



# Midwest Poultry Consortium

### Mission Statement

*The Midwest Poultry Consortium is organized to provide leadership, support and resources for poultry education and research in member states.*

**Strategies.** Strategies, established in 1995 by the initial MPC Board of Directors, are continuously improved to meet the needs of the poultry industry and provide the foundation on which decisions are made.

**Leadership.** Support, maintain and enhance poultry science education and research at member state universities.

**Education.** Provide students with an emphasis in poultry science and encourage them to enter the poultry field.

**Research.** Increase basic and applied research in poultry and food science at member state universities.

**Communication.** Facilitate communication, coordination and interaction between industry, universities, government and interested public.

*Following a two-year pilot program with the University of Florida and the Florida Poultry Federation, the MPC Board of Directors accepted Florida as a full member state in July, 2006. This created cross-country collaboration providing additional resources for the Center of Excellence Scholarship Program.*



### Wentworth Receives 2010 Outstanding Service Award

Bernie Wentworth is the eighth recipient of MPC's Outstanding Service Award. Bernie has been a long-time supporter and participating faculty member of the MPC's Center of Excellence Program, in addition to being integral to its formation 15 years ago. He was awarded the COE's Pulletzer Prize, which is awarded to the Faculty Member of the Year. Therefore, in recognition of his unyielding support for and dedication to COE students and the poultry industry as a whole, it is with deep appreciation that MPC awarded Bernie Wentworth the 2010 Outstanding Service Award. Wentworth joins past recipients, Lou Arrington, Senator Tom Harkin (IA), Wendy Wintersteen (Iowa State University), Dennis Casey (Hy-Line International), Sue Lamont (Iowa State University), Ron Kean (University of Wisconsin-Madison), Bob Sparboe (Sparboe Companies), and Congressman Tom Latham (IA). *Congratulations Bernie!*



Bernie Wentworth  
2010 Recipient

### New Strategies for COE Student Recruitment

MPC was tasked with recruiting a wider student audience in a shorter amount of time. As a result, MPC changed the Center of Excellence (COE) Program application process to allow for earlier internship coordination and better full-time job placement. One of the biggest changes implemented was moving the application deadline from the first of March to the first of December. The earlier date was intended to allow MPC recruiters to conduct phone interviews with each applicant before the review committee made their selections and to allow companies to consider students who are interested in internships at an earlier date.

To recruit for the 2011 COE Program, MPC representatives visited universities in all 13 member states in September and October. In addition to career fairs, an emphasis was placed on classroom visits and presenting at the college's animal-focused clubs (i.e., Poultry Science Club and Block and Bridle Club). Animal Science professors were also asked to send COE informational emails to students within their department. In total, MPC representatives participated in 13 career fairs and gave presentations at 6 student clubs and over 40 classrooms.

The new strategies resulted in a record number of student applicants. "This was the best group of student applications that we have ever reviewed. The screening committee had a tough decision in awarding scholarships as there were so many qualified students who applied. This is a great sign that the program is continuing to grow," said Beth Nelson, President of the Midwest Consortium. "The COE program is a great opportunity for students to collaborate and network with both students and faculty from different universities throughout our member states."

# MPC Board of Directors

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Rose Acre Farms

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Hy-Line North America

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Sonstegard Foods

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Maple Leaf Farms

**Rick Van Puffelen - Allied**  
Chore-Time, an EPS Division

**Lou Arrington - Ex Officio**  
Midwest Poultry Federation

## Consortium Holds Annual Meeting & Research Summit

Held in conjunction with its MPRP Research Summit, MPC's Annual Meeting was held on Tuesday, March 16. MPC President Beth Nelson welcomed those in attendance and reviewed the Consortium's website, activities over the past year, finances, sponsors and the status of the Midwest Poultry Research Program.

The Secretary's report was given by Nita Nurmi (Sparboe Companies) and the Treasurer's report by Pat Soleid (Jennie-O Turkey Store).

Former COE student Dan Wilson gave a testimonial which detailed his experience at the COE Program and the benefits it provides to both students and industry. Dan discussed the day-to-day activities of students in the program, the long term friendships which are formed and the career benefits the program and internships offer students. Wilson graduated from Purdue University with a degree in Pre-vet/Animal Production and is currently attending Purdue's Veterinary School.

MPC held its fourth Midwest Poultry Research Program (MPRP) Research Summit to set new priorities for 2010. With more than 50 participants representing academia and all sectors of the poultry industry, the Summit provided the opportunity to re-evaluate existing priorities for continued relevance and to add topics of emerging importance. Overall, 9 out of the 13 Consortium states were represented.

## MPRP Funding Now Totals Over \$4 Million

MPC places a high priority on securing funds for the Midwest Poultry Research Program (MPRP). MPC representatives met with Congressional staff on both the House and Senate Agricultural Appropriations Committee to garner support for continued MPRP funding. Thanks to Senator Harkin, Senator Grassley, Senator Klobachar and Congressman Latham, MPRP received \$471,000 in FY'10, bringing the total awards to over \$4.6 million for poultry research projects. This was great news given the tight budget situation in Congress and serves as evidence of the high regard in which this program is held in Washington.

Each year, the MPC issues a call for proposals which are reviewed by a screening committee representing industry sectors and researchers. MPRP funding is awarded competitively with 40% going to critical industry needs regardless of species, 20% going to broiler research, 20% going to turkey research and 20% going to layer research (see page 8 for 2010 awards). MPC is grateful to Iowa State University for their dedication to MPRP!

## COE Receives CHS Foundation Grant

MPC was awarded a grant of \$3,000 from the CHS Foundation to support the activities of the MPC's Center of Excellence Scholarship Program (COE). This was the sixth year of involvement in the Center of Excellence Scholarship Program for the CHS Foundation and demonstrates their dedication and commitment to agriculture and poultry education in our member states. *Thanks CHS Foundation!*

## "Like" Us on Facebook

Social media channels have grown in popularity as new marketing and promotion tools. The Center of Excellence joined Facebook - find us online and stay updated with COE news (Center of Excellence Scholarship/Internship Program page)!



## MPC Staff

**Beth Nelson**, President  
**Jon Dockter**, Associate Director  
**Jenna Knoblauch**, Student Director  
**Sherry Liu**, IT Director  
**Chelsea Russell**, Student Recruiter

4630 Churchill Street, #1  
St. Paul, MN 55126  
651.766.8118  
mpc@mwpoultry.org  
www.mwpoultry.org

# COE Center of Excellence Scholarship/Internship Program

As the Midwest Poultry Consortium's Center of Excellence (COE) Scholarship Program completes its 15th year, the COE continues to educate students in poultry science and helps ensure the availability of qualified poultry graduates for employment within the industry.

The COE is unique in guiding students through recruitment, education, internship, employment and networking opportunities in the poultry industry. The program brings together key faculty from participating universities and the foremost private industry experts, offering the strongest research-based poultry science education available in MPC member states. This program combines problem solving and state-of-the-art hands-on training in laboratory situations, interactive classroom lectures and field trips for up to 30 scholarship recipients each year. Student scholarships include on-campus housing and up to 18 credits, which are earned in two six-week summer sessions. These courses complement a number of majors, and credits are transferable to the student's home university. Students are encouraged to participate in industry internships to further their poultry education. MPC strives to continuously improve this program to benefit students and the poultry industry for years to come.

## 2010 SESSION I

### Avian Physiology

Murray Bakst, USDA

Richard Balander, Michigan State University

Mary Beck, University of Nebraska-Lincoln

**Mark Berres, University of Wisconsin-Madison**

Patricia "Scotti" Hester, Purdue University

Alice Wentworth, University of Wisconsin-Madison

Bernie Wentworth, University of Wisconsin-Madison

### Breeder Flock & Hatchery Management

Darryl Barker, Hy-Line International

**Ron Kean, University of Wisconsin-Madison**

Sally Noll, University of Minnesota

Mike Wineland, North Carolina State University

### Poultry Products Technology

Deana Jones, Russell Research Center

Michael Musgrove, Russell Research Center

Joe Regenstein, Cornell University

**Mark Richards, University of Wisconsin-Madison**

## 2010 SESSION II

### Poultry Nutrition

**Mike Lilburn, The Ohio State University**

Carl Parsons, University of Illinois

**Mike Persia, Iowa State University**

### Avian Health

**Mark Cook, University of Wisconsin-Madison**

Rob Porter, University of Minnesota

### Poultry Enterprise Management

Chad Gregory, United Egg Producers

**Darrin Karcher, Michigan State University**

**Ken Koelkebeck, University of Illinois**

Keith Kulow, Daybreak Foods

Chad Larson

Nick Levendoski, Organic Valley Farms

Jeremy Lies, Gold'n Plump

Brad Lillie, MacFarlane Pheasants

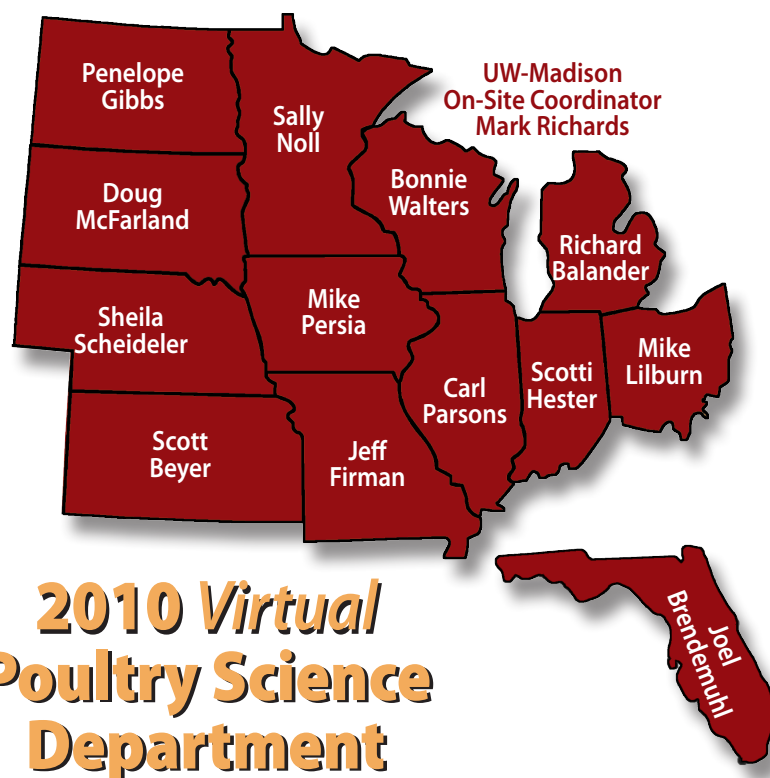
Tom Lohr, Henning Construction

Neil O'Sullivan, Hy-Line International

Chris Roedl, Daybreak Foods

**Course Coordinators indicated in bold type.**

*A special thanks to Lou Arrington for his commitment and service to COE students during COE.*



## 2010 Virtual Poultry Science Department

### Wednesday Night Forums

On Wednesday evenings, students are able to interact with industry leaders in order to learn more about the poultry industry and future career opportunities. 2010 Forum participants:

**Kelsey Campbell & Rocky Lisowski, Gold'n Plump**

**Michelle Early, Jennie-O Turkey Store**

**Henry Kohl, Maple Leaf Farms**

**Jenna Knoblauch, Midwest Poultry Consortium**

**Bernie Murphy, Jones-Hamilton Co.**

**Nita Nurmi, Sparboe Farms**

## COE Program Continues Success in Education

The COE Program continues to be successful in educating students in poultry science. The Midwest Poultry Consortium traveled to 15 career fairs to recruit for the 2010 Program. Twenty-eight students, representing 13 universities were awarded scholarships. Of the five seniors who completed the COE program in 2010, two have gone on to graduate school and the other three have pursued employment within the poultry industry. To date, 287 students have participated in the program, with 143 completing both summer sessions.

		Breakdown of COE Students															
Year	Number of Students	Other	FL	IA	IL	KS	MI	MN	MO	NE	ND	OH	IN	SD	UWM	UWRF	Total:
2010	28	0	1	2	1	3	4	4	1	1	1	2	5	0	2	1	28
2009	29	0	2	1	2	1	3	3	2	2	1	1	6	1	1	3	29
2008	29	1	2	3	1	1	3	3	3	1	1	0	4	0	3	3	29*
2007	30	2	1	3	1	2	3	2	1	0	1	1	8	1	3	1	30
2006	39	3	4	4	0	1	5	4	0	0	1	1	9	3	2	2	39
2005	30	4	3	4	1	0	1	2	0	3	1	1	2	2	4	2	30
2004	25	0	0	2	1	2	2	3	0	3	1	2	3	0	5	1	25
2003	23	0	0	2	0	2	2	1	0	2	1	4	4	0	5	0	23
2002	31	0	0	3	2	3	3	2	0	1	1	2	5	0	9	0	31
2001	32	0	0	1	2	4	4	0	0	2	0	1	6	2	9	1	32
2000	36	0	0	1	2	3	4	2	0	0	0	3	3	4	12	2	36
1999	26	0	0	1	0	0	6	3	0	1	0	2	2	1	9	1	26
1998	22	0	0	0	3	2	3	3	0	1	0	3	2	0	3	2	22
1997	29	0	0	1	2	2	0	2	0	2	0	5	1	1	10	3	29
1996	21	0	0	0	2	2	0	1	2	2	0	2	0	1	8	1	21
<b>Total:</b>		<b>10</b>	<b>13</b>	<b>28</b>	<b>20</b>	<b>28</b>	<b>43</b>	<b>35</b>	<b>9</b>	<b>21</b>	<b>9</b>	<b>30</b>	<b>60</b>	<b>16</b>	<b>85</b>	<b>23</b>	<b>430</b>

\*29 Scholarships were awarded; however, one additional student paid their own way to attend COE classes.

<b>Total COE Students:</b>	<b>287</b>
<b>Students who completed both years:</b>	<b>143</b>

### Universities Represented in 2010

Iowa State University	<b>2</b>
Kansas State University	<b>3</b>
Michigan State University	<b>4</b>
North Dakota State University	<b>1</b>
Purdue University	<b>5</b>
The Ohio State University	<b>2</b>
University of Florida	<b>1</b>
University of Illinois	<b>1</b>
University of Minnesota – St. Paul	<b>4</b>
University of Missouri	<b>1</b>
University of Nebraska	<b>1</b>
University of Wisconsin – Madison	<b>2</b>
University of Wisconsin – River Falls	<b>1</b>

### 2010 Internships

Many of the MPC member companies provide internships and on-the-job training for COE students/graduates. The internships fit the academic timetable for participating universities and complement COE courses.

**Persephone Allen - Hy-Line Int'l**  
**Maria Arendt - Gold'n Plump-Arcadia**  
**Zane Baker - Sparboe Farms**  
**Elizabeth Beilke - Michael Foods**  
**Kevin Bolek - Vencomatic**  
**Amy Davis - Gold'n Plump-Arcadia**  
**Jesse Holmgren - Willmar Poultry Company**  
**Rheannon Jordan - Fremont Farms**  
**Keturah Kreider - MacFarlane Pheasants**  
**David Larson - Rose Acre Farms**  
**Landon Lewis - Maple Leaf Farms**  
**Shane Mart - Cal-Maine Foods**  
**Rebekah Nortrup - Purdue University**  
**Alison Park - Sparboe Farms**  
**Abby Sielaff - Centurion Poultry**  
**Rebecca Strong - Maple Leaf Farms**  
**Corey Van Denburgh - Willmar Poultry Company**  
**Myah Walker - Sparboe Farms**  
**Breanna Wimmier - Gold'n Plump-St. Cloud**

**Internship Host:** We are seeking companies willing to provide hands-on experience for our COE students. If your company is willing to host a COE student intern, please contact the MPC office.



## "Spellbindin' Good Time" Banquet Marks COE Graduation

Marking the end of its 15th year of educating students in the area of poultry science, the Midwest Poultry Consortium held its year-end banquet and awards ceremony for the Center of Excellence Scholarship Program. The "Spellbindin' Good Time" Banquet gathered more than 60 students, family members, staff, board members, faculty and industry representatives. The event honored both students and faculty for their accomplishments and hard work in completing another successful summer session.

The COE provides students interested in careers in poultry with an intense, six-week curriculum in poultry science to better prepare them for employment within the industry upon graduation. The COE gives students an emphasis in poultry science delivered by leading poultry faculty, internship opportunities which pave the way for future employment within the industry and the opportunity to develop lifelong friendships with other students over the course of the six-week session.

The banquet provided both students and industry representatives an opportunity to become better acquainted and visit about potential employment opportunities within the poultry industry.



David Hurd (MPC Chair) and Bernie Wentworth (COE faculty member).



The awards ceremony honored Devin Brand as the class clown (Yolkster Award), Cory Van Denburgh as the most dedicated student (Ducks in a Row Award), and David Larson and Kevin Bolek (in a tie) as the most intelligent students (Egghead Award). The Pullet-zer Prize which recognizes the faculty member of the year was awarded to Mark Cook of the University of Wisconsin-Madison (nominees included Lou Arrington, Murray Bakst, Mark Berres, Scotti Hester, Deana Jones, Ron Kean, Mike Lilburn, Mark Richards, Alice Wentworth, Bernie Wentworth, and Mike Wineland). ***Congratulations Mark!***

The presentation of diplomas to COE graduates by on-site coordinator Mark Richards gave well-deserved recognition to students who have completed both years of the COE. 2010 graduates include: Zane Baker, Bobbi Christenson, Amy Davis, Jesse Holmgren, Rheannon Jordan, David Larson, Rebekah Nortrup, Michele Prothman.

The evening was capped off with the antics of Robinn Lange, a well-known hypnotist, who demonstrated the power of hypnosis on willing and able participants. Those in the audience thoroughly enjoyed the



**2010 COE Graduates:**  
Front row (L to R): Rheannon Jordan, Bobbi Christenson, Michelle Prothman, David Larson. Second row (L to R): Amy Davis, Rebekah Nortrup, Zane Baker, Jesse Holmgren. ***Congratulations to our COE graduates!***

show while no one who volunteered embarrassed themselves... much.

The Midwest Poultry Consortium extends very special thanks to the "Spellbindin' Good Time" banquet sponsors who made the event such a success:

Evonik Degussa Corporation  
Gold'n Plump  
Henning Construction  
Jennie-O Turkey Store  
Rose Acre Farms  
Sparboe Farms

## Students in the News

**Kevin Bolek**, a 2010 participant of the Center of Excellence Scholarship Program, has accepted the position of Technical Sales Representative, with Vencomatic in Des Moines, IA. Kevin, a 2010 graduate of Michigan State University, majored in Animal Science.

**Caleb Englin**, a 2009 participant of the Center of Excellence Scholarship Program, has accepted the position of Assistant Live Production Supervisor with Jennie-O Turkey Store in Spicer, MN. Caleb, a 2009 graduate of South Dakota State University, majored in Animal Science.

**Dale Perez**, a 2008-2009 participant of the Center of Excellence Scholarship Program, will be the Teaching Assistant for the Poultry Products Technology course at COE this summer while he pursues his Masters degree at the University of Wisconsin-Madison. Dale, a 2009 graduate of University of Wisconsin-Madison, majored in Animal Science.

**Robert (Max) Pfund**, a 2008-2009 participant of the Center of Excellence Scholarship Program, recently accepted a Leadership Trainee position with Moark in Connecticut. Max, a 2009 graduate of Michigan State University, majored in Animal Science.

**Alex Ties**, a 2007-2008 participant of the Center of Excellence Scholarship Program, has accepted the position of Quality Control Coordinator, with Perdue Farms in Indiana. Alex, a 2008 graduate of Kansas State University, majored in Animal Science.

**Nancy Warfield**, a 2008-2009 participant of the Center of Excellence Scholarship Program, has accepted the position of Technical Service Research/QA Coordinator with Jennie-O Turkey Store in Willmar, MN. Nancy, a 2009 graduate of the University of Minnesota, majored in Animal Science.

# MPRP Midwest Poultry Research Program

The Midwest Poultry Research Program (MPRP) is a public/private project created to effectively address priority research needs of the poultry industry in MPC member states (Florida, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin).

The goal of MPRP is to improve efficiency and sustainability of poultry production through integrated, collaborative research and technology transfer. MPRP focuses on priority areas of local need and problems of regional/national scope while encouraging multi-disciplinary research networks which enhance limited state and industry resources. Funding for MPRP is distributed competitively in the following manner: 40% for critical industry needs regardless of species or subject area; 20% for broiler research; 20% for turkey research; and 20% for layer research.

Established in 2001, MPRP received an initial appropriation from Congress of \$400,000. Through the 2010 allocation, **MPRP is now responsible for \$4 million+ in poultry research!** When coupled with industry cash match contributions, MPRP has contributed nearly **\$6 million** to poultry research. This program has been extremely successful in addressing some of the most pressing research needs in the poultry industry, renewing interest among students in poultry research and engaging industry in the research taking place at our member universities.

## 2010 MPRP Review Committee

Tim Barman, Cooper Farms

Bernie Beckman, Hy-Line International

Bruce Behrends, AGRI-TECH

Amin Fadl, University of Wisconsin

Jeff Firman, University of Missouri

Penelope Gibbs, North Dakota State University

Gordy Gingras, Evonik Degussa

Henry Kohl, Maple Leaf Farms

Bill Lanners, Gold'n Plump

Brad Lillie, MacFarlane Pheasants

Brian McComb, Jennie-O Turkey Store

Doug McFarland, South Dakota State University

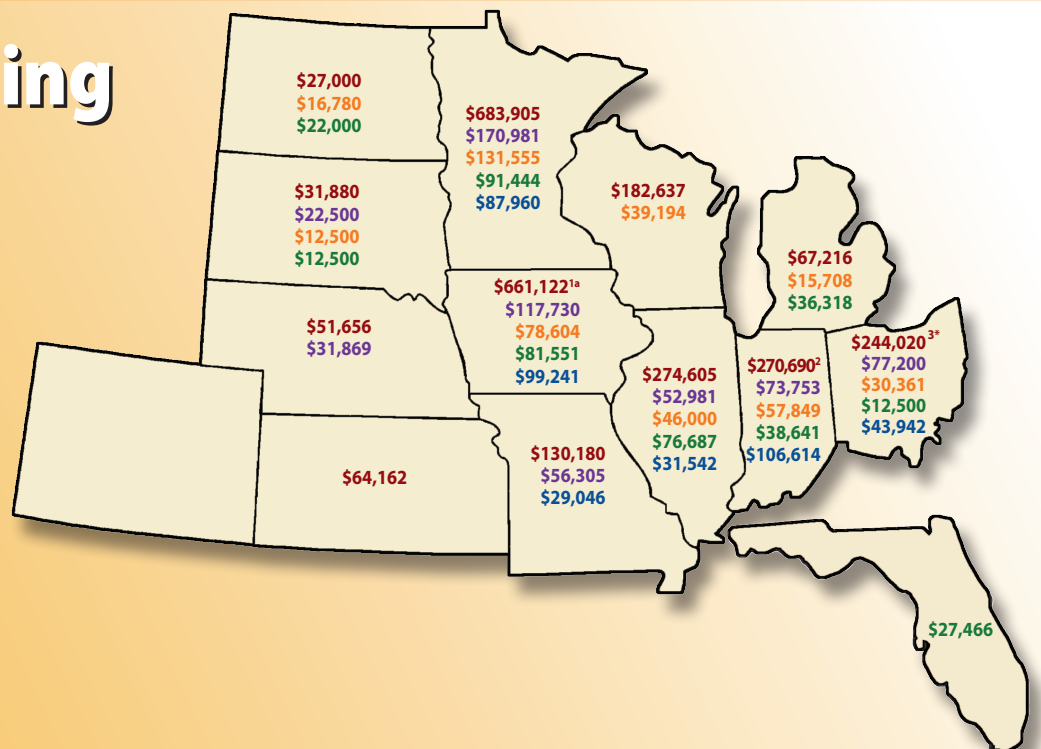
Hongwei Xin, Iowa State University

## MPRP Review Committee Approves Research Projects

The Midwest Poultry Consortium worked closely with the House and Senate Ag Appropriations committees to maintain funding for the Midwest Poultry Research Program for FY '10. Through those efforts, the MPRP was appropriated \$471,000 for FY10. After USDA overhead and administrative costs were removed, the MPRP had \$398,345 to distribute to research projects. In November, a request for proposals was distributed which generated a total of 34 projects representing 12 of the 13 land grant universities in the Consortium, requesting a total of \$1,450,537. The Review Committee, which met in Minneapolis to allocate funding, had very difficult decisions to make, but ultimately awarded funding to 11 projects.

## MPRP Funding by State

02-06 Funding  
2007 Funding  
2008 Funding  
2009 Funding  
2010 Funding



<sup>1</sup>\$50,009 Mississippi State University  
<sup>2</sup>\$1,000 University of California-Davis  
<sup>2</sup>\$1,000 Washington State University  
<sup>3</sup>\$10,000 University of Arkansas  
<sup>a</sup> 6,100 University of Maryland  
<sup>\*</sup>\$18,360 University of Arkansas

2010 MPRP Projects	MPRP Funds
<b>Further Evaluation of a New Precision-Fed Chick Assay for Determining Amino Acid Digestibility &amp; Metabolizable Energy of Feed Ingredients for Poultry</b> <i>U of IL - Parsons</i>	<b>\$31,542</b>
<b>Evaluation of Energy Values of Various Oil Sources When Fed to Poultry</b> <i>ISU - Persia</i>	<b>\$30,000</b>
<b>A Comprehensive Assessment of Aviary Laying-Hen Housing Systems for Egg Production in the Midwest</b> <i>ISU - Xin</i>	<b>\$69,241</b>
<b>Fractionated Clostridium Septicum Antigens for Turkey Clostridial Dermatitis Vaccines</b> <i>U of MN - Foster</i>	<b>\$54,360</b>
<b>Studies on Pathogenesis &amp; Immunity to Turkey Clostridial Dermatitis</b> <i>IU of MN - Nagaraja</i>	<b>\$33,600</b>
<b>Modeling Amino Acid Requirements for Turkeys</b> <i>U of MO - Firman</i>	<b>\$29,046</b>
<b>Regulation of Duck Breast Muscle Growth &amp; Development</b> <i>OSU - Velleman</i>	<b>\$43,942</b>
<b>Impact of Non-Antibiotic Treatments for Prevention of Coccidiosis on Gut Inflammation &amp; Integrity in Broilers</b> <i>Purdue - Ajuwon</i>	<b>\$40,500</b>
<b>Does Formulation on a Digestible Basis for Amino Acids Make Productive &amp; Economical Sense for Laying Hens?</b> <i>Purdue - Applegate</i>	<b>\$29,214</b>
<b>Osteoporosis in Egg Laying Strains of Chickens: Early Pre-Pubertal Exposure to Mechanical Loading</b> <i>Purdue - Hester, Garner</i>	<b>\$36,900</b>
<b>Total Research</b>	<b>\$398,345</b>

## 2010 MPRP Project Objectives

### Further Evaluation of a New Precision-Fed Chick Assay for Determining Amino Acid Digestibility and Metabolizable Energy of Feed Ingredients for Poultry

U of IL – Parsons

**Project Award: \$31,542**

**Objectives:** The project objectives are 1) to further evaluate a new precision-fed broiler chick assay for rapidly and accurately determining AA digestibility and TME of multiple samples of DDGS and MBM that vary in quality and to compare values determined by the new chick assay with those determined by the currently used ad libitum-fed chick assay and the precision-fed rooster assay; 2) to determine if the new precision-fed chick ileal digestibility assay is yielding accurate AA bioavailability values; and 3) to evaluate the new precision-fed chick assay for determining the effects of various feed enzymes on AA digestibility and ME.

### Evaluation of Energy Values of Various Oil Sources When Fed to Poultry

ISU – Persia

**Project Award: \$30,000**

**Objectives:** The project objectives are 1) to utilize broilers, layers and turkeys to determine the energy utilization (metabolizable energy values for feed formulation) for the variety of oils and fats that are typically fed in poultry diets; and 2) to evaluate oils with various characteristics to build a model to predict energy values based on composition (i.e., fatty acid profile, free fatty acid level and moisture) and quality (i.e., peroxide value).

### A Comprehensive Assessment of Aviary Laying-Hen Housing Systems for Egg Production in the Midwest

ISU – Xin

**Project Award: \$69,241**

**Objectives:** The project objective is to identify and promote housing system(s) and management practices that will lead to improved animal welfare, working condition for the workers, hen production performance, safe and quality products, environmental soundness, efficient use of natural resources and economic viability for both the producers and the consumers. This study will systematically assess two 50,000-hen aviary layer houses in Iowa by performing the following measurements and analysis over a one-year period (one full production cycle): 1) Continuous measurement of gaseous (NH<sub>3</sub>, CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>) and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) concentrations (indoor exposure for birds and humans) and emissions (to the atmosphere); 2) Continuous measurement of the metabolic rate of the hens and heat and moisture production at the house level; 3) Electricity use for lighting, building ventilation, manure-drying and total operation; and fuel use for supplemental heating; 4) Hen production performance (feed use, water use, hen-day and hen-house egg production, cage weight, feed conversion, percentage of floor eggs, mortality); 5) Hen behaviors (aggression, cannibalism, dustbathing) and welfare (feather score, tibia strength, keel/wings injuries); 6) Microbiological quality (incidence and molecular characterization of environmental *Salmonella spp.* occurring in the aviary system vs. traditional housing); and 7) Economic analysis of production costs and cash returns.

### Fractionated Clostridium Septicum Antigens for Turkey Clostridial Dermatitis Vaccines

U of MN – Foster

**Project Award: \$54,360**

**Objectives:** The project objective is to produce large quantities of *Clostridium septicum* bacterium which will be inactivated by denaturation then fractionated for the production of soluble antigen vaccines. *Clostridium septicum* is the primary known causative agent of cellulitis in turkeys and in the absence of vaccination, has caused and will continue to cause significant economic losses to the turkey production industry. The overall goals of this project are to 1) to propagate *Clostridium septicum* in 10L batches under anaerobic conditions. The



bacterins (killed, inactivated whole cultures) will be prepared using formalin. Due to the highly pathogenic nature of *Clostridium septicum*, this portion of the project will be outsourced to a known contractor (Newport Laboratories, Worthington, MN); 2) to prepare toxoids (a toxin and other soluble excreted toxins that are *Clostridium septicum*-specific) by ammonium sulfate precipitation of the fractionated bacterin supernatant; 3) to prepare the following highly immunogenic preparations from the bacterins: a) whole bacterin extracts; b) cell wall extract; and c) polysaccharide fraction; 4) to formulate the above fractionated bacterin antigens with detergents for administration of vaccines to turkeys; and 5) to field test the fractionated bacterin antigens (not part of this proposal).

#### **Studies on Pathogenesis and Immunity to Turkey Clostridial Dermatitis**

U of MN - Nagaraja

**Project Award:** \$33,600

**Objectives:** The project objectives are 1) to develop a Disease model with *Clostridium perfringens*/*C. septicum* for Clostridial dermatitis in turkeys. This will enable us to define the natural course of the disease and thus better understand the pathogenesis of Clostridial dermatitis; and 2) to expand on understanding the toxic principles (secretory proteins) of *Clostridium perfringens*/*C. septicum* that may be responsible for Clostridial dermatitis. This will provide the basis of pathogenicity of *Clostridial* isolates and will help us to identify and develop an effective vaccine for the control of Clostridial dermatitis.

#### **Modeling Amino Acid Requirements for Turkeys**

U of MO – Firman

**Project Award:** \$29,046

**Objectives:** The project objectives are 1) to predict nutrient requirements based on turkey body weight; 2) to test model through live bird response; and 3) to achieve a reduction of feeding costs through use of the model to look at nutrient requirement/diet cost anomalies.

#### **Regulation of Duck Breast Muscle Growth and Development**

OSU - Velleman

**Project Award:** \$43,942

**Objectives:** The first project objective is to evaluate the structural state of the duck breast muscle in males and females in seven Maple Leaf Farms purebred lines. These data will aid in the implementation of appropriate selection strategies as the morphological structure affects product quality. The second objective will focus on the expression of myosin heavy chain to assay developmental changes across the lines and with sex. This objective will also provide an indication of the repair of the breast muscle in response to muscle fiber damage. Accordingly the following specific aims will be pursued: 1) To evaluate duck breast muscle development and morphology in dams and drakes in seven Maple Leaf Farms purebred lines; and 2) To determine the temporal and spatial localization of myosin heavy chain in the breast muscle with regard to developmental age, sex and genetic line.

#### **Impact of Non-Antibiotic Treatments for Prevention of Coccidiosis on Gut Inflammation and Integrity in Broilers**

Purdue - Ajuwon

**Project Award:** \$40,500

**Objectives:** The project objective is to determine the effect of alternative treatments (essential oils, direct fed microbials and yeast)

that are currently marketed for the prevention of incidence and severity of coccidiosis and enteric diseases on gut inflammation and integrity.

#### **Does Formulation on a Digestible Basis for Amino Acids Make Productive and Economical Sense for Laying Hens?**

Purdue – Applegate

**Project Award:** \$29,214

**Objectives:** The project objective is to build upon previous work funded by the Midwest Poultry Consortium in 2009; wherein amino acid digestibility is being determined on 24 ingredients in laying hens and compared to that of the broiler (the latter comparison through industry matching with Evonik Degussa). Ingredient amino acid digestibility determined in the 2009 grant include: 3 corn, 3 soybean meal, 6 meat and bone meals, 5 bakery by-products, 5 DDGS and 2 wheat midds samples. Further comparisons through industry sources have/will allow for three additional high-protein DDG(s) and several canola meal samples in 2010. Ingredients for this study were collected throughout the Midwest (NE, MN, KY, IL, IN, OH and MI). Thus, this project will provide a continuation of the digestible amino acid concept and hen-specific database of ingredient digestibility by providing a proof-of-concept study demonstrating efficacy and economics of a) total versus digestible amino acid formulation basis; and b) level of amino acid formulation.

#### **Osteoporosis in Egg Laying Strains of Chickens: Early Pre-Pubertal Exposure to Mechanical Loading**

Purdue – Hester, Garner

**Project Award:** \$36,900

**Objectives:** The project objective is to determine if early pre-pubertal exposure to mechanical loading will culminate in improvements in skeletal mineralization and integrity. A long term goal (not part of this proposal because of the one year limitation for completion of work) is to evaluate hens in the egg laying phase to determine if early perch use as pullets reduces the need for perches during the egg laying phase.

### **2009 MPRP Project Summaries**

*The following summaries are abbreviated versions of the 2009 MPRP reports.*

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#### **Anti-Salmonella and Anti-Campylobacter Properties of Sodium Metasilicate on Commercially Available Ready-to-Cook Broiler Breast Meat and Carcasses Stored at 4±1°C for 12 Days**

U of FL – Williams

**Project Award:** \$27,466

**Summary:** The results will have significant economic impact on poultry processors as well as retailers and consumers. An additional antimicrobial agent will be available to control *Salmonella* and/or *Campylobacter* in poultry. Findings in this study for broilers will also be applicable to turkey carcasses and cut-up turkey retail portions.

*Experiment 1.* The 2% SMS marinade treatment, which is the maximum approved level for poultry, resulted in reduction in *Salmonella* on the chicken breast samples. The data revealed that 2% SMS was effective in controlling the growth of *Salmonella* in ready-to-cook skinless



and boneless chicken breasts, which could result in enhancing microbiological safety of raw poultry. The SMS treatments were not effective in controlling *Campylobacter*, which suggested the need for usage levels greater than the 2% approved by USDA FSIS in poultry marinades and the need for additional research.

**Experiment 2.** The 1 and 2% concentrations of SMS were effective in controlling the growth of *Salmonella* and *Campylobacter* in the boneless and skin-on chicken breast meat samples evaluated in this study. The level of sodium metasilicate used in Experiment 2 was above the USDA FSIS approved level, and, therefore, could not be used in food products, but might have application for use in postharvest environments of food animals to control pathogens. However, additional research is essential.

### **Effects of Feeding Low-Density Diets to Hy-Line W-36 Laying Hens on Production and Profitability**

U of IL– Koelkebeck, Parsons

**Project Award:** \$45,000

**Summary:** The results showed that feeding Hy-Line W-36 hens diets with increased nutrient density seem to have a greater effect on egg production in later phases rather than early in the lay cycle. Results indicate that increasing nutrient density in the diet of a laying hen will increase egg production, egg weight and feed efficiency. However, these benefits do not take effect in early production and seem to be most effective in later stages of the lay cycle. In addition to the above results, this study showed that if hens in a commercial setting are fed a lower nutrient dense diet than is recommended by the breeder, production performance may be comprised. Thus, the implications of this study to the commercial layer industry suggest that the proper nutrient dense diet should be fed particularly if Hy-Line W-36 hens are used.

### **Development of Evaluation of a New Precision-Fed Chick Assay for Determining Amino Acid Digestibility and Metabolizable Energy of Feed Ingredients**

U of IL– Parsons

**Project Award:** \$31,687

**Summary:** A new precision-fed chick assay (PFC) was developed for determining ileal amino acid digestibility in feed ingredients for chickens. This new assay provides a more rapid and inexpensive method that is complementary to the currently established SIAAD and PFR assays. When the new PFC assay was compared to SIAAD and PFR assays for several feed ingredients, there were no consistent differences in amino acid digestibility among the three methods. These results indicate that all three assays are acceptable methods for determining amino acid digestibility in feed ingredients for chickens.

### **Enhancing Foaming Properties of Egg Albumen By Using Modified Soy and Egg Proteins**

ISU – Wang

**Project Award:** \$37,396

**Summary:** To improve foaming properties of egg white albumen, soy protein isolate (SPI) and egg proteins were modified to make basic proteins, i.e., proteins with isoelectric point (pI) in the alkaline range. SPI and egg yolk proteins were successfully modified to have pI of 10, and sonication was shown to increase protein dispersibility after the ethyl esterification reaction. However, only the addition of sonicated and modified SPI (SMSPI) showed improvement of foaming properties in the 5% egg albumen model system with 0.4% egg yolk addition (as-is basis) for lipid contamination simulation. Therefore, SMSPI was used in

making angel food cake to examine if the cake performance reduction due to yolk contamination of the egg albumen would be restored or overcome by adding such alkaline protein. Cake performance was improved when cream of tartar was used with the modified soy protein, but not by SMSPI alone. The basic protein and cream of tartar seemed to have certain degree of synergistic effect on the height and volume of the final cake. In conclusion, basic soy protein can be made and added to egg albumen to improve its foaming properties and cake performance.

### **Assessing Hen Response to Ammonia and Thermal Comfort Combinations via Preference Test**

ISU – Xin

**Project Award:** \$44,155

**Summary:** The first analysis was completed to determine if responses of the birds between the first and second applications of the conditions were significantly different. The difference in time of occupation between high condition and low condition was 16.4 ( $\pm 8.6$  S.E.) minutes per hour for the first application, and  $-8.5$  ( $\pm 10.8$  S.E.) minutes per hour for the second application. Although the difference was not significant at the 0.05 level due to the large variances, the probability ( $p=0.09$ ) was close to the borderline, hence deserving further evaluation. Results were broken down into treatment application 1 and 2, but as none were significantly different, the average of the two applications is repeated.

The second analysis evaluated if the baseline compartmental choice influenced the preference when environmental conditions were applied. When analyzed these values showed a strong relationship between compartmental choices at baseline and their compartmental choice when the test conditions were applied ( $p=0.021$ ). The majority of the test birds (9 out of 15) showed the same compartmental preference in both treatment applications that they showed in the baseline period. One test bird preferred the low condition while two test birds preferred the high condition in both treatment applications.

In order to remove compartmental preference, t-test was used to determine if the difference in compartment occupation time between the low condition and the baseline was significantly different from zero. When this difference is significantly different from zero, a negative value means the high condition was preferred and a positive value means the low condition was preferred. Because the occupation data were normalized to a percentage of time (POT), the absolute differences of low minus baseline and high minus baseline are equal with opposite signs. The average difference in POT between the low compartment and the same compartment at baseline was  $-1.7 \pm 6\%$  (mean  $\pm$  SE,  $p=0.51$ ). During the 16-hr light period (05:30 - 9:30 h) the difference was  $-3.8 \pm 7\%$  (mean  $\pm$  SE,  $p=0.51$ ). The results indicate that these birds did not make a clear choice between the two conditions provided. The difference in feed usage between the low condition and baseline was  $4.08 \pm 7.0$  g/d ( $p=0.49$ ); and the difference in water usage between the low condition and baseline was  $6.4 \pm 9.3$  g/d ( $p=0.53$ ).

Another measurement evaluated in this study was the number of movements each test bird made during the periods when the conditions were applied. The overall number of movements for the treatment application period ( $\sim 48$  hours) was  $57 \pm 8$  (mean  $\pm$  SE). There were four periods with very high numbers of movements ( $>100$ ). Three of them corresponded to the hen's switching of her preference from baseline to testing conditions. There were seven periods during which a hen switched a compartmental preference from baseline to the treatment. There seems to be an indication (by the large number of movements) that some birds were having a difficult time choosing a compartment.

The primary issue addressed in this study was if the birds would choose thermal comfort or better air quality. The data suggested no clear preference, as evidenced by the time spent under test conditions, feed and water usage. The hens showed strong compartmental preferences that they developed during baseline conditions, which carried through as test environmental conditions were applied. Birds that did change compartmental preference with environmental conditions often had more frequent movements possibly indicating difficulty choosing.

This study tells us that the birds will not avoid a cool condition down to 18.3°C (65°F) when combined with better air quality. This means that from the hens' comfort perspective, there is not a reason to avoid ventilation for improved indoor air quality in the winter as long as the indoor temperature can be maintained at or above 18.3°C (65°F).

#### **Comparison of Carcass Appearance, Texture Quality and Sensory Profile of Broilers Chilled by Air, Evaporative Air or Water Immersion** MSU – Kang

**Project Award:** \$36,318

**Summary:** *Experiment 1.* During chilling, carcass temperature was most effectively reduced by WC (55 min), followed by EAC (120 min), and AC (155 min). After the chilling, both WC and EAC carcasses picked up moisture by 4.6% and 1.0% of their weights, respectively, whereas AC carcasses lost their weight by 1.5%. Upon cutting at 5 h postmortem, WC carcasses showed the highest moisture loss (2.6%), the second (0.4%) by EAC and the least (0.3%) by AC. After 24 h storage, almost 83% of the absorbed water came out as purge in WC carcass parts whereas EAC and AC maintained their weights as close as the pre-chilled weights.

When moisture contents of 24 h-aged carcass parts (breast, wing, thigh, drumsticks and back) were measured, no significant differences were found on each of five parts among the chilling methods. In instrumental color and visual evaluations by panelists, AC carcasses showed darker appearance, more yellow color and surface discoloration than WC or EAC carcasses.

*Experiment 2.* No significant difference was found among the chilling methods in moisture content, cooking yield and shear force of deskined breast fillets stored overnight. However, the pH (5.6) of 24 h-stored fillets was higher in WC than in AC (5.5) and EAC (5.5). In surface color of skinless breasts, WC showed a higher CIE L\* value than AC or EAC, whereas AC exhibited more red (higher CIE a\*) and yellow (higher CIE b\*) than the other two chilling methods.

When raw breast meat was made into gels, there was no significant difference in cooking loss, moisture content, shear stress and shear strain, regardless of chilling methods. In consumer sensory evaluations, AC breasts showed a higher juiciness score than WC and EAC breasts, but no significant difference was found for flavor, texture and overall acceptability.

Currently, water chill has been a common chilling method in the United States mainly due to chilling efficacy and no weight loss. The generic advantages of WC are challenged by water shortage, cost of waste management and revised USDA rules. WC appears to have some up-front advantages during chilling, however, AC possesses more potential advantages after-the-chilling such as water saving, reduced waste management and juicier product.

Additional information for the overall benefits of three chilling methods are required to compare not just for a poultry chilling step but for the entire processing, including value-added products and environmentally friendly processing for the future.

#### **Development of Immunogens to Protect Against Turkey Cellulitis, Part II** U of MN – Foster

**Project Award:** \$42,333

**Summary:** The Qiagen vector system allowed us to produce DHFR/α toxin fragment peptide fusion products following induction of the host bacteria with IPTG. There was a huge induction of the predicted 31kDa recombinant DHFR/α toxin fragment fusion peptide (Lane 2; denatured lysate) compared to the uninduced bacteria control (Lane 1). Lanes 3 and 4 show purification of the 31kDa recombinant DHFR/α toxin fragment fusion peptide from native and denatured lysate, respectively. While levels of recombinant fusion protein were estimated to be in the 1-5 mg range from the denatured lysate, removal of the urea used to denature the bacterial inclusion bodies that harbored the recombinant fusion peptides caused the proteins to precipitate into misfolded insoluble material. We were able to recover 31kDa His-tagged recombinant peptides using Ni-agarose columns but purity (Lane 3) and recovery (Lanes 3 and 4) were disappointing.

To overcome recombinant proteins forming insoluble bacterial inclusion bodies, each of the α toxin – DHFR fusion protein fragments were cloned into the pET 32a+ vector system which allows recombinant peptides to be fused with a readily soluble thioredoxin protein that deposits the fusion peptides into the bacterial cytosol for extraction using methods that maintain the protein in a native conformation. We included the DHFR motif in this fusion protein since it increases in vivo protein stability and displays low immunogenicity. Lane 4 is the native lysate from 1mM IPTG 1 hr. induced bacteria with 4mM added DTT (to modify the folding rate of the recombinant thioredoxin/DHFR α toxin fragment fusion peptide), and the purified His tagged protein at 43 kDa (Lane 5). Based on a protein standard curve, 24 mg/L of purified fusion protein was recovered.

In collaboration with Nature Technologies, Inc., recombinant fusion proteins made using their proprietary process for production of thermostable fusion peptides in a native conformation are being tested. Enough native purified recombinant flagellin/α toxin and thioredoxin/DHFR α toxin fragments (10-15mg each) exists for an in vivo analysis to determine the degree of protection against *Clostridium septicum* when the birds are challenged. In an initial vaccination trial, newly hatched turkey poults were vaccinated with either 10 or 50ug purified recombinant flagellin/α toxin fragments /0.2ml, with or without a booster given three weeks later using Freund's complete adjuvant before being challenged with *Clostridium septicum*. Unvaccinated challenged birds served as infection controls. Analysis of anti-*Clostridium septicum* antibody production was determined by ELISA using purified recombinant α toxin fragments, or recombinant fusion proteins (flagellin) as antigens. Antibody specificity to *Clostridium septicum* α toxin was determined by comparing antibody titers against the α toxin fragments to titers generated against the fusion proteins. Functionality of the antibody response was determined by in vitro neutralization assays, and by histological examination of tissues harvested from all experimental groups. While there were antibodies raised against both the purified recombinant α toxin fragments as well as the fusion protein, results were somewhat inconclusive since the amount of antigen and a second vaccination didn't appreciably change antibody titers. Interestingly, not all unvaccinated control birds died when challenged due to high levels of circulating maternal antibodies to the *Clostridium septicum* α toxin. Additional vaccination protocols are planned using our recombinant purified *Clostridium septicum* α toxin subunit peptides.

## Energy Value of Corn Co-Products as Affected by Fat and Fiber Components

U of MN – Noll

**Project Award:** \$49,111

**Summary:** The TMEn for the three products were 2837, 2635 and 2701 kcal/kg (as fed) and the digestible lysine coefficients were 61, 62 and 74%, respectively for the products containing 11, 9, and 7% crude fat. No differences of significance were found for fiber. The AMEn of the corn oil was determined to be 10,000 kcal/kg which was greater than the gross energy content of 9400 kcal/kg.

Feed intake and feed efficiency of the turkeys was affected by treatment. Feed intake was greater and feed efficiency (f:g) was increased (2.66 vs. 2.74) when comparing the reduced ME diet to the control ME series. Treatments 3 and 4 with corn oil performed similarly to the respective controls containing white grease.

Comparing the substitution of 20% DDGS without any correction for energy (not isocaloric), indicated that only the 9% CF had poorer feed efficiency as compared to the standard ME control.

Assessing energy content of DDGS using feed efficiency as an indicator in this study was partially confounded by the tendency of the turkeys fed the DDGS diets, with the exception of DDGS9, as DDGS11 and DDGS7 tended to have better gain compared to the control treatments without DDGS. Thus, the increased feed intake associated with the DDGS containing diets also responded with some increased gain perhaps minimizing feed/gain responses among treatments. Similar TME values were obtained for DDGS9 and DDGS7 which were lower in crude fat than that for DDGS11. As the results indicate, the metabolizable energy value for DDGS which is lower in fat content should be decreased but the content of fat is probably not the only factor influencing the energy value. DDGS9 also had poorer lysine digestibility as compared to DDGS7 and perhaps poorer protein digestibility influenced the metabolizable energy content.

The energy value of the crude corn oil appeared to be overestimated by the AME assay. Based on results of the feeding trial, at a minimum, the AMEn of corn oil appeared to be similar to that of choice white grease (7550 kcal/kg). However, in the poult assay, the corn oil had greater metabolizable energy.

In conclusion, DDGS products with 11-12% crude fat could be assigned ME of 2850 kcal/kg, 9-10% crude fat, 2800 kcal/kg; and 7-8% crude fat, 2700 kcal/kg. Products with poorer amino acid digestibility may also influence the metabolizable energy content and additional adjustments may be needed.

## Coccidiosis in Game Birds: Part III

NDSU – Gibbs

**Project Award:** \$22,000

**Summary:** Coccidia were isolated from samples obtained from outbreaks on farms in 22 states. A total of 30 isolates were from pheasants, 20 from chukars and 30 from bobwhite quail flocks. Using a combination of direct microscopic examination, biological properties and molecular techniques (PCR), we identified *Eimeria colchici* and *E. phasianis* as the most pathogenic species in pheasants, *E. kofoidi* and *E. legionensis* in the chukar and *E. lettyae* in bobwhite quail. These species were always present in outbreaks involving extensive mortality. Other species were also present in pheasants and quail, but were of lesser pathogenicity. One or more unidentified new species were observed in chukars and quail, but were rare.

Various anticoccidial products available for use in other poultry were tested for effectiveness in preventing coccidiosis in these birds. The products varied widely in effectiveness against the modern isolates. Some older products, such as amprolium, were not effective even at high levels, presumably because of build-up of drug resistance in the coccidia because of many years of usage. Some drugs had little innate effectiveness, as has been previously reported in the literature. Lasalocid (Avatec), the most widely used product in pheasants and chukars, had moderate to good activity, although much less than reported in the 1980s. Other ionophores (related drugs) were not as effective as Avatec. Some synthetic chemical products had excellent activity. Robenz, Deccox and Clinacox were highly effective. However, it is cautioned that the use of these products should be limited, as the risk of rapid drug resistance is high. This was confirmed by the isolation of highly resistant coccidia from a farm where Robenz had been used earlier in the season. The isolate was also resistant to most other products as well. Rofenaid, a potentiated sulfa product, was highly effective against most isolates, but probably should be reserved for treatment rather than prevention because of its cost. Continued testing during the second year of the study showed that there was considerable variation in the response of field coccidia to drugs, probably as a result of differing history of product usage in different locations.

During the second year (part III) of the study, we concentrated on establishing principles of immunization in the bird hosts. Studies were conducted with each species of bird to show that the birds would indeed become immune to reinfection after initial exposure, as has been shown for chickens and turkeys. Using small doses of live coccidia, we were able to induce protection in pheasants, chukars and bobwhite quail, which was effective against a severe exposure. Surprisingly, there seemed to be cross-protection between some of the types of coccidia. Further studies were done with birds on litter floors, simulating a commercial production environment. Chukars vaccinated with live coccidia and with Coccivac-T (a commercial turkey coccidiosis vaccine), developed protective immunity, but suffered significant mortality during the immunization process. This suggests that live chukar coccidia are too prolific to be used in this way. The vaccine strains would have to be attenuated for this approach to be practical. The results with Coccivac-T were promising, but further studies are needed to prove that the birds were actually becoming protected from the exposure or whether accidental contamination from the chukar coccidia was responsible. These results have prompted some to initiate field studies with Coccivac-T in chukars. Thus far, the results of these tests are encouraging. If attenuated strains of coccidia are required for use in vaccines, additional funding will be required for their development.

## Regulation of the Growth of Poultry Skeletal Muscle

SDSU – McFarland; OSU – Velleman

**Project Award:** \$25,000

**Summary:** Estradiol effects were measured on turkey pectoralis major satellite cell proliferation. Insulin levels were maintained at a basal level (5 ng/mL) and insulin growth factor (IGF-I) concentrations ranged from 0 ng/mL to 100 ng/mL. Estradiol was included in the treated cultures at 10-12 M. These results suggest that the addition of estradiol possibly stimulates endogenous production of IGF by satellite cells. A positive effect on proliferation was observed with lower levels of IGF-I. At higher levels of IGF-I, proliferation was inhibited by the presence of estradiol suggesting that estradiol is preventing further increases in proliferation by an unknown mechanism.



The effect of increasing concentrations had differential effects on the expression of myogenin, glypican-1 and syndecan-4 during the proliferation of the turkey pectoralis major satellite cells. Myogenin, a muscle specific transcription factor, expressed during differentiation is decreased by increasing estradiol. In contrast, both syndecan-4 and glypican-1 expression are increased in response to estradiol. Syndecan-4 is thought to function during muscle cell proliferation and glypican-1 during differentiation.

### **Determination of Ileal Digestibility of Amino Acids from Feed Ingredients for Laying Hens**

Purdue – Applegate

**Project Award:** \$38,641

**Summary:** Results show that same feed ingredients (e.g. MBM) from different locations (or processing techniques) varied widely in digestibility. For broilers, the range of apparent Met (73.5-85.7%), Lys (74.3-85.9%) and Thr (66.1-78.6%) digestibility varied widely. Similar trends were seen after standardization (Met, 76-88.4%; Lys, 76.6-88.3%, and Thr, 72.4-82.7%). Meat and bone meal sample 4 was generally the least digested while MBM3 and 7 were the most digested (based on AA digestibility) out of

the 7 MBM samples in broilers and laying hens. Unlike in the MBM sample with huge variations in AA digestibility between samples, variations between DDGS sample both in the laying hens and broilers were minimal.

In comparisons between ingredient use, considerable differences were noted. Generally, hens had 7.2%-units less CP digestibility of all DDGS samples. For MBM samples, four of the seven had lower digestibilities of CP by hens when compared to broilers (7.4%-units on average). Adedokun et al. (2009) noted the standardized total amino acid digestibility values for laying hens were lower for corn, higher for meat and bone meal (only 1 used for this study), but not different for the remaining ingredients (2 DDGS samples, SBM, or canola meal) when compared with broilers.

In summary, AA digestibility values from these feed ingredients are high and can be a good source of AA for broilers and laying hens. However, there is the need to procure feed ingredients from a reliable and consistent source so as to minimize variability in birds' performance. Formulation on a digestible amino acid basis may reduce cost, reduce AA excretion and increase flock uniformity and performance; but it is important to realize that data from a broiler database for ingredient digestibility may not be applicable to that of laying hens.

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