Embryonic Requirements to Meet Genetic Potential

By Donna Hill
DVM, MAM, Diplomate ACPV

The embryo (chick and poult) incubation requirements to maximize genetic potential are:

1. Adequate Maternal Investment
   • Energy
   • Hormonal
2. Embryo Temperature during Incubation
   • 98.8-100.4°F
   • 37.1-38°C
3. Dry Down
   • 11-14%
4. Chick: Egg Weight Yield
   • 67-68%

Continued on page 2

Broiler Performance Data (Region)

<table>
<thead>
<tr>
<th>Feed cost/ton w/o color ($)</th>
<th>SW</th>
<th>Midwest</th>
<th>Southeast</th>
<th>Mid-Atlantic</th>
<th>S-Central</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed cost/lb meat (¢)</td>
<td>11.60</td>
<td>11.51</td>
<td>12.60</td>
<td>12.97</td>
<td>12.33</td>
</tr>
<tr>
<td>Days to 4.6 lbs</td>
<td>2.59</td>
<td>2.07</td>
<td>3.09</td>
<td>3.17</td>
<td>2.86</td>
</tr>
<tr>
<td>Med. cost/ton (¢)</td>
<td>45</td>
<td>45</td>
<td>45</td>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>Chick cost/lb (¢)</td>
<td>3.90</td>
<td>3.20</td>
<td>3.79</td>
<td>3.60</td>
<td>3.55</td>
</tr>
<tr>
<td>Vac-Med cost/lb (¢)</td>
<td>0.09</td>
<td>0.02</td>
<td>0.19</td>
<td>0.12</td>
<td>0.16</td>
</tr>
<tr>
<td>WB &amp; 1/2 parts condemn. cost/lb</td>
<td>0.26</td>
<td>0.26</td>
<td>0.28</td>
<td>0.32</td>
<td>0.32</td>
</tr>
<tr>
<td>% mortality</td>
<td>4.01</td>
<td>4.79</td>
<td>4.72</td>
<td>5.54</td>
<td>5.34</td>
</tr>
<tr>
<td>Sq. Ft. @ placement</td>
<td>0.76</td>
<td>0.73</td>
<td>0.76</td>
<td>0.75</td>
<td>0.81</td>
</tr>
<tr>
<td>Lbs./Sq. Ft.</td>
<td>6.35</td>
<td>7.46</td>
<td>6.80</td>
<td>7.27</td>
<td>6.68</td>
</tr>
<tr>
<td>Down time (days)</td>
<td>13</td>
<td>9</td>
<td>11</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

Data for week ending 5/15/99
Embryonic Requirements to Meet Genetic Potential

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The problem that we see in today's yield type breeds in a multiage, multistage incubation process is caused by:

- Embryo requirements have not changed
- The embryo itself has changed physiologically
- Incubation practices have not changed to meet the embryo needs
- Consistency of embryos with optimal incubation decreases
- Genetic susceptibility to variation has increased

The factors that have contributed to the problem are:

- Increased egg numbers in machines
- No change in machine volume
- Increased egg size
- Increased obstruction of airflow
- Decreased conductance of the eggshell
- CPMH practices
- Multiage incubation
- Multistage incubation
- Decreased fertility
- Increased genetic susceptibility
- Embryo growth and respiration demands peak at the plateau stage. It is at this time that the ability of the shell to exchange gas is exceeded because of decreasing conductance.
- Old hatchery airflow design

The result is that:

- Heat Removal is less consistent. More embryos are incubated above 100.4F after 11 days of age
- It is more difficult to optimize moisture loss and more embryos have insufficient moisture loss
- This impacts carbohydrate metabolism, post hatch performance, organ maturation losses are seen as increased one week mortality. Dehydration is increased especially on days one through four.
- Decreased hatchability with increased late dead, pips, culls
- Decreased field performance potential from genetic potential

DEHYDRATION has Three Causes
~3 CAUSES
- Young breeder flock
- One week mortality is generally not incubation related, but rather caused by the small chicks inability to maintain adequate body heat in the normal environment from pull through brooding.

Broiler Performance Data (Company)

<table>
<thead>
<tr>
<th>Live Production Cost</th>
<th>Average Co.</th>
<th>Top 25%</th>
<th>Top 5 Cos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed cost/ton w/o color ($)</td>
<td>126.33</td>
<td>121.83</td>
<td>118.03</td>
</tr>
<tr>
<td>Feed cost/lb meat (¢)</td>
<td>12.26</td>
<td>11.57</td>
<td>11.09</td>
</tr>
<tr>
<td>Days to 4.6 lbs</td>
<td>45</td>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>Med. cost/ton (¢)</td>
<td>2.87</td>
<td>1.79</td>
<td>.163</td>
</tr>
<tr>
<td>Chick cost/lb (¢)</td>
<td>3.77</td>
<td>3.55</td>
<td>3.09</td>
</tr>
<tr>
<td>Vac-Med cost/lb (¢)</td>
<td>0.12</td>
<td>0.04</td>
<td>0.09</td>
</tr>
<tr>
<td>WB &amp; 1/2 parts condemnation cost/lb</td>
<td>0.30</td>
<td>0.19</td>
<td>0.12</td>
</tr>
<tr>
<td>% mortality</td>
<td>4.89</td>
<td>3.96</td>
<td>4.05</td>
</tr>
<tr>
<td>Sq. Ft. @ placement</td>
<td>0.76</td>
<td>0.73</td>
<td>0.74</td>
</tr>
<tr>
<td>Lbs./Sq. Ft.</td>
<td>6.75</td>
<td>6.76</td>
<td>7.17</td>
</tr>
<tr>
<td>Down time (days)</td>
<td>12</td>
<td>13</td>
<td>11</td>
</tr>
</tbody>
</table>

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- Rectal temperatures
  - Normal: 103.6F - 104.2F, 39.8C-40.1C
  - Problem: less than 103.6F, 39.8C
- Set/Pull Time
- Incubation Quality

Hatchability and Incubation Quality are generally related:

~ Young and Prime Breeder Flock
  - Late Dead
  - Air temperature in setter egg mass too cool
  - Chilling eggs at transfer
  - Chilling eggs in hatcher immediately after transfer

~ Prime and Older Flocks
  - Late Dead, Pips, Culls
  - Heat removal from embryo is inadequate
    - Setter
    - Hatcher

What is Incubation Quality??? The Chicken or Turkey of the 1970’s is Not the Same as Chicken or Turkey in 1999. 1/5th of the growth period of a domestic turkey is in the egg. 1/3 of the growth period of a broiler chicken is in the egg. The setter or hatcher Set Point does not equal the fertile Embryo Temperatures.

Incubation for Quality Chick

~37 to 38 C.
~98.8 to 100.4F
• Lundy, 1969
• Wilson, 1991

~ Older breeder flocks eggs, 36.5C, 97.7F
• French, 1994
  • Old breeder flock eggs probably are optimally incubated at a 98.8 to 100.4 embryo temperature, but the lower set point is necessary to adequately remove heat from the embryo. The old breeder flock presents a management problem because although each individual egg is producing more heat, the egg mass as a whole is less fertile and is producing less heat. The machine then decreases airflow to compensate for the decreased animal heat. This means that the heat removal from each individual egg is diminished.

Hatchability
~95 to 104.9F
35 to 40.5C
• Lundy, 1969
• Wilson, 1991

As you can see, there is a much tighter window to hatch for quality chicks than hatchability.

The following is a literature review that discusses the impact of embryo heat and shell conductance changes as they relate to the incubation of today’s yielding type broilers. This is only a partial literature review. It is designed to give the reader a basic review of the incubation issues that the industry must address to maximize the genetic potential of today’s yield breed types. The articles that I have mentioned will lead you to a wealth of research that is crucial to understand and ameliorate production problems in yield type birds.

~ Plateau in heat production day 16-17
  • Romijn and Lokhorst, 1956; Decuypere et al., 1979

~ Maximal gaseous flux in the last days of incubation
  • Lomholt, 1977, Tullett and Board, 1976

~ Partial arterial oxygen pressure is low and critical in the last days of incubation
~ Chick embryo acts a poikilotherm until hatch, Therefore:

Any factor such as increased body temperature, which increases metabolism, puts an additional load on survival rate and decreases hatchability, Decuypere, 1992
Tolerance of variation in the physical environment may be less wide for domesticated species than for wild birds, Vleck, 1991

Genetic Tolerance to Increased Temperature within Strain, Different Lines, Hatchability, Cornish Strain, Decuypere, 1992
Embyros from broiler chicks are more sensitive to temperature fluctuations, both at the upper and lower levels of incubation temperature range, than embryos from layer strains, Decuypere et al., 1992
Sensitivity to heat treatments varies with embryo age, Ande and Wilson, 1981

~ Time to 50% decrease in hatch after exposure to 43.3C, 110F
  • 12 hours at 3 days
  • 4 hours at 7 days
  • 7 hours at 11 days
  • 7 hours at 16 days
  • 5 hours at 19 days

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Embryonic Requirements to Meet Genetic Potential

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Optimum incubation temperature and egg size, turkeys, French, 1993
~All eggs incubated at 37.5°C till 15 days
~15-25 days three incubation temperatures, 36.5°C, 97.7°F (low), 37.5°C, 99.5°F (normal), 38.5°C, 101.3°F (high)
~80 gram eggs and 100 gram eggs
  • Smaller eggs hatched best in normal treatment
  • Larger eggs hatched best in the low treatment

Optimum incubation temperature and egg size, (French, 1993)
~Eggs of known weight
~Three different incubation temperatures,
  • 36.5°C, 97.7°F (low)
  • 37.5°C, 99.5°F (normal)
  • 38.5°C, 101.3°F (high)

Optimum incubation temperature and egg size, French, 1993
~High treatment
  • Hatchability decreased with increasing egg weight
  • Increased 16-25 day mortality
~Normal treatment
  • Hatchability not influenced by egg size less than 90 grams
  • Hatchability decreased with egg size greater than 90 grams
~Low treatment
  • Hatchability of the heaviest eggs was highest

Effect of Incubation Temperature on the Gross Pathology of Turkey Embryos, French, 1994
~Eggs incubated at 36.5°C, 37.5°C, 38.5°C
~At 38.5°C, 101.3°F
  • Mortality peak, 15 to 20 days of incubation
  • Subcutaneous hemorrhage
  • Head in the small end with excess albumin
  • Oedematous head
  • Ruptured yolk sac
  • Eye cataracts
  • Swollen down pumules
  • Pale down color

High incubation temperatures induce herniation of the viscera in fowl embryos, Ancel and Lallemand, 1941
Ono et al, 1994
~Embryos subjected to 48C
~Time to heart stop was measured
  • As embryo age increased, tolerate time decreased
  • Older embryos had higher internal temperatures at the start of the experiment
  • All embryos died at the internal temperature of 46.5°C, 115.7°F

Energy Metabolism during the Plateau Stage, Christensen, 1996
~Oxygen is required for fat metabolism
~During the plateau stage, carbohydrate is the only source of energy available
~Late in incubation, only the yolk fat is available. Carbohydrate was used in development
~Glucose is stored in the heart, liver and kidney. It is used to survive the hypoxia of hatch.
~Late dead embryos have decreased blood glucose and depleted glycogen stores
~Selected lines vs Random Bred Controls, Christensen et al.
  ~1st week embryonic mortality lower in selected line than RBC
  ~Pipping mortality higher in selected line than RBC
  ~Eggshell conductance constants are lower in selected lines, (less oxygen availability)
  ~Metabolic rate during external pipping and posthatch is reduced in selected lines

Energy Metabolism during the Plateau Stage, Christensen et al.
~Lower oxygen, embryos rely more on stored glycogen for energy during pipping
~Selected lines had less stored glycogen than RBC. (Hepatic and cardiac glycogen stores and blood plasma concentrations)
~In earlier work, blood plasma concentrations at hatch correlated with post hatch growth to 12 weeks

Bottom Line, Christensen et al.
Data suggests that there may be a relationship between carbohydrate accrual prior to pipping, utilization during pipping, and the subsequent embryonic survival during pipping and hatching that is associated with the genetics of growth or egg production

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Selected vs Random Bred Control, Christensen et al.
- Carbohydrate metabolism during the hypoxic stress of hatch is depressed in selected lines
- Added oxygen
  - Improved survival of RBC, not selected lines
  - Does not alleviate the stress of the plateau stage in selected lines

Growth selected line vs Random Bred Control, Christensen et al.
- At day 25 eggs incubated at 36.8°C, 98.2°F or 37.3°C, 99.1°F
- Increased temperature
  - Improved hatch in RBC
  - Decreased hatch in selected lines
  - Depleted the existing glycogen stores to aid embryos from all lines in surviving the increased heat
- At the plateau stage embryos are sensitive to 0.5°C, 0.9°F changes
- Genetics and environment affect survival

Conductance, weight loss, and embryonic mortality, Christensen et al., 1982
- Eggs with late dead embryos had
  - lower conductance than those that hatched or had early dead mortality
  - lower percentage of initial egg mass lost
  - lower amounts of water vapor lost per square centimeter of surface area
  - the same egg weights and surface area of other groups
- The gaseous conductance of some eggshells is insufficient to meet embryo demands late in incubation

Christensen, 1996
- With selection for growth
  - increased egg size
  - decreased conductance constant
  - the faster the turkey grows, the slower the embryo respires and grows
  - growth of the embryo hasn’t increased prior to day 24
- The growth of the tissues and its effects on oxygen occur during the plateau stage in oxygen consumption

Broiler Egg Size, Conductance and Hatchability, Ogunshile and Sparks

Older Breeder Flock Eggs
- Increased size
- Increased metabolic heat, increased embryo temperature
- Decreased gaseous conductance of the shell
  - Increased hypoxia and/or hypercapnia
- Increased air resistance
  - Increased embryo temperature

High Altitude, Christensen
- High altitude eggs
  - contain more water
  - contain more albumin
  - contain less yolk
  - have reduced conductance constants
- Eggs from the high altitude used less carbohydrate to hatch than those from sea level (altricial vs precocial)

Maternal thyroid hormones in turkeys selected for growth, specifically T3, may influence the interrelationships of functional eggshell properties, gluconeogenesis and blood plasma glucose to enhance hatchability and poult quality, Christensen

Stored eggs, turkeys, Christensen
- Eggs stored greater than 7 days
- Conductance constants greater than 6
- Improved hatch with increasing incubation temperature in the first two weeks of growth
  - Improvement seen in both early and late embryo mortality

How much variation is there within the zone of incubation conditions that guarantees optimal hatchability in order to obtain the highest “chick quality”

Chick Quality must be defined in terms of goals, Decuypere et al., 1992
- Post hatching growth
- Feed conversion
- Livability
- Thermoregulatory abilities
- Stress Susceptibility
- Reproductive performance

The best hatchability does not equal the best chick quality
According to the latest National Agricultural Statistics (NASS) report, commercial hatcheries in the 15-State weekly program set in incubators 184 million eggs during the week ending May 15, 1999. This was up 4 percent from the eggs set the corresponding week a year earlier. Average hatchability for chicks hatched during the week was 82 percent.

Broiler hatchery and “Chicken and Eggs” and Economic Research Service (ERS) “Livestock, Dairy and Poultry Situation and Outlook” Reports

Broiler Eggs Set in 15 Selected States Up 4 Percent

According to the latest National Agricultural Statistics (NASS) report, commercial hatcheries in the 15-State weekly program set in incubators 184 million eggs during the week ending May 15, 1999. This was up 4 percent from the eggs set the corresponding week a year earlier. Average hatchability for chicks hatched during the week was 82 percent.

Broiler Chicks Placed Up 3 Percent

Broiler growers in the 15-State program placed 147 million chicks for meat production during the week ending May 15, 1999. Placements were up 3 percent from the comparative week in 1998. Cumulative placements from January 3, 1999 through May 15, 1999 were 2.74 billion, up 3 percent from the same period a year earlier.

April Egg Production Up 3 Percent

U.S. egg production totalled 6.77 billion during April 1999, up 3 percent from the 6.60 billion produced in 1998. Production included 5.69 billion table eggs and 1.08 billion hatching eggs, of which 1.01 billion were broiler-type and 67.0 million were egg-type. The total number of layers during April 1999 averaged 321 million, up 3 percent from the total average number of layers during April 1998. April egg production per 100 layers was 2,109 eggs, down fractionally from 2,117 eggs in April 1998.

All layers in the U.S. on May 1, 1999, totaled 320 million, up 3 percent from a year ago. The 320 million layers consisted of 261 million layers producing table or commercial type eggs, 56.8 million layers producing broiler-type hatching eggs, and 2.77 million layers producing egg-type hatching eggs. Rate of lay per day on May 1, 1999, averaged 69.5 eggs per 100 layers, down fractionally from the 69.6 a year ago.

Laying flocks in the 30 major egg producing States produced 6.40 billion eggs during April, up 2 percent from April 1998. The average number of layers during March, at 303 million, was up 3 percent from a year earlier.

Egg-Type Chicks Hatched Up 8 Percent

Egg-type chicks hatched during April totaled 42.0 million, up 8 percent from April 1998. Eggs incubators totaled 35.4 million on May 1, 1999, down 1 percent from a year ago.

Domestic placements of egg-type pullet chicks for future hatchery supply flocks by leading breeders totaled 287,000 during April 1999, down 14 percent from April 1998.

Broiler Hatch Up 4 Percent

The April 1999 hatch of broiler-type chicks, at 734 million, was up 4 percent from April of the previous year. There were 635 million eggs in incubators on May 1, 1999, up 4 percent from a year earlier.

Leading breeders placed 7.04 million broiler-type pullet chicks for future domestic hatchery supply flocks during April 1999, up 5 percent from April 1998.

Turkey Net Returns Turn Positive

According to the Economic Research Service (ERS), negative net returns in 1996 through mid-1998 kept production flat or decreasing over the last three years. A return to profitability in July 1998 and continued profitability in 1999 should encourage the strongest turkey production increase since 1996. Turkey production is expected to increase about 2 percent in 2000. Strengthening of the export market would also provide a boost for the turkey sector.

Reductions in feed costs (23 percent below a year ago for the first half of 1999) and slightly stronger turkey prices will keep producers above break-even compared to losses of over 8 cents per pound in the first half of last year. Returns are expected to continue stronger than a year ago through the rest of 1999.

...Production is expected to be nearly unchanged in 1999 with lower production in the first half of the year offset by production increases in the second half. Poult placements in March were only down 1 percent and April placements were up 4 percent indicating stronger production this summer. Total domestic turkey supplies will be about unchanged from last year as lower exports and smaller ending stocks offset the lower carry-in stocks. Per capita supplies are expected to be slightly lower. Prices are expected to be about 3 cents higher than a year ago at wholesale and nearly unchanged at retail for 1999. In 2000 prices are expected to weaken slightly with the increase in production.

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Excerpts...“Broiler Hatchery and “Chicken and Eggs”
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Poultry Exports To Rise Modestly in 2000
...Broiler exports for 2000 are expected to recover slightly to 4.6 billion pounds.
...Turkey exports in 2000 are forecast to be approximately 400 million pounds, about even with the 1999 forecast.
...Total egg shipments in 2000 are expected to reach 200 million dozen, about 4 percent higher than the forecast for 1999, but still below the levels achieved in 1995 through 1998.

Broiler Whole Bird Condemnation (Company)

<table>
<thead>
<tr>
<th></th>
<th>Average Co.</th>
<th>Top 25%</th>
<th>Top 5 Co.’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Septox</td>
<td>0.309</td>
<td>0.247</td>
<td>0.178</td>
</tr>
<tr>
<td>% Air sac</td>
<td>0.280</td>
<td>0.129</td>
<td>0.071</td>
</tr>
<tr>
<td>% I.P.</td>
<td>0.152</td>
<td>0.071</td>
<td>0.019</td>
</tr>
<tr>
<td>% Leukosis</td>
<td>0.025</td>
<td>0.005</td>
<td>0.007</td>
</tr>
<tr>
<td>% Bruise</td>
<td>0.011</td>
<td>0.010</td>
<td>0.004</td>
</tr>
<tr>
<td>% Other</td>
<td>0.023</td>
<td>0.014</td>
<td>0.010</td>
</tr>
<tr>
<td>% Total</td>
<td>0.800</td>
<td>0.475</td>
<td>0.289</td>
</tr>
<tr>
<td>% 1/2 parts condemnations</td>
<td>0.386</td>
<td>0.280</td>
<td>0.184</td>
</tr>
</tbody>
</table>

Data for week ending 5/15/99

About Donna Hill
Dr. Donna Hill earned her Doctorate in Veterinary Medicine from Louisiana State University in 1986. She earned a Masters in Avian Medicine from the University of Georgia in 1988. Dr. Hill is a Diplomate of the American College of Poultry Veterinarians. Currently, Dr. Hill is a Technical Consultant for Hoeschst Roussel Vet. Her areas of concentration are: Hatcheries: chick quality and performance and processing: product quality, yield and food safety.
Prior to joining Hoechst Roussel, Dr. Hill was with Perdue Farms from 1990-1998. At Perdue she was the Director of Health Services and the Regional Veterinary Services Manager for Delmarva, Virginia and West Virginia.
Before joining Perdue, Dr. Hill was the Director of Veterinary Services for Peterson Farms.

OBITUARY
Harry W. Yoder Jr.
Athens
Harry W. Yoder, Jr., 70, died May 27, 1999.
Born Aug. 2, 1928 in Chicago, IL, Dr. Yoder was the son of the late Harry W. and Mary Hurst Yoder, Sr. He grew up in Mt. Morris, Ill. He received a BS degree in 1950 from the Univ. of Illinois and a DVM degree in 1954 from Iowa State Univ. He served 2 years at the Walter Reed Institute of Research in Washington, D.C. and then returned to Iowa State Univ. and received his Ph.D in Microbiology in 1963.
In 1965 the family moved to Athens where Dr. Yoder was employed as a Research Veterinarian at the USDA-ARS-Southeast Poultry Research Laboratory for 28 years. Dr. Yoder worked in the area of Avian Mycoplasma and developed a technique to eliminate Mycoplasma from eggs by heat treatment.
As a member of the American Association of Avian Pathologists, he served in numerous capacities, including President. He was very honored to have been a co-editor of four editions of “Diseases of Poultry”.

The Poultry Informed Professional Newsletter is published with support from Bayer Corporation
Meetings, Seminars and Conventions

1999

June

June 3-5: Alabama Poultry & Egg Convention, Sheraton Birmingham. Details from Alabama Poultry & Egg Association, P.O. Box 240, Montgomery, AL 36101-0240. Phone (334) 265-2732; Fax (334) 265-0008

June 4-5: Arkansas Poultry Festival, Arlington Hotel, Hot Springs, Ark. Contact: Judy Kimbrell, Arkansas Poultry Federation, P.O. Box 1446, Little Rock, Ark. 72203. Phone (501) 375-8131.

June 10-12: Poultry Neonatal Health and Disease Workshop, Life Learning Center, Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada. Contact: Dr. Bruce Hunter, Dept. of Pathobiology, Ontario Veterinary College, University of Guelph, Guelph, Ontario, NIG 2WI. Phone (519) 824-4120, ext. 4625.


June 18-19: Georgia Veterinary Medicine Association, Jekyll Island, Georgia. Contact: Beth Monte, Georgia Veterinary Medical Assn., 3050 Holcomb Bridge Road, Norcross, GA 30071. Phone: (770) 416-1633.

June 18-19: 51st Delmarva Chicken Festival, Crisfield, Md. Contact: Delmarva Poultry Industry, R.D. 6, Box 47, Georgetown, Del. 19947. Phone (302) 856-9037

June 22-24: 26th Poultry Science Symposium, Poultry Feedstuffs, Supply, Composition and Nutritive Value, Peebles, Edinburgh, Scotland, UK. Contact: Dr. Jim McNab, Roslin Institute (Edinburgh), Roslin, Midlothian EH25 9PS, Scotland, UK. Fax +44(0) 131-440-0434.

1999

July

July 10-14: American Association of Avian Pathologists (AAAP) Annual Meeting, Hilton Riverside Hotel, New Orleans, LA. Contact: AVMA Housing Bureau, 108 Wilmot Road, Suite 400, Deerfield, IL 60015-0825. Phone: (800) 424-5250, Fax: (800) 521-6017.

July 27-30: International Conference & Exhibition on Veterinary Poultry, Beijing, China. Contact: Mr. Li Wei, Secretariat of ICEVP 99, Room 3011, Yuanliwuye Building, No. 19 Huixindongjie (Xiyuan), Beijing 1000029, P.R. China, Fax: +86 10 64950374

1999

August


1999

September

September 19-23: European Symposia on Quality of Poultry Meat, Eggs and Egg Products, Bologna, Italy. Contact: Chairman of Organising Committee, Professor Achille Franchini, University of Bologna, Via San Giacoma 9, 40126 Bologna, Italy. Fax: +39 (0) 51 251936.


September 23-29: 26th World Veterinary Congress, Lyon, France. Contact: Mondial Vet 1999, CNVSPA, 40 rue de Berri, F75008 Paris, France. Fax: +33 (0) 153 83 91 69.

September 28: WESTVET 10, Western Meeting of Poultry Clinicians and Pathologists, Post Hotel, Lake Louise, Alta. Canada. Contact: Dr. Stew Ritchie, Phone: (604) 854-6600, Fax: (604) 854-6100, e-mail: cpltd@uniserve.com