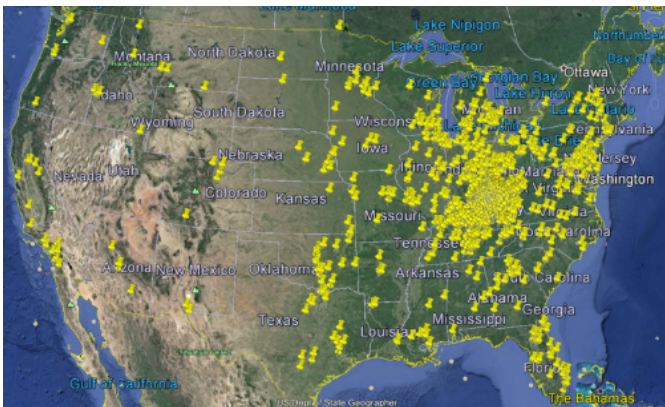
The UK Veterinary Diagnostic Laboratory's primary goal is to develop, apply, and utilize state-of-the-art technology and scientific knowledge to improve animal health and marketability, preserve the human-animal bond, and to help protect the public health.

Quality Philosophy and Objectives

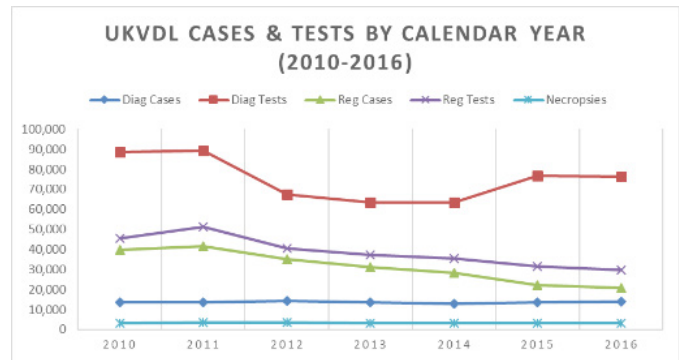
Every employee of the UKVDL is committed to quality, integrity, and excellence in all work completed. To meet our mission and achieve our vision, we must:

- Ensure client satisfaction by consistently meeting or exceeding customer requirements.
- Demonstrate competence in accordance with AAVLD Essential Requirements through the performance of high quality diagnostic testing in accordance with ISO 17025 standards and guidelines.
- Continuously improve diagnostic information and dissemination processes.
- Integrate contemporary laboratory practices throughout the laboratories.
- Ensure employee health and safety.
- Provide employees with training and tools to facilitate our quality effort.

The Laboratory's success is measured by customer satisfaction, meeting professional standards, meeting the essential American Association of Veterinary Laboratory Diagnosticians (AAVLD) Accreditation requirements, and our response to service demands. These quality objectives are reviewed for continuing compliance on a recurring basis.



Locations of clients submitting accessions to UKVDL, 2011-2016



Graphics by Dr. Jacqueline Smith, UKVDL Epidemiology Section Head

	Diag Cases	%Change	Diag Tests	%Change	Reg Cases	%Change	Reg Tests	%Change	Necropsies	%Change
2010	13,487		88,582		39,705		45,565		3,172	
2011	13,491	0%	89,199	1%	41,538	5%	51,180	12%	3,645	15%
2012	14,227	5%	67,424	-24%	35,093	-16%	40,635	-21%	3,398	-7%
2013	13,655	-4%	63,436	-6%	31,251	-11%	37,354	-8%	3,100	-9%
2014	12,976	-5%	63,564	0%	28,142	-10%	35,552	-5%	3,244	5%
2015	13,493	4%	76,803	21%	22,319	-21%	31,534	-11%	3,208	-1%
2016	14,082	4%	76,554	0%	20,682	-7%	29,709	-6%	3,258	2%

Outreach

The UKVDL continues to build and enhance outreach programs throughout the Commonwealth of Kentucky. The Kentucky VetLabNet listserv continues to distribute animal health bulletins; the list has grown to more than 2,000 UKVDL clients, scientists, farmers, and stakeholders. The UKVDL web site at www.vdl.uky.edu is continuously updated with information relating to diagnostic testing, epidemiologic surveillance data, near-real time GIS maps of disease distribution, and more. Social media was implemented in 2016 to engage clients and potential clients via Facebook and Twitter. The UKVDL faculty and staff continue to contribute articles quarterly to the KVMA journal, the Kentucky Cattleman Association *Cow Country News*, the *Bluegrass Equine Digest*, *Equine Disease Quarterly*, and other lay publications.

The UKVDL director, faculty, and staff continue to deliver lectures at scientific and lay meetings and participate in the monthly Equine Diagnostic and Research Seminar Series at the UKVDL. These seminars are filmed by *The Horse* magazine, edited, and made available as webinars. These seminars have been viewed in more than sixty countries.

- Reproduction in Sport Horses—Etta Agan Bradecamp, Rood and Riddle Equine Hospital
- UK Equine Showcase—Multiple speakers, Fayette County Cooperative Extension Office
- Kentucky Breeders' Short Course—Multiple speakers, Fayette County Cooperative Extension Office
- Navicular Disease—Jim Schumacher, University of Tennessee
- How Tumors Develop from Transformed Cells to Cancer Models of Multi-stage Tumor Development—David Hurley, University of Georgia
- Pushing and Pulling across the Blood Gas Barrier Mechanisms of EIPH—David Poole, Kansas State University
- Animal Genetics Testing and Research Lab Services—Kathryn Graves, University of Kentucky Animal Genetics Testing and Research Laboratory, and Martin Nielsen, University of Kentucky Gluck Equine Research Center
- Drug Clearance—Jennifer Davis, North Carolina State University

- Sport Horse Lameness—Brett Furlong, B.W. Furlong and Associates
- Infectious Disease Diagnosis—Nathan Slovis, Hagyard Equine Medical Institute

Other outreach events (select)

- Food Animal Practitioner Conference, UKVDL Auditorium, approximately 65 veterinarians and other guests in attendance. February 25.
- Food Animal Practitioner Conference, UKVDL Auditorium, approximately 70 veterinarians and other guests in attendance. August 18.
- The director and six UKVDL employees attended the AAVLD meeting in Greensboro, NC, for continuing education and delivering scientific presentations.
- Dr. Craig Carter, Executive Director of the World Association of Veterinary Laboratory Diagnosticians, is overseeing the planning for the biennial meeting in Sorrento, Italy. June 2017.
- Veterinary Diagnostic Laboratory Services in Appalachian Counties, second annual meeting of the Center for Animal Health in Appalachia, Lincoln Memorial University College of Veterinary Medicine, Ewing, VA. October 20–21.
- See the Ruminant Veterinarian and Epidemiologist's reports below for additional outreach activities.

Disease Diagnoses and Outbreak Responses (select)

- January: Holstein dairy, chronic pleuritic with pulmonary emphysema, 7 dead, 7 sick out of 265 on farm.
- February: Boer goat operation, Haemonchosis, verminous pneumonia, 11 dead, 10 sick, out of 62 on farm.
- March: Mixed bovine operation, septicemia, 12 dead, 1 sick out of 41 on farm.
- April: Backyard poultry operation, mycoplasma septicemia, peritonitis, 3 dead, 100 on farm.
- May: Alpaca operation, copper deficiency, 1 dead, 2 sick, 25 on farm.
- June: Canine breeding operation, canine parvovirus enteritis and coccidiosis, 2 dead, 11 sick, out of 13 in kennel.
- July: Mixed bovine operation, arsenic toxicosis, 6 dead, 2 sick, out of 19 on farm.
- August: Mixed bovine operation, Mycoplasma bronchopneumonia, 3 dead, 1 sick out of 275 on farm.

- September: Canine household pets, methamphetamine toxicosis, 1 dead, two sick out of three in household.
- October: Equine, thoroughbred, Typhlocolitis, Salmonellosis, 1 dead, 2 sick, unknown number on farm.
- November: Feline, cattery, American domestic shorthair, feline infectious peritonitis and meningitis, 1 dead, 39 sick, out of 40 animals.
- December: Sheep operation, selenium deficiency, myocardial degeneration, rumenitis, 6 dead, unknown sickness, unknown flock size.

Notable Achievements or Advancements

- Led UKVDL efforts to maintain national accreditation in the American Association of Veterinary Laboratory Diagnosticians (every five years; most recent full accreditation approved in 2016), the USDA National Animal Health Laboratory Network (NAHLN), the FDA Veterinary Laboratory Investigation and Response Network (VetLIRN), the National Poultry Improvement Program (NPIP), faculty and staff continuing medical education initiatives, and participation in outbreak response.
- Continued support for faculty and staff to enhance the UKVDL outreach programs through one-day symposia and seminars such as food animal (Dr. Michelle Arnold), equine (all faculty), poultry (Meg Steinman and Dr. Lynne Cassone), toxicology (Dr. Cindy Gaskill). The monthly Equine Diagnostic Research Seminars reach a global audience through our partnership with *The Horse* magazine.
- Worked closely with Mr. Ryan Redimarker, UKVDL business office manager, to provide a clear vision and oversight for a UKVDL strategic and marketing plan to improve client services, enhance testing and collection of fees, and purchase high value instrumentation to modernize our laboratory sections.
- Served as key liaison with Lincoln Memorial University leaders to sustain our cooperative agreement to provide training for veterinary medical students in exchange for significant funds that can be used to improve UKVDL services and research capability in support of Kentucky animal agriculture.

- Continue to oversee the operation of a real-time animal disease cluster detection system for Kentucky.
- Continue to provide support for faculty and staff to travel to professional meetings for continuing education and to host professional exhibits for display at local, state and national meetings as needed
- Supported and guided Dr. Jackie Smith, UKVDL epidemiologist, in fostering the growth of KY-VetLabNet listserv to more than 2,000 subscribers to maintain a high level of situational awareness for veterinarians and farmers through alerts and bulletins.
- Continue to oversee epidemiological field investigations and research studies for clients as requested or needed, generating intramural and extramural funding for the UKVDL.
- Regular articles published in the journal of the Kentucky Veterinary Medical Association (since 2005) and the Kentucky Cattleman Association (since 2009) magazine.
- Continued support for Dr. Laura Kennedy as PI in the furtherance of the Kentucky Horse Racing Necropsy Program funded by the Kentucky Horse Racing Commission and the Equine Drug Research Council.
- Supported and guided Dr. Erdal Erol in the continued development of several problem-based diagnostic testing panels that assist veterinarians in obtaining the earliest definitive diagnosis on clinical cases.
- Continued support for Dr. Erdal Erol in his role as a member of the Joint National VS-AAVLD Antimicrobial Resistance Working Group.
- Continued support for Dr. Michelle Arnold in her role as a Co-PI on the Southeast Quality Milk Initiative to improve milk quality in the southeast.
- Continued support for Dr. Jennifer Janes in her role as PI on an internally funded project to identify genetic determinants in Wobbler Syndrome in horses.
- Continued support for Dr. Cindy Gaskill and Dr. Lori Smith in the modernization of instrumentation and staffing in the toxicology laboratory.
- Continued support for Dr. Cindy Gaskill in establishing a residency program in Veterinary Toxicology.
- Continued support for Dr. Alan Loynachan as a co-PI on the development of a genetically defined live attenuated equine herpesvirus-1 vaccine for the horse.
- Supported and guided Dr. Jackie Smith in the development and implementation of sophisticated GIS near-real-time mapping systems to provide situational awareness and surveillance regarding the confirmation and distribution of animal and zoonotic diseases in Kentucky.
- Continued support of Dr. Jackie Smith in the production and dissemination of the weekly Reportable Disease alerts distributed to the Office of the Kentucky State Veterinarian's office.
- Continued support for James Mason and Derrick Miles in the upgrade of the raid array for UKVDL network and production servers to improve the performance of the Laboratory Information Management System (LIMS) and other applications that support UKVDL clients.

Initiatives and Programs

- Evaluation of the Zoetis USDA licensed equine leptospirosis vaccine during the first reproductive season of use.
- Metagenomics diagnostic laboratory section for UKVDL will work closely with the Gluck Equine Research Center for a future hire of a bioinformatics faculty member to assist in the formation of a metagenomics research effort within the Department of Veterinary Science.
- Develop and implement paperless regulatory test reporting systems and procedures (EIA, CEM).

Major Issues and Challenges

- Personnel turnover: 8/67 (12%) turnover during this reporting period.
- Generation of new fee for service income to help sustain laboratory operations. Continue to develop and utilize creative strategies to strategically and selectively increase fees on tests to improve income, monitor the utilization of the laboratory by existing clients, and recruit new clients. Generated new revenue through engaging in research projects with drug and vaccine companies. Successfully pursued grant funding which allows for salary cost

sharing and purchases of equipment. Working now to sustain and grow the cooperative agreement with Lincoln Memorial University to train DVM students.

- Funding for major purchases: Three major instrument, major equipment, and software purchases totaling over \$181,000 during this reporting period.
- Increased building maintenance costs: Facilities maintenance costs have nearly tripled since moving into the expanded/renovated facilities in 2011 and will continue to rise as the facilities age (the expanded facilities came with no new maintenance funding). The director met with Dr. Rick Bennett to discuss possible sources of funds to assist with building maintenance at UKVDL.

Director's Leadership Contributions (select)

- President and executive director, American Veterinary Epidemiology Society, 5-year term, 2015–2020.
- Member, Advisory Board, Center for Animal Health in Appalachia, 2015–2016.
- Member, OIE-WHO-FAO-United Nations Global Alliance for Global Rabies Eradication, Expert Committee, 2015–present.
- Executive director, World Association of Veterinary Laboratory Diagnosticians (WAVLD) since 2000. Coordinated planning for the meeting in Sorrento, Italy, June.
- Member, Kentucky Livestock Care and Standards Commission and Equine Health and Welfare Council (Governor appointment).
- Member, National One Health Initiative Advisory Board, 2010–2016.
- Member (Ex Officio), Kentucky Farm Bureau (six species committees), 2014–2016.
- Adjunct Professor, Epidemiology, College of Public Health, University of Kentucky, 2012–2016.
- Adjunct professor, Epidemiology, College of Veterinary Medicine, Lincoln Memorial University, 2014–2016.
- Active member of eight standing committees of the AAVLD.

Future Issues and Challenges, Planning and Priorities

- Establish a contingency fund to respond to emerging, re-emerging, and Foreign Animal Disease outbreak responses.
- Continue planning for the training of veterinary students in the LMU-DVM program and the effective utilization of funds generated by this project.
- Explore the establishment of a collaborative network of laboratories and/or industry partners to embrace diagnostic metagenomics to assist in the identification of emerging and new potential pathogens related to animal disease.
- Establish endowments to establish post-doctoral residency programs and applied research at UKVDL.
- Pursue maintenance funding from the Kentucky legislature or elsewhere to sustain the expanded UKVDL facilities.
- Continue to explore outreach and continuing educational programs utilizing the UKVDL auditorium.
- Pursue funding to plan and construct veterinary historical exhibits in the hallways of the new UKVDL administration wing.

Section Reports

Bacteriology/Mycology

Dr. Erdal Erol, Section Head; Mr. Steve Locke, Section Supervisor

The bacteriology/mycology section of the UKVDL receives specimens to culture for the isolation and identification of potentially pathogenic bacteria and fungi from livestock, companion, and other animals. The section performs susceptibility testing on isolates for the treatment of specific pathogens to safeguard the health of animals in Kentucky and beyond. This section performs cultures for *Taylorella equigenitalis* and *T. asinigenitalis* for the federal/state CEM regulatory program in equines. Other specialized cultures and testing techniques include: anaerobic culture, mycoplasma culture, mastitis culture and fluorescent antibody testing for leptospires and clostridia (blackleg). This section also performs cultures for the National Poultry Improvement Plan (NPIP) In addition, bacteriology/mycology section participates in annual proficiency testing for AAVLD, NPIP salmonella, FDA Vet-LIRN salmonella and listeria.

In June, two additional technicians were certified and trained for *Taylorella* (CEM) culture. The bacteriology section is currently using the MALDI-TOF biotyper as a cutting edge instrument for the quick identification of microorganisms. This equipment has already significantly decreased turn-around time on the identification of many bacteria. We are confident that this new technology will increase client satisfaction with our microbiology service offerings.

Highlights

- 9,159 aerobic cultures were performed on samples submitted to the UKVDL; significant bacterial pathogens were found in these samples, such as: Nocardioform bacteria, coliforms, Beta-hemolytic streptococci, *Salmonella*, *Pasteurella*, *Mannheimia*, *Bibersteinia*, *Trueperella*, *Mycoplasma*, and *Staphylococci*.
- 7,155 CEM cultures were performed for the CEM regulatory screening program.
- 3,293 antimicrobial susceptibilities were performed to determine the antimicrobials that could be used for their treatment in exposed animals (MIC broth microdilution method).
- 1,469 specimens were tested for leptospires by fluorescent antibody testing.
- 1,057 specimens were cultured for NPIP Salmonella testing. Our participation in NPIP helps poultry industry improve infectious disease control and eradication programs.
- 408 anaerobic cultures were performed. *Clostridium perfringens* and *C. difficile* screening was the predominant focus.
- 146 ruminant mastitis cultures were performed. Often collaborate with extension veterinarian Dr. M. Arnold for communication of treatment options to client.
- 180 specimens were tested for fungal pathogens.
- 101 *Clostridium chauvoei* (blackleg) and *Clostridium septicum* fluorescent antibody tests were performed.

Virology

Dr. Erdal Erol, Section Head; Ms. Sharon K. Ray, Section Supervisor

The virology section aids veterinarians and animal owners to diagnose viral infections, treat, and protect their animals.

Section also works closely with UKVDL Pathology section to test for evidence of viral infections in necropsy specimens. In addition, the section performs a high volume of regulatory tests for national sales, and for both the national and international movement of animals. The virology section provides information to the field veterinarians and animal owners regarding sample selection, preservation, shipping procedures and interpretation of results.

Highlights

Virology conducted numerous virus neutralizations, virus isolations, ELISAs, and fluorescent antibody tests (FA) in support of animal agriculture not only in Kentucky but across the country. See the virology table for the variety and number of tests completed.

Molecular Diagnostics

Dr. Erdal Erol, Section Head

The primary mission of the molecular diagnostic section at the UKVDL is to provide molecular testing on the clinical specimens submitted by animal owners, veterinarians, and pathologists. A number of molecular assays, in the formats of gel-based PCR, real-time PCR, multiplex gel-based PCR, or multiplex real-time PCR are being utilized because of their speed, specificity, and sensitivity. The section also analyzes specimens received from the virology and bacteriology sections to obtain a confirmatory diagnosis. In addition, Dr. Erol provides consultations to Kentucky veterinarians and animal owners on the areas of appropriate sample collection and submission, therapeutic advice, interpretation of test results, determination of appropriate tests, and differential diagnosis. The molecular biology section personnel consist of Dr. Erdal Erol, two full-time technicians, and one half-time technician.

Highlights

- The molecular diagnostics section successfully demonstrated its ability to provide accurate, rapid, high-volume testing. This section also became an accredited member of the USDA's National Animal Laboratory Health Network and passed several federal proficiency tests such as Foot and Mouth disease, Classical Swine Fever, Avian influenza

Virology Tests

Test	Procedure	2015	2016
Bovine Coronavirus	FA	47	0
Bovine Respiratory Syncytial Virus	FA	97	6
Bovine Respiratory Syncytial Virus	VN	31	23
Bovine Viral Diarrhea	ELISA	5712	7510
Bovine Viral Diarrhea	FA	750	464
Bovine Viral Diarrhea 1	VN	60	59
Bovine Viral Diarrhea 2	VN	60	59
Canine Adenovirus	FA	21	11
Canine Corona Virus	FA	20	21
Canine Distemper Virus	FA	75	76
Canine Herpesvirus	FA	43	43
Canine Parainfluenza 2	FA	27	14
Canine Parvovirus	FA	93	96
Equine Adenovirus	FA	2	2
Equine Herpesvirus 1	FA	779	847
Equine Herpesvirus 1	VN	235	51
Equine Influenza A1	HI	142	5
Equine Influenza A2	HI	143	5
Equine Rotavirus	FA	18	16
Equine Viral Arteritis	FA	45	4
Equine Viral Arteritis	VN	12999	14046
Feline Herpesvirus	FA	31	32
Feline Infectious Peritonitis	FA	49	68
Feline Panleukopenia	FA	49	60
Infectious Bovine Rhinotracheitis	FA	266	131
Infectious Bovine Rhinotracheitis	VN	82	75
Parainfluenza-3 Virus	FA	71	4
Porcine Circovirus	FA	4	5
Porcine Parvovirus	FA	4	5
Porcine Reproductive & Respiratory Syndrome	FA	7	5
Potomac Horse Fever	IFA	392	153
Rotavirus	IFA	0	0
Transmissible Gastroenteritis Virus	FA	0	13
Vesicular Stomatitis IN	VN	1722	1319
Vesicular Stomatitis NJ	VN	1722	1319
Virus Isolation	VI	544	567
West Nile IgM Capture	ELISA	113	147

Overall test totals are up this past year by 29.3 percent from 2015.

Molecular Diagnostic Tests

Avian Influenza	198
Calf Diarrhea Panel (corona virus, rotavirus, <i>E. coli</i> , <i>Salmonella</i> and <i>Cryptosporidium</i>)	184
Bovine Respiratory disease-Viral panel (viral diarrhea virus, corona virus, Respiratory syncytial virus and herpes virus)	255
Bovine Respiratory disease-Bacterial panel (<i>M. haemolytica</i> , <i>P. multocida</i> , <i>H. somni</i> and <i>M. bovis</i>)	136
<i>Clostridium perfringens</i> Toxin Typing	115
Nocardioform actinomycetes (<i>Amycolatopsis</i> spp and <i>Crossiella equi</i>)	72
Equine Arteritis Virus	125
Equine Herpesvirus 1	282
Equine Herpesvirus 2	95
Equine Herpesvirus 3	34
Equine Herpesvirus 4	55
Equine Herpesvirus 5	50
Equine Influenza	262
Equine Protozoal Myeloencephalitis	23
<i>Lawsonia intracellularis</i>	170
<i>Leptospira</i>	109
<i>Mycobacterium paratuberculosis</i>	112
<i>Mycoplasma gallisepticum</i>	37
Potomac Horse Fever	383
<i>Salmonella</i>	792
<i>Streptococcus equi</i>	424
<i>Tritrichomonas foetus</i>	152

and Exotic New Castle Disease. The membership enables this unit to participate in national veterinary disease surveillance and provide rapid coordinated diagnostic response in the event of future outbreaks within the veterinary industry.

- Dr. Erol performed independent and collaborative research with other scientists, particularly in the topic of equine abortions caused by infectious diseases. The results were published and presented at several national and international meetings.

See the molecular diagnostic table for the number and variety of major tests performed by the section.

Pathology

Dr. David Bolin, Section Head

The UKVDL pathology section is composed of eight faculty pathologists, four histology technicians, four full-time necropsy technicians, and three part-time necropsy student workers. The pathologists perform complete necropsy examinations on animals, histopathology on necropsy cases and surgical biopsy specimens, and cytological examinations on body fluids and fine needle tissue aspirates, all submitted by veterinarians, producers, and pet owners. The pathologists are fully supported by other laboratory sections in necropsy investigations.

As part of the comprehensive necropsy examination, additional laboratory tests are ordered by the pathologist to aid in confirming a diagnosis. The abnormal findings observed at necropsy are correlated with other laboratory tests, including microscopic examination of tissues, and a comprehensive report is prepared for each pathology case.

Teaching has been an additional responsibility of pathologists at UK-VDL and will be expanded in the near future. One pathologist, in cooperation with Lincoln Memorial University (LMU), is responsible for the development, implementation, and administration of a curriculum in diagnostic pathology and supporting disciplines for fourth-year students from LMU College of Veterinary Medicine. The first rotation of students is July 2017. Furthermore, short reviews (1–2 weeks) in diagnostic pathology are offered to veterinary surgical and internal medicine residents to fulfill the pathology requirement for the American College of Veterinary Surgeons and American College of Veterinary Internal Medicine.

Research activities of VDL pathologists, in collaboration with scientists at the Gluck Equine Research Center and other university departments, are varied and involve a wide variety of equine diseases. These include:

Pathology Tests

Species	Number
Avian	110
Bovine	939
Caprine	95
Equine	1,618
Ovine	69
Porcine	33
Small animal	369
Miscellaneous	49
Laboratory animal	9
Total	3,335

- Pathology and immune function in aged PPID horses
- Retrospective analysis of diseases in aged horses
- Evaluation of a *R. equi* pili-based vaccine
- Evaluation of the mucosal inflammatory responses to larvicidal treatment
- Identification of genetic factors responsible for establishment of equine arteritis virus carrier state in stallions
- Identifying genetic determinants in wobbler syndrome
- Determine minimum toxic dosage of diphacinone in horses
- Proximal sesamoid pathology in thoroughbred catastrophic breakdown injuries
- Maturation of the articular growth complex in the medial femoral condyle of young thoroughbreds
- Magnetic resonance imaging of sub-clinical osteochondrosis in horses
- Kentucky horse racing necropsy program
- In vivo evaluation of the safety and efficacy of extracorporeal oxygenation in sheep

Highlights

Necropsy Examinations

Postmortem examinations (necropsies) are conducted on whole animals, specimens from field necropsies and equine placentas submitted to the VDL with the purpose of identifying any pathologic changes that would indicate an inflammatory or neoplastic disease process, physical injury, poisoning, or any other process that results in illness.

Biopsies

Tissue lesions are removed surgically or portions biopsied from live animals and sent to the laboratory for determination of the type of disease process, recommendations for additional surgical treatment if necessary and prognosis. Tissue specimens are processed and microscopic slides prepared for the pathologists to examine by microscopy. Tissue specimens representing 2,917 cases were processed and examined. A report with diagnosis was produced for each case. Typical turnaround on these cases is 24 to 48 hours.

Cytologies

Preparations of cells harvested and/or aspirated from abnormal lesions or body fluids are placed on microscopic slides and stained for examination under the microscope by the pathologists. Cytological examinations were performed, diagnoses made, and reports generated for 391 cases.

Clinical Pathology

Bonnie L. Decker, Section Head

The primary mission of the clinical pathology section is to provide chemistry, hematology, endocrine, urinalysis, fluid analysis, fecal parasite exams, and other testing to animal owners, veterinarians, and the agriculture community. The section also provides support and testing to UKVDL's pathologists and testing related to necropsy as well as University of Kentucky equine and animal science researchers who can submit specimens to Clinical Pathology for monitoring various chemistry, hematology, and endocrine levels in their research animals.

Clinical Pathology hosts two to three Morehead State University veterinary technician students every year to help them complete their practicum.

Clinical Pathology completes its testing same day as receipt with a few exceptions to get information to the submitting veterinarian as soon as possible to aid in the treatment of their clients' animals.

The department personnel consist of 1.50 full time employees. A section chief with a BS MT (ASCP) and 40 years' experience in veterinary and human diagnostic laboratory testing works full time. A part time veterinary technician with 21 years' experience occupies the half-time position in the section. Other qualified UKVDL personnel are available for backup and consultation as needed.

Clinical pathology is dedicated to meeting the current and future needs of the agriculture community, companion animal community and veterinarians.

Highlights

Clinical pathology was able to replace an aging chemistry analyzer with a dedicated veterinary chemistry analyzer, the ALFA Wassermann Vet Axcel. After extensive comparison and verification testing it was put into service in November 2016.

Clinical Pathology Tests

Test	Number
Bovine panel	127
Canine panel	88
Caprine panel	9
Chemistry panel	39
Equine panel	188
Feline panel	45
Hepatic panel	1
Porcine panel	1
Renal panel	5
Ruminant panel	10
Electrolyte panel	100
Eye Fluid panel	211
Fluid Examination	61
Urinalysis	83
CBC	468
CBC no diff.	9
Differential Only	2
ACTH	7
Calcium	1466
Cortisol	303
Cryptosporidia	58
Fecal Exam	905
Fibrinogen	111
Giardia Antigen	9
Parasite ID	1
Phenobarbital	159
Progesterone	332
Stone Analysis	223
Total T3	39
T4	163
K-9 TLI	6
Total	5023

Quality Control/Quality Assurance

Mary Harbour, Section Head

The goal of the University of Kentucky Quality Management System (QMS) is to ensure quality of all test results and continuous improvement of all services to clients. The design of the QMS and Quality Assurance program is based on American Association of Veterinary Diagnostic Laboratory (AAVLD) requirements, International Standards Organization (ISO) guidelines (ISO 17025), and Organization of International Epizootics (OIE). In addition to fulfilling these requirements, the UKVDL QMS helps fulfill the university's mission of improving service delivery while achieving excellent human relations (internally and externally), sound leadership, and effective communications.

The quality assurance section now consists of two employees, a quality assurance manager and full time quality assistant. The requirements for maintaining the QMS are continuously being updated. The assistant position was created to meet the increasingly more stringent AAVLD

requirements, OIE, NAHLN, and federal mandates.

Since 2010 UKVDL has been a part of the National Animal Health Laboratory Network (NAHLN). QA maintains and manages UKVDL information on the NAHLN portal. This portal provides information to NAHLN about the capacity of national laboratories in the event of a food animal outbreak. The portal also contains NAHLN policies and procedures as well as NVSL, USDA, and NAHLN proficiency testing results and reports. The section continues to prepare quarterly reports to the NAHLN. The QA manager serves on the NAHLN Methods Technical Working Group Committee.

To maintain conformance to all requirements, the QA manager attended the Quality Assurance Committee meeting at the annual AAVLD meeting and AAVLD auditor training. The QA manager assisted other AAVLD auditors on an audit of another AAVLD laboratory in another state.

In 2014, the quality assurance section implemented new quality system software. This software has improved document control, streamlined internal audits, improved equipment inventory, improved competency and training assessments, and improved corrective action investigations. The software has replaced most paper documentation and provided more electronic documentation of the quality system. Quality Assurance will continue to monitor and update policies and procedures to meet the AAVLD requirements.

Ruminant Extension

Dr. L. Michelle Arnold

The ruminant extension veterinarian works closely with the College of Agriculture, Food and Environment (CAFE) faculty, UKVDL faculty and clients, county extension agents, producer organizations, state livestock commodity specialists, and state and federal regulatory agencies regarding all veterinary ruminant health issues. The most important function is outreach to food animal veterinarians through regular continuing education programs, newsletters, and animal health bulletins. By developing this close work-

ing relationship between practicing veterinarians and UKVDL faculty, better diagnostic work-ups on challenging diagnostic cases and complex investigations result in more definitive answers for the producers of Kentucky.

The livestock disease risk and occurrence, its diagnosis, treatment, prevention, and control form the core of the information disseminated from this position. New university research, governmental directives, and other stakeholder concerns are also communicated broadly for discussion and action to benefit producers throughout Kentucky.

Highlights

- Coordinated the selection and presentation of 11 continuing education awards to Southeastern Dairy veterinarians.
- Hosted two food animal veterinary continuing education meetings.
- Presented health modules for five sessions in the Pasture to Plate program.
- Served on the dairy faculty search committee that selected new faculty member Dr. Joao Costa.
- Continued to teach the health portion of the undergraduate classes in beef and dairy science and a veterinary lab to the dairy class.
- Attended the “Thoracic Ultrasound and Pre-Mortem Diagnostics in an Outbreak Situation” AABP pre-conference seminar.
- Continued to serve on the BVD Task Force at the request of the Kentucky state veterinarian.
- Participated in numerous field days, producer meetings and farm visits throughout the state.
- Writes a monthly health article for Cow Country News, the newsletter of the KY Cattlemen’s Association
- Regularly contributes to the KVMA newsletter, Off the Hoof (UK Beef electronic newsletter), and KY Dairy Notes (UK Dairy electronic newsletter).
- Educated producers, extension personnel and veterinarians about the new Veterinary Feed Directive through many regional meetings and articles.
- Continued to serve as the attending IACUC veterinarian for the UK Swine Unit and as veterinarian of record on several research projects.

- Coordinated a “blood drawing lab” at the Coldstream Dairy for all students on any IACUC protocol on the farm.
- Served on two graduate committees for Ph.D. candidates and was the outside examiner for a third.
- Served as a judge for the Graduate Poster Session and participated as a reviewer for the Dairy Research Showcase.
- Continued to expand the database of food animal veterinarians, which currently contains 400 veterinarians and 288 clinics.
- Participated in producer meetings, conference calls, and program development with faculty from six southeastern land grant institutions funded by the Southeast Quality Milk Initiative (SQMI) grant. Moderated the SQMI morning educational session and presented results for Objective 4 to the stakeholders at the 2016 Annual Meeting held in Tifton, Georgia. Coordinates the printing and distribution of the SQMI quarterly newsletter to veterinarians throughout the Southeast.
- Managed cases at the UK Veterinary Diagnostic Laboratory including recording in-depth histories, determining necessary tests, participating in complex disease investigations, and interpretation and communication of results to veterinarians and producers.
- Served on the Farm Bureau Advisory Board for Beef, Dairy and Small Ruminants (sheep and goats).
- Served as a stakeholder for the USDA Forage Animal Production Research Unit (FAPRU).
- Represented the University of Kentucky at the National Cattlemen’s Beef Association (NCBA) Convention in San Diego during several health-related meetings.

Kentucky veterinarians, extension agents, producers, government entities, and the university benefit from a strong livestock sector, and health is a major component. In 2016, this position served to reach each of these stakeholders for the overall improvement of livestock health and sustainability of the food animal veterinary profession.

Serology

Meg Steinman, Section Head

The mission of the serology section is to provide accurate and timely results for both diagnostic and regulatory testing. The results generated provide veterinarians and regulatory personnel with data upon which to base their decisions. Many of our tests can be done on multiple species, and some are species specific. This section offers a wide variety of testing by various types of methodologies.

- **Poultry:** The section participates in USDA audits performed by the KY NPIP official to maintain status as an NPIP approved laboratory. Personnel have attended National Poultry Improvement Plan (NPIP) approved training courses. Two new poultry tests were added: infectious bronchitis virus (IBV) antibody test and infectious bursal disease (IBD) virus antibody. The section passed the Avian Influenza proficiency test for 2016.
- **Equines:** The section successfully passed USDA-APHIS audits and proficiency tests to continue to offer Equine Infectious Anemia (EIA) antibody testing and piroplasmosis testing.
- **Bovines and ruminants:** The section offers a variety of antibody tests performed on serum from bovines and other ruminant species.
- **Canine and feline:** The section offers a variety of tests that can be run on dogs and cats, including the tick panel for canines. This panel includes detection for antibody to ehrlichia, borrelia burgdorferi (Lyme disease), anaplasma, and rickettsia (Rocky Mountain Spotted Fever).
- **Porcine:** The section offers regulatory testing for swine including brucellosis antibody and pseudorabies (PRVgB).

Additional activity

- Section head serves on a National Animal Health Laboratory Network Exercises and Drills Working Group. The purpose of this group is to develop exercises to help prepare for a disease outbreak in the food animal. This year the committee developed a training exercise to determine a laboratory's ability to implement a response plan to keep the food supply safe. Findings

Serology Tests

Test	Methodology	2015	2016
Anaplasma phagocytophilum (Canine)	ELISA	14	26
Anaplasma Antibody (Bovine)	cELISA	524	769
Avian Influenza Antibody	ELISA	11,483	19,951
Babesia caballi (equine piroplasmosis)	cELISA	391	262
Theileria Equi (equine piroplasmosis)	cELISA	391	262
Fungal Serology: Blastomyces (Canine, Feline, various warm-blooded animals)	AGID	124	95
Histoplasmosis (Canine, Feline, various other species)	AGID	113	89
Bluetongue antibody (Bovines)	cELISA	99	205
Bovine Leukemia Virus antibody	cELISA	377	664
Ruminant Pregnancy Test	ELISA	1,397	1,980
Brucella antibody (BAPA)	Plate agg	1,090	605
Brucella antibody card test	Agg	7	229
Brucella antibody (Equine)	Plate Agg	14	22
Brucella antibody (melitensis: Caprines)	Agg	41	46
Brucella antibody (Plate test)	Agg	13	9
Canine Brucella antibody	Agg	99	140
Canine pregnancy	ELISA	1	2
Caprine arthritis/encephalitis virus antibody	cELISA	279	186
Contagious Equine Metritis antibody	CF	1,145	1,168
Epizootic Hemorrhagic Disease antibody (Bovine)	AGID	128	121
Equine Infectious Anemia antibody	AGID	408	517
Equine Infectious Anemia antibody	ELISA	15,327	13,234
Equine Infectious Anemia: stockyard samples	ELISA	3,221	3,138
Ehrlichia antibody (Canine)	ELISA	13	21
Feline Immunodeficiency Virus antibody (FIV)	ELISA	38	25
Feline Infectious Peritonitis Antibody (FIP)	ELISA	35	40
Feline Leukemia Virus antigen	ELISA	40	29
Heartworm antigen (Canine)	ELISA	14	13
Infectious Bronchitis Virus (IBV) antibody (poultry)	ELISA		90
Infectious Bursal Disease Virus (IBD) antibody (poultry)	ELISA		189
Johnes antibody (Bovines and Caprines)	ELISA	1,615	2,381
Leptospirosis: (Multi-species): canicola	MAT	294	219
grippotyphosa	MAT	5,125	4,438
hardjo	MAT	537	486
icterohaemorrhagiae	MAT	314	219
pomona	MAT	5,336	4,711
Borrelia burgdorferi antibody (Lyme Disease, Canine, Equine, Feline)	ELISA	31	28
Mycoplasma gallisepticum antibody (Poultry)	ELISA	30,616	32,844
Mycoplasma synoviae antibody (Poultry)	ELISA	30,616	32,844
Neospora caninum antibody (Bovine, Canine)	cELISA	359	301
Newcastle Disease Virus Antibody (NDV, poultry)	ELISA	31	112
Ovine progressive pneumonia antibody (OPP)	cELISA	14	6
Pseudorabies antibody (Porcine)	ELISA	125	113
Rocky Mountain Spotted Fever antibody (RMSF)	IFA	12	27
Salmonella pullorum-typhoid antibody (poultry)	Agg	21,950	19,870

from the exercises will help determine the strengths and weaknesses of the individual laboratory, and identify what needs to be in place to help respond.

- Section head is a member of the Poultry Health Advisory Board for Kentucky.
- The section is participating in two research projects looking at MAT leptospiral titers in serum and vitreous fluid.
- The section is working on implementation of electronic distribution of all EIA test results.

Toxicology

Dr. Cynthia L. Gaskill, Section Head

The primary mission of the UKVDL toxicology section is to provide toxicological diagnostic testing capabilities and consultations to Kentucky veterinarians, UKVDL pathologists, county extension agents, livestock producers, pet owners, state officials, and others. A large variety of toxicological tests are available, including analyses for metals and minerals; organic compounds including a multitude of pesticides, drugs and other chemicals;

biological toxicants such as plant, insect, bacterial, and fungal toxins; and numerous other toxicants. Tests are performed in tissues, gastrointestinal contents, biological fluids, baits, feeds, forages, water, soil, and many other substances.

Consultation services include assistance with therapeutic advice, differential diagnoses, residue considerations, toxicological risk assessments, determination of appropriate tests, appropriate sample collection, and submission recommendations, interpretation of analytical results, and other general toxicological information. Alerts, updates and toxicological information regarding cases of poisoning or contaminated animal feeds are also provided to the State Veterinarian's office.

The toxicology section personnel consist of Cynthia Gaskill, DVM PhD ABVT, clinical veterinary toxicologist and section head; Lori Smith, PhD, senior analytical chemist; Michelle Helm, BSc, technician; Kyle Francis, MSc, research analyst; Joseph Johnson, BSc, research analyst; Megan Romano, DVM, toxicology resident; and student interns.

Highlights

- The most common causes of poisoning diagnosed at the UKVDL included:
 - **Cattle, sheep, goats:** Yew (Taxus), nitrate, sodium, lead, arsenic, selenium, ammonia, sulfur, ionophores, buckeye
 - **Horses:** Botulism, yew (Taxus), antibiotic feed contaminants
 - **Dogs and cats:** Anticoagulant rodenticides, bromethalin, illicit drugs
- Received continued funding from several federal and other grants, totaling over \$162,000 for this calendar year. This funding provides support for instrumentation, personnel, and supplies to develop analytical methods and complete inter-laboratory validations studies, to investigate poison cases involving drugs and feeds, and advance understanding of a number of important toxicants. Our FDA grants involve collaboration with several veterinary diagnostic laboratories including the Davis California Animal Health and Food Safety laboratory, Iowa State University Veterinary Diagnostic laboratory, the Washington Animal Disease Diagnostic Laboratory, and others.

Toxicology: The most commonly performed toxicology tests in 2016

Test	Number of panels	Number of analyses
Anticoagulant rodenticide panel – Liver. Panel includes analyses for 8 ACR compounds. LC-MS/MS method	29	232
Arsenic - whole blood. ICP-MS method		5
Bromide – serum. IC method		43
Clostridium botulinum – sent to referral lab. PCR method		9
Cobalt – serum, plasma, blood. ICP-MS method		3,039
Cyanide – forages, blood, other. Cyantesmo colorimetric method		8
Ergovaline – UPLC method		296
Ethylene glycol/glycolic acid panel –GC/FID method		6
GC/MS organic compound screen		17
Examine contents – visual, microscopic		15
Lead – whole blood. ICP-MS and anodic stripping voltammetry methods		36
Mercury – various samples. ICP-MS		9
Metal panels – liver and kidney tissue, blood, feeds, water, environmental samples. Panel includes analyses for 14 different inorganic elements. ICP-MS method	146	2,044
Trace mineral panels – liver and serum. Panel includes analyses for 7 trace elements. ICP-MS method	727	5,089
Mycotoxins – feeds. 6 mycotoxins. HPLC and GC methods		30
Nitrate/nitrite panel – ocular fluid, serum, water, forages, other. IC and colorimetric methods	123	246
pH – forage, rumen contents, other samples. pH meter		43
Selenium – serum, blood. ICP-MS method		29
Sodium – brain. ICP-MS method		14
Other tests (misc. tests including those with < 5 requests each). Various methods		23
Total number of analyses		11,233

- Initiated the first UKVDL veterinary toxicology residency program, one of only three such programs in the country. The first toxicology resident post-doctoral scholar began the residency program in August.
 - Provided serum and plasma cobalt analyses for several horse racing jurisdictions. Performed over 3,000 cobalt analyses.
 - Completed new SOPs, including methods for anticoagulant rodenticide analysis of liver and operations of the new UPLC-MS/MS instrumentation.
 - Hosted student interns from the Forensic Science Internship program at Eastern Kentucky University.
 - Section head mentored six Lincoln Memorial University veterinary student summer interns for a research project evaluating Kentucky's county animal shelters as part of the new collaborative agreement between UK and LMU, and taught 20 contact hours for the LMU 2nd year veterinary toxicology course.
 - Continued providing forage ergovaline analyses for the University of Kentucky Pasture Evaluation program and for producers and UK extension agents.
 - Participate in numerous proficiency programs to ensure quality results.
- The UKVDL toxicology section participated in several additional research projects directly applicable to improvements in diagnostic offerings. Funding from these projects helped support instrumentation and personnel also used for diagnostic purposes. Some of the 2016 projects included:
- Evaluation of Kentucky barn owls for evidence of chemical contaminations
 - Study of liver metal concentrations in Kentucky racehorse break-down cases
 - Inter-laboratory method validation for Aflatoxins B1 and M1 in liver (collaboration with Iowa State University)
 - Inter-laboratory method validation study for carbamates in rumen contents (collaboration with the California Animal Health and Food Safety laboratory)
 - Quantitation of metals in pet jerky treats, tissues and blood (collaboration with Washington Animal Disease Diagnostic laboratory and University of Idaho Analytical Sciences laboratory)
 - Initiated a study to determine the minimum toxic dosage of the anticoagulant rodenticide diphacinone in horses.

Epidemiology

Dr. Jacqueline L. Smith, Section Head

The UKVDL epidemiology section plans and conducts veterinary epidemiological research experiments that lead to the earliest detection of animal disease outbreaks, with our primary mission being to provide animal disease surveillance, and assist veterinarians in the investigation of serious and unusual disease problems. Daily monitoring of finalized necropsy and lab testing data streams provide near real-time disease cluster analysis. The section also conducts data acquisition and statistical analysis in support of the Office of the State Veterinarian, USDA, and to provide animal health situational awareness for industry stakeholders. Many of these studies lead to publication in peer-reviewed journals

and lay publications. Disease reporting to the state veterinarian (reportable infectious diseases, disease of interest, emergency disease notification) is performed weekly for the typical endemic diseases, while unusual or emergency disease situations are reported immediately.

In-depth field investigations to better characterize disease outbreaks for identifying causative etiology through the collection of diagnostic specimens and recommending diagnostic testing are provided free of charge to any farm/producer in Kentucky at the request of a local client with the approval of the UKVDL administration.

Highlights

- Section head completed a graduate certificate in digital cartography from the University of Kentucky

- Conducted 236 telephone consults regarding suggestions, recommendations and information related to animal health issues
- Statistical requests (from UKVDL faculty, UK faculty, state and federal officials, local veterinarian): 211 requests (1-10 hrs each)
- Graphics requests: 261 (2-10 hrs each)
- Reportable disease reports sent: 52 weekly reports (approximately 1hr each week)
- Created the UKVDL Disease Mapping Initiative
- Completely overhauled the UKVDL website's epidemiology footprint
- Created the @UKVDL Twitter feed
- Created the UKVDL Facebook page
- Created the UKVDL Vimeo page for short UKVDL videos

Agricultural Economics

Executive Summary

The Department of Agricultural Economics contains eight assistant professors and is experiencing growth in the quality of refereed publications and the number of external grants that support graduate students. The Ph.D. program suffers from uncompetitive assistantship levels. This situation is being addressed. On the positive side, graduate students are actively presenting and publishing research, getting teaching experience, seeking and receiving funding for projects, leading meaningful international projects, and performing well in the job market.

Research Programs

During 2016, the department contained 11 faculty who were actively involved in research. Areas of specialization range from production economics (2), to marketing and trade (4), to environmental and resource economics (2), to economic development (2), to equine economics (1). Research is also performed by the Com-

munity Economic Development Initiative of Kentucky (CEDIK), which is housed in our department, and by extension faculty engaged in farm management, livestock marketing, and horticultural marketing. Relative to peer institutions, we have a comparative strength in farm management and production economics, with strong collaborations among research faculty, extension faculty, our ten Kentucky farm business management specialists, and researchers in other departments within the College.

Graduate Degree Programs

The department administers M.S. and Ph.D. programs in agricultural economics, with approximately 20 to 25 students in each program. The recent filling of vacant faculty positions with highly skilled junior faculty is already elevating the graduate program and generating more grant-funded assistantship support. The grad students themselves are well-organized and seek ways to develop their competitiveness through journal

authorship, conference presentations, teaching experience, and special projects in locations such as Haiti, China, and Benin. Challenges include uncompetitive assistantship levels, few funding opportunities for M.S. students, and slow time to graduation.

Significant Achievements

In 2016, Ph.D. students received offers for faculty and post doc positions at peer institutions including the University of Arizona and the University of Connecticut. One of our Ph.D. students was selected as one of 35 top innovators under the age of 35 in francophone countries and has generated much funding for his research. A group of faculty applied for a National Needs Fellowship grant that, if awarded, would dramatically improve graduate student assistantships. The number of articles published in high-impact journals (e.g., *AJAE*, *JAERE*, *JARE*, *Agricultural Economics*, *Economic Inquiry*, *China Economic Review*) increased sharply in 2016.

Animal and Food Sciences

The Department of Animal and Food Sciences (AFS) is involved in all three mission areas of the college (research, teaching, and outreach), and currently includes 35 full-time faculty, 50 staff employees, 45 graduate students, and 5 postdoctoral scholars. Our current distribution of faculty effort is approximately 39 percent research, 30 percent teaching, and 31 percent extension, and over the past three years the department has averaged approximately \$4.1 million per year in extramural funding. The department provides instruction for two undergraduate degree programs, animal sciences (approximately 360 students) and food sciences (approximately 45 students). Animal sciences majors can choose one of three options: animal industry, food industry, and pre-professional. The food sciences degree program meets the requirements for accreditation by the Institute of Food Technologists and the National Organization of Food Science Professionals. In addition, the depart-

ment is heavily involved in instruction for the multidisciplinary equine science and management undergraduate degree program (approximately 350 students).

Research and Laboratory Facilities

The department has laboratory and animal space in W.P. Garrigus Building and state-of-the-art beef cattle, sheep, and swine facilities at C. Oran Little Research Center, dairy and poultry facilities at Coldstream Farm, equine facilities at Maine Chance Farm, and beef cattle facilities at the Research and Education Center that are utilized by faculty and staff for conducting important research and training of graduate students. On-campus laboratories are equipped with instrumentation that allows trace mineral, vitamin, lipid, amino acid, hormone, enzyme, stable and radioactive isotope analyses. Facilities for meat and food processing are also available and support research and graduate student training.

Research Programs and Faculty Expertise

The department's faculty and professional staff uses a multidisciplinary approach to address research areas from the cellular level to production systems, with the ultimate goal of enhancing animal production efficiency, improving health and well-being of animals and people, improving quality of life in society, and providing consumers with a healthy, safe food supply. Current research efforts are a good blend of discovery and applied research.

Disciplines of research in AFS include human, ruminant, non-ruminant and equine nutrition, nutritional and anaerobic microbiology, physiology, genetics and animal breeding, and food science. Faculty and professional staff are involved in collaborative efforts with other scientists in the College of Agriculture, Food and Environment and other colleges within the University of Kentucky, as well as with

investigators from other research facilities across the U.S. and the world. These kinds of collaborative efforts allow research efforts to focus on developing solutions to complex problems.

AFS faculty and staff play a key role in the University of Kentucky's Superfund Research Center that conducts biomedical and environmental research with the goal of minimizing the negative health and environmental impacts of organic chemicals found in hazardous waste sites. Other departmental personnel are leading efforts for the Food Systems Innovation Center, a multidisciplinary program involving collaborations between AFS, agricultural economics, dietetics and human nutrition, and biosystems and agricultural engineering, whose programs and activities help answer important questions for entrepreneurs involved in the local foods industry. Equine researchers in the department are an integral part of the college's Equine Program efforts, and provide innovative nutrition research for one of Kentucky's signature industries.

Graduate Degree Programs

AFS provides opportunities for students to pursue Doctorate (Ph.D.) and Masters (M.S.) degrees in animal sciences. Graduate research work in the broad areas of nutrition, management, animal care and well-being, and reproductive physiology may be conducted with beef cattle, dairy cattle, horses, poultry, sheep, swine, and companion animal species. Students

with interests in foods may specialize in meats, dairy products, food microbiology, muscle biology, or food chemistry.

Significant Achievements

The faculty and graduate students in AFS received numerous acknowledgments of excellence in 2016, including:

- Dr. Youling Xiong elected Fellow in the International Academy of Food Science and Technology.
- Dr. Sunday Adedokun received the Poultry Science Association Early Achievement Award for Research.
- Dr. Tony Pescatore selected as one of 18 Fellows to participate in the USDA funded Global Thinking Academy.
- Dr. Robert Harmon received an American Dairy Science Association Fellow Award and inducted into the Animal and Food Sciences Hall of Fame.
- Graduate student Mahesh Nair received a \$10,000 Meat Industry Suppliers Alliance Foundation scholarship.
- Graduate student Amanda Pesqueira received the American Society of Animal Science Omega 3 Protein Award.
- Graduate student Matthew Borchers received the National Milk Producer's Federation Dairy Leadership Scholarship and elected as Vice-President of the American Dairy Science Association Graduate Student Division.
- Graduate student Elizabeth Eckelkamp elected as Treasurer of the American Dairy Science Association Graduate Student Division.

- Graduate student Tatijana Fisher received a Certificate of Excellence for her research paper at the Poultry Science Association Annual Meeting.
- Graduate student Morgan Pyles received the 2nd place Outstanding Poster Award at the American Society of Animal Science – American Society of Nutrition Symposium held at the Joint American Dairy Science Association / American Society of Animal Science Annual Meeting.
- Dr. Jeffrey Lehmkuhler received the Southern Section American Society of Animal Science Extension Award.
- Dr. Jack McAllister received the Kentucky Dairy Development Council Dairy Promoter Award.
- Staff member Ryan Chaplin received the Kentucky Farm Bureau Excellence in Agriculture Award.
- Dr. Kristine Urschel, Dr. Roberta Dwyer, Dr. Mary Rossano, and academic coordinator Ann Leed nominated for the Ken Freedman Outstanding Advisor Award.
- Dr. Surendranath Suman received a UK Teachers Who Made a Difference Award.
- Graduate student Mahesh Nair received a Dissertation Year Fellowship Award from the graduate school.
- Dr. Kyle McLeod received the college's Thomas Poe Cooper Research Award.
- Dr. Jamie Matthews received the George Mitchell Outstanding Faculty Service to Graduate Students Award from Gamma Sigma Delta.

Biosystems and Agricultural Engineering

The Department of Biosystems and Agricultural Engineering at the University of Kentucky began its professional engineering curriculum in the fall of 1957. Through December 2016 the program has granted more than 540 bachelor of science degrees. The department currently has 16 full-time faculty members, 15 of which in tenured or tenure-track titles and 1 in a lecturer title. The department currently hosts more than 200 undergraduate students and 25 graduate students. The degrees offered by the Department of Biosystems and Agricultural Engineering are:

- Bachelor of science in Biosystems engineering (BSBN)

- Master of science in Biosystems and Agricultural Engineering (MSBAE)
- Doctor of Philosophy (PhD)

The areas of specialization offered for undergraduate students are: bioenvironmental engineering, food and bioprocess engineering, machinery systems automation engineering, controlled environment systems, pre-biomedical engineering, pre-veterinary medicine and pre-med tracks. Research and extension programs are active in bioenvironmental engineering, food and bioprocess engineering, machine systems automation engineering and controlled environment systems.

Highlights

- Faculty attracted more than \$5 million of funding to the University this calendar year.
- Dr. Akinbode Adedeji was selected to participate in the Carnegie African Diaspora Fellowship Program, through which he visited the University of Ibadan Nigeria from May to June.
- Dr. Carmen Agouridis was recognized for her work on soil and water terminology standards with the ASABE 2016 Standards Development Award.
- Dr. Carmen Agouridis was honored by the College of Education at the University of Kentucky as a Teacher Who Made a Difference.

- Dr. Donald Colliver directs the Kentucky Industrial Assessment Center (IAC) which was selected by the U.S. Department of Energy as the Outstanding Industrial Assessment Center. This is the first time in 40 years of IACs that a new center has received this award.
- Dr. Czar Crofcheck sustained her winning streak when she was selected as the Tau Beta Pi Outstanding Biosystems Engineering Teacher.
- Dr. Alicia Modenbach was selected as the recipient of the national Gale A. Holloway Professional Development Award.
- Dr. Sue Nokes was selected as the 2016 Distinguished Alumnus of the Food, Agricultural, and Biological Engineering department at The Ohio State University.
- Dr. Sue Nokes was selected as an American Society of Agricultural and Biological Engineering (ASABE) fellow.
- Dr. Michael Sama received a superior paper award from ASABE.
- One of BAE's senior design teams won first Place in ASABE national G.B. Gunlogson Student Environmental Design Competition.
- Dr. Nokes received the inaugural Research Empowerment Award, College of Food, Agriculture, and Environment at the University of Kentucky.

Community and Leadership Development

Our mission is to strengthen the capacities of individuals, organizations, and communities to act on their shared visions and challenges. We do this by basing our instructional and outreach programs on science-based research. The department was formed in 2002 and brought together faculty from rural sociology, agricultural education, agricultural communication, and program and staff development. Forming a new department necessitated changes and new approaches in how faculty approached their research endeavors as well as restructuring curricula at both the undergraduate and graduate levels. Undergraduate programs that were previously instruction-based (community communication and agricultural education, for example) now contain active and successful research components. The graduate program was revised to strengthen the foundations of social science theory and research methods. Our overall focus is moving beyond the disciplinary approach of the past to a process stressing cross-disciplinary and collaborative partnerships in all aspects of our research, instructional, and outreach programs.

Research Programs and Faculty Expertise

All faculty in Community and Leadership Development have doctoral degrees and training from major research universities in a variety of fields such as communication, education, rural sociology, community development, and cultural anthropology. Collaboration among our departmental faculty extends to other units in the College of Agriculture, Food and Environment and other colleges on the UK campus including College of Arts

and Sciences, College of Medicine, College of Education, and College of Communications.

Our diverse faculty have varied research interests, including:

- Agricultural education including the role of STEM, school scheduling impact on education, teacher efficacy and job satisfaction, and youth and adult partnerships.
- Issues relating to community health, obesity, and supporting the health of SNAP-Ed.
- Topics relating to beginning farmers, family farms and social relationships, sustainability, the role of marketing projects in Appalachia, and community food projects.
- Communications in a community context, including issues relating to online journalism, citizen journalism, role of communication in community development, and community based public health campaigns.
- Environment and land use, labor of agrodiversity, and land and the role of politics and migration.
- Land grant universities and knowledge in the Black Belt South.
- Encouraging innovations and entrepreneurship locally, nationally, and internationally, including utilization of a community innovation lab to understand community engagement.
- Understanding communities and community development and the role of 4-H youth development in communities.

Graduate Degree Program

The master of science degree in community and leadership development at the University of Kentucky is a unique

multidisciplinary program that prepares students for a broad range of careers or for pursuing a Ph.D. in several different disciplines (agricultural education, agricultural leadership and development, communications, rural sociology). The curriculum integrates a solid foundation in social science theory and research methods. Students are challenged to understand and then apply both theory and methods in diverse contexts as both independent and collaborative scholar/professionals. Graduate students are expected to be engaged professionals participating in scholarly organizations, social change initiatives, community development associations, or community media campaigns. They should demonstrate the depth and breadth of their knowledge and skills through applied service or research projects. Finally, students are expected to contribute their expertise as academic, organizational, and community leaders. Many of our faculty and students collaborate on research, teaching, or outreach projects. Their work often involves a partnership with citizen groups, community-based organizations, and/or state or local governmental units in order to address a particular set of social issues.

Significant Research Achievement, Honors, and Awards

- P. Dyk was editor and author of Community Development Special Journal Issue Turning the Tide on Poverty.
- K. Tanaka organized Food Systems Studies Symposium: Summit of All Things Food, funded by a Sustainability Challenge Grant from the President's Sustainability Advisory Council.

Dietetics and Human Nutrition

The Department of Dietetics and Human Nutrition (DHN) is committed to being FIRST, a student-centered department and, with the assistance of many community-based partners, offers a wide range of academic, research, and community development opportunities. Our core values are designed to support learning, discovery, and engagement and include:

- Focus on the contributions to excellence in learning, discovery, and engagement.
- Innovation in ideas will contribute to evidence-based best practices in the profession.
- Respect for others will allow service to others to be our highest priority.
- Success is reached by empowering all individuals to reach their full potential.
- Teamwork fosters partnerships between students, faculty, alumni, and community.

Two undergraduate programs—dietetics and human nutrition (400 students)—are offered, as well as a graduate program for a master of science degree in nutrition and food systems. The bachelor of science in human nutrition offers appropriate preparation for further study or professional careers in nutrition and other health related fields, particularly medicine, dentistry, pharmacy, physician assistant, physical therapy, public health, food policy, and nutrition research. The bachelor of science in dietetics prepares individuals to be experts in the field of food and nutrition and is accredited by the Accreditation Council for Education in Nutrition and Dietetics (ACEND). Graduates are prepared to apply for a dietetic internship to become eligible to sit for the national registry exam to earn the credential of registered dietitian nutritionist (RDN). An additional pathway to the bachelor in dietetics is acceptance into the DHN Coordinated Program in Dietetics, which includes the academic programing plus the dietetic internship. A new certificate for juniors and seniors in Nutrition for Human Performance was implemented with partners from the College of Health Sciences and College of Education.

Since community service is the cornerstone of DHN, opportunities abound for students to participate in meaningful experiential activities, especially related to food insecurity. DHN supports the Campus Kitchen at the University of Kentucky (CKUK). CKUK is a student service organization that provides a sustainable approach to reducing food waste while providing healthy meals to those struggling with hunger. CKUK recovered 9,765 pounds of food and served around 6,072 meals last year. Selected out of 51 universities, CKUK was named 2016 Campus Kitchen of the Year. AmeriCorps VISTA oversees supervision of hunger-related opportunities. DHN also sponsored the first annual Hunger Dialogue where students, advocates, and community leaders shared ideas and created a vision to improve food security across Kentucky. Other DHN-supported organizations, such as Sustainable Solutions to Overcome Poverty (SSTOP) and Universities Fighting World Hunger (UFWH) provide a platform for student leadership development.

Research Programs and Faculty Expertise

DHN addresses community dietary-related issues through undergraduate and graduate education, research, and outreach/extension. All DHN undergraduate students participate in research projects that lead to a poster session or presentation. Faculty are dedicated to finding innovative solutions to real-world problems facing Kentucky, our nation at large, and the world beyond. The long-term goal is to reduce the risks of food insecurity, obesity, and chronic diseases and to contribute to evidence-based best practices in the profession of dietetics and human nutrition.

DHN has state-of-the-art facilities for educational and research purposes, including food preparation and food development laboratories and a BOD POD used for standard body composition assessment. Faculty have expertise in food systems, food insecurity, nutrition and chronic disease, entrepreneurship,

environmental contaminants, and weight loss management. Recent funding was awarded through national competitive processes from the National Institute of Environmental Health Sciences, U.S. Department of Agriculture; National Heart, Lung and Blood Institute; Cooperative State Research, Education and Extension; National Institute of Food and Agriculture; Centers for Disease Control; and the American Livestock Breeds Conservancy.

Graduate Degree Program

DHN offers a master of science in nutrition and food systems and seeks to educate students using a multidisciplinary approach in order to emphasize the impacts of food systems and diet on human health while exploring strategies to reduce the risk of chronic disease among individuals and communities. Our goal is to provide students with an expertise in nutrition and food systems, learning to apply practical and critical thinking skills to nutrition-related problems in an evolving global society.

Significant Achievements

DHN success has been accomplished by empowering students, faculty, community partners, and clients to reach their full potential in determining their own health through education, research, and outreach/extension. DHN is known for such programs as Food Insecurity and Accessibility; Plate It Up Kentucky Proud; Homebased Microprocessing; Lemon Tree Cafe; Superfund Nutrition Outreach; Children, Youth and Families at Risk; and Behavioral Mindful-based Weight Management. We have on staff two Provost Teachers of the Year; four Kentucky Academy of Nutrition and Dietetics Outstanding Dietitians of the Year; two participants of the Bluegrass Academic Leadership Academy, an initiative of the Bluegrass Higher Education Consortium; one participant of UK's Women Executive Leadership Development Program (WELD) – all indicating the strong leadership abilities of the faculty in the Department of Dietetics and Human Nutrition.

Entomology

The Department of Entomology is continually seeking opportunities to enhance our abilities to address the changing needs of our global citizenry and is dedicated to providing high quality research, extension, and instruction to meet those needs. Our department strives for creative synergies between fundamental and applied entomological research, developing long-term solutions to entomological problems while providing answers that address immediate short-term needs. We integrate research, graduate education, and extension activities to synergize our efforts, maximize our productivity, and enhance our effectiveness, and this approach has proven successful.

Historically, we played a key role addressing a critical need of the equine industry through the MRLS (Mare Reproductive Loss Syndrome) crisis. More recently our research, graduate education, and extension activities are addressing pollinator protection and invasive species ecology and management in urban, agricultural, and natural resource settings. Our response to the global outbreaks of bed bugs and the Zika virus crisis demonstrate our proactive and progressive approaches to responding to critical needs of Kentucky, the nation, and the world.

Faculty in the department are dedicated instructors who take pride in their graduate and undergraduate teaching. Graduate course content is continually evaluated for relevance and effectiveness. Our faculty are actively involved in a number of undergraduate degree programs, including agricultural biotechnology (ABT), sustainable agriculture, and an individualized program in entomology within the Bachelor of Science program in agriculture. Faculty teach undergraduate courses that are key components of several majors within the College of Agriculture, Food and Environment (CAFE) (e.g., Forestry and Natural Resources, Horticulture, and Plant and Soil Sciences) and Arts and Sciences (Biology). Each semester for the past 15 years the department has taught a course (ENT 110) that fulfills a natural sciences requirement in the current University Studies Program (USP) at the University of Kentucky. Faculty are actively engaged in mentoring undergraduate students in research

topics that stimulate creative thinking and enhance the undergraduate learning experience while providing a mechanism to support graduate education and contribute to individual research programs.

Research Programs and Faculty Expertise

Protection of Natural Resources from Invasive Pests

The Rieske-Kinney's research group integrates field and laboratory approaches to address behavioral and ecological issues in forest ecosystems in the context of herbivore-plant relations, feeding guild interactions and interactions among plant stressors. With an emphasis on invasive species, this group is evaluating how disturbance forces, directly and indirectly, impact arthropod abundance, herbivory and herbivore success, forest community dynamics, and employs integrative approaches to develop mitigation strategies. The Rieske-Kinney and Palli labs teamed up with USDA collaborator Dr. Duan Jian to develop RNAi-based methods to control insects that attack trees.

Community Entomology (Urban, Recreational, Home and Garden)

Dan Potter's research program supports sustainable management of insect pests and conservation of pollinators, natural enemies, and other beneficial insects in urban and suburban landscapes. This group works at the interface of applied ecology and integrated pest management to clarify the interactions between plants, pests, and beneficial invertebrates and their responses to anthropogenic disturbances such as pesticide inputs and habitat modification. For more than 38 years this program has generated a substantial portion of the world's primary literature on Japanese beetles, root-feeding white grubs, scale insects, wood borers, and other key pests of urban landscapes while providing guidelines and leadership for implementing conservation biological control, host plant resistance, and urban biodiversity conservation.

The Haynes laboratory conducts research on bed bug biology, behavior, and control. The reemergence of this blood-feeding insect as a major pest in the urban environment has led to focused attention

on a wide range of issues related to their biology and control. This group has determined that resistance to pyrethroids is widespread and is likely the major factor in the recent resurgence of bed bugs. Our discovery of this insecticide resistance, which has been corroborated by several other groups, has fundamentally changed the way the pest control industry deals with this pest and undoubtedly resulted in improved pest management procedures. These pest management procedures include the use of combination products which are alternatives to pyrethroids (typically a pyrethroid and a neonicotinoid), inhibitors of oxidative phosphorylation (such as chlorfenapyr), and desiccants (most notably silica gel). Collaborations among Haynes, Palli and Mike Potter pursued research on bed bugs in diverse and exciting directions, including identification genes responsible for insecticide resistance among bed bug populations collected from across the United States. They have also collaborated with UK Agricultural Economics on assessing impacts of bed bugs on the hotel and lodging industry.

Medical Entomology—Disease Vector Management

The invasive mosquito *Aedes albopictus* (the Asian tiger mosquito) is a significant biting pest and competent vector in a large portion of the United States, including Kentucky. A component of the current research in the Dobson lab is dedicated to understanding how *Ae. albopictus* behaves in a non-endemic habitat. Ongoing research is centered on a series of Mark-Release-Recapture (MRR) experiments in which both traditional and novel insect marking technologies are applied to mark non-biting male mosquitoes, which are released into the environment and then recaptured at various time periods thereafter. Results obtained from this research will help estimate dispersal, longevity, and relative population sizes in the field, which will enhance understanding and the ability to control this pest species. The interaction between mosquitoes and their *Wolbachia* infections, which are obligate, intracellular bacteria that can affect insect reproduction, are also being studied. In addition to characterizing the

general impacts on mosquito fitness, we are also developing strains and strategies that may be used for manipulating medically important mosquito populations. We are currently collaborating with an abatement district in California to field trial a mosquito-suppression approach.

The Brown laboratory provides teaching, research, and service regarding insect-borne diseases and other arthropod-related human health problems. The lab provides services to the professional and lay community in the area of public health education. They maintain a reference collection of the Commonwealth's mosquito fauna, as well as other arthropod vectors. Inasmuch as possible, the lab provides mosquito, tick, sand fly, and other vector identifications for state and county public health authorities, and answers questions from the public and media concerning public health entomology issues. The lab carries out cooperative research projects with many varied organizations, both public and private. These programs include disease surveillance programs, vector ecology research, and public health education. Laboratory staff are available to address questions from the media concerning insects and other arthropods posing a public health threat.

Fundamental/Translational Research

Interfering with regulatory mechanisms involved in critical physiological processes such as molting, metamorphosis, diapause, and apoptosis can result in the death of pest insects. Studying some of these processes of pest insects and disease vectors at the molecular level may help in the identification of targets that can be used for pest and disease vector control. The Palli laboratory uses whole genome sequence data and functional genomics approaches including transcriptomics, metabolomics, RNA interference (RNAi), and genome editing to identify genes that are critical for the survival of insects. The genes identified are being used to develop high throughput screening assays for identification of target-specific insecticides, as well as to perform toxicogenomics and pharmacogenomics that can help elucidate the effects of candidate pesticides on the pest ecosystem.

Environmental stress is a major determinant of insect population dynamics and species ranges. The Teets's lab inves-

tigates the physiological and molecular mechanisms by which insects tolerate environmental stress using an integrative approach to understand stress at the molecular, cellular, organismal, and population level, with a particular focus on stress associated with overwintering. Overwintering conditions vary strongly across latitudinal gradients, and climate change is leading to warmer and more variable winter conditions. Three specific areas of research in this lab are: (1) investigating the cellular and molecular mechanisms governing rapid responses to low temperature, (2) integrating physiology and genomics to understand arthropod adaptations to Antarctica and other extreme environments, and (3) investigating the genetic basis of freeze tolerance, i.e., the ability of select insects to survive internal freezing. While much of this research is basic, there is also interest in applications of insect stress biology, specifically, an ongoing project funded by the USDA which uses transgenic methods to enhance the stress tolerance of insects used in sterile release programs. Insights from cold tolerance work may inform organ cryopreservation efforts.

Insect diseases ubiquitously effect populations of beneficial and pest insects. The Webb lab focuses on the effects of insect viruses of Lepidoptera to understand both their beneficial role in controlling insect populations and the ways in which insect viruses may be modified to regulate and control lepidopteran pest populations. Research in the Zhou lab is focused on the understanding of: (1) the genetic underpinnings govern social behaviors in eusocial termites and (2) the evolution of eusociality in the wood-feeding dipterans. This research is particularly interested in genes potentially affecting caste differentiation (worker-soldier and worker-reproductive transition, respectively) and termite behaviors (aggression, isolation, undertaking, learning and memory, foraging, and parental care).

The Rittschof laboratory studies the evolutionary consequences and mechanistic underpinnings of behavioral plasticity, particularly in the context of social interactions that influence health and immune function as well as behavior. Current research focuses on socially-induced variation in aggression and other aggression-related behavioral phenotypes in the

honey bee, as well as the neurobiological underpinnings of these behaviors. Aggression in honey bees is of particular interest because research shows that high aggression is associated with health resilience. This research combines perspectives from behavioral ecology, behavioral genomics, and neuroscience.

The Fox group works on the evolution of insect life histories and behavior and the scientific peer review process. The primary focus of the research continues to be at the interface of ecology, evolutionary biology, behavior, and genetics of insects. Our major projects over the past couple of years have focused on four themes: Adaptation to new environments (a long-term experimental evolution experiment using the agricultural pest seed beetle, *Callosobruchus maculatus*), the mechanisms underlying adaptive life history that exhibits plasticity in egg size (using the non-pest seed beetle, *Stator limbatus*), the ecology and genetics of inbreeding depression, and the evolution of genital spines and mating behavior in response to sexual conflict in seed beetles. The inbreeding depression work focuses on the genetics and environmental sensitivity of inbreeding depression (especially focusing on responses to stress), the influence of inbreeding on the evolution of mating behavior, and how mating behavior mediates inbreeding and inbreeding depression.

Research in the Sharkey lab focuses largely on the taxonomy, phylogenetics and systematics of parasitic wasps in the family Braconidae. Members of this family are parasitoids of other insects and many are important in the natural and biological control of insect pests. The major goals are to produce phylogenetic hypotheses (classifications) for genera and higher taxa of selected parasitic wasps and to describe and provide identification keys for constituent taxa. In doing so, they have increased the specimen holdings at the Hymenoptera Institute and other museums for comparative and morphological study. In the past 5 years, they deposited thousands of specimens identified to species. By providing identification services, the program benefits by being able to catalog specimen information and the museums benefit by having their specimens identified by a world-recognized expert. They added digital information on thousands of braconid specimens to an ever-growing,

web-accessible Integrated Digitized Biocollection (IDigBio)-supported database (<http://symbiota4.acis.ufl.edu/scan/portal/index.php>). They developed and published a better understanding of the relationships among braconid wasps and their host associations. This knowledge could aid in biological control efforts in cases where one or more hosts become pests, as species-specific parasitoids have been among the most successful biological control agents. Their papers have led to a better understanding of the identification and phylogenetic relationships of the parasitoid species contained within, which is essential information when developing biological control programs.

Agricultural Entomology—Sustainable IPM

The long-term goals of the Obyrcki research group are to improve human attempts to manipulate and enhance populations of predatory insects based on a fundamental understanding of population-level variation in these natural enemies. Human-assisted movement and release of insect parasitoids and predatory insects for the suppression of arthropod pests represent one of the major practices of biological control. Delineating the population structure of widely distributed species provides a strong basis for understanding population-level differences, which in species manipulated by humans may be critical to understanding the consequences of our activities.

Recent efforts in the White lab have revealed that a facultative symbiont dictates the breadth of host plants attacked by an agricultural pest, the cowpea aphid. Such findings have major implications for understanding sudden shifts in crop attack patterns by pest insects. We have subsequently started collaborating to characterize bacterial symbionts in a different aphid, the sugarcane aphid, which has recently exhibited such a host plant shift, to devastating effect in sorghum crops.

RNAi has become a widely used reverse genetic tool to study gene function in eukaryotic organisms and is being developed as a technology for insect pest control. Four laboratories in this department (Palli, Rieske-Kinney, Webb, and Zhou) are working on RNAi. The Palli and Webb labs are developing methods for us-

ing nanoformulation of double-stranded RNA to control insects that attack crops, trees and transmit infectious diseases. The lack of standardized ecological risk assessment procedures is considered by many to be the bottleneck for establishing RNAi as a viable pest control alternative. Research in the Zhou laboratory is focused on: (1) the development of an ecological risk assessment framework to assess the potential risks associated with RNAi transgenic crops and (2) the integration of RNAi into pest control practices against urban pests, including dsRNA-mediated baiting system for termite control.

Graduate Degree Programs

The Department of Entomology offers graduate work leading to the Master of Science (Plan A—Thesis, and Plan B—Non-thesis) and the Doctor of Philosophy degrees. The graduate student handbook is updated as needed and is available on the department's website (<http://www.ca.uky.edu/entomology/dept/gradprogram.asp>). Individual graduate programs are planned by students in consultation with their advisor, advisory committee, and the director of graduate studies. Study and research are available in various areas of entomology including applied entomology, behavior, biochemistry, biological control, ecology, genetics, plant resistance, insect biology, medical and veterinary entomology, molecular biology, physiology, systematics, and taxonomy. The discipline of entomology, similar to all agricultural and biological sciences, has evolved significantly during the past two decades and continues to undergo rapid changes. To increase flexibility in the core curricula, the Ph.D. and M.S. core curricula are the responsibility of the graduate faculty in Entomology, which represents a change from prior responsibility at the graduate school level.

Significant Research Achievements, Honors and Awards, and Innovative Programs

Entomology students presented at many conferences and won numerous awards. A few notable examples are:

- Four of our students won the North Central Branch Student Travel Award to attend the annual meeting of the North Central Branch of the Entomological Society of America, Cleveland, OH, June.

logical Society of America, Cleveland, OH, June.

- Two of our students won prizes in a competition for students at the North Central Branch of the Entomological Society of America, Cleveland, OH, June.
- Two Ph.D. students from UK Entomology, Smitha George and Bernadette (Bernie) Mach, won the President's Prize for Outstanding Presentations at the 2016 International Congress of Entomology (ICE).
- Sydney Crawley won Shripat Kamble Urban Entomology Graduate Student Award for Innovative Research (2016). MUVE (Medical, Urban, and Veterinary Entomology) section award presented at the International Congress of Entomology meeting, MUVE Governing Council, Orlando, FL. Also won first place award in the student paper competition held at the National Conference on Urban Entomology annual meeting, Albuquerque, NM, and first place in the Ph.D. Student Paper Competition at the American Mosquito Control Association annual meeting, Savannah, GA.
- Qian "Karen" Sun, a postdoctoral researcher, won Student Transition and Early Professionals (STEP) Travel Award to present at the International Congress of Entomology, Orlando, FL.

Awards and Honors

- Ken Haynes served as the president of the International Society for Chemical Ecology.
- Mike Potter won the ESA Distinguished Achievement Award in Urban Entomology.
- Raul Villanueva won the Friends of IPM Award—Southern Region School IPM Working Group.
- Clare Rittschof was selected as Entomological Society of America Science Policy Fellow.
- Joe Collins is serving as National Plant Board President for 2015–2017.
- Carl Harper is serving as National Gypsy Moth Management Board Chair for 2014–2016.
- Dr. Nick Teets, winner of ESA Early Career Professional Research Award.

Family Sciences

Family Sciences is a strong unit that makes significant contributions to the College of Agriculture, Food and Environment and the University of Kentucky. The department generates some of the highest student credit hours in the college, our majors contribute to the university's compelling interest in diversity, and our research productivity (controlling for research distribution of effort) is one of the highest in the college. Our research profile is enhanced because two faculty members in the department edit respected journals in our field. The department includes two active research labs supported by endowments: the Adolescent Development Lab

directed by Alexander Vazsonyi and the Family Interaction Research Lab directed by Ronald Werner-Wilson.

Our graduate program has continued to grow, and we have recruited more diverse students, including international students as well as students from traditionally underrepresented groups. We successfully mentor these graduate students by providing them opportunities to publish with faculty members (the majority of publications and presentations include graduate student co-authors) and they are graduating and successfully competing for positions. It is notable that faculty mentoring is occurring throughout

the department as more faculty members are supervising theses and dissertations.

We have systematically investigated appropriate online course delivery and have received approval to teach several courses on-line. We identified a handful of courses that seemed appropriate to this delivery strategy and identified tactics to ensure rigor and minimize academic misconduct (i.e., requiring Proctor U for all on-line courses offered by our department) that can plague this approach to teaching. We have also become more active in providing study abroad opportunities to students, including experiences in Greece, Korea, Japan, and Costa Rica.

Forestry and Natural Resources

The Department of Forestry and Natural Resources (FNR) is one of 14 academic departments within the College of Agriculture, Food and Environment at the University of Kentucky. It is one of only a few professionally accredited degree programs in the college and the only accredited Bachelor of Science in Forestry degree program in the state. As a result, the department is responsible for servicing all of the demand for forestry undergraduate programs. Wildlife education is also a focus area of the department, and FNR recently established an undergraduate wildlife minor. Graduate instruction is currently offered through the Master of Science in Forest and Natural Resource Sciences program and through adjunct appointments in other departments (Plant and Soil Sciences, Animal Sciences, Biology) as well as participation in the interdisciplinary Integrated Plant and Soil Sciences Ph.D. program. This involvement enables faculty to recruit and offer Ph.D. opportunities to aspiring students while the development of the FNR Ph.D. program continues.

The department is also responsible for the majority of forestry and forestry-related research and cooperative extension programming in Kentucky. Approximately 47 percent of the state is occupied by highly diverse forests. This diversity also extends to the 430,000

individuals who own the forest. According to the latest estimates, the state supports a forest products industry with cumulative impacts over \$14 billion and is typically one of the top three hardwood log and lumber producing states in the country. This sector directly employs approximately 25,000 workers, or more than 60,000 when supporting industries are considered. The biologic and sociologic diversity associated with Kentucky's forests and its economic importance is reflected in the department's stated mission "to enhance the ecological, economic, and social benefits of forests and related natural resources to elevate the quality of life for Kentuckians and beyond."

Along with its undergraduate and graduate education mission, FNR has also been for many years one of the leading contributors to the college's interdisciplinary Natural Resources and Environmental Science Bachelor of Science Program, having been foundational in the program's development in 1991. Our faculty and staff not only teach many of the classes in the program but continue to serve in key leadership positions. In addition to FNR's educational mission and engagement the department houses, our research and extension faculty and staff play leading roles in a number of initiatives, including:

- Forest Health Research and Education Center, a collaborative effort between

UK FNR, the USDA Forest Service Southern Research Station, and the Kentucky Division of Forestry

- Urban Forest Initiative, a collaborative that advocates for and elevates the function, value and perception of urban forests in the Bluegrass Region
- Center for Forest and Wood Certification, a certification incubator for forest owners and industries in the eastern U.S.
- Kentucky Master Logger Program, the state mandated logger education and training program directed by UK FNR, Kentucky Forest Industries Association, and the Kentucky Division of Forestry

In summary, Kentucky contains 12 million acres of ecologically and commercially valuable forests that are supported by FNR's tripartite purpose of teaching the future generation of forest, wildlife, and natural resource managers; conducting research to improve management and conservation; and outreach to share the findings of relevant research being conducted not only in Kentucky but from around the country. FNR's focus and work supports the College of Agriculture, Food and Environment in striving to promote the integration of research, instruction, and extension to discover new knowledge as well as to address issues of importance to the Commonwealth, the nation, and the world.

Horticulture

The Department of Horticulture continues to move toward a position of national leadership in organic and sustainable horticultural production practices and continues as a major player in the College of Agriculture, Food and Environment for the undergraduate programs in sustainable agriculture, horticulture plant and soil sciences, agriculture biotechnology, and the undergraduate certificate program in distillation, wine and brewing sciences. The department has basic and applied research programs with national and international reputations particularly in the area of biofuels, plant microbiomes, cellulose metabolism, life-cycle analyses, agroecology, seed biology, and basic plant physiology and biochemistry. Our most productive young faculty members are taking active roles throughout the college

and university and are shaping the future of the department. The department has had a significant increase in the number of competitive grant dollars and research publications per FTE in research, as well as an increase in the quality of publications over the past two years. Within the college the department ranks third in a number of scholarly metrics. The department's research farm is home to a 30-acre organic farming unit and the community supported agriculture program. Horticulture graduate faculty actively participate in the integrated plant and soil science graduate program by teaching in graduate level courses and mentoring graduate students. Horticulture faculty and staff have received numerous awards and recognition including:

- Dr. Krista Jacobsen was named winner of the CAFE Instruction Empowerment Award.
- Dr. Winston Dunwell was inducted into the Kentucky Nursery and Landscape Association Hall of Fame.
- Dr. Rick Durham received an honorary degree from the Kentucky FFA Association.
- Dr. A. Bruce Downie was selected by the Indian National Science Academy (INSA) for the Dr. BP Pal Distinguished Chair Award.
- Ms. Ruth Scott made two presentations at the U.K. Women's Forum Conference.
- Mr. Dave Lowry received the outstanding CAFE Staff Award in the Technical/Paraprofessional Category.

Human Environmental Sciences

The School of Human Environmental Sciences provides a multidisciplinary arena for research partnerships in the human sciences, including a direct link to incorporate family sciences, dietetics and human nutrition, retailing and tourism management, and family and consumer sciences extension professionals across the state in translational research projects. Through the Research Center for Families and Children (RCFC), collaborative projects are designed and implemented. Four multidisciplinary projects were coordinated through the RCFC in 2016.

Rural Child Poverty Nutrition Center

The Rural Child Poverty Nutrition Center (RCPNC) was established in 2015 through funding from the United States Department of Agriculture Food and Nutrition Service (USDA-FNS). As a national center, the RCPNC works to improve coordination among nutrition assistance programs, including the USDA-FNS Child Nutrition programs, through outreach projects in persistently poor counties in fifteen states. Through improved coordination, program participation is expected to increase which will decrease child hunger in these targeted communities. In 2016, the center awarded seventeen grants totaling over \$1.3 million to

agencies serving twenty-seven counties. The RCPNC hosted a workshop to provide awardees with training necessary to initiate their projects successfully and four follow-up webinars offering technical assistance. All awardees completed a community needs assessment in their target counties to better identify existing barriers to program participation. The results of the needs assessment were used to develop creative strategies to improve access to nutrition assistance for families and children, and awardees are currently working with their coalitions to implement these strategies.

Regional Nutrition Education and Obesity Prevention Centers of Excellence – National Coordination Center

The School of Human Environmental Sciences received funding through the USDA to establish the National Coordination Center (NCC) for the Regional Nutrition Education and Obesity Prevention Centers of Excellence in 2014. The center aggregates and disseminates research findings and identifies common themes and results from the five regional centers. Outcomes from the National Coordination Center in 2016 included two conference presentations and publi-

cation of an executive summary. The NCC conducted a review of research projects from the regional centers, which resulted in a research project inventory and other categorical organization systems to be used for dissemination of results. Nine of twenty-seven research studies concluded in 2016. Below are highlights from two of the projects.

- A longitudinal project found food cost savings from \$5 to \$30 per month through improvements in resource management for families completing the Expanded Food and Nutrition Education Program curriculum. In addition, participants increased safe food handling, vegetable intake, and fruit intake.
- A direct education project combined with a policy, systems, and environment intervention found a 70 percent improvement in food resource management through replication of the program in another state.

Collaborative Environmental Approaches to Reduce Obesity Disparities in Kentucky

Through a cooperative agreement with the U.S. Department of Health Services, Centers for Disease Control, cooperative extension staff are working to address

obesity in the six Kentucky counties with adult obesity prevalence in excess of 40 percent. Community coalitions convened, conducted asset assessments, and identified strategies to make environmental-level changes to enhance access to physical activity and healthy foods. In 2016, \$115,527 was invested in projects to improve physical activity infrastructure. Counties conducted educational programs targeted to improving health

literacy, enhancing nutrition education and increasing physical activity. More than \$150,000 in additional funding has been leveraged through community coalitions to further enhance their work.

Health and Wealth

Health and financial habits can be influenced through the information that students received during their formative college years. The health and wealth sur-

vey utilizes validated questions to better understand the UK HES student's current health and financial knowledge. The survey information is collected through SONA, a cloud-based participant management software, in which students have already participated and approximately 150 students will participate each semester. The responses to these questions can inform faculty to prepare students for life beyond the university.

Landscape Architecture

The primary mission of the Department of Landscape Architecture is the undergraduate program in landscape architecture, which prepares students for entry into the profession of landscape architecture. Research in the department is largely in the areas of design thinking and metacognition, geospatial analysis,

stream morphology and change, and cultural landscape preservation. The Council of Educators in Landscape Architecture (CELA) named Brian Lee as editor of *Landscape Journal*, the premier academic journal in landscape architecture, in 2016. The department also engages in an active program of community design assistance,

led by an extension faculty member, Jayoung Koo, who collaborates with the college's Community Economic Development Initiative of Kentucky. Faculty and student engagement in community design in 2016 included the communities of Princeton, Standford, Midway, Louisville, Lexington, and Maysville, and others.

Plant and Soil Sciences

An overarching goal in the Department of Plant and Soil Sciences is to improve, through scholarly research, the understanding of plant and soil systems as sustainable resources for human use while preserving and enhancing environmental quality. We address a broad subject matter including the chemistry, physics and biology of plant, soil and environmental systems ranging from the molecular, to the whole plant, to the ecosystem scale. This diverse research portfolio underlays our participation in the Integrated Plant and Soil Sciences graduate program. The department includes 43 full-time faculty members and nearly 50 graduate students and 60 staff employees. Our distribution of faculty effort is approximately 60 percent research with the remainder divided between extension and instruction. Over the past five years the department has averaged \$3,345,000/year in extramural funding and in 2015–2016 received \$159,000 in grant funding per full-time researcher.

While many of our students are enrolled for M.S. and Ph.D. degrees in the recently created Integrated Plant and Soil Sciences program, students are still also receiving degrees from several legacy programs.

Highlights

- Our wheat breeding program released the new variety, Pembroke 2016, and the tobacco breeding program released KT215LC with improved resistance to black shank and Fusarium wilt.
- Researchers began participating in a major regional project "Optimizing cropping systems for resilience to stress."
- The industrial hemp agronomic research program continued to grow with major projects on genomics of oil quantity/quality, hemp for forage, field-scale cannabinoid production, techniques for genetic modification, and three standard variety trials evaluating entries for grain/seed production, dual purpose (grain and fiber production), and fiber-only production.
- Cover crop research and extension projects remained a focus including the project "Nitrogen contributions from different cover cropping systems established following full season soybean."
- Forage specialists worked on "Developing science-based recommendations to efficiently manage forages, herd health, and productivity on organic dairies."
- A project to improve fragipan agri-

culture has shown promising results. Annual ryegrass looks promising at breaking down the fragipan. Not only does ryegrass have a deep root system that can penetrate the pan, but it also releases chemicals that can help break it apart.

- Receiving significant funding from the Kentucky Soybean Promotion Board, the Kentucky Corn Growers, and the Kentucky Small Grain Growers Association, the department manages an irrigation research field at the West Kentucky Research and Education Center and continued the research project "Irrigating the soil to maximize the crop."
- In molecular biology research, projects continued on "Flavonoid isolation from intact plants: A nanoparticle-based approach," "Host genotype control of strain specific nitrogen fixation," and messenger RNA modification with NSF funded projects "CPSF30 at the convergence of cellular signaling and RNA processing" and "Alternative polyadenylation and non-stop mRNAs in Arabidopsis."
- A research effort in an international consortium to study nanoagrochemicals (NanoFARM) began.

Plant Pathology

The mission of the Department of Plant Pathology is to improve understanding of plant disease through research, and to utilize this knowledge to educate students and Kentucky residents about plant diseases. By these means, the department promotes plant health throughout the Commonwealth and encourages the use of economical, science-based disease management practices intended also to minimize negative environmental impacts. Traditional research strengths of the department have been physiology of plant disease and resistance, plant virology, and plant mycology.

In 2016, published department research programs have addressed evaluation of traditional and novel methods to control plant diseases; identification and characterization of fruit pathogens; biochemistry and genetics of induced and systemic acquired disease resistance in rice, soybeans and the model plant, *Arabidopsis thaliana*; functional changes

in plant cell membranes and associated proteins when infected with tombusviruses or rhabdoviruses; biosynthesis of toxic and beneficial alkaloids produced by endophytic fungi; and numerous first reports of plant pathogens in Kentucky and worldwide. These research programs were supported by grants from the U.S. Department of Agriculture, National Science Foundation, National Institutes of Health, and Kentucky Science and Engineering Foundation, as well as grants from multiple corporate sponsors and commodity support.

The department maintains two plant disease diagnosis laboratories, one on the Lexington campus, and the other at UKREC in Princeton, Kentucky. Together, these laboratories conduct more than 4,000 diagnoses annually. These laboratories provide up-to-date diagnostic records and integrate them with the Southern and National Plant Diagnostic Networks, and are essential for timely and effective Coopera-

tive Extension programs for growers and other stakeholders to manage plant diseases. In 2016 the department implemented a PCLinic database to enhance integration with the regional and national networks.

This department offers a dissertation-based Doctor of Philosophy degree and a thesis-based Master of Science degree. In both programs, students take approximately two years of coursework that has been designed by the faculty to enhance knowledge of plant physiology, microbiology, genetics, molecular biology, biochemistry, and plant pathology, as well as skills, standards, and ethics in scientific philosophy, research techniques, and writing and oral communication. Typically the department has approximately 10 to 12 Ph.D. students and candidates, and one or two M.S. students. In 2016, four students in the department were awarded Ph.D. degrees. Graduate student research projects are generally relevant to the betterment of Kentucky agriculture and biotechnology.

Retailing and Tourism Management

The Department of Retailing and Tourism Management (RTM) includes two major programs; Merchandising Apparel and Textiles and Hospitality Management and Tourism. The department faculty includes two lecturers, three assistant professors, five associate professors and two full professors. The goals of the department are to enhance the teaching and research of all faculty and to improve the employability of our students. To improve the teaching and research of all faculty we have increased the number of collaborations among faculty, and placed more focus on publications rather than conference presentations. To improve student employability, we have organized a professional development team that offers resume reviews by professionals and the opportunity to participate in mock interviews. We continue to use the RTM Advisory Board members to enhance course content, such as industry related assignments and to help with finding students internships and job opportunities. The lecturer for RTM 340 (Internship Preparation) has worked to revise her class to include soft skill development.

The revision of this course is based on research findings conducted by Wesley and Jackson and published in 2016.

As we move forward, it is our goal to increase grant writing and continue to enhance student experiential learning by building stronger relationships with industry. Our online Master's degree has been launched and students can enroll in the program beginning fall 2017. The RTM department has increased the number of faculty teaching abroad. As a department, we have increased their number of study tour opportunities for students both domestically and internationally. Domestic tours include Atlanta and New York and internationally Italy and Greece. Other activities in the program include the inclusion of the Belle Brezing collection in a documentary on her life, and the selling of the UK plaid items. The textile testing lab under the direction of Dr. Easter provides testing services to the textile and apparel industry. The lab also provides research and laboratory technician experience to both graduate and undergraduate students. The lab also provides funding for graduate student

research assistants and the opportunity for students to conduct thesis research projects with the industry and gain experience in solving real world problems.

We hope to continue to expose our students to a variety of activities outside the classroom to enhance their coursework that will prepare them for this global economy.

Overview of research programs and faculty expertise

- **R. Cavendar.** Brand management of luxury fashion goods; sustainable development in the luxury goods sector; the role of interactive technology as a pedagogical support in large lecture courses.
- **E. Easter.** ALM: Quality Control Laboratory. Provides a test piece service for the Association for Linen Management. The Clothes Care Research Center™ (CCRC), a cooperative effort among Cotton Incorporated, GE Consumer and Industrial, and Procter and Gamble. The University of Kentucky's Textile Testing Laboratory provides unbiased oversight to design and con-

duct CCRC's research projects to help consumers save time and money by identifying the best in-home cleaning and maintenance techniques to extend the life and performance of fabrics.

- **V. Jackson.** Perceived importance of soft skills between retailing and tourism management students, faculty, and businesses; women of colour in leadership.
- **MinYoung Lee.** Consumer emotion and experience in retail environment and social responsibility issues.
- **Tracy Lu.** Service management and consumer behaviors in service settings, particularly on the topics of customer engagement, loyalty, and interactive

experiences in local communities and travel destinations.

- **K. Spillman.** Expression of the self through dress, public, private and secret self (PPSS Model), and developing ways to assist women in Ghana
- **J. Swanson.** Investigating challenges involving public policy related to tourism, motivations associated with education abroad travel, and transformational travel—investigating how travelers may change their psychological understanding of themselves based on their travel experiences.
- **S. Wesley.** Local retail development, tourist retailing and shopping, and education abroad.

Description of Graduate Degree Programs

Master of Science in Retailing and Tourism Management has two formal options (1) Merchandising, Apparel and Textiles (MAT) and (2) Hospitality Management and Tourism (HMT) with a single set of “core” requirements and individual support selections for both options. In preparation for our proposed online master's degree, all courses in the program have been revised and approved as online courses and are ready for implementation.

Veterinary Science

The Department of Veterinary Science supports the Commonwealth's equine industry through its research, teaching, and service activities. The dissemination of new knowledge and information generated from these activities to our stakeholders is of paramount importance to our program.

The overall goal of the research activities of this department is to improve the health and wellbeing of the horse through the generation and application of new knowledge. Research programs within the Department of Veterinary Science encompass various disciplines including infectious disease, immunology, parasitology, reproduction, musculoskeletal diseases, genetics and pharmacology.

The infectious disease group focuses on ways to improve the diagnosis, treatment and prevention of diseases caused by important equine pathogens including equine arteritis virus (P. Timoney, Balasuriya), equine herpesvirus (Balasuriya, Chambers), equine infectious anemia virus (Issel, Cook) and equine influenza virus (Chambers), as well as those bacterial infections caused by *Streptococcus equi*, *Leptospira* (J. Timoney), and *Rhodococcus equi* (Horohov).

The research emphasis of the immunology program focuses on immune function and dysfunction in foals (Horohov), aged horses and those with endocrinopathies

(Adams). Parasitology research focuses on ways to reduce the impact of parasitic infections through improved diagnostic and treatment strategies against intestinal worms (Nielsen, Lyons) and *Sarcocystis neurona* (Howe), the cause of equine protozoal myeloencephalitis. This work includes the development of a novel technology for determining parasite burdens in horses (Nielsen), identification of the development of anthelmintic resistance (Lyons), and host-parasite interactions (Nielsen, Howe).

The reproduction group works on the causes of infertility in both mares and stallions with emphasis on equine placentitis (Ball, Troedsson), testicular (Ball) and embryonic development (Estell-Vico).

The musculoskeletal group continues to work on the molecular regulation of chondrocytes (MacLeod) as well as the underlying molecular basis for equine stenotic myelopathy (Janes). There is also continued interest in the underlying pathologies associated with racing-associated breakdowns (MacLeod, Kennedy, Janes).

The genetics group contributes to our overall understanding of the equine genome and its role in various diseases of the horse (Bailey), as well as providing genetic testing services to various breed organizations (Graves).

The current emphasis of the pharmacology program focuses on the impact of environmental contamination on race-horse blood testing results (Tobin).

The education mission of the Department of Veterinary Science focuses on providing opportunities for our students to develop those skills necessary to become the next generation of scientists. There are currently 17 Ph.D. and 6 M.S. students in our department. These students are distributed throughout each of the research disciplines in our program. Their research projects address important issues of equine health ranging from discovery science approaches using state-of-the-art cellular and molecular techniques through translational studies with direct clinical applications. We also hosted over two dozen students from this and other universities who worked on research projects with departmental faculty.

The service mission of the department involves both the diagnostic services provided by the UKVDL (detailed elsewhere), genetic testing services and programmatic outreach efforts. The department hosts a variety of seminars and meetings that inform veterinarians and other stakeholders of our most recent accomplishments. The faculty also provides expert consultation service to various segments of the equine industry.

Kentucky Agricultural Experiment Station Projects

Hatch, McIntire-Stemmis, and Animal Health projects for calendar year 2016, as reported in the USDA Current Research Information System (CRIS) database, follow.

Agricultural Economics

- A Comprehensive Study of Kentucky's Equine Industry—*Stowe, C.; Rossano, M.; Coleman, R.; Davis, A.*
- Agricultural and Rural Finance Markets in Transition (NC1014, NC221, NCT-194)—*Freshwater, D.*
- Benefits and Costs of Natural Resources Policies Affecting Ecosystem Services on Public and Private Lands—*Schieffer, J.*
- Economic Effects of Adaptive Behavior with Precision Agriculture Technology—*Dillon, C.*
- Family Firms and Policy in Times of Disruption (NC1030)—*Robbins, L.W.*
- Food Safety Incidents and the Food Supply Chain: The Impacts on Consumers and Producers and the Strategic Response of Supply Chain Managers and Food Industry Leaders—*Saghaian, S.H.*
- Food Safety Standards and Certification: Implications for Producers and Certifiers—*Zheng, Y.*
- The Impact of Enhancing Community Capitals on Rural Economic Development—*Davis, A.*
- The Importance of U.S. Food and Agricultural Trade in a New Global Market Environment—*Reed, M.*
- Modeling and Testing Kentucky Farmers' Use of Climate and Weather Forecasts—*Kusunose, Y.*
- Nanotechnology and Biosensors—*Hu, W.*

Animal and Food Sciences

- Construction of Active Protein Membranes for the Formation of Functional Oil-in-Water Food Emulsions—*Xiong, Y.*
- Development of Methodology for the Analyses of Intrinsic Free Radicals in Foods—*Boatwright, W.*
- Effects of Selenium in Free-Choice Mineral-Vitamin Mixes on Genes, Proteins and Metabolites of Beef Cattle Consuming Endophyte-Infected Tall Fescue—*Matthews, J.C.*
- Enhancing the Competitiveness and Value of U.S. Beef—*Suman, S.*
- Enteric Diseases of Food Animals: Enhanced Prevention, Control, and Food Safety—*Newman, M.*
- Environmental Pollutants, Nutrition and Vascular Endothelial Cell Function—*Hennig, B.*
- Factors Affecting Phosphorus Concentrations and Phosphorus Digestibility in Pasture Herbage Consumed by Grazing Animals—*Lawrence, L.*
- Integrated Approach to Enhance Efficiency of Feed Utilization in Beef Production Systems—*Matthews, J.C.*
- Limitations in Small Intestinal Carbohydrate Assimilation in Beef Cattle—*Harmon, D.*
- Management Systems to Improve the Economic and Environmental Sustainability of Dairy Enterprises (Rev NC-1119)—*Bewley, J.M.*
- Mastitis Resistance to Enhance Dairy Food Safety—*Bewley, J.M.*
- Metabolic Relationships in Supply of Nutrients for Lactating Cows (NC 1009)—*McLeod, K.R.*
- National Animal Nutrition Program—*Lindemann, M.*
- Nutritional Systems for Swine to Increase Reproductive Efficiency—*Lindemann, M.*

- Ovarian Influences on Embryonic Survival in Ruminants—*Bridges, P.J.*
- Poultry Production Systems and Well-being: Sustainability for Tomorrow—*Adedokun, S.*
- Regulating the Signaling Pathways that Determine Skeletal Muscle Mass—*Urschel, K.*

Biosystems and Agricultural Engineering

- Animal Production Systems: Synthesis of Methods to Determine Triple Bottom Line Sustainability from Findings of Reductionist Research—*Taraba, J.*
- Development of a Distributed Control and Data Acquisition System for Variable-rate Applications in Precision Agriculture—*Sama, M.*
- Engineering for Food Safety and Quality—*Adedeji, A.*
- Integrated Systems Research and Development in Automation and Sensors for Sustainability of Specialty Crops—*Dvorak, J.*
- Marketing and Delivery of Quality Grains and BioProcess Coproducts—*Montross, M.D.; McNeill, S.G.*
- Quantification of Best Management Practice Effectiveness for Water Quality Protection at the Watershed Scale—*Edwards, D.*
- The Science and Engineering for a Biobased Industry and Economy—*Shi, Jian*

Community and Leadership Development

- A Framework for Secondary Schools Agriscience Education Programs that Emphasizes the STEM Content in Agriculture—*Epps, R.*
- Agricultural Education Research—*Hains, B.*
- Interactions of Individual, Family, Community, and Policy Contexts on the Mental and Physical Health of Diverse Rural Low-income Families—*Dyk, P.*
- Renewing an Agriculture of the Middle: Value Chain Design, Policy Approaches, Environmental and Social Impacts—*Tanaka, K.*

Entomology

- A Sustainable Approach for Protecting Our Forests from Emerald Ash Borer, with Applications to Other Exotic Wood-boring Invaders—*Rieske-Kinney, L.K.*
- Bacterial Symbionts and Defensive Traits in Insects—*White, J.*
- Biological Control in Pest Management Systems of Plants—*Harwood, J.D.*
- Biological Control of Arthropod Pests and Weeds—*Obyrcki, J.*
- Biological Improvement of Chestnut through Technologies that Address Management of the Species, Its Pathogens and Pests—*Rieske-Kinney, L.K.*
- Biology, Ecology and Management of Emerging Disease Vectors—*Dobson, S.L.*
- Biology, Impact, and Management of Soybean Insect Pests in Soybean Production Systems—*Obyrcki, J.*
- Colony Collapse in Termites: RNA Interference-mediated Genetic Manipulation—*Zhou, X.*
- Comparative Ecological and Phonological Studies of Predatory Lady Beetles (Coleoptera: Coccinellidae)—*Obyrcki, J.*
- Defining and Utilizing Selected Molecular Features of Insect Viruses—*Webb, B.A.*

- Identifying Weak Links in Bed Bug Biology—*Haynes, K.*
- Inbreeding Depression in Mating Biology Following Population Bottlenecks in a Storage Pest—*Fox, C.W.*
- Integrative Research on the Overwintering Biology of Insects—*Teets, N.*
- Management of Pests and Conservation of Beneficial Insects in Urban Landscape—*Potter, D.*
- Molecular Analysis of Insecticide Resistance—*Palli, S.S.*
- Quantifying the Effect of Habitat Structure on Biological Control—*Harwood, J.D.*
- Research, Development and Implementation of Mosquito Management Components in Kentucky—*Brown, G.*
- Spatiotemporal Relationships in Forest-floor Food Webs—*Harwood, J.D.*
- Systematics, Taxonomy, Biodiversity, and Food Web Interactions of Ichneumonidae (Insecta: Hymenoptera)—*Sharkey, M.; Chapman, E.*

Forestry and Natural Resources

- Autecology and Population Dynamics of Reintroduced Elk in a Denatured Landscape of Appalachia: Implications for Management of Kentucky's Mixed-mesophytic Forest—*Cox, J.*
- Evaluating the Use of Light Detection and Ranging (LIDAR) Information to Improve Forest Management Decisions—*Contreras, M.*
- Forest Management and Foraging Habitat of Bats Vulnerable to White-nose Syndrome—*Lacki, M.J.*
- Multiscale Approaches to Investigate the Effects of Various Anthropogenic Disturbances on Stream-inhabiting Amphibians and Reptiles—*Price, S.*
- Silvicultural Approaches to Enhance the Resiliency of Oak-dominated Forests to Disturbance—*Lhotka, J.*
- The Oak-fire Hypothesis: Using Fire to Manage Oak Forest Ecosystems in the Central and Southern Appalachians—*Arthur, M.A.*
- Using Remotely-sensed Data to Evaluate Post-fire Vegetation and Fuel Dynamics in Central and Appalachian Hardwood Forests—*Arthur, M.A.*
- Water Resources in a Changing World: How Changes in Climate and Land-use Influence Water Quality and Quantity in the Cumberland Plateau Region of Kentucky—*Barton, C.*

Horticulture

- Defining the Role(s) of Plant Sorbitol Dyhydrogenase—*Archbold, D.*
- Developing Optimized Cucurbit Systems—*Williams, M.*
- Environmental and Genetic Determinants of Seed Quality and Performance (from W1168)—*Geneve, R.L.*
- Identification and Predicting LEA Protein Interacting Proteins—*Downie, A.B.*
- Improving Economic and Environmental Sustainability in Tree-fruit Production through Changes in Rootstock Use—*Archbold, D.*
- Microbial Based Herbicide Discovery Focused on Cellulose Biosynthesis Inhibitors—*DeBolt, S.*
- Multi-state Evaluation of Wine Grape Cultivars and Clones—*Archbold, D.*

Sustainable Practices, Economic Contributions, Consumer Behavior, and Labor Management in the U.S. Environmental Horticulture Industry—*Ingram, D.L.*

Human Environmental Sciences

EFNEP Related Research, Program Evaluation and Outreach—*Mullins, J.*

The Influence of Social Media on Attendee Behavior—*Lu, Y.*

Plant and Soil Sciences

A Comparison of Soil Seed Bank Dynamics of Herbicide Resistant and Nonresistant Amaranthus Species—*Baskin, C.*

Beneficial Reuse of Residual and Reclaimed Water: Impact on Soil Ecosystem and Human Health (formerly W 2170) —*D'Angelo, E.*

Breeding and Genetics of Forage Crops to Improve Productivity, Quality, and Industrial Uses—*Phillips, T.D.*

Determining Potential Interactions of Genetics and Management in Maize—*Lee, C.*

Development of External Regulation of Transgenic Traits in Crop Plants—*Davies, H.*

Effects of Coatings on the Behavior of Manufactured Zinc Oxide Nanoparticles in Soil and Zinc Bioavailability to Plants—*Urrine, J.*

Effects of Fungal Endophyte Symbiosis in Tall Fescue Pasture Nutrient Dynamics and Resilience to Climate Change—*McCulley, R.*

Enhancing Nitrogen Utilization in Corn Based Cropping Systems to Increase Yield, Improve Profitability and Minimize Environmental Impacts (NC1032/218) —*Grove, J.*

Enhancing Wheat Breeding through Selection for Resilience to Climate Change—*Van Sanford, D.*

Evaluation of Soybean Varieties for Use in Kentucky—*Pfeiffer, T.*

Performance of Small Grain Varieties in Kentucky—*Van Sanford, D.*

Genetics and Biochemistry of Phosphate Solubilization by Rhizosphere-dwelling Microbes—*Moe, L.*

Functional Metagenomic Analysis of Soil-dwelling and Plant-associated Microbial Communities—*Moe, L.A.*

Genetic Control of Pod Shattering in Soybeans—*Zhu, H.*

Influence of Tall Fescue Cultivar and Endophyte Genotype Combinations on Root System Architecture, Exudate Composition, and Soil Biogeochemical Processes—*McNear, D.*

Management and Environmental Factors Affecting Nitrogen Cycling and Use Efficiency in Forage-based Livestock Production Systems—*Goff, B.*

Messenger RNA 3' End Formation in Plants—*Hunt, A.*

Nitrate-dependent Iron (II) Oxidation in Soils—*Matocha, C.*

Nitrifier Community Ecology Influences on Trace Gas Evolution from Agricultural Soil—*Coyne, M.*

Onsite Wastewater Treatment Systems: Assessing the Impact of Climate Variability and Climate Change—*Lee, B.*

Plant Genetic Resources Conservation and Utilization—*Phillips, T.D.*

Reduction of Tobacco-specific N-nitrosamines (TSNA) in Dark Tobaccos—*Bailey, W.A.*

Regulation of Gene Expression During Plant Embryogenesis—*Perry, S.E.*

Soil, Water, and Environmental Physics Across Scales—*Wendroth, O.*

The Chemical and Physical Nature of Particulate Matter Affecting Air, Water and Soil Quality (NCR 174) —*Karathanasis, A.*

Tobacco Breeding and Genetics—*Miller, R.*

Turfgrass and the Environment (was NCERA 192) —*Barrett, M.*

The Cytokinin Signaling Mechanism and Plant Growth—*Smalle, J.*

Plant Pathology

Characterization of Emerging Viruses—*Goodin, M.*

Characterization of Resistance Gene-mediated Signaling and Role of Oleic Acid and Glycerol 3-Phosphate in Plant Defense—*Kachroo, P.*

Dissecting Defense Signaling Pathways in Soybean and Arabidopsis—*Kachroo, A.*

Elucidating and Manipulating Alkaloid Biosynthesis Pathways in the Plant-symbiotic Epichloe and Neotyphodium Species of Fungi—*Schardl, C.*

Inhibition of Tombusvirus Replication by Exploiting Novel Host Factors—*Nagy, P.*

Locoweed and Its Fungal Endophyte: Impact, Ecology, and Management—*Schardl, C.*

Molecular Biology of the Interaction between Corn and Corn Stalk Rot Fungi—*Vaillancourt, L.J.*

Mycotoxins: Biosecurity, Food Safety and Biofuels Byproducts (NC129, NC1025)—*Vaillancourt, L.J.*

Population Dynamics and Fitness Roles of Host Specificity Genes in the Fungus *Magnaporthe oryzae*—*Farman, M.L.*

Veterinary Science

Control of Equine Gastrointestinal Parasites: Immunology, Host Genetics, and Drug Resistance—*Nielsen, M.*

Control, Transmission, and Prevalence of Natural Infections of Internal Parasites of Equids—*Lyons, E.T.*

Developmental Progenitor Cells of Articular Cartilage—*MacLeod, J.*

Equine Herpesvirus-1 and Equine Interferon Types 1 and 3—*Chambers, T.*

Equine Infectious Anemia Virtue Detection and Control in Equid Populations—*Issel, C.J.; Cook, R.F.; Cook, S.J.*

Genetic Basis of Attenuation of the T953 Strain of EHV-1 and Development of a Genetically Defined Live Attenuated Equine Herpesvirus-1 Vaccine—*Balasucriya, U.*

Interactions of Equine Viral Pathogens with the Equine Innate Immune System—*Chambers, T.M.; Horohov, D.W.*

Investigation of *Sarcocystis neurona* Genes Involved in Parasite Survival and Pathogenesis—*Howe, D.K.*

National Animal Genome Research Program—*Bailey, E.*

Minimizing the Impact of Feral Horses on Agricultural Lands: Tuboovarian Ligation via Colpotomy as a Method for Sterilization in Mares—*Ball, B.*

Reference Standards, Internal Standards and Critical Reagents/Regulatory Analytes for Analytical/Toxicological Approaches to Needs in Equine Medicine and Racing Regulation—*Tobin, T.*

Studies on Regulation of Reproduction in the Horse—*Ball, B.*

The Immunological Basis for *Rhodococcus Equi* Susceptibility in the Foal—*Horohov, D.W.*

Vasomodulatory Effects of Endophyte Infected Tall Fescue Seed and Comparison of a KY31 Tall Fescue Pasture vs a Novel Endophyte Tall Fescue Pasture for Grazing Mares—*McDowell, K.; Lawrence, L.; Bush, L.*

Collegewide Extramural Funding

*This information, generated from the Office of Sponsored Projects Administration database, includes any award with a start date within the reporting period (January 1, 2016–December 31, 2016) and any budgetary addition or reduction to existing projects processed within the reporting period. Grants are listed under the departments of the principal investigators.**

Agricultural Economics

Total—\$2,265,314

AMSTA training 2.0, Pennsylvania State University, \$3,575—*Davis, A., Meyer, A.*

Bluegrass Harvest: Expanding CSA Markets, Agricultural Marketing Service, \$444,776—*Woods, T., Davis, A., Williams, M.*

CEDIK Appalachian Health Career Scholarships, New York Community Trust, \$70,000—*Davis, A.*

CEDIK Downtown Revitalization Power Program, Appalachian Regional Commission, \$1,464,251—*Davis, A., Kahl, D., Koo, J., Naugle, L.*

Determining the Economic Value of Poultry Litter for Kentucky Corn Producers, Kentucky Corn Growers Association, \$18,469—*Shockley, J., McGrath, J., Ritchey, E.*

Determining the Economic Value of Poultry Litter for Kentucky Soybean Producers, Kentucky Soybean Promotion Board, \$18,469—*Shockley, J., McGrath, J., Ritchey, E.*

Developing, Practice and Implementing Written Marketing Plans and Risk Management Skills through Crop Marketing and Risk Management Clubs, University of Arkansas, \$50,000—*Davis, T.*

Evaluating Best Practices - Farm to Institution, Agricultural Marketing Service, \$73,890—*Davis, A., Hu, W., Woods, T.*

Governors Minority Student College Preparation Program, KY Council on Postsecondary Education, \$59,150—*Tyler, Q.*

Implement Plan of Work for the Southern Region Sustainable Agriculture Research and Education (SARE) Professional Development Program (PDP) Plan of Work, University of Georgia, \$28,334—*Meyer, A.*

Kentucky Local Foods Resource Mapping, Pennsylvania State University, \$30,000—*Davis, A., Meyer, A., Woods, T.*

Kentucky Youth Seminar Cooperative Tour, CHS Foundation, \$4,400—*Tyler, Q.*

Agricultural Programs

Total—\$336,780

- Building Capacity for Watershed Leadership and Management in Twelve Mississippi River Basin States, University of Wisconsin, \$2,680—*Gumbert, A.*
- Kentucky AgrAbility, National Institute of Food and Agriculture, \$178,000—*Palmer, G.*
- Managing Poo: Adoption of Nutrient Management and Conservation Practices, KY Energy and Environment Cabinet, \$81,100—*Gumbert, A., Higgins, S.*
- Multi-Jurisdictional Coordination Functional Exercise II, Animal and Plant Health Inspection Service, \$75,000—*Higdon, A., Dwyer, R., Newman, M.*

Animal and Food Sciences

Total—\$3,702,714

- 2016 Central and Eastern European Conference on Health and the Environment, National Institute of Environmental Health Sciences, \$40,000—*Hennig, B.*
- 2016 Princess Chulabhorn International Science Congress, National Institute of Environmental Health Sciences, \$21,825—*Hennig, B.*
- An Investigation into the Effect of Enzyme Treatments on Ileal and Total Tract Digestibility of Nutrients in 21d Broiler Chickens, DuPont, \$82,734—*Adedokun, S.*
- Director's Conference Support: 2016 CEECHE, National Institute of Environmental Health Sciences, \$3,000—*Hennig, B.*
- Economic evaluation of DeLaval Herd Navigator, DeLaval International AB, \$10,500—*Bewley, J., Mark, T.*
- Effect of Different Fat Sources and Vitamin E Status on Antioxidant Status, Carcass Characteristics, and Meat Quality of Pigs Grown to Heavy Slaughter Weight, National Pork Board, \$117,079—*Lindemann, M., Jang, Y., Rentfrow, G.*
- Evaluating the Effects of Two Sources of Sodium (NaCl and NaHCO₃) on Phytase Efficacy - Mineral Metabolism and Bone Ash in 21-d-old Broiler chickens, AB Vista, \$68,045—*Adedokun, S.*
- Evaluation of a Sodium Hypochlorite Teat Dip, GEA Farm Technologies Incorporated, \$12,130—*Bewley, J.*
- Evaluation of Effects of Daily BCS on Disease, Reproduction and Feed Efficiency using the DeLaval BCS System, DeLaval International AB, \$60,388—*Bewley, J., Mark, T.*
- Fishing For a Novel Source of Methionine in Organic Poultry Feed: Exploring the Potential of Invasive Asian Carp as Sustainable Fish Meal, University of Arkansas, \$30,000—*Pescatore, A.*
- Genomic Selection for Improved Fertility of Dairy Cows with Emphasis on Cyclicity and Pregnancy, Colorado State University, \$15,787—*Amaral-Phillips, D.*
- Improving Fertility of Dairy Cattle Using Translational Genomics, University of Missouri, \$46,946—*Amaral-Phillips, D.*
- Kentucky Beef Network VIII Master Education Series, Kentucky Beef Network, \$194,622—*Lehmkuhler, J., Amaral-Phillips, D., Anderson, L., Bullock, K., Burdine, K., Burris, W., Halich, G., Smith, S.*
- Living Up to Her Potential: Increasing Dairy Cow Productivity and Welfare Using an Improved Understanding of Sleep, Ohio State University, \$13,500—*Bewley, J.*

- Mechanism Studies for Rheological Property Enhancement of Pork Myofibrillar Proteins/ Gels Induced by Oxidation and Enzyme Treatment, Ajinomoto Company Incorporated, \$60,000—*Xiong, Y.*
- Nutrition and Superfund Chemical Toxicity, National Institute of Environmental Health Sciences, \$2,448,757—*Hennig, B., Brewer, D., Gaetke, L.*
- Pilot Efficacy Study to Assess the Effect of an Endo-1,3-β-D-Glucanase (CMG 3640) Inclusion in Corn-Soybean Meal Diets Containing Increasing Concentrations of DDGS, Elanco Animal Health, \$42,000—*Lindemann, M.*
- Post Doctoral Fellow -- Lizza Macalintal, Alltech Biotechnology Inc, \$116,425—*Pescatore, A., Macalintal, L.*
- Professional Training for Extension Agents in KY and OK in Food Safety and Sanitation Related to Farmer's Market, University of Georgia, \$78,166—*Vijayakumar, P., Newman, M., Rentfrow, G.*
- SBIR [Phase I]: Fluoxetine ± Diphenhydramine Leads to Tight Junction Opening and Dry-off Acceleration, Amelgo LLC, \$32,134—*Bewley, J.*
- Southeast Quality Milk Initiative: Implementing Science-based Recommendations in the Field, University of Tennessee, \$26,000—*Amaral-Phillips, D.*
- Southeast Quality Milk Initiative: Implementing Science-based Recommendations to Control Mastitis & Improve Milk Quality in the Southeast, University of Tennessee, \$134,576—*Bewley, J., Arnold, L., Garkovich, L.*
- Southern Training, Education, Extension, Outreach, and Technical Assistance Center to Enhance Produce Safety, University of Florida, \$48,100—*Newman, M., Rentfrow, G., Vijayakumar, P., Woods, T.*

Associate Directors

Total—\$1,051,094

- 2015-16 Acquisition of Goods and Services for the USDA Offices in Ag North, Agricultural Research Service, \$52,874—*Bennett, A.*
- Equine Medical Director 2017-18, KY Horse Racing Commission, \$188,879—*Oliver, L.*
- FAPRU SCA, Agricultural Research Service, \$809,341—*Bennett, A., Workman, S.*

Biosystems and Agricultural Engineering

Total—\$1,051,516

- Alliance for Food Security through Reduction of Postharvest Loss and Food Waste, Oklahoma State University, \$5,960—*McNeill, S.*
- AMPLIFIES Ghana: Assisting Management in the Poultry and Layer Industries by Feed Improvement and Efficiency Strategies in Ghana, Oklahoma State University, \$29,086—*McNeill, S.*
- Borlaug 2015 Mexico (Cuchillo) GRA @UKY, Foreign Agricultural Service, \$29,028—*Taraba, J., Reed, M., Sama, M.*
- Extrusion Processing for Value-added Production of Food and Feed, National Institute of Food and Agriculture, \$50,000—*Adedokun, S.*
- Factors that Affect Packing During Storage, Ohio State University, \$25,453—*Montross, M., McNeill, S.*
- Fellowship for Josh Jackson: Forage and Resource Management Tool for Beef Producers Implementing Rotational Grazing, National Institute of Food and Agriculture, \$150,000—*Montross, M.*

- FY-17 Kentucky Radon Education Program, KY Cabinet for Health and Family Services, \$26,054—*Fehr, R.*
- Hydraulic Flume Demonstration of Backwater Effects, Hopkinsville Surface and Stormwater Utility, \$4,055—*Agouridis, C.*
- Kentucky Energy Education Outreach Program, KY Energy and Environment Cabinet, \$100,000—*Fehr, R.*
- KSEF RDE: Efficient Routing with Multiple Vehicles for Agricultural Area Coverage Tasks, KY Science and Technology Co Inc, \$30,000—*Dvorak, J., Sama, M.*
- LIDAR and Photogrammetry to Map Alfalfa Yield and Quality Using Unmanned Aircraft Systems, National Institute of Food and Agriculture, \$250,000—*Dvorak, J., Goff, B., Jackson, J., Montross, M., Sama, M.*
- Nigeria Capacity Building on Stored Commodities, Foreign Agricultural Service, \$63,203—*McNeill, S.*
- On-farm Biomass Processing: Towards an Integrated High Solids Transporting/Storing/ Processing System, National Institute of Food and Agriculture, \$13,227—*Nokes, S., Crofcheck, C., DeBolt, S., Halich, G., Lee, C., Montross, M., Smith, S., Stombaugh, T.*
- Program Income: Technical Assistance for Energy Audits and Renewable Energy Projects in Rural Kentucky, Rural Development, \$450—*McNeill, S., Montross, M., Overhults, D.*
- RII Track-2 FEC: Assembling Successful Structures: Lignin Beads for Sustainability of Food, Energy, and Water Systems, Louisiana State University, \$275,000—*Nokes, S., Shi, J.*

Community and Leadership Development

Total—\$149,806

- Developing Entrepreneurial Youth in Resource-depleted Communities, National Institute of Food and Agriculture, \$134,672—*Vincent, S., Hanley, C., Kahl, D.*
- Impacts of Value-based Supply Chains on Small and Medium-Sized Farms, University of Minnesota, \$15,134—*Tanaka, K.*

Entomology

Total—\$1,677,625

- 2015 IR-4 Biopesticide Project, University of Florida, \$0—*Dobson, S.*
- Apple Commodity Survey, Animal and Plant Health Inspection Service, \$15,731—*Lensing, J.*
- CAPS 2016 - Corn, Animal and Plant Health Inspection Service, \$19,637—*Lensing, J.*
- CAPS 2016 - Forest Pests Survey, Animal and Plant Health Inspection Service, \$18,906—*Lensing, J.*
- CAPS 2016 - Infrastructure, Animal and Plant Health Inspection Service, \$28,161—*Lensing, J.*
- CAPS 2016 - Nursery Survey, Animal and Plant Health Inspection Service, \$5,956—*Lensing, J.*
- CAPS 2016 - Soybean, Animal and Plant Health Inspection Service, \$8,813—*Lensing, J.*
- Development of Artificial Blood for Mosquitoes, Bill and Melinda Gates Foundation, \$217—*Dobson, S.*
- Development of New RNAi-based Control Technologies for Use in Plant Health Emergencies, Animal and Plant Health Inspection Service, \$82,500—*Palli, S.*
- Development of Novel Insecticide Synergistic for Resistance Management, Agricultural Research Service, \$120,000—*Palli, S.*
- Development of RNAi in Woody Plants for Broad Scale Management of Tree Pests, Forest Service, \$45,000—*Rieske-Kimney, L., Abbott, A., Palli, S.*

- Do Blossom End Rot Fungus and Asian Chestnut Gall Wasp Interact on Chestnut, Northern Nut Growers Association, \$6,700—*Rieske-Kinney, L., Vaillancourt, L.*
- Epigenetic and Posttranslational Modifier Regulation of Juvenile Hormone Action, National Institute of General Medical Sciences, \$280,000—*Palli, S.*
- Evaluating A21065B Efficacy on Wireworm, White Grubs and Seedcorn Maggot in US Corn, Syngenta Crop Protection, \$22,000—*Bessin, R.*
- Firewood Scout in Kentucky, Animal and Plant Health Inspection Service, \$8,231—*Lensing, J.*
- FY 15-16 UK Mosquito Surveillance, KY Department for Public Health, \$20,400—*Brown, G.*
- FY 17 UK Mosquito Surveillance, KY Department for Public Health, \$20,000—*Brown, G.*
- Grape Commodity Survey, Animal and Plant Health Inspection Service, \$19,983—*Lensing, J.*
- Gypsy Moth Survey, Animal and Plant Health Inspection Service, \$252,600—*Lensing, J., Harper, C.*
- Imported Fire Ant Survey, Animal and Plant Health Inspection Service, \$3,783—*Lensing, J.*
- Improving the Efficacy of Sterile Insect Technique by Enhancing Male Performance with Targeted Overexpression of Antioxidant Defense Systems, National Institute of Food and Agriculture, \$85,481—*Teets, N.*
- Integrating IPM into IRM Theory for Improved Resistance Management and Pest Suppression, Iowa State University, \$60,000—*Fox, C., Harwood, J., Obrycki, J.*
- Invasive Pest Outreach in Kentucky, Animal and Plant Health Inspection Service, \$54,491—*Lensing, J.*
- Kentucky Contact for the Southern Region Regulatory Information Network, North Carolina State University, \$5,000—*Lucas, P.*
- Kentucky IPM Extension and Implementation Program:2014 - 2017, National Institute of Food and Agriculture, \$65,000—*Bessin, R., Dunwell, W., Gauthier, N., Knott, C., Lucas, P., Saha, S.*
- KSEF RDE: Calcium-dependent Signaling Mechanisms Governing Rapid Cold Hardening in Insects, KY Science and Technology Co Inc, \$30,000—*Teets, N.*
- KSEF RDE: Developing a Spider Model System for Understanding Interactions Among Endosymbionts, KY Science and Technology Co Inc, \$30,000—*White, J.*
- KSEF RDE:Identifying Mechanisms of Resilience to Health Stressors in the Honey Bee (*Apis mellifera*), KY Science and Technology Co Inc, \$29,863—*Rittschof, C.*
- Looking for Old and New Foes to Prevent BYDV Transmission on Wheat, Kentucky Small Grain Growers Association, \$13,022—*Villanueva, R., Bradley, C.*
- Management of Brown Marmorated Stink Bug in US Specialty Crops, North Carolina State University, \$46,025—*Bessin, R., Obrycki, J., Villanueva, R.*
- Mechanisms of RNA interference, Iowa State University, \$130,000—*Palli, S.*
- Monitor Gypsy Moth Populations for Slow the Spread Program, Slow the Spread Foundation, \$44,000—*Harper, C.*
- Operation Monarch for Golf Courses: Developing Protocols for Monarch Butterfly Conservation Plantings in Golf Course Naturalized Roughs, United States Golf Association, \$48,720—*Potter, D., Munshaw, G., Redmond, C.*
- Phytophthora ramorum Survey, Animal and Plant Health Inspection Service, \$25,578—*Lensing, J.*
- SBIR Phase 2 - Biological Vector Control Reducing Arboviruses, Including Dengue and Chikungunya, MosquitoMate Incorporated, \$31,827—*Dobson, S.*
- Family and Consumer Sciences**
Total—\$1,054,956
- 2016 MTAC Grant, Purdue University, \$228,700—*Ashurst, K.*
- Collaborative Environment Approaches to Reduce Obesity Disparities in Kentucky, Center for Disease Control and Prevention, \$826,256—*Vail, A., Bastin, S., Brewer, D., Davis, A., Gustafson, A., Kurzynske, J., Mullins, J., Stephenson, T., Webber, K.*
- Forestry and Natural Resources**
Total—\$573,214
- ABR-PG Standards and Cyber Infrastructure that Enable "Big-Data" Driven Discovery for Tree Crop Research, Washington State University, \$146,082—*Abbott, A., Stringer, J.*
- Daniel Boone National Forest and Triplett Creek Landscape Restoration Partnership, Forest Service, \$48,000—*Arthur, M.*
- Estimating Kentucky's Forest Inventory at the County Level with Improved Precision by Combining FIA Data with Remote Sensing, GIS, and Small-Area-Estimation Techniques, Forest Service, \$25,000—*Yang, J.*
- Evaluating Habitat Utilization and Baseline Abundance of Northern Long-Eared Bats at Mammoth Cave National Park, National Park Service, \$27,000—*Lacki, M.*
- Evaluating Chemical Fingerprinting as a Tool to Rapidly Screen Hybrid Chestnut for Disease Resistance, American Chestnut Foundation, \$3,000—*Conrad, A., Abbott, A.*
- Evaluating the Impact of Snake Fungal Disease on Wild Snake Populations, National Geographic Society, \$15,000—*Price, S.*
- Evaluating the Influence of the Forestry Reclamation Approach on Hydrology and Water Quality in Appalachian Coal Mines, Surface Mining Reclamation and Enforcement, \$195,490—*Barton, C., Agouridis, C.*
- Forest Stewardship Outreach Project, KY Energy and Environment Cabinet, \$40,000—*Thomas, W., Stringer, J.*
- Forest Stewardship, Publicity, Training, KY Division of Forestry, \$10,000—*Stringer, J.*
- Invasive Plant Cost-Share Project, KY Energy and Environment Cabinet, \$43,642—*Thomas, W., Stringer, J., Stringer, J.*
- Stewardship Outreach Project, KY Energy and Environment Cabinet, \$20,000—*Thomas, W., Stringer, J.*
- Horticulture**
Total—\$465,838
- Alternative Substrate for Soilless Production of Vegetables, University of Georgia, \$12,834—*Saha, S., Ingram, D.*
- Clean Water3 - Reduce, Remediate, Recycle: Informed Decision-making to Facilitate Use of Alternative Water Resources and Promote Sustainable Specialty Crop Production, Clemson University, \$86,093—*Ingram, D.*
- Covers Crops Under Cover: Evaluating Costs, Benefits, and Ecosystem Services of Cover Crops in Year-round High Tunnel Production Systems, University of Georgia, \$203,277—*Jacobsen, K., Haramoto, E., Phillips, T., Woods, T.*
- Developing Specialty Crop Resources to Aid Farmers Seeking to Diversify, KY Department of Agriculture, \$27,694—*Cassady, C.*
- Reinventing Sustainable Protection Systems for Cucurbit Production, Iowa State University, \$59,634—*Williams, M., Bessin, R., Harwood, J., Woods, T.*
- Specialty Crop: Evaluating Low Tunnel Vegetable Production Systems for Improving Local Food Availability in Kentucky, KY Department of Agriculture, \$26,352—*Wright, S., Jacobsen, K., Saha, S.*
- Specialty Crop: Selection and Preservation of Uba Tuba, a Specialty Pepper, KY Department of Agriculture, \$49,954—*Snyder, J., Strang, J.*
- International Programs**
Total—\$73,602
- Haiti Policy Analysis Matrix, Foreign Agricultural Service, \$73,602—*Reed, M., Hanley, C.*
- Kentucky Small Business Development Center**
Total—\$1,560,499
- Kentucky Small Business Development Center, Small Business Administration, \$1,516,999—*Naugle, L.*
- KY Small Business Development Center Lease, Commerce Lexington Inc, \$13,500—*Naugle, L.*
- Louisville SBDC Local Support, Louisville Metro Government, \$30,000—*Naugle, L.*
- Kentucky Tobacco Research and Development Center**
Total—\$4,112,149
- BAT LYTobacco1, British American Tobacco, \$322,010—*Yuan, L., McNees, C., Moe, L.*
- Development and Distribution of a Certified Reference Cigarette Suitable for Research Applications and Establishing a Proficiency Testing Program at the University of KY Reference Cigarette Program, Food and Drug Administration, \$700,000—*Chambers, O., Ji, H., Yuan, L.*
- Development and Standardization of Accelerated Tobacco Curing Protocols to Quantify the Propensity for TSNA Production and Accumulation, Council for Burley Tobacco, \$4,000—*Canete, S.*
- Evaluation of the Efficacy of HP 400 in Reducing TSNA's - 2016 Field Season, Council for Burley Tobacco, \$2,000—*Jack, A., Fisher, C., Ji, H.*
- Next Generation Sequencing Aided Study of Influence of the Systemic Suckercide Maleic Hydrazide on Global Changes of Tobacco Gene Expression, Council for Burley Tobacco, \$5,000—*Pattanaik, S., Yuan, L.*
- Program Income: Smokeless Tobacco Reference Product Development, Distribution and Research, Food and Drug Administration, \$1—*Chambers, O., Canete, S., Jack, A., Ji, H., Moe, L., Yuan, L.*
- Program Income: Development and Distribution of a Certified Reference Cigarette Suitable for Research Applications and Establishing a Proficiency Testing Program at the University of KY Reference Cigarette Program, Food and Drug Administration, \$75,213—*Chambers, O., Ji, H., Yuan, L.*
- Sample Preparation for TSNA Analysis, Council for Burley Tobacco, \$4,000—*Jack, A., Fisher, C., Ji, H.*

Smokeless Tobacco Reference Product Development, Distribution and Research, Food and Drug Administration, \$2,999,925—*Chambers, O., Canete, S., Jack, A., Ji, H., Moe, L., Yuan, L.*

Landscape Architecture

Total—\$15,400

Geographic Information System Processing of Remotely-sensed Data for Analyzing Land Cover Change in Cultural Landscapes, Department of the Interior, \$15,400—*Crankshaw, N., Lee, B.*

Merchandising, Apparel and Textiles

Total—\$25,182

2016 Cotton Incorporated Laundry Study, Cotton Incorporated, \$24,000—*Easter, E.*
Quality Control Lab for NAALM, Association for Linen Management, \$1,182—*Easter, E.*

Nutrition and Food Science

Total—\$961,827

KY CYFAR PD&TA Program, University of Minnesota, \$25,000—*Kurzynske, J., Ashurst, K., Stivers, W.*
Smart Shopping - Adolescent Intervention to Improve Food Shopping Practices Where You Live and Learn, National Institute of Food and Agriculture, \$746,827—*Gustafson, A., Mullins, J., Vail, A.*
Specialty Crop: Plate It Up! Kentucky Proud Recipe Development and Evaluation for Consumers and Producers: Healthy Meals that Serve One or Two, KY Department of Agriculture, \$50,000—*Stephenson, T., Vail, A.*
Strong Dads, Resilient Families, National Institute of Food and Agriculture, \$140,000—*Kurzynske, J., Ashurst, K., Jones, K.*

Plant and Soil Sciences

Total—\$4,105,029

Accelerating the Development of FHB-resistant Soft Red Winter Wheat Varieties, Agricultural Research Service, \$67,005—*Van Sanford, D.*
Addition of Blue Mold Resistance to KTTII Burley Tobacco Varieties, Council for Burley Tobacco, \$8,000—*Miller, R.*
An Integrated Approach to Understand the Agronomic Responses to Poultry Litter Use and Soybean and Corn Production Systems, KY Corn Growers Association, \$35,000—*Ritchey, E., Haramoto, E.*
An Integrated Approach to Understand the Dynamics of Poultry Litter Use in Corn and Soybean Production Systems, Kentucky Soybean Promotion Board, \$35,000—*Ritchey, E., Bradley, C., Haramoto, E.*
BAT GW Tobacco1, British American Tobacco, \$1,166,766—*Wagner, G., Mihaylova-Kroumova, A., Zaitlin, D.*
Bayer FG72, Bayer CropScience GmbH, \$10,000—*Slack, C., Carter, S.*
Burley Tobacco Breeding and Genetics, Philip Morris International Management SA, \$282,500—*Miller, R.*
Can Fusarium Head Blight Vomitoxin Levels Be Reduced with Agronomic Practices?, Kentucky Small Grain Growers Association, \$35,750—*Knott, C., Bradley, C.*
Can Manipulation of Fungal Endophyte Diversity Positively Influence Tall Fescue Pasture Sustainability and Ecosystem Functioning?, National Institute of Food and Agriculture, \$149,736—*McCulley, R., Harwood, J.*
Corn Frigipan Remediation, Kentucky Corn Growers Association, \$15,000—*Murdock, L., Grove, J.*
Cover Crop Interseeding to Manage Herbicide-resistant Weeds, North Carolina State University, \$28,641—*Haramoto, E., Phillips, T.*
Develop Science-based Recommendations to Efficiently Manage Forages, Herd Health and Productivity on Organic Dairies in the Southeastern US, University of Tennessee, \$476,804—*Smith, S., Bewley, J., Burdine, K.*
Developing Irrigation Management Strategies for Soybean Production in Humid Regions of the Southern U.S., Southern Soybean Research Program, \$50,000—*Wendroth, O., Knott, C., Lee, C., Murdock, L., Sama, M.*
Development of High #3 Soybeans, Kentucky Soybean Promotion Board, \$29,470—*Hildebrand, D.*
Development of Pale Yellow Dark Burley, Council for Burley Tobacco, \$3,500—*Fisher, C., Jack, A.*
Do Critical Soil Phosphorus Concentrations Vary In Space and if so Why?, Foundation for Agronomic Research, \$70,000—*McGrath, J.*
Double Crop Project (Joint with USB), Kentucky Soybean Promotion Board, \$5,000—*Knott, C.*
Enhanced Chia Production & Product Usage, Kentucky Small Grain Growers Association, \$25,445—*Hildebrand, D.*
Enhancing Burley Tobacco Production Labor Efficiency 2016, Council for Burley Tobacco, \$10,000—*Pearce, R., Snell, W., Swetnam, L.*
Enhancing Wheat Breeding through Selection of Robust Disease Resistant QTL that Function in a Variable Climate, National Institute of Food and Agriculture, \$120,000—*Van Sanford, D.*
Evaluation and Control of Ground Sucker Formation in Burley Tobacco Varieties, Council for Burley Tobacco, \$6,000—*Miller, R., Smalle, J.*
Field Trial Evaluation of Foliar Applied Microbial Exudate in Grass Grown for Hay Production or Grazing, Mendel Biological Solutions LLC, \$10,265—*Goff, B.*
Fragipan Remediation, Kentucky Small Grain Growers Association, \$15,000—*Murdock, L.*
Fragipan Remediation 2016 Soybean, Kentucky Soybean Promotion Board, \$25,000—*Murdock, L., Karathanasis, A.*
Genetic Selection of Hemp with Higher CBD Levels, Zifora SRL, \$135,252—*Hildebrand, D., Phillips, T.*
Improved Chia Production & Product Usage, Kentucky Small Grain Growers Association, \$23,903—*Hildebrand, D.*
Improving Soybean Yield in the Double Crop Soybean Production System, North Central Soybean Research Program, \$20,000—*Knott, C.*
Inoculating Soybeans to Try to Increase Yield, Kentucky Soybean Promotion Board, \$18,000—*Lee, C., Knott, C.*
Intensive Management: An Option to Increase Double-crop Soybean Yields?, Kentucky Soybean Promotion Board, \$39,435—*Knott, C., Bradley, C.*
Investigation of Mixed Population of Palmer Amaranth and Waterhemp with Multiple Herbicide Resistance, Kentucky Soybean Promotion Board, \$17,330—*Green, J., Haramoto, E.*
Irrigating the Soil to Maximize the Crop - An Approach for Corn to Efficient and Environmentally Sustainable Irrigation Water Management in Kentucky - Year 3 of 3, Kentucky Corn Growers Association, \$24,168—*Wendroth, O., Lee, C.*

Kentucky SO 22 Lee 2016-01-N6-06. SOYBEAN PROP LP, Monsanto Co, \$6,048—*Lee, C.*
Kentucky SO 23 Lee 2016-01-N6-07. SOYBEAN PROP HP, Monsanto Co, \$5,040—*Lee, C.*
Kentucky SO24 Lee 2016-01-B3-03, Monsanto Co, \$11,200—*Lee, C.*
KSEF RDE: Genetic Regulation of Nodulation Specificity in Medicago Truncatula, KY Science and Technology Co Inc, \$30,000—*Zhu, H.*
Management Tools to Improve Forage Quality and Persistence of Alfalfa, Cornell University, \$27,138—*Smith, S.*
Marker Design Based on Genotyping by Sequencing for Blue Mold Resistance in Tobacco, Council for Burley Tobacco, \$5,000—*Yang, S., Li, D., Miller, R.*
Mon Corn, Monsanto Co, \$6,300—*Slack, C., Carter, S.*
Monsanto SO 25, Monsanto Co, \$14,560—*Slack, C., Carter, S.*
Monsanto SO26, Monsanto Co, \$8,400—*Slack, C., Carter, S.*
Optimizing Soil Moisture Sensor Placement under Western Kentucky Irrigated Systems for Soil and Water Conservation, Natural Resources Conservation Service, \$25,000—*Lee, B., Knott, C., Ritchey, E.*
Optimizing the Integration of Annual Forages into Tobacco Systems, Council for Burley Tobacco, \$5,000—*Goff, B., Haramoto, E., Pearce, R.*
Optimizing Winter Cover Crops for Weed Management in Soybeans, Kentucky Soybean Promotion Board, \$38,093—*Haramoto, E.*
Performance of Small Grain Varieties in Kentucky, Kentucky Small Grain Growers Association, \$12,133—*Bruening, W.*
Program Income: U.S. Wheat and Barley Scab Initiative's Networking and Facilitation Office and Website, Agricultural Research Service, \$24,815—*Van Sanford, D.*
Providing a Better Understanding of Cover Crop-Soil Interactions, Natural Resources Conservation Service, \$75,000—*Ritchey, E., Coyne, M., Haramoto, E., Lee, B., McGrath, J., Shockley, J.*
RCPP 1277- Overgrazing and Soil Degradation on Horse Farms, Natural Resources Conservation Service, \$129,750—*Smith, S.*
Renewal-Center for the Environmental Implications of Nanotechnology, Duke University, \$137,999—*Unrine, J., Tsyusko-Unrine, O.*
Rhizosphere Priming Effects on Legacy Organic Phosphorus (Po) in a Winter Wheat/Corn Rotation, National Institute of Food and Agriculture, \$499,400—*McNear, D., Grove, J., McGrath, J.*
Soft Red Winter Wheat Breeding and Variety Development for Kentucky, Kentucky Small Grain Growers Association, \$65,625—*Van Sanford, D.*
Soil Bank Project, Natural Resources Conservation Service, \$558—*Coyne, M.*
Soil Morphology Course 2016-2018, KY Department for Public Health, \$20,000—*Karathanasis, A.*

Plant Pathology

Total—\$627,018

2016-2017 Kentucky SARE MSP Training, University of Georgia, \$11,111—*Vincelli, P.*
Applied Management of Fusarium Head Blight in Kentucky, Agricultural Research Service, \$20,328—*Bradley, C.*

Brassicaceous Cover Crops to Reduce Root Knot Nematode and Improve Soil Quality in High Tunnel Tomato, University of Georgia, \$14,990—*Pfeuffer, E., Saha, S.*

Developing a Comprehensive Management Program for Foliar Diseases of Soybean (Phase II), Southern Illinois University, \$47,036—*Bradley, C.*

Development of Validated Systems of Resistance to Pathogens on Sweet Potato, Rural Development Administration of Korea, \$150,000—*Kachroo, A.*

Examining the Importance of Dynamic Trafficking in Systemic Acquired Resistance, National Science Foundation, \$140,000—*Kachroo, A., Kachroo, P.*

Improving Fungicide Application Recommendations for Managing Fusarium Head Blight of Wheat and Barley, Kentucky Small Grain Growers Association, \$14,130—*Bradley, C., Stombaugh, T.*

Independent and Plant-mediated Inhibition of Plant Pathogens in Tomato by Fermentation Byproduct Research, Alltech Biotechnology Inc, \$35,000—*Pfeuffer, E., Kachroo, P.*

iPIPE: Corn Component, North Carolina State University, \$38,357—*Bradley, C.*

KSEF RDE: Characterizing Soybean Glycerolipid Activities Inmicrobial Defense and Lipid Synthesis, KY Science and Technology Co Inc, \$29,999—*Kachroo, A.*

KSEF RDE: Next Generation Protein Expression Vectors Derived From Coffee Ringspot Virus, KY Science and Technology Co Inc, \$30,000—*Goodin, M., Hunt, A., Zaillin, D.*

Managing Frogeye Leaf Spot of Soybean with Foliar Fungicides and Resistant Varieties, Kentucky Soybean Promotion Board, \$19,868—*Bradley, C.*

SARE MSP Program Assistant 2016, University of Georgia, \$22,222—*Vincelli, P.*

Southern Plant Diagnostic Network, Kentucky Component, University of Florida, \$15,000—*Vincelli, P.*

Student Sponsorship - Erica Fealko: Independent and Plant-mediated Inhibition of Plant Pathogens in Tomato by Fermentation Byproduct, Alltech Biotechnology Inc, \$38,977—*Pfeuffer, E., Kachroo, P.*

Plant Pathology—RCTF

Total—\$210,000

Blocking RNA Virus Replication through the Antiviral Functions of Cellular Helicases, National Institute of Allergy and Infectious Diseases, \$210,000—*Nagy, P., Kovalev, N.*

Plant Sciences Agronomy—RCTF 1

Total—\$30,000

KSEF RDE: Investigation of Regulatory Networks to Enhance Plant Regeneration by Somatic Embryogenesis, KY Science and Technology Co Inc, \$30,000—*Perry, S.*

Regulatory Services

Total—\$665,530

BSE Rule and Medicated Feed Inspections, Food and Drug Administration, \$51,530—*Harrison, G., Green, K.*

Implementation of the Animal Feed Regulatory Program Standards in Kentucky, Food and Drug Administration, \$600,000—*Johnson, D., Harrison, G., Webb, S.*

Limestone Testing Agreement, KY Department of Agriculture, \$14,000—*Sikora, F.*

Tracy Farmer Center for Sustainability and the Environment

Total—\$125,000

STEM PRIDE Year 2 Funding, KY Council on Postsecondary Education, \$125,000—*Hanley, C., Moe, L.*

UK Veterinary Diagnostic Laboratory

Total—\$186,289

Avian Influenza Surveillance, KY Department of Agriculture, \$20,000—*Carter, C.*

Bovine Spongiform Encephalopathy Testing and Related Services, KY Department of Agriculture, \$11,600—*Carter, C.*

FDA Vet-LRN Veterinary Diagnostic Laboratory Cooperative Agreement Program Funding, Food and Drug Administration, \$16,500—*Gaskill, C., Carter, C., Erol, E.*

Maintaining Laboratory Designation, Animal and Plant Health Inspection Service, \$138,189—*Carter, C.*

Veterinary Science

Total—\$1,405,638

Combination Anthelmintic Therapy: Short and Long Term Benefits, Zoetis LLC, \$54,208—*Nielsen, M.*

Comparative Chondrogenic Potential of Equine Fetal Progenitor Cells and Adult Mesenchymal Stem Cells, American College of Veterinary Surgeons, \$22,942—*MacLeod, J.*

Developmental Progenitor Cells of Articular Cartilage, Morris Animal Foundation, \$121,547—*MacLeod, J.*

Effect of Yeast Cell Wall (ActigenTM) Supplementation on Metabolic, Inflammatory, and Microbiota Changes in EMS vs Control Horses, Alltech Biotechnology Inc, \$25,000—*Adams, A.*

Engineered Probiotics for Farm Animal and Human Nematodes, University of Massachusetts, \$57,620—*Nielsen, M.*

Evaluation of the Mucosal Inflammatory Responses to Larvicidal Treatment, Zoetis LLC, \$20,132—*Nielsen, M.*

Fluorescence-based Diagnostic Imaging Modalities, MEP Equine Solutions LLC, \$40,954—*Nielsen, M.*

Identification of Genetic Factors Responsible for Establishment of Equine Arteritis Virus Carrier State in Stallions, National Institute of Food and Agriculture, \$599,331—*Balasureiya, U., Bailey, E., Cook, R., Horohov, D., MacLeod, J., Squires, E., Timoney, P., Troedsson, M.*

IgG(T) Antibodies Identify Foals at Risk for R Equi, Grayson Jockey Club Research Foundation Inc, \$62,407—*Horohov, D.*

Inhibition of Type-1 Interferon Response by EHV-1, Grayson Jockey Club Research Foundation Inc, \$67,863—*Chambers, T., Balasureiya, U., Horohov, D.*

Merial Anthelmintic Efficacy Study 2016, Merial Ltd, \$20,297—*Nielsen, M.*

MicroRNA as a Marker of Placental Health in the Mare, American Quarter Horse Foundation, \$20,000—*Loux, S., Ball, B.*

Research on Equine Endocrine Disorders of Pituitary Pars Intermedia (#PPI#), Equine Metabolic Syndrome/Obesity/Laminitis and Geriatric Horse Healthcare/Nutritional Management, Mars Horsecare UK Limited, \$165,000—*Adams, A.*

Sex-hormone-binding Globulin: a Biomarker for Anabolic Abuse, KY Horse Racing Commission, \$97,862—*Ball, B., Esteller Vico, A.*

Smartphone Egg Count Validation Study, Zoetis LLC, \$30,475—*Nielsen, M.*

Multidisciplinary Grants Led by Other Colleges*

104B State Water Resources Research Institute Program 2016 - 2021, US Geological Survey, \$92,335—*Agouridis, C., Edwards, D., Lee, B., Price, S.*

A Microalgae-based Platform for the Beneficial Reuse of CO₂ Emissions from Power Plants, Department of Energy, \$484,651—*Croftcheck, C.*

Appalachians Together Restoring the Eating Environment (Appal-TREE): Advancing Sustainable CBPR Interventions to Improve Healthy Diet in Rural Appalachian Children, National Institute on Minority Health and Health Disparities, \$509,795—*Mullins, J.*

Center for Rural Health Research, Health Resources and Services Administration, \$700,000—*Davis, A.*

Central Appalachian Regional Education Research Center, National Institute of Occupational Safety and Health, \$1,009,308—*Purschwitz, M.*

Energy is Elementary, KY Council on Postsecondary Education, \$110,000—*Hanley, C.*

FEEDER: Foundations for Engineering Education for Distributed Energy Resources, University of Central Florida, \$123,637—*Colliver, D.*

Health Education: Curriculum and Professional Development for K-8 DoDEA teachers, National Institute of Food and Agriculture, \$159,600—*Peritore, N.*

In Vivo Evaluation of the Safety and Efficacy of Extracorporeal Circuits for Long-term Cardiopulmonary Support, Xenios AG, \$790,565—*Jackson, C.*

Kentucky Industrial Assessment Center (KIAC): Developing the Next Generation Energy Assessment Engineering Workforce, Department of Energy, \$150,000—*Colliver, D.*

Kentucky Research Consortium for Energy and Environment, Department of Energy, \$15,000—*Price, S.*

Kentucky Research Consortium for Energy and Environment (KRCEE), Department of Energy, \$495,000—*Price, S.*

KY IDEa Network of Biological Excellence (KBRIN), University of Louisville, \$289,500—*Farman, M.*

Light Sheet Microscope, Office of the Director, \$597,054—*Palli, S.*

Mechanisms of Oxacycle- and Olefin-installing Iron/20(oxo)glutarate Oxygenases, Pennsylvania State University, \$64,594—*Schardl, C.*

Ovulation and Luteal Formation in Rodents, Monkeys, and Women, National Institute of Child Health and Human Development, \$1,206,466—*Bridges, P.*

Reconciling Nanoceria's Jekyll and Hyde Reputation Toward Safer Nanotherapy, National Institute of General Medical Sciences, \$333,437—*Umrine, J.*

Southeast Center for Agricultural Health and Injury Prevention, National Institute of Occupational Safety and Health, \$1,118,837—*Namkoong, K., Purschwitz, M., Vincent, S.*

University of Kentucky - Summer Academy - GEAR UP KY 3.0 Yr5, KY Council on Postsecondary Education, \$250,000—*Grabau, L., Vincent, S.*

*Only College of Agriculture co-investigators are listed.

Intellectual Property

GenBank Register

Entomology

- Desneux, N., and J.A. White. Uncultured *Candidatus Hamiltonella* sp. clone AfabHam1 16S ribosomalRNA gene, partial sequence. Accession KT336569.
- Desneux, N., and J.A. White. Uncultured *Serratia* sp. clone ApomSer1 16S ribosomal RNA gene, partial sequence. Accession KT336570.
- Desneux, N., and J.A. White. Uncultured *Candidatus Hamiltonella* sp. clone BbraHam1 16S ribosomal RNA gene, partial sequence. Accession KT336571.
- Desneux, N., and J.A. White. Uncultured *Candidatus Hamiltonella* sp. clone MeupHam1 16S ribosomal RNA gene, partial sequence. Accession KT336572.
- Desneux, N., and J.A. White. Uncultured *Candidatus Hamiltonella* sp. clone MrosSer1 16S ribosomal RNA gene, partial sequence. Accession KT336573.
- Jennifer White had 33 additional accessions.

Plant Pathology

- Bradley, C.A. *Cercospora soja* S9 genome scaffold Csoj_1. Accession AHPQ01000001.1.
- Bradley, C.A. *Cercospora soja* S9 genome scaffold Csoj_2. Accession AHPQ01000002.1.
- Bradley, C.A. *Cercospora soja* S9 genome scaffold Csoj_3. Accession AHPQ01000003.1.
- Bradley, C.A. *Cercospora soja* S9 genome scaffold Csoj_4. Accession AHPQ01000004.1.
- Bradley, C.A. *Cercospora soja* S9 genome scaffold Csoj_5. Accession AHPQ01000005.1.
- Carl Bradley had 1,799 additional accessions.
- Farman, M.L. *Magnaporthe oryzae* BdBar16-1, whole genome scaffold00001. Accession LXON01000001.1.
- Farman, M.L. *Magnaporthe oryzae* BdJes16-1, whole genome scaffold00001. Accession LXOO01000001.1.

- Farman, M.L. *Magnaporthe oryzae* B71, whole genome scaffold00001. Accession LXOP01000001.1.
- Farman, M.L. *Magnaporthe oryzae* BdMeh16-1, whole genome scaffold00001. Accession LXOQ01000001.1.
- Farman, M.L. *Magnaporthe oryzae* BdMeh16-1, whole genome scaffold00002. Accession LXOQ01000002.1.
- Mark Farman had 23,342 additional accessions.
- Schardl, C.L. *Epichloe festucae* Fl1 genomic scaffold scaffold00001. Accession KV751188.1.
- Schardl, C.L. *Epichloe festucae* Fl1 genomic scaffold scaffold00002. Accession KV751189.1.
- Schardl, C.L. *Epichloe festucae* Fl1 genomic scaffold scaffold00003. Accession KV751190.1.
- Schardl, C.L. *Epichloe festucae* Fl1 genomic scaffold scaffold00004. Accession KV751191.1.
- Schardl, C.L. *Epichloe festucae* Fl1 genomic scaffold scaffold00005. Accession KV751192.1.
- Christopher Schardl had 124 additional accessions.
- Vaillancourt, M.J. *Colletotrichum graminicola* M5.001 genome contig00001. Accession MRBI01000001.1.
- Vaillancourt, M.J. *Colletotrichum sublineola* CgS11 genome scaffold00001. Accession MQVQ01000001.1.
- Vaillancourt, M.J. *Colletotrichum fioriniae* isolate HC557 glyceraldehyde-3-phosphate dehydrogenase (GAPDH) gene, partial cds. Accession KX161774.1.
- Vaillancourt, M.J. *Colletotrichum fioriniae* isolate HC557 beta-tubulin (TUB2) gene, partial cds. Accession KX161773.1.
- Vaillancourt, M.J. *Colletotrichum fioriniae* KY95 beta-tubulin (TUB2) gene, partial cds. Accession KT777705.1.
- Lisa Vaillancourt had 9,047 additional accessions.

Veterinary Science

- Balasuriya, U.B.R., and E. Bailey. Whole genome sequences for three horses. Accession SRX1097022.

- Balasuriya, U.B.R., and E. Bailey. Whole genome sequences for three horses. Accession SRX1097495.
- Balasuriya, U.B.R., and E. Bailey. Whole genome sequences for three horses. Accession SRX1097492.

Gene Expression Omnibus

Animal and Food Sciences

- Cerny, K.L., R.A.C. Ribeiro, and P.J. Bridges. Effect of lipopolysaccharide (LPS) on the expression of inflammatory mRNAs and microRNAs in the mouse oviduct. Accessions GSE89096, GSE89094, and GSE89095.

Patents Issued

Biosystems and Agricultural Engineering

- Nokes, S., B.C. Lynn, S. Rankin, B. Knutson, M. Montross, and M. Flythe. On-farm integrated high-solids processing system for biomass. Patent 9,376,697. Issued June.

Entomology

- Haynes, K., P. Michael, C. Loudon, R. Corn, and M. Szyndler. Microfabricated surfaces for the physical capture of insects. Patent 9,468,203. Issued October.

Kentucky Tobacco Research and Development Center

- Indu, M., and N. Dey. Unique nucleic acid promoter formed from two or more promoter sequences. Patent 9,322,028. Issued April.

Plant Pathology

- Dewey, R.E., B. Siminszky, S.W. Bowen, and L. Gavilano. Alteration of tobacco alkaloid content through modification of specific cytochrome P450 genes. Patents 9,228,194, 9,228,195. Issued January.

Publications

All publication dates are 2016 unless otherwise noted.

Annual Report

- One Hundred and Twenty-eighth Annual Report of the Kentucky Agricultural Experiment Station, 2016.* College of Agriculture, Food and Environment, University of Kentucky, Rick Bennett, Director.

Books and Book Chapters

Agricultural Economics

- Freshwater, D. Economic transformations: Understanding the determinants of rural growth. Chapter 8, pp. 99–107. IN: D. Brown and M. Shucksmith, ed. *Routledge International Handbook of Rural Studies*. Routledge, NY.
- Garcilazo, E., S. Marta, A. Rodriguez-Pose, and D. Freshwater. *Adopting a Territorial Approach to Food Security*. OECD Publishing, Paris.
- Krawchenko, T., A. Schumann, and D. Freshwater. *Governance of Land Use in Poland*. OECD Publishing, Paris.

- Noguera, J., and D. Freshwater. Rural-urban in a peri-urban context. Chapter 11, pp. 133–142. IN: D. Brown and M. Shucksmith, ed. *Routledge International Handbook of Rural Studies*. Routledge, NY.
- Weber, B., and D. Freshwater. The death of distance? Networks, the costs of distance and urban-rural interrelationships. Chapter 13, pp. 154–164. IN: D. Brown and M. Shucksmith, ed. *Routledge International Handbook of Rural Studies*. Routledge, NY.

Animal and Food Sciences

- Dwyer, R.M. Equine zoonoses: Consequences of horse-human interactions. Chapter 25, pp. 643–657. IN: A. Sing, ed. *Zoonoses—Infections Affecting Humans and Animals: Focus on Public Health Aspects*. Springer Publishing, Dordrecht, Germany.
- Hennig, B., M.C. Petriello, B.J. Newsome, J.T. Perkins, and D. Liu. Chapter 3. Antioxidant

- therapy against environmental pollutants and associated diseases. Part 4: Nutritional antioxidant intervention against environmental pollution. IN: *Nutritional Antioxidant Therapies: Treatments and perspectives*. Springer-Verlag, Germany.
- Jacob, J.P., and A.J. Pescatore. Assessing the sustainability of organic egg production. Chapter 12. IN: J. Roberts, ed. *Achieving sustainable cultivation of eggs*. Volume 2. Burleigh Dodds Science Publishing Limited. ISBN-print 978-1-78676-080-7.

Biosystems and Agricultural Engineering

- Agouridis, C.T., and T.M. Sanderson. Understanding ecosystems and their services through Apollo 13 and Bottle Models. Chapter 10, pp. 89–96. IN: L.B. Byrne, ed. *Learner-Centered Teaching Activities for Environmental and Sustainability Studies*. Published online: doi:10.1007/978-3-319-28543-6.

Croftcheck, C. Light scattering applications in milk and dairy processing in light scattering technology for food property, quality and safety assessment. Pp. 319-330. IN: Renfu Lu, ed. CRC Press, Boca Raton, FL. Published online: doi:10.1201/b20220-13.

Dutta T., J. Shi, J. Sun, X. Zhang, G. Cheng, B.A. Simmons, and S. Singh. Ionic liquid pre-treatment of lignocellulosic biomass for biofuels and chemicals. IN: *Ionic Liquids in the Biorefinery Concept: Challenges and Perspectives*. Rafal Bogel-Lukasik edition. Royal Society of Chemistry.

Zheng, Y., J. Shi, M. Tu, and Y.S. Cheng. Principles and development of lignocellulosic biomass pretreatment for biofuels. IN: Yebo Li, ed. *Advances in Bioenergy*. Elsevier.

Community and Leadership Development

McLaughlin, B., Hull, S., Namkoong, K., Shah, D. V., D. H. Gustafson. We all scream for ice cream: Physical desires and positive identity negotiation in the face of cancer. Pp. 81-98. IN: A. Novak and I.J. El-Burki, ed. *Defining Identity and the Changing Scope of Culture in the Digital Age*. IGI Global, Hershey, PA.

Dietetics and Human Nutrition

Stephenson, T.J., and W.J. Schiff. *Human Nutrition: Science for Healthy Living*. Revised edition. McGraw-Hill Publishing.

Entomology

Fulton, S., L.E. Dodd, and L.K. Rieseke. Evaluating the energetic value of lepidopteran bat prey using bomb calorimetry. Pp. 85-90. IN: S.R. Trimboli, L.E. Dodd, and D. Young, ed. *Celebrating Diversity of Research in the Mammoth Cave Region*. 10th Research Symposium. Mammoth Cave National Park, Kentucky

Haynes, K. F. Genetic control of moth sex pheromone signal and response. Pp. 89-100. IN: J.D. Allison and R.T. Cardé, ed. *Pheromone Communication in Moths: Evolution, Behavior and Application*. University of California Press.

Palli, S.R. Applications of RNAi to control insect pests. IN: A. Chakravarty and S. Sridhara, ed. *Arthropod Diversity in the Tropics and Sub-tropics*. Springer.

Forestry and Natural Resources

Griffitts, R., L.E. Dodd, and M.J. Lacki. The activity of *Myotis sodalis* and *Myotis septentrionalis* changes on the landscape of Mammoth Cave National Park following the arrival of white-nose syndrome. Pp. 70-75. IN: S.R. Trimboli, L.E. Dodd, and D. Young, ed. *Celebrating Diversity of Research in the Mammoth Cave Region*. 10th Research Symposium. Mammoth Cave National Park, Kentucky.

Stringer, J. Oak regeneration challenges. Chapter 6m, pp. 63-72. IN: P. Keyser, T. Fearer, C.A. Harper, ed. *A Practical Guide to Managing Oak Forests in the Eastern United States*. CRC Press. ISBN: 13:978-1-4987-4287-0.

Horticulture

Antonious, G.F. Soil amendments for agricultural production. Chapter 7, pp. 157-187. IN: M.L. Larramendy and S. Soloneski, ed. *Organic Fertilizers: From Basic Concepts to Applied Outcomes*. Intech, Rijeka, Croatia. ISBN 978-953-51-4701-5.

Landscape Architecture

Brent, J., M. Campbell Brent, N. Crankshaw, E. Heavrin, and K. Hudson. *Federal Stewardship of Confederate Dead*. U.S. Department of Veterans Affairs, Washington D.C.

Plant and Soil Sciences

Arndt, D., and J.M. Unrine. Redox interactions between nanomaterials and biological systems. Chapter 7, pp. 188-205. IN: T. Dziubla and D.A. Butterfield, ed. *Oxidative Stress and Biomaterials*. Elsevier, Philadelphia, PA.

Fukushige, H., and D. Hildebrand. Hemp (*Cannabis sativa* L.). Chapter 11.3, pp. 291-299. IN: T. McKeon, D. Hayes, D. Hildebrand, and R. Weselake, ed. *Industrial Oil Crops*. Academic Press, Elsevier, Burlington, MA.

Hayes, D.G., and D. Hildebrand. Perilla (*Perilla frutescens*). Chapter 11.9, pp. 328-332. IN: T. McKeon, D. Hayes, D. Hildebrand, and R. Weselake, ed. *Industrial Oil Crops*. Academic Press, Elsevier, Burlington, MA.

Lee, B.D., and J. Kabrick. East and central farming and forest region and Atlantic basin diversified farming region: Land resource regions N and S. Chapter 12, pp. 227-241. IN: L.T. West, M.J. Singer, A.E. Hartemink, ed. *Soils of the USA*. Springer, New York, NY.

McKeon, T.A., D.G. Hayes, D.F. Hildebrand, and R.J. Weselake. Introduction to industrial oilseed crops. Introduction, pp. 1-13. IN: T. McKeon, D. Hayes, D. Hildebrand, and R. Weselake, ed. *Industrial Oil Crops*. Academic Press, Elsevier, Burlington, MA.

Mouneyrac, C., J.M. Unrine, L. Giamberini, O.V. Tsyusko, C. Santaella, R.T. DiGiulio, and F. Schwab. Ecotoxicology principles for manufactured nanomaterials. Chapter 2:5, pp. 141-175. IN: M. Weisner and J.-Y. Bottero, ed. *Environmental Nanotechnology, Applications and Impacts of Nanomaterials*. Second edition. McGraw-Hill Education, New York, NY.

Rienzi, E.A., B. Mijatovic, C.J. Matocha, F.J. Sikora, and T.G. Mueller. Use of spectral data from on-the-go multispectral cameras to monitor soil surface moisture: The partial least square regression for data mining, analysis, and prediction. Chapter 6. IN: M.R. Goyal, S. Nambuthri, and R. Koech, ed. *Technological Interventions in Management of Irrigated Agriculture*. Apple Academic Press, Waretown, NJ.

Serson, W., M. AL-Amery, S. Patel, T. Phillips, and D. Hildebrand. Chia (*Salvia hispanica*). Chapter 11.1, pp. 278-287. IN: T. McKeon, D. Hayes, D. Hildebrand, and R. Weselake, ed. *Industrial Oil Crops*. Academic Press, Elsevier, Burlington, MA.

Plant Pathology

Bradley, C.A. Diplodia (Stenocarpella) leaf streak. Pp. 45-46. IN: G.P. Munkvold and D.G. White, ed. *Compendium of Corn Diseases*. Fourth edition. The American Phytopathological Society, St. Paul, MN.

Kachroo, P., G.H. Lim, and A. Kachroo. Nitric oxide-mediated chemical signaling during systemic acquired resistance. Pp. 245-261. IN: D. Wendehenne, ed. *Nitric Oxide and Signaling in Plants*. Volume 77. Academic Press Ltd-Elsevier Science Ltd, London.

Mueller, D., K. Wise, A. Sisson, D. Smith, E. Sikora, C. Bradley, and A. Robertson, ed. *A Farmer's Guide to Soybean Diseases*. The American Phytopathological Society, St. Paul, MN.

Sasvari, Z., and P.D. Nagy. Exploration of plant virus replication inside a surrogate host, *Saccharomyces cerevisiae*, elucidates complex and conserved mechanisms. Pp. 35-65. IN: A. Wang and X. Zhou, ed. *Current Research Topics in Plant Virology*. Springer International Publishing, Cham, Switzerland. Published online: doi:10.1007/978-3-319-32919-2_2.

Wise, K., D. Mueller, A. Sisson, D. Smith, C. Bradley, and A. Robertson, ed. *A Farmer's Guide to Corn Diseases*. The American Phytopathological Society, St. Paul, MN.

Veterinary Science

Adams, A.A., and D.W. Horohov. The immune system of the older horse. Chapter 3, pp. 23-29. IN: M.J.B. Felipe, ed. *Equine Clinical Immunology*. John Wiley and Sons.

Balasuriya, U.B.R. Equine arteritis virus. Chapter 31, pp. 277-285. IN: D. Liu, ed. *Molecular Detection of Animal Viral Pathogens*. CRC Press, Boca Raton, FL.

Balasuriya, U.B.R. *Arteriviridae* and *Roniviridae*. Chapter 25, pp. 463-476. IN: N.J. MacLachlan and E.J. Dubovi, ed. *Fenner's Veterinary Virology*. Academic Press, Elsevier, Burlington, MA.

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Balasuriya, U.B.R., and W.K. Reisen. *Flaviviridae*. Chapter 30, pp. 525-545. IN: N.J. MacLachlan and E.J. Dubovi, ed. *Fenner's Veterinary Virology*. Academic Press, Elsevier, Burlington, MA.

Chambers, T.M., and U.B. Balasuriya. Equine influenza. Chapter 44, pp. 383-392. IN: D. Liu, ed. *Molecular Detection of Animal Viral Pathogens*. CRC Press, Boca Raton, FL.

Graves, K. The code behind the color. Pp. HS-520 1-HS-520 16. IN: *Horse Smarts Reference Manual*. American Youth Horse Council, McDonald, NM.

Leroux, C., and R.F. Cook. Equine infectious anaemia virus. Chapter 20, pp. 177-190. IN: D. Liu, ed. *Molecular Detection of Animal Viral Pathogens*. CRC Press, Boca Raton, FL.

Swerczek, T. Tyzzer's disease. Pp. 199-201. IN: S.E. Aiello, M.A. Moses, and D.G. Allen, ed. *The Merck Veterinary Manual*. Merck, Kenilworth, NJ.

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Progress Reports

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PR-707: 2016 Kentucky Small Grains Variety Performance Test

PR-708: 2016 Kentucky Hybrid Corn Performance Test

PR-709: 2016 Alfalfa Report

PR-710: 2016 Red and White Clover Report

PR-711: 2016 Orchardgrass Report

PR-712: 2016 Tall Fescue and Bromegrass Report

PR-713: 2016 Timothy and Kentucky Bluegrass Report

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Dwanyen, L., and J.D. Hans. Attitudes toward postpartum depression based on risk factors and diagnosis. Presentation, National Council on Family Relations Annual Conference, Minneapolis, MN. November.

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Harris, C., A.T. Vazsonyi, H. Phagava, K. Pagava, and P.A. Michaud. Extracurricular activities and problem behaviors: Mediating effects by sleep functioning among Georgian and Swiss adolescents. Poster, Society for Research on Adolescence Biennial Meeting, Baltimore, MD. March.

Heath, C.J. Consumer vitality with an eroding middle-class: Possibility or pipe dream? Keynote Presentation, Family Economics and Resource Management Conference, New Orleans, LA. March 10.

Hosier, A.F. Keys to embracing aging: What we learn from centenarians. Presentation, Midwest Women in Agriculture Conference, Columbus, IN. February.

Hosier, A.F., and A. Rist. UK Cooperative Extension and the trauma program Stand Up to Falling. Presentation, Kentucky Fall Prevention State Summit, Lexington. August.

Hunter, J.L. Planning for tomorrow: Estate planning considerations. Presentation, Association of Financial Counselors, Planners, and Educators. November.

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- Shin, S., H. Kim, C.J. Heath, and T. Higgins. Retirement savings: A new approach from self-regulation. American Council on Consumer Interests (ACCI) Annual Conference, Washington, D.C. June 9.
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- Zurlo, K., S. Shin, and H. Kim. Retiring poor in New Jersey: The projected expenditures on government programs for older adults. AARP State Retirement Savings Resource Center.
- Zurlo, K., W. Yoon, and H. Kim. Adult children's long term care experiences and their ownership of long term care insurance. Presentation, 69th Annual Scientific Meeting of Gerontological Society of America, New Orleans, LA. November 16–20.
- ### Forestry and Natural Resources
- Arant, P.L., M.J. Lacki, J.M. Lhotka, and J.W. Stringer. Effects of shelterwood harvests and patch cuts on habitat use of *Myotis* species in the central Appalachians. Presentation, Forestland Group LLC, Charleston, WV.
- Conners, T.E. How to be successful with your small hardwood sawmill. Presentation, New England Kiln Drying Association, Shelburne, New Hampshire. November.
- Conners, T.E. Introduction to railroad crosstie production and grading. Presentation, New England Kiln Drying Association, Shelburne, NH. November.
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- Cox, J.J. Capturing white-tailed deer fawns. Kentucky Afield TV series. Published online: <https://www.youtube.com/watch?v=faBVN9BdiOQ>.
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- Cox, J.J. Going wild with science. Presentation, UK STEMcats program. Oct 10.
- Dement, W., J.M. Lhotka, C.D. Barton, and J.W. Stringer. Effect of grading on productivity of high-value tree species in Appalachian surface mines. Society of American Foresters National Convention, Madison, WI. November 2 to 5.
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- Freitag, R., L. Ribeiro, M. Contreras, J. Stringer, C. Osborne, C. Reeves. 2015. Evaluating the feasibility of using a security camera system for time and motion studies of timber harvesting equipment. Poster, 38th Annual Council on Forest Engineering (COFE) Meeting, Lexington.
- Freytag, S.B., S.J. Price, S.J. Bonner, B.L. Muncy, A.N. Drayer, and C.D. Barton. Occupancy dynamics of stream salamanders in degraded and reference headwater streams. Association of Southeastern Biologists Annual Meeting, Concord, NC. March 30–April 2.
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- Gauntt, J., T.E. Conners, R. Pearce, and B. Crawford. Tie grading guide app for iPhone and Android platforms, beta version (programming by Western Wood Preservers Institute staff). Released for public use September 2016.
- Griffitts, R., L.E. Dodd, and M.J. Lacki. The activity of *Myotis sodalis* and *Myotis septentrionalis* changes on the landscape of Mammoth Cave National Park following the arrival of white-nose syndrome. 10th Research Symposium, Mammoth Cave National Park, KY.
- Haymes, C., J. McDermott, J. Hast, G. Jenkins, W. Bowling, K. Sams, and J.J. Cox. White-tailed deer fawn survival in a southeastern Kentucky population. 39th Annual Southeastern Deer Study Group Meeting, Raleigh, NC. February 15–18.
- Lacki, M.J. Biology, ecology and natural history of threatened and endangered bats in Kentucky. Keynote Speaker. Symposium on Bats and Forest Management in a Changing Environment: A Workshop/Training for Land Managers, Kentucky Chapter of The Wildlife Society, Richmond, KY.
- Lhotka, J.M. Disturbance dynamics in upland oak forests with specific reference to the charcoal iron industry. 36th Annual Central States Forest Soils Workshop, Aurora, KY. October 11.
- Lhotka, J.M. Forest community patterns and regeneration ecology of oak-dominated forests within Land between the Lakes. 36th Annual Central States Forest Soils Workshop, Aurora, KY. October 11.
- Lhotka, J.M., R.A. Cunningham, and J.W. Stringer. Effect of silvicultural gap size on long-term species growth, stand yield, and economic value in upland *Quercus* dominated stands. Presentation, 10th IUFRO International Workshop on Uneven-aged Silviculture, Little Rock, AR. May 31–June 2.
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- McDermott, J.R., C.A. Haymes, G. Jenkins, W. Bowling, J.T. Hast, K. Sams, and J.J. Cox. Southeastern Kentucky white-tailed deer project update. Oral presentation. Midwestern Deer and Turkey Study Group Meeting, General Butler State Resort Park, KY. August 22–25.
- McKenzie, J.M. S.J. Price, L.J. Fleckenstein, A.N. Drayer, and J.M. Lorch. Assessment of snake fungal disease in Kentucky. Association of Southeastern Biologists Annual Meeting, Concord, NC. March 30–April 2.
- Price, S.J. Patterns and processes in urban environments allow for unique ecological investigations: A herpetological perspective. Experimental Urban Ecology Workshop, Ecological Research and Education Center, University of Kentucky, Lexington. November 12.
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- Shaffer, J.D., D.J. Reed, C.P. Bate, S.K. Gleeson, and J.J. Cox. Prescribed fire impacts on tree seedling growth in a Kentucky Bluegrass Savanna-Woodland remnant. Ecological Society of America (ESA) Annual Meeting, Ft. Lauderdale, FL.
- Shaffer, J.D., D.J. Reed, C.P. Bate, S.K. Gleeson, and J.J. Cox. Prescribed fire impacts on tree seedling growth in a Kentucky Bluegrass Savanna-Woodland remnant. 2016 Joint Meeting of the Kentucky and Tennessee Prescribed Fire Councils, Ft. Campbell, KY.
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- Slabach, B. and J.J. Cox. All in the family? Linking sociality and relatedness to group dynamics of large mammals. Annual Meeting of The Wildlife Society, Raleigh, NC.
- Slusher, A., J. Johnson, M. Lacki, and J. Treanor. Altitude- and sex-specific variation in roosting behavior and thermoregulation of *Myotis lucifugus*. 96th Annual Meeting of the American Society of Mammalogists, Minneapolis, MN.
- Slusher, A., J. Johnson, M. Lacki, and J. Treanor. Microclimates of roosting structures and the influence on thermoregulation and behavior in female *Myotis lucifugus*. Bat Research News 57:97.

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Lacki, M.J. Biology, ecology and natural history of threatened and endangered bats in Kentucky. Keynote speaker. Symposium on Bats and Forest Management in a Changing Environment: A Workshop/Training for Land Managers, Kentucky Chapter of The Wildlife Society, Richmond, KY.

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Plant and Soil Sciences

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Bailey, A. Thinking ahead for topping and sucker control in burley tobacco. *Burley Stabilization Corporation Grower newsletter*, June.

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Smith, S.R., K. Lea, and R. Watson. High quality forages for horses: Recommendations for pasture and hay. Proceedings, 6th Korea-Japan-China Grassland Conference. Jeju Island, Korea. August 17–21.

Smith, S.R. Summary of plenary and keynote presentations: Sessions 1–3. Proceedings, 10th

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Smith, S.R. Low "reduced" lignin alfalfa: advantages for hay and grazing. Proceedings, Heart of America Grazing Conference. Lexington. January 25–26.

Smith, S.R. Novel endophyte varieties: What's the difference? Proceedings, Forages at KCA Annual Meeting, Owensboro, KY. January 16.

Kadnar, A., K. Lea, C. Gaskill, L. Smith, and S.R. Smith. Ergovaline stability in stored tall fescue samples. Proceedings, American Forage and Grassland Conference. Baton Rouge, LA. January 10–13.

Smith, S.R. Similarities and differences of novel endophyte varieties. Proceedings, American Forage and Grassland Conference. Baton Rouge, LA. January 10–13.

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Plant Pathology

Mueller, D.S., K.A. Wise, A.J. Sisson, T.W. Allen, G.C. Bergstrom, D.B. Bosley, C.A. Bradley, K.D. Broders, E. Byamukama, and M.I. Chilvers, et al. Corn yield loss estimates due to diseases in the United States and Ontario, Canada, from 2012 to 2015. *Plant Health Progress* 17:211–222. Published online: doi:10.1094/PHP-RS-16-0030.

Veterinary Science

Adams, A.A. Evaluating seasonal influences on hormone responses to a diagnostic test (thyrotropin-releasing hormone stimulation) advocated for early diagnosis of pituitary pars intermedia dysfunction. Proceedings, 62nd Annual Convention of the American Association of Equine Practitioners, Orlando, FL. December 3–7.

Adams, A.A. Immunosenescence and how it affects care of the older horse. Proceedings, 62nd Annual Convention of the American Association of Equine Practitioners, Orlando, FL. December 3–7.

Bailey, E. Commentary on genomic tools and horse diseases. *Equine Disease Quarterly* 25(4):1.

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Dominguez, M., S. Munstermann, and P. Timoney. International horse movements and disease risk. *European Trainer* 54:73–74, 76–77.

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Esteller-Vico, A. How to interpret endocrine diagnostics for the subfertile mare. Proceedings, 62nd Annual Convention of the American Association of Equine Practitioner, Orlando, FL. December 3–7.

Esteller-Vico, A. Using progesterone as a diagnostic tool during equine pregnancy. *Equine Disease Quarterly* 25(3):4–5.

- Fabiani, J., E. Lyons, and M. Nielsen. Parasite dynamics in naturally infected and untreated horse foals. Proceedings, 61st Annual Meeting of the American Association of Veterinary Parasitologists, San Antonio, TX. August 6–9.
- Horohov, D. Foal immunity: Clinical applications. Proceedings, 62nd Annual Convention of the American Association of Equine Practitioners, Orlando, FL. December 3–7.
- Leathwick, D., S.C.J. Donecker, M. Nielsen, and T. Geurden. Equine cyathostomins: Modelling biology and drug resistance. Proceedings, 61st Annual Meeting of the American Association of Veterinary Parasitologists, San Antonio, TX. August 6–9.
- Morales, A., A. Méndez, K. Brewer, C. Huges, and T. Tobin. Detection of prohibited substances and their consequences for the horse industry. Proceedings, First Congress of the Veterinary Science and Food Science and Technology, Cordoba, Spain.
- Nielsen, M., K. Krebs, J. Bellaw, J. Scare, H. Gravatte, and C.R. Reinemeyer. Larvicidal efficacy against mucosal equine strongyles. Proceedings, 61st Annual Meeting of the American Association of Veterinary Parasitologists, San Antonio, TX. August 6–9.
- Nielsen, M., D. Leathwick, C. Saueremann, J. Donecker, and T. Geurden. How equine parasitology computer models become handy for both testing and generating hypotheses. Proceedings, 61st Annual Meeting of the American Association of Veterinary Parasitologists, San Antonio, TX. August 6–9.
- Nielsen, M.K. It's sexy and it glows: The value of a smartphone-based parasite egg counting system. Proceedings, 62nd Annual Convention of the American Association of Equine Practitioner, Orlando, FL. December 3–7.
- Nielsen, M.K. Management of the horse with pinworm. Proceedings, British Equine Veterinary Association Congress, Birmingham, England. September 6–10.
- Nielsen, M.K. Potential re-emergence of the large strongyles. Proceedings, British Equine Veterinary Congress, Birmingham, England. September 6–10.
- Saueremann, C., J. Donecker, M. Nielsen, D. Leathwick, and T. Geurden. Equine *Parascaris* spp.: Modelling biology and drug resistance. Proceedings, 61st Annual Meeting of the American Association of Veterinary Parasitologists, San Antonio, TX. August 6–9.
- Scare, J., E. Lyons, and M. Nielsen. Combination deworming: A possible solution or source of exacerbation for the disappearing drug classes? Proceedings, 61st Annual Meeting of the American Association of Veterinary Parasitologists, San Antonio, TX. August 6–9.
- Scare, J., P. Slusarewicz, J. Bellaw, M. Noel, and M. Nielsen. Accuracy and precision of a smartphone-based parasite egg count system. Proceedings, 61st Annual Meeting of the American Association of Veterinary Parasitologists, San Antonio, TX. August 6–9.
- Smith, J. Syndromic surveillance and spatial epidemiology. *Equine Disease Quarterly* 25(2):4–5.
- Timoney, P. The asymptomatic carrier stallion: Critical role in venereal disease transmission. *Equine Disease Quarterly* 25(4):4–5.
- Timoney, P. White paper: International threat from spread of selected equine diseases. Proceedings, NIAA/USAHA Equine Diseases Forum, Denver, CO. January 19–21.
- Timoney, P. Vector-borne diseases and the emergent threat they pose. *Equine Disease Quarterly* 25(3):3.
- Timoney, P.J. White paper: Disease risks associated with international movement of equine. Proceedings, NIAA/USAHA Equine Diseases Forum, Denver, CO. January 19–21.
- Timoney, P.J. Getah virus. DEFRA/AHT/BEVA Equine Quarterly Disease Surveillance Reports 12(2):11–14.
- Timoney, P.J. Vesicular stomatitis. DEFRA/AHT/BEVA Equine Quarterly Disease Surveillance Reports 12(1):16–19.
- Troedsson, M.H.T. Untitled response. *Reproduction in Domestic Animals* 51(2):336.

Graduate Degrees

Degrees listed are from the 2016 spring semester, 2016 second summer session, and 2016 fall semester.

Ph.D. Dissertations

Agricultural Economics

- Hu, Xiaowen.* Income and physical activity choices: A comparison between United States and China.
- Li, Xile.* Price analysis under production differentiation in green coffee markets.
- Wang, Xiaojin.* Essays on agricultural market and policies: Imported shrimp, organic coffee, and cigarettes in the United States.
- Zhong, Hua.* Essays on farmer willingness to participate in best management practices in the Kentucky River watershed.

Animal and Food Sciences

- Fisher, Tatijana.* Specialty poultry production: Impact of genotype, feed strategies, alternative feedstuffs, and dietary enzymes on the growth performance and carcass characteristics of heritage breed chickens.
- Murphy, Sean.* Ecology of two reintroduced black bear populations in the central Appalachians.
- Yang, Jiayi.* Relative reactivity of protein and lipid to oxidants in different bi-phasic systems and its implication in sausage quality.

Biosystems and Agricultural Engineering

- Schiavone, Drew F.* Heat and mass transfer in baled switchgrass for storage and bioconversion applications.

Entomology

- Crawley, Sydney.* The chemical ecology of bed bugs (*Cimex lectularius*, L.) and the impact of a neurotoxic insecticide on physiology and behavior.
- Dye, Kyndall.* Subacute effects of Prallethrin on behavior of mosquitoes (Diptera: Culicidae) and other human disease vectors.
- Goodman, Mark.* Endosymbiotic bacteria in the bed bug, *Cimex lectularius* L. (Hemiptera: Cimicidae).
- Gujar, Hemant.* Hormonal and nutritional regulation of molting, metamorphosis, and reproduction in bed bugs, *Cimex lectularius*.
- Jackson, Kelly.* Variable consequences of toxic prey on generalist insect predators.
- McNamara, Timothy D.* The manipulation and examination of *Wolbachia* in medically important mosquitos.
- Penn, Hannah.* Effects of landscape, intraguild interactions, and a neonicotinoid on natural enemy and pest interacts in soybean.
- Pook, Victoria.* Investigating Ichneumonidae: Insights into species identification and venom composition.

Family Sciences

- Mains, M.* Hosting an International Exchange youth: The influence on the family.
- Jackson, K.* Secrecy in the context of romantic relationships.

Forestry and Natural Resources

- Biennmüller, Richard.* Influence of structural disturbance on stream function and macroinvertebrate communities in Upper Coastal Plain headwater streams.
- Murphy, Sean.* Ecology of two reintroduced black bear populations in the central Appalachians.

Horticulture

- Roy, Sutapa.* Polyphenol content and differential expression of flavonoid biosynthetic pathway genes of *Fragaria* spp. with white fruit.
- Tateno, Mizuki.* Cellulose biosynthesis in *Setaria viridis* as a model organism for C4 Panicoideae.
- Brabham, Chad.* Chemical genetic dissection of cellulose biosynthesis.

Plant and Soil Sciences

Integrated Plant and Soil Sciences

- Starnes, D.* The effects of manufactured nanomaterial transformations on bioavailability, toxicity, and transcriptomic responses of *Caenorhabditis elegans*.

Soil Science

- An, R.* Studies on the PQQ-Dependent phosphate solubilization among rhizosphere dwelling bacteria.
- Lewis, R.* Toxicity of engineered nanomaterials to plant growth promoting rhizobacteria.
- Liu, S.* Tillage and fertilization influences on autotrophic nitrifiers in agricultural soil.
- Slaughter, L.* Effects of *Epiclloë coenophiala*-tall fescue symbiosis on plant-microbe-soil interactions in a temperate pasture.

Plant Physiology

- Kempinski, C.* Insights into triterpene metabolism in model monocotyledonous and oilseed plants genetically engineered with genes from *Botryococcus braunii*.
- Schluttenhofer, C.* Transcriptional regulation of specialized metabolites in *Arabidopsis thaliana* and *Catharanthus roseus*.

Plant Pathology

- Eid, Mohammed A.A.* Understanding the molecular mechanisms underlying RSV1 mediated resistance to SMV in soybean.
- El-Shetehy, Mohamed H.* Molecular and biochemical signaling underlying arabidopsis-bacterial/virus/fungal interactions.
- Lim, Gah-Hyun.* Role of Plasmodesmata localizing—and double-stranded RNA binding—proteins in systemic immunity and plant defense.
- Viana Xavier, Katia.* Genetic diversity of *Colletotrichum sublineola* on sweet sorghum and wild sorghum relatives in Kentucky and the Southeastern U.S.

Veterinary Science

- Thampi, Parvathy.* Role of skeletal paracrine signals in the proliferation and chondrogenic differentiation of interzone cells.
- Adam, Emma.* Differential gene expression in equine cartilaginous tissues and induced chondrocytes.

M.S. Theses

Agricultural Economics

- Almojel, Suliman Abdulaziz S.* Characteristics of United States seafood consumers.
- Asgari, Ali.* Legitimacy of local food in the U.S. market: Comparative consumer perspectives.
- Cui, Xiuwei.* Determining the value of birthrank and parent age in Thoroughbred racehorses.
- Dong, Hao.* Demand for pork and meat in China.

Hansen, Charlotte Rose. Economic considerations of aggressively treating the influenza virus in equines.

- Ilunga, Yves Tshikunga.* Home cooking and willingness to pay: Local blueberry pancake, muffin, and banana bread mixes in a take-and-bake experiment.
- Johnson, Stephanie M.* The value of Kentucky's equine industry to Kentucky state residents: A contingent valuation study.
- Mattingly, Jesse Wayne.* Coffee in China: Market trend and consumer demand.
- Soley, Graham Taylor.* Farmed and wild-caught shrimp in Kentucky and South Carolina: Consumer preference for Homegrown by Heroes, community supported fishery, and other quality attributes.
- Zhang, Hongyi.* The impact of food recall on third-party certification adoption.
- In addition, three non-thesis master's degrees were awarded in calendar year 2016.*

Animal and Food Sciences

- Latham, Christine.* Effects of dietary amino acid supplementation on measures of whole-body and muscle protein metabolism in aged horses.
- Meng, Luxi.* Acoustic emission of *Lactococcus lactis* ssp. *lactis* C2 infected with three bacteriophages c2, sk1 and ml3.
- Mimiko, Jasmyn.* Relationships between behavioral measures and productivity in finishing beef cattle.
- Pesqueira, Amanda.* Fatty acid profile in ruminal content and blood plasma of finishing beef cattle, supplemented with different sources of fat.
- Pyles, Morgan.* Effect of maternal diet on select fecal bacteria in mares and their foals.
- Smith, Kelsey.* Towards determination of the threonine requirement of yearling horses fed varying dietary compositions using the indicator amino acid oxidation method.
- Wood, Lauren.* Post weaning supplementation of April-born Polypay and White Dorper lambs grazing alfalfa/orchardgrass pasture.

Biosystems and Agricultural Engineering

- Berry, Ashlan.* Development of regional and hydraulic geometry curves for the eastern Kentucky coalfields.
- Empson, Danielle.* Induction of cellulase in high solids cultivation of trichoderma reesei for enhanced enzymatic hydrolysis of lignocellulose.
- Kirtley, Amos B.* Up regulation of heat shock protein 70B (HSP70B) and SSA1 in *Chlamydomonas reinhardtii* via HSP70A-RBCS2 and PSAD promoter.
- Rhea, Nicholas A.* Evaluation of flocculation, sedimentation, and filtration for dewatering of algal biomass.
- Ruwaya, Mathew J.* Automated solid-substrate cultivation of the anaerobic bacterium *Clostridium thermocellum*.
- Singh, Manjot.* Physico-chemical rheological and baking properties of Proso millet.
- Simpson, William S. Jr.* Recirculating calcium hydroxide solution: A practical choice for on-farm high solids lignocellulose pretreatment.
- Williams, Rachel.* Effectiveness of biochar addition in reducing concentrations of selected nutrients and bacteria in runoff.

Wright, Kameryn I. Long-term effects of forestry best management practices on hydrology and water chemistry in three Appalachian headwater catchments.

In addition, one non-thesis master's degree was awarded in calendar year 2016.

Community and Leadership Development

Duwall, Whitney Prather. The evolving role of electric cooperatives in economic development: a case study of Owen Electric Cooperative and Jackson Energy Cooperative.

Dutton, Shari. Change in perceived teacher self-efficacy of agricultural educators after a greenhouse management workshop.

Franklin, Rashawn. An evaluation of the techniques and strategies for recruiting African-Americans by 1862 land-grant universities.

Jenkins, Courtney. Perception, opportunity, empowerment, and policy: Women's influence in Kentucky agriculture.

Kirby, Andrea Taylor. Against the odds: A study of low socioeconomic status students' enrollment in higher education

Tennison, Megan. Identifying the core elements of developing student leaders in a college ambassadors program.

Rowland, Kendra Horn. Work-life balance for agricultural educators in Kentucky.

Russell, Rebecca. Perceptions of secondary agricultural education programs, the National FFA Organization, and agricultural careers of students not enrolled in a high school agricultural program.

Hockersmith, Luci. Comprehensive sexuality education in Kentucky.

Hyden, Heather. Cultivating a culture of food justice: Impacts of community based economies on farmers and neighborhood leaders in the case of fresh stop markets in Kentucky.

Schafbuch, Morgan. Expectancy-value in the enrollment factors of agricultural education youth.

In addition, thirteen non-thesis master's degrees were awarded in calendar year 2016.

Dietetics and Human Nutrition

Butterworth, Brooke F. Promoting healthy eating and physical activity: A qualitative examination of community-based obesity interventions in rural Kentucky.

Dawahare, Mollie Y. Promoting healthy home-cooked family meals: Evaluation of a social marketing program targeting low-income mothers.

Dickens, Emily. Color Your Plate: A pilot nutrition education intervention to increase fruit and vegetable intake among older adults participating in the congregate meal site program in Kentucky senior centers.

Martin, Mandee E. Comparison of quick methods for determining body composition in female collegiate athletes and obese females.

Moore, Shirlena M. Principals' and school food service workers' perceptions of the implementation of the community eligibility provision.

O'Nan, Sean. Evaluation of diet composition of pediatric cancer survivors as a need for nutrition counseling.

Family Sciences

Baity, C. Healthy reintegration: The effectiveness of military teen adventure camp participation on adolescent perceptions of self-efficacy.

Bortz, P. Exploring effectiveness of an affectionate gesture phone app.

Cui, G. Do beliefs about sex behaviors mediate the link between parent-adolescent communication about sex and risky sexual behaviors?

Dwanyen, L. Postpartum depression: The effects of a video intervention on knowledge and stigma.

Gassova, Z. Characteristics and ethics of e-therapy websites with marriage and family therapists.

Hardin, T. Educational experiences of foster children and communication patterns of key stakeholders: The foster parent experience.

King, J. How therapists use and choose mindfulness to treat trauma.

Norwick, J. "Don't Have Sex, You'll Get Pregnant and Die!": Female university students' experiences with abstinence-only education.

Novakova, L. Perception accuracy in predicting actor and partner sexual and relational satisfaction in couple relationships.

Oliver, K. College educated, African American women's marital choices.

Parrett, D. Family dinner across generations: My home times have changed.

Pinsky, I. Attachment quality and sexual satisfaction and functioning in romantic relationships of combat veterans.

Forestry and Natural Resources

Freytag, Sara Beth. Effects of mountaintop removal mining on population dynamics of stream salamanders.

Murphy, Mason. Capture and population structure of *Necturus maculosus* in central and eastern Kentucky.

Oldham, Christian. Investigations in cryptic species: Considerations and applications for estimating detection, occupancy, and abundance of semi-aquatic snakes.

Plant and Soil Sciences

Crop Science

De Oliveira, E. Optimization of doubled haploid production in burley tobacco (*Nicotiana tabacum* L.).

In addition, one non-thesis master's degree was awarded in calendar year 2016.

Integrated Plant and Soil Sciences

Shelton, C. Field evaluations of burley lines containing alleles minimizing nicotine to nornicotine conversion.

Retailing and Tourism Management

Farashahi, Behnoosh. Quality evaluation of denim jeans at three price points.

In addition, four non-thesis master's degrees were awarded in calendar year 2016.

Veterinary Science

Goedde, Lauren. Effects of feeding a yeast-based supplement containing docosahexaenoic acid (DHA) from a heterotrophically grown microalgae, vitamin E, and selenium on stallion sperm motion characteristics.

Graduate Enrollment

Note: Graduate enrollment data are from the UK Office of Institutional Research <http://www.uky.edu/iraa/studentdata/enrollment>.

<http://www.uky.edu/iraa/studentdata/enrollment>

	2015	2016	net chg
Agricultural Economics			
Master's	22	21	-1
Doctorate	27	28	1
Major Total	49	49	0
Animal and Food Sciences			
Master's	28	19	-9
Doctorate	23	28	5
Major Total	51	47	-4
Biosystems and Agricultural Engineering			
Master's	14	13	-1
Doctorate	10	10	0
Major Total	24	23	-1
Entomology			
Master's	14	17	3
Doctorate	18	15	-3
Major Total	32	32	0
Family Sciences			
Master's	20	16	-4
Doctorate	22	19	-3
Major Total	42	35	-7
Forestry and Natural Resources			
Master's	20	20	0
Doctorate*			0
Major Total	20	20	0
Retailing & Tourism Management			
Master's	10	14	4
Doctorate*			0
Major Total	10	14	4
Dietetics and Human Nutrition			
Master's	23	19	-4
Doctorate*			0
Major Total	23	19	-4
Plant Pathology			
Master's	0	3	3
Doctorate	13	19	6
Major Total	13	22	9
Plant and Soil Sciences/Horticulture			
Master's	25	23	-2
Doctorate	40	39	-1
Major Total	65	62	-3
Rural Sociology/Career, Technology and Leadership Education			
Master's	39	33	-6
Doctorate	9		-9
Major Total	48	33	-15
Veterinary Science			
Master's	8	6	-2
Doctorate	17	20	3
Major Total	25	26	1
Grand Total	402	382	-20

*Degree type not offered.

Financial Statement

Statement of Federal Formula Funds

Fiscal Year 2016

Income

Federal Funds	
Hatch	5,918,715
Hatch Multi-State	1,193,496
McIntire-Stennis	593,354
Animal Health	57,302
Total Federal Funds	7,762,867
State Funds	
Total State Funds	29,234,001
Total Funds	36,996,868

Expenditures

	Federal	State	Total
Personal Services	6,147,338	24,507,027	30,654,364
Travel	110,170	477,855	588,026
Other Operating Expenses	1,144,214	4,002,791	5,147,005
Equipment	361,144	246,329	607,473
Total Expenditures	7,762,867	29,234,001	36,996,868

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Agricultural Experiment Station 2016-2017

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Departments

Following are departmental faculty and leadership lists for calendar year 2016. (R) denotes Experiment Station appointment.

Agricultural Communications

Skillman, L.M., Director

Agricultural Economics

Maynard, L.J., Professor and Chair (R)
Batte, M.T., Part-time Research Professor
Brown, R., Senior Lecturer
Buck, S., Assistant Professor (R)
Burdine, K.H., Assistant Extension Professor
Dasgupta, S., Adjunct Assistant Professor
Davis, A., Associate Extension Professor
Davis, T.D., Assistant Extension Professor
Dillon, C., Professor (R)
Freshwater, D., Professor (R)
Gorton, W.T., Adjunct Assistant Professor
Halich, G., Assistant Extension Professor
Hu, W., Professor (R)
Isaacs, S., Extension Professor
Kusunose, Y., Assistant Professor (R)
Mark, T., Assistant Professor (R)
Meyer, A.L., Extension Professor
Reed, M.R., Professor (R)
Robbins, L.R., Professor (R)
Saghaian, S., Associate Professor (R)
Schieffer, J.K., Assistant Professor (R)
Shockley, J., Assistant Extension Professor
Simon, M.E., Adjunct Assistant Professor
Skees, J.R., Professor (R)
Snell, W.M., Extension Professor
Stowe, C.J., Associate Professor (R)
Woods, T.A., Extension Professor
Zheng, Y., Assistant Professor (R)

Animal and Food Sciences

Coffey, R.D., Chairman and Extension Professor
Aaron, D.K., Professor (R)
Adedokun, S.A., Assistant Professor (R)
Aiken, G.E., Adjunct Associate Professor
Amaral-Phillips, D.M., Extension Professor
Anderson, L.H., Extension Professor
Andries, K.M., Adjunct Assistant Professor
Ao, T., Adjunct Assistant Professor
Bewley, J.M., Associate Extension Professor
Boatright, W.L., Professor (R)
Brennan, K.M., Adjunct Assistant Professor
Bridges, P.J., Assistant Professor (R)
Bullock, K.D., Extension Professor
Burris, R., Extension Professor
Camargo, F.C., Associate Extension Professor
Coleman, R.J., Associate Extension Professor
Cox, N.M., Dean, College of Agriculture
Cromwell, G.L., Post-Retire Professor (R)
Dawson, K.A., Adjunct Professor
Dwyer, R.M., Professor
Ely, D.G., Professor (R)
Flythe, M.D., Adjunct Assistant Professor
Harmon, D.L., Professor (R)
Harmon, R.J., Professor (R)
Heersche, Jr., G., Extension Professor
Heleski, C.R., Lecturer
Hennig, B., Professor (R)
Hicks, C.L., Professor (R)

Holder, M., Assistant Research Professor (R)
Klotz, J.L., Adjunct Assistant Professor
LaBonty, E.A., Lecturer
Lawrence, L.M., Professor (R)
Lehmkuhler, J.W., Associate Extension Professor
Lindemann, M.D., Professor (R)
Matthews, J.C., Professor (R)
McLeod, K.R., Associate Professor (R)
Newman, M.C., Associate Professor (R)
Pescatore, A.J., Associate Chair and Extension Professor
Pierce, J.L., Adjunct Assistant Professor
Rentfrow, G.K., Associate Extension Professor
Rossano, M.G., Associate Professor (R)
Strobel, H.J., Adjunct Associate Professor
Suman, S.P., Associate Professor (R)
Tidwell, J., Adjunct Assistant Professor
Tricarico, J.M., Adjunct Assistant Professor
Urschel, K.L., Associate Professor (R)
Vanzant, E.S., Associate Professor (R)
Vijayakumar, P.P., Assistant Extension Professor
Wahrnund, J.L., Lecturer
Wang, C., Adjunct Assistant Professor
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