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Editor: Dr Stephen Collett, Associate Professor
Co-Editor: Dr Pedro Villegas, Professor
Department of Population Health

Phone (706) 542-1904 Fax (706) 542-5630
e-mail: Ashley Moody at armoody@uga.edu

Enterococcus cecorum-related arthritis and osteomyelitis in broilers and broiler breeders

Natalie K. Armour, Stephen R. Collett, Susan M. Williams

University of Georgia, Poultry Diagnostic and Research Center, Athens, GA 30602

The isolation of *Enterococcus cecorum* from arthritis and osteomyelitis lesions, and its association with lameness outbreaks in broilers and broiler breeders has sparked increased interest in this topic. In this issue, we describe recent *E. cecorum*-related lameness cases in Georgia, review common features of reported cases, and discuss how this usually harmless gastrointestinal tract inhabitant can occasionally cause significant disease.

Contents

Broiler Live Production Cost	Average Company
Feed Cost/ton w/o color ($)	312.79
Feed cost /lb meat (c)	28.89
Days to 4.6 lbs	41
Chick cost / lb (c)	5.07
Vac-Med cost/lb (c)	0.06
WB & ½ parts condemn. Cost/lb	0.22
% mortality	4.60
Sq.Ft. @ placement	0.82
Lbs/sq. ft.	7.35
Downtime (days)	15

Data for week ending March 11th 2011

Enterococcus cecorum is a normally innocuous inhabitant of the gastro-intestinal tract of various mammals and birds (Devriese *et al.*, 1991, 1992a, 1992b, 1994; Baele *et al.*, 2002). It was not until 2002 that this organism was associated with clinical disease in poultry, when it was isolated from osteomyelitis lesions following outbreaks of lameness in broilers in Scotland (Wood *et al.*, 2002) and in the Netherlands (Devriese *et al.*, 2002). More recently, a succession of similar outbreaks of *E. cecorum* arthritis and osteomyelitis have occurred in broilers and broiler breeders in the United States (Aziz and Barnes, 2007), Belgium (De Herdt *et al.*, 2008), Canada (Stalker *et al.*, 2010) and Hungary (Makrai *et al*, 2011). *E. cecorum* related disease can cause significant economic loss, due to mortality (predominantly as a result of culling), poor feed conversion and increased condemnations at processing. Recurrent outbreaks of lameness in affected houses with subsequent flocks have exacerbated the impact of this disease (De Herdt *et al.*, 2008; Gingerich, 2009). Recently, several cases of *E. cecorum*-related arthritis and osteomyelitis were diagnosed in broilers and broiler breeders in the state of Georgia.

Case Reports

History and clinical signs: The outbreaks of lameness involved one broiler farm and five broiler breeder farms in Georgia. Affected birds displayed a variety of clinical signs, including swollen, inflamed hocks, "hock-sitting" (a characteristic posture involving resting on the hocks, with back arched and legs raised slightly off the ground and extended forward) and paresis to complete posterior paralysis. Mortality (including culls) attributed to lameness was estimated to be 5-7% during rearing, and was non-responsive to in-feed chlortetracycline medication. The broiler flock was 48 days of age at the time of submission, while breeder flocks ranged from 3.5 to 18.5 weeks of age. Males were predominantly affected.

Figure 1. A 49 day old male broiler breeder displaying a characteristic posture associated with compression of the spinal cord

Necropsy findings: Vertebral lesions were a feature of the breeder cases, and involved osteomyelitis of the caudal thoracic vertebra immediately cranial to the kidneys (T6, with occasional involvement of adjacent vertebrae), with impingement on the spinal cord, and dorsal collapse of the vertebral column in some cases. The affected bone had lost its normal architecture, and was typically friable and pale yellow, with caseous exudates in some cases. Advanced vertebral osteomyelitis lesions correlated well with the "hock-sitting" posture and posterior paresis / paralysis. A significant percentage of lame birds had femoral osteomyelitis and septic arthritis of the hock joints; sometimes in the absence of vertebral lesions. In addition to the skeletal lesions, there was evidence of respiratory disease (conjunctivitis, tracheitis and airsacculitis) in the broiler flock and in the 3.5 week old breeder flock. These breeders had moderate to severe bursal atrophy, which was confirmed microscopically.

Figure 2. Vertebral osteomyelitis, with dorsal collapse of the vertebral column and spinal cord compression

Diagnostic testing: *E. cecorum* was isolated in pure culture from affected hock joints and from femur and vertebral osteomyelitis lesions. The isolates were initially identified as suspect *Enterococcus* sp. based on their cultural characteristics, Gram stain morphology and negative catalase reaction. The API20STREP® identification system (bioMérieux Inc., Durham, NC) consistently identified the isolates as *Streptococcus bovis*. However, the reaction profiles corresponded with those previously described for *Enterococcus cecorum* (Devriese *et al*., 2002), and subsequent analysis of cultures with the bioMérieux Vitek 2 Compact bacterial identification system confirmed that the isolates were indeed *E. cecorum*. Microscopic examination of the vertebral lesions revealed osteomyelitis and granuloma formation, with characteristic intralesional cocco-bacilli. Lesions were typically associated with narrowing of the vertebral canal and necrosis of the spinal cord white matter. Affected birds were serologically negative for MG and MS, and no respiratory viruses were isolated from trachea, lung and kidney samples.

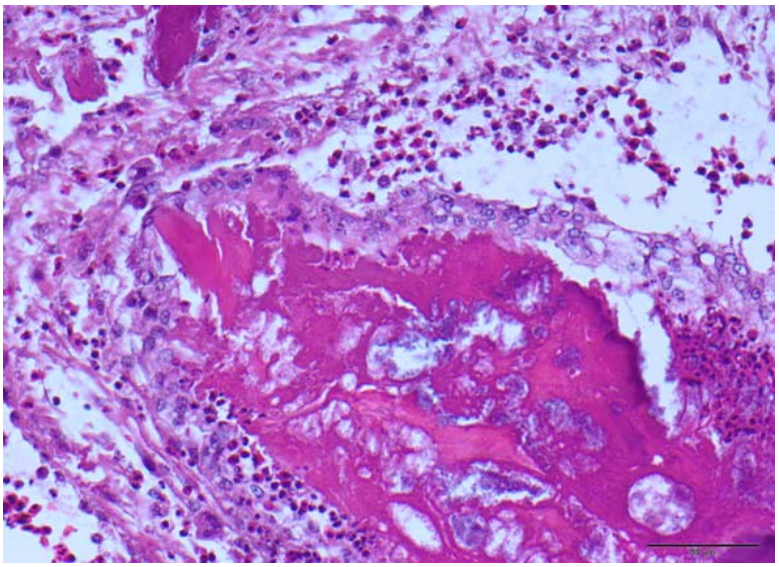

Figure 3. Granulomatous inflammation: necrotic bone with bacteria surrounded by multinucleated giant cells and heterophils

Figure 4. Pure culture of *E. cecorum* on blood agar, demonstrating alpha hemolysis (greening of the agar surrounding the colonies)

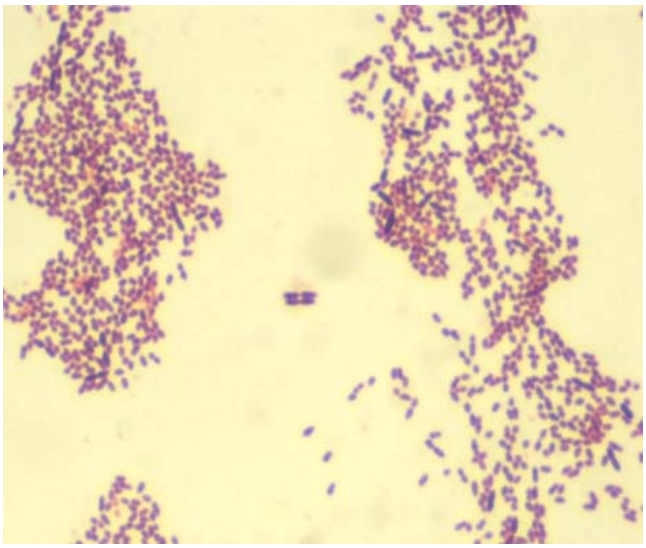

Figure 5. Gram stain of a pure culture of *E. cecorum*, showing characteristic Gram positive cocco-bacilli

Discussion:

While the pathogenesis of *E. cecorum* related osteomyelitis is not well understood, common features in epidemiology and clinical presentation have led to several authors to suggest mechanisms by which this "normal" GIT inhabitant exerts its pathogenic effects.

Location of the lesion: Vertebral osteomyelitis in poultry frequently involves the 5th to the 7th thoracic vertebra. The second to the fifth thoracic vertebra are fused, and the seventh thoracic vertebra is fused to the lumbar and sacral vertebra (Wise, 1975). Since the sixth thoracic vertebra is "free", it is subject to increased mechanical stress, and it is conceivable that microtrauma, with consequent inflammation and hemorrhage, could create a sequestration site for *Enterococcus cecorum*.

Sex of the bird: Weight bearing stress is greatest in heavy breeder males, and would explain why the male broiler breeders are predominantly affected. This finding is consistent with previous reports of the disease affecting predominantly male chickens (Aziz and Barnes, 2007; De Herdt *et al*., 2008; Gingerich, 2009; Stalker *et al*., 2010; Makrai *et al*., 2011).

Bird age: The age of onset of clinical signs caused by to *E. cecorum* osteomyelitis varies. In broilers, the disease has been reported in birds as young as 7 to 14 days of age (De Herdt *et al*., 2008), but it appears to manifest later in broiler breeders, with reports of disease between 6 and 10 weeks of age (Aziz and Barnes, 2007). This could be a function of growth rate, which is significantly higher in broilers than in breeders. In the Georgia cases described here, the broilers were 48 days of age, while the broiler breeders ranged from 3.5 to 18.5 weeks of age.

Respiratory, intestinal and epithelial damage: *E. cecorum* is a normal component of the gastrointestinal flora of chickens. Disturbance of the normal gut microbial balance could conceivably cause a relative increase in *E. cecorum* numbers in the GIT, and thus in the poultry house environment. Invasion into systemic circulation may occur as a result of damage to the respiratory, intestinal or integumentary barriers. Peak prevalence of lameness cases in Georgia coincided with a particularly cold and wet winter. On several farms where ventilation was compromised, wet litter and increased ammonia levels resulted. In addition to precipitating respiratory disease and causing footpad dermatitis, these conditions create a favorable environment for the survival and sporulation of coccidian oocysts, thus potentially creating multiple opportunities for *E. cecorum* to invade systemically. In the field situation, it may be difficult to determine the initial insult that precipitated the outbreak of *E. cecorum* related lameness, because of the time taken for lesions severe enough to cause clinical signs to develop.

Immunosuppressive diseases: In the 3.5 week old breeder chickens described here, there was evidence of bursal damage, probably as a result of infectious bursal disease (IBD) virus infection. Consequent immuno-

suppression would impair the ability of the immune system to respond to bacterial infection.

Virulence potential: Differences in virulence potential of clinical *E. cecorum* isolates in comparison with "normal" gastrointestinal isolates have been suggested (De Herdt *et al.*, 2008; Stalker *et al.*, 2010), although this has not been proven.

Prevention and treatment: Despite the lack of clarity on pathogenesis and predisposing causes of *E. cecorum* related disease in poultry, there are several management interventions which have shown effect in reducing the incidence of *E. cecorum* lameness cases in subsequent flocks. Complete clean-out and disinfection with fumigation of the house, litter replacement (with litter composting in subsequent grow-outs), water line cleaning and continuous water sanitation were reported to reduce the incidence of disease (Gingerich, 2009). Preventative treatment with amoxicillin and/or tylosin at regular intervals stopped the pattern of recurrent disease in Belgian broiler flocks (De Herdt *et al.*, 2008).

Disease prevalence: The lack of reports of *E. cecorum* related disease in poultry prior to 2002, compared with the increasing number of outbreaks reported recently have led several authors to suggest that this is an "emerging disease". Theories on the possible role of increasing virulence of *E. cecorum* isolates, the increased prevalence of concurrent infections, genetic selection and changing nutritional requirements, as well as the effect of restrictions on the use of feed additives have been proposed to explain the apparent increased prevalence of the disease (De Herdt *et al.*, 2008). Improved diagnostic techniques and equipment have also likely contributed to increased isolation and detection of *E. cecorum,* which has rather fastidious cultural requirements, and which may not be correctly identified using standard rapid identification systems. It is also possible that thorough investigation of lameness cases, incorporating sectioning of the vertebral column and sampling of osteomyelitis lesions for bacterial culture will reveal a higher-than-expected prevalence of this disease, even in flocks which are not experiencing lameness outbreaks.

Differential diagnosis: Vertebral osteomyelitis should be differentiated from other causes of spinal cord compression, notably spondylolisthesis ("kinky back"; caused by the sub-luxation of adjacent vertebral bodies in a transverse plane) and scoliosis (lateral deviation of the spinal vertebrae) (Thorp, 1994), which are similar to vertebral osteomyelitis in their clinical presentation.

More research is needed to understand the epidemiology and pathogenesis of *E. cecorum* related osteomyelitis in broiler and breeder flocks, to enable strategic prevention and control of this potentially significant disease.

References:

Aziz, T. and Barnes, H. J. Is spondylitis an emerging disease in broiler breeders? World Poultry 23(12):44-45. 2007.

Baele, M., L. A. Devriese, P. Butaye and F. Haesebrouck. Composition of enterococcal and streptococcal flora from pigeon intestines. Journal of Applied Microbiology 92(2):348-351. 2002.

De Herdt, P., P. Defoort, J. van Steelant, H. Swam, L. Tanghe, S. Van Goethem, M. Vanrobaeys. Enterococcus cecorum osteomyelitis and arthritis in broiler chickens. Vlaams Diergeneeskundig Tijdschrift 78:44-48. 2008.

Devriese, L. A., J. Hommez, R. Wijfels and F. Haesebrouck. Composition of the enteococcal and streptococcal intestinal flora of poultry. Journal of Applied Bacteriology 71(1):46-50. 1991.

Devriese, L. A., L. Laurier, P. De Herdt and F. Haesebrouck. Enterococcal and Streptococcal species isolated from faeces of calves, young cattle and dairy cows. Journal of Applied Bacteriology 72(1):29-31. 1992.

Devriese, L. A., J. I. Cruz Colque, P. De Herdt and F. Haesebrouck. Identification of the tonsillar and anal enterococcal and streptococcal flora of dogs and cats. Journal of Applied Bacteriology 73(5):421-425. 1992.

Devriese, L. A., J. Hommez, B. Pot and F. Haesebrouck. Identification and composition of the streptococcal and enterococcal flora of tonsils, intestines and faeces of pigs. Journal of Applied Bacteriology 77(1):31-36. 1994.

Devriese, L. A., K. Cauwerts, K. Hermans and A. M. Wood. *Enterococcus cecorum* septicemia as a cause of bone and joint lesions resulting in lameness in broiler chickens. Vlaams Diergeneeskundig Tijdschrift 71:219-221. 2002.

Gingerich, E. Spinal abscesses hit US broiler flocks. Watt Poultry USA, December 2009.

Makrai, L., C. Nemes, A. Simon, E. Ivanics, Z. Dudas, L. Fodor, R. Glavits. Association of *Enterococcus cecorum* with vertebral osteomyelitis and spondylolisthesis in broiler parent chicks. Acta Vet Hung, 59(1):11-21. 2011.

Stalker, M. J., M. L. Brash, A. Weisz, R. M. Ouckama and D. Slavic. Arthritis and osteomyelitis associated with *Enterococcus cecorum* infection in broiler and broiler breeder chickens in Ontario, Canada. Journal of Veterinary Diagnostic Invetigation 22:643-645. 2010.

Thorp, B. H. Skeletal disorders in the fowl: A review. Avian Pathology, 23(2):203-236. 1994.

Wise, D. R. Skeletal abnormalities in table poultry: A review. Avian Pathology 4(1):1-10. 1975.

Wood, A. M., G. MacKenzie, N. C. McGillveray, L. Brown, L. A. Devriese, and M. Baele Isolation of *Enterococcus cecorum* from bone lesions in broiler chickens. Veterinary Record 150(1):27. 2002.

Excerpts from the latest USDA National Agricultural Statistics Service (NASS) "Broiler Hatchery," "Chicken and Eggs" and "Turkey Hatchery" Report and Economic Research Service (ERS) "Livestock, Dairy and Poultry Situation Outlook"

Chickens and Eggs

Released March 22, 2011, by NASS, Agricultural Statistics Board, USDA

February Egg Production Up 1 Percent

U.S. egg production totaled 7.01 billion during February 2011, up 1 percent from last year. Production included 6.03 billion table eggs, and 974 million hatching eggs, of which 908 million were broiler-type and 66 million were egg-type. The total number of layers during February 2011 averaged 339 million, down slightly from last year. February egg production per 100 layers was 2,065 eggs, up 1 percent from February 2010.

All layers in the U.S. on March 1, 2011, totaled 339 million, down 1 percent from last year. The 339 million layers consisted of 282 million layers producing table or market type eggs, 54.1 million layers producing broiler-type hatching eggs, and 3.02 million layers producing egg-type hatching eggs. Rate of lay per day on March 1, 2011, averaged 73.9 eggs per 100 layers, up 1 percent from March 1, 2010.

Egg-Type Chicks Hatched Down 7 Percent

Egg-type chicks hatched during February 2011 totaled 37.3 million, down 7 percent from February 2010. Eggs in incubators totaled 40.0 million on March 1, 2011, up 3 percent from a year ago. Domestic placements of egg-type pullet chicks for future hatchery supply flocks by leading breeders totaled 264 thousand during February 2011, down 11 percent from February 2010.

Broiler-Type Chicks Hatched Up 1 Percent

Broiler-type chicks hatched during February 2011 totaled 709 million, up 1 percent from February 2010. Eggs in incubators totaled 642 million on March 1, 2011, down slightly from a year earlier. Leading breeders placed 7.11 million broiler-type pullet chicks for future domestic hatchery supply flocks during February 2011, up 2 percent from February 2010.

Broiler Hatchery

Released March 23, 2011, by NASS, Agricultural Statistics Board, USDA

Broiler-Type Eggs Set In 19 Selected States Up 1 Percent

Commercial hatcheries in the 19-State weekly program set 208 million eggs in incubators during the week ending March 19, 2011. This was up 1 percent from the eggs set the corresponding week a year earlier. Average hatchability for chicks hatched during the week was 84 percent. Average hatchability is calculated by dividing chicks hatched during the week by eggs set three weeks earlier.

Broiler Chicks Placed Up Slightly

Broiler growers in the 19-State weekly program placed 170 million chicks for meat production during the week ending March 19, 2011. Placements were up slightly from the comparable week a year earlier. Cumulative placements from January 2, 2011 through March 19, 2011 were 1.85 billion, up 1 percent from the same period a year earlier.

Turkey Hatchery

Released March 15, 2011, by the NASS, Agricultural Statistics Board, USDA

Eggs in Incubators on March 1 Up 4 Percent from Last Year

Turkey eggs in incubators on March 1, 2011, in the United States totaled 27.9 million, up 4 percent from March 1, 2010. Eggs in incubators were down 2 percent from the February 1, 2011 total of 28.4 million eggs. **Please note that regional estimates have been discontinued:** NASS will no longer publish regional *Turkey Hatchery* estimates. Only estimates at the United States level will be published due to the limited number of hatcheries involved.

Poults Hatched During February Up 8 Percent from Last Year

Turkey poults hatched during February 2011, in the United States totaled 23.1 million, up 8 percent from February 2010. Poults hatched were down 4 percent from the January 2011 total of 24.0 million poults.

Net Poults Placed During February Up 6 Percent from Last Year

The 22.3 million net poults placed during February 2011 in the United States were up 6 percent from the number placed during the same month a year earlier. Net placements were down 1 percent from the January 2011 total of 22.6 million.

Current Month Charts

Broiler Performance Data Live Production Cost	Region					Average Company
	SW	Midwest	Southeast	Mid-Atlantic	S-Central	
Feed Cost/ton w/o color ($)	316.90	320.91	384.51	302.88	316.55	312.79
Feed cost /lb meat (c)	30.25	29.31	26.21	28.19	29.50	28.89
Days to 4.6 lbs	40	41	41	42	40	41
Chick cost / lb (c)	4.63	5.28	5.11	4.90	4.97	5.07
Vac-Med cost/lb (c)	0.07	0.08	0.03	0.08	0.02	0.06
WB & ½ parts condemn. Cost/lb	0.28	0.18	0.24	0.20	0.18	0.22
% mortality	4.97	4.74	5.25	4.73	4.27	4.60
Sq.Ft. @ placement	0.88	0.83	0.80	0.78	0.82	0.82
Lbs/sq. ft.	7.53	6.96	7.31	7.70	7.65	7.35
Downtime (days)	18	14	14	14	15	15

Broiler Whole Bird Condemnation	Region					Average Company
	SW	Midwest	Southeast	Mid-Atlantic	S-Central	
% Septox	0.142	0.098	0.243	0.143	0.072	0.128
% Airsac	0.138	0.045	0.091	0.070	0.050	0.079
% I.P.	0.059	0.008	0.017	0.010	0.022	0.028
% Leukosis	0.031	0.000	0.000	0.000	0.001	0.008
% Bruises	0.002	0.005	0.001	0.001	0.001	0.002
% Other	0.010	0.014	0.003	0.008	0.010	0.011
% Total	0.382	0.171	0.355	0.233	0.156	0.255
% ½ parts condemns	0.268	0.243	0.284	0.231	0.306	0.269

Data for week ending March 11th 2011

Previous Month Charts

Broiler Performance Data Live Production Cost	Region					Average Company
	SW	Midwest	Southeast	Mid-Atlantic	S-Central	
Feed Cost/ton w/o color ($)	314.74	279.99	296.87	312.86	308.86	306.63
Feed cost /lb meat (c)	28.69	25.96	27.97	29.98	28.86	28.46
Days to 4.6 lbs	41	40	42	40	40	41
Chick cost / lb (c)	5.18	4.78	4.59	4.65	4.75	4.90
Vac-Med cost/lb (c)	0.08	0.04	0.08	0.07	0.02	0.06
WB & ½ parts condemn. Cost/lb	0.19	0.24	0.21	0.27	0.19	0.23
% mortality	4.91	4.64	4.88	4.62	4.42	4.71
Sq.Ft. @ placement	0.83	0.80	0.78	0.89	0.82	0.82
Lbs/sq. ft.	6.96	7.45	7.84	7.49	7.66	7.38
Downtime (days)	14	14	14	19	17	16

Broiler Whole Bird Condemnation	Region					Average Company
	SW	Midwest	Southeast	Mid-Atlantic	S-Central	
% Septox	0.106	0.235	0.158	0.146	0.093	0.140
% Airsac	0.060	0.088	0.065	0.119	0.048	0.080
% I.P.	0.009	0.008	0.015	0.056	0.027	0.028
% Leukosis	0.001	0.001	0.000	0.006	0.000	0.002
% Bruises	0.006	0.001	0.002	0.002	0.002	0.003
% Other	0.016	0.006	0.0011	0.012	0.009	0.011
% Total	0.197	0.339	0.252	0.341	0.179	0.264
% ½ parts condemns	0.247	0.299	0.243	0.295	0.307	0.287

Data for week ending Feb. 25th 2011

Meetings, Seminars and Conventions

2011 April

April 11 –14, 2011. National Institute for Animal Agriculture (NIAA) Annual Conference. San Antonio, TX. For more iufo: http://www.animalagriculture.org/Solutions/Annual%20Conference/2011/Home.html

April 13-16, 2011. AMI International Meat, Poultry, & Seafood Industry Convention and Exposition. To be held at McCormick Place in Chicago, IL. http://www.amiexpo.com/

2011 May

May 15-18, 2011. 1st International Avian Respiratory Disease Conference Georgia Center for Continuing Education, University of Georgia, Athens, GA. For more information, please contact Dr. Mark Jackwood, mjackwoo@uga.edu.

May 17-19, 2011. VIV Russia 2011. To be held in Moscow, Russia at the International Crocus Exhibition Center . For more information: http://www.vivrussia.nl/en/Exposant.aspx

May 22-25, 2011. Alltech's 27th International Animal Health and Nutrition Symposium. To be held in Lexington, Kentucky. For more information, please go to http://www.alltech.com/symposium/en/Pages/default.aspx

2011 June

June 9-11, 2011. VIV Turkey 2011. To be held in Istanbul, Turkey at the Istanbul Expo Center.. More info: http://www.vivturkey.com/indexen.html

2011 July

July 16-19, 2011. AVMA Annual Convention. The American Veterinary Medical Association is holding this event with the Poultry Science Association (PSA) and the American Association of Avian Pathologists. St. Louis, MO. For more info: https://ww.avmaconvention.org/avma10/public/Content.aspx?ID=2816&sortMenu=101001

2011 August

August 14-18, 2011. XVII Congress & Exhibition of the World Veterinary Poultry Association
Cancun, Mexico. More info: www.congressmexico.com

2011 September

September 7-9, 2011. 30th Poultry Science Symposium on Alternative Systems for Poultry – Health, Welfare and Productivity. To be held at the University of Strathclyde, John Anderson Campus, Glasgow, UK. For more info, go to http://www.wpsa-uk.com/newSite/meetings/30thPoultryScienceSymposium.html

September 18-22, 2011. IEC's Annual Marketing and Production Conference. The International Egg Commission will hold this event in Washington D.C. this year. Further details to be announced.

September 29-October 5, 2011. USAHA Annual Meeting. The U.S. Animal Health Association will be holding this event in Buffalo Adam's Mark Hotel in Buffalo, NY. More info: http://www.usaha.org/meetings/

2011 October

October 10-14,2011. 30th World Veterinary Congress 2011. To be held at the Congress Safari, Cape Town, South Africa. For more information, please visit http://www.worldvetcongress2011.com/

October 31—November 4, 2011. 18th European Symposium on Poultry Nutrition. Located in Çeşme - İzmir - Turkey and organized by the Turkish branch of the WPSA . Please visit http://www.espn2011.org/ for more info.

Reminder

All previous issues of the Poultry informed Professional are archived on our website www.avian.uga.edu under the Online Documents and The Poultry Informed Professional links.