DANDER

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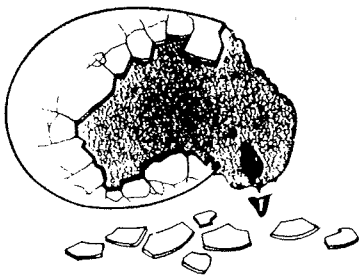
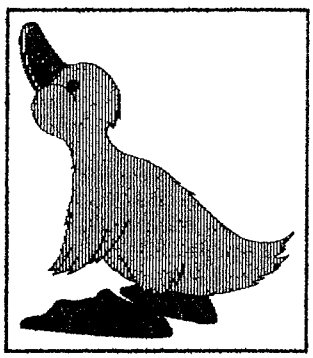


Editorial

It was great to attend the AVPA Scientific Session at Attwood, Melbourne Nov 13 and 14 1995. Once again I am encouraged at the depth of scientific expertise in the Australian Poultry Industry, which is holding on by the tips of its fingers in the face of continuing downsizing and relocation and dislocation. I was particularly impressed with the research that was done on quantifying the best way to beak trim birds. It was marvelous to look at the colourful pictures of nerve sensors in the beak of the chicken, and to boggle at the functions of each of the various receptor types. I will certainly be observing beak trimming with much more care in the future! Welfare investigations of this type will become more and more important in the future as the industry seeks to understand the impact of management procedures for optimum production. The meat processing industry is entering the phase of using emu and ostrich meat for human consumption. Codes of Practice and hazard charts are monitoring all of the critical welfare aspects such as transport, handling and processing. There are redrafts of Codes of Welfare which include chickens and contain. mandatory stunning prior to stunning. Yet despite years of looking at welfare, I still see trucks driving along the road with crates peeking over the front edge of the front baffle board and birds in full wind blast. It seems that we are either unable to self regulate and fix these things. Why do I still pass the squashed chickens on the freeway ! It is good to see Codes of Practice which routinely audit the structure of carrying crates and latches and enforce through legislation corrective action. Codes of Practice also require that birds be housed under cover and that hazard charts be constructed to show that personnel handling birds know how to do so. These people are audited by professional quality auditors using Codes as standard. Operators undertake declarations that they will abide with the Codes of Practice. This is simple quality assurance strategy. International standards (ISO9000) is gradually infiltrating the poultry industry and will have a positive impact on poultry welfare. I support the drive towards auditing Maybe one day there will be an exclusive welfare audit! The challenge for the poultry industry will be to combine the science of beak receptors with the auditing skills of ISO9000 standards. This system will provide the poultry industry with the tools (evidence it is called in auditing circles) to demonstrate that what is done is sound, up to scientific pace and verified by outside parties. Like so many aspects of the poultry processing and egg laying industry, there are many changes facing the poultry veterinarian and poultry companies. I encourage all individuals to develop auditing skills, as it makes one look at what is taken as NORMAL with a new light !



Happy New Year !

PIX96 is a goer folks....

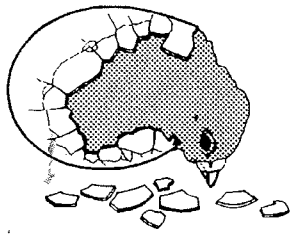
Set aside :

ANA Hotel 14,15,16 April 1996 ,

Surfers Paradise, Sunny Most of the time Queensland

AVPA scientific symposium follows on 17 and 18 April 1995.

Rod Jenner is the person with the inside information... just ask him by phoning 07-206-6444.



Australian Veterinary Poultry Association

I have been asked to include in this issue of DANDER current AVPA executive and office holders. The election results at the February 1995 AGM were as follows:

President	Paul Macqueen
Vice- President	Peter Groves
President Elect	Peter Young
Secretary/Treasurer	Garry Cross
Scientific Meeting Co-ordinators	
Melbourne	Chris Morrow
Gold Coast	Peter Young
AVPA Councillor	Clive Jackson
WVPA Bureau Memb.	Garry Cross
Standing Committee Convenors	
Animal Welfare	Vivien Kite
Therapeutics	Tom Grimes
Exotic Disease	Kim Critchley
Dander Editorial Committee	
Grant Richards	
Geoff Crawford	

The Melbourne Scientific Meeting has now passed and I would like to express my gratitude to Chris Morrow and his team for his efforts in arranging a superb meeting with interesting and high quality scientific presentations and a most enjoyable dinner. I would also like to thank the AVPA members who presented papers at the conference for their contributions. Once again our thanks go to the Victorian Institute of Animal Science for making the venue and associated services available to the AVPA,

Looking forward, our next meeting will be our 1996 AGM and two day scientific meeting which is a back to back meeting with PIX at the ANA Hotel at Surfers Paradise.

PIX	April 14, 15 & 16
AVPA	April 17 & 18

Further details will be available in February through an AVPA mailing or before by contacting Rod Jenner. However for those wishing to present research results, clinical reports etc please contact Peter Young **now** to ensure your place on the program.

For those who would like to inject a little of their time and energy into the AVPA and its future (even if you are unable to attend the April meeting) I ask that you consider standing for office at the 1996 AGM. A Queensland based President in 1996 could do with some support from Queensland based executive members.

If you would like to contact me on this or any other AVPA matter please call me on

(02) 8780088 - work
(02) 8684237 - home

I look forward to seeing many AVPA members, sustaining members and guests on the Gold Coast in April.

Until then I wish you all an enjoyable end to 1995 and an exceptional good 1996. With good intention and considerable attention, you **can** have it the way you want it.

Paul Macqueen
AVPA President.

During the AVPA Conference in Melbourne the following notes were typed onto computer. They are presented here as a guide and make no claim to be authoritative. If you have a query, please contact the speaker.

In ovo day 18 and day old vaccination for IBD
by Phil Lerbach Cyanamid Websters

IBDV destroys B lymphocytes in bursa

Current vaccination strategies:

Breeders: hyperimmunisation, live followed by killed in breeder. Passive Antibodies in broilers protect.
Broilers: 1 day old vaccine injection: mild vaccines, prefer low maternal antibodies. Also day 7-14 live vaccine in broilers is used.

In OVO strategy 18 days of incubation vaccine designed to show a timed release in the growing broiler bird in a range o maternal Abs. Mix vaccine virus with specific antiserum to IBD. Developing for European market in the first instance; B877-BDA mixed with specific antiserum
Results of experiments in SPF birds using this combination

day 18 embryos
virus alone, virus freeze dried with antiserum and control
analysed hatchability, weight gains over 28 days, bursa bwt ratio, presence of antigen, and immune response

Bursal histology scored 3,5,7,14,28 days post hatch. No follicle damage in controls, vaccine alone showed very early infection and destruction of the follicles, BUT combination showed delayed emergence of the vaccine virus up to 14 days. Detection IBD antigen by precipitin test: combination shows delayed virus release.

Birds failed to mount immune response with virus alone, but by delaying emergence allow delay of emergence of immune response and provide Antibody protection

Challenge data indicates clinical protection against virulent challenge: very small trials

IN OVO does:
.precise dose administration
.single vaccination effective for the life of the broiler
.delays virus release
.effective in range of low to high maternal Antibodies
.safe and effective for day 18 in ovo injection

Will be a safe and effective way of vaccinating broiler birds

.may be able to be in combination with such as Mareks
. timing of breakthrough related to level of maternal AB, mechanism is unknown
.You can't titre the virus any more in the vaccine.

Update of progress on BLS research
by Trevor Ellis WA

Symptoms of infection:
Liver and spleen pathology
Increasing mort, decrease eggs, decrease chick quality. Spleen enlargement, yolk sac regression, liver size increase, some evidence of peritonitis. Histo shows multi organ inflammatory disease. Mono clonal techniques being developed such as Ag detection ELISA
Capture Elisa is significantly more sensitive also works using issues and detects to a lower level than the gel test. Next step is attempting cell capture: requires actively dividing cells and in range of SPF cells

Neutralisation tests: Incomplete serum neutralisation noted
Route of infection studies:
intracrop inoculation, intranasal: intracloacal does not work as well of at all . Aerosol spread" readily spreads 0.5m and maybe up to 2m. Spreads to in-contacts.
Virus characterisation progressing
.can not visualise under EM.
Looks like RNA agent between 50 and 100 nm, ether insensitive
Will keep plugging away to cause

Gregg Underwood
Baiada Poultry

Editorial note: This session started with audience stretching exercises... gluteal ischaemia was reversed.... also.... I believe that the proceedings of the conference are not released. If anyone is interested in any of the attached, I suggest Gregg is contacted.

23 presenters: 180 delegates:

The outline of the programme is:

The B Cell dependent immune system
Michael Ratcliffe, Mc Gill University

The T-dependent immune system
Thomas Gobel, Basel Institute for Immunology

Stem cells and hematopoiesis
Kelly McNagny, European Molecular Biology Laboratory

The micro-environment of the chicken immune system
Suzan Jeurissen, Netherlands Institute for Animal Science and Health

Contribution of the avian immune system to our understanding of immunology
Max Cooper, Howard Hughes medical Institute

The avian MHC (B-locus) and its function
Jim Kaufman, Basel Institute for Immunology

Avian Cytokines
Pete Kaiser, Institute for Animal Health, Compton

The avian complement system
Tom Koppenheffer, Trinity University, Texas

Comparative immunology of avian species
David Higgins, University of Hong Kong

Neoplastic Diseases
Ton Schat, Cornell University

Respiratory Diseases
Peter Russell, Royal Veterinary College, London

Immunity to Salmonella and other bacteria
Paul Barrow, Institute for Animal Health, Compton

Immunity to coccidia
Elaine Rose, Institute for Animal health, Compton

Immunosuppressive Diseases: viruses
Brian Adair, Northern Ireland Department of Agriculture

Immunosuppressive diseases: dietary agents
Mark Cook, University of Wisconsin

Immunomodulation
Kirk Klasing, University of California

Environment-Immunity interactions
Rod Dietert, Cornell University

Neuroendocrine-immune interactions
James Marsh, Cornell University

Current methods of delivery of poultry vaccines
Bill Blaxendale, Intervet Pty Ltd

Vaccines of the future
Ivan Morrison, Institute for Animal Health, Compton

Editorial PSSt: At 18:00 every night the agenda listed:

BAR OPENS IN WHITEKNIGHTS HALL

and at 23:59

BAR CLOSES

I regret that there is no more information available on this section of the Conference.

TODAYS NEW PHRASE

At a Total Quality Management seminar participants were discussing processes. In particular they wanted words which described the key factors in a process which effected the end result.

The word: EXCITEMENT FACTORS

I knew there was a phrase missing from my life.....

Progress in the development of a CAV ELISA
by Sharon Cummingham, RMIT

VP3 protein involved in immunity
Use VP3 as antigen for ELISA: aim of work this year. VP3 expressed in E coli

Good response observed action of fusion protein with monoclonal Abs produced against range of Abs

Attempted to detect range of anti-CAV Abs in a selection of chicken sera. All sera tested according to o/s kits: Guildhay and Belfast and KPL

Assume ELISA kit needs refining to reduce high non-specific background absorbance: chicken serum needs to be sticky.

Next action could be to cleave GST-VP3 to allow VP3 for use in an ELISA

Some discussion about the sensitivity of the Guildhay test, particular with SPF sera

Protein yield from the E coli important

Also developing CAV ELISA based on VP1: early days to say if GST cleaving method is causing problems: Differing sources of SPF sera are being used to develop ELISA kits.
Question from the audience:
Does a panel of known CAV positive and negatives need to be developed to be shared around. This may assist in test development.

CAV detection: Western Blot
by Alex Coombes: Charles Sturt University

Extremely hard to eradicate CAV from the environment.

Full infection:
immunosuppression and skin lesions increase susceptibility to secondary skin infections, atrophy of the lymphoid organs

Subclinical in older chickens causes decreased weight gain, lower income.

CAV is a significant economic threat

Circular single strand DNA genome,, 2319 bases, 3 overlapping reading frames, a 3 intracellular viral proteins (VP1,2,3).

Western blotting:Run on PAGE then nitrocellulose membrane detected all three proteins in poly acrylamide gel

On western blot extra bands detected using australian isolate: not previously reported

PAGE detects 3 viral proteins, several larger proteins. Using Western Blot: VP1, VP3: 3 more bands in VP3 region: possible breakdown products:

Can a quick Ag test be developed.....
Trial to spot infected cells on a membrane and get a colour deposition on the membrane.
Can tissue samples be collected and make an impression ont nitrocellulose membrane ? Malaysian experience: liver, spleen, bursa, thymus and non species controls: tiger intestine, horse brain, horse pancreas, deer liver.

Preliminary Results:
Nice strong reaction with thymus from CAA infected bird.

Spleen reaction if use VP1 MCAb probe. Test using chicken faeces and blood is a possibility: confirmatory test . Antigen detection test: useful in the field? Is PCV better clinically.

In Mixed source flocks serology useful to show horizontal transmission ???

Ostrich fading syndrome

by Trevor Ellis WA Dept of AG

Feb 1996, Zimbabwe origin birds in WA from quarantine developed feather loss in chick, runting, in-appetance, morbidity and mortality. Primary lesion mucoid enteritis, pale bone marrow. Extensive areas of necrotic enteritis. Spleens reduced in size. Histologically thickened Lamina propria, vacuolation at basement membrane area, proteinaceous fluid, PAS positive. Bacto grew a range of opportunistic organisms.
EM: non consistent finding
Virus isolation: chick embryo: non specific. One NDV isolation: non pathogenic
Explant cultivation: gut tissue and buffy coat leukocytes revealed on day 30: large foamy cells in monolayer which started to spread. Monolayer to direct EM: 100nm particles: budding effects"retrovirus ? But is this Cause or merely passenger ?
Need to identify uninfected ostriches: positive and negative controls required. Have designed challenge studies trying to reproduce disease
Three groups five 4 wk chicks dosed orally, subcut: trials in isolation
Pathologists noted spectacular depletion of lymphocytes. May be not a spumavirus. Need to re- infect chickens with isolate.

Spread of fading syndrome maybe co-incidentally linked to movement resulting from excitement and movement from having ostriches out of quarantine. Condition believed to be in Australia before the ostriches were released.

Submissions to Dander can be faxed to: 03-9789-7959
or posted to:
Grant Richards, 29 Tantani Street, Frankston North, VIC 3200.

OR

Dr Geoff Crawford
Charles Sturt University
PO Box 588
Wagga Wagga, NSW 2678

H paragallinarum isolates from South African Coryza

Jeanette Miflin, Yerongpilly

Coryza is Gm negative, requires V factor, is NAD dependent and Grows with a nurse culture

In Natal (South Africa) from 1989 onwards, coryza isolates did not require V factor for growth. Labs Verified the disease forming agent. Didn't exhibit satellitism in lab.

Ornithobacterium rhinotracheale new organism described recently described. Isolated in pure culture from pneumonia air sacculitis: cases death:

Seems to be reported around world. Don't know if in Australia.

24 cultures (Coded) from SAfrica sent to Australia.
Bio chemistry, serological testing, PCR, REnd Analysis and Ribotype profiling.

PCR: 2 assays developed: recombinant clone AND 23S rRNA. Applied these direct to colonies: direct off plates

REA restriction enzymes digest DNA: many different fragments hard to detect results. REA: single band difference can be contentious: only one cut difference between O.r. and other coryza organisms.

Ribotyping: probe label 16 sRNA gene DNA adheres to nylon membrane

Ribotyping more consistent thus far, and the lab was able to spilt to Natal isolates into groupings.

The origin of O.r. unknown. Field evidence suggests that there has been selection thru vaccine selection pressure.

Ribotyping useful epidemiological tool

Significance of Or unknown. It is a continuing problem in South Africa.

Thanks forwarded to Robert Bragg, University Pretoria

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ILT vaccine ILT A20 in combination with Mg vaccine (Vaxsafe Mg)

Fiona Gordon, Cyanamid Websters

ILT A20 is a plaque purified clone of SA2. Vaxsafe Mg is a ts-11 mutant

A combined ILT/Mg vaccine cost effective. Bivalent not possible at the moment, but vaccines can be mixed and administered together

Objective of trials was to confirm in vitro and in vivo compatibility

No drop in titre due to the mixing of the vaccines prior to administration.

Field trials and challenge studies

Field: no detectable ILT Sn or Mg ELISA titres prevaccination
Over 10 day period: 6 to 7 pv some respiratory reactions and resp symptoms. Disappeared by 10 days pv. 5w/o pullets vaccinated with the combination.

Challenge studies: ILT study and Mg challenge separately:

Birds challenged 3 wk pv intratracheal, and checked daily for 2 weeks
ILT: controls 13/15 birds died due to ILT, remainder showed symptoms consistent with ILT infection: SIG Diff when compared with the vaccinates.

Mg trial: controls did not develop lesions: trend to show unvaccinated birds had heavier breathing in non-vaccination period

CONCLUSIONS:

MG TS-11 and ILT show In vitro compatibility

ILT indicated efficacy of protection. Mg Challenge unclear.

Cyanamid - Webster seeking ILTSA2 for eyedrop

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Virulence in Fowl Adenoviruses

by Jackie McAllsiter CSIRO Parkville

Adenoviruses have penton bases on the outer capsule from which fibres stick out. DNA virus.
The aim is to determine the areas of the FAV genome responsible for virulence.
Two viruses were studied:
CFA 40 versus CFA 3: very similar, except for virulence. Six recombinants developed by transcriptase and checked for purity.

Suspect virulence region of virulent adenoviruses defined.
No ideas of the mechanisms which are producing these differences
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NOTE: this is a very reduced summary of some excellent comparative work.
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RECIPE DU JOUR a la CHARLES

1. Use a lightly greased BBQ - while it is OK to have chops, steak and sausages already cooking, some chicken spare ribs, deboned thighs, marinated drumsticks or even a half bird cooking is best.

2. Remove the center from a piece of fresh bread - say 4-5 cm diameter. (you can use imperial inches if you wish)

3. Place bread on the hotplate and gently press down so the hole in the center forms a "well".

4. Crack an egg into the hole. Add grated parmesan, seasoning or any other condiment to your preference. While cooking it is a good time to have a beer, swat blowies, fend the dog away from the BBQ and lock the gate to stop the neighbors from invading because they have been attacked by the aromas wafting from your BBQ.

5. After 5 minutes flip over to seal the other side.

6. Leave on for an unspecified time. This depends on how well done you want the yolk. Hard cooked is better, as this tends to stop embarrassing splurge when you bite and burst the yolk !

YUMMMMMMMYY

The potential use of cytokine therapy in poultry

by John Lowentha CSIRO Parkville

Cloning of avian gamma interferon gene

Problem: newly hatched chickens susceptible to disease in early stages. Cytokine may be used to enhance effect of current vaccines. Development of studies has taken longer than anticipated. Cloning of the avian interferon gene attempted.

Type 1 interferon genes shown to be potent vaccine adjuvant in a number of animals. They are produced by wide range of cells in body, quite stable to heat and Ph, and combine to same cell receptor on the cell surface.

Type 2 (gamma) interferon is produced only by T cells and is sensitive to heating and Ph exposure. Binds to a different receptor.

Methods to make gamma interferon were discussed:

Comparing human and avian interferon, overall homology very low (35%)

Gamma interferon has potential to enhance viral immunity and maybe a powerful adjuvant

****

MG vaccination breakdown and other problems

by Kim Critchley

Tylan in feed first to TS-11 vaccinated birds.

Egg drops continued.

Question from audience: Was vaccination too late for natural challenge on the farm ?

Spastic paresis in broiler meat chickens

Just after shift to finisher: sporadic

Low calcium and magnesium may be depressed

Serological testing

by Denise O'Rourke, CSIRO Animal Health

13 years ago labs used: Virus isolation, AGP, FAT, HA, HI, AGP, FAT, EST, SAGP

Laboratory systems were transformed by the arrival of the ELISA:

Objective, quick, simple, sensitive, can be easily standardised, can be automated, software available, several tests using a single dilution, specific

Problems: non-specific reactions, technical problems such as washing, Cost
ELISA reasonably expensive may be up to 10 times higher than other reagents
ELISA have varying sensitivities : more sensitive with more problems with background reactions or maybe more insensitive when compared with earlier tests.

Lets review what the future holds:
Potential future or alternative tests:
PCR
Restriction fragment length polymorphism
"blotting"
Biosensors: monoclonal antibody, recombinant antigens, phage display,

LATEX AGGLUTINATION
Overcomes some of the problems with ELISA testing and reagent sensitivity.
Could this be more cost effective ?
Comment: with ELISA you are buying the technology OR is it the consideration that ELISA is not supplying what is needed.
Standardisation can have legal implications
It is noted that the trend in human is to DNA probes: highly specific.
Can depend if you want a quantitative or qualitative result. Latex can be titrated.

Cost of assay includes total cost of components; HI ND vs ELISA: take all into control, ELISA is cheaper in most cases.

It is important to note that commercial kits enable test standardisation between laboratories.

Beak trimming and pain receptors

by Chris Lunam, SA

Chris studied pain receptors in beak trimming and the declawing of emus. Her specialist field is this study of Neuromas and pain in birds. Receptors and fibers and the association of pain in the beak are important if correct methods for beak trimming are to be established.

Beak pivotal in birds: eating, drinking, preening, aggression, perhaps thermoregulation and sensory

Herbst corpuscles: detect pressure: dorsal surface upper beak
Grandry corpuscles-pressure
Merkel cells-touch
Free nerve endings: pain. temperature
Taste buds-food selection
Salivary glands-feedings

blood vessels-thermoregulation

Receptor distribution in distal 3mm of the upper beak: this is what is removed during beak trimming

By removing receptors, and cutting nerve fibers one expects modifications in behaviour:
reduced food intake, starve outs, decrease in uniformity, beak die back, acute and chronic pain
(electrophysiological studies)

Upper and lower beak innervated by the trigeminal nerve:: ophthalmic upper and lower intramandibular nerve

Breakdown in the ophthalmic nerve: immunohistochemistry: sensitive technique, visualise small diameter fibers: pain. Enables an accurate account of the effects of the toxins on the number and distribution of nerves. Distinguish between different types of nerves using polypeptides.

In the beak nerve fibers run parallel to the blood vessels.

Salivary glands surrounded by nerve fibers which are somehow associated with the release of mucous

Pain fibers: mammals mechanoreceptors : pinching gives pricking pain
AND
Polymodal receptors: pressure, irritants, burning pain on stimulation. Not myelinated

Beak identical to mammals:

Therefore the response to injury leads to hyperalgesia.

Injury....prostaglandin and potassium released>>> platelets and Masts>>>loop develops which builds up serotonin and histamine in the ICF stimulates other noiceptors which continues.

CNS events: chronic pain is probably CNS involved:
internuerones get excited, get impulses release amino acids, peptides>>>turn on sympathetic neurones>>>release catecholamines which turn on nococeptors some distance form the original site.

Other way of pain is through development of a neuroma. Nerves distal to point of cut slight degeneration sprouting of the cut nerves>>neuroma. One reinnervates target, sprouting nerves culled. Occasionally neuroma persists, and remains as a tangled mass of fibers. Cut nerves set up spontaneous impulses and cause CNS changes. Cycle of chronic pain. CNS connections can not be changed back.

risk of neuromas: age of trimming:all developed neuromas at 5 weeks. neonatal will not form neuromas. ASAP >>>may not get neuromas forming.

Severity 2.3 vs 1/2 upper beak at hatch.

Cauterisation time can influence development of a neuroma. 700C blade temp. 4s vs 2 secs compared.

correlated gross effects with histo effects: silver impregnation: COP trimming: nerve parallel. look regenerative

2/3 beak, 4 secs at hatch twisted mass nerves

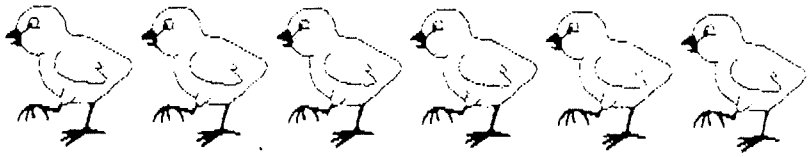
contd next page ------>>>>>>>>>

Poor trimming form small focii of damaged nerve fibers. Fibers enter into the epidermis

1/2 of upper beak at hatch we found no neuromas in the birds: transient neuromas at 10 weeks. sensory perception present and innervated by nerves

Trimming 2/3rds beak at hatch, 3/3 had neuromas

At hatch maximum ability of beak to regenerate. Max culling of axons. Avoids potential source of chronic pain.



ANA Hotel - Surfers Paradise, Qld
14, 15 & 16 April 1996

PIX96
1996 Poultry Information Exchange

Implementation of PCR for *Mycoplasma gallisepticum* and *Mycoplasma synoviae*

J.K. Miflin[1] and C. Morrow[2]

[1] Animal Research Institute, Yeerongpilly
[2] Victorian Institute of Animal Science, Attwood

A PCR assay developed at VIAS for the detection of *M. gallisepticum* and *M. synoviae* was trialled at ARI. Due to the use of different PCR machines at the two institutions, some changes had to be made to the protocol, including the use of an oil overlay and the changing of cycle step times. Working with purified DNA, the test was re-optimised for $MgCl_2$ and primer concentration. It appeared that each species had different optima, necessitating the implementation of separate tests for the two species. This is unfortunate firstly, because it creates twice as much work, and secondly, the internal positive control (Epos) cannot be used under these circumstances. However, a preliminary evaluation was conducted with purified DNA, pure broth cultures and field swabs.

Both Mg and Ms tests worked well with pure DNA and broth cultures. Rod Jenner from Golden Cockerel kindly provided 45 palatine cleft swabs for analysis. For flocks with current infection, the PCR results agreed with the known flock status. However, for flocks vaccinated 12 weeks prior to testing, the Ms status was correctly determined but not the Mg status. This is probably because the *M. gallisepticum* vaccine strain does not persist for long in vaccinated birds.

In conclusion, the VIAS PCR has been able to be implemented at ARI, but has required some modification. Field evaluation of the modified PCR has demonstrated that it is an effective diagnostic tool for current or recent infection. The question is, would industry be interested in such a test on a user pays basis, and if so, should it be offered at a regional level or at a single national laboratory.