



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.



Participating States

Xin Receives 2011 Outstanding Service Award

Dr. Hongwei Xin, Iowa State University, was recognized as the 2011 recipient of MPC's Outstanding Service Award. Dr. Xin has been a poultry researcher at ISU since 1993 and has been an active participant in MPC's Midwest Poultry Research Program for many years. When overall MPRP Project Director Don Reynolds left ISU, Dr. Xin stepped in and provided strong leadership, oversight and advocacy and has administered the program since that time. Dr. Xin also serves as the director of ISU's Egg Industry Center, created to add value to the egg industry through research, learning and technology transfer. Dr. Xin's enthusiastic dedication to and support of the Midwest Poultry Consortium's Midwest Poultry Research Program and the poultry industry as a whole, earned him MPC's 2011 Outstanding Service Award.



Dr. Hongwei Xin
2010 Recipient

Dr. Xin, the 10th recipient of MPC's Outstanding Service Award, joins past winners: Bernie Wentworth, University of Wisconsin (2010); Lou Arrington, WI Poultry & Egg Association (2009); Senator Tom Harkin (2008); Wendy Wintersteen, Iowa State University (2007); Dennis Casey, Hy-Line North America (2006); Sue Lamont, Iowa State University (2005); Ron Kean, University of Wisconsin (2004); Bob Sparboe, Sparboe Companies (2003); and Congressman Tom Latham (2002). *Congratulations Dr. Xin!*

MPC's Hallmark Program, COE Has Record-Breaking Year

The Center of Excellence (COE) Program has been educating students in poultry science for 16 years with over 300 students participating in the Program. While it is not a requirement to take both summer sessions, 154 students have earned a poultry emphasis by participating in all six COE courses.

The COE staff traveled to 14 career fairs in 13 states and gave presentations in 40+ classrooms and club meetings. Due to recruitment efforts, the COE Program received a record-breaking number of applications; 65 eager students applied for the 2011 program and 28 scholarships were awarded.

The 2011 class proved to be a group with strong career goals; every student participated in a summer internship with an MPC member company. MPC has found industry retention is greater when students participate in at least one internship, so more emphasis has been placed on internship opportunities. MPC now follows undergraduate students who have completed the COE Program and strives to place them in summer internships, keeping them involved in the industry through graduation. 2011 was a record-breaking year with 30 internships with member companies.

MPC Board of Directors

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Gordy Gingras - Allied
Evonik Degussa Corporation

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Sparboe Companies

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Hy-Line North America

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Willmar Poultry Company

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Alan Koch - Allied

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Kevin Roberson - Egg

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Sonstegard Foods

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Chore-Time, an EPS Division

Lou Arrington - Ex Officio

Midwest Poultry Federation

Consortium Holds Annual Meeting

MPC's Annual Meeting was held Tuesday, March 15, 2011, with MPC President Beth Nelson welcoming those in attendance and reviewing the status of the Midwest Poultry Research Program (MPRP) and the activities related to the Center of Excellence Scholarship/Internship Program, including the record number of applicants (65), career fairs, and internship opportunities for the coming year.

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 Michael Schmidt, Quality Assurance Manager with Sparboe Farms, gave a testimonial regarding the influence the Center of Excellence Scholarship/Internship Program (COE) had on his professional career. He touched on the classroom experience at the University of Madison, the value of his internships, the strong industry connections developed at the summer school and the benefits it provides to both students and industry. Michael also discussed the day-to-day activities of the students in the program, the intensity of the classes, and the career benefits the program and internships offer students. Schmidt gave credit to the COE for his start in the poultry industry and is a strong advocate of the program. Schmidt graduated from South Dakota State University with a degree in General Agriculture, with a poultry emphasis.

COE Student Survey Results

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 experts from private industry, 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.

MPC conducted a COE Student Survey for 2006-2011 COE students in order to accurately evaluate and improve the COE program. A link to the 24-question online survey was sent to 109 students and was completed by 77 students (71% return rate). The 2005 COE Survey was returned by 58% of COE students, reflecting a 13% improvement in return rate.

With the current state of the economy, MPC sponsor companies want to be sure their funding is making a positive impact on the future of the poultry industry. The survey reflects a positive return on their investment! The following page will highlight the survey results.

INTERNSHIP HOSTS NEEDED

**Companies are being sought to provide hands-on experience for COE students.
If your company is willing to host a COE intern, please contact the MPC office.**

MPC Staff

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

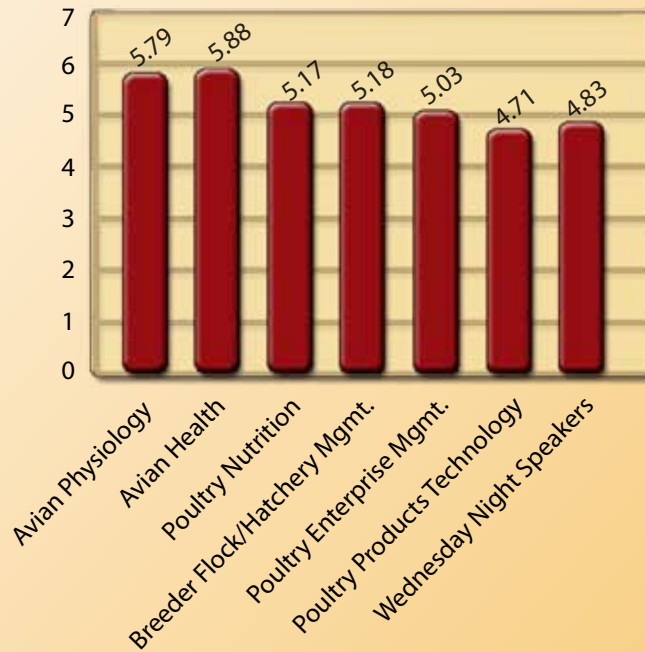
4630 Churchill Street, #1
St. Paul, MN 55126
651.766.8118
mpc@mwpoultry.org
www.mwpoultry.org

COE COURSES

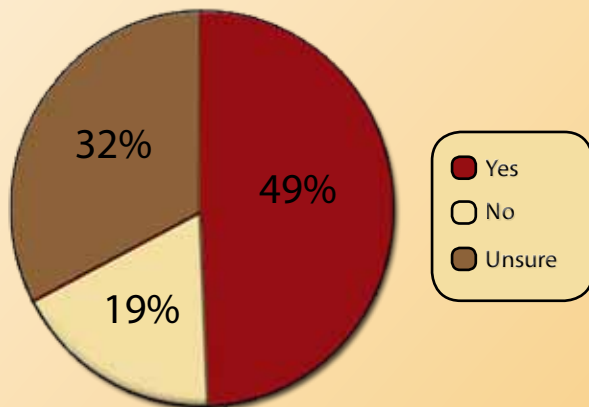
Courses are prepared and taught by experienced poultry industry representatives and outstanding faculty from participating universities and related agencies. The six courses are offered in a sequence of Summer Sessions I and II. The MPC Coordinating Council evaluates course content and modifies the curriculum as needed, aligning the COE Program with current industry practices.

MPC wanted to know how well each of the COE courses prepared students for a future in the poultry industry or academics. Survey results showed Avian Health ranked the highest, followed by Avian Physiology, Breeder Flock/Hatchery Management, Poultry Nutrition, Poultry Enterprise Management, and Poultry Products Technology. Wednesday night forums were implemented a number of years ago to provide COE students the opportunity to interact with industry leaders, learn more about the poultry industry, and explore future career opportunities.

How well did COE courses/events prepare you for your job (or graduate school if applicable)



Would you have accepted a job from your internship employer?



INTERNSHIPS

MPC coordinates internships and on-the-job opportunities for COE students. The internship fits into the academic timetable for each participating university and complements the summer's academic courses at the University of Wisconsin-Madison. Students are able to take courses for six weeks and work in a poultry-related internship for 4-6 weeks during the summer. Once graduated from the COE Program, students can also participate in a full-summer internship.

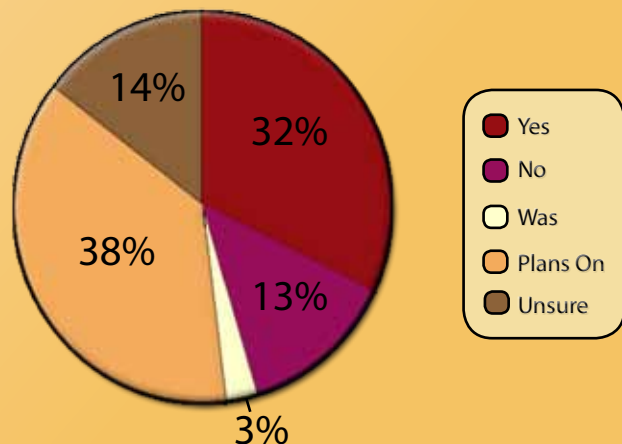
Survey results show 49% of students would have accepted a full-time position from their internship provider if it were offered. MPC has found industry retention is higher if students have the opportunity to participate in at least one internship during COE.

Hands-on experience is invaluable – 90% of the COE students believed their internship was a positive experience. This is reflected in the fact that 77% of the students participated in at least one internship (compared to 64% in the previous 5 years).

EMPLOYMENT STATS

To evaluate the effectiveness of the COE Program, it is important to look at job placement and retention. The survey showed 32% of COE students are currently employed in the poultry industry and 38% plan to work in the industry. Thus, 70% of the COE students are or plan on working in the poultry industry, compared to 64% during the previous 5-year survey. Those not working in the poultry industry went down to 13%, compared to the previous survey where 22% were not pursuing a career in the industry. The majority of the "unsure" students (14%) are still enrolled in their undergraduate program; this highlights the need for MPC internships following COE completion. Keeping students involved in the poultry industry through graduation helps ensure industry retention.

Current Poultry Employment Status



COE 2011 COE Program – Faculty, Guest Speakers, & Students

As the Midwest Poultry Consortium's Center of Excellence (COE) Scholarship Program completes its 16th year, the COE continues to educate students in poultry science and helps ensure the availability of qualified poultry graduates for employment within the industry. This would not be possible without experienced poultry industry representatives and outstanding faculty from participating universities and related agencies. The six courses are offered in a sequence of Summer Sessions I and II. The MPC Coordinating Council evaluates course content and modifies the curriculum as needed, aligning the COE Program with current industry practices.

2011 SESSION I

Avian Physiology

Mark Berres, University of Wisconsin-Madison

Patricia "Scotti" Hester, Purdue University

Bernie Wentworth, University of Wisconsin-Madison

Breeder Flock & Hatchery Management

Ron Kean, University of Wisconsin-Madison

Sally Noll, University of Minnesota

Ian Rubinoff, Hy-Line International

Mike Wineland, North Carolina State University

Poultry Products Technology

Deana Jones, Russell Research Center

Michael Musgrove, Russell Research Center

Mark Richards, University of Wisconsin-Madison

2011 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, West Liberty Foods

Nick Levendoski, Organic Valley Farms

Jeremy Lies, Gold'n Plump

Brad Lillie, MacFarlane Pheasants

Tom Lohr, Henning Construction

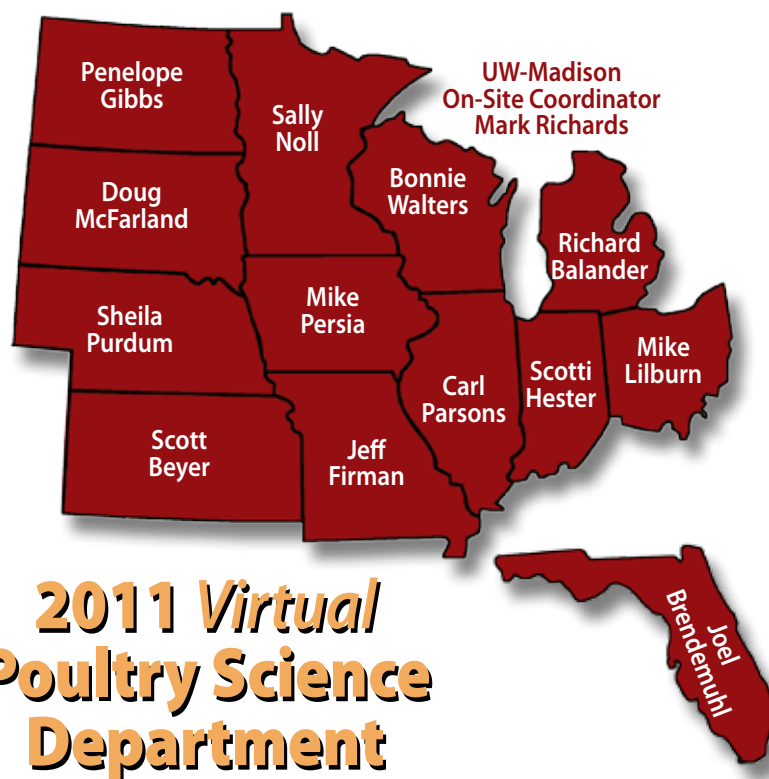
Kevin Murdoch, Maple Leaf Farms

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.



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. 2011 Forum participants:

Craig Burda, Bobbi Christenson, & Rocky Lisowski, Gold'n Plump

Krista Eberle, United Egg Producers

David Hurd, Rose Acres

Jenna Knoblauch, Midwest Poultry Consortium

Brad Lillie, MacFarlane Pheasants

Tara Lindsay & Jaime Parizek, West Liberty Foods

Record-Breaking Interest in COE Program

MPC's 2011 Center of Excellence Scholarship/Internship Program received the highest number of student applicants to date with 65 students eager to compete for COE scholarships! Twenty-eight students representing 13 universities were awarded scholarships to attend six weeks of accelerated poultry science courses which began June 6th at the University of Wisconsin-Madison. Of the 28 students, 11 became COE graduates earning them a Poultry Science Emphasis. In order to graduate, a student must complete all six COE courses which are offered in two 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:
2011	28	1	2	2	1	2	3	3	1	0	1	0	5	1	3	3	28
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
Total:		11	15	30	21	30	46	38	10	21	10	30	65	17	88	26	458

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

Total COE Students:	304
Students who completed both years:	154

Universities Represented in 2011

Augsburg College	1
Iowa State University	2
Kansas State University	2
Michigan State University	3
North Dakota State University	1
Purdue University	5
University of Florida	2
University of Illinois	1
University of Minnesota – St. Paul	3
University of Missouri	1
University of Wisconsin – Madison	3
University of Wisconsin – River Falls	3

2011 Internships

Another record breaker was achieved in 2011 - 30 internships were hosted by MPC member companies! MPC has found students' participation in an internship improves retention within the industry.

Persephone Allen - West Liberty Foods
Maria Arendt - GNP (Gold'n Plump) St. Cloud/Arcadia
Elizabeth Beilke - Hy-Line International
Lorryn Bolte - Willmar Poultry Company
Kindra Burger - Cal-Maine Foods
Alexandra Copeland - Willmar Poultry Company
James Denney - Rose Acres
Emmanuel Fernandez - University of Florida
Quentin Ford - Maple Leaf Farms
Crystal Ganz - GNP (Gold'n Plump) Arcadia
Kevin Gast - Sparboe Farms
Lauren Kane - University of Illinois Poultry Farm
Samuel Knudsen - Family poultry farm
Keturah Kreider - Maple Leaf Farms
Landon Lewis - Sparboe Farms
Kathryn Meloche - GNP (Gold'n Plump) St. Cloud
Kristin Merriman - Daybreak Foods
Lauran Morman - West Liberty Foods
Neva Nachtrieb - Sparboe Farms
Faith Pronschinske - GNP (Gold'n Plump) Arcadia
Elizabeth Rezac - Hy-Line International
Chad Risch - GNP (Gold'n Plump) Arcadia
Abigail Sielaff - Center Fresh Group
Shepard Sonstegard - GNP (Gold'n Plump) St. Cloud
Rebecca Strong - Purdue University
Joseph Sylve - Rose Acres
Corey Van Denburgh - Center Fresh Group
Kailynn VanDeWater - MacFarlane Pheasants

“Spellbindin’ Good Time” Banquet Marks COE Graduation

Concluding its 16th year of providing a poultry science emphasis to students interested in pursuing careers in poultry, the Midwest Poultry Consortium held its year-end banquet and awards ceremony for the Center of Excellence (COE) Scholarship/Internship Program on July 12 at Madison’s Best Western Inn on the Park Capitol Square. The “Casino-Nite” Banquet attracted more than 65 students, family members, staff, board members, faculty, and industry representatives and honored both students and faculty for their accomplishments and hard work in completing another successful COE 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 in the upper Midwest, 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 “Casino-Nite” Banquet began with a dice game which awarded the first person to roll doubles twice the privilege of carving their table’s turkey – a “highly coveted” honor. The dinner was followed by the evening’s awards ceremony which honored James Denney as the class clown (Yolkster Award), Corey Van Denburgh (for the second straight year) as the most dedicated student (Ducks in a Row Award), and Emmanuel Fernandez as the most intelligent student (Egghead Award). The Pullet-zer Prize which recognizes the faculty member of the year was awarded to Ron Kean of the University of Wisconsin-Madison (nominees also included Mark Berres, Mark Cook, Scotti Hester, Mike Lilburn, Sally Noll, and Mike Persia). **Congratulations Ron!**

The presentation of diplomas to COE graduates by on-site coordinator Dr. Mark Richards gave well-deserved recognition to students who’ve completed both years of the COE. 2011 graduates include: Persephone Allen, Maria Arendt, Elizabeth Beilke, Kindra Burger, Quentin Ford, Keturah Kreider, Landon Lewis, Kathryn Meloche, Abigail Sielaff, Rebecca Strong, and Corey Van Denburgh.



2011 COE Graduates: Front row (L to R): Abigail Sielaff, Keturah Kreider, Maria Arendt, Kindra Burger. Second row (L to R): Kathryn Meloche, Persephone Allen, Elizabeth Beilke, Corey Van Denburgh, Rebecca Strong, Quentin Ford, Landon Lewis. **Congratulations to our COE graduates!**

The Casino-Nite fun continued with attendees playing blackjack in an effort to increase their “funny money” in order to bid on generous prizes donated by MPC sponsor companies. Special thanks go to the following companies for generously donating Casino-Nite prizes: Lou Arrington, Aviagen Turkeys, Chore-Time Egg Production Systems, Cooper Farms, GNP (Gold’n Plump), Hybrid Turkeys, Jennie-O Turkey Store, and Sparboe Farms.

Students and industry representatives took advantage of the great opportunity to become better acquainted and visit about potential employment opportunities within the poultry industry.

The Midwest Poultry Consortium extends a big thank you to our event sponsors Evonik Degussa Corporation, GNP (Gold’n Plump), Hy-Line North America, Jennie-O Turkey Store, Land O’Lakes Purina Feed, Naturally Recycled Proteins, Rose Acre Farms, and Sparboe Companies for making the “Casino-Nite” Banquet such a success.



MPC President, Beth Nelson, carves turkey for guests.

Students in the News

Zane Baker, a 2008-2009 participant of the Center of Excellence Scholarship Program, has accepted the position of Management Trainee with Sparboe in Iowa. Zane, a May 2011 graduate of Iowa State University, majored in Animal Science.

Kevin Bolek, a 2010 participant of the Center of Excellence Scholarship Program, has recently 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.

Amy Davis, a 2009-2010 participant of the Center of Excellence Scholarship Program, has accepted the position of Operations Associate with Cargill in Missouri. Amy, a December 2011 graduate of the University of Illinois, majored in Animal Science.

Laura Iesue, a 2010 participant of the Center of Excellence Scholarship Program, has accepted the position of Production Supervisor with Cal-Maine in Rossburg, Ohio. Laura, a May 2011 graduate of The Ohio State University, majored in Animal Science/Pre-Vet.

Rheannon Jordan, a 2010-2011 participant of the Center of Excellence Scholarship Program, has accepted the position of Breeder Manager with Hy-Line in Warren, IN. Rheannon, a 2012 graduate of Purdue University, majored in Animal Science with an Animal Production Concentration.

Neva Nachtrieb, a 2011 participant of the Center of Excellence Scholarship Program, has accepted the position of Research Assistant with Dr. Persia and Iowa State University in Ames, IA. Neva, a May 2011 graduate of Iowa State University, majored in Animal Science. Neva will start graduate school at Iowa State University in January 2012.

MPRP Midwest Poultry Research Program

The Midwest Poultry Consortium (MPC) began as a program which was dedicated to addressing the critical need to improve the availability of poultry science education at land grant universities in the upper Midwest and to ensure the poultry industry maintained a well qualified pool of prospective candidates for future employment. It wasn't until the late 1990's that the Midwest Poultry Consortium began contemplating, "How can we complement the COE?" It was at that time that the MPC started working towards a program that would provide research funding which would be devoted to addressing the priority research needs within the poultry industry. Doing so, it was thought, would not only help address some of the industry's most complex and challenging problems, but at the same time, complement the COE by engaging not only researchers, but students interested in careers in the poultry industry who serve as techs, assistants, and grad students assigned to those projects.

Then in 2001, after a lot of hard work and diligent effort, it happened - funding for the Midwest Poultry Research Program (MPRP) was appropriated. A research summit quickly followed to determine industry priorities and funding for projects began in earnest in 2002. Since then, over \$5 million has been used to fund 140 poultry-related research projects covering everything from food safety to animal welfare. While its direct benefit to the industry is obvious, indirectly it has provided immeasurable benefit as well. From fostering greater collaboration among poultry researchers to providing insight into some of the most complex research issues facing the industry, the MPRP has been a valuable component of the research infrastructure of the poultry industry for the better part of the past decade.

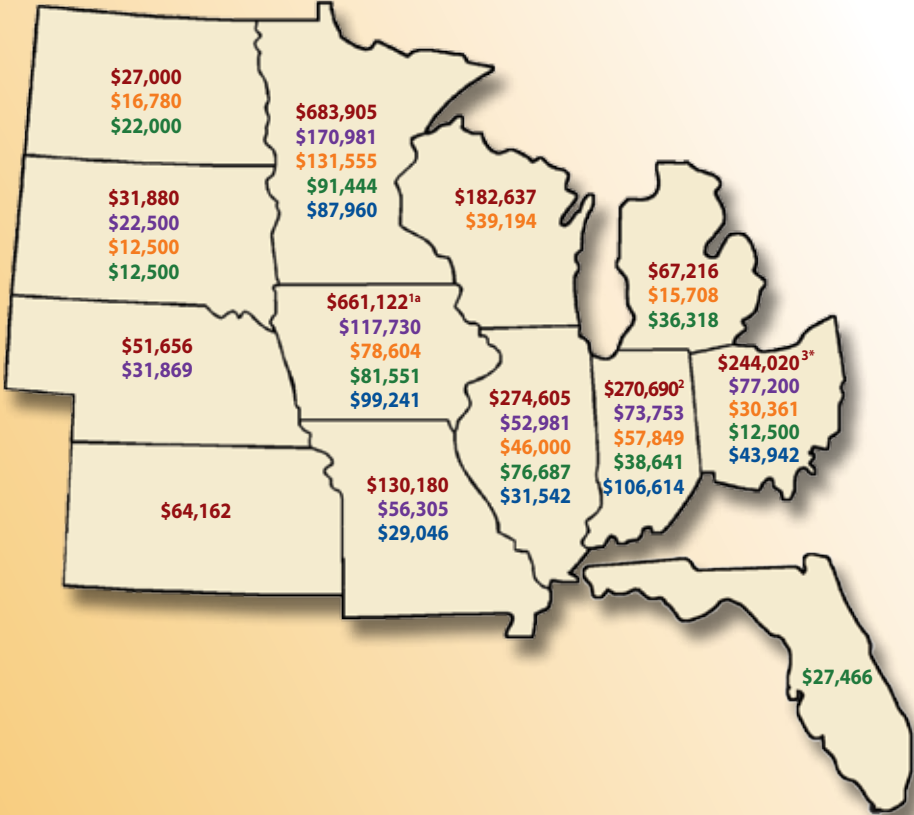
And while the program has not been funded as of late, it still continues to provide benefits to the industry, as demonstrated in the final results of the projects funded in FY 2010 which are now finishing their final work (a snapshot of those results can be found later in this annual report and in full on the MPC website located at <http://www.mwpoultry.org/MPRPProjectDB.php>).

As MPC continues to focus on the Center of Excellence Scholarship/Internship Program, it is committed to re-establishing the MPRP as well. Today, the funding climate in Washington, D.C. is as difficult as it has been in years. However, there remain a handful of representatives who understand the value of agricultural research and its impact on our country's economy and ability to remain competitive. MPC is committed to working with these lawmakers moving forward in a continuing effort to revive MPRP funding.



MPRP Funding by State

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



¹\$50,009 Mississippi State University
²\$1,000 University of California-Davis
²\$1,000 Washington State University
³\$10,000 University of Arkansas
^a 6,100 University of Maryland
^{*}\$18,360 University of Arkansas

2010 MPRP Project Reports

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

Summary: Digestibility of AA varied among the 3 DDGS samples; however, there were no consistent differences among the 3 assays. For example, the PFR generally yielded higher values than the SIAAD and PFC for DDGS 1 and 2 but not DDGS 3 and differences between the SIAAD and PFC were not consistent. The PFR yielded significantly higher values than the SIAAD and PFC for some AA in DDGS 4 but not for others. The last DDGS 4 was very dark in color and had lysine digestibility of only 41-51% for the 3 assays.

For the MBM, 16 samples were evaluated in the PFR and the 2 lowest and 2 highest AA digestibility samples were then evaluated in the PFC. Both assays did well differentiating the poor and high quality MBM, which differed greatly in AA digestibility. There were differences in AA digestibility between assays, but these were not consistent. The samples were not evaluated in the SIAAD due to insufficient amounts of sample.

A new PFC has been developed for determining ileal AA 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 DDGS and MBM samples, there were no consistent differences in AA digestibility among the 3 methods. These results indicate that all 3 assays are acceptable methods for determining AA digestibility in feed ingredients for chickens.

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

ISU – Persia

Project Award: \$30,000

Summary: Direct comparison of the excess energy contributed by the 3% oil diets against the energy determined through the slope of the regression line equations, for each of the oil sources fed to broilers, provided an average of a 69% increase over the energy value derived from the equations. The comparison of the 2% oil diets fed to the first-cycle laying hens provided an average of a 51% increase. This increase in estimated energy by difference in comparison to slope-regression analysis can be attributed to an extra caloric effect of the additional fat, due to increased digesta transit time and absorption rate of dietary energy. This extra energy comes from increased utilization of other components of the diet and not from the fat itself, but must be removed from the calculations to accurately determine the energy value of the various fat and oil sources.

Although there are some differences in the utilization of these fats between layer and broiler species (soy oil and poultry fat), the results generally fall within the accepted historic values for these fats and oils. One point to note is the variability in the energy content of the AV blended oils. It suggests that care must be taken in selecting AV blended oil due to possible variable energy content and quality.

In conclusion, dietary fat continues to be a valuable method to increase chicken dietary energy. The extra-caloric effect of dietary fat was validated and we are currently working with the data to generate predictive equations for these fat sources.

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

ISU – Xin

Project Award: \$69,241

Summary: 1) Average daily emissions rates of ammonia, carbon dioxide, and methane for the aviary hen houses were found to be 0.15, 78, and 0.10 g/bird/day. These values are higher than reported values for manure-belt hen houses, but lower than reported values for high-rise hen houses. Particulate matter emissions of the aviary houses were found to be higher than reported values for layer barns, with emission rates of 105 and 8 mg/bird/day for PM10 and PM2.5, respectively. 2) Total heat production rate of the hens and house-level latent heat production rate for the aviary housing system averaged 6.15 and 1.85 W/kg. These values are comparable to the values found with traditional housing systems. 3) The aviary houses had 25 fewer eggs per hen housed during the production period of 18-80 week as compared to Hy-line brown layer guidelines. Cumulative mortality was 10.2% compared to the 4.2% suggested in the guideline. Feed conversion was somewhat poorer at 3.59 lb/doz eggs as compared to the guideline of 3.31 lb/doz. 4) The aviary barns do use some supplemental heat (22 gallons LP for one house – House 2 and 106 gallons for the other house – House 3 with higher set-point temperature); however, its primary usage was not in the coldest months, but instead was used in the spring when there was a great fluctuation in the ambient temperature. The fluctuating temperature led to over-ventilation of the barns, which in turn called for supplemental heating. Barn set-point temperature impacts LP use. The electric energy use in these barns is driven mainly by the ventilation fans, but in winter the blowers for manure drying are in fact the primary power consumer. The amount of time these blowers run should be evaluated. 5) The production cost for the aviary system was about 60% higher than for the conventional system. The higher cost mainly results from the higher housing and equipment costs relative to the larger space per bird housed in the aviary system. Hence, it is critical to evaluate if/how the space per bird can be reduced without affecting the hen's well-being. Poorer feed conversion, related to the hen genetics, also contributes to the higher production cost. Eggs in the aviary houses also had higher percentage of checks which may be improved by adjusting the diets or by equipment design/operation. The projected payback period for the aviary system may range from >40 years to 3 years, depending on feed cost and egg price. 6) Some welfare assessment parameters such as keel injuries changed over time within the same group of hens, and further research is needed to determine risk factors for correction. Litter was a valuable resource for these hens that, on average, accessed the litter area more than once daily. 7) The mPCR assay approach provides an accurate and rapid method for quickly identifying *Salmonella* spp. among suspect isolates recovered from poultry production environments. Incorporation of this mPCR in an FDA/NPIP-based isolation workflow may speed the acquisition of actionable data on the presence of *Salmonella*, differentiate between generic *Salmonella*, *Salmonella* subspecies I, *S. Typhimurium* and *S. Enteritidis*, and eliminate wasteful downstream testing of false-positive non-*Salmonella* isolates.

Fractionated *Clostridium Septicum* Antigens for Turkey Clostridial Dermatitis Vaccines

U of MN – Foster

Project Award: \$54,360

Summary: The pET expression vector system to produce recombinant *Clostridium septicum* α toxin protein with a fusion peptide (NCAT-TXN) was used in this experiment. The peptides will be used for side-by-side comparison to the previously prepared NCAT and NCAT-MBP (Nature Technology Corp. Lincoln, NE).

Both the NCAT and NCAT-MBP for a cytotoxicity assay were used to be sure that deleting the internal 28 amino acids from the wild type α toxin protein rendered the peptide non-cytolytic and thus safe to use in vaccination trials. The NCAT protein alone was not toxic to the SupT cells at concentrations of 100 μ g/well (1 mg/ml). The NCAT-MBP showed increasing cytolytic effects at greater than 25 μ g/well (250 μ g/ml). For the vaccination trials, only 50 μ g/dosage was used which is well below the limits of cytotoxicity. The wild type *Clostridium septicum* causes cell lysis at levels between 10-50 pg/ml (data not shown).

A vaccination trial was performed using 40 day-old poults for each of the following vaccines: 1) 50 μ g NCAT protein alone + Adjuvant; 2) 50 μ g NCAT-MBP + Adjuvant; 3) 50 μ g of the NCAT bacterin lysate used to prepare the purified NCAT protein + Adjuvant; and 4) 50 μ g of the NCAT bacterin lysate used to prepare the purified NCAT protein without adjuvant. Vaccines were administered on days 2 and 21 (formulated with aluminum hydroxide adjuvant for groups 1 and 3 or with aluminum phosphate adjuvant for group 2). In addition, 30 poults were sham injected with either alum adjuvant or saline (control birds), and 10 poults were sacrificed at day 1 for analysis of pre-immune serum levels. Half of all birds were bled at 14, 21, 35, and 53d for ELISA. All birds were challenged at 53d with 0.5ml *Clostridium septicum* (1×10^7 cfu), monitored for mortality for 72h, then sacrificed by cervical dislocation with about 25% of the birds selected for necropsy. An additional experiment to test the effects of temperature and humidity on the mortality of the birds after being challenged was conducted by placing half of each group of vaccinated and controls birds at 64°F-72°F with ambient humidity and the other half at 72°F-80°F with approximately 10-15% increased humidity. The NCAT alone (blue tag) protected better than the NCAT-MBP (red tag) and the NCAT Bacterin +/- adjuvant (yellow and orange tags, respectively) provided 60-65% protection. This suggests that a formulation of bacterin alone with no adjuvant could be a cost effective vaccine. Of interest, 61% of all the birds that died following challenge were from the groups that had received the higher temperature and humidity. ELISA was performed on the sera samples collected throughout the trial. The following was revealed: 1) pre-immune sera reacting to NCAT was very low; 2) the NCAT alone (blue tag) showed significant titers at 21d but titers were not significant at 25 or 53d. This also correlates with the 67.5% survival rate. 3) the NCAT-MBP (red tag) did not show appreciable titers at 14, 21, 35, and 53d and this correlates with the 50% survival rates. It is possible that the immune response observed was primarily against the MBP and not the NCAT. Upon receiving the 2nd injection, the antibody titers should have increased 3-5 fold, or even greater. This dramatic increase was not observed. It is theorized that the circulating antibody levels present in the birds was too high when the birds received the 2nd vaccination at 21d suggesting that subsequent immune responses were greatly reduced by clearance and that the 2nd vaccination should be delayed until around 35d; 4).

The NCAT bacterin lysate + adjuvant (yellow tag) showed the highest titers at week 3 and was significant but again declined and became non-significant at 35 and 53d. The higher titers correlate with the 60% survival. Once again the reduced titers after 21d were probably due to antibody clearance; and 5) the NCAT bacterin alone (orange tag) did not show significant titers at any time tested, probably due to clearance, although the ELISA data did not correlate to the 65% survival rate.

Studies on Pathogenesis and Immunity to Turkey Clostridial Dermatitis

U of MN - Nagaraja

Project Award: \$33,600

Summary: Dexamethasone (Dex) is a gluco-corticoid known to induce cell mediated immuno-suppression and lower resistance to infection in various animal species including turkeys. Dex at a dose rate of 2mg/kg was found to cause osteomyelitis in turkeys when challenged with *E. coli*. The results from this study showed that turkeys become susceptible to *Clostridial Dermatitis* when immuno-suppressed. However, development of *Clostridial Dermatitis* lesions was minimal.

Coccidial infection is very common in turkeys. A breach in the integrity of the intestinal tract is attributed as the reason for the increased colonization, severe infection, and mortality caused by *C perfringens* in these birds. In these studies, *C perfringens* and *C septicum* do not appear to cross the intestinal barrier in turkeys following a breach caused by coccidial infection to cause *Clostridial Dermatitis* in turkeys. The findings were contrary to earlier findings where, a breach in the integrity of the intestinal tract is attributed as the reason for the increased colonization, severe infection and mortality caused by *C perfringens* in chickens.

Clostridium perfringens isolate UMNCP01 that appeared most potent differed in their secretory protein profile from less potent isolate like UMNCP06. The role of hypothetical protein 1232 needs to be further investigated. The functional annotation of this protein is suggestive of a protease. It has been reported that *C perfringens* produces extracellular toxins including beta2 toxin, enterotoxin, perfringolysin, collagenase, lambda toxin, hyaluronidase, dnase, neuraminidase and urease. These results also suggest involvement of different toxins of *C perfringens* in pathogenesis of *Clostridial Dermatitis* in turkeys.

The proteomic profiles of all *C septicum* isolates appeared identical. The major secretory toxins in *C septicum* isolates identified were alpha toxin, septicolysin, sialidase, Dnase, flagellin and Gelson precursor (actin depolymerizing factor). The Gelson precursor (actin depolymerizing factor) might have some role in the pathogenesis of *Clostridial Dermatitis*, but more studies are warranted to confirm this assertion. Since *C septicum* genome is not completely sequenced, not much information is available for the development of a recombinant vaccine at this point. Unlike *C perfringens* only one type of proteomic profile was observed for *C septicum* isolates. These results support the findings in the MLST analysis as well as previous reports that genomes of *C septicum* poultry isolates are highly conserved.

The results of the study offered an in-depth understanding of the pathogenesis of *Clostridial Dermatitis*. The disease model offers promise for use as a challenge model in the development of vaccines against *Clostridial Dermatitis* in turkeys. The findings also helped in refining the composition of the inactivated vaccine for better protection against *Clostridial Dermatitis* in turkeys.

Modeling Amino Acid Requirements for Turkeys

U of MO – Firman

Project Award: \$29,046

Summary: The results were somewhat unexpected, as past research in the laboratory has resulted in similar performance between turkeys fed ideal protein negative control rations and industry standard positive control rations. After further examination and analysis of the feed ingredients, it was determined that analyzed nutrient levels in the rations did not meet expected levels. For the birds consuming the negative control ideal protein diet, formulated to meet digestible amino acid requirements as closely as possible, this resulted in amino acid deficiencies and, therefore, reduced growth.

Feeding turkeys makes up a large percentage of the total cost of production. The current goal in the industry has shifted away from just feeding to reach certain growth standards to meeting maximum growth in the most cost efficient manner, or finding the least cost per unit of gain. Developing feeding programs that utilize concepts such as ideal protein, formulation programs that calculate the ingredient combinations that will closely meet the birds' nutritional requirements at the least possible cost, digestible amino acid values, and crystalline amino acid supplementation has allowed the poultry industry to reduce dietary crude protein to decrease excess amounts of amino acids and the cost of rations. Formulation of diets with a reduced level of crude protein alone can achieve significant cost savings. Using ideal protein ratios appears to be the best nutritional approach for cost savings, but it is imperative to have confirmed values for amino acid levels and digestibilities in the feedstuffs and to use a safety factor when formulating for commercial diets. It does not appear that changing diets based on diet costs is a cost-effective strategy, as bird growth is impaired. Formulation strategies are likely the other main approach to cost savings, and further research in this area is necessary.

Regulation of Duck Breast Muscle Growth and Development

OSU - Velleman

Project Award: \$43,942

Summary: The current study evaluated breast muscle development in 5 Maple Leaf lines, XH1F, XH1O, XH2T, XM2S, and ZS1F. The XH1F and XH2T lines were similar in their morphological development pattern. Both of these lines exhibited a period of rapid muscle fiber growth between 30 to 40 d of age. Growth during this period of time is due to hypertrophy caused by the activation and fusion of myogenic satellite cells with existing muscle fibers. Selection practices favoring hypertrophy result in large diameter muscle fibers frequently termed giant fibers. Giant fibers are 3-5 times the size of normal muscle fibers. Giant fibers have been associated with meat quality problems in broilers. In general, the giant fibers lead to structural and metabolic abnormalities within the fibers as the fibers outgrow the available supply of nutrients to sustain them from necrosis. In contrast to growth by hypertrophy, muscle growth by hyperplasia results in an increased number of fibers with smaller diameters. The period of fiber formation or hyperplasia is limited to the embryonic period of development where muscle fiber number is determined.

The XH1F in conjunction with its large muscle fibers has limited perimysial connective tissue space leading to muscle fiber

degeneration. Having sufficient connective tissue spacing is important to permit blood circulation into the muscle through the capillary network. The capillaries are necessary for oxygen supply, which is particularly important for a muscle that respire by both aerobic and anaerobic respiration. The duck breast muscle likely contains a mixture of aerobic and anaerobic muscle fibers so maintaining capillary beds will be important for the metabolic function of the muscle. As the fibers become larger there is reduced capillaries surrounding a single fiber, which is problematic for muscles undergoing oxidative metabolism (red muscle) and for glycolytic muscle (white muscle) which represents a reduced support network to remove lactic acid. Increased concentrations of lactic acid within the muscle will decrease muscle pH. In turkeys, the pale soft exudative condition is associated with an increase in lactic acid and decrease in pH (Sosnicki and Wilson, 1991). The XH2T line was similar to the XH1F line except it was more moderate in terms of the morphological features described for the XH1F.

The XM2S line had a morphological breast muscle structure at 40 d of age that is a mix of "normal" sized and giant muscle fibers. Fiber degradation was noted in the larger muscle fibers which is typical for excessively large muscle fibers. Because of the mix of muscle fibers in the 40 d old breast muscle, it appears that this line has received moderate selection pressure for muscle mass accretion. Also with many of the muscle fibers having a smaller diameter compared to the XH1F and XH2T lines, more perimysial connective space is available.

The XH1O line had the smallest diameter muscle fibers at 20 d through 40 d of age. In terms of perimysial connective tissue space at 40 d of age, only the ZS1F line had more perimysial area. The breast muscle overall is healthy in appearance with well defined muscle fiber bundles and individual muscle fibers. It had limited giant fibers. There was some degeneration, but not as significant as the XH1F or XH2T lines. The muscle fiber structure is very uniform and regular indicating selection for muscle mass accretion, but selection has been less directed towards the hypertrophy phase of muscle growth.

The ZS1F line is difficult to categorize in terms of its muscle dimensions. This is the most variable of the lines in terms of fiber characteristics and overall morphological assessments. Because of these irregularities, this line may be a female line that has received limited selection for muscling.

Of the lines that were examined in the present study, the XH1F breast muscle is of concern because of its massive muscle fiber size, limited connective tissue spacing, and significant muscle fiber degradation. The XH2T line has similar attributes but is less severe. However, all of the lines do have morphological issues as can be seen by the moderate morphological scores.

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

Purdue - Ajuwon

Project Award: \$40,500

Summary: Antibiotics have been widely used in animal production since the 1940s. In the fifties, it was also demonstrated that antibiotics could improve animal performance and gut health (Coates et al., 1955) and this led to widespread use of antibiotics in poultry feed. In this study, the improvement of BWG and feed efficiency by salinomycin treatment was as expected. These data confirmed that Salinomycin improves animal performance (Duffy et al., 2005). Also,

Salinomycin significantly reduced interleukin-6 expression in the early stage of the birds in the ileum. Direct fed microbials (DFMs) or probiotics improve animal performance partly by maintaining a beneficial gut microflora (Callaway et al., 2008). Although studies have shown that DFMs enhance growth of birds (Lee et al. 2010), growth improvement was not observed in Avicorr treatment in this study. Indeed, lower digestibility of DM, energy, N and P was obtained in the Avicorr treatment compared to the other treatments at 21 d suggesting that it might depress nutrient utilization in the early stage of the birds. However, depressed utilization of these nutrients did not reflect in reduced animal performance.

Alphamune is a yeast extract containing mannan-oligosaccharides and β -glucans. It is reported to increase the BW and feed efficiency, improve immune response, and reduce salmonella colonization in chickens (Van Immerseel et al., 2000). However, in this study growth performance improvement was not found with Alphamune use. However, alphamune may reduce IL-6 expression in ileum compared with control group. Although Orego-Stim had no effect on the growth performance, it suppressed the expression of multiple inflammatory cytokines in the cecal tonsils. The reduction of most inflammatory cytokines by Orego Stim in the cecal tonsils at 42 d indicates it might have significant anti-inflammatory property, perhaps due to its essential oils content.

In conclusion, although several studies have shown the beneficial effects of DFMs, yeast and essential oils on poultry performance, results of this experiment indicate that under experimental challenge with coccidian vaccine, these benefits may not be achieved. Additional experiments using field isolates of *Eimeria* may better replicate field conditions of coccidiosis incidence and may allow better capture the benefits of these anti-coccidial alternatives.

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

Purdue – Applegate

Project Award: \$29,214

Summary: Five hundred and twelve Hyline Variety W36 hens were used in this study. The study was conducted as a 2 x 4 factorial experimental arrangement from 30-46 weeks of age. Diets were formulated on a total (TOT) or digestible (DIG) basis (2) as well as by amino acid density (4). All diets used the ratio of amino acid to Lys based on that published in Hyline's management guide for the W36 (2009). Four amino acid density diets were fed (low, medium, medium/high, and high) as described for diets formulated on a total basis. For the digestible amino acid diets, the lysine digestibility of similar nutrient specification corn and SBM diets were used to establish the digestible amino acid targets for the low, medium, medium/high, and high series diets based on the same targeted intake (700, 750, 800, and 850 mg/h/d) and similar ratios then used versus lysine for the remainder of amino acids. All diets had 6.0% pork meat and bone meal and 10% DDGS (total of 16% of byproduct ingredients). These ingredient inclusions were based in consultation with laying hen nutritionists from NE, IA, MN, IN, and OH to have a "realistic" inclusion of by-product ingredients.

The Low and High diet series for each of the DIG and TOT diets was made (i.e., as basal diets) and used to mix the Medium and Medium/high diets in differing proportions as to minimize the influence of mixing errors. For this study 48 cages of hens (2 birds per cage, 84 in²/

bird) were fed each diet. Feed intake was determined monthly from 4 cage blocks (12 blocks per diet). Egg production was determined daily, and egg weights determined from a 2 day egg collection on a weekly basis. Every 4 weeks (34, 38, 42, and 46 wk of age), eggs from a 2 day collection were used for determination of specific gravity, egg components (dry shell, albumen, and yolk) from 36 cages per diet. Every 8 weeks (38 and 46 wk of age), the albumen and yolk were retained from the egg break-outs and freeze-dried for determination of solids yield.

Diets were mixed on a monthly basis. Four diets (TOT high, TOT low, DIG high, and DIG low) were analyzed for amino acids content.

Data were analyzed as a 2 x 4 factorial, with curvilinear relationships of amino acid density within each amino acid formulation method (DIG vs TOT). In addition to egg production measures (egg number, egg weight, egg component, and solids yield) and feed-to-egg conversion (number and mass); production (egg number and mass) over feed cost was determined for each 6 pen block per diet and return on feed investment evaluated. In the future, a spreadsheet tool will be developed, such that variables such as egg, egg component, and ingredient pricing can be altered and profit/loss determined.

Feed intake did not differ between experimental groups throughout the course of the study. However, hens on the lowest amino acid intake lost the most BW during this 16 wk laying period (8.1%). For egg production (amount and mass), the amino acid density largely affected production. While formulation method (digestible vs. total) did not drastically impact number or mass of eggs produced, there was a trend towards formulation on a digestible basis having improved production for birds fed the "Medium" level versus those fed on a total amino acid basis (3.3 eggs or 15.1 oz more over a 16 wk lay).

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

Purdue – Hester, Garner

Project Award: \$36,900

Summary: Past studies evaluating intervention strategies for improving bone integrity in laying hens have done so during the egg production cycle, when the adult birds may already be experiencing osteoporosis. At this point, nutritional manipulation and changes in management practices, such as increased exercise, may not have as large an impact in alleviating bone fractures of hens as would earlier intervention with pullets. Early intervention to improve skeletal health in egg laying strains of chickens has received little attention. The results of the current study suggest that mechanical loading achieved through perching have beneficial effects on pullet health by stimulating leg muscle deposition and increasing the BMC of certain bones without causing a decrease in BMD.

Additional information gleaned from this study was to determine when bone fractures occur during the pullet phase, which is important for assessment of chronic pain. Results show bone fracture did not occur in caged pullet flocks prior to 12 wk of age regardless of whether pullets had access to a perch or not. Likewise, Wilkins et al. (2005) reported no problem with bone fractures in pullet flocks. Instead, perch access provided benefits to pullets as compared to those chickens without access. Perches encouraged pullet activity leading to larger pullets with perhaps larger skeletal frame and with greater BMC. These changes in pullet development as a result of perching could ultimately lead to

long-term health benefits during adulthood, and particularly at end of lay when osteoporosis is especially problematic.

Keel bone deformation is perhaps caused by continued pressure exerted on the keel when chickens sit on the perch (Sandilands et al., 2009). Callus formation of the keel, as a result of bone fracture, occurs in hens with moderate to severe keel deformities (Käppeli et al., 2011). Pullets of the current study showed no keel bone deformities regardless of whether or not they had access to the perch, similar to results of Käppeli et al. (2011) who reported few deformities of the keel during rearing for pullets given access to perches.

Hyperkeratosis (hypertrophy of the corneus layer of the skin) occurs on the toe- and foot-pads of caged hens and is caused by increased compression load of the toe- or foot-pad on the wire floor of the cage as well as the perch. Our results showed that pullets up to 12 wk of age had healthy feet and that the presence of perches in the pullet cage had no effect on hyperkeratosis score.

The major downside to providing perches in pullet cages of the current study was the higher mortality experienced during the first 3 wk of age. The higher incidence of starve outs for the chicks with perches

as compared to controls suggests that the perches were interfering with the chick's ability to find or access the feeder, although BW of live chicks between treatments were similar at 3 wk of age. Although 2 chick mortalities assigned to the perch treatment were dehydrated, packed cell volume at 4.4 wk of age indicated that the perches did not interfere with drinking as hemoconcentration was not apparent. However, by this age, mortality had subsided.

Perches used in the current study have been field-tested by Big Dutchman, mainly being used by the European egg industry in aviary systems. Material cost for perches is estimated at \$4.92/meter (\$1.50/foot). Assuming a labor cost of US \$12/h and 10 to 15 minutes to install, the estimated labor cost of the installation of metal perches is US \$2 to \$3/cage. (K. Krogman and T. Pollard, Big Dutchman, Holland, MI, personal communication).

Implications for the poultry industry are that the addition of perches to pullet cages offer benefits relative to pullet skeletal health, but further study is needed to investigate the high incidence of early chick mortality during the first 3 wk of life and to determine long term effects during the egg laying cycle.

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