



# The Poultry Informed Professional

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## Some Studies With An Avian Pneumovirus Isolated In The United States

Presented by Dr. Jane K.A. Cook, Head of Avian Research, Intervet UK

### Introduction

The avian pneumovirus, turkey rhinotracheitis virus (TRT) was the first avian pneumovirus to be described. The disease caused by this virus was first reported in South Africa in the late 1970s (Buys et al., 1980), where it had a devastating effect on the turkey industry of that country, from which it never recovered. It is a highly contagious upper respiratory tract infection, characterized by nasal discharge, rales and some sneezing. High morbidity results. Mortality is variable, depending on many factors including management practices, such as ventilation levels and stocking density, or the presence or absence of particular organisms capable of acting as secondary pathogens

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**Broiler Performance Data (Region)  
 Live Production Cost**

	SW	Midwest	Southeast	Mid-Atlantic	S-Central
Feed cost/ton w/o color (\$)	123.45	125.68	133.29	133.71	129.29
Feed cost/lb meat (¢)	11.64	11.52	13.01	13.50	12.91
Days to 4.6 lbs	45	45	45	45	45
Med. cost/ton (¢)	2.47	1.95	3.51	2.94	2.47
Chick cost/lb (¢)	3.94	3.39	3.81	3.64	3.58
Vac-Med cost/lb (¢)	0.10	0.02	0.23	0.08	0.18
WB & 1/2 parts condemn. cost/lb	0.25	0.25	0.39	0.33	0.38
% mortality	4.38	4.88	5.59	5.61	6.10
Sq. Ft. @ placement	0.77	0.74	0.77	0.75	0.82
Lbs./Sq. Ft.	6.35	7.50	6.67	7.37	6.84
Down time (days)	16	13	12	15	14

Data for week ending 3/20/99

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## Some Studies With An Avian Pneumovirus Isolated In The United States

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(Cook et al., 1991). In laying turkeys, the virus has been shown to cause substantial drops in egg production and poor egg shell quality, both under field (Stuart, 1989) and experimental (Cook et al., 1996) conditions.

Avian pneumovirus has also been incriminated as a pathogen in chickens and can certainly infect that species (Jones et al., 1987; Buys et al., 1989; Hafez, 1993). However, it is still not clear whether the virus is capable of causing disease on its own in that species, or whether it is involved in a more complex disease condition, involving other agents. One of the firmest indications that TRT virus can be involved as a pathogen in chickens is the observation of the benefits that result from the use of TRT vaccines in chickens. The only other avian species in which avian pneumovirus infection has been demonstrated are pheasants and guinea fowl (Gough et al., 1998). However, the possible role of wild birds in the epidemiology of avian pneumovirus infections merits further study.

This paper reports results of experimental studies carried out to investigate the relationship between different strains of avian pneumovirus.

### Analysis of Virus Strain

Strains of TRT virus, isolated from both turkeys and chickens in many countries, have been compared by means of in vitro cross neutralization tests. This work showed that all strains so far studied belong to a single serotype (Cook et al., 1993). However, when these same strains were tested against neutralizing monoclonal antibodies which recognize the G glycoprotein (Juhasz & Easton, 1994). These workers demonstrated extensive differences in the nucleic acid sequence of the G glycoprotein of the same TRT virus strains. As a result of this work, two subgroups, A and B, were designated, by analogy with the mammalian pneumovirus, human respiratory syncytial virus.

### The US Situation

Some years after the initial outbreaks of TRT were described from South Africa, the disease was reported in the Middle East, parts of Europe and then the UK, where the casual agent was isolated (McDougall & Cook, 1986; Wilding et al., 1986; Wyeth et al., 1986) and characterized as an avian pneumovirus (Cavanagh & Barrett, 1988). Mainly on the basis of serological studies, rather than isolation of the virus, avian pneumovirus infection has now been demonstrated in many countries world wide, including the Far East. However, until recently, there was no evidence of avian pneumovirus infection in the

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**Broiler Performance Data (Company)  
Live Production Cost**

	Average Co.	Top 25%	Top 5 Cos.
Feed cost/ton w/o color (\$)	129.04	121.07	114.17
Feed cost/lb meat (¢)	12.61	11.60	11.12
Days to 4.6 lbs	45	45	45
Med. cost/ton (¢)	2.73	1.54	1.44
Chick cost/lb (¢)	3.86	3.53	3.95
Vac-Med cost/lb (¢)	0.10	0.06	0.01
WB & 1/2 parts condemn. cost/lb	0.34	0.18	0.17
% mortality	5.47	4.25	4.78
Sq. Ft. @ placement	0.77	0.75	0.71
Lbs./Sq. Ft.	6.74	6.72	7.30
Down time (days)	14	13	11

Data for week ending 3/20/99

**Broiler Whole Bird Condemnation (Region)**

	SW	Mid-West	S. East	Mid-Atlantic	S. Central
% Septox	0.344	0.386	0.194	0.458	0.381
% Airsac	0.159	0.184	0.704	0.307	0.432
% I.P.	0.059	0.054	0.235	0.182	0.206
% Leukosis	0.009	0.008	0.010	0.037	0.007
% Bruise	0.003	0.010	0.017	0.005	0.014
% Other	0.022	0.013	0.044	0.018	0.071
% Total	0.602	0.651	1.204	1.018	1.112
% 1/2 parts condemnations	0.388	0.368	0.371	0.292	0.419

Data for week ending 3/20/99

## **Some Studies With An Avian Pneumovirus Isolated In The United States**

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United States of America. This situation changed in 1997, however, with the reports from the State of Colorado of TRT-like clinical signs in turkeys in that State.

A virus was isolated from respiratory tract material collected from infected turkeys in that disease outbreak by Dr. Dennis Senne NVSL, Ames, Iowa (Senne et al., 1997). The method used was to give the material two blind passages via the yolk sac of SPF embryos, at which time hemorrhages were observed on the embryos together with some mortality (Senne, 1998). Harvested material was then inoculated onto chick embryo fibroblast (CEF) cultures. After several passages, cytopathic effect, typical of avian pneumovirus was observed. Preliminary characterization of this isolate as an avian pneumovirus was achieved by immunofluorescence-staining of infected monolayers using a TRT-conjugated antiserum. This isolate has been designated the Colorado isolate. A very similar disease was subsequently reported in turkeys in Minnesota (Senne et al., 1998; Anon., 1998) and an avian pneumovirus has now been identified in that State (Kapur, 1998). Although the disease has apparently been eradicated in Colorado, avian pneumovirus infection continues to be of major concern to the turkey industry in Minnesota (Anon, 1998). Preliminary data indicate a close relationship between the viruses isolated from the two areas (Kapur, 1998). As the result of a collaborative project with Dr. Senne's group, preliminary characterization of the Colorado isolate has been undertaken at Intervet UK and that work is reported here.

### **In Vitro Characterization of the Colorado Isolate**

#### **Growth of the Colorado Isolate**

Until the Colorado isolate was described, a common feature of all known avian pneumoviruses was that they caused ciliostasis in tracheal organ cultures (TOC). Because of this, passage in TOC was the preferred method for primary isolation of the virus from field material (McDougall and Cook, 1986). Interestingly, results to date indicate that the Colorado isolate is only very poorly ciliostatic, even after several in vivo passages in turkeys. Therefore, TOC cannot be considered to be a practical system for the isolation of this virus. Embryo inoculation via the yolk sac route appears to be the optimum system for primary isolation. Thereafter, the virus will grow in a number of cell culture systems, such as CEF.

#### **Serum Neutralization Tests**

In an attempt to determine the antigenic relationship between the Colorado isolate and previously described avian pneumoviruses, the Colorado isolate was compared with TRT subgroup A and B strains in in vitro cross neutralization tests. The results obtained showed that when monospecific antisera to each virus was used, whilst there was complete cross neutralization between subgroups A and B, there was no neutralization between subgroup A or B strains and the Colorado isolate. However, a hyperimmune antiserum, prepared against a subgroup A strain, did neutralize the Colorado isolate to some extent.

Further in vitro neutralization tests were performed with monoclonal antibodies, which both recognized and differentiated between, the subgroup A and B strains of TRT virus (Cook et al., 1993). None of them neutralized the Colorado isolate.

These neutralization test results suggest that the Colorado isolate of avian pneumovirus may be a different serotype from the earlier subgroup A and B TRT viruses.

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## **Some Studies With An Avian Pneumovirus Isolated In The United States** *Continued from page 3*

### **ELISAs**

ELISAs have been developed in which each of the three avian pneumoviruses was used as coating antigen. These ELISAs were used to test antisera raised in birds to each of the three avian pneumovirus strains. When either a subgroup A or a subgroup B strain was used as antigen, a good antibody response was detected in sera raised to the A and B strains, but not in antisera raised to the Colorado isolate. It was necessary to use the Colorado isolate as the ELISA antigen in order to detect antibodies to that virus.

### **In Vivo Protection Studies**

Experiments were performed in which groups of birds were inoculated (“vaccinated”) at a young age with one of these three avian pneumoviruses, then challenged three weeks later with the homologous or heterologous strains. Protection against challenge was assessed by scoring clinical signs for each bird individually following challenge.

It is well known that prior vaccination with a live-attenuated vaccine developed from either a TRT subgroup A or a subgroup B strain protects fully against challenge with either subgroup A or B (Cook et al., 1995; 1998). However, the results of the recent studies have shown that these two vaccines are also able to protect fully against challenge with the Colorado isolate.

When the Colorado isolate was used as a “vaccine” and administered first, however, it provided only very poor protection against challenge three weeks later with either subgroup of TRT virus, although it did protect against homologous challenge. This provides evidence for only a one-way relationship between the Colorado isolate and TRT subgroups A and B.

### **Diagnosis**

Probably the most common method of diagnosing avian pneumovirus infections is on the basis of serological response, using an ELISA. Commercial ELISA kits are available for the diagnosis of infections caused by subgroup A and B strains, although the sensitivity of these kits is still often inferior to that of ELISA systems in use in a number of research laboratories. The results described above, regarding the use of ELISAs in which subgroup A or B strains are used as the antigen, have important implications for diagnosis of infections caused by the Colorado isolate of avian pneumovirus and emphasize the importance of using that virus as antigen in a diagnostic ELISA in US.

The use of the polymerase chain reaction (PCR) for the diagnosis of avian pneumoviruses has been reported for both subgroups A and B (Li et al., 1993) and the Colorado isolate (Kapur, 1998). Diagnostic tests based on the PCR can be both sensitive and rapid and are likely to gain increasing favor in the future. It is, however, necessary that they are carefully validated before use.

### **Conclusions**

Infections caused by avian pneumoviruses are relatively recent events. The first reports of disease caused by this group of viruses being described from South Africa in the late 1970s (Buys et al., 1980), although the casual agent was not identified and characterized until much later (McDougall & Cook, 1986; Cavanagh & Barrett, 1988). For the next decade, infections caused by this virus were reported throughout much of the world, causing disease of considerable economic importance in both turkeys and chickens in many countries. Throughout this time, only one serotype of avian pneumovirus was described, within which two subgroups were identified (Juhasz & Easton, 1994). Fortunately for the control of infection, good in vivo cross

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protection was shown between these two subgroups (Cook et al., 1995; 1998). It was not until 1997 that avian pneumovirus infection was first reported in the United States of America (Senne et al., 1997). Initial reports were from Colorado, but the virus was subsequently reported in Minnesota, where the infection has continued to cause severe economic and welfare problems in turkeys (Senne et al., 1998; Anon., 1998).

The evidence to date suggests that there is some antigenic relationship between the Colorado isolate and TRT subgroups A and B, because subgroup A and B strains protect against challenge with the Colorado isolate. However, the reverse is not true and this, together with the results of the neutralization tests, suggest that the Colorado isolate may be the first known example of a new serotype of avian pneumovirus.

For good serological diagnosis of infection caused by the Colorado isolate, it is essential that the homologous virus be used as antigen in the ELISA. The use of PCRs in the diagnosis of avian pneumovirus infection is likely to increase in the future. These highly sensitive assays must be used with great care, because of the risk of accidental contamination and appropriate controls must be included in each test.

Experimental work has shown that live-attenuated vaccines developed from either a subgroup A or a subgroup B TRT strains provide excellent protection against challenge with the Colorado isolate. However, preliminary evidence from field observations in Minnesota suggests that the infection there may possibly be controlled adequately by good biosecurity and other disease control measures and that vaccines may not be required. It is too early to know whether or not this will prove to be the case.

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### Dr. Mark W. Jackwood Promoted to Professor, Avian Medicine, University of Georgia

Dr. Mark W. Jackwood, Associate Professor, Department of Avian Medicine, University of Georgia has been promoted to Professor, Department of Avian Medicine. Mark

received his B.S. and M.S. from the University of Delaware, and Ph.D. from Ohio State. He joined the staff as Associate Professor in 1989 and was appointed to Graduate Faculty in 1992.

Dr. Jackwood's honors and awards include 1993 Creative Research Medal, University of Georgia Research Foundation, "Rapid detection and serotype identification for infectious bronchitis virus". 1996 Pfizer Animal Health Awarded for Research Excellence, UGA College of Veterinary Medicine and 1996 Upjohn Achievement Award for Outstanding Contributions to the Field of Avian Medicine Research, American Association of Avian Pathologists.

Dr. Jackwood and his associates have several patents pending and in the submission stage.

## Tenure Track Position in Poultry Medicine

The University of Tennessee College of Veterinary Medicine is seeking applicants for a new tenure track faculty position in poultry medicine. The position is in the Department of Comparative Medicine. Candidates must have a DVM degree and be certified by the American College of Poultry Veterinarians (or board eligible). An advanced degree in poultry medicine is highly desirable. The position is 50% research and 50% service/teaching. The successful candidate will be expected to develop a food safety research program at the processing and/or production level. Epidemiology and/or HACCP (Hazard Analysis Critical Control Points) experience and training is highly desirable. Service components of the position will include diagnostic duties in collaboration with existing diagnosticians of the College. Duties may include field service in support of commodity, consumer, university extension and industry groups. Teaching will be assigned within the professional and graduate curriculum. The position is a full-time, tenure track position at the Assistant or Associate Professor level. Salary is commensurate with qualifications. Inquiries and/or applications (letter of interest and a curriculum vitae) should be sent to Dr. John C. New, Jr., Chair, Search Committee, Department of Comparative Medicine, Box 1071, Knoxville, TN, 37901-1071, (423) 974-5576, e-mail: jnew@utk.edu. Applications will be considered until an appropriate candidate is found.

*The University of Tennessee is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA employer.*

### Broiler Whole Bird Condemnation (Company)

	Average Co.	Top 25%	Top 5 Co.'s
% Septox	0.364	0.254	0.275
% Airsac	0.342	0.132	0.090
% I.P.	0.158	0.067	0.053
% Leukosis	0.017	0.007	0.005
% Bruise	0.014	0.014	0.013
% Other	0.036	0.012	0.017
% Total	0.951	0.476	0.452
% 1/2 parts condemnations	0.395	0.260	0.233

Data for week ending 3/20/99

**Excerpts from the latest  
National Agricultural Statistics  
Service USDA Reports  
“Broiler Hatchery  
and “Chicken and  
Eggs”(NASS)**

**February Egg Production Up 3 Percent**

U.S. egg production totaled 6.9 billion during February 1999, up 3 percent from the 6.11 billion produced in 1998. Production included 5.30 billion table eggs and 987 million hatching eggs, of which 92 million were broiler-type and 60.0 million were egg-type. The total number of layers during February 1999 averaged 323 million, up 3 percent from the total average number of layers during February 1998. February egg production per 100 layers was 1,947

eggs, down fractionally from 1,950 eggs in February 1998.

All layers in the U.S. on March 1, 1999 totaled 324 million, up 3 percent from a year ago. The 324 million layers consisted of 264 million layers producing table or commercial type eggs, 56.6 million layers producing broiler-type hatching eggs, and 2.86 million layers producing egg-type hatching eggs. Rate of lay per day on March 1, 1999, averaged 69.7 eggs per 100 layers, up fractionally from the 69.6 a year ago. Laying flocks in the 30 major egg producing states produced 5.95 billion eggs during February, up 3 percent from February 1998. the average number of layers during February, at 305 million, was up 3 percent from a year earlier.

**Egg-Type Chicks Hatched Up 3 Percent**

Egg type chicks hatched during February totaled 35.6 million, up 3 percent from February 1998. Eggs in incubators totaled 35.3 million on March 1, 1999, up 2 percent from a year ago. Domestic placement of egg-type pullet chicks for future hatchery supply flocks by leading breeders totaled 267,000 during February 1999, up 12 percent from February 1998.

**Broiler Hatch Up 3 Percent**

The February 1999 hatch of broiler-type chicks, at 662 million, was up 3 percent from February of the previous year. There were 624 million eggs in incubators on March 1, 1999, up 3 percent from a year earlier.

Leading breeders placed 6.88 million broiler-type pullet chicks for future domestic hatchery supply flocks during February 1999, up 10 percent from February 1998, according to the National Agricultural Statistics Service (NASS) “Chicken and Egg” Report.

**Broiler Eggs Set In 15 Selected States Up 4 Percent**

According to NASS “Broiler Hatchery” report commercial hatcheries in the 15-state weekly program set in incubators 182 million eggs during the week ending March 20, 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 2 Percent**

Broiler growers in the 15-state weekly program placed 146 million chicks for meat production during the week ending March 20, 1999. Placements were up 2 percent from the comparable week in 1998. Cumulative placements from January 3, 1999 through March 20, 1999 were 1.57 billion, up 4 percent from the same period a year ago.



*The Poultry Informed Professional Newsletter is published with support from Bayer Corporation*

# Meetings, Seminars and Conventions

1999

April

**April 9-13: North Carolina/South Carolina Joint Turkey Federations Spring Meeting**, Embassy Suites Hotel, Myrtle Beach, S.C. Contact: North Carolina Turkey Federation, 4020 Barrett Dr., Suite 102, Raleigh, N.C. 27609. Phone (919) 783-8218.

**April 13-14: Arkansas Poultry Symposium**, Holiday Inn, Springdale, AR. Contact: Judy Kimbrell at Arkansas Poultry Federation. Phone (501) 375-8131.

**April 14-15: Poultry Industry Conference & Exhibition**, Western Fairgrounds, London, ON. Sponsored by the Ontario Poultry Council. Contact: Box 4550, Stn "D", London, ON. N5W 5K3. Phone (519) 438-7203; Fax (519) 679-3124.

**April 14-16: 'Turkeys' 21st Technical Turkey Conference**, Shrigley Hall Hotel, Pott Shrigley, Nr Macclesfield, Cheshire, UK. Contact: Conference Office, PO Box 18, Bishopdale, Leyburn DL8 3YY, US. Fax: +44 (0)1969 663764

**April 24-27: 48th Western Poultry Disease Conference**, Landmark Hotel & Conference Centre, Vancouver, BC. Contact: Lina Layikte, Conference and Event Services, 1 Shields Avenue, University of California, Davis, CA 95616. Phone (530) 757-3331; Fax: (530) 757-7943; E-mail: confandeventsSVCS@vcdavis.edu

**Apr 29-May 2 — Georgia Poultry Federation Annual Spring Mtng.**, Brasstown Valley Resort, Young Harris, Ga. Contact: Georgia Poultry Federation, P.O. Box 763 Gainesville, Ga. 30503. Phone:770-532- 0473

1999

May

**May 5-6: Trace Mineral Sympm. & Nutrition Conf.**, Fresno, Calif. Contact: California Animal Nutrition Conference Steering Committee, California Grain & Feed Assn., 1521 1 St., Sacramento, Calif. 95814. Phone (916) 441-2272.

**May 6-7: National Breeders Roundtable**, St. Louis, MO. Contact: USPOULTRY, 1530 Cooledge Road, Tucker, GA 30084-7303. Phone (770) 493-9401; fax (770) 493-9257; e-mail mlyle@poultryegg.org or Internet www.poultryegg.org/.

**May 12-13: Texas Poultry Federation Board Meeting**, Dallas. Details from Texas Poultry Federation, P.O. Box 9589, Austin, TX 78766-9589. Phone (512) 451-6816; fax (512) 452-5142.

**May 12-13: British Pig and Poultry Fair**, National Agricultural Center, Stoneleigh Park, Warwickshire, England. Contact: Roual Agricultural Society of England, National Agricultural Center, Stoneleigh Park, WarwickshirCV8 2LZ, UK. Fax:+441203696900

**May 22: GPF Night of Knights**, Cobb Galleria Centre, Atlanta, GA. Contact: Georgia Poultry Federation, P.O. Box 763, Gainesville, Ga. 30503. Ph: (770) 532-0473.

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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 2W1. Phone (519) 824-4120, ext. 4625.

**June 16-18: North Carolina/Virginia Egg Assn. Meeting & Mid-Atlantic Layer Workshop**, Sands Ocean Club Resort, Myrtle Beach, S.C.; Dr. Kenneth Anderson, North Carolina State Univ., Poultry Science Dept., Scott Hall/Campus Box 7608, Raleigh, N.C. 27695.

**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 27-30: International Conference & Exhibition on Veterinary Poultry**, Beijing, China. Contact: Mr. Li Wei, Secretariat of ICEVP'99, Room 3011, Yuanliwuyue Building, No. 19 Huixindongjie (Xiyuan), Beijing 100029, P.R. China. Fax: +86 10 64950374.