Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Department of the Environment and Heritage, 2006

Australian Government
Department of the Environment and Heritage

Reader's Guide

This page contains links to the Main Document (Hygiene Protocols). The Main Document also contains references to other files (supplementary information documents, SIDs), all of which are Adobe Acrobat documents.

Copyright

This publication is available online at:
http://www.environment.gov.au/about/publications/index.html

Disclaimer

Note
This document describes Hygiene Protocols for the Prevention and Control of Diseases (Particularly Psittacine Beak and Feather Disease) in Australian Birds. It has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Executive Summary

Psittacine Beak and Feather Disease (PBFD) was listed as a Key Threatening Process in April 2001 under the Environment Protection and Biodiversity Conservation Act (1999). Consequent to this, the *Threat Abatement Plan (TAP) for Psittacine Beak and Feather Disease affecting endangered psittacine species* was published in 2005. This plan gives priority to three nationally listed threatened psittacine species that are at most risk from the disease. The TAP lists five Action Plans under the headings National Coordination, Research, Disease Monitoring, Management Strategies and Education and Extension. These protocols deal with parts of Action Plans 2 (Research) and 5 (Education and Extension).

The protocols contain information of value to recovery teams, zoos, wildlife carers, veterinarians and aviculturists. They concentrate on quarantine matters and endangered psittacine birds, both captive and wild. In considering quarantine aspects, diseases of quarantine importance other than PBFD that can be detected by laboratory tests are included.

Areas covered include:

- The incubation period of PBFD and its application to a quarantine period;
- The effectiveness of disinfectants on BFD virus;
- Current hygiene tools, techniques and practices used to control the transmission of diseases in birds;
- The ability of husbandry facilities to implement a minimum set of hygiene standards;
- Development of protocols for clinical and post-mortem evaluation, quarantine, sample collection, transport of birds and specimens, disinfection, response to test results, and disposal of dead birds;
- Pathology/laboratories to which samples should be forwarded; and
- Notification procedures in the event of a positive or negative diagnosis.

The report establishes a framework for controlling and preventing diseases in captive and wild populations of psittacine birds, and produces recommendations for dealing with specific diseases.

Contents

Introduction

This report is a response to some of the Action Plans recommended in the *Threat Abatement Plan (TAP) for Psittacine Beak and Feather Disease affecting endangered psittacine species*. The TAP listed five Action Plans under the headings National Coordination, Research, Disease Monitoring, Management Strategies and Education and Extension. This report deals with parts of Action Plans 2 (Research Actions 2.4 and 2.5) and 5 (Education and Extension Actions 5.1 and 5.2), as well as additional items requested by the Department of the Environment and Heritage.

1. Acronyms for Psittacine Beak and Feather Disease and Beak and Feather Disease Virus

There has been confusion about the acronymns that may be applied to PBFD and its causative virus. PBFD has also been called psittacine circovirus disease, or PCD. However, the latter acronym clashes with that of porcine circovirus disease. Additionally, the acronym PCV (psittacine circovirus) clashes with that of porcine circovirus.

The family *Circoviridae* contains two genera; *Circovirus* and *Gyrovirus*. Chicken anaemia virus (CAV) is the only member of the *Gyrovirus* genus. There are three official members of the *Circovirus* genus, the two porcine circoviruses PCV1 and PCV2, and beak and feather disease virus (BFDV) (Pringle, 1999; Bassami *et al.*, 1998). There is, however, a growing list of avian circoviruses, and a tentative classification may be summarised as follows:

Genus *Circovirus*

Official:

- Porcine circovirus PCV1 and PCV2
- Beak and feather disease virus BFDV

Tentative:

- Columbid or Pigeon circovirus PiCV
- Canary circovirus CaCV
- Goose circovirus GoCV
- Duck circovirus DuCV
- Starling circovirus StCV
- Raven circovirus RaCV

Genus *Gyrovirus*

- Chicken anaemia virus CAV

The International Committee on Taxonomy of Viruses states that psittacine beak and feather disease is to be called PBFD to avoid confusing it with Budgerigar Fledgling Disease, and the virus is to be called BFD virus. In this document psittacine beak and feather disease will be referred to as PBFD and the virus that causes the disease as BFDV.

2. Recommendation for a Quarantine Period to Avoid Spread of BFDV between Populations (TAP Action 2.4)

Quarantine means a place of isolation where birds of unknown health status may be maintained and subjected to health checks for a period before being introduced to a healthy population after passing the health checks. To eliminate the possibility of transferring pathogens to the "disease-free" breeding flock, the quarantine module is preferably separate to the facility where birds are maintained for breeding. A recommendation for a quarantine period necessary to avoid spreading pathogens, especially BFDV, between bird populations, will be recommended.

The quarantine described in this section is aimed at psittacine birds, but with slight modification can be adapted to any bird species.

BFDV is a non-enveloped virus and is extremely difficult to inactivate physically or chemically. A proposed quarantine period will be based on the detection of antigen and antibody for BFDV. Obviously, a quarantine protocol for an endangered species should not address BFDV alone. Other pathogens that can significantly affect the viability of a captive population and which are considered of quarantine importance include:

- Avian Gastric Yeast (*Macrorhabdus ornithogaster*)
- Avian influenza virus
- Avian polyomavirus (APV)
- *Chlamydophila psittaci*
- External and internal parasitism
- Gram-negative bacteria
- *Mycobacterium* spp.
- Newcastle disease virus
- Psittacid herpesvirus 1 (Pacheco's disease virus)

Incubation period of PBFD

Please read an explanation of how the Haemagglutination (HA) and Haemagglutination Inhibition (HI) tests are conducted and interpreted.

With current knowledge and under natural conditions, it is not possible to place a maximum time on the incubation period for PBFD, since the time of infection is usually unknown. In nestling cockatoos, the incubation period of PBFD is a minimum of 21 to 28 days following the intravenous injection of the virus, and so will be variably longer for a natural infection, depending on the species and even among individuals of the same species (Raidal *et al.*, 1993). Raidal (1994) reported that in susceptible galah chicks the onset of clinical signs ranged from 30 to 72 days, and with susceptible sulphur-crested cockatoo (SCC) chicks 28 days. Ignoring absence of powder downs (in those species that produce powder downs), a moult is necessary to express lesions in the plumage and this could take up to 12 months (as long as the bird is HI negative). Some infected birds remain feather lesion-free before they become stressed and succumb. Some infected birds can appear healthy and produce infected

young (Raidal, 2005). Raidal (2005) advised that PCR screening of blood is the most sensitive way of detecting infection followed by PCR on feathers and HA testing of feathers or faeces. HI testing on a flock basis also reveals whether the flock is infected. The most practical recommendation for detecting BFDV antigen is a minimum of two separate blood and feather PCR tests at least 1 month apart (Raidal, 2005). However, some BFDV positive birds might remain undetected and a further test after 4 weeks is advisable. HA testing provides a quantifiable indication of virus excretion and, when used in conjunction with PCR, provides a valuable internal control mechanism for interpreting results. From a diagnostic view point it is advantageous to know both results. By applying all 4 tests on a flock basis (PCR blood, PCR feather, HA feather, HI blood) it is possible to detect early viraemia and antibody and antigen in feathers. If repeated 4-6 weeks later, any developing antigen or antibody can be detected. A further test 4-6 weeks later would detect late developing antigen or antibody.

Other tests being developed for antibody detection such as ELISA (enzyme-linked immunosorbent assay) and latex agglutination (LA) may provide more sensitive and accurate methods for assessing seroconversion in individual birds being held in quarantine and may be able to differentiate antibody response to experimental vaccination from natural infection.

Conclusion
A quarantine period of at least 63 days is recommended, with testing for BFDV at day 0, day 28 and day 56, leaving a week for results to be delivered.

3. Test Effectiveness of Disinfectants on Closely Related Viruses (TAP Action 2.5)

Until a method of in vitro assessment of the viability of BFDV is available, the effectiveness of disinfectants on the virus cannot be assessed. Thus it was necessary to review the efficacy of disinfectants on closely related viruses, namely PCV and CAV.

From the review, it can be inferred that both Virkon S and glutaraldehyde, when used on an organic matter-free surface at the higher recommended concentration (2%), and for a contact time of 10 minutes, will inactivate any viable BFDV that might be present on the surface. Of the two, Virkon S is recommended as it is safer to use near humans and birds. Once a system of growing BFDV and assessing its viability is developed, its susceptibility to these disinfectants can be assessed. Virkon S has low toxicity to humans and birds and is effective against all viruses. It is not approved for use on human skin.

Virkon S at 1% is the only disinfectant recommended for use against all families of viruses by the AUSVETPLAN.

For disinfection of waste and equipment and disinfection procedures, see Section 8.

4. Quarantine of Captive Birds

Quarantine protocols are always viewed as overkill and too expensive before a crisis, but never after a crisis!

This report concentrates on PBFD and psittacine birds, both captive endangered species and psittacine birds in the wild. In considering quarantine aspects, other diseases that can be detected by laboratory tests are included.

Captive birds are housed in a foreign environment, a key essence of which is overcrowding, compared to that which occurs in the wild. The potential for disease to occur is greatly magnified, and so intensively managed birds should be provided with an environment that minimises the potential for disease and its spread. Biosecurity is a major part of managing intensive populations of birds. As in introduction to quarantine, please refer to the following documents:

The methods of transmission of pathogens
The importance of boot baths, face masks and disposable gloves
Lessons on biosecurity from the poultry industry

The poultry industry checklist shows the extent to which a poultry integrator will go to protect its investment in genetics, nutrition, intensification, disease control and marketing commitments. On the other hand, most aviculturists' motives in Australia are not purely economic, since very few people make a living from aviculture. They derive pleasure from keeping and interacting with birds and from their discussions with other aviculturists. They enjoy their hobby and are proud of their ability to manage and breed a hard-to-breed or rare species. Many make money from their hobby opportunistically and this helps to partly sustain their hobby.

The great majority of aviculturists do not protect their birds from wild birds and do not have a quarantine policy. They allow other aviculturists to visit their facility and they themselves visit other private aviaries. Some take their birds to shows and return them to their aviary without going through a quarantine period or protocol. Newly acquired birds are similarly introduced to the aviary. Some aviculturists, however, will go to some effort to have a quarantine policy but it is usually *ad hoc* and without a technical basis, and therefore not effective.

Many of the diseases and problems that arise in aviculture (as in any farming enterprise) are linked more to mismanagement than to particular disease agents. To counter this problem, Speer (1991, 1995) proposed the "closed aviary concept" (CAC) to apply to a single location enclosing all modules of an avicultural facility, with designated areas and limitation of the flow of traffic and fomites. The CAC is based on the recognition that disease agents can compromise a facility, and utilises the concepts of isolation, traffic control and sanitation to prevent this.

Biosecurity for handling threatened species bred in captivity can deal with two possibilities:

- Progeny naturally reared and released into the environment, either immediately ("hard release") or after acclimatisation ("soft release"); and
- Progeny naturally and artificially reared and released into the environment. Limitations to this option are the ability of a facility to handle larger numbers of birds, lack of dedicated staffing and finances. It also introduces domestication to a species that is to be introduced to the wild. However, it offers more progeny in a shorter time.

The goal of a recovery program is to improve the short to long term viability of wild populations. If mismanaged, simply increasing numbers in the wild through captive breeding can decrease the long-term viability of wild populations. In order to do this, it is important that there is only one species within the confines of the facility and that basic biosecurity protocols are followed.

Clipsham (1996) discussed the areas to address when selecting a site for an avicultural facility:

- Does the local environment suit the species - it is better to manage birds in an environment that suits them, rather than having the expense of modifying an aviary complex to provide a suitable environment.
- Drainage. The site must be well drained so that there is no potential for water to pool and act as an insect breeding ground, or to remain moist and harbour potential pathogens. Dry flooring is essential.
- Potential for crop production for the birds, or harvesting natural foods.
- Legal zoning status - local council - disposal of effluent
- Are crops grown nearby? Potential for pesticide spray.
- For what is the surrounding land used for? For will it be used? Will future zoning changes make it difficult to keep birds in the area?
- If located in a large town, can become a target for theft, curiosity; and
- Proximity to poultry operations. The poultry industry has always claimed that the presence of an avicultural facility is a serious threat to poultry. The reverse applies, even more so, since proximity to poultry operations has implications in the event of zoning restrictions and possible de-stocking associated with an outbreak of an exotic or serious disease Additionally, the possibility of impacts arising from nearby avicultural operations should be researched.

Some of these principles apply to wild bird rehabilitation facilities.

Setting up an Ideal Facility

The following description applies to the setting up of an ideal facility. Birds in an existing facility can be transferred to a facility such as this after going through effective quarantine.

To prevent unauthorised human traffic and access by ground animals, the entire facility needs to be contained securely by perimeter fencing. Each module within the facility would need to be protected by an effective alarm system.

All modules within the facility must provide protection from environmental extremes.

All personnel on the facility should have an intercom system to avoid having to enter modules unnecessarily. These have the potential to act as a fomite, and care must be taken to use them only outside modules.

The general principles of traffic flow within the facility apply - young birds to old, healthy to suspect, clean to contaminated or dirty and so on.

i. **Food**

The birds should be maintained on a high level of nutrition, since this is one of the most cost-effective means of ensuring productivity (Clipsham 1996). This can be a commercial formulated diet, or a prepared diet. With respect to the OBP, birds to be released must be offered a variety of natural foods as close as possible to what they would eat in nature (this is what happens now).

Checklist for food:

- Possible bacterial contamination of fruit prior to purchase - thorough soaking in chlorine and then wash in filtered halogen- and protozoa-free water to eliminate disinfectant residue.
- Grains may have been contaminated by bacteria and fungi prior to purchase. It is not uncommon for mice to be present in stores of grain. If possible, grain should be cultured for bacterial contamination and examined for the presence of *Aspergillus* spp. There should be no access by rodents or other mammals, insects or spiders, where food is stored.
- Seeds sprouted with chlorinated water should be rinsed thoroughly with filtered halogen-free and protozoa-free water before being fed to birds.
- Food preparation areas should have an impervious surface, cleaned and disinfected with 2% Virkon S for 10 minutes after use, leaving no disinfectant residue.
- All food receptacles should be cleaned immediately after use.
- Cold storage of frozen or fresh foods should be in a restricted area in the food storage area, and free of bird involvement.
- Any grain that becomes moistened should be immediately discarded.
- Use disposable powderless nitrile gloves.
- Handles and other fomites (doors, refrigerators, implements) should not be contaminated.
- Food bowls should be ceramic, stainless steel or glass, since metals may be toxic and chelate some antibiotics and other chemicals. Food bowls should be accessible from outside the aviary so as to minimise bird disturbance.

ii. ***Water***

The water supply may contain metals and protozoa, as well as chemicals used to sterilise the water, such as chlorine and monochloramine. Hose-delivered water should be purged for at least 2 minutes to expel any accumulated pathogen load (*Pseudomonas*, coliforms). The water supply should be purified with a water purifier/deioniser. There are many models of relatively cheap devices, some free-standing that need to be loaded with water, and some that can be connected to a tap. They deliver halogen-and protozoa-free water, and all modules (including the food preparation area) should be equipped with one of these devices. Automated water

systems spread pathogens and should be avoided. Water bowls should be accessible from outside the aviary, so as to minimise bird disturbance.

A proposal for the design of an Office Complex, a breeding facility without a hatchery or nursery, and a breeding facility with hatchery and nursery, showing bird movement between modules, is shown in the document Captive Breeding Facility.

5. Disease Monitoring of Captive Birds Prior to and During Quarantine

Monitoring of captive birds for specified pathogens is performed prior to entering quarantine, during the quarantine period, in the Breeder modules, and at pre-release.

Pre-quarantine examination (e.g., performed in veterinary hospital)

- Source of the birds. Wild caught? Aviary-bred?
- If aviary bred, look at:
    1. The source
    2. Presence of other birds, other species
    3. What disease control/monitoring systems are in place?
    4. What is the disease history of the bird/birds?
- Have all equipment necessary to collect specimens, in order to reduce stress.
- Complete physical examination - see Clinical Evaluation Protocol
- Pyrethrin spray for external parasites (particularly non-blood- sucking external parasites).
- Treat with moxidectin 200µg/kg (nematodes, external blood-sucking parasites)
- Treat with praziquantel for tapeworm 10-20 mg/kg *per os*, repeat in 14 days (may not show up on a faecal flotation).
- Sample collection (some birds may need isoflurane anaesthesia for these procedures, depending on the species, individual bird disposition and the expertise of the collector). Collect blood, feather with blood quill, cloacal swab, oral swab, faecal sample. See Table 1 (below) for tests.
- Identify all birds - closed rings when nestlings.
  Sex through plumage
  Endoscopy ONLY if there is a breeding problem
  No microchipping for neophemas
    1. Identification number
    2. Date and time
    3. Parents (if known)
    4. Age
    5. Body weight
    6. Comments
- Accurate records, especially of weight, must be maintained
- Quarantine starts on entry of last bird. If new birds arrive and are placed in the quarantine module with a previous batch, all birds within the module must re-

commence their quarantine period. If new birds arrive after quarantine for a batch has commenced, they must wait, or be placed in a different module.

Quarantine Recommendations (see Table 1 below)

- 63-day quarantine.
- Faecal smear and faecal flotation performed monthly during quarantine. (done in-house), looking for budding yeasts, hyphae, motile bacteria and spirochaetes, nematodes, cestodes, trematodes, coccidia and other protozoa, *M. ornithogaster*.
- Bacterial/fungal enteritis: in-house faecal culture and sensitivity can be performed very cheaply. This can be done fortnightly if considered important, based on known morbidity/mortality factors.
- External parasites - pyrethrin sprays only if parasites are observed.
- *Chlamydophila* PCR (antigen) and *Immunocomb* (antibody) plus in-quarantine treatment with doxycycline only if positive.
- Gram stain of oral, faecal or cloacal swab
- If large numbers of Gram-negative bacteria are found, look at husbandry issues before using antibiotics.
- During quarantine, if any bird is positive for BFDV or PsHV, they are culled and all negative birds in the consignment go back to day 0. Birds with APV should cease shedding virus in 4-16 weeks - isolate and test.

Table 1: Pre-quarantine and Quarantine Monitoring of Captive Birds

Pathogen	Sample	Day	Test Method	Laboratory
-	Blood	1	Complete blood count	a, c, d
Various	Blood	1	Blood smear - parasites	a, c, d
BFDV	Blood Feather Blood	1, 28, 56 1, 28, 56 1, 28, 56	PCR, HI HA PCR	c c e
APV	Blood	1, 28	PCR	c, d, e
PsHV-1	Blood	1, 28	PCR	c, d, e
PsHV-1	Cloacal swab	1, 28	PCR	c, d
NDV	Serum	1, 28	HI	b

C. psittaci	Serum	1*	Immunocomb (antibody)	a, b, c, d
C. psittaci	Blood	1*	CHLM probe	e
C. psittaci	Tracheal/ oropharyngeal swab	1*	PCR (antigen)	b
Bacteria, yeasts, internal parasites	Faecal (swab). Can be combined sample	1, 28, 56	Wet mount for AGY, protozoa Smear - Gram stain for bacteria Flotation (parasite eggs)	a, c, d
Bacteria, yeasts	Crop	1, 28	Smear - Gram stain for bacteria Smear - stain for protozoa	a, c, d
Various	External parasites	1	Expert identification (if deemed necessary)	f

Key to Table:

a. Private laboratories - see Appendix 5.
b. AAHL, State Government Agriculture Laboratories
c. Charles Sturt University, Murdoch University (Raidal)
d. University of Sydney (Phalen)
e. Genetic Science Services
f. Murdoch University (Mr. Russell Hobbs)

For contact addresses of these laboratories, see section 18.
* Treatment is at the discretion of the AV, only if there is evidence of infection. Sample again after treatment is completed.

Breeder Module

- Test for quarantine pathogens annually
- If one or more birds is positive for BFDV or PsHV, they are culled and all negative birds in the breeder module enter quarantine.
- If one or more birds is positive for *Chlamydophila*, all birds in the breeder module are treated with doxycycline as for Strategy to Respond to Test Results for Psittacosis.
- While the breeder birds are in quarantine, the breeder module is cleaned and disinfected as for Section 8.

Juvenile release testing

Birds moving from either the breeder module or nursery module to juvenile flights, and from the juvenile flights to the release site, should have a full physical exam only. A random or pooled faecal sample may be used to keep a base line on stress, since when moved, parrots

tend to have up to 30-40% Gram negative smears and return to normal within 2-3 weeks, the birds remaining healthy in the meantime.

If one or more birds is positive for BFDV, PsHV or APV, they are culled and all negative birds re-enter quarantine. They are not released until they pass quarantine. Unfortunately, it may be 12 months later before they can be released.

If one or more birds is positive for *C. psittaci*, all birds in the breeder module are treated as for Strategy to Respond to Test Results for Psittacosis.

6. Clinical evaluation of and clinical examination protocols for captive and wild birds (TAP Actions 5.1 and 5.2)

Actions 5.1 and 5.2 of the TAP stated that effective education and extension material for PBFD such as clinical evaluation protocols are needed by field workers and wildlife managers, to promote detection of the disease in priority species of psittacine birds and an assessment made of the true impact of the disease. Such information is to be distributed to wildlife managers, veterinarians, wildlife carers and aviculturists to assist in the detection of PBFD in priority species.

For checklists of the clinical examination of captive and wild birds, see the following documents:

Field Clinical Evaluation Protocol for Birds Suspected of being affected with PBFD
Full Checklist for Clinical Evaluation of Captive Birds
Checklist for Clinical Evaluation of Wild Birds
Checklist form for Clinical Examination of a Captive Bird
Checklist form for Clinical Examination of a wild Bird
Equipment Lists

Note that these checklists apply for the full clinical examination of a bird, and for all diseases.

7. Post Mortem Procedures and Protocols for Captive and Wild Birds

As for Section 5, Actions 5.1 and 5.2 of the TAP stated that effective education and extension material for post-mortem protocols are needed by field workers and wildlife managers, to promote detection of the disease in priority species of psittacine birds and an assessment made of the true impact of PBFD. Once again, the materials is to be distributed to wildlife managers, veterinarians, wildlife carers and aviculturists to assist in the detection of disease in priority species.

A necropsy (post mortem examination, autopsy) is the examination and dissection of a body after death to determine the cause of death, to investigate disease states present and identify changes produced by disease prior to death. The word “autopsy” is reserved for a post mortem examination of humans, “necropsy” for animals.

In the field, a necropsy will provide information on the general health of a species in an area, and is an important facet of studying a particular disease of one or more species of birds in an area, or a country.

A necropsy requires a systematic examination of the entire carcase and the collection of samples for aids to diagnosis. Fresh carcases (not frozen) are preferred to those that are decomposed or thawed. When frozen carcases are thawed, ice crystals penetrate the cell membranes which allows cytoplasmic fluids to escape, resulting in a carcase “swimming” in red-tinged fluid. The slower the thawing process, the less fluid escapes.

Any person performing, or assisting with, a necropsy should be aware of:

- All methods of pathogen transmission.
- Any zoonotic diseases associated with birds.
- Aseptic technique for specimen collection.
- How to protect themselves from contamination.
- How to dispose of contaminated equipment.
- How to dispose of carcases.
- How to forward specimens to a laboratory.

Persons conducting an avian necropsy must know how to conduct one, and know the “normal.” A field necropsy should be carried out by a person who has been trained in the technique. This includes veterinarians who may have conducted necropsies only on mammals. Smokers and persons with known immunosuppression should not perform necropsies.

Protective equipment should be worn during a necropsy. In a laboratory situation, and if chlamydophilosis or avian influenza is suspected, this consists of disposable hair cover (to prevent aerosols from entering the hair), disposable nitrile gloves, disposable P2 particulate filter face mask, safety glasses (that can be disinfected), disposable solid front gowns with cuffed sleeves that are either impermeable or covered with a PVC apron, and rubber boots. Personnel who cannot wear a P2 mask because of facial hair or other fit-limitations should wear loose fitting hooded or helmeted powered air purifying respirator (PAPR).

Gowns, gloves and masks should be discarded after the specimens have been processed. Remove the mask after the gown and gloves. Do not touch the mask front when removing the mask from the face - the mask tabs only should be touched.

Careful attention should be given to hand hygiene after removal of protective clothing and especially before touching the face, eyes or mucosal surfaces.

It is obvious that such precautions cannot be easily undertaken in the field, and operators should wear disposable nitrile gloves, safety glasses (that can be disinfected), overalls, a PVC

apron (if the bird is greater than 4 kg), and rubber boots. Depending on ambient air flows, a disposable P2 particulate filter face mask may be worn.

For checklists of the post-mortem examination of captive and wild birds, see the following documents:

A Full Necropsy Protocol - post-mortem procedure for both captive and wild birds.
Necropsy protocol for a bird with suspected PBFD
Avian Post Mortem Checklist 1
Avian Post Mortem Checklist 2
Equipment Lists

8. Disinfection of Waste and Equipment

Virkon S has been recommended as the disinfectant of choice in Section 2 (Action 2.5).

Soaps and detergents are necessary to reduce organic matter on, and effectively clean, equipment and buildings. They are also effective (once all visible organic matter is removed) against lipid enveloped viruses.

Once premises have been thoroughly cleaned of organic matter, they are treated with 2% Virkon S solution and left for 24 hours. Ensure that surfaces are covered by disinfectant solution for at least 10 minutes.

Equipment that has been thoroughly cleaned of visible organic matter can be immersed in 2% Virkon S for at least 10 minutes, taking care that parts of the equipment are not uncovered by the solution during that period.

Surfaces that have been thoroughly cleaned of visible organic matter may be covered with 2% Virkon S for at least 10 minutes' contact time, taking care that the solution the solution does not dry out in spots during that time. Clean all equipment and surfaces of any residual disinfectant to avoid the possibility of corrosion of metals or transfer of disinfectant to birds.

Any wooden equipment, such as perches and nest boxes, should be disposed of and replaced with new perches and nest boxes. Use solid timber and avoid using new particle board (possible toxic ingredients) for nest boxes.

Disposal of carcases and their products is covered in Section 11. Waste from captive or wild birds (faeces, urine, uneaten food and discarded litter such as sand, gravel etc) should be placed in a wet-strength plastic bag which is then placed in a clearly labeled heavy duty opaque plastic bag which displays the universal biohazard label, for disposal as medical waste by a municipal contractor. Any sharps container must be disposed of similarly. Waste must never be placed outside a module where wild mammals and birds can access it, or where wind might distribute it to a remote site.

In situations where there is considerable waste to dispose of, it is possible to compost it, but the material must not be accessible to mammals and birds, and must be contained so that it cannot spread to other sites. In addition, a composting site must take into account the water table and leachate from the compost.

9. Collection of Samples for Submission to a Laboratory

Tissue samples will need to be collected from:

- captive threatened species:
    1. as part of regular disease monitoring; or
    2. from a dead or sick bird
- wild species:
    1. from a dead or sick bird; or
    2. as part of a disease investigation program

In Australia, private laboratories supply equipment when you sign up to have them process samples from birds. These usually consist of a selection of blood collection tubes, sterile swabs, sterile swabs with transport medium, 60 mL plastic specimen containers, specimen carrier bags with flap for specimen form, specimen forms and consignment notes.

Contact the laboratory (State, private or other) or State Australian Wildlife Health Network (AWHN) coordinator prior to collecting samples to ensure that your samples are appropriate for your investigation.

Note that most private laboratories no longer offer a service for necropsy examination of birds, but do provide services for testing of avian necropsy specimens.

When submitting samples to a laboratory:

- Always label containers (NOT THE LID) with the species of bird, your ID number, location of collection, the date and a description of the sample contained.
- All labels must be written in indelible ink or pencil (do not use ball-point pens)
- Do not submit needles or syringes;
- Notify the laboratory of any hazard;
- Notify the laboratory of any processing you have done (eg. fixing a blood smear with isopropyl alcohol).
- Always use clean instruments (ie, not your necropsy instruments) to collect tissue samples for microbiology. Always collect tissue samples for microbiology before you touch tissues with your necropsy instrument or gloved hands.

Sample collection is covered in the document Collection of Samples. You should also see Equipment Lists.

10. Transportation Protocols for Birds and Samples

Live Birds

Live birds may be transported by land, water or air. In Australia, land and air transportation is usually preferred. IATA regulations have been adopted by many land as well as air transporters (IATA 2005). The IATA Live Animals Regulations (LAR) are available for sale at the IATA Website. A transportation protocol for live birds is in an accompanying PDF.

Samples

Although most packaging instructions apply to consignments of bodies and tissues by air, many couriers require similar compliance for land shipment of such specimens. The IATA Dangerous Goods Regulations (IATA 2006) are available for sale at the IATA website.

It is important that guidelines for the safe packaging and transportation of infectious substances are strictly followed. The sender, carrier, postal employees, airline and other transportation personnel, as well as the receiver, must all be protected from the possibility of acquiring infection from exposure to infectious microorganisms that might escape from broken, leaking or improperly packaged material.

The packaging of bodies and tissue samples for transportation must minimise the potential for damage during transportation, as well as ensure the integrity of the specimens for their rapid and meaningful processing. A transportation protocol for bodies and tissues is available in an accompanying PDF.

11. Handling and Disposal Procedures for Samples and Dead Birds.

The disposal of bird carcases and samples must at all times avoid contaminating of the environment.

Unopened birds are accepted by Waste Recycling Companies in each State with the following acceptance criteria:

- The bodies must be free of human pathogens;
- The bodies must be intact or death must have resulted from acute trauma – e.g. being hit by a vehicle;
- The bodies must be contained in leak-proof, opaque plastic bags free of any staining or residues on the outer surfaces;
- The bodies must not be compacted before or during transport;

- If a load is odorous on arrival at a Waste and Recycling Centre it will be turned away. Acceptance is subject to the usual conditions applying to Special Wastes; and
- Veterinary wastes arising from surgical procedures, clinical trials and research are regarded as Medical Waste and are not accepted.

In the veterinary sense, Medical Waste is defined as waste consisting of:

- a needle, syringe with needle, surgical instrument or other article that is discarded in the course of veterinary practice or research and has a sharp edge or point capable of inflicting a penetrating injury on a person who comes into contact with it; or
- a vessel, bag or tube containing a liquid body substance; or
- an animal carcass discarded in the course of veterinary practice or research; or
- a specimen or culture discarded in the course of veterinary practice or research and any material that has come into contact with such a specimen or culture; or
- any other article or matter that is discarded in the course of veterinary practice or research and that poses a significant risk to the health of a person who comes into contact with it.

Medical waste should be stored:

- in a manner that is not offensive and that minimises the threat to health, safety or the environment.
- in containers in a secure location.
- in an area that can be easily and immediately cleaned and disinfected in case of accidental spillage.

Any waste mixed with medical waste is medical waste.

Sharps such as needles, syringes with needles and surgical instruments are to be placed into a suitable container that:

- is puncture-resistant, leak-proof, shatter-proof and able to withstand heavy handling
- displays the universal biohazard label and has a label clearly indicating the nature of the contents
- has an opening which is accessible, safe to use, and designed so that it is obvious when the container is full
- is sealed when full or ready for disposal
- can be handled without danger of the contents spilling or falling out.

All medical waste other than sharps are to be placed in a clearly labeled heavy duty opaque plastic bag which displays the universal biohazard label. Bags intended for domestic use are unsuitable for this waste. The bags should be tied to prevent leakage or expulsion of solid or liquid wastes during storage, handling or transport and ensure they will not be subject to compaction by any compacting device.

Under no circumstances should an opened bird’s carcase, parts or secretions, whether from a captive or wild bird, be disposed of in any way other than as Medical Waste.

Body Disposal for Captive Populations of Threatened Species

A necropsy should always be performed on any birds that die. It is imperative that mortalities be forwarded to an avian veterinarian as soon as possible, so that the cause of death can be determined. The avian veterinarian should use the normal method of the veterinary practice for disposal of medical wastes arising from avian necropsies.

Personnel in recovery plans that do not have access to an avian veterinarian should perform a necropsy according to the Full Necropsy Protocol, and forward a complete range of tissue specimens to a laboratory in the State. The carcase, together with disposable gloves and mask and any materials such as plastic ware and swabs should be placed in a wet-strength plastic bag which is then placed in a clearly labeled heavy duty opaque plastic bag displaying the universal biohazard label, for disposal as medical waste by a municipal contractor. Any sharps container must be disposed of similarly.

In either case, the state government wildlife authority, DEH and the Australian Wildlife Health Network (AWHN) should be notified:

- of the death;
- that specimens have been collected and forwarded to a laboratory; and
- of all laboratory results.

Body Disposal for Wild populations

Provided appropriate equipment is available (see Equipment Lists) mortalities should be necropsied according to the protocol outlined in the Full Necropsy Protocol. Samples should be forwarded as above and State Government Parks Authority, DEH and the AWHN should be notified as above.

If equipment is not available, wet the plumage with a 1% detergent solution, place the carcase in two sealable plastic bags, and freeze to at least -20°C. Identify the carcase with a number, its sex, whether adult, subadult, young or neonate, the date of collection and the date of freezing, what findings were made with skin and plumage inspection, and what signs were observed prior to death (if the bird was not found dead). Forward the carcase to the state governmental laboratory for a necropsy, where it will be disposed of according to the Laboratory's procedures. Private laboratories no longer offer a necropsy service.

Place carcases necropsied in the field, together with disposable gloves and mask and any materials such as plastic ware and swabs, into a plastic bag which is then placed in a clearly labelled heavy duty opaque plastic bag displaying the universal biohazard label, for disposal as medical waste by a municipal contractor. Any sharps container must be disposed of similarly.

Take care to avoid contaminating the environment with material from the carcase. Immediately clean any contamination and disinfect with 2% Virkon S solution. Remember that dirt, gravel and similar material cannot be disinfected, and so if the contamination is minor, attempt to clean up the area where the contamination occurred and place it into the disposal bag with the carcase.

12. Strategies to Respond to Test Results and Notification

The interpretation of test results is a sophisticated process that requires years of training and consideration of many variable relationships (eg, immunology, epidemiology, microbiology, nutrition, species, age, spectrum of clinical signs, and so on).

Recommendations for strategies to respond to test results should be given by knowledgeable laboratory personnel or avian veterinarians.

In the event that an exotic disease is suspected (Newcastle disease, avian influenza, West Nile virus clinical infection, duck virus enteritis (duck plague) or duck virus hepatitis), or mycobacteriosis, notify the nearest Regional Veterinary Officer (RVO) by telephone from the outbreak property.

If you cannot contact the RVO, then telephone the Emergency Animal Disease Watch Hotline on 1800 675 888 (24 hours).

For any death involving sampling, the state government wildlife authority, DEH and the Australian Wildlife Health Network (AWHN) should be notified:

- of the death;
- that specimens have been collected and forwarded to a laboratory; and
- of all laboratory results.

For normal reporting (as in an annual report) , the same as above, as well as all active participants (eg, Taroona, Adelaide Zoo and Healesville Sanctuary) and stakeholders.

On receiving test results confirming the presence of a particular disease, the following strategies may be taken:

- Internal and external parasites
- Pacheco's disease virus
- *Chlamydophila psittaci*
- Avian Gastric Yeast (*Macrorhabdus ornithogaster*)
- Avian polyomavirus (APV)
- Newcastle disease and avian influenza viruses

13. Cross-jurisdictional Impediments and Legislation

Everyone has the responsibility to obtain approval to transport birds and samples across State borders. There are State import and export requirements for movement of birds (captive or wild) across State borders. This is not an EBPC requirement.

The NSW State Government can now licence institutions, not individuals for interstate movement of birds or samples. There is now no need for Institution to Institution (eg Taroona to a Museum or University) licencing for movement of birds.

In some cases, a Recovery Plan may have to register certain operations or the management of the birds with a State-legislated Animal Ethics Committee. The following web sites are representative of either legislation or position statements on captive birds:

- **The National Consultative Committee on Animal Welfare (NCCAW)**
  This is a non-statutory body established by the then Minister for Primary Industries and Energy in 1989.
- **Code of Practice for the Welfare of Captive Birds in the A.C.T.**
  This Code of Practice for the Australian Capital Territory has been prepared from a consideration of the welfare of birds held in captivity. Its purpose is to provide general guidelines on the minimum standards of accommodation, management and care that are appropriate to the various species of captive birds.
- **National Guidelines for the Housing of Caged Birds**
  This code has been prepared by NCCAW from a consideration of the welfare of cage birds held in captivity. Its purpose is to provide general guidelines on the minimum standards of accommodation, management and care that are appropriate to the various species of cage birds. These guidelines will be considered for adoption at their April 2006 meeting.
- **Animal Welfare Documents**
  Under the Australian Constitution, state and territory governments have primary responsibility for animal welfare within Australia. Each state and territory government has laws to prevent cruelty and to promote the welfare of animals by legislating standards for their care and treatment. Most states and territories have incorporated the Australian model codes of practice for the welfare of animals under their jurisdiction's 'Prevention of Cruelty to Animals' legislation. The Australian (Federal) Government has responsibility for trade and international agreements.
- **Pest Bird Control**
  Prepared by the National Consultative Committee on Animal Welfare, this is a position statement that recognises there are some species or groups of birds that may cause agricultural damage and/or other problems.
- **Royal Society for the Prevention of Cruelty to Animals**
- **RSPCA Policy on Companion Animals**. This document describes the Housing of Pet Birds.
- **Victorian Code of Practice for the Housing of Caged Birds**
- **Smithsonian National Museum of Natural History**
  Guidelines use of wild birds in research.
- **IATA Live animal regulations**
- **IATA Live animals transport by air**
- **Air Transport of Animals (AFFA)**
- **Animal Ethics Infolink - Wildlife Research**
- **Licenses to Transport Animals into and out of NSW**
- **World Organisation for Animal Health**
- **CITES** (the Convention on International Trade in Endangered Species of Wild Fauna and Flora)

14. Acknowledgments

Garry Cross drafted the Protocols with input from:

- Officers of the Department of the Environment and Heritage, in particular Chris Young, Belinda Parkes, Emma Lowe and Michael Koppmann,
- Susie Anderson (Secretary, Avicultural Society of Australia),
- Doug Black (Veterinarian, Moama, VIC),
- Nicolai Bonne (PhD Student, Murdoch University (Prof Shane Raidal)),
- Chris Bunn (Manager Office of CVO, AFFA),
- David Buckley (Manager, Avian Section, AFFA, Canberra),
- Karen Dobson, President, Association of Avian Veterinarians, Australian Committee,
- Bob Doneley (Veterinarian, Toowoomba, QLD),
- Adrian Gallagher (Veterinarian, Brighton, QLD),
- Stacey Gelis (Veterinarian, Coolum Beach, QLD),
- Kathy Gibson (Senior Veterinary Officer Biosecurity Australia, DAFF, Canberra),
- James Harris (Veterinarian, Sandy Bay, TAS),
- Mark Holdsworth (Project Manager, Threatened Fauna and Coordinator Orange-bellied Parrot Recovery Program DPIWE Tasmania),
- Peter Holz (Healesville Sanctuary),
- Sandy Hume (Veterinarian, Canberra),
- Ross Perry (Veterinarian, Sydney NSW),
- David Phalen, (University of Sydney),
- Philip Pogson (Facilitator, The Leading Partnership),
- Michael Pyne (Veterinarian, Currumbin Sanctuary),
- Shane Raidal, (Charles Sturt University),
- David Schultz (Veterinarian, Adelaide Zoo),
- Patrick Shearer (PhD Student, Murdoch University (Prof Shane Raidal)),
- Derek Spielman (Veterinarian, Sydney NSW) ,
- Michael Weston (Manager, Research and Conservation Department Birds Australia (Royal Australasian Ornithologists Union), and
- Graham Wilson (Manager, NPWS Biodiversity Management Unit, NSW National Parks & Wildlife Service).

15. References

- Bassami, MR, Berryman D, Wilcox GE and Raidal SR 1998. Psittacine beak and feather disease virus nucleotide sequence analysis and its relationship to porcine circovirus, plant circoviruses, and chicken anaemia virus. *Virology* **249**: 453–459.

- Clipsham R. 1996. Aviculture Medical Management, in *Diseases of Cage and Aviary Birds*, Third Ed. Eds. WJ Rosskopf and RW Woerpel. Williams and Wilkins Maryland USA. Pp 880-903.

- Pringle CR. 1999. Virus taxonomy - 1999. The Universal System of Virus Taxonomy, updated to include the new proposals ratified by the International Committee on Taxonomy of Viruses during 1998. *Archs Virol*. **144**: 421-429.

- Raidal SR, 2005. Personal communication
- Raidal SR, Firth GA and Cross GM. 1993. Vaccination and challenge studies with psittacine beak and feather disease virus. *Aust Vet J*. **70**: 437-441
- Raidal SR. 1994. Studies on Psittacine Beak and Feather Disease. PhD Thesis, The University of Sydney, Sydney.
- Speer BL. 1991.Avicultural Medical Management. An Introduction to Basic Principles of Flock Medicine and the Closed Aviary Concept. *Vet Clins Nth Am: Sm Anim Prac*. **21**: 1393-1404
- Speer BL. 1995. The Closed Aviary Concept, in *The Large Macaws: Their Care, Breeding and Conservation*. Eds Abramson J, Speer BL and Thomsen JB. Raintree Publications Fort Bragg California. Pp 267-271.

16. Glossary

17. Australian Laboratories

18. Contact Addresses

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Avian Gastric Yeast

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the disease Avian Gastric Yeast, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Avian Gastric Yeast

Avian Gastric Yeast (AGY - megabacteriosis, macrorhabdosis) is caused by a yeast, *Macrorhabdus ornithogaster*. *M. ornithogaster* is a Gram-positive yeast, and was believed to be a bacterium for many years (Tomaszewski *et al.*, 2001).

AGY has been associated with a chronic wasting condition ("going light") in the budgerigar, but can affect many psittacine and non-psittacine birds, including ostriches (Huchzermeyer *et al*., 1993). The organism inhabits the lumen of the mucosal glands of the proventriculus and can be seen in faeces and or crop washes of most but not all infected birds. Presumably the clinical signs are related to impaired gastric secretion and dysfunction (Filippich and Parker, 1994).

Clinical signs

AGY is commonly detected in some species, but disease is rarely seen. The signs are mostly unremarkable and non-specific. Birds appear "fluffed up", and vomiting may occur - slimy seeds are regurgitated. Some birds may vomit blood.

Changes in the droppings may be apparent, from a slight looseness to severe diarrhoea.
Birds may eat frantically, but in reality are just grinding their seeds instead of ingesting it - a fine powdery material accumulates in the seed dishes.

Birds gradually lose weight and usually die in poor body condition, although sometimes death can occur more quickly.

Birds with AGY are very susceptible to other diseases such as trichomoniasis, feather mite infestation, cnemidocoptic mange and chlamydophilosis.

In the acute form, birds usually die within a few days. In the chronic form, they become progressively more emaciated and debilitated over weeks or months and then either die, or appear to recover but then relapse weeks or months later (Gerlach, 1994).

Necropsy

Birds are often thin, with wasting of the breast muscles.
Feathers around the head may be covered in dried regurgitated material, and the feathers around the vent often stained with faecal material.
The mucosa of the proventriculus is rough, raised, and discoloured. An early change is the accumulation of sticky mucus in the proventriculus, and in some birds ulceration and bleeding at the proventricular-ventricular junction is seen. The crop may become distended with a frothy mixture of water, mucus, fine particles of ground seed and undigested discoloured seed partially regurgitated from the stomach.

Diagnosis History, signs, lesions.
The organism can be seen on wet mounts of faeces or proventricular scrapings
Gram stains of faeces or crop washes.
Histopathology of the proventricular-ventricular junction - palisades of the organism
Differentiate from candidiasis, trichomoniasis, salmonellosis.

Treatment Amphotericin B 5g/L ml of drinking water, administered for 30 days (or orally 100 mg/kg by gavage BID 30 days). Treatment for 30 days is recommended because there is evidence of resistance to this agent, and that eradication of the organism is not achieved unless a long treatment is given to infected birds.

References

1. Filippich LJ and Parker MG. 1994. Megabacteriosis and proventricular/ventricular disease in psittacines and passerines. Proc Ass Avian Vet, pp 287-293

2. Gerlach, H. 1994. Bacteria In *Avian Medicine: Principles and Application.* Editors B. W. Ritchie, G. J. Harrison, and L. R. Harrison, 949-983. Lake Worth, Florida: Wingers Publishing Inc.

3. Huchzermeyer FW, Henton MM, Keffen RH 1993 High mortality associated with megabacteria of proventriculus and gizzard in ostrich chicks. *Vet Rec,*133: 143-144

4. Tomaszewski, EK, Snowden KF, Phalen DN. 2001 The Whipple paradox: megabacteria exposed as fungi. *Procs Assoc Avian Vets*, 99-100

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Avian Influenza

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the disease Avian Influenza, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Avian Influenza

Definition: An infectious disease of birds, pigs, Horses, seals, whales, cats, mink, primates and humans, caused by strains of influenza A virus. The disease in chickens and turkeys can be peracute, highly contagious and fatal.

Synonyms: Influenza, AI, highly pathogenic avian influenza, HPAI, fowl plague, FP, avian flu. Fowl plague is an historic term and denotes an acute, highly virulent disease of the domestic fowl caused by influenza A virus subtype H7, associated with any N subtype.

Aetiology: Influenza viruses types A, B and C belong to the Family *Orthomyxoviridae*. Type specificity is determined by the nature of the nucleoprotein and matrix antigens, which are **antigenically similar** among all influenza A viruses. Types B and C affect only humans.

The influenza virion consists of a sphere about 100nm in diameter, covered with "spikes": densely arranged radial projections. These spikes are of two different kinds. One kind combines with erythrocytes and causes them to agglutinate (haemagglutinin - H) and the other dissolves the linkage between the H spike and the erythrocyte. The second spike is an enzyme, neuraminidase (N).

The hemagglutinin causes influenza viruses to attach themselves to cells. After infection antibodies to the H spike are formed by the host, preventing reinfection by the same strain of influenza virus. Considerable antigenic variation is observed in the hemagglutinin molecule.

The N spike is completely different in appearance and function from the H spike. Neuraminidase may be responsible for getting the assembled virion out of infected cells. Antibodies are formed against N after infection but they are of less importance in providing protection from infection. The N molecule also shows antigenic variation, although it is less variable than that which occurs in the H molecule.

Influenza A viruses display two kinds of antigenic variation in their main H and N antigens. The first kind of change, called **antigenic drift**, consists of a series of minor alterations within a group of similar H or N molecules. The second variation is called **antigenic shift** and is an abrupt and major change in the composition of either the H or N antigens (or both), which, by convention among virologists, are designated H_0, H_1, H_2, H_3, N_1, N_2 and so forth. Antigenic drift, therefore, occurs within a subtype, while antigenic shift denotes a change from one subtype to another.

Influenza viruses differ from most other animal viruses in that the RNA, or ribonucleic acid, that contains their genetic information is replicated and included in the virion as **eight separate single-strand segments**. This segmentation of the RNA means that genetic recombination, or reassortment, can occur readily during mixed infection with different influenza A strains. The recombination of RNA segments is probably of key importance in accounting for major antigenic variations of influenza viruses. Each RNA

segment has been shown to include the genetic information required to code for a single virus protein; eight proteins are synthesised by the virus in the infected cells.

Epidemiology: All the subtypes of influenza A virus have been isolated from waterfowl, and the virus appears to produce unapparent intestinal infections in these birds. Even though the birds show no signs, they excrete the virus into the environment from their respiratory tract, conjunctival secretions and faeces. Other birds are infected horizontally either by direct or indirect contact. The incubation period can be as short as a few hours. All ages are susceptible. The virus is not transmitted vertically, since the embryos die before hatching. The 8-segmented viral genome allows the segments to reassort when a cell is infected with two different influenza viruses, yielding a potential 256 genetically different virions. Such mixed infections are not uncommon in nature - two or more antigenically different viruses have been isolated recovered from free-flying ducks and gulls. Genetic reassortment between human and avian viruses has been suggested as the mechanism by which new human pandemic strains arise.

The virus attacks all cells of the body, including those of the heart, and so cardiac output decreases, resulting in interstitial oedema throughout the body, most evident subcutaneously. Some viruses will cause severe disease in one species of bird, and no signs in another. In addition viruses that appear antigenically similar will also differ in the pathogenicities for one species.

Signs: Signs depend on the species of bird affected, age, sex, environmental factors and the virulence of the virus, and include respiratory, GIT and nervous. Often there is sudden death, with no other obvious signs or lesions. In less acute infections, the birds become depressed, do not eat, and there is decrease egg production. Mild to severe coughing and sneezing with naso-lacrimal lacrimation and oedema and cyanosis of the head, combs and wattles are also seen. Diarrhoea will also be seen, and nervous signs usually occur only in adults. With highly pathogenic viruses, morbidity and mortality may be 100%.

Lesions: Lesions vary within and depend on the species infected and the pathogenicity of the virus. In a flock, all lesions will be seen, but not all lesions occur in the one bird. In the case of highly pathogenic viruses, there may be no lesions because the birds have died so rapidly. There may be severe subcutaneous oedema, especially noticeable over the wattles, comb and legs. These areas will also appear cyanotic (reduced cardiac output plus vascular stasis). Widespread visceral petechiation will also be seen. In layer females, the ovary is flaccid, and several yolks will have ruptured, producing a pseudo "egg peritonitis". A severe inflammation of the GIT will be present, sometimes so severe that the mucosa is necrotic.

Diagnosis: Definitive diagnosis depends on isolation and characterisation of the virus. Differentiate from ND, mycoplasmosis, fowl cholera and chlamydophilosis. Avian influenza is a NOTIFIABLE DISEASE, rapid diagnosis is important.

Treatment: None permitted in Australia. An outbreak would be handled by slaughter of clinical flocks, disinfection of depopulated premises, quarantine, geoserology, slaughter of seropositive populations and disinfection of depopulated seropositive farms, buildings and equipment.

Control: Use of vaccines not permitted. Prevent access of wild birds to poultry sheds, feed stores and water supply.
Be aware of how infectious agents spread and use accepted principles of biosecurity and good management.

Biosecurity Measures:

Poultry producers should take the following steps to keep diseases like AI from infecting their flocks:

- Permit only essential workers and vehicles to enter the farm.
- Provide clean clothing and disinfection facilities for employees.
- Clean and disinfect vehicles (including tyres) entering and leaving the farm.
- Avoid visiting other poultry farms.
- Do not loan or borrow equipment or vehicles from other farms.
- Keep an "all-in/all-out" philosophy of farm management.
- Control the movement of all poultry and poultry products from farm to farm.
- Never "skim" mature birds from a flock for sale to a live poultry market.
- Thoroughly clean and disinfect poultry houses between each lot of birds.
- Prevent contact with wild or migratory birds.
- Do not use water that may have been contaminated by wild birds.

Markets:

- Use plastic instead of wooden crates for proper cleaning and disinfection.
- Keep scales and floors clean of manure, feathers, and other debris.
- Disinfect all equipment, crates, and vehicles **before** returning them to the farm.
- Keep incoming poultry separate from unsold birds.
- Clean and disinfect the marketplace after every day of sale.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Avian Polyomavirus Infection

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the disease Avian Polyomavirus Infection, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Avian Polyomavirus Infection

Avian polyomavirus or avipolyomavirus (APV) is a member of the Family *Papovaviridae*, which is subdivided subdivided into two genera, the papillomaviruses and the polyomaviruses. APV is classified under the polyomaviruses, and is unique among polyomaviruses because it can cause death. The infection has been called budgerigar fledgling disease, papovavirus infection, and APV infection. Most species of psittacine birds appear to be susceptible to infection, as well as *Estrilidae* and *Ploceidae*, appear to be susceptible to infection (Forshaw *et al*., 1998; Pass, 1985; Johnston and Riddell, 1996). APVs cause pansystemic disease in finches and psittacine birds but have been reported as causes of skin disease only in psittacine birds.

APVs were first reported as a cause of skin disease and mortality in juvenile budgerigars (Bernier *et al*., 1981; Bozeman *et al*., 1981). APVs from different host species appear to be morphologically, antigenically and genetically similar. However, Phalen *et al*. (2001) reported genetic diversity of avian polyomaviruses.

Like BFDV, APV are probably capable of causing disease in all psittacine species. However nestling and juvenile birds are most susceptible. The majority of birds that die of APV infection are hand-raised nestlings (Phalen *et al.*, 2001). Most birds which recover from the acute phase of APV disease make a complete *clinical* recovery. Chronic progressive skin disease is not a feature of APV infection. However, persistent virus infection and excretion are common sequelae. Concurrent APV and circovirus infection can occur.

Epidemiology

The virus may infect birds by the following methods:

- Exposure to infected birds
- Introduction of infected nestlings from another aviary
- Introduction of infected nestlings into a pet shop
- Presence of PCD infected birds
- Exposure to APV-shedding cockatiels, budgerigars, lovebirds
- Nestling-nestling; parent-nestling; handfeeding-nestling
- Do not mix valuable birds with budgies, cockatiels or love birds as the disease is common in these species.
- Many PCD virus-infected birds shed APV in skin and feather dander. Many of these birds (lovebirds, budgerigars, cockatiels) go for long periods without showing signs of PCD, but shed both viruses.

Horizontal transmission is the major method of infection in an epidemic but vertical transmission probably also occurs. Virus is excreted in feather dander and droppings. Infection persists in the kidneys of carrier birds and virus is excreted intermittently in the droppings, probably during times of stress. Polyomaviruses are thermostable, can withstand freeze-thawing and they remain infective in contaminated environments.

APV carriers may be seropositive or seronegative and their serological status can change over time. Up

to 100% of birds in a flock may be persistently APV-infected, but not all will be excreting virus at the time of sampling.

Parent-raised birds (not budgerigars or African lovebirds) do not seem to become diseased, but excrete the virus for up to 12 weeks. Hand-raised birds can have a high mortality.

In an Australian serosurvey of wild cockatoos, 64% of wild SCC had antibodies to APV. Thus it is possible that SCC and other Australian species are original host for APV, and that they have been shipped around the world (Raidal *et al*., 1998).

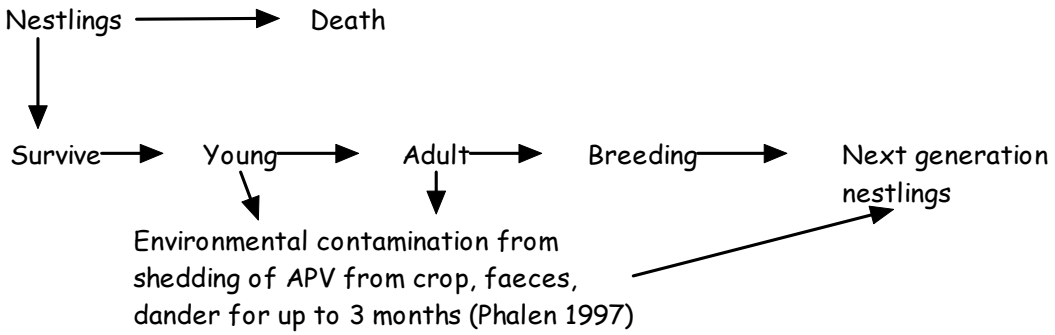


Figure 1: Cycle of APV from generation to generation

Clinical signs

APV infection is primarily a disease of nestling birds. Affected nestlings may be ataxic or have head tremors - in some outbreaks the virus targets the cerebellum. There may be abdominal distension due to hepatomegaly and ascites; subcutaneous petechiae or ecchymosis or a generalised pallor. The mortality rate in this age group can be 100%. Death usually occurs within 48 hours of the development of clinical signs. Gross necropsy lesions may be absent. The crop is often distended with food. A severe drop in hatchability has also been reported.

Older budgerigar nestlings may fail to develop normal contour feathers and affected contour feathers may lack normal barbs. The rectrices and secondary remiges may fail to develop. There may be a lack of down feathers on the back and abdomen and a lack of contour feathers on the head and neck. At necropsy there may be cardiomegaly, hydropercardium and hepatomegaly or focal hepatic necrosis. Microscopically, inclusion bodies are found in the kidney tubules, heart, liver, spleen, thymus, bursa of Fabricius, skin and brain.

In non-budgerigar nestling psittacine birds, APV causes widespread haemorrhage, with or without enlarged liver and spleen. Phalen (2001) reported that affected nestling cockatoos may present with respiratory signs. Histologically there is necrosis of the liver and spleen and inclusion bodies are found only in the spleen, kidney and liver. Most cases have been reported in nestling macaws (*Ara* sp), eclectus parrots (*Eclectus* species), conures (*Aratinga* species), and Indian ring-necked parakeets (*Psittacula krameri krameri)*. The disease is typically uncommon to rare in the nestlings of African grey parrots (*Psittacus erithacus*), cockatoos (*Cacatua* species), and Amazon parrots (*Amazona* sp) (Phalen *et al*., 2001). Africa lovebirds and budgerigars are the species in which the disease predominantly occurs.

Most adult psittacine bird infections are asymptomatic and go unrecognised.

APV in Finches and Canaries

- Nestling deaths at 2-3 weeks old.
- Depressed, off food, delayed crop emptying, regurgitation, swollen abdomen.
- Birds that survive often have poor development and beak abnormalities.
- Recovered birds may become carriers.

Diagnosis

A presumptive diagnosis of APV infection can be made from the history, clinical and pathological features. However, histopathological, bacteriological and serological investigations should be used to rule out differential diagnoses. Tests which are sensitive and APV-specific are required for making a definitive diagnosis.

Histopathology

APV infections cause marked basophilic karyomegaly in many tissues, in particular the feather follicles, kidney and liver. Basophilic intranuclear inclusions can be found in persistently infected kidneys but they cannot be differentiated morphologically from other viral infections. A definitive diagnosis requires the use of electron microscopy.

Virus isolation

Psittacine polyomavirus can be cultured *in vitro* in budgerigar embryo fibroblast (BEF), chicken embryo fibroblast (CEF) or chicken embryo kidney (CEK) cell cultures. However, virus isolation is generally not available for routine diagnosis.

Serology

Antibodies to APV have been detected by immunodiffusion, virus neutralisation assay (VN) and indirect immunofluoresence. Serology is probably more sensitive than cloacal DNA-probe for detecting polyomavirus infection on a flock basis.

Prevention and Control

Latency: Must be taken into account when trying to control the disease.

Quarantine

Aviculturists with a disease-free situation, should be encouraged to maintain a closed flock with strict hygiene and quarantine procedures. This includes eliminating exposure to free-flying wild birds and regulating all food, utensils and humans with access to the birds. APV probably remain infectious under the fingernails of well-meaning visitors for long periods. New stock should be obtained from certified seronegative and APV-free aviary flocks. They must be held in quarantine and confirmed as APV-free preferably both by serology and DNA-probe before being incorporated into the breeding flock.

In a non-budgerigar non-African lovebird psittacine outbreak, the infection will spread rapidly in a nursery. If affected nestling birds survive, they may shed APV for u8p to 16 weeks. If a newly acquired cockatoo is positive, re-test in 12 weeks and 16 weeks. If negative at both these testings, the bird is safe to exit quarantine.

Control

A vaccine is not available in Australia. In an endemic situation an effort should be made to eradicate horizontal transmission between birds and between batches of young birds. Accurate record-keeping and regular disease monitoring are most important. It may be desirable to identify APV carriers and isolate these birds in a separate facility. Incubators and brooders must be capable of being thoroughly cleaned and disinfected between clutches, using 2% Virkon S.

In USA the vaccine is used to immunise birds at 5 weeks and again 2-3 weeks later. Birds will be protected 4 weeks later. Thus protection is from 9-14 weeks of age, and vaccination cannot protect chicks that are less than 9 weeks of age from death. If a bird is shedding virus, vaccination of no use.

References

1. Bernier G, Morin M, Marsolis G: A generalized inclusion body disease of the buidgerigar (Melopsittacus undulatus) caused by a papovavirus-like agent. Avian Dis 25: 1083-1092, 1981

2. Bozeman LH, Davis RB, Gaudry D et al: Characterization of a papovavirus isolated from fledgling budgerigars. Avian Dis 25: 972-980, 1981

3. Forshaw D, Wylie SL and Pass DA. Infection with a virus resembling papovavirus in Gouldian finches. Aust Vet J 65: 26-28 1988

4. Johnston KM and Riddell C. Intranuclear inclusion bodies in finches. Can Vet J 27: 432-434. 1996

5. Phalen DN, Tomaszewski EL, Boatwright K and Lafferty S. 2001. Genetic Diversity of Avian Polyomaviruses: Clinical Implications. Procs Ass. Avian Vets. Orlando Florida. pp 171-172

6. Raidal SR, Cross GM, Tomaszewski E, Graham DL and Phalen DN, A serologic survey for avian polyomavirus and Pacheco's disease virus in Australian cockatoos. *Avian Pathology*. 1998. 27: 263-268. 22 ref.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Chlamydophilosis

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the disease Chlamydophilosis, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Chlamydophilosis

Chlamydophilosis is also known as parrot fever and psittacosis (psittacine birds), ornithosis (non-psittacine birds) and psittacosis (humans). It is caused by *Chlamydophila psittaci*, formerly known as *Chlamydia psittaci*. Thus the disease that we currently call chlamydiosis and caused by *Chlamydia psittaci* is now chlamydophilosis and caused by *Chlamydophila psittaci* (Everett *et al*., 1999).

Avian chlamydophilosis is a significant bacterial disease of wild, captive and intensively reared birds. The agent responsible, *Chlamydophila psittaci*, is an obligate intracellular parasite.

C. psittaci is a significant zoonosis and the term "psittacosis" has been used to describe the disease in humans to distinguish psittacosis from the venereal disease caused by *C. trachomatis*. Avian chlamydophilosis (AC) may range from a rapidly fatal peracute disease to a subclinical latent infection, depending on host factors and the strain of *C. psittaci* involved. The body systems primarily affected include the respiratory and gastrointestinal tracts (including the liver), the cardiovascular system, the spleen and the eyes. Significant mortality and morbidity may occur as a result of the disease, particularly in parrots and turkeys.

Structure and Life Cycle

Chlamydiae are spherical intracytoplasmic organisms 0.2 μm to 1.5 μm in diameter (depending on their stage of development). They have a cell wall similar to Gram-negative bacteria and they parasitise energy (ATP from the host's mitochondria. The two major morphological stages in the life cycle of chlamydiae are termed the elementary body (EB) and the reticulate body (RB). The EB is the smaller infectious form (0.2-0.3 μm diameter) characterised by a thick, rigid cell wall and very dense cytoplasm. It may be found outside the host cell. The RB is larger (0.6-1.5 μm), has a thinner cell wall, less dense cytoplasm, and is the vegetative stage which reproduces by binary fission. Different strains of *C psittaci* are recognised on the basis of antigenic and pathogenic differences. Avian strains of *C. psittaci* are distinct from mammalian strains (Moulder, 1985)

Epidemiology

All bird species including domestic poultry are susceptible. Turkeys are very susceptible, chickens are relatively resistant. Surveys of avian chlamydophilosis in feral pigeons have revealed carrier rates of 50 - 90%. High rates of infection are commonly reported in psittacine birds and in some zoos the rate may reach 100%.

Chlamydophilosis is often introduced into an aviary by infected birds which die several days later (often with uncertain signs) or which infect other birds in the aviary, which die two to three weeks later. The incubation can be very short, birds may begin shedding chlamydia within a few days of being infected or it can be very long.

In natural hosts, chlamydial strains are thought to be "host adapted", i.e. the host-parasite relationship has had time to evolve towards an equilibrium state. Thus, in its "normal" host, a chlamydial strain may be relatively avirulent and remain latent unless the bird is stressed, whereas in an abnormal host the same strain may be highly virulent and cause epizootic disease. Overt disease in the normal host may be induced by stress factors such as poor nutrition and hygiene, overcrowding, bacterial or protozoal disease,

shipping, racing, migration, breeding, inclement weather or moulting. Prevalence of chlamydophilosis in native birds can rise from a normal value of less than 5% to 100% when they are trapped and crowded together.

Chlamydophilosis is common in wild Eastern Rosellas and Crimson Rosellas in NSW and Victoria during winter. Periodic outbreaks occur in aviary birds where the disease is endemic and the birds are undergoing their first moult (particularly the *Neophema* species). Often there is a history of stress such as moulting, surgical sexing and overcrowded transport.

Young birds are more susceptible to chlamydial infection because they are immunologically immature and are often exposed to the organism excreted by the parent birds due to the stresses associated with breeding.

In wild and captive flocks with endemic chlamydophilosis the majority of birds carry latent infections. Mortality and morbidity is highest amongst the young, however, losses generally don't exceed 20%. In contrast, where infective organisms are introduced to disease-free flocks, mortality may approach 90%. The latter scenario occurs most commonly where wild infected birds are able to mingle with naive domestic poultry flocks or where new birds are introduced to existing stock without adequate prophylaxis.

C. psittaci is excreted in the faeces and nasal discharges of infected birds. The organism is resistant to drying and can remain infectious for several months. Some infected birds can appear healthy and shed the organism intermittently. Shedding can be activated by stress factors, including relocation, shipping, crowding, chilling, and breeding.

Pathogenesis

Transmission of *C. psittaci* occurs most commonly by inhalation (less often by ingestion) of infective EBs shed in faeces, lacrimal and nasal secretions and respiratory exudates. Infected birds may transmit chlamydia by regurgitative feeding of their young. Transmission may occur via consumption of infected carcasses by predatory birds. Arthropod vectors such as lice, mites and simulid flies can transmit chlamydia (Eddie *et al.*, 1962).

Dissemination is favoured during periods of stress (e.g. poor nutrition, overcrowding, concurrent disease, shipping, racing and migration) due to activation of latent infection followed by excretion of large numbers of infective organisms - with or without the development of disease.

Behavioural traits which favour or enhance transmission include:

- colonial nesting, e.g. amongst herons, egrets, cormorants, pigeons and sparrows.
- regurgitation feeding of young by parents
- certain natural feeding strategies which promote aggregations of birds in a potentially contaminated environment.

Chlamydophila psittaci has a predilection for cells of the respiratory tract, serous cavities and reticuloendothelial system, especially mononuclear phagocytes. Multiplication of chlamydiae results in cell lysis and this combined with the host's inflammatory response causes the clinical manifestations of avian chlamydophilosis - conjunctivitis, rhinitis, airsacculitis, pericarditis, hepatic and splenic necrosis and arteritis. Enteric infections are common in most avian species. Excretion of infective EBs occurs in faeces and diarrhoea is a common clinical sign.

Chlamydial infections elicit both humoral and cell mediated immune responses. Acute fatal disease and recurrent subacute attacks occur, but there is a tendency toward chronic latent infections. The acute inflammatory reaction evoked by chlamydial invasion probably contributes to the pathogenesis of disease

by producing secondary injury to tissues.

Latency is an equilibrium between the host's immune defences and the pathogen's intracellular persistence. The pathogen is quiescent - present but not multiplying, while the host remains infected and susceptible to future episodes of disease should its immune defences be impaired.

Differences in pathogenicity of certain strains for certain species of bird may be related to the degree and mode of exposure, the route of infection and the hosts innate resistance which in itself is subject to physiological and environmental influences. After aerosol inoculation the organism multiplies in the lung, air sacs and pericardial membrane. By 48 hours organisms can be detected in blood, liver, spleen and kidney cells and after 72 hours there is excretion of organisms in the faeces and nasal secretions.

Clinical Signs

The clinical signs of chlamydophilosis may be indistinguishable from several other febrile septicaemic diseases of birds and differential diagnoses should include salmonellosis, tuberculosis, erysipelas, mycoplasmosis, pasteurellosis, *E. coli*, and aspergillosis. The usual time between exposure to C. psittaci and onset of illness ranges from 3 days to several weeks. However, active disease can appear years after exposure. Affected psittacine birds often have distended sinuses, blepharitis, sneezing, serous oculonasal discharge, dyspnoea, tail-bobbing, green diarrhoea, depression. Sudden death may be the only history (Vanrompay, 1995; Johnston *et al.*, 1999)

In affected turkey flocks, birds may be thin and anorexic, pyrexic and have yellow-green diarrhoea. There may be a rapid drop in egg production (up to 40%).

Young ducks with acute chlamydophilosis are depressed, anorexic, ataxic, and have diarrhoea and a serous to purulent oculonasal discharge. There may be terminal convulsions. Ducks with chronic chlamydophilosis may just appear emaciated and in poor health.

Acute cases in chickens involve mainly cardiovascular and gastrointestinal signs, with low mortalities and only in young.

Acute disease in pigeons presents as anorexia, ill-thrift, diarrhoea, weakness, conjunctivitis, blepharitis, rhinitis, creaking and rattling respiratory sounds. Chronic disease - weak, thin, emaciated. May have transient diarrhoea with mild infections.

Lesions

Most birds which die of acute chlamydophilosis have marked splenomegaly and hepatomegaly but the presence of fibrinous or fibrino-purulent exudates on serosal surfaces, as well as congested organs such as liver and spleen is sufficient to initiate confirmatory diagnostic tests. These include cytological examination of smears; culture; and immunological tests. Histopathology is unreliable for confirming a diagnosis. Cytology is often more reliable. Elementary bodies may be visualised in liver and spleen smears with appropriate stains (Macchiavello, Giemsa, Giminez, Castenada) within macrophages in affected tissues. Fluorescent antibody stains are a rapid diagnostic test (the smear should be dried and then fixed in acetone).

Tentative diagnoses can be made on the basis of seeing EBs in stained tissues but because of their similarity to some other bacteria e.g. mycoplasmas, diagnosis should be confirmed by demonstration of chlamydial growth in experimental hosts after inoculation, demonstration of chlamydial antigen or significantly rising titres of antibody.

There is no single test or combination of tests which will determine that a bird is free of chlamydiae.

Methods for diagnosing chlamydophilosis

Diagnosis is by clinical signs supported by tests such as the Clearview® test (Oxoid) which detect chlamydial group specific antigen (designed for *C. trachoma*). The Clearview® test has limitations for antemortem use. These tests have a high sensitivity and lower specificity particularly if used on faecal or cloacal swabs due to cross-reactions with other antigens (Fudge, 1997). Other methods of diagnosis include histochemical staining, tissue culture and serology such as the Immunocomb® test (Flammer, 1997).

Combining a PCR test with a serologic titre offers the most thorough diagnostic plan (Tully, 2001).

Treatment

Doxycycline, is highly recommended for the treatment of acutely ill birds and has produced the most consistent therapeutic results in most birds. It is lipophilic which results in tissue concentrations higher than other tetracyclines. Its half life is 22 hours as opposed to 8 hours for tetracycline, and absorption from the gut is rapid, almost complete (95% vs 25% -80% for other tetracyclines) and subject to less interference from calcium. A major advantage of this drug is that it has less of an adverse effect on normal gut flora than other tetracyclines due to its rapid absorption and excretion as an inactive conjugate in the faeces. The incidence of secondary infections while on medication is reduced. Intravenous dose route of 10-100 mg/kg body weight for 1 to 2 doses, followed by oral administration (5-25 mg/kg, per os BID) for 45 days.

Psittavet (Vetafarm) - doxycycline hydrochloride 40 mg/g green powder). Dose: for parrots 10 g/l drinking water.; for pigeons 5 g/l drinking water for 45 days. Add citric acid 125 ppm for potentiation.

Doxyvet - The Australian Pigeon Company. Doxycycline hydrochloride 120mg/g. Dose 1.5 g/L in DW for birds.

Supportive and adjunctive therapy

- Elimination of concurrent parasitic, bacterial and fungal infections. Candidiasis can be treated with nystatin. Supplementary lactobacillus can be fed (psittacine isolate).
- Fluid and electrolyte therapy is advised for depressed and dehydrated birds. Warmed lactated Ringers administered subcutaneously at 5 - 10 mls/100 g BW is effective.
- Hypoglycaemic birds should be supported with intramuscular dextrose.
- Anorectic birds will require tube feeding.
- New birds should not be introduced to the aviary/flock without first being isolated and put on a 45 day course of prophylactic medication
- Sick birds should be isolated in a small enough cage to prevent excessive flying, kept warm and uncrowded (preferably 1 or 2 birds to a cage) in surroundings that are cleaned and disinfected daily.
- All surfaces with which infective organisms may come in contact should be cleaned and disinfected with 2% Virkon S solution.

Prevention and Control

Prevention and control of avian chlamydophilosis is reliant on isolation and treatment of affected birds, quarantine and prophylactic treatment of potentially infected birds and detection of carriers of the disease.

The source of infection of a flock should be identified where possible and further contact with infective organisms prevented. Contact between potentially infected wild birds and their droppings and poultry should be prevented.

Affected birds should be isolated and treated with doxycycline under sanitary conditions with minimum stress to the birds. The rest of the flock should be periodically monitored for several months after an outbreak to determine if infection has spread. It is wise to treat the rest of the flock prophylactically, as diagnosis of subclinical carriers is not very efficient.

Quarantine and treatment of new birds prior to introduction to a flock should last at least 45 days, depending on the treatment regime for the species involved. Provided there is no direct or indirect contact with wild birds, aviculturists should be able to maintain chlamydia free premises by instituting a single yearly 45 day course of CTC in the feed for all resident birds. Stress associated with handling, transport, housing and nutrition should be avoided and bird owners are advised to buy birds directly from breeders with known healthy stock. Anti-chlamydial prophylaxis pre- and post-shipment should be mandatory.

Doxycycline doses of 50 mg/kg may cause regurgitation in some psittacine birds (Carpenter, 2001).

Owners should be counselled that introduction of new birds can reinfect the original stock and they should be advised on appropriate preventative measures. Owners that present sick birds should be advised to seek referral to an infectious disease expert. Humans should not be treated prophylactically. Breeders and dealers should be acquainted with the clinical signs.

References

1. Carpenter JW, Mashima TY and Rupiper DJ (2001). *Exotic Animal Formulary*, 2nd Ed. WB Saunders Company. Pp 118-119.

2. Eddie B, Meyer KF, Lambrecht FL and Furman DP. 1962. Isolation of ornithosis bedsoniae from mites collected at turkey quarters and from chicken lice. *J Infect Dis*. 110: 231-237

3. Everett KDE, Bush RM, Anderson AA. 1999. Emended description of the order Chlamydiales, proposal of Parachlamydiaceae fam. nov. and Simkaniaceae fam. nov., each containing one monotypic genus, revised taxonomy of the family *Chlamydiaceae*, including a new genus and five new species, and standards for the identification of organisms. *Int J Syst Bacteriol*. 49:415–440.

4. Flammer K. Chlamydia. 1997. In: Altman RB, Clubb SL, Dorrestine GM, Quesenberry K, eds. *Avian Medicine and Surgery.* Philadelphia, PA: WB Saunders, pp 364–379.

5. Fudge AM. 1997. A review of methods to detect *Chlamydia psittaci* in avian patients. *J Avian Med Surg.* 11:153–165.

6. Moulder JW. 1985. Comparative biology of intra-cellular parasitism. *Microbiol Rev* 49: 298-337.

7. Tully TN Jr. 2001. Update on *Chlamydophila psittaci* on avian patients. *Semin Avian Exotic Pet Med*. 10: 20-24.

8. Vanrompay D, Ducatelle R, Haesebrouck F. 1995. *Chlamydia psittaci* infections - a review with emphasis on avian chlamydiosis. *Vet Microbiol*. 45: 93-119.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

External and Internal Parasitism

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the disease External and Internal Parasitism, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

External and Internal Parasitism

EXTERNAL PARASITISM

Mites

Feather mites (family *Analgesidae*) often show specific preferences for different locations on the feathers or for specific types of feather. Quill mites (*Syringophilus, Dermoglyphus*) burrow into the feather shaft resulting in a powdery-white appearance. After the feather has been eaten away the calamus remains within the follicle which may fail to regenerate normal feathers. The mites can be demonstrated amongst the powdery debris squeezed out of an affected feather shaft.

Many species of *Cnemidocoptes* mites cause **mange** in birds. The most common are *C. mutans* of poultry and *C. pilae* in budgerigars (and many other parrots) and canaries. The mites spend their entire life on the bird. The lesions can occur on any featherless part of the skin and are characterised by raised honeycombed encrustations on the cere, beak, eyelids and feet. Occasionally it becomes generalised and affects feather follicles. Cnemidocoptic mange is easily controlled with 2 treatments of moxidectin or ivermectin (200 µg/kg) 4 weeks apart. The drug can diluted and administered directly to the skin or in the drinking water.

Dermanyssus gallinae and *Ornithonyssus sylvarium* are large mites which attack poultry and other bird species. They are blood sucking mites which may be found on or off the host. *Dermanyssus* lay eggs off the host, *Ornithonyssus* on the host. Their life cycle is completed in 7 days. Heavy infection causes irritation and anaemia. Both mites may infect humans causing pruritis. Wild birds (particularly sparrows and starlings) nesting in houses are sometimes the source of mites which attack humans.

Mites are probably the most common ectoparasite that affect birds. They are usually smaller than 2 mm and transmit many diseases

Feather mite – *Dermanyssus gallinae* (red mite)

- White when fasting, red when eating
- Can affect all birds, not so much raptors and psittacine birds
- Does not live on bird - visits at night
- Feeds at night. Female lays eggs 12 hours after a feed, hatch in 48 hours
- Adults survive 8-12 months without feeding
- Not common on raptors and psittacine birds

Northern Mite – *Ornithonyssus sylvarum*

- Life cycle entirely on host
- Can survive only a few days off host
- Most bird species susceptible
- Direct transmission
- Ornithonyssus sp commonly found on nestling psittacine birds.
- Mites can survive up to 4 weeks off the host (Arends, 1997).

Quill Mites: *Syringophilus bipectinatus, Dermoglyphus elongatus*

- Live inside quills - body narrow and elongated
- Not host-specific
- Many birds suit
- Skin Mites: *Epidermoptes bilobatus, Michrolichus avus*
- Small mites, affect most birds
- Life cycle on host

Visceral mites: *Sternostoma tracheacolum* (rhinonyssid mites)

- Affects many birds
- Canaries commonly affected
- Gouldian finch – species not known

Subcutaneous mites: *Laminosioptes cysticola and Hypodectes sp.*

- Look like small white grains of rice
- Mites are usually dead and surrounded by connective tissue
- Eventually calcify
- Life cycle unknown

Skin mites - Epidermoptes bilobatus and *Michrolichus avus* (epidermoptic mites)

- Soft, rounded body
- ound on many birds
- Life cycle unknown, probably on host
- Lesions can become secondarily infected

Trombiculid mite larvae

- Can infect the skin of canaries, pigeons, and psittacine birds.
- Affected birds are usually non-pruritic
- Oedematous skin of the leg (dorsal to the hocks) and abdomen.
- Secondary infections often occur.

Cnemidocoptic mites - *Cnemidocoptes pilae* and *Cnemidocoptes mutans*

Domestic fowl: *C mutans*

- Transmission direct and indirect
- Scaley face in budgerigar
- Scaley leg in domestic chicken
- Raised white-yellow honeycomb-like encrustations on the cere, beak and around the eyes
- Elbows, legs and skin around the cloacal opening
- The lesion can look like flour on the skin, especially in SCC
- Eventual deformity in the budgerigar
- Malocclusion of the beak
- Treatment moxidectin 200 micrograms/kg once a week

Canary: Tassle foot, also featherless parts of skin.

Sulphur Crested Cockatoo - may look like flour. Disfigurement of beak

Domestic fowl: *C mutans*

- Scaley leg
- Burrows under scales of legs, inducing a rough, raised, powdery appearance

- Proliferation of the scales of the legs and digits
- Lameness or loss of skin may result

Control of mites

Applying a pyrethrum spray (Avian Insect Liquidator concentrate (Vetafarm products)) to the birds, their nest material, nest box and the walls of the aviary. The insecticide should be applied to the skin, not the feathers, as this is where the mites reside.
The insecticide should be applied weekly for three times (ie, over 2 weeks).
Mites can spread on people and other fomites.

Prevention of mite infection

Regular monitoring of the aviary and nestboxes for evidence of mites.
Treatment of adult birds prior to breeding
New nest boxes each year, treated with pyrethrum spray and allowed to dry before being used for breeding.
Moxidectin administered to each bird at 200 μg/kg will kill blood sucking mites.

Lice

Many species of lice can affect the skin of birds usually without feather damage. Lice are larger than mites and are usually apathogenic although they may cause a mild pruritis. Dull, damaged feathers, presence of eggs.

- Very common external parasites of birds - larger than mites.
- Dorso-ventrally flattened body.
- No wings, legs have hooks at the end
- Eggs laid on feathers
- Heaviest infections on sick birds
- They tend to be *HOST*-specific - transmission direct
- Pruritis, damaged feathers, dull plumage
- Lice can be seen with eyes – but do you observe them????
- Presence of eggs – some look like wasp nests around calamus
- Treatment - once a week, 2-3 times:
  - pyrethrin-based insecticides
  - Ivermectin/moxidectin for BITING lice
  - Lice cannot survive away from the host so treatment of the environment is not absolutely essential.

Ticks (*Argasidae, Ixodidae*)

- Oval flattened body when fasting, round after eating.
- *Argas persicus* – the fowl tick. Can affect many bird species by causing blood loss and is a vector for avian spirochaetes. In tropical areas they can be the most important ectoparasites of poultry.
- The life cycle may be completed within 8 weeks in warm weather. In temperate climates the ticks remain inactive off the bird in crevices during cold weather. Nymphs live up to 15 months without a feed and adults can survive many years off the host!
- Pale yellow to grey 15mm long – adults 8 legs, larvae 6 legs
- Shelter in dark in day, feed at night
- Larvae stay on fowl in day

- Transmits *Borrelia anserina*, the cause of tick fever
- The presence of these ticks is an aid to diagnosis

Ixodes ticks have been reported as a cause of paralysis but are more likely to cause anaemia due to blood loss.

Fleas (*Ceratophyllus gallinacea, Echidnophagia gallinacea* [the "stick-fast flea"])

- Small insects with laterally flattened body
- Adults have no wings – they can run and jump
- Fix mouth to skin and suck blood
- Poultry and nesting birds
- Vectors of infectious diseases
- Seen mainly in free range poultry in tropical areas.
- The mouthparts of the adults are buried in the skin which prevents them from moving around.
- Eggs drop off and the developing stages are found in the soil.

Hippoboscid **flies** live between the feathers in many species. They fly out briefly and then dart back into the plumage. They are non-pathogenic but may transmit *Haemoproteus* and viral pathogens.

Mosquitoes can irritate nestlings. It may be necessary to control mosquitoes in specific situations to prevent the transmission of poxviruses (and other viruses) and blood parasites. Mosquito netting, Shelltox ministrips and mossie zappers may be necessary.

Many **filaroids** inhabit the subcutaneous connective tissue of birds often without causing an inflammatory response. *Avioserpens taiwana* infects ducks in Asia, and induces granulomas in the skin of the submandibular area and thighs. Skin **flukes** (*Collyriclidae*) produce granulomas and fibrous cysts around the cloaca of many bird species.

HELMINTH PARASITES OF THE ALIMENTARY SYSTEM

Nematodes

Ascaridiasis

Ascarids are not uncommon in psittacine bird collections in Australia. The species has not been determined. Ascarids have a direct life cycle (no intermediate host required). In the domestic fowl, infective eggs hatch in the proventriculus and duodenum and spend the first nine days living free in the posterior part of the duodenum (Ruff and Norton, 1997). The worms then penetrate the mucosa of the duodenum, causing bleeding. By day 17-18 after ingestion of the eggs, they re-enter the lumen and grow to maturity and lay eggs, usually in about another 10-12 days (the time form ingestion to maturity being about 28-30 days). Ruff and Norton (1997) stated that under optimal conditions, the eggs in the droppings became infective in 10-12 days, but under adverse conditions this could be longer.

Control

For those birds that need to feed on the ground, the usual method of control for internal parasiticism, namely, housing in a suspended cage after eradication of the nematode, is not an option. If the birds are housed so that they can feed on the ground, then a concrete floor should be provided. Sand or other relatively fine and inert material should be spread over the concrete,

and this should be removed every 7 days, the concrete cleaned and disinfected and residual disinfectant removed, and new clean material spread over the concrete. The birds should be treated with moxidectin 200 micrograms/kg and again 3 weeks later (to remove any worms that might have hatched and grown to pre-maturity since the first treatment). Presuming that the life cycle for domestic fowl ascarids applies, then if this regime is followed, then the life cycle of the OBP ascarid would be broken. Treatment with moxidectin would also kill blood sucking external parasites..

Prevention

The management practices described above should interrupt the life cycle of the worm, and it is one pathogen that can be controlled merely by management. The birds may be treated with moxidectin 200 µg/kg if evidence of infection is seen (eg, faecal examination whenever they are handled), and investigations carried out to determine where the infection was re-introduced.

Treatment:

Fenbendazole	Panacur 25 Intervet Australia P/L. Fenbendazole 25 g/L 25-50 mg/kg PO SID x 3-7 days, or 100 mg/kg PO once
Mebendazole	25-50 mg/kg PO once
Levamisole	15 mg/kg PO once
Oxfenbendazole	Oxfen LV Virbac Australia P/L Oxfendazole 45.3 g/L. 20 mg/kg PO once. 2.5 mL/L DW.
Thiabendazole	100-200 mg/kg PO BID x 10 days
Albendazole	Valbazen broad spectrum lamb, sheep and goat drench (Coopers Animal Health) 19 mg/mL. 5 mL/L DW x 3 days (or 0.1mL/50g BW x 3 days.

Capillaria may be a problem in psittacine birds. Affected birds lose weight, sometimes with diarrhoea. Adult capillaria burrow into and beneath the intestinal epithelium causing haemorrhage and inflammation. They are small and easily overlooked at necropsy. The eggs can incite an inflammatory reaction and are released when the mucosa sloughs.

Detection of capillaria oocysts in the faeces is best done by repeated faecal wet-preps because excretion of oocysts is intermittent and they often fail to float on salt solutions. The oocysts have bipolar caps. Adult nematodes may sometimes be seen in faecal wet-preps.

Anthelmintics which are poorly absorbed have little effect on the adult nematodes because of their protected position beneath the mucosa.

Moxidectin - Cydectin oral drench for sheep 1g/L Fort Dodge Australia P/L. Dose 400 µg/kg BW. Some practitioners use 1000 µg/kg.
Oxfendazole - (Oxfen LV) 20 mg/kg PO once. 2.5 mL/L DW.

Cestodes

Tapeworms are an uncommon problem, but can occur in psittacine birds. The adult tapeworm consists of a length of segments which live within the intestinal tract. These segments are shed in the droppings and are ingested by insects or earthworms.

Most cases of tapeworm infestation go unnoticed. However, relatively large lengths of tapeworm can sometimes be seen in the droppings or hanging down from the vent of infected birds. A single treatment

is usually effective for individual pet birds. Eradication of tapeworms from infected flocks of finches and pigeons may be difficult because part of the life cycle is within insects or earthworms. Common species include *Raillietaenia, Choanataenia, Gastronemia, Idiogenes, Amoebataenia*.

Many anthelmintics do not kill tapeworms. Niclosamide Panacur 2.5 and Netobimin are effective drugs for treating tapeworms but are difficult to administer to a flock of finches. Praziquantel is available in water-soluble powder form from Vetafarm P/L in 100g and 1kg packages.

References

1. Arends, JJ. 1997. External Parasites and Poultry Pests, in *Diseases of Poultry*, 10th Ed. Eds Calnek BW, Barnes HJ, Beard CW and Saif YM. Iowa State University Press, Ames, Iowa. Pp 785-813.

2. Ruff MD and Norton RA. 1997. Internal Parasites, in *Diseases of Poultry*, 10th Ed. Eds Calnek BW, Barnes HJ, Beard CW and Saif YM. Iowa State University Press, Ames, Iowa. Pp 815-864.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Gram-negative Bacterial Diseases

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes Gram-negative Bacterial Diseases, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Gram-negative Bacterial Diseases

The presence of *Enterobacteriaceae* is abnormal in psittacine birds. The bacteria of significance are *Escherischia coli*, *Salmonella* spp, *Yersinia* spp and *Campylobacter* spp., and all of these have the ability to be opportunistic pathogens. They may multiply in birds that are stressed by transport or excessive handling, and can be transmitted to birds by their handlers. Diagnosis is by demonstration of Gram-negative organisms in a faecal smear.

E. Coli infection, Colibacillosis

Birds are continuously exposed to contaminated faeces, water and dust. "Normal" *E. coli* commensals may cause disease in an immunocompromised or stressed host, as may any Gram-negative organism. Secondary infections often follow viral or mycoplasmal infections or adverse environmental conditions. The isolation of *E. coli* from the intestine or faeces of a psittacine bird with signs of enteritis should be regarded as significant.

Clinical signs

- **Airsacculitis and pneumonia**: Severe respiratory disease can occur associated with dusty litter, excessive ammonia or other adverse environmental conditions. With these conditions, *E. coli* is a secondary pathogen in association with *Mycoplasma* spp.
- **Omphalitis** due to *E. coli* infection results in a moist navel and a retained infected yolk sac. A peritonitis is often present. The gall bladder is often distended indicating that the chick had not eaten. Common in ostrich chicks.
- **Salpingitis**: Adult layers can get a distended oviduct filled with caseous exudate which has a foul odour
- **Coligranulomas** (Hjaerre's disease) occur in the liver, spleen or other organs and rarely in the intestinal wall. They are often confused with mycobacteriosis. Common in ostrich chicks.
- **Arthritis** is a rare manifestation of colibacillosis.

Diagnosis

Clinical signs and culturing E. Coli from infected tissue.
Eliminate the possibility of other pathogens acting as primary infections.
The presence of Gram-negative organisms in a faecal smear requires treatment

Prognosis

There is usually a low incidence in a flock situation. However, for small hobby farms and ostrich rearing units the prognosis for individual affected birds is poor.

Salmonellosis

Salmonellosis is an acute febrile septicaemic disease of chickens and poults and a chronic enteritis of birds of all ages, caused by a serotype of the genus Salmonella. The genus is divided into two species (*S. enterica* and *S. bongori*), several subspecies, and more than 2,000 serotypes. While some serotypes are very highly host-adapted (*S. pullorum* and *S gallinarum*), others are pathogenic to a wide range of animals and birds (e.g., *S. typhimurium*). In psittacine birds, *S. typhimurium* is the most common isolate and the most dangerous for birds and their handlers.

Transmission of salmonellae is via contaminated equipment, feed, water, litter, carrier birds, rodents, pets, flies and humans. Vertical transmission occurs by eggshell contamination (not transovarial). Once established, organisms may be shed in faeces for the life of the bird.

Clinical signs in lories include acute disease and high mortality, while in African grey parrots the signs are more chronic, including a suppurative subcutaneous infection, granulomatous dermatitis, arthritis and tenovaginitis (Gerlach, 1994).

Acute lesions include dehydration, gastroenteritis and enlarged liver and spleen. Chronic lesions include fibrinous polyserositis and arthritis.

Diagnosis

Clinical signs and isolation and identification of the causative salmonella.

Yersiniosis (Pseudotuberculosis)

Yersinia pseudotuberculosis and *Y. enterocolitica*. Infection in psittacine birds is rare. The clinical signs and treatment are as for salmonellosis, but in addition the organism may gain access to the body via skin abrasions.

Campylobacteriosis

Campylobacteriosis is caused by *Campylobacter jejuni*. This organism can rarely affect psittacine birds, and may be isolated from clinically ill as well as from clinically normal birds. Clinical signs include weakness, diarrhoea, weight loss and mortality. Lesions include enlarged liver and spleen, enteritis and dehydration.

Treatment of Gram-negative Infections

- If granulomas are present, the drug may not be able to penetrate and kill contained bacteria.
- Oral antibiotics are effective in treating E. coli infections limited to the intestinal mucosa.
- Lactulose may be used to reduce intestinal pH
- *Lactobacilli* (preferably isolates from normal psittacine birds) may lower intestinal pH and establish a normal flora.
- For psittacine birds, treatment is required because of the possible public health hazard.
- Handlers should wash hands thoroughly (the organism may transfer both ways).
- Control of flies, vermin, cleaning and disinfection of the aviary.
- Proper storage of food
- Fluid therapy for dehydrated birds
- Appropriate antibiotics based on culture and sensitivity of the causative organism

Reference

- Gerlach, H. 1994a. Bacteria In *Avian Medicine: Principles and Application.* Editors B. W. Ritchie, G. J. Harrison, and L. R. Harrison, 949-983. Lake Worth, Florida: Wingers Publishing Inc.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Mycobacteriosis

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the disease Mycobacteriosis, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Mycobacteriosis

Mycobacteriosis is a chronic disease caused by *M. avium* (MA), *M. genevense* (MGE) and *M. tuberculosis*. *Mycobacterium avium-intracellulare-scrofulaceum* (MAIS) complex serotypes 1, 2 and 3 are pathogenic for birds. Very little is known about MGE. Mycobacteriosis sometimes occurs in older free range or backyard poultry flocks and aviary flocks of passerine birds (particularly Gouldian finches).

Some characteristics of these bacteria make the disease difficult to treat and explains why disease control authorities opt to kill affected flocks and dispose of contaminated dirt. These characteristics are:

- Mycobacteria grow slowly and lesions and clinical signs develop slowly.
- The bacteria live in the cells of infected birds and are consequently difficult to kill and thus infected birds must be treated for many months.
- The bacteria have a resistant cell wall that makes them resistant to many disinfectants and the environment.
- An infected premise is difficult, if not impossible, to clean and disinfect.

Epidemiology

A ubiquitous organism and all birds are susceptible to infection. Man, most species of livestock, and other mammals may also be infected. Transmission is by ingestion of contaminated carcasses, soil, feed or water. The organism is shed in the faeces and urine. The disease can occur in free-living wild birds which have a close association with domestic stock (eg. starlings, sparrows, pigeons) and in scavengers such as silver gulls. Mycobacteriosis is rarely a significant flock problem. Psittacine birds are the only avian order susceptible to *M. tuberculosis* - usually older amazons and *Brotogeris* sp. It is more commonly found in intensively housed bird populations.

Signs

Chronic severe weight loss and muscle atrophy are often the only clinical signs. Some birds may have diarrhoea, lameness, and an unthrifty appearance (poor feathering). Some birds die without signs. Mycobacteriosis is rare in parrots and may be localised to nodular or diffuse keratinous skin lesions at mucocutaneous junction of the eyes and beak (VanDer Heyden, 1996; Jaensch, 2000)

Lesions

Gross pathological findings are often confined to the intestinal tract and liver, but are frequently seen in bone marrow or pneumatised bones. The intestinal tract is often uniformly thickened, firm and pale. There are often pale nodules throughout the liver and sometimes the pancreas, spleen, lung, and bone marrow may be involved.

Diagnosis

Demonstration of typical acid-fast bacilli in Ziehl Neelson stained faecal smears and smears from lesions. Histopathology of lesions usually reveals a diffuse or nodular granulomatous enteritis and hepatitis. Large numbers of macrophages containing acid-fast bacilli are usually the predominant cell type. Culture of lesions should always be done to rule out other acid-fast bacilli.

Zoonotic Implications

MTB, MGE, and MA are potential human pathogens. Birds usually become infected with MTB from one of its owners and readily infects healthy humans. MA and MGE infections in psittacine birds appear to pose little risk to healthy humans, but are a significant risk to immunosuppressed humans.

Treatment

Notifiable disease. Treatment is extremely unreliable, so birds are usually euthanised. Mycobacteria are resistant to the typical physical and chemical methods of destruction - they can survive months to years in the environment.

Control

Do not use dirt flooring or other material that cannot be disinfected. Remove wooden, dirt, or gravel floors.

Reading

1. Antinoff N, Hoefer HL, Kiehn TE, Bottger EC. Mycobacteriosis caused by *Mycobacterium genavense* in a psittacine bird. *Proc Assoc Avian Vet*, 1996;169-170.

2. Drew ML. Dermatitis associated with *Mycobacterium* spp. in a blue-fronted Amazon parrot. *Proc Assoc Avian Vet*, 1991:252-253.

3. Montali RJ, Bush M, Thoen CO *et al*. Tuberculosis in captive exotic birds. JAVMA, 1976;169:920.

4. Phalen DN. Avian mycobacteriosis. Proc Assoc of Avian Vet, Aus Committee. 1998; 71-74.

5. Rosskopf WJ, Woerpel RW, Lane R. Avian tuberculosis in the grey cheeked parakeet and other related *Brotogeris* parakeets - incidence, clinical characteristics, clinical pathology, lesions, and possible treatment. Proc Assoc Avian Vet, 1986:219-233.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Newcastle Disease

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the disease Newcastle Disease, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Newcastle Disease

***Definition*:** Newcastle disease (ND) is an acute, mild to severe, highly infectious and pathogenic disease of birds caused by a paramyxovirus. Depending on the viral strain, exposure to ND virus (NDV) may lead to a subclinical infection or a range of syndromes including respiratory, intestinal and nervous signs, with mortalities up to 100%.

The natural hosts of NDV are domestic poultry, including chickens, turkeys, ducks, geese, pigeons, quail, pheasants, guinea fowl and ostriches, and many species of captive caged birds and wild birds (Alexander 2000). Susceptibility varies between species, with chickens the most likely to show clinical ND, and water birds the least likely to be affected clinically (Kaleta and Baldauf 1988).

ND takes its name from the town of Newcastle-upon-Tyne, where the first outbreak was reported in 1926.

***Synonyms*:** ND; exotic ND; Asiatic ND; VVND; pneumoencephalitis; *Maladie de Newcastle*; *Enfermedad de Newcastle*; *Pneumoencephalitis Avium*; *Pseudopestis Avium*; Ranikhet disease. It is often incorrectly called Newcastle's disease. The modern poultry industry is highly susceptible to NDV, since over the last 40 years, the industry has developed into a highly integrated production system, the interconnections and interrelationships of which provide a means for the rapid spread of this devastating disease should it enter the system. Since all avian species are probably susceptible to NDV, and the different species differ in their susceptibilities to a particular NDV strain, any species can be a source of virus for any other species.

***Epidemiology*:** Can cause a conjunctivitis in humans.

Since the emergence (or recognition) of this apparently new disease of chickens, there have been three panzootics. The **first panzootic** began with the emergence of ND in chickens in England and South East Asia in 1926. The disease had disappeared from England by 1928. Two waves of spread have been recognised. The first occurred in the Far East and Eastern Europe between 1926 and 1942, and the second in Europe, Africa and the Americas in the late 1940's and early 1950's. It has been postulated that between 1926 and the early 50's the disease circulated in South-East Asia and that chance introductions from this source to other countries occurred, e.g., England in 1926, Australia in 1930 and Kenya in 1935. The slow spread of the disease was attributed to the underdeveloped state of the poultry industry, consisting mainly of backyard flocks with no international trade.

The **second panzootic** apparently arose in the late 1960's in the Middle East. This panzootic spread to other continents faster than the first, due to the international air trade in psittacine species, which rapidly spread the virus.

The **third panzootic** is the current neurotrophic ND which occurs mainly in racing pigeons. The NDV involved shows marked variation from classical strains and has been

isolated from flocks of domestic fowl in Great Britain, Germany, Saudi Arabia, Austria and Uganda, turkeys in Israel, ducks in Switzerland, and psittacine species in Germany (Alexander *et al*, 1985).

***Aetiology*:** NDV is placed in the genus *Rubulavirus* of the subfamily *Paramyxovirinae* and the family *Paramyxoviridae*. The genus *Rubulavirus* contains avian paramyxoviruses 1-9, with Newcastle disease virus being avian paramyxovirus 1 (APMV-1, PMV-1). Although there are different pathotypes of NDV, antigenically they are the same. They each vary in their spreadability, transmissibility, immunogenicity, virulence, heat susceptibility, ability to elute erythrocytes, and so on.

Transmission: There are two main reservoirs of NDV. Avirulent virus is mainly associated with waterfowl, and highly virulent viruses with tropical birds, especially psittacine species. Some avian Orders have a high level of susceptibility to NDV (*Phasianiformes* [gallinaceous birds, pheasants]; *Psittaciformes* [parrot-like birds]; *Struthioniformes* [ratites]; and *Columbiformes* [pigeons and doves]), others have an intermediate susceptibility (*Strigiformes* [owls]; *Falconiformes* [falcons]; *Accipitriformes* [eagles]; *Ciconiiformes* [storks]; *Sphenisciformes* [penguins]; and *Passeriformes* [sparrows and song birds]), while others have minimal susceptibility (*Anatiformes* [waterfowl]; *Pelicaniformes* [pelicans, shags]; *Ralliformes* [coots]; *Lariformes* [gulls]; and *Carianiformes* [cranes]). This grouping reflects a general rather than a specific predictability.

Thus birds living in close contact with water appear to be resistant to developing clinical signs after infection, and it has been postulated that such birds have had a long phylogenetic relationship with NDV, since the virus survives well in sea or fresh water, and waterfowl would have received considerable exposure during their evolution. Granivorous and fructivorous birds are moderately susceptible to NDV, while omnivorous birds are most sensitive. Gregarious species are more likely to develop ND than solitary species. Among mammals, man is the only species in which infection has occurred naturally, and this usually results in a mild conjunctivitis. The ability of the virus to multiply in mammalian hosts is limited, and mammals play little or no part in the natural spread of the disease, except during an outbreak when they might passively transfer virus.

NDV spreads along three avenues: the domestic poultry industry with its vertical integration; intra- and intercontinental avian migration, and the pet bird trade. The virus is **not** transmitted vertically. Some embryos will be infected before being enclosed by the shell, but these die before hatching. It is thus theoretically possible to hatch ND-free eggs from a viraemic and shedding flock.

The most important manner of spread is the movement of domestic poultry, including day-old chicks, hatching eggs, live and dead birds and poultry offal, the migratory movements of infected wild avian species, the mechanical transfer of virus by rodents and wind transmission of the virus. Spread of the virus is facilitated by its high resistance to adverse environmental conditions, its wide avian host range, and its ability to persist in poultry carcases and offal. Under modern conditions of poultry management, airborne dissemination of virus has become of particular importance in local spread of the virus, particularly in houses utilising exhaust fans.

Signs

Poultry: The clinical signs of ND in susceptible chickens vary, depending on the virulence and tissue tropism of the virus. Disease caused by viscerotrophic velogenic ND (VVND) virus starts suddenly and progresses rapidly. Birds stop eating, have ruffled feathers, and become listless. The combs and wattles become cyanotic and oedematous, and there is a serous to mucopurulent ocular discharge and conjunctivitis. A greenish-yellow diarrhoea is commonly present. Rales, sneezing, coughing, nasal discharge, and laboured breathing with gaping and extended head and neck, may be seen. Nervous signs (tremors, torticollis, opisthotonus, incoordination) are usually seen only in older birds, and then only when the disease in the flock is advanced. Egg production usually ceases. Morbidity and mortality may reach 100%. Infection with mesogenic ND viruses results in a less severe disease, with respiratory and nervous signs predominating and severe effects of egg production. Younger birds are more severely affected (Alexander, 2003; Allan *et al*., 1978).

Lentogenic ND viruses may cause mild respiratory signs and egg production drops, with negligible to low mortality in young chickens. Infection with avirulent ND viruses is unapparent, with seroconversion being the only evidence of infection. However, avirulent ND viruses have been implicated in respiratory disease complexes in broiler chickens.

***Lesions*:** The predominant lesions in an outbreak of VVND in the domestic fowl are focal diphtheritic, necrotic or haemorrhagic lesions throughout the alimentary tract. Velogenic and mesogenic pathotypes cause serous to catarrhal or haemorrhagic exudation in the trachea, with congestion and oedema of the lungs and airsacculitis. The ovary is usually flaccid and contains congested, discoloured, degenerating follicles. Yolk may be present in the abdominal cavity. Subcutaneous oedema may be present over the head, eyelids, comb, wattles and neck, but this is not as marked as that seen in outbreaks of avian influenza in the domestic fowl. The conjunctivae may be swollen, oedematous and haemorrhagic, so much so that they protrude over the lids. Infection with lentogenic strains usually causes only a mild tracheitis and airsacculitis.

Microscopic lesions seen in the domestic fowl include hyalinisation of capillaries and arterioles, hyaline thrombosis and necrosis of endothelial cells with associated oedema and haemorrhage. Following infection with VVND virus, necrotic haemorrhagic foci develop in lymphoid aggregates throughout the gastrointestinal tract. Central nervous lesions are most commonly seen in the cerebellum, brain stem, mid-brain and spinal cord, and consist of neuronal degeneration, gliosis, endothelial cell hypertrophy and perivascular lymphocytic accumulation. Lesions in the trachea vary with the virulence of the virus strain. They range from deciliation and degeneration of epithelial cells to epithelial hyperplasia and infiltration of the *lamina propria* by lymphocytes. Degeneration and necrosis of lymphoid tissues, together with vascular damage and haemorrhage may be present in parenchymatous organs.

Pigeons: In 1981, an infectious disease with nervous signs was first seen in Mediterranean racing pigeons. The earliest reports of the disease were from Italy in 1981. In 1982, there were reports in the Continental lay press of the disease. It is likely, however, that the disease

started in Iraq in 1977 and spread to Egypt by 1981. It was probably misdiagnosed as pigeon herpesvirus encephalitis, since the pigeon NDV variant was later grown from cultures of herpesviruses isolated from diseased pigeons in Iraq in 1977. The disease was introduced into Belgium in 1981 by two racing pigeons which were imported from Italy. The disease spread rapidly in Belgium and Germany because of the highly organised pigeon racing and extensive trade in these birds. In April 1983, the Ministry of Agriculture, Fisheries and Food placed a ban on the racing and importation of pigeons from the Continent to Great Britain. In spite of this, the disease was diagnosed in a loft in Cornwall in June of 1983 and was widespread in lofts in Great Britain six months later. The disease spread internationally and the virus has been isolated from pigeons in most of Europe, as well as in Israel, Egypt, The Sudan, Uganda, South Africa, Hong Kong, Japan, Canada and the United States of America (Alexander *et al*. 1985).

The incubation period of pigeon ND varies from a few days to several weeks, so that in any outbreak, new clinical cases continue to appear in the loft for up to 5-8 weeks after it appeared in the loft. Initially, pigeons drink excessively, with intestinal signs (watery to haemorrhagic diarrhoea) appearing first followed by nervous signs (head tremor, torticollis, paralysis of wing(s) and/or leg(s), and loss of visual acuity, with affected pigeons pecking at and missing grain). If the disease is contracted during moulting, then poor feathering may result. Respiratory signs are always absent. Pigeons may return to health after a convalescence of up to 6 months, but can have a persistent diarrhoea (chronic enteritis for several months. All viruses isolated from diseased racing pigeons were similar and of PMV-1 serotype.

The pigeon variant NDV caused ND in domestic fowl in Great Britain in 1984. At first, there appeared to be no direct or indirect contact between these poultry flocks and pigeons. Subsequent investigation revealed that the flocks had been fed grain which had been stored in the Liverpool docks, and that this grain was contaminated by pigeon carcases and faeces. Pigeon PMV-1 was isolated from these carcases and from the grain itself. In Great Britain it is common to feed egg-laying bird rations which are merely mixed at the mill, so that the virus was not heated at any stage. The majority of the flocks affected received such a ration, and other outbreaks probably resulted from secondary spread. The source of four outbreaks could not be determined. During 1983 192 racing pigeon lofts were confirmed as infected with NDV. In 69% of these outbreaks, pigeon racing was implicated in the spread of the disease, while some outbreaks were traced to visits by owners to infected lofts. Vaccination of birds against NDV had been banned in Great Britain in 1981. Because of the pigeon ND, vaccination of pigeons using an inactivated oil emulsion vaccine was permitted from September 1983. In flocks effectively vaccinated, no outbreaks occurred. Of 866 outbreaks of the disease in pigeon lofts in Great Britain since, 92% occurred in unvaccinated flocks, and 7% in either inadequately vaccinated flocks or flocks vaccinated after clinical signs appeared in the loft (Alexander *et al.* 1985).

Game Birds and Turkeys

Pheasants, quail and partridges are more susceptible to NDV than guinea fowl and turkeys. These species have been associated with outbreaks of ND in the domestic fowl. Turkeys may be long-term carriers of the virus, since NDV has been isolated from a turkey kept in isolation for 12 months. Generally the occurrence of ND in game birds and waterfowl follows an outbreak of the disease in the domestic fowl.

Wild Waterfowl

At times other than during annual migration, waterfowl are unlikely to receive significant exposure to NDV. However, when they become infected, they do not develop clinical signs, and remain carriers and shed it for long periods. Most sampling of waterfowl has been undertaken just prior to or during annual migration, when the population density is high and the birds have spent significant periods in the one area. In this aquatic environment, intestinal infection and transmission by the faecal-oral route would spread NDV (and other pathogens). During migration, weakened and diseased waterfowl are unlikely to complete their migration, and will either die or fall victim to predators. Evolutionary environmental adaptations have ensured that exposure to pathogens is minimised. At breeding, most birds pair off and tend to separate from other pairs, tend to build a new nest each year, minimising exposure to pathogens, they remove the droppings of offspring, and also any weakened and underdeveloped offspring. Fledglings also tend to stay with their own parents, and avoid living for long periods at the one site. Breeding, hatching and rearing usually coincides with a period of abundant food supply, thus ensuring that the offspring receive optimal nutrition. Humoral antibody will presumably effectively protect offspring in a stable environment. Any pathogens that infect the environment are rapidly inactivated by ultraviolet light.

In Western Australia, NDV was isolated from aquatic species, with a high prevalence in pelagic species. All NDV isolates from these birds were avirulent for the domestic fowl. Aquatic birds also carry and excrete avirulent NDV, and lentogenic viruses circulate among them. Velogenic viruses have not been isolated from wild aquatic birds, although they can carry and excrete velogenic viruses in captivity. It is possible that migratory waterfowl might shed NDV into the water supply of domestic poultry, but it is unlikely that such viruses will be virulent.

Domestic Pet Birds

The development of clinical signs in pet and free-living non-aquatic birds is the same as that observed in the domestic fowl. As in the domestic fowl, the outcome of infection depends on the virulence of NDV, dosage and method of entry of the virus; the age of the challenged bird and whether it has innate resistance; whether the bird has passive or active antibody; and whether the bird is undergoing stress at the time of challenge.

The transport of psittacine species has been associated with many of the outbreaks of ND in domestic fowl that occurred throughout the world in 1970-1971. Because of the relationship between VVND viruses and the rapid international movement of psittacine species, many countries imposed quarantine restrictions on the importation of such birds.

It is not known how exotic birds become infected with VVND virus. As with waterfowl, environmental adaptations ensure that exposure to pathogens is minimised. However, once birds are captured and either imported or smuggled into a country, their caging results in a breakdown of these protective mechanisms, and infectious agents accumulate. Infection in transit when birds from different sources are mixed must also be considered. Modern air transport ensures the rapid transport of such birds to their destination and so many birds will be incubating viral diseases on their arrival at a quarantine station and show no clinical signs.

Recovered psittacine birds may carry and excrete NDV for months (Kaletea and Baldauf 1988).

Diagnosis Although a clinician may strongly suspect ND in a flock of domestic fowl, the disease cannot be unequivocally diagnosed clinically or pathologically, because of the similarities of many of the clinical signs to those of other poultry diseases. Final diagnosis is based on isolation and characterisation of the virus, which must include pathotyping, since there is a wide diversity in the disease-causing potential of NDV isolates. Pathotyping is necessary, since there have been instances of the isolation of non-pathogenic, vaccinal or endemic strains from birds with clinical disease typical of virulent strains, as well as of the isolation of pathogenic strains from asymptomatic birds. The main objective of characterising NDV isolates is to assess their pathogenicities for the domestic fowl. Suitable specimens for isolation are tracheal swabs, as well as tissues taken from the respiratory and alimentary tracts at autopsy. The virus will grow readily in embryonated eggs of the domestic fowl, and a wide range of avian and mammalian cell cultures. Isolation of NDV is confirmed by haemagglutination inhibition by monospecific antisera.

Once the virus is identified, various pathotyping tests may be undertaken: the mean death time (MDT) in 9-11 day-old embryonated eggs of the domestic fowl; the intracerebral pathogenicity index (ICPI) in one day-old chicks of the domestic fowl; and the intravenous pathogenicity index (IVPI) in six week old chicks of the domestic fowl. Using these methods, ND viruses are broadly grouped into three pathotypes: velogenic (highly pathogenic); mesogenic (moderately pathogenic); and lentogenic (mildly pathogenic to non-pathogenic). Velogenic viruses are further subdivided according to the predominant clinical syndrome produced in infected domestic fowl, into viscerotrophic velogenic (VVND), neurotrophic velogenic and pneumotropic velogenic strains.

Reverse-transcription polymerase chain reaction (RT-PCR) and sequencing of the cleavage site may be used to determine pathogenicity of NDV isolates (Alexander 1997). Panels of mouse monoclonal antibodies have also been used to establish antigenic profiles of NDV isolates (Alexander *et al*. 1997).

The HI test is most widely used serological test (Alexander 2000). APMV-1 may show some antigenic cross-reactions in HI tests with APMV-3 and APMV-7 (Alexander 1997), but these can be resolved by the use of suitable antigen and antiserum controls.

ND must be differentiated from AE, encephalomalacia, thiamine deficiency, MD (neural form), virulent avian influenza, avian cholera.

***Treatment*:** None. ND is an OIE listed disease agent and is notifiable in all Australian states and territories. Outbreaks of ND occurred in Australia in 1930, 1932, 1998, 1999, 2000 (Westbury 2001), and also in 2002 in NSW.

***Control*:** Government quarantine. Vaccination

References

1. Allan, W. H. , J. E. Lancaster, and B. Toth. 1978. *Newcastle Disease Vaccines*. FAO Animal Production and Health Series. Rome: Food and Agriculture Organization of the United Nations.

2. Alexander, D. J. 1997. Newcastle disease and other avian *Paramyxoviridae* infections. In *Diseases of Poultry*. 10th ed., Editors B. W. Calnek, H. J. Barnes, C. W. Beard, L. R. McDougald, and Y. M. Saif, 541-69. London, UK: Mosby-Wolfe

3. Alexander DJ 2000. Newcastle disease and other avian paramyxoviruses. *Revue Scientifique Et Technique Office International Des Epizooties* 19, no. 2: 443-62.

4. Alexander, D. J. 2003. Newcastle disease, other avian Paramyxoviruses, and Pneumovirus infection. In *Diseases of Poultry*. 11th ed., Editors Y. M. Saif, H. J. Barnes, J. R. Glisson, A. M. Fadly, L. R. McDougald, and D. E. Swayne, 63-99. Ames, Iowa, USA: Iowa State Press.

5. Alexander, D. J., G. W. Wilson, P. H. Russell, S. A. Lister, and G. Parsons. 1985. Newcastle disease outbreaks in fowl in Great Britain during 1984. *The Veterinary Record* 117, no. 17: 429-34.

6. Kaleta, K. F., and C. Baldauf. 1988. Newcastle disease in free living and pet birds. *Developments in Veterinary Virology* 8: 197-246.

7. Westbury, H. A. 2001. Newcastle disease virus: an evolving pathogen? *Avian Pathology* 30: 5-11.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Psittacid Herpesvirus Disease

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the disease Psittacid Herpesvirus Disease, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Psittacid Herpesvirus Disease

Two psittacine herpesviruses, Psittacid Herpesvirus 1 (PsHV1) and Psittacid Herpesvirus 2 (PsHV2), have been described. PsHV1 has been associated with two main disease syndromes in psittacine birds: Pacheco's disease and mucosal papillomas (MP, internal papillomatous disease, IPD, cloacal papillomatosis) (Tomaszewski *et al*., 2003). PsHV2 is a newly described virus most commonly found in African grey parrots. The virus can be inactivated by heating to 56°C for 10 minutes or by exposing it to pH <5 (Ritchie 1995).

In birds that recover from infection, the virus appears to cause persistent, latent infections with intermittent or continuous viral shedding (Phalen *et al*., 2001). Host-adapted strains of PsHV1 may cause a mild, subclinical, latent infection in a natural psittacine host, but severe disease in an unnatural psittacine host (Phalen *et al*., 2004). In a latently infected bird, virus shedding can be intermittent, but is more likely during periods of stress such as transport and the introduction of new birds (Ritchie 1995).

Pacheco's disease (Pacheco's Parrot Disease)

Pacheco's disease has been reported in several countries where South American and Australasian psittacine birds are kept as pets. Cockatoos and Amazon parrots are highly susceptible and usually die acutely. Macaws are also very susceptible but usually show clinical signs for several days before death. Conures, particularly Nanday and Patagonian, appear to be resistant to severe disease and may become carriers. Although there appears to be variation in susceptibility of different species of parrots to infection with Pacheco's virus, it must be assumed that they are all probably susceptible until proved otherwise.

Pacheco's disease *per se* has not been reported in Australia. However, mucosal papillomas in macaws have been reported, and these are a chronic manifestation of Pacheco's disease.

Signs

PD was initially described by Pacheco and Bier (1930) and the cause characterised as a herpesvirus by Simpson *et al*. (1975). In species that show clinical signs, there is only a brief illness, and birds in excellent body condition may be found dead with full crops (indicating a rapid death). With infection by virulent strains, birds may be found dead without showing clinical signs. In some birds, death is preceded by lethargy and puffing of the feathers. There may be moist droppings and/or regurgitation of a clear or sanguineous fluid. The mortality in susceptible species can be very high, and most birds die within 48 hours of initial clinical signs. Any bird that recovers from infection should be considered a carrier (Phalen *et al*., 2001).

Some birds may survive infection, be permanently immune and become carriers (latently infected). Although appearing normal, they nonetheless excrete virulent virus and so may infect other birds. Latently infected birds shed virus in the faeces after periods of stress, such as transportation and overcrowding. The virus is extremely difficult to detect in carrier flocks. Serum neutralising antibody levels in recovered birds may be useful in identifying birds that have been recently exposed, but may not be helpful in identifying carriers since these may have declining or non-detectable antibody levels. Carrier birds may also excrete virus intermittently, and so would need to be serially sampled.

Lesions

There may be no gross lesions in birds that have died rapidly. Most show enlarged spleens and livers and areas of necrosis of liver tissue. Because these clinical signs and gross pathology are not specific proof of PD, histopathology and other aids to diagnosis, such as serological tests, are necessary to confirm the diagnosis. Histopathology shows amorphous areas within the nuclei of liver cells (these contain viral particles), as well as necrosis of areas of the liver and haemorrhage within the liver.

Epidemiology

- Australian species of parrots have been involved in outbreaks of Pacheco's disease overseas.
- As with most herpesviruses, PsHV1 produces asymptomatic carriers in some psittacine birds.
- There is no evidence that PsHV1 is transmitted through the egg.
- PsHV1 has the potential to cause severe losses in parrots under stress such as in birds in importation quarantine.
- PsHV1 can be readily isolated from affected organs of parrots affected with Pacheco's disease, but no satisfactory practical method has been developed for identifying asymptomatic carrier birds.
- Inactivated vaccines have been used in North America and Europe in attempts to control Pacheco's disease, mainly under outbreak conditions. It is very difficult to assess their effectiveness from evidence provided in the published literature.
- It would be impossible to prevent the introduction of Pacheco's virus into Australia if parrots are imported from countries that have traded in aviary birds for many years, e.g. countries in North America and Europe.
- It could be expected that the introduction of Pacheco's virus into some aviaries in Australia would cause significant disease problems, particularly in the early stages of an outbreak.
- There is no evidence to indicate what effect Pacheco's disease has on native wild populations of parrots.
- Birds with mucosal papillomas are carriers of PsHV1, since the virus is present in the mucosal papillomas (Styles *et al*., 2004).

Diagnosis

Diagnosis is based on clinical signs, post-mortem findings and detection of the virus by cell culture, serology or PCR (Phalen *et al*., 2001). Virus isolation from living birds is done on cloacal and/or oropharyngeal mucosal samples, or from faeces or blood feathers. Virus can also be isolated from the blood, liver, spleen, kidney, lung or cerebellum (Gravendyck *et al*., 1998). PCR can be used to detect PsHV1 antigen in diseased and apparently healthy carrier birds. A second test 4-6 weeks after the first will increase the sensitivity of the assay (Phalen *et al*., 2001).

Treatment

Acyclovir has been successfully used to reduce death rates. Administration by IV, IM, and oral routes has been used. Note that treatment with acyclovir does not prevent establishment of carrier status and latent infection.

Prevention

Quarantine. Avoid crowding and other periods of stress. An inactivated vaccine is available in the USA, but there have been adverse reactions to its use (Gerlach 1994).

Mucosal Papillomas

Introduction

- The etiology of mucosal papillomas is now known to be Pacheco's disease herpesvirus, PsHV1.
- MP affects a number of psittacine species, but is most commonly seen in macaws, Amazon parrots and hawk-headed parrots, and also in budgerigars, a cockatiel and an African grey parrot.
- MP has been reported in a number of captive psittacine species in Europe and U.S.A., and was identified in two male green-winged macaws (*Ara chloroptera*) which had not previously been in contact with each other and had been imported in separate legal shipments into Australia in 1993.
- MP have not been reported in wild psittacine populations.
- MP have been reported only rarely in Australian species of parrots kept in overseas aviaries.
- The disease has been reported in Australia in macaws.
- There are no satisfactory screening tests that can be applied to detect subclinically affected birds or birds that may have recovered from the disease.
- When eggs are collected from affected birds and hatched in isolation, it is not known whether the progeny remain free of internal papillomatous disease when they are also reared in isolation.
- Treatment of birds with cloacal papillomas produces equivocal results.
- Control procedures incorporating regular examinations, treatment and segregation of affected birds appear to have been successful.
- Not all susceptible parrots infected with PsHV1 develop clinical signs (Phalen *et al*., 2004).

Clinical Signs

MP are associated with wart-like lesions on mucosal surfaces, most commonly in the cloaca and choanal cleft but also on the oropharynx, conjunctiva, larynx, oesophagus, crop, proventriculus, ventriculus, nasal mucosa and nasolacrimal duct. Many birds ultimately develop bile duct or pancreatic carcinomas or both. Even though affected birds may live for years with MP many will lose condition and die or are euthanased.

Clinical signs depend on the location of the lesions. Birds with lower intestinal or cloacal lesions may strain, have pasted vents, odoriferous or bloody droppings, recurrent enteritis, flatulence or cloacoliths. Those with oral cavity or upper gastrointestinal lesions may show dysphagia, dyspnoea, wheezing, gastrointestinal blockage, anorexia, vomiting, weight loss, dilatation of the proventriculus or ventriculus or passing whole seeds. Infertility or reduced fertility may occur because of genital tract obstruction or general ill health. Death can result from suffocation as a result of laryngeal obstruction, intestinal obstruction or debilitating systemic disease. Initially some birds do not show any clinical signs but develop problems if stressed by other illness or environmental factors. Some authors report periods of regression and recrudescence of lesions ranging from 2 to 18 months.

Chronic irritation, vitamin A deficiency and environmental stress have been suggested as contributing to the development of MP. MP needs to be differentiated from other causes of mucosal tissue proliferation, including psittacine poxvirus (an exotic disease in Australia but widespread overseas), granulation tissue and squamous metaplasia due to hypovitaminosis A. Other gastrointestinal diseases such as proventricular dilatation syndrome, bacterial infections, chlamydophilosis or parasitic infections could mimic MP involving the upper gastrointestinal tract, liver or pancreas.

Examination for lesions

Some birds with MP exhibit no clinical signs but examination of the cloaca or choana under general anaesthesia may reveal early lesions. The vent may be soaked with alcohol and illuminated with a bright light. The end of a cotton bud is introduced into the cloaca, the tip pushed to one side and slowly withdrawn to ease out the cloacal lining and allow for inspection. The process is repeated on the opposite

side. It is difficult to examine the most proximal aspect of the cloaca in this manner. The mucosa should be pink in colour (in African grey parrots the muco-cutaneous junction is pigmented), slightly moist and completely smooth in texture.

Papillomatous lesions appear as large distinct masses or as numerous small, raised lesions covering the mucosa. These friable growths may be pink or white and tend to bleed easily when bruised. On gross examination they may cloacal prolapses or granulation tissue. Acetic acid (5%) will turn papillomatous tissue white, helping to identify suspect tissue. Cloacal lesions often result in prolapse of the either the papilloma or the proctodeum. Severe congestion and oedema may hinder reduction of the prolapse.

Incubation period
MP appears to have a long incubation period, since papillomas develop in parrots within a year of infection with PsHV1 (Phalen *et al*., 2004). Bile duct and panreatic duct carcinomas may develop within a few years of the onset of mucosal papillomas (Phalen *et al*., 2004).

Diagnosis
The disease should be distinguished from cutaneous papillomas which affect epidermal, as opposed to mucosal surfaces. Cutaneous papillomas have been shown to be associated with papillomavirus in chaffinches, brambling finches and an African grey parrot.

The detection of PsHV1 infection with PCR on a combination of oral and cloacal mucosal swabs and blood samples. Even though, viral DNA may not be detected in all latently infected birds (Phalen *et al*., 2004).

Treatment
Treatment is palliative, recurrence is common and birds probably remain infectious. Surgical excision is usually followed by strictures and abnormal vent healing. Electrosurgery, cryosurgery, radiation therapy and the use of autogenous vaccines have been attempted but long term follow up of treated birds has not been reported.

Eradication and prevention
Vectored toward control and eradication of the causative herpesvirus and re-stocking with negative birds.

References

1. Gerlach H. 1994. Viruses In *Avian Medicine: Principles and Application.* Editors B. W. Ritchie, G. J. Harrison, and L. R. Harrison, 862-948. Lake Worth, Florida: Wingers Publishing Inc.

2. Gravendyck M, Balks E, Schroder-Gravendyck A-S, Eskens U, Frank H, Marschang RE, and Kaleta EF. 1998. Quantification of the herpesvirus content in various tissues and organs, and associated post mortem lesions of psittacine birds which died during an epornithic of Pacheco's parrot disease (PPD). *Avian Pathology* 27: 478-89.

3. Pacheco G and Bier O (1930). Epizootie chez perroquets du Bresil. Relations avec la psittacose. *Comptes rendus Seance de la Societe Biologique*. **105**: 109-111.

4. Phalen DN, Tomaszewski EL, Jones J, Radabaugh S, Dahlhausen R, and Jenkins T. 2001. Diagnosis of parrots infected with Pacheco's disease viruses. *Proceedings of the 22nd Annual Conference of the Association of Avian Veterinarians,* Technical Editor E. Bergman, pp 87-89 Bedford, Texas, USA: Association of Avian Veterinarians.

5. Phalen DN, Tomaszewski EK and StylesDK. 2004. Epizootiology, diversity and pathogenicity of Psittacid Herpesviruses. In *Proceedings of the 25th Annual Conference of the Association of Avian Veterinarians* 47-51. Bedford, Texas, USA: Association of Avian Veterinarians

6. Ritchie BW. 1995. *Avian Viruses: Function and Control*. *Herpesviridae*. Wingers Publishing, Lake Worth Florida. pp 171-222.

7. Simpson CF, Hanley JE, Gaskin JM. 1975. Psittacine herpesvirus infection resembling Pacheco's parrot disease. *J Infect Dis* 131: 390-396. 1975

8. Styles, D. K., E. K. Tomaszewski, L. A. Jaeger, and D. N. Phalen. 2004. Psittacid herpesviruses associated with mucosal papillomas in neotropical parrots. *Virology* 325, no. 1: 24-35.

9. Tomaszewski, E. K., E. F. Kaleta, and D. N. Phalen. 2003. Molecular phylogeny of the psittacid herpesviruses causing Pacheco's disease: correlation of genotype with phenotypic expression. *Journal of Virology*. 77: 11260-11267.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Zoonoses

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes Zoonoses and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Zoonoses: Avian Disease Pathogens Transmissible to Humans

Some avian pathogens can be transmitted to humans. Some have been described in detail, such as *Chlamydophila psittaci*, avian influenza virus, Newcastle disease virus and avian mycobacteria. Avian zoonotic diseases are covered in detail by Carpenter and Gentz (1997) and McCluggage (1996).

When working with birds, as long as the necropsy protocols as outlined in the Full Necropsy Protocol are followed, then the likelihood of contracting a pathogen from a bird is greatly minimised. In any case, accurate records of all bird contacts should be maintained for at least one year so that sources of infected birds and potentially exposed persons can be identified. Records should include the species of bird(s), individual bird identification, source of the bird(s), and any illnesses or deaths among the birds, particularly signs of ocular or nasal discharge, diarrhoea, or low body weight.

If you suspect a notifiable disease (chlamydophilosis, Newcastle disease, Avian influenza, avian tuberculosis or *Salmonella enteritidis*), State Stock Diseases Acts place an obligation on you to immediately notify an inspector.

Other pathogens that may be communicated to humans include:

Salmonella and *Arizona* infections
Listeria monocytogenes
Giardia sp. (Giardiasis)
Encephalitozoon sp in African lovebirds
Cryptococcus neoformans (Cryptococcosis)*

***Cryptococcosis**

This disease is of some interest to field workers and is described more fully here. Cryptococcosis is a significant zoonosis, caused by *Cryptococcus neoformans*, and has been reported in several species of birds. *C. neoformans* can cause a severe meningitis in humans. There are two subtypes:

C. neoformans var. *neoformans* (serotypes A & D) - found in bird droppings; and
C. neoformans var. *gattii* (serotypes B & C) - found in *Eucalyptus* spp (Ellis and Pfeiffer, 1990:

- *Eucalyptus camaldulensis* (River Red Gum)
- *E. tereticornis* (Forest Red Gum)
- Also *E. blakelyi, E. gomphocephala and E. rudis*

The yeast is spread by basidiospores released from specific host plants, or desiccated blastoconidia (yeast cell form) disseminated from accumulations of dried pigeon dung.

Affected birds may have swollen sinuses, beak or skin tumours around the face, but can also have a mucoid oculonasal or choanal discharge.

In psittacine birds cryptococcosis often presents as a proliferative tumour of the nasal passages or beak or adjacent skin which, grossly, could easily be confused with a primary neoplasm. Instead the mass

consists of inflammatory tissue and significant numbers of organisms (Raidal and Butler, 2001).

Signs in pigeons include swellings around the head and conjunctivitis. The beak is not involved. Signs in psittacine birds include conjunctivitis and beak lesions.

References

1. Carpenter JW and Gentz EJ 1997 zoonotic diseases of avian origin. In Avian Medicine and Surgery, Eds Altman RB, Clubb SL, Dorrestein, GM and Quesenberry K. WB Saunders Company. pp 350-363

2. Ellis DH and Pfeiffer TJ. (1990). Natural habitat of Cryptococcus neoformans var gattii. J Clin Microbiol, 228, 1642-1644.

3. McCluggage DM. 1996 Zoonotic disorders, in Diseases of Cage and Aviary Birds, Third Edition, eds Rosskopf WJ and Woerpel RW. Williams and Wilkins Baltimore USA. Pp 535-547

4. Raidal SR and Butler R5 (2001) Chronic Rhinosinusitis and Rhamphothecal Destruction in a Major Mitchell's Cockatoo (Cacatua Leadbeateri) due to *Cryptococcus Neoformans var gattii* J. Avian Med. Surg.]. Vol. 15, no. 2, pp. 121-125.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Boot baths, Gloves and Face Masks

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes *Boot Baths, Gloves and Face Masks* and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Bootbaths

There has been much debate over the efficacy of boot baths. Some say they are ineffective, others that they work and others that, although ineffective, if used after shower in-shower out, they instil a sense of responsibility and awareness of biosecurity in staff. Time constraints within a busy facility, as well as gross organic overload, make boot "baths" at the best a quaint ritual.

There are a number of problems associated with the use of boot baths:

1. Personnel step over them when supervisors are absent;
2. Rubber boots have an irregular porous surface in which microorganisms are present and so disinfectants cannot contact them;
3. The upper parts of rubber boots do not come into contact with the disinfectant and so act as a fomite, possibly transferring potential pathogens to a clean area;
4. If the lower, grossly contaminated parts of boots are not scrubbed to rid them of mud and other detritus, the disinfectant solution is rapidly neutralised by organic overload;
5. The contact time is of the order of a couple of seconds, when most manufacturers of disinfectants stipulate times of at least 10 minutes; and
6. When freshly prepared, bootbaths do reduce bacterial contamination on grossly clean boots, but it is commonplace for the disinfectant solution to be placed in the bootbath at the beginning of each day and left to become a thicker and thicker microbial soup as the day progresses.

Furuta *et al*. (1993), using orthodichlorobenzene solution as a disinfectant, compared boots dipped in a bootbath containing a recommended dilution of disinfectant with control boots and no significant differences were observed between them. Sundheima and Eide (1999) found high levels of bacterial contamination in boot baths. Morley *et al.* (2005) stated that disinfectant boot baths should not be expected to disinfect bootwear, but they may help in reducing the risk for nosocomial infection when used with effective disinfectants. The concentration of disinfectant in the baths should be monitored to ensure effective disinfection.

Amass *et al.* (2000, 2001) found that scrubbing visible manure from boots enhanced the removal of significant numbers of bacteria. However, simply walking through a boot bath did not reduce bacterial counts on the boots. Standing in a boot bath for up to 2 minutes without scrubbing off the manure also did not significantly reduce bacterial counts except when using a cost-prohibitive disinfectant. Scrubbing visible manure off in a water bath was as efficacious as scrubbing manure off in a disinfectant bath as far as reducing bacterial counts. However, scrubbing manure off in a bath of disinfectant contaminated the disinfectant solution and rendered the boot bath ineffective.

They concluded that the use of boot baths might place pigs at risk of infection because microbial contamination was being transported on boots between modules on the farm.

Boot baths are rarely managed correctly, but can be effective. They should be replenished or refilled at regular intervals. Boot baths do remind personnel of the need for hygiene.

For these reasons, boot baths are not recommended, and that, as a minimum hygiene practice, staff entering a facility and modules within a facility change their clothing and boots and wear disposable gloves and head cover in each module, and change on exit, leaving the disposable gloves in a container. Best practice would be to shower in and shower out. They should not take any utensils or equipment into the module - any used there should be dedicated to that module and remain there.

Disposable Gloves

Wearing disposable gloves will be recommended in modules within a quarantine facility. They should be worn at all times during a necropsy.

Repeated exposure to disposable natural rubber latex gloves has been associated with allergic reactions such as skin rashes, asthma and even anaphylactic shock. In addition, some people may be allergic to the cornstarch powder placed in the gloves to facilitate putting them on and off - removing the gloves causes a significant aerosol of cornstarch (NIOSH, 1997).

Refer to the following web sites: Union Safe Site
Workers Health Centre

Once a user is sensitised to latex in gloves, any contact with latex can trigger a reaction. The National Institute for Occupational Safety and Health (USA) recommends that persons allergic to latex wear a medical alert bracelet (NIOSH 1997).

Powderless nitrile gloves are generally the material of choice for a necropsy, especially if gloves are recommended by an authority and there is a risk, however small, that their use might harm an employee. Another advantage is that they do not stick together, a problem with latex gloves.

- Before use, check the gloves for tears or holes.
- Use a glove of the correct size - gloves that are too small restrict movement, are uncomfortable and may tear whereas overlarge gloves may interfere with fine movements and may even slip.
- When working, it may be advisable to wash the gloves frequently with water.
- When a glove is removed, care should be taken to avoid the contaminated exterior contacting the skin.
- Never handle fomites while wearing gloves.
- When doing a necropsy, it is preferable to speak into a recording device, rather than taking hand-written notes or relying on your memory to record your findings later.
- Wash hands thoroughly after removing gloves.

Surgical Face Masks

Suppliers of surgical face masks make the claim that disposable caps and face masks are a "protective barrier from blood and body fluids". The standard for surgical face masks applies to use in health care where it is necessary to keep cross-contamination between the health care worker and the patient to a minimum (not the other way!). The standard does not apply to situations where an additional degree of respiratory protection may be required from the risk of airborne transmission infection from another person to the person wearing the mask.

There are four types of respirator/surgical masks available in Australia – Australian Standards 1715 and 1716:

- P3: full face piece, highly effective
- P2: preferred for protection against viruses, if used correctly. May not be effective at high respiratory rates (hard work). Also international standard P95.
- P1: lowest form of resistance
- Non-approved personal protective equipment surgical mask – seal around side of face is not protective

Standards 1715 and 1716 are available at:

http://www.standards.com.au/catalogue/script/search.asp

A P2 mask is uncomfortable to wear for long periods.

Surgical face masks protect the carcase and other people mainly by diverting the flow of air from breathing straight out and over the carcase to redirecting it away from the carcase. If you cover a carcase with glad-wrap or a piece of transparent plastic before you open the abdominal cavity, you will not be exposed to the aerosol plume that may come up to your face. After that, if there is no breeze coming toward you from the carcase, you are unlikely to be exposed to aerosols from the carcase. For example, if you hold a candle at arm's length, you can blow it out relatively easily, but if you try to suck it out, you have to bring the candle very close to your face and will probably burn your nose. In reality, air flows over your face to go through your mouth and nose, so that a surgical mask, instead of only allowing air to come through the mask material, gives limited protection because the air tends to flow under the fairly poor seal around the face. Further, many masks direct expired air up the face, fogging glasses if worn. Fogged glasses make it impossible to perform a safe necropsy and increase the risk of contamination or injury. Face masks do keep people from touching their face with their fingers, a potent fomite.

Additionally, should either an aerosol or air containing pathogens reach the face, the eyes are unprotected and provide an excellent entry site. This is why full-face masks (P3 standard) are recommended for high-risk situations.

An employer should recommend that a class P2 mask with valve (about $2-3 each), be worn, and that safety glasses be worn.

References

1. Amass SF, Vyverberg BD, Ragland D and Dowell CA, Anderson CD, Stover JH, Beaudry DJ. 2000. Evaluating the efficacy of boot baths in biosecurity protocols. *Swine Health and Production*. 8:169-173.

2. Amass SF, Ragland D and Spicer P. 2001. Evaluation of the efficacy of a peroxygen compound, Virkon®S, as a boot bath disinfectant. *Swine Health and Production*. 9:121-123.

3. Furuta, Kenji, Shimonokado, Hideaki, Fujihara, Hidenori and Shinzato, Dentoku . 1993. Effect of foot bath on reduction of bacteria contaminating working boots. *Japanese Poultry Science*. 30: 62-65.

4. Morley PS, Morris SN, Hyatt DR and Van Metre DC. 2005. Evaluation of the efficacy of disinfectant footbaths as used in veterinary hospitals. *J Am Vet Med Assoc*. 226:2053-8.

5. NIOSH (1997). American NIOSH Alert ; Preventing Allergic Reactions to Natural Rubber Latex in the Workplace (DHHS (NIOSH) Publication No. 97-135, June 1997). http://www.cdc.gov/niosh/latexalt.html

6. Sundheim, G. and Eide, O. K. 1999. Microbial study of foot-baths. *Maelkeritidende*. 112: 405-407.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Design of a Captive Breeding Facility for a Recovery Program

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the *Design of a Captive Breeding Facility for a Recovery Program*. The document has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Office Complex

A suggested layout for an office complex is presented in Figure 1. It can be seen that the office complex comprises an entry that is always locked and access is only by authorised personnel. The complex comprises an office, toilets, staff amenities, a workshop, a food storage area and a food preparation area. The office complex should be air-conditioned, and windows should not be opened in normal circumstances (windows are needed for the office - to see people leaving and returning to the complex from the facility, and the food storage and the workshop room - to see people arriving with deliveries at the food and workshop delivery ramps.

Drainage from the Office Complex must be contained and not enter the facility proper.

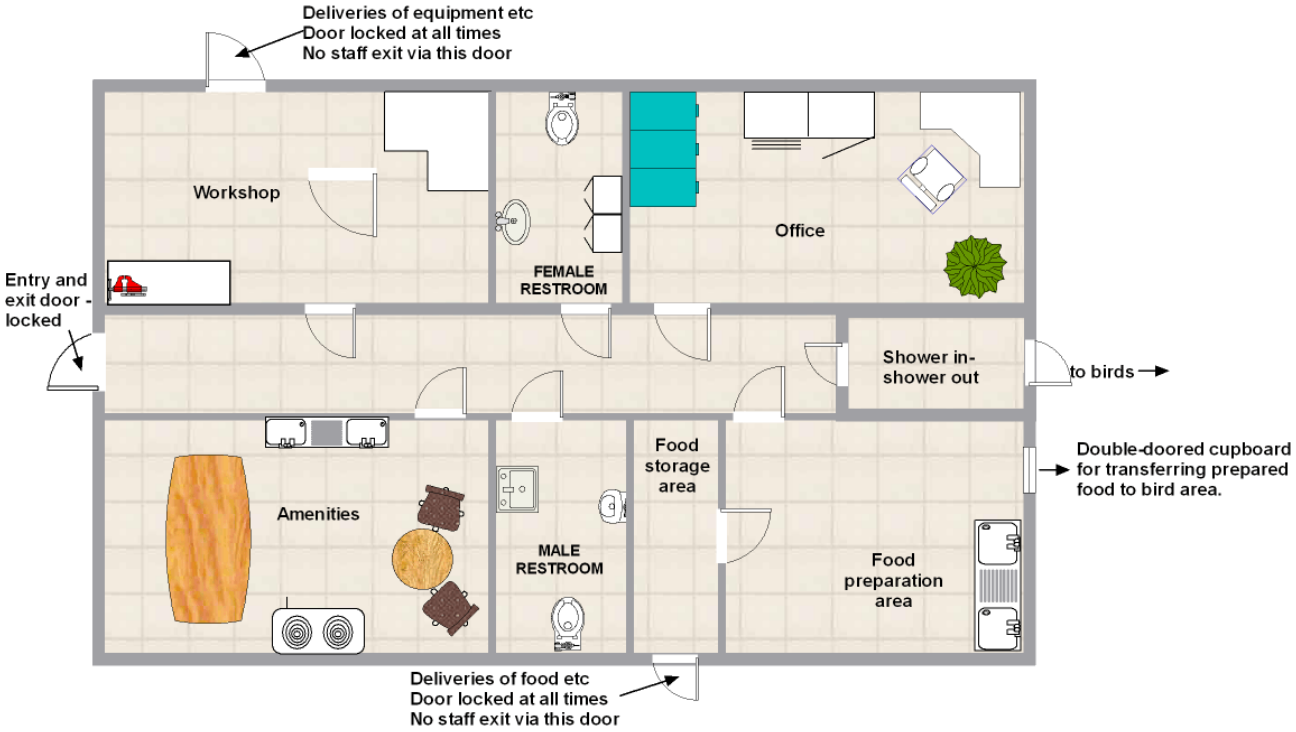


Figure 1: Suggested layout for an office complex

Delivery docks are placed at the workshop and the food storage area. These docks are enclosed, are accessed by a sliding door, and have an impervious floor that can be disinfected with 2% Virkon S prior to deliveries (allowing 10 minutes' contact time). Food deliveries should be in containers that have had no contact with birds. If there is any possibility that deliveries to the workshop dock have had contact with birds, then they should be disinfected with 2% Virkon S for 10 minutes prior to being placed on the dock. The external door is opened, materials delivered, the door closed and then the workshop or food delivery internal door opened to gain access.

There is no exit from the office complex from either the food delivery or equipment delivery doors.

Personnel going from the office complex to other modules (Breeder, Juvenile, Hatchery or Nursery) need to shower and change their clothing and footwear. When entering modules, disposable plastic overshoes, disposable gloves and head covering are donned. On departure from the module, the footwear is left in the module and the disposable gear placed in a disposal bin. Personnel going from breeders to juveniles and vice versa do the same.

It is preferable for any service personnel, such as electricians or plumbers, not to have had contact with birds for the previous 36 hours. Any equipment they need should be disinfected with 2% Virkon S for 10 minutes' contact time on visibly clean equipment.

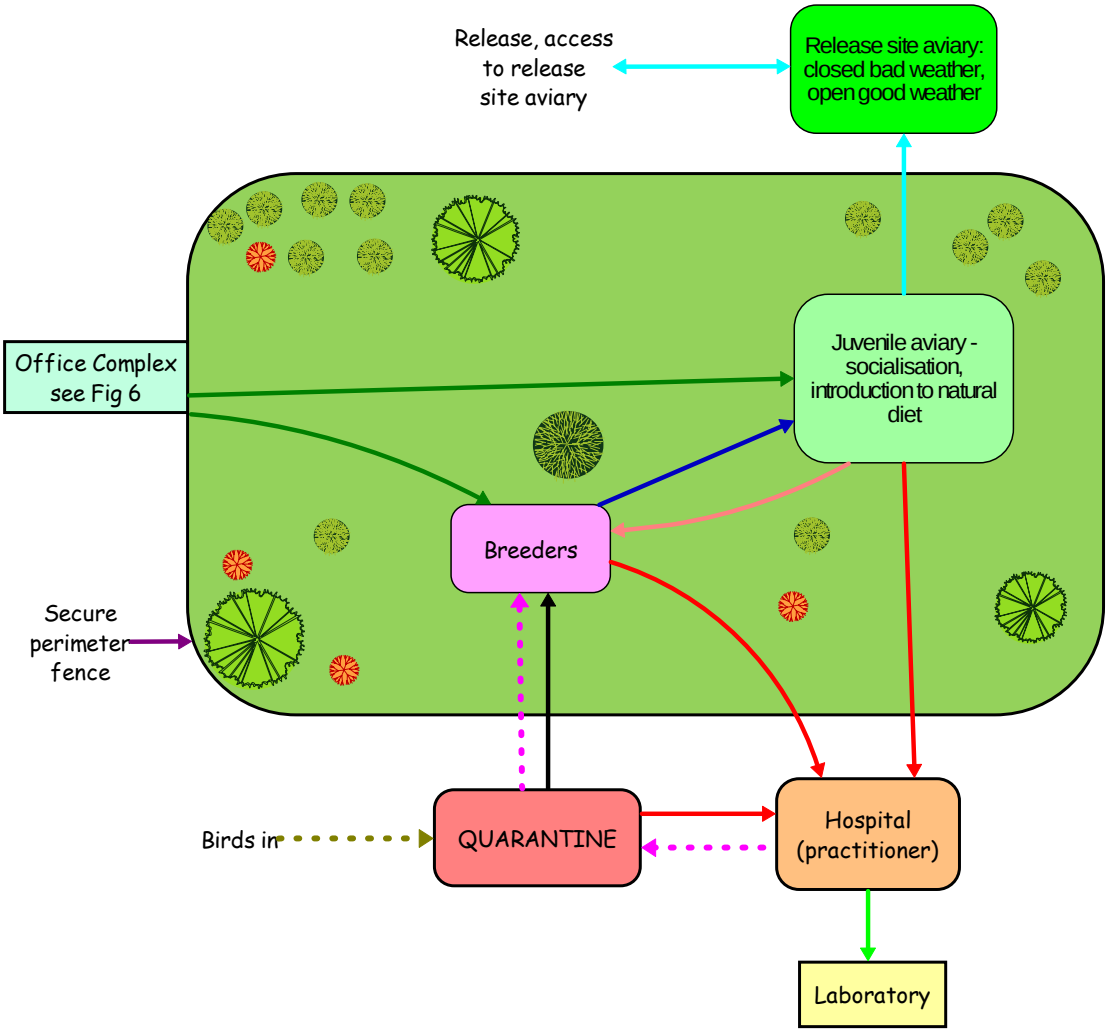
There should be a separate spray pack of disinfectant in each module. This is to stay within the module and should always be visibly clean and the exterior disinfected with 2% Virkon S after use.

The Food Preparation Area should be constructed as follows:

- Drainage is from centre of the room to walls (see later - construction of modules).
- The floor should be constructed of effectively sealed concrete, or consist of large tiles with minimum grout.
- Stainless steel and tiles with a concrete floor are desirable.
- All benches are to be mounted from the walls.
- There should be a dish washer - dishes, bowls and bottles that come out of a dishwasher are virtually sterile.
- Utensils can be either stainless steel or ceramic.

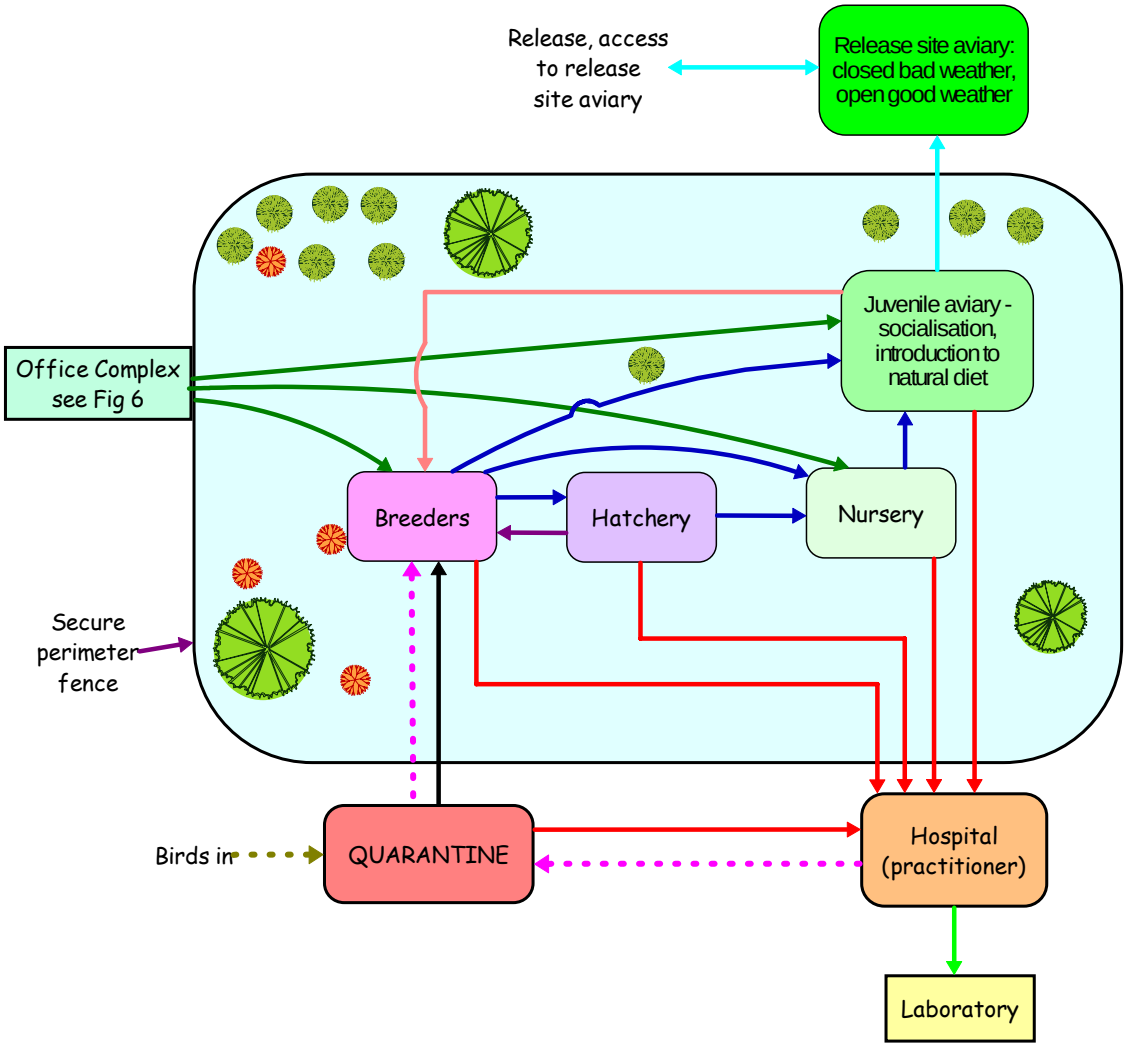
Food must be free of *Salmonella* and fungi (*Aspergillus*). Any food that falls to the floor is to be rejected. Food (and water, if necessary) is delivered directly from the kitchen to the various modules via a double-doored cupboard.

Suggested designs for a facility with breeder and juvenile modules (Figure 2), and one with breeder, hatchery, nursery and juvenile modules (Figure 3), follow.



Key:
- food to breeders and juveniles
- birds from quarantine to breeders
- birds from breeders to juveniles
- morbidity/mortality
- juveniles selected for breeding juveniles to breeders
- specimens from hospital to laboratory
- juveniles to release site and release
- recovered birds from hospitals to quarantine and then to breeders

Figure 2: Proposed design for breeding (without hatchery or nursery), showing bird movement between modules



Key:
- food to breeders and juveniles
- birds from quarantine to breeders
- birds from breeders to juveniles, from either hatchery or nursery, from hatchery to nursery, from nursery to juveniles
- morbidity/mortality
- juveniles selected for breeding juveniles to breeders
- specimens from hospital to laboratory
- juveniles to release site and release
- recovered birds from hospitals to quarantine and then to breeders

Figure 3: Proposed design for facility with hatchery and nursery, showing bird movements between modules

Construction of modules

All modules must provide protection from environmental extremes. The modules should be separate, with the quarantine and hospital modules off-site. Modules should be placed in the facility with a mind to bird flow patterns (Figures 2 and 3).

Effectively sealed concrete floors are essential for vermin control and biosecurity. Sand, various gravels or dirt accumulate pathogens and transmit diseases via the faecal-oral route, and cannot be disinfected. Clipsham (1996) recommended that concrete be poured to extend at least 15 cm beyond the external walls to discourage rodent entry, and to drop from the centre to the edges 2.5 cm for every 1.2 metres. By having floor drains at the edges of the module, drains are placed away from traffic patterns.

Any benches are to be mounted from the walls.

Clipsham (1996) stated that concrete cinder block was the material of choice for walls, since it was insulative and reduced noise substantially. Metal is preferable to wood, but transmits heat and cold. Divisions between aviaries should be solid or double wired to prevent contact between neighbouring birds.

The roof should be impervious and drain adequately. Water run-off should be carried away from the module. Water from the roof may contain faecal material from wild birds, so care should be taken to exclude it from entering the aviary. Aviaries should be totally covered by solid roofing to prevent faeces from wild birds entering the aviary. Lazerlite or other clear material may be used to provide light into the aviary. If there is a high risk of contact with wild birds, wired parts of the module should be double-wired, either by incorporating a walkway at the front, or a space of 0.5 metres between the wires. There should always be two doors between the birds and the outside of the module, to prevent escapes.

Wire should be of stainless steel or nylon mesh (neophemas). Galvanised wire is not recommended.

All-stainless steel suspended cages allow droppings and uneaten food to fall to the ground below, avoiding the faecal-oral route of transmission of pathogens. However, the OBP needs access to solid ground, for example, impervious concrete with non-pathogen-containing sand or similar material spread over the concrete. OBPs need natural "ground foraging", an important habit for birds that are to be released. A tray of soil with growing grasses that they would access in the wild could also be provided. These would need to be removed and replaced every 7 days, before *Ascaris* spp eggs become infective (see here).

Quarantine Module (figures 2 and 3)

The facility should be fully enclosed with one entrance and locked at all times. With this proposal, the quarantine module is external to the breeding and rearing facility. If the quarantine module is placed within the facility it raises the problem of containment of possibly sick birds that is avoided by having it at a remote location. For similar reasons, the hospital is also external to the facility. The quarantine module can be either nearby or remote. It is important that the hospital is nearby.

- Birds enter the quarantine module after undergoing pre-quarantine testing.
- The quarantine period starts with the arrival of the last bird.
- If any new birds are added to the quarantine module after quarantine has commenced, the quarantine period must be re-commenced.
- If a bird has a positive antigen test at either the second or third tests, then the quarantine period must be re-commenced.
- Birds are delivered securely from quarantine via the office complex to the breeder module. Birds enter the breeder module only after they have passed a minimum quarantine period in the quarantine area, passing all testing criteria and having received

all required treatments.

- Any birds leaving the facility to the hospital that have recovered, must go through quarantine before re-entering the facility. If birds are in quarantine and any birds are added, then all birds in quarantine must re-commence their quarantine period.

Breeding Module (Figures 2 and 3)

- Birds are received from either the quarantine or juvenile modules. All nest boxes used by breeding birds in a year's breeding should be disposed of and replaced by new nest boxes.
- The new boxes should be sprayed with a pyrethrum spray and allowed to dry before installation. All porous equipment, such as perches, should be replaced monthly.

Hatchery (Figure 3)

- This module is totally enclosed and separately serviced.
- There should be a minimum of three incubators, one to incubate, one to hatch and a spare.
- Eggs are received only from the breeder module.
- Eggs that are pipping may be returned to the hen of origin in the breeder module.
- Eggs that hatch in the hatchery and cannot be placed with a hen are transferred to the nursery for hand raising.
- There should be a back-up generator to cover power failure.
- One way to maximise the number of fledgling birds produced is to implement practices used by aviculturists in Australia. Eggs can be "pulled" from the hens, replaced with false eggs, the eggs artificially incubated and replaced under the hen at pip. The parents then feed the nestlings for the first 10-14 days, at which stage they are removed and hand-fed, allowing the parents to second-clutch. Indeed, some *Neophema* hens may return to lay at 14-18 days and can attack their clutch at this time. See Closed Aviary Concept - this practice applies to a situation where birds will remain in captivity and there is ample genetic base. In an endangered species program, there is a very limited genetic base, and problems of inferior stock may be encountered if numbers are maximised for introduction to the wild.

Nursery (Figure 3)

Hand-rearing of OBP nestlings may not be an option in the short term, since there is a risk of imprinting. Cross-fostering may result in the chicks being imprinted on the call of the foster parent (e.g, a blue-winged parrot), and not that of the OBP.

The nursery module is the most sensitive area of the facility (Clipsham 1996) - contamination with microorganisms is a particular concern. Personnel entering the nursery should change shoes (or don disposable overshoes), and put on disposable gloves and headwear. The nursery should:

- be totally enclosed
- receive birds from the breeder module and hatchery, and never from outside the facility.
- have separate personnel
- have impervious and easily cleanable and disinfected surfaces
- have sufficient power outlets to allow for brooders - birds should be housed in separate brooders

Records are vital to the success of nursery operation

- Identification
- Date.
- Age
- Complete physical examination
- Parents
- Weight in grams on entry
- Daily weight, just prior to first morning feed
- Diet (amount taken each feed)
- Behavioural notes

Juvenile Module (Figs 2 and 3)

- The juvenile module receives birds from the breeder module (Figures 2 and 3), or the nursery (Figure 3).
- Fledged birds are allowed to socialise in this module.
- Some of these birds may be used for breeding. These birds can be transferred to the breeder complex and do not need to enter quarantine.
- This module may qualify as a "soft release" module, provided the birds are given access to the foods they will eat after release.

Morbidity/mortality

- Any dead bird or bird with clinical signs of illness is securely transferred to the hospital.

- Such birds may come from the breeder or juvenile modules (Figure 2) or from the breeder, hatchery, nursery or juvenile modules (Figure 3). Specimens from the hospital go to a laboratory.
- No problems will arise from the veterinary hospital performing, and collecting specimens from necropsies.
- However, for sick birds, the veterinary hospital should have a separate room or facility within the hospital that does not receive other client's birds for consulting. This room could even be a demountable. There should be minimal possibility of transfer of pathogens, with the clinician changing clothes, and wearing disposable gloves**.**

If an avian veterinarian must visit the facility, whatever module, it is preferable they come directly from home first thing in the morning after a shower and change of clothes at home and shower in to the facility. The clinician is to wear shoes that are not worn to the clinic, and hire a taxi to get to the facility, in order to avoid bringing pathogens that might be present in a clinic vehicle. Veterinary equipment would be a major problem in this instance, and this is why it is better to transport sick birds to the clinic, and when recovered, such sick birds would enter quarantine.

Environmental Cultures

Environmental cultures of specific areas should be undertaken whenever a building is cleaned and disinfected to assess if the cleaning process is effective and if resistance is developing to Virkon-S.

Release Site

Socialised, physically fit juveniles that have been exposed to foods they will encounter at the release site, may be taken to an aviary at the release site. The birds may be released immediately or later, depending on the weather. If the weather is inclement, the birds are maintained in the aviary until the weather improves. After one end of the aviary is opened, the birds can enter and leave at will. Feeding stations are also provided at the site. At the current site, such birds mix with wild birds and have been seen to immediately eat wild foods in the area.

Managing Bird Feeding Stations:

- If crowding at the station occurs, another station should be provided. Crowding is a key factor in spreading disease.
- Keep feeding stations clean, using daily 2% Virkon S on a visibly clean surface for at least 10 minutes contact time.
- Stations should be safe, with no sharp edges or points.
- Some pathogens that might be transferred at feeding stations include *Salmonella* spp, *Trichomonas* spp, *Aspergillus* spp.

Nest boxes provided for released and wild birds

Each year, prior to disinfection of the nest boxes, samples of the nest material are to be assessed for BFDV, APV and *Chlamydophila psittaci* antigen, ensuring that cross-contamination of samples does not occur, and that samples are labeled according to nest box of origin. Nest boxes shall be cleaned and disinfected annually six months before re-occupation by wild and/or released birds.

In summary, a facility should be designed so that:

wild mammals and birds cannot gain access to captive birds;
it has a floor that is impervious and does not degrade;
drainage is from the centre to the edges; and
waste does not contaminate the environment.

Consequently, if personnel understand the concepts of hygiene, how pathogens are transmitted and the epidemiology of the diseases that are to be excluded from the captive birds, then management will contribute the great part of disease control in a captive bird facility.

Reference

1. Clipsham R. 1996. Aviculture Medical Management, in *Diseases of Cage and Aviary Birds*,3rd Ed. Eds WJ Rosskopf and RW Woerpel, Williams and Wilkins Maryland USA. pp 880-903.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

The Effectiveness of Disinfectants Used on Viruses Closely Related to BFDV

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the *Effectiveness of Disinfectants used on Viruses Closely Related to BFDV*, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

The Effectiveness of Disinfectants used on Viruses Closely Related to BFDV

Introduction

A disinfectant is a chemical agent that destroys pathogenic bacteria, but not necessarily spores and not all viruses. A disinfectant is usually applied to an inanimate object (such as a bench) to destroy infective agents that might be present on the object. A dirt, sand or gravel floor cannot be disinfected as easily.

Although many disinfectants have a noticeable odour, they should never be used as a deodoriser. The source of any objectionable odours should be eliminated and not masked by a more acceptable odour.

For a disinfectant to be effective:

1. it must be applied to a surface that has been cleaned of debris and macroscopic organic matter, usually by thorough scrubbing and washing with soap or detergent solutions. If left on the surface, such debris and organic matter will reduce the effectiveness of the disinfectant; and
2. it must be applied to the surface for the recommended minimum period, usually 5-10 minutes, but up to 30 minutes for some disinfectants.

Direct contact between the disinfectant and microorganism is required for disinfection. Microorganisms may be protected from the disinfectant solution by dirt, blood, bubbles, grease and so on. Soaps and detergents are an important facet of disinfection because they are used to remove organic material, dirt or grease from surfaces to be disinfected, and can even kill lipid-enveloped viruses. Many common disinfectants have detergent combinations that enhance their actions.

Microorganisms vary in their resistances to physical and chemical agents that might be applied to kill them. Disinfectants that destroy bacteria may not destroy fungi or viruses. Bacterial spores are more resistant than vegetative forms, non-enveloped non-lipid-containing viruses are more resistant than lipid-enveloped viruses. Microorganism resistance may be summarised (in order of decreasing resistance) in Figure 1 as follows:

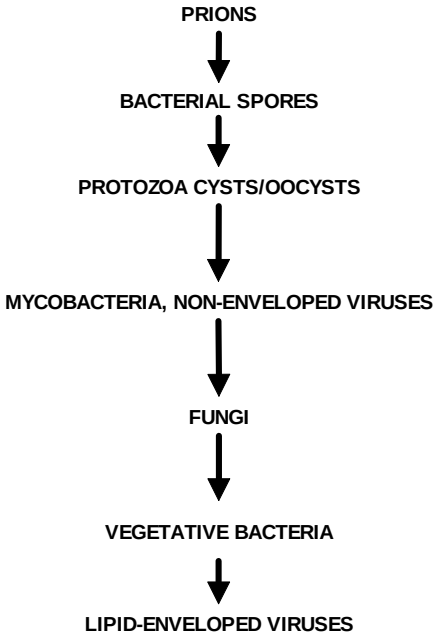


Figure 1: Descending Order of Resistance to Disinfectants

Types of Disinfectants

The types of disinfectants which might be used in a bird facility will be described as follows: aldehydes (formaldehyde and glutaraldehyde), peroxyacid compounds, hypochlorites, iodophors, phenol, quaternary ammonium compounds and alcohols.

i. Aldehydes

Formaldehyde

This may be purchased as either a powder (paraformaldehyde) or a liquid (40% solution with water [37% by weight], called formalin. Because of its carcinogenicity, volatility, caustic action, and danger to humans, it should never be used near birds. It has previously been used extensively as a fumigant in hatcheries in the poultry industry.

Glutaraldehyde

Glutaraldehyde at an acid pH will act only at a bacterial spore's surface, whereas at an alkaline pH it penetrates the spore. Thus it is usual to add an alkalinising agent such as a quaternary ammonium compound (QAC) to glutaraldehyde products. Glutaraldehyde is chemically related to formaldehyde with similar efficiency but without the handling disadvantages of formalin. However, glutaraldehyde usage is associated with occupational health and safety issues - some people develop extreme sensitivity to it, and staff refuse to handle it. It is contraindicated for use in surgical equipment because of the need to rinse the equipment thoroughly with sterile water to avoid the irritation it causes to tissues.

ii. Peroxygen Compounds

Peroxyacetic acid or peracetic acid is made by mixing acetic acid with hydrogen peroxide. Most preparations contain peracetic acid (~5%) and hydrogen peroxide (~20%). On degradation, peroxyacetic acid breaks down to acetic acid (vinegar), water and oxygen. The destruction of spores is greatly increased with both higher temperatures and stronger concentrations. One of the

most striking characteristics of peracetic acid compared to other disinfectants is the low concentration needed to achieve the desired antimicrobial efficacy.

Virkon S is comprised of potassium peroxymonosulfate (50%), sodium chloride, sulphamic acid (5%), malic acid, sodium hexametaphosphate (a buffer), sodium dodecyl benzene sulphonate (a detergent - 15%), amaranth colour (an indicator) and lemon peel extract to provide a characteristic odour. Virkon S is sold as a pink powder that is mixed with water to form a 1% or 2% solution (i.e. 10g or 20g per litre). As the solution ages it becomes pale, indicating that it needs to be replaced. The solution is stable for 7 days. It should not be used as a hand-wash. A 1% solution has a pH of 2.6 and is non-irritant to skin and eyes. It is corrosive to metals over time if it is not thoroughly rinsed off.

iii. Hypochlorites

Chlorine disinfectants are effective against enveloped viruses, vegetative bacteria and fungi.

Hypochlorites contain about 70% of available chlorine. Hypochlorites are available either as:

- a powder containing calcium hypochlorite and sodium hypochlorite (NaOCl), combined with hydrated trisodium phosphate; or
- a liquid containing NaOCl in concentrations 1-15% (Dychdala, 1991).

Scott (1980) found in test conditions that 0.175 percent sodium hypochlorite was the most effective and practical broad-spectrum disinfectant of 22 products tested against a range of different viruses.

Hypochlorites are rapidly inactivated by organic matter, light and heat. Increasing the pH decreases the biocidal activity of chlorine, while decreasing the pH increases the activity. Hypochlorites function best at pH 5-7 (optimum 6), the range at which hypochlorous acid is formed, the chemical that exerts the disinfectant activity. Free chlorine is destructive to clothing and metal, including stainless steel, and is very irritating to the skin, eyes and respiratory system. Hypochlorites must be used carefully around birds because of their odour and residual effect.

iv. Iodophors

An iodophor is a combination of iodine complexed with carriers such as polyvinylpyrolidone or non-ionic surfactants. The carrier allows a sustained release of iodine, and the iodine remains bound to the carrier until the free iodine in solution falls below equilibrium, when additional iodine is released into solution. When used correctly, they are supposed to enhance the bactericidal activity of iodine (Gottardi, 1991). They are less toxic and irritating than aqueous or alcoholic iodine solutions.

When an iodophor becomes colourless, it is no longer effective. It is effective in cold or hot water, soft or hard water, and can be applied to all surfaces, especially in hatcheries and nurseries.

Iodophors must be applied at the manufacturer's recommended concentration - for example a full-strength (10%) solution of povidone iodine releases only 10% of the free available iodine that is released from a 1% solution.

v. Phenol (carbolic acid)

Phenol is a colourless crystalline solid with a characteristic lysol-like odour. It is the chemical that is used to compare other disinfectants for determining the "phenol coefficient", their ability to kill test microorganisms to that of phenol (O'Connor and Rubino, 1991). Phenol disinfectants are unsuitable for use in a bird environment, because of their odour and persistence in the environment.

vi. Quaternary ammonium compounds

One product, F10, consists of polihexanide 4g/L, benzalkonium chloride 54g/L, non-toxic ampholytics and sequesterants. Polihexanide is a chemical used as a biocide for control of micro-organisms and algae in swimming pools, spas, disinfectant in veterinary products and as a sanitiser for milk handling equipment. Its efficacy claims are:

- bacteria (1:500 for 2 minutes)
- Fungi, yeasts and moulds (1:500 15 minutes)
- fungal spores (1:250 30 minutes)
- enveloped viruses (1:500, 10-30 minutes)
- non-enveloped viruses - infectious bursal disease virus and parvovirus (1:125, 30 minutes), and
- bacterial spores (1:125 for 30 minutes).

The product has been used safely as an aerosol to treat respiratory infections, including fungi and yeasts (Verwoerd, 2001, Chitty, 2002). No claims are made for circoviruses.

There is no evidence at present that F10 inactivates BFDV.

QACs are classified as follows:

- **First Generation**: An example is benzalkonium chloride. These have minimal biocidal activity and are commonly used as preservatives;
- **Second Generation**: These are substituted benzalkonium chlorides, an example of which is alkyl dimethyl benzyl ammonium chloride. These have high biocidal activity.
- **Third Generation**: These are also called "dual QACs" (for example: one contains equal parts of alkyl dimethyl benzyl ammonium chloride and alkyl dimethyl ethylbenzyl ammonium chloride. These QACs have increased biocidal activity, stronger detergency, and increased safety to the user (lower toxicity).
- **Fourth Generation**: These are also called "Twin or Dual Chain QACs". Examples are didecyl dimethyl ammonium chloride and dioctyl dimethyl ammonium chloride. They are superior to other QACs in germicidal performance, lower foaming, and have an increased tolerance to protein loads and hard water.
- **Fifth Generation**: These are mixtures of fourth generation and second-generation QACs (e.g., didecyl dimethyl ammonium chloride + alkyl dimethyl benzyl ammonium chloride). They have excellent germicidal performances, are active under more hostile conditions and are safer to use.

vii. Alcohols

Alcohols denature bacterial proteins. In the absence of water, proteins are not readily denatured by alcohol, so a 70-85% solution is generally recommended. Ethyl alcohol and isopropyl alcohol

kill most vegetative bacteria and enveloped viruses but are ineffective against bacterial spores, mycobacteria, protozoa and non-enveloped viruses.

Resistance of Related Viruses to Physical and Chemical Agents

BFDV, chicken anaemia virus (CAV) and porcine circovirus (PCV) are classified as *Circoviridae*. Thus it would be expected that BFDV would have similar environmental sensitivities to those of CAV and PCV. As BFDVs ability was unaffected by incubation to 80°C for 30 min (Raidal and Cross, 1994 - see Figure 2), BFDV appears to have a similar heat sensitivity to that of CAV and PCV. At higher incubation temperatures the titre declined. No change in HA titre occurred following treatment with chloroform. CAV and PCV can be propagated in tissue culture (BFDV cannot) so it is possible to investigate their physical and chemical stabilities. Table 1 shows some physical and chemical characteristics of these viruses.

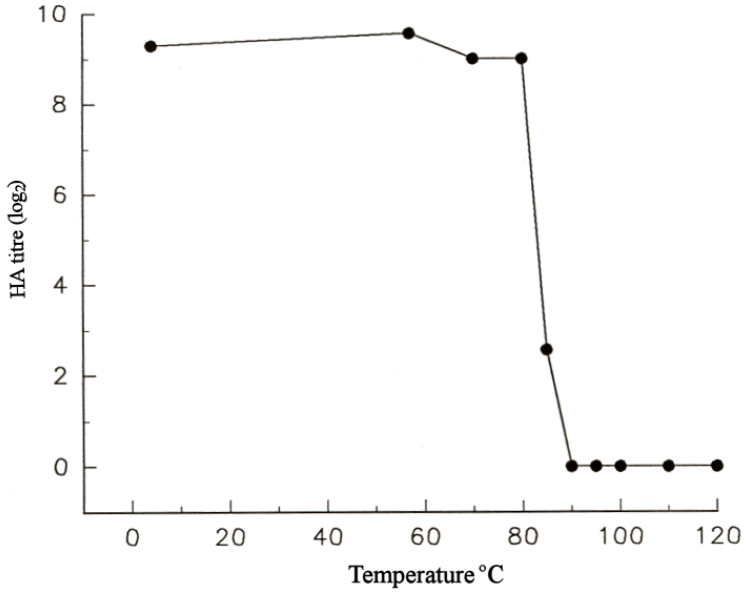


Figure 2: Effects of incubating BFDV for 30 minutes at temperature (Raidal, 1994).

Table 1 Physical and Chemical Characteristics of CAV and PCV

Treatment	CAV	PCV
Ethyl ether	resistant[1]	resistant[1,7]
Chloroform	resistant[1]	resistant[1,7]
pH 3.0 for 3 hours	stable[1]	stable[1,7]
70% ethyl alcohol	resistant[1]	resistant[1,7]
90% acetone for 24 hours	resistant[2]	-
50% phenol in liver suspension	inactivated[3]	-
5% phenol @ 37°C for 2 hours	resistant[3]	-
0.1N NaOH 2h @ 37°C; 24 h @ 15°C	resistant[4]	-
1% glutaraldehyde for 10 min @ RT	inactivated[4]	-
0.4% β-propiolactone @ 5°C for 24 h	inactivated[4]	-
5% formaldehyde @ RT for 24h	inactivated[4]	-
10% iodine @ 37°C for 2 h	inactivated[4]	-
10% hypochlorite @ 37°C for 2 h	inactivated[4]	-
Formaldehyde fumigation for 24 h	resistant[4]	-
Chlorhexidine 0.78%	-	resistant[7]
Formaldehyde 0.78%	-	resistant[7]
Iodine 0.47%	-	resistant[7]
Ethylene oxide fumigation for 24 h	resistant[4]	-
70°C 1 hr, @ 80°C for 15 min	resistant[5]	resistant[1]
95°C 35 min; @ 100°C for 10 min	inactivated[6]	-
70°C for 15 min	resistant[5]	resistant[1]
5-10% NaOH	-	resistant[1] reduction[7]
1:32 hypochlorite	-	resistant[1]
8% formaldehyde	-	resistant[1]
Potassium perogymonosulohate, sodium chloride (Virkon S) 1-2%	inactivated[8]	inactivated[7]
Quaternary ammonium 0.5-2.34%	-	reduction[7]
Phenol 0.4%	-	reduction[7]
Hypochlorite 4.68%	-	reduction[7]

1. Allan *et al.*, 1994
2 Taylor, 1992
3 Yuasa *et al.,* 1979
4 Yuasa, 1992
5. Goryo *et al.*, 1985
6 Urlings *et al.*, 1993
7. Royer *et al.*, 2001
8. Wyeth, 1990

Table 2: Properties of some Disinfectants

Disinfectant group	Example	Use Dilution	Contact Time Mins 20°C	BACTERIA			VIRUSES		Fungi	Comments
				Vegetative	Spore	Mycobacteria	Non-enveloped	Enveloped		
Organic acid surfactant Peroxygen compound	Virkon S	0.5-1%	10	Yes	Yes	Yes	Yes	Yes	Yes	OK in presence of organic matter Mild skin irritant - Respiratory irritant (dust)
Glutaraldehyde	Glutacide Key 200 Microcide disinfectant Terminator broad spectrum disinfectant	1-2%	10	Yes	Yes	Yes	Yes	Yes	Yes	OK in presence of organic matter Toxic to birds Skin, eye, respiratory irritant No evidence that it is carcinogenic
Hyochlorites, chlorine	Bleach	100-10,000 ppm	10-60	Yes	Yes*	Yes*	Yes*	Yes	Yes	Rapidly inactivated by organic matter Work best at pH 5-7 Lose activity >80°C Toxic to birds, ruins clothing Produces carcinogenic by-products Skin, eye, respiratory irritant Corrosive to metals
Iodophors	Betadine (Povidone iodine)	25-1600 ppm	20-30	Yes	Variable*	No	No	Variable*	Yes	Rapidly inactivated by organic matter Work best at pH 5-7. Can be corrosive Lose activity >80°C Skin, eye irritant
Phenol	1-stroke environ	1:256	10	Yes	No	No	No	Variable*	Yes	Rapidly inactivated by organic matter Toxic to birds Skin, eye, respiratory irritant
Quaternary ammonium compounds QACs	ViraClean (F10)	1000-20000 ppm	30	Yes	No	No	No	Variable*	Variable	May support growth of Gram negative bacteria Work best at pH >7 Inhibited by hard water Inactivated by proteins, soaps and detergents
Polihexanide	F10	1000-10,000ppm	30	Yes	Yes*	No	only IBD virus Parvovirus	Yes*	Yes	APVMA review on possible carcinogenicity July 2005
Acohols	Ethyl alcohol Isopropyl alcohol	70-85%	15-20	Yes	No	No	No	Variable	Yes	Eye irritant Requires long contact time Evaporates, so items must be soaked in alcohol

* At higher concentrations. Protozoa - killed by glutaraldehyde or peroxygen compound. IBD - infectious bursal disease

Table 1 demonstrates that both CAV and PCV are very resistant viruses. They are inactivated by recommended dilutions of glutaraldehyde and Virkon S applied for the recommended times, and it may be inferred that BFDV would also be inactivated by these disinfectants.

Table 2 shows examples of disinfectants, recommended dilutions, recommended contact times, and efficacy against vegetative bacteria, bacterial spores, mycobacteria, non-enveloped and enveloped viruses and fungi. The table shows that Virkon S and glutaraldehyde are effective across a broad range of pathogens.

Figure 3 shows inferred efficacy from Table 2.

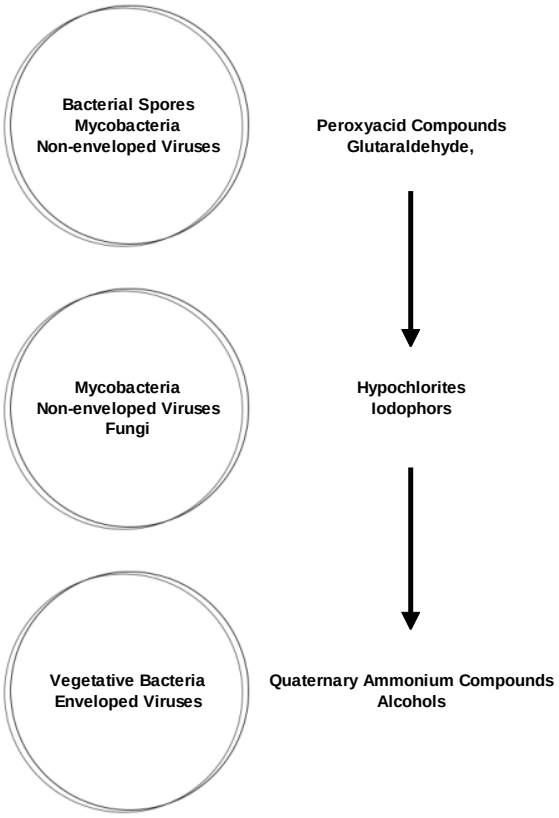


Figure 3: Descending efficacy of disinfectants

References

1. Allan GM, Mackie D, McNair J, et al. 1994. Production, preliminary characterization and applications of monoclonal antibodies to porcine circovirus. Vet Immunol Immunopath. **43**:357-371.

2. Chitty J. 2002. A novel disinfectant in psittacine respiratory disease. *Procs 23rd Ann Conf Expo Ass Avian Vets* August 26-30. Monterey, Ca USA. Pp 25-27.

3. Dychdala, G.R. 1991. Chlorine and chlorine compounds. In S.S. Block, ed. *Disinfection, Sterilization and Preservation*, 4th ed., London and Philadelphia, Lea & Febiger. Pp. 131–151

4. Goryo M, Sugimura H, Matsumoto S, Umemura T and Itakura C. 1985. Isolation of an agent inducing chicken anaemia. *Avian Pathol* **14**: 483-496

5. Gottardi W. 1991. Iodine and iodine compounds. In SS Block (ed.). *Disinfection, Sterilization and Preservation*. Lea and Febiger, Philadelphia, PA. Pp. 152-166.

6. Merianos JJ. 1991. Quaternary ammonium antimicrobial compounds. . In SS Block (ed.). *Disinfection, Sterilization and Preservation*. Lea and Febiger, Philadelphia, PA. Pp. 225-255.

7. O'Connor DO and Rubino JR. 1991. Phenolic compounds. In SS Block (ed.). *Disinfection, Serilization and Peservation*. Lea and Febiger, Philadelphia, PA. Pp. 204-224.

8. Raidal ST and Cross GM.1994.The haemagglutination spectrum of psittacine beak and feather disease virus. *Avian Pathol* **23**: 621-630

9. Raidal 1994 PhD Thesis

10. Royer R, Nawagitgul P, Halbur P and Paul P. 2001. Susceptibility of porcine circovirus type 2 commercial and laboratory disinfectants. *J Swine Hlth and Prod*. **9**:281-284.

11. Scott FW. 1980. Virucidal disinfectants and feline viruses. *Am J Vet Res*. **41**: 410–414.

12. Taylor SP. 1992. The effect of acetone on the viability of chicken anaemia agent. *Av Dis* **36**: 753-754

13. Urlings HAP, de Boer GF, van Roozalaar DJ and Koch G. 1993. Inactivation of chicken anaemia virus in chickens by heating and fermentation. *Vet Q*.**15**: 85-88

14. Verwoerd R. 2001. Aerosol use of a novel disinfectant as part of an integrated approach to preventing and treating aspergillosis in falcons in the UAE. *Falco* **17**: 15-17.

15. Wyeth 1990. Ministry of AG Fisheries and Food CVL Lab New Haw Weybridge. The Virucidal Effect of Virkon S on Chicken Anaemia Agent. Efficacy document

16. Yuasa N. 1992. Effect of chemicals on the infectivity of chicken anaemia virus *Avian Path* **21**: 315-319

17. Yuasa N, Taniguchi T and Yoshida I. 1979. Isolation and some characteristics of an agent inducing anaemia in chicks. *Avian Dis* **23**: 366-385

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Haemagglutination and Haemagglutination Inhibition

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes *Haemagglutination and Haemagglutination Inhibition*, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Haemagglutination and Haemagglutination Inhibition

The haemagglutination (HA) test for BFDV is used to detect the presence of and titrate the virus, which agglutinates some avian erythrocytes (red blood cells, RBCs).

The haemagglutination inhibition (HI) test is used for detection and titration of specific antibodies to BFDV. In the HI test, a constant amount of BFDV is added to doubling dilutions of serum from a test bird, and incubated for a set time. At that time, RBCs sensitive to the virus under the conditions of the test are added and the incubation continued. If agglutination occurs, the serum does not contain virus-specific antibody. If agglutination does not occur, then the sample contains virus-specific antibody. The HI test is really a neutralisation test with RBC agglutination as the indicator. The principle of the test is to determine, by dilution, the level of (agglutination) inhibiting antibodies in a bird's serum that will prevent the agglutination of the indicator system (susceptible RBCs). The great majority of birds with HA titres for BFDV do not have antibody to the virus, and so lack a HI titre. The majority of birds with antibody to the virus (HI titre) do not excrete the virus, as long as they do not have contact with the virus. Interpretation of the test is shown in Figure 1.

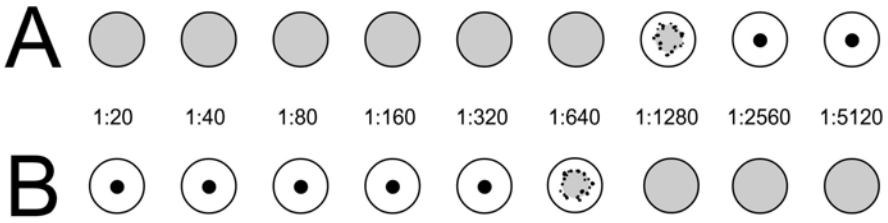


Figure 1. Diagram of a sample hemagglutination assay detecting viral antigen (A) and a hemagglutination inhibition assay for a different bird detecting viral antibody (B). Serial doubling dilutions from 1:20 shows the complete hemagglutination end point in A is 1:640, and the complete hemagglutination inhibition end point in B is 1:320.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Lessons on Biosecurity from the Poultry Industry

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes *Lessons on Biosecurity from the Poultry Industry*, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Lessons on Biosecurity from the Poultry Industry

Biosecurity is the term used to include all measures taken to exclude transmissible microorganisms, parasites, insects, mammals and wild birds from entering and infecting the poultry flock being protected.

The information in this section is presented as a check list, and comes from personal involvement in the poultry industry for 30 years, and recent discussions with Dr P Groves (2005).

1. Farms are isolated and protected by security perimeter fencing to exclude people, dogs, foxes, cats and native animals. Signs are posted at intervals along the fence, and at the entrance to the farm -"Restricted Entry", "Authorised Personnel Only". Entry is not possible without the Farm Manager's authority, acting on Company policy.

2. Flocks are categorised as "Elite" (usually Great-Grandparent and Grandparent), and are usually duplicated in 2-4 locations in Australia. The parent level is a multiplication level and the degree of biosecurity is not as tight as with elite flocks,.

3. Personnel are not permitted to keep pigs, poultry or caged birds at home (similar pathogens that might be transmitted via personnel to birds).

4. Personnel are not permitted to visit other poultry farms or bird shows.

5. Visitors are not permitted entry.

6. Plumbers, electricians and other service-people are required not to have visited other poultry premises for at least 36 hours, and are required to shower in-shower out with complete clothing change, and any tools and equipment they bring on the premises are cleaned and disinfected prior to entry.

7. All personnel entering the farm (including vaccination teams, artificial insemination teams, catchers, etc) shower in and shower out. Clothes are left on one side of the shower, the person showers, and clothing is provided on the farm side. Entry to sub-farms within the farm is by shower in-shower out, with head cover as well. At the parent level, boots only are changed at each sub-farm.

8. A log is kept of all essential visitors. Each visitor is required to sign in and acknowledge that they have not been in contact with birds for the previous 36 hours.

9. A log is kept of all vehicles - they must pass an all-over sanitising spray at the entry point. Particular emphasis is placed on cleaning and disinfecting the driver's floor and pedals, if he/she needs to exit the vehicle whilst on the farm. The driver must not touch anything on the farm with their hands, since steering wheels, gear levers, trafficators and so on are potent fomite surfaces. They may touch controls on the truck.

10. All coops, crates and equipment must be cleaned and disinfected prior to and after use.

11. A strong vector control program is maintained for insect, mammalian and avian vectors, by the use of bait stations, the cleaning up of feed spills, and a policy of no animals or pets at home or on-site.

12. Each building housing poultry mammal and bird-proof: fully enclosed, with no openings to the environment.

13. Vegetation around poultry sheds is mowed regularly, and debris is not permitted to accumulate.

14. All sheds on the farm are cleaned and disinfected between flocks.

15. Litter must be pesticide-free.

16. Each shed contains birds of one age - all-in, all-out.

17. All birds are observed at least twice daily, and any sick or dying birds are collected and submitted to the company laboratory. Sick and dead birds are not carried from sub-farm to sub-farm.

18. A farm communications system avoids the necessity of moving personnel around the farm. Personnel work only in assigned areas and do not go to other areas on the farm.

19. Only pellets formed at a temperature of 85-95°C are used to feed elite flocks. Food prepared while the pelletiser comes up to temperature is routed to less critical farms of the company. Protein sources (soy bean, canola meal, meat meal) are monitored for *Salmonella* spp. Flocks are also monitored for *Salmonella* spp. during their production life. To minimise the possibility of introducing *Salmonella* spp to a farm, elite flocks are fed vegetable protein only.

20. Some farms use surface water. Any solids contained in the water are removed by physical filtration or treatment with alum. Water is chlorinated to 3 ppm residual chlorine, and some farms add UV-light sterilisation. Bore water supply is checked for bacterial and chemical load. Some farms use municipal supplies.

21. In hatcheries, personnel shower in-shower out, and each person works in a dedicated area within the hatchery.

22. Vaccines are an important facet of disease control within an intensive poultry facility.

23. Some companies use bootbaths but “as a tool to reinforce biosecurity concepts”, using boots put on after shower in - shower out .

Reference

Groves P. 2005. Veterinary Consultant, Australian Poultry Industry. Personal communication

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Methods of Transmission of Pathogens

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the *Methods of Transmission of Pathogens*, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Methods of Transmission of Pathogens

Nelson and Tablante (2004) stated that biosecurity is informed common sense - "you do not bring germs to birds and do not bring birds to germs". Personnel and facilities are the weakest links.

Preventing pathogen transmission to birds requires an understanding of how they are transmitted. Transmission is the passing of a disease agent from an infected bird or group of birds to a previously uninfected bird or group of birds. Once inside the body, even in either a vaccinated bird or a previously infected and recovered bird, infectious agents can multiply and be passed from one bird to another. Some can survive outside the body for a considerable length of time in an intermediate medium such as water or food. Others die quickly without the protection of the body. Microorganisms that cause disease (pathogens) may be transmitted from one bird to another by one or more of the following means:

i. **Direct**: Physical transfer and replication of the agent occur through physical contact between an infected bird and a susceptible uninfected healthy bird. Direct contact includes touching an infected individual (including mutual preening), sexual contact, contact with oral secretions (mutual preening, mutual feeding), or contact with body lesions. Direct transmission requires close contact with an infected individual. Examples of diseases transmitted directly in this way include PBFD, papovavirus infection, Pacheco's disease and tuberculosis.

ii **Indirect**. Where a viable infectious agent on a surface enters a susceptible uninfected healthy bird when it contacts the surface and then replicates in that bird. Some PBFD infected birds (for example, king parrots, rainbow lorikeets, budgerigars and eclectus parrots) may excrete the virus without showing clinical signs. Some organisms can survive on surfaces for extended periods. It is possible that some nesting hollows that have been occupied by PBFD-affected birds may harbour viable BFDV for long periods. To reduce transmission by indirect contact, frequently touched surfaces should be properly disinfected. Frequently touched surfaces that may carry pathogens (also called fomites) include:

- Nest boxes, cages, nests
- Transport boxes
- Traps, nets
- Utensils such as knives, spoons
- Food and water receptacles.
- Medical instruments
- Hands, clothing, hair, footwear
- Telephones, including mobile phones. The buttons of any electrical device.
- Computer keyboards, mice
- Pens, pencils, phones, office supplies
- Spectacles
- Door knobs, door handles, handrails
- Keys
- Steering wheels, gear levers etc
- Tables, chairs
- Light switches

- Electrical tools
- Plumbing tools
- Hair, in particular the hairs on the forearms and back of hands.

Examples of diseases that may be spread in this way include PBFD, Pachecos's disease and psittacosis.

iii. **Droplet**, where contaminated droplets contact surfaces of the eye, nose, or mouth. This is also referred to as **droplet contact transmission**. Droplets containing microorganisms can be generated when an infected bird coughs or sneezes.

Droplets are too large to be airborne for long and quickly settle out of air onto fomites.

Examples of diseases transmitted in this way include avian influenza, Newcastle disease and tuberculosis

iv. **Airborne**, where droplet nuclei (residue from evaporated droplets) or dust particles containing microorganisms can remain suspended in air for long periods of time. These organisms must resist drying and be able to survive for long periods outside the body and must be resistant to drying. Airborne transmission allows organisms to enter the upper and lower respiratory tracts. Fortunately, only a few pathogens may be transmitted by air.

Pathogens capable of airborne transmission include:

- Tuberculosis
- Newcastle disease
- Aspergillosis in hatcheries
- PBFD
- Psittacosis

v. **Faecal-oral**: usually associated with organisms that infect the digestive system. Microorganisms enter the body by the ingestion of contaminated food or water. Inside the digestive system (usually within the intestines) these microorganisms multiply and are shed from the body in faeces. A susceptible bird may ingest the pathogen in the faeces, or via contaminated water or food.. Dried faeces around cloaca may be spread over the plumage to other birds by mutual preening. Wooden nest boxes should be destroyed after once-only use. Rain water from gutters may be contaminated with bird droppings

Examples of diseases transmitted in this way are gastro-intestinal parasites, papovavirus infection, salmonellosis, tuberculosis and PBFD.

Faecal-oral transmission can be reduced by:

- Suspending cages
- Placing of food and water receptacles away from possible faecal contamination by the birds.
- Disinfecting frequently touched surfaces to prevent indirect contact transmission
- Increased personnel awareness of hygiene concepts.

vi. **Sexual**: via mating. For example, *Mycoplasma meleagridis* in the turkey

vii. **Iatrogenic transmission**: transmission by medical procedures such as vaccination, administration of therapeutics, artificial insemination and endoscopic sexing.

viii. **Vector-borne**: Agents transmitted by animals such as flies, mosquitos, mites, fleas, ticks, rats, and mammals (e.g., rats, mice). The most common vector for disease is the mosquito, a vector for avian malaria, West Nile virus and avian pox. Since vectors are mobile, they increase the transmission range of a disease. Biting is not the only way vectors can transmit diseases. Diseases may be spread through the faeces of a vector as well as by biting.

ix. **Vertical transmission** can occur either congenitally or genetically.

- **Congenital vertical transmission** occurs *in utero* or *in ovo* as in the case of lymphoid leukosis virus when it is shed by the domestic fowl hen into the egg albumen and transmitted to the embryo. On hatch, the chicks have a chronic viraemia and immune tolerance to exogenous virus. Leukaemia is common in such chicks. Other micro-organisms, such as *Mycoplasma* spp., can access the yolk surface as it contacts the inner surface of the left caudal thoracic airsac when passing to the infundibulum. Organisms are transferred to the surface of the yolk, are enclosed by albumen and shell, and at hatch, they replicate and the chick acts as a source of horizontal transmission (see below) of *Mycoplasma* spp.

- **Genetic vertical transmission** occurs when viral DNA (lymphoid leukosis virus in the domestic fowl) is integrated into gametic DNA of the sperm or ova and transmitted to the embryo.

If the hen excretes an infectious antigen that contaminates the eggshell after lay, the nestling may be infected by the horizontal route (see below) at hatching

Additional terms that are mentioned in relation to the transmission of diseases include the following:

Horizontal transmission may occur through droplet, airborne, faecal-oral, sexual, iatrogenic or vector-borne routes. Direct horizontal transmission occurs when a susceptible bird is infected following contact with an infected parrot or contaminated discharges. Indirect horizontal transmission involves an intermediate vehicle (living or inanimate), that transmits the agent between infected and susceptible parrots (e.g., a person).

Carriers are bird reservoirs of infection that fail to show significant signs of infection. They can continue to serve as a reservoir even after apparent recovery from a disease. Examples of pathogens that can be transmitted by carriers include those causing Pacheco's disease, chlamydophilosis and PBFD (lorikeets, budgerigars, king parrots).

Reference

1. Nelson TM and Tablante NL 2004. Stomp the Invisible Enemy. Web Page: http://www.agnr.umd.edu/MCE/Publications/Publication.cfm?ID=645

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

The Closed Aviary Concept

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the *Closed Aviary Concept*, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

The Closed Aviary Concept

Many of the diseases and problems that arise in aviculture are linked more to mismanagement than to disease agents. In order to counter this problem, the "closed aviary concept" (CAC) was proposed by Speer (1991; 1995), to apply to a single location enclosing all modules of an avicultural facility, with designated areas and limitation of the flow of traffic and fomites .

The CAC has the following tenets:

- Aviculture is farming. The aviary must be productive, irrespective of how many birds are present. An aviary consists of the birds, the buildings and the owner/manager.
- Productivity is the lifeblood of the farm. Without production the farm cannot be supported.
- Time and cost must always be justified. Management effort must be justified in terms of physical time and expense.
- The flock takes precedence over the individual. Flock health concentrates on the group and not on the individual.
- Culling and replacement is fundamental for improvement. If a bird does not perform (health-wise, behaviour-wise or reproductively), it must immediately be removed from the facility (this concept is valid for a domesticated species - culling and selection is domestication, which is not desirable for a species to be released into the wild).
- Stock management protocols are dictated by productivity parameters. Management efforts are dictated by desired production parameters. (This concept applies to a situation where birds will remain in captivity and there is ample genetic base. In an endangered species program, there is a very limited genetic base, and problems of inferior stock may be encountered if numbers are maximised for introduction to the wild).
- The operation shall be restricted to one or a few taxonomic orders or genera. If restricted to one species, disease and management problems are far fewer than with multiple species.
- Preventive medicine is more desirable and economical than symptomatic medicine. It is better to avoid disease than treat it medically.
- Most flock diseases indicate flawed management and are not a viable avicultural diagnosis unto themselves. Whenever a disease appears in an aviary of birds, attention should be focused on defining the links that allowed the disease to establish.
- Short term goals must be prioritised and realised to achieve long term goals. Achieving short term goals brings the long term goals to fruition.
- Drugs are not a substitute for sound management. Over-use of drugs will mask mismanagement in the short term. Multiple drug resistance and subclinical disease will eventually make the avicultural facility unproductive and so uneconomic.

Speer's concept had separate quarantine, breeding aviary and nursery buildings, with separate isolation areas for each of the birds from the breeding aviary and nursery. Exit from the facility was from the breeding aviary and nursery. The concept is as follows in Figure 1 (after Speer 1995, page 270). This diagram, however, is flawed, since sick birds that recover do not go back through quarantine.

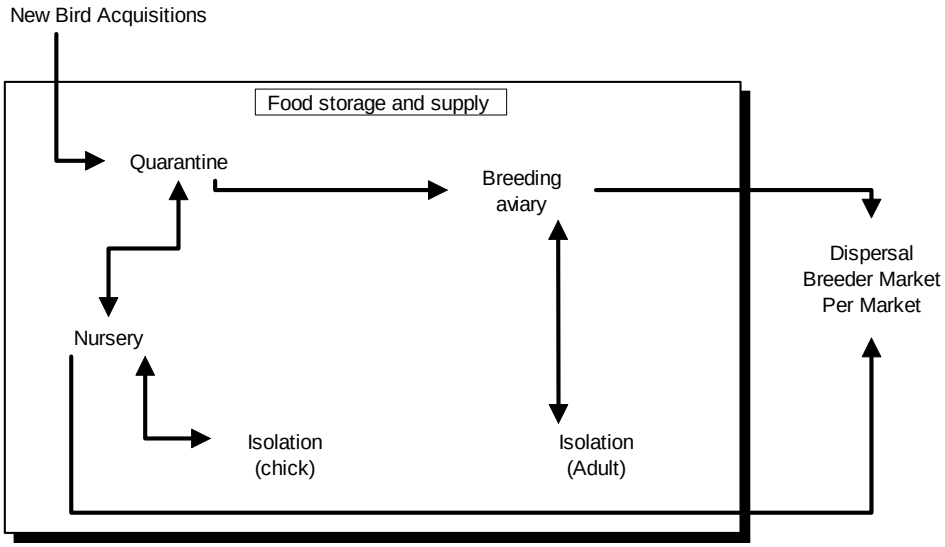


Figure 1: Flow chart illustrating the Closed Aviary Concept

References

1. Speer BL 1991. Avicultural Medical Management. An Introduction to Basic Principles of Flock Medicine an d the Closed Aviary Concept. Vet Clins North Am: Small Anim Pract. **21**: 1393-1404

2. Speer B 1995. The Closed Aviary Concept. *The Large Macaws: Their Care, Breeding and Conservation* ed. J Abramson, BL Speer and JB Thomsen. Raintree Publications Fort Bragg California pp. 267-271

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Full Checklist for the Clinical Evaluation of Captive Birds

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes a Full Checklist for the Clinical Evaluation of Captive Birds, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Full Checklist for Clinical Evaluation of Captive Birds.

History

Aviary History

- Is the floor gravel, sand, dirt or concrete?
- Are perches dowel, natural or other?
- Is the bird in a suspended cage?
- Is the wire stainless steel, galvanised, nylon mesh, or other?
- How old is the aviary? Does the metal show signs of weathering?
- How often is the floor of the aviary cleaned or changed?
- Contact with wild birds?
- Is the aviary pest (rodent, insect) and predator (rodent, snake) proof?

Social History

- Reproductive status?
- Captive bred or wild caught?
- Hand reared?
- Number in aviary?
- Time in captivity?
- Tame, timid or aggressive?

Nutritional History

- Food and water dishes cleaned daily?
- Are the feeding and watering receptacles metal, plastic or ceramic?
- How often are food and water changed?
- Is the bird eating?
- Has the diet been changed recently?
- Dietary components – seed, natural or commercial
- Water source – rain, dam, tank, town, chlorinated, fluoridated?
- Are water pipes copper, galvanised or plastic?
- Food storage: temperature, humidity, length of time
- Food preparation - hygiene

Visual Examination in Aviary (if possible)

- Are feathers normal?
- Are feathers missing? PBFD
- Is the bird bright, alert and responsive?
- Is the bird fluffed-up or listless and sleepy - indication of illness.
- Is the bird coughing, sneezing, vomiting?
- Is there an eye (ocular) discharge? A nasal discharge?
- Is the bird tail-bobbing or mouth-breathing (respiratory effort)?

Droppings

- The amount of faeces is determined by feed intake
- Are the urates white or discoloured (off-white, green?) Budgerigars defaecate 20-50, and sulphur-crested cockatoos 8-12 times a day.
- Diet determines appearance
- Fruit and vegetables in diet can increase the size of the dropping, or increase/discolour the urine content
- Seed diet - formed green stool
- Formulated diet - a larger stool with more water. If food is coloured, faeces will be that colour. A bird may eat only one colour (usually red). More urine on formulated diet - drinks more water
- Fruit/vegetables - colour - more watery droppings
- Blood - abnormal. If there is blood, is it clotted, on the surface of the faeces, or mixed with faeces? Cloacal papillomas?
- Size. Usually big one first thing in the morning. If large droppings persist during the day, a problem
- Fewer and larger droppings when female is in a reproductive cycle - oviduct presses on intestine.
- Undigested food - abnormal
- Watery urine - excess greens, heavy metal poisoning
- Watery faecal portion - enteritis
- Urine: blood - heavy metal intoxication?

Clinical examination involves a systematic head-to-toe approach

Physical Examination

- Assess body mass
- Evaluate pectorals
- A bird in good body condition has a rounded, firm pectoral muscle and minimal subcutaneous fat
- A thin bird has a prominent keel and wasted pectorals.
- Fat birds often have large fat pads over pectorals and protruding abdomens
- Get *everything* you will need ready *before* capture and perform the examination in a closed, small, uncluttered room with no clear windows and all fans turned off. Dim the lights for diurnal species and use bright lights for nocturnal species.
- Always have a net ready to capture escapees

Feathers and Skin

- Feathers should be smooth, shiny and clean with normal colouration.
- Small clots of blood may matt feathers together and obscure small puncture wounds below.
- Presence of mites, lice: hold wings extended, up to light to check for mites and eggs within the feather vanes (may need slight magnification aid).
- Powder down should be present, large amounts will be produced by the cockatoos.
- Missing groups of feathers or misshapen feathers indicates PBFD or APV infection.
- Presence of mites, lice
- Check skin for evidence of burning (eg, electrocution)
- The keel is vulnerable to trauma, acute or chronic.

The Head and Neck

- Check skull for bruising, lacerations
- Eyes clear, moist, shining, symmetrical, centred
- Iris muscle striated and partially under voluntary control
- The eyes, sinuses and nasal cavity are all related anatomically, so infection of one may involve all three.
- There should be no discharges from the eyes, nostrils or choanal slit. Swellings and feather loss around the eye may indicate sinusitis
- Check for the presence of mites in the trachea using a bright light through the stretched skin of the neck. May also indicate of the trachea is congested or contains fluid
- Beak should be healthy and shiny, but covered by powder down in those species that produce it
- Beak abnormalities are common, usually asymmetry or abnormal length are seen: upper/lower length; overgrown side; crossed beak; grooves; cracks, necrosis. Psittacine beaks should be covered in powder down
- Maxillary and mandibular portions of beak should meet evenly
- A sticky, matted head indicates vomiting
- Open beak and inspect oral cavity: tongue, choana, and glottis
- Inspect ears for signs of discharge, polyps, tumours, parasites or erythema
- Palpate the neck for neck injuries, oesophageal fistulae. Staining of feathers may be the only evidence of a neck wound.
- The crop should have soft fluctuant contents. Look for crop fistula.

The Limbs

- Extend wings to check for normal colour, range of movement, masses, feather picking, fractures and luxation.
- Should be equal length and carried evenly and correctly.
- Lice and mites. Do not forget to examine joints
- Extend legs and check grasp (if bird is alive), range of movement, masses, feather picking, fractures and luxation.
- Check skin of legs.
    - Excessive scaliness is associated with nutritional deficiency,
    - Honeycomb-like lesions and tassle-foot indicate *Cnemidocoptes* spp (scaly leg and face mite).
    - Leg bands – bands can be open or closed
    - Plantar aspect of foot - bumblefoot
    - Trauma

The Pectoral area and Abdomen

- Should be flat, forming part of a continuous curve with the keel bone.
- If the abdomen is enlarged, it could be fluid or a solid mass
- Palpate from the side, especially if egg bound, to avoid life threatening compression of the caudal *Vena Cava*.
- Eggs, neoplastic masses and fluid can be palpated.
- Examine preen gland at base of tail in those species that have a preen gland

Cloacal Examination

- The cloaca should be clean. Pasting of the vent is due to diarrhoea or may be associated with leg weakness, obesity, severe generalised weakness or abdominal masses.
- Checking for cloacal papillomas is most important when examining the South American spp such as macaws, amazons and toucans.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Checklist for the Clinical Evaluation of Wild Birds

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes a Checklist for the Clinical Evaluation of Wild Birds, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Checklist for Clinical Evaluation of Wild Birds.

Clinical examination of wild birds is covered in the section Full Checklist for Clinical Evaluation of Captive Birds, with the following variation for history:

History

- Site and date of collection
- Species, sex, date and location of collection
- Name and contact details of finder
- Is sickness related to age (young, old)?
- Reproductive status?
- Is this the only bird sick/dead, or are more than one sick/dead?
- Are more than one species involved?
- Are there any recent changes in the environment - storms, rain, temperature?
- Any treatment received prior to examination?
- Any unusual behaviour or physical appearance?
- How many birds are at risk in the area?

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Protocol for Field Evaluation of Psittacine Beak and Feather Disease in Wild Australian Psittacine Birds

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes a Protocol for the Field Evaluation of Psittacine Beak and Feather Disease in Wild Australian Psittacine Birds, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Protocol for Field Evaluation of Psittacine Beak and Feather Disease in Wild Australian Psittacine Birds

---

Psittacine Beak and Feather disease (PBFD) can affect all Australian psittacine birds of any age. It is a viral disease characterised by feather abnormalities, beak and claw deformities and eventual death. PBFD should be considered in any bird showing signs of abnormal feather loss or development. This document will set out how to identify birds with the disease.

The feathers of psittacine birds (and other genera) are dusted with a fine talcum powder-like substance, powder down. Small amounts of this powder are produced by powder down feathers (pulviplumes) located among ordinary feathers, but in some species (cockatoos and cockatiels) the major part is produced in areas of powder down feathers called the powder down patches. In cockatoos and cockatiels the powder down patches are located over the back, just above the tail base, between the shoulder joint and hip joint on both sides. Parrots do not have powder down patches, but significant amounts of powder down are produced by pulviplumes distributed among the other feathers. Powder down may contribute to waterproofing and dims the sheen of a feather. When psittacine birds are handled, powder down is transferred to the hands, fingers and clothes (Figure 1). If you rub your fingers together, a greasy or slippery sensation is felt. Lack of powder down is highly suggestive that the bird is currently affected by BFDV.

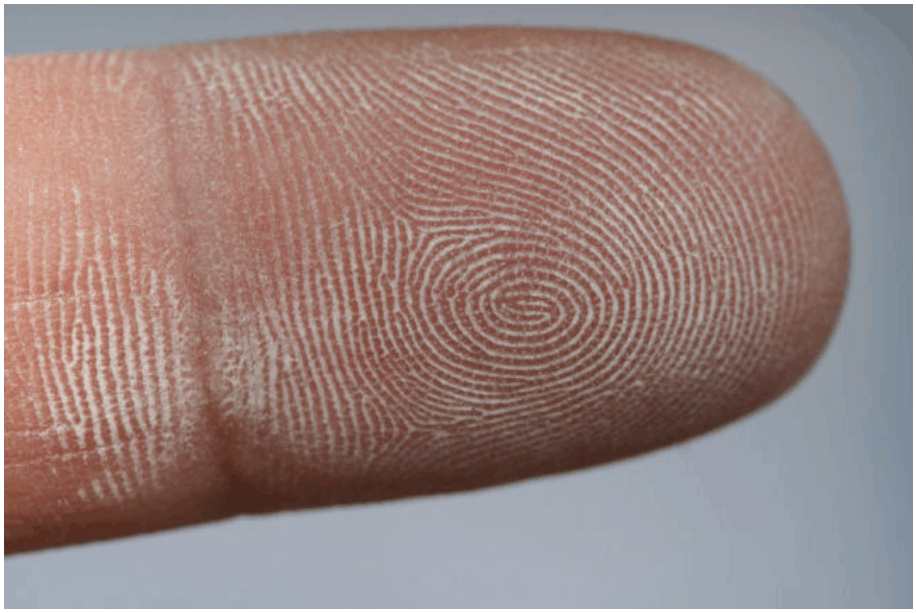


Figure 1

Powder down feathers are the only ones that grow continuously, and instead of moulting, the tips disintegrate into flakes of keratin. This keratin is distributed among the plumage by preening, and coats the beak with a fine floury film. Since these feathers are continuously growing, PBFD virus can infect their active follicles

(those of other feathers may be inactive at the time) and kill them. Thus the first sign of PBFD in psittacine birds is a lack of powder down, leading to dirty plumage in white psittacine birds, and a shiny beak). The classical signs of feather loss and distortion, constriction and congestion of the quill (the calamus or featherless portion of the rachis that is inserted into the skin) are not seen until the major feather moult, and this could take up to a year. Immature lorikeets affected by PBFD often have bilaterally approximately symmetrical irregularities in the surface texture of both upper and lower beaks that is more obvious when viewed with oblique lighting. These beak changes are very common in young "runners" but often grow out (like a "black hammered nail") as the beak lightens in colour. All normal cockatoos have a bald spot on the head, covered by the crest feathers.

The signs of PBFD may be classified into acute (sudden and rapid onset) and chronic (insidious and long term).

Acute PBFD

The acute phase is rarely seen, and usually occurs in fledgling birds during their first feather growth after replacement of the neonatal down. Some cockatoo chicks may be affected while they are still covered with neonatal down, and so no feather abnormalities will be seen. Affected birds are depressed, have an empty crop and a watery yellow or green diarrhoea. BFDV can cause an acute hepatitis and high titres of virus can be detected in the livers and bile of affected birds. Indeed, some birds may die of acute hepatitis without obvious feather lesions. The primary flight and tail feathers may be rapidly lost, surrounding the bird in its nest hollow (Figure 2). There may be no quill necrosis, but the quill is swollen, soft, wet and full of blood, bending easily (Figure 3). If the blood is squeezed out, the quill remains flattened. The area where the feathers where connected to the wings or tail is wet (from subcutaneous oedema - Figure 4). Death can occur within one week of showing signs, with some birds proceeding to the chronic phase.

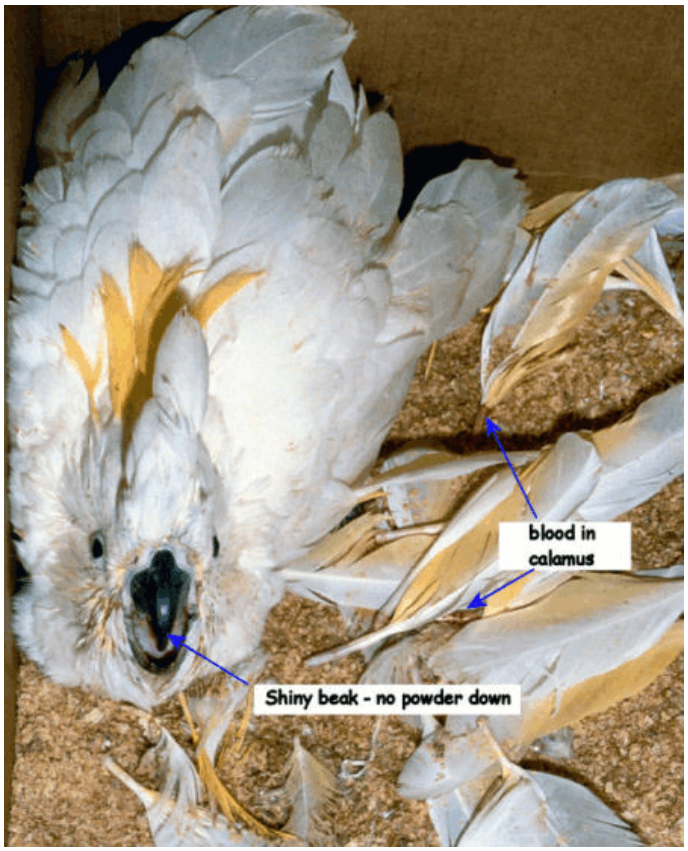


Figure 2

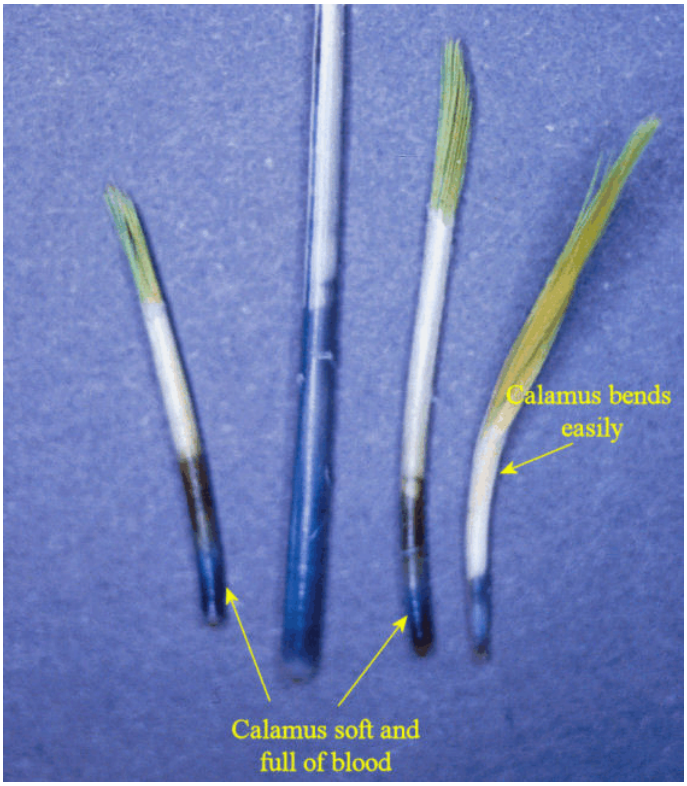


Figure 3

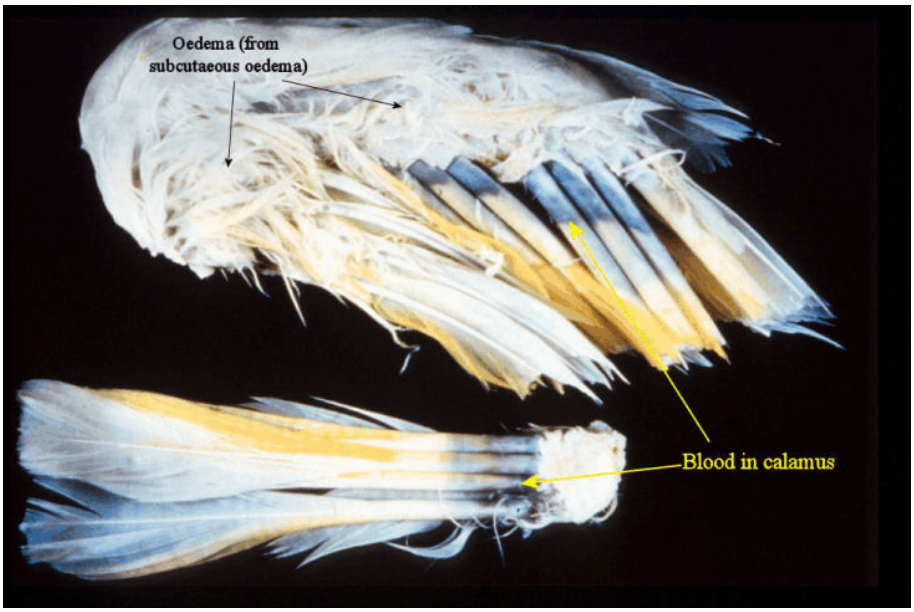


Figure 4

Chronic PBFD

Chronic PBFD develops slowly and becomes more apparent at a moult, and an affected bird may lose its feathers without appearing sick. Feathers that are shed (they can also be easily plucked) are usually shorter than normal, with a constriction of the quill, drying and twisting of the quill tip, curling and twisting of the quill, and dried blood within the quill (Figure 5).

Figure 5

In *Neophema* spp., king parrots and lorikeets, apparently normal feathers which fall easily with minimal handling, may be the only clinical sign. The first clinical sign in birds with green plumage may be the development of yellow feathers which appear grossly normal in other respects (Figure 6).

Figure 6

On the extremities the skin may become scaly, thickened and moist. Areas no longer covered by feathers may become sunburnt (appearing bluish in sulphur-crested cockatoos and orange in Major Mitchell cockatoos - Figure 7). Chronic skin ulcers can occur at the elbows and wing tips (Figure 8). Beak, and less commonly, claw deformities occur in some birds, particularly cockatoos and rosellas (Figure 9). The oral surface junction of the upper beak with the hard palate is where beak necrosis may first be recognised in cockatoos. It may be seen as a brown crusty scabby lesion that bleeds easily if scraped. The beak can become abnormally soft and brittle and the upper and lower tips elongated. Transverse or longitudinal fractures or delaminations often occur. In severe cases, necrosis of the oral epithelium and osteomyelitis can cause the beak to slough (Figure 10).

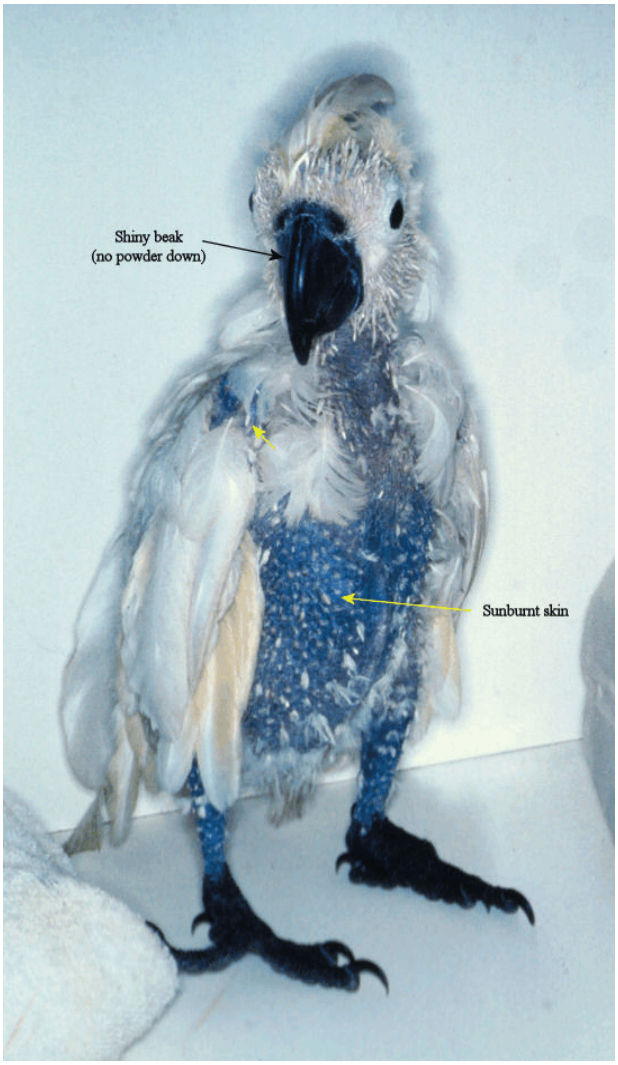


Figure 7

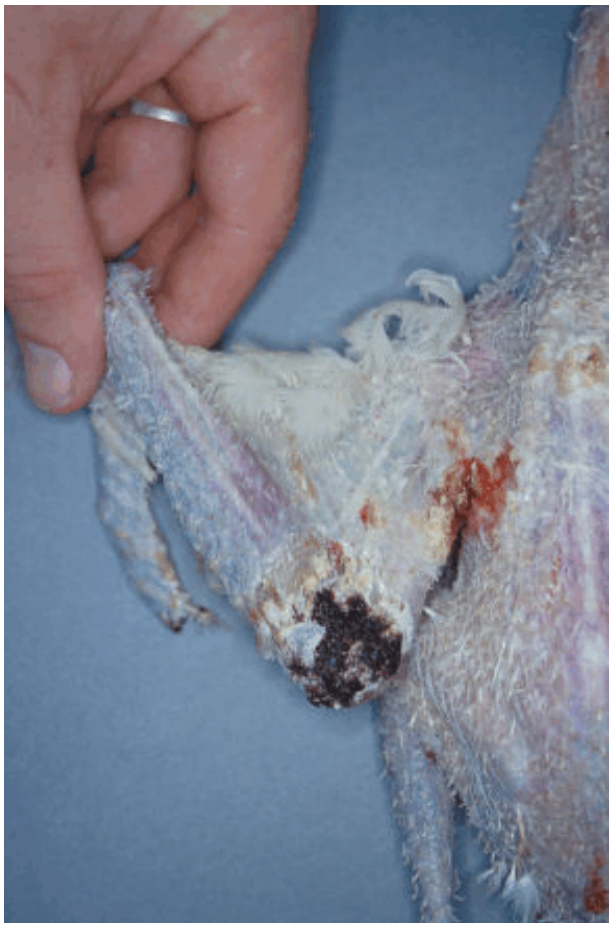


Figure 8 - Chronic skin ulcer at elbow of SCC

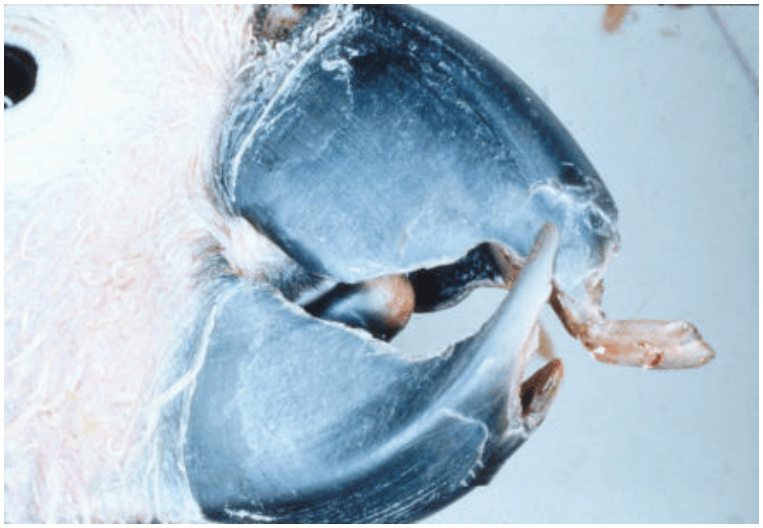


Figure 9

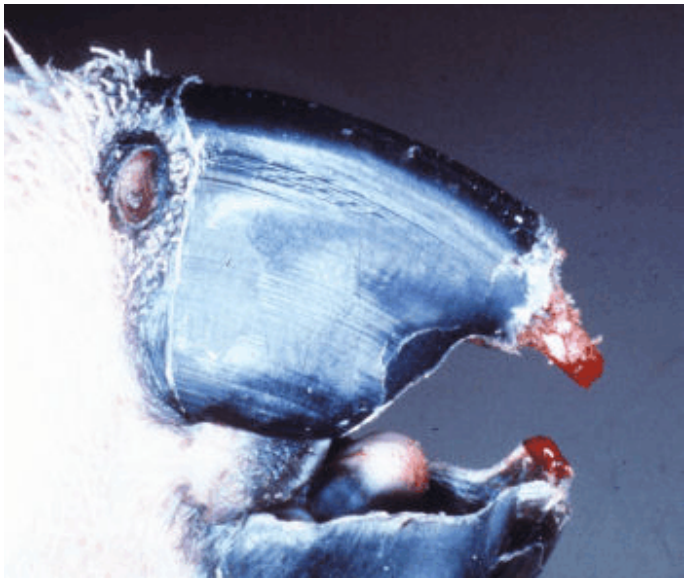


Figure 10

Some species resist the effects of the virus. Budgerigars (*Melopsittacus undulatus*), lorikeets (*Trichoglossus* spp), king parrots (*Alisterus scapularis*) and eclectus parrots (*Eclectus roratus*) may show no signs other than growing discoloured feathers (yellow where green feathers should be). Usually they lose only their primary and tail flight feathers ("runners"), and these may or may not grow back (Figures 11 and 12).

Pathology tests are necessary to confirm many cases of PBFD.

Figure 11

Figure 12

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Sample Collection

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes Sample Collection and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Collection of Samples for Submission to a Laboratory

Specimen Collection

i. *Collection of Tissue Samples*

Microbiology

Tissues should be collected using clean forceps and a scalpel. Collect about 5 g of tissue and place it in a sterile 25 ml container, place in a small plastic bag, seal and label the bag using an indelible marker. You may wish to place the bag and seal it in a second bag. Always collect tissue for refrigeration or freezing (bacteriology or virology) as early as possible during the necropsy to avoid contamination by gut contents, feathers or other organic matter. If necessary, collected tissues may be placed in a refrigerator (4-8°C) or freezer (-20°C or colder is best) and maintained at that temperature until shipped to the laboratory.

Histopathology

Specimens for histopathology should be sufficiently small to allow for adequate fixation. A piece of tissue should generally be no thicker than 5 mm. If there is a lesion, ensure that there is a portion of "normal tissue" adjacent to the lesion, since many diseases are diagnosed based on microscopic examination of the "margin" between a normal and abnormal tissue. If you have not shipped the specimen after 24 hours, change the formalin to ensure that thorough fixation is obtained. Note that in most instances, all tissues from the one bird may be placed in the one container.

ii. *Collection of faecal samples*

Birds' droppings are a combination of faeces (dark), uric acid crystals or urates (white) and urine (colourless and rarely seen in the field) (Figure 1). The uric acid portion may be dissolved in the urine portion. The consistency and colour of droppings vary with diet, water consumption and species of bird. Blood may arise from the cloaca, digestive or urogenital tracts. Yellow or green-stained uric acid may indicate a liver problem. Undigested seed should be considered abnormal and indicates a primary mal-digestion problem and/or rapid passage of ingesta through the digestive tract.

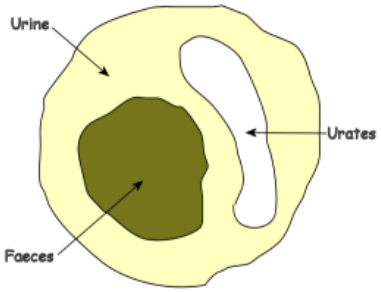


Figure 1: Diagram of a typical avian dropping. The urine is coloured yellow for clarity. Mostly it is colourless and clear.

- Swabs intended to detect the presence of an organism in faeces should be covered with readily visible quantities of faeces.
- A cloacal swab is most likely to detect what is present within a host compared to a fresh faecal sample that is more likely to detect what is present within a host as well as what is present on and around the sampled area.
- When collecting a fresh faecal sample, ensure that it is not contaminated with urates or urine, and that you do not force the swab beneath the faecal material. If for bacterial culture, place the sample (fresh) in a sterile container.
- Worm eggs in faeces may be identifiable up to 7 days after being passed by the bird.
- For motile protozoa, faecal samples must be examined microscopically within 10-15 minutes of being passed.

Faecal smear

A faecal smear may be made by placing a drop of faeces or a solution of faeces in saline, on to a slide and spreading it thinly. Allow to dry or dry with a hair dryer for shipment to the laboratory. The smear may be fixed by heating gently for a few seconds in the flame of a Bunsen burner or the heat from a hair dryer. Advise the laboratory that you have done this.

iii. ***Collection of blood samples***

- **Anticoagulated blood samples**

  - Blood samples are collected into different types of tubes according to what test is desired.
  - Blood must be drawn with a minimum of negative pressure or trauma and be gently mixed (inverted but never shaken) with the anticoagulant. Partially clotted samples are of no value either to you or the laboratory.
  - Venous blood is preferred since samples are less likely to be clotted or haemolysed.
  - Test requiring whole blood should be collected in the correct anticoagulant with the correct blood to anticoagulant ratio (1-2 mg EDTA per ml).
  - Store samples at 4°C. Air-dried blood smears are stored at room temperature and should never be refrigerated (condensation may destroy cell morphology).
  - Do not pack the blood in direct contact with dry ice, wet ice, pre-frozen ice-packs or other frozen specimens, even if the container in which you place the blood is insulated.
  - For serum or plasma samples, time, heat and vibration can haemolyse red blood cells, releasing mainly potassium and lactic dehydrogenase into the serum. After separation from the clot, storage at room temperature and rapid transportation to the laboratory ensure accurate results.
  - Blood should be collected in the supplied tubes to the "fill line" indicated. If you fill the tube with too much blood, the sample may clot. If filled with too little blood, the erythrocytes may contract due to osmosis. Paediatric tubes are used for collection of avian blood.

  Anticoagulants most commonly used are as follows:

  Purple top: This contains potassium - ethylene diamine tetra acetic acid (EDTA) and is used for complete blood counts and lead estimation. EDTA binds calcium in the blood and so prevents coagulation. Always submit two air-dried and fixed blood smears as well.

Green top: This contains lithium heparin, which prevents coagulation by interfering with the conversion of prothrombin to thrombin and the action of thrombin on fibrinogen. Blood for avian CBCs is best collected in heparin.

- **Clotted blood samples**

Serum is preferred to plasma for the majority of biochemical tests, since the anticoagulants used to obtain plasma may either contain or bind with the item being measured.

Blood is collected into a red top (plain) tube that contains no anticoagulant and allowed to clot. For serologic assays, serum should be separated from the clotted blood as soon as possible to prevent deteriorating red blood cells from contaminating the serum. After about 1 hour at room temperature the clot should be gently separated from the side of the tube and allowed to retract. After the clot has retracted (after 2-3 hours at room temperature), centrifuge the sample and transfer the serum using a Pasteur pipette into a clean plain tube. If a centrifuge is not available, wait 4-6 hours, do not agitate the tube, and gently transfer as much serum as possible with a Pasteur pipette, being careful not to transfer blood cells.

If blood is collected in a tube with polymer gel and clot activator (SST - serum separator tube), the clot will form more rapidly.

- **Blood sample on filter paper**

  - Place several drops of blood from each bird directly onto a piece of Whatman No. 3 filter-paper (Brugh and Beard 1980; Park *et al* (1987).
  - Allow the blood-soaked filter-paper to dry in a vertical position at room temperature at 37°C for 2 hours.
  - Keep the sample at room temperature - there is no need to refrigerate.
  - Submit the dried sample to the laboratory for analysis.

iv. ***Collection of Samples for Microbiology (bacteriology or virology)***

- Tissue swabs may be collected for virology, bacteriology or serology. Always observe aseptic technique.
- Always collect samples for microbiology in sterile containers.
- Biopsy material can be aseptically wrapped in sterile gauze soaked in sterile saline and placed in a sterile container.
- Swabs for bacteriology are supplied with transport medium incorporated in the tube into which the swab is placed for transportation to the laboratory. This medium prevents the swab from drying out and preserves the bacteria.
- If a bacteriological sample is collected with a swab, ensure that the swab is inserted into the transport medium at the bottom of the tube into which the swab is inserted. Swabs for bacteriology do not require refrigeration if shipped within 24 hours.
- Viral transport medium needs to be maintained at 4°C until the sample is placed into it. Swabs or tissues for virology need to be frozen until shipped and during shipping. Some viruses cannot withstand freezing, particularly the enveloped RNA viruses. It is better to contact the laboratory before shipping a sample, especially if you know what type of virus you are interested in isolating.
- Always ensure that the swab is within the expiry date period.
- Swabs of the oral or choanal areas should be slightly to moderately moist following

sample collection.

- It is advantageous to submit an air-dried smear, prepared prior to plunging the swab into the transport medium - air-dried smears for microbiology should not be fixed. These smears should be left at room temperature. Smears should be made using another swab so the swab submitted for microbiological investigations is not contaminated from touching the slide.
- The immunoassay for chlamydial antigen requires a conjunctival swab that HAS NOT been placed into transport medium.
- For blood cultures, overnight incubation at 37°C is optimum for growth of any organisms present, but subsequent transportation in an esky (ie with an ice brick) will not harm the organisms, merely inhibit further growth. The organisms grown overnight will be ample for laboratory identification and further investigation.
- Sterile, sealable swabs, not cotton-tipped applicators, should be used for collecting samples for culture, cytology, or PCR-based assay.
- The type of swab chosen will vary based on the type of culture submitted (ie, aerobic or anaerobic, viral, bacterial).
- Swabs containing a liquid transport medium (not gel), should be used for collecting samples for virology. It is better to submit a dry swab for PCR and not place it in liquid.

v. *Blood Collection Sites*

The blood volume

The blood volume of birds is 6-12% of body weight. Up to 10% of the blood can safely be collected from a normal healthy bird (ie 1% of its body weight).

SCC	800 g	8.0 ml
galah	360 g	3.6 ml
rosella	200 g	2.0 ml
budgerigar	40 g	0.4 ml

A minimum of 0.5 ml is needed for packed cell volume (PCV), red blood cell count (RBCC) and white blood cell count (WBCC) and differential. In the smallest birds, however, only 2-3 drops can be collected.

One person can restrain a bird (up to 2 kg) for bleeding from the jugular vein. However, considerable training is required to become adept at bleeding from the jugular vein, and this is why most people opt to bleed from the wing vein. An assistant will be needed when bleeding from the wing or medial metatarsal vein. The medial metatarsal vein in some species (penguins, waterfowl, raptors and pigeons) is more reliable than the wing vein.

Venepuncture technique

- The choice of site for venepuncture in birds depends on the species, the level of assistance and personal preference. As with other species adequate restraint is the most important factor.
- A fine needle (25 - 30 gauge), depending on the size of the bird, and a tuberculin or 2 mL syringe are best.
- Ensure that the plunger of the syringe is free before you start!
- Drawing back too hard on the plunger of th/e syringe can cause the vein to collapse, only slight negative pressure is required.
- Slightly withdrawing or turning the needle sometimes starts blood flow.
- Squeezing the foot when bleeding from the medial metatarsal vein helps blood flow. Wild birds are generally easier to bleed than tame birds due to the greater blood pressure from stress.

- Do not use heparinised syringes and then transfer blood samples into EDTA as the cell morphology is irreversibly altered.
- *Always be ready to apply pressure to the venepuncture site after removing the needle to minimise haematoma formation.*

Jugular vein

- The right jugular is usually much larger than the left and is located on the right side of the neck adjacent to the trachea. This is great for right handed, but not so good for left-handed, people. The jugular is the vein of choice for collecting large volumes of blood. It is impossible to accidentally stick the carotid. The site is recommended for all birds up to 2 kg body weight, and assistance is usually not needed.
- It is readily seen because most birds (except pigeons and some waterfowl) have a featherless tract in this area. The jugular vein is best not used in birds that lack a featherless tract in this area.
- Wrapping the bird in a towel often prevents the bird from flapping and scratching. However, more control is obtained by using bare hands, but this requires much confidence in restraint of birds.
- Restrain the bird on your lap, with your right elbow leaning gently on the bird's right side.
- Small birds may be held in the left hand, ensuring that the abdomen is not compressed (so as not to compromise respiration).
- Do not apply pressure on the bird's abdomen, since the bird needs the abdomen to breathe. Mild pressure can be applied to the thoracic area, however.
- Separate the feathers on the right side of the neck and expose the jugular vein.
- Stretch the neck between the index finger and thumb because the vein and other structures are very mobile. The vein is occluded with the left thumb, and the neck slightly flexed to the bird's left.
- The feathers of the neck can be flattened with a very small amount of 70% alcohol, allowing the area to be seen without obstructing feathers.
- Do not pluck the feathers from this area as you may tear the skin.
- The vein should be entered with the bevel side up in the direction of the head.
- Left-handed people prefer to enter the vein in the direction of the tail.
- Obtain the desired amount of blood by gently and slowly withdrawing the plunger.
- Apply gentle pressure to the entry site until there is no evidence of bleeding.
- Release the bird's head.

Brachial (wing) vein

- The brachial vein is suitable for all birds but is generally used on larger caged birds . This is the vein of choice for gallinaceous birds and pigeons.
- An assistant restrains the bird on its side on a flat surface, and pulls the lower wing out.
- The vein can be seen on the ventral surface of the humerus (a superficial branch runs across the elbow) directly beneath the skin.
- The vein is very mobile.
- Swab the area with 70% alcohol and introduce the needle into the vein.
- Place pressure over the vein until bleeding stops.
- A subcutaneous haematoma frequently forms. This can be minimized by:
  - directing the needle distally;
  - sliding overlying skin to one side during sampling and then allowing it to move back on removal of the needle, prior to applying pressure on needle removal; and
  - collecting directly into a micro haematocrit tube
- The skin over the vein of small birds may be sterilised with 70% alcohol, allowed to dry, and the vein gently pricked with the tip of a hypodermic needle and blood collected with a capillary tube. Smearing the skin with a small amount of petroleum jelly makes the

blood form a large drop which can be more easily collected.

Medial metatarsal (leg) vein

This is a useful site for larger species including waterfowl, penguins, gallinaceous birds, raptors and pigeons. The vein is located on the medial side of the lower leg running dorso-medially over the tibiotarsal-tarsometatarsal joint and crosses the tibiotarsal joint at its flexor aspect.

The vein is visible in most species although it may be difficult to locate in wrinkled or pigmented skin. Adequate assistance with restraint is important, especially with raptors. The advantages of this technique are that there is a very low risk of haematoma formation and it is useful for rapid multiple collection of smaller samples. Multiple attempts at blood collection will result in tissue thromboplastin contamination of the sample and clot formation. In small birds, the area may be sterilised with 70% alcohol, allowed to dry, and the vein gently pricked with the tip of a hypodermic needle and blood collected with a capillary tube.

Blood Smearing technique

A blood smear is made with blood containing no heparin or EDTA The slide to slide technique commonly causes cellular rupture, especially of white cells (smudge cells). Using bevel-edged microscope slides will reduce this effect.

The coverslip to slide (see Figure 2) or coverslip to coverslip methods are
considered the most likely method to avoid damage to the fragile avian WBCs and hence will minimize smudge cells.

- Place one drop of fresh unclotted blood in the centre of a microscope slide near the frosted end.
- Gently drop a coverslip (24 mm x 50 mm) on top of the blood at right angles to the slide.
- As blood begins to spread, pull the slide and coverslip apart horizontally.
- Do not allow the blood to spread to the sides of the coverslip before producing the smear.
- Do not pull the coverslip away from the slide's surface when making the smear.
- Rapidly air dry or use an air conditioner or hair dryer gently on low setting and do not refrigerate (condensation will destroy cell morphology).
- Identify each slide with date and the animal's identification.

The coverslip to coverslip technique is similar to the slide to coverslip method.

Be aware that during transportation, cover slips with smears are more prone to damage than glass slides.

Blood smears should not be refrigerated and must be kept dry (condensation may destroy cell morphology). They must reach the laboratory within 3-4 days. If fixed with absolute methanol for 5-10 seconds and then dried, they may be kept much longer. Advise the laboratory that the smears have been fixed with absolute methanol.

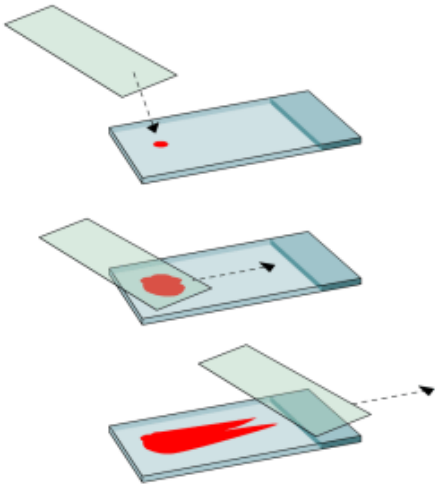


Figure 2. Method of preparing an avian blood smear by the coverslip to slide technique.

HYGIENE PROTOCOLS FOR THE PREVENTION AND CONTROL OF DISEASES (PARTICULARLY BEAK AND FEATHER DISEASE) IN AUSTRALIAN BIRDS

5 – Checklist for Clinical Examination of Captive Birds

This form has active fields that cannot be incorporated into this document. Please refer to the document checklist-form-clinical-examination.pdf

6 – Checklist for Field Clinical Examination

This form has active fields that cannot be incorporated into this document. Please refer to the document checklist-form-field-examination.pdf

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Full Necropsy Protocol

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes a Full Necropsy Protocol. It has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Full Necropsy Protocol (Captive Bird)

Introduction

It is important that personnel who may be performing necropsies undergo training in the technique, including specimen collection and how to submit them. This is especially important now that avian influenza has become a significant threat.

While conducting your necropsy, you will look for changes in size, colour, shape and texture of organs and the presence of foreign bodies.

Occasionally, carcases may need to be frozen. In these circumstances, and after recording the findings of a full inspection of the skin and plumage, wet the plumage with a 1% detergent solution, placed in two sealable plastic bags, and store at -20°C or less. The detergent allows the liquid to penetrate the feathers, preventing them acting as insulation and so delaying the cooling of the internal parts of the carcase. Identify each frozen carcase with a number, sex, whether adult, sub-adult, young or neonate, the dates of collection and of freezing, the findings from inspection of the skin and plumage, and any signs were observed prior to death (if the bird was not found dead).

A necropsy needs to be undertaken:

- to determine why an individual bird has died
- to collect specimens from a bird or birds when it is known what caused the death(s)
- to investigate multiple mortalities in one species in an area
- to investigate multiple mortalities of more than one species in an area

A necropsy may be undertaken with assistance. If assistance is not available, then the person conducting the necropsy should have a hands-free voice recorder to record all observations. Begin recording just prior to donning disposable gloves, and place it in a secure pocket. Ensure that the microphone does not interfere with your mask. Never touch the recorder while you are wearing gloves. Alternatively, you may rely on your memory and fill in a checklist at the end of the necropsy.

If images need to be taken, and assistance is not available, then disposable gloves are to be removed and the image taken. Under no circumstances is the camera to be handled with disposable gloves.

Human Health

Zoonoses

Some avian diseases of Australian native psittacine birds are transmissible to humans (eg, *Chlamydophila psittaci*, Salmonella spp, rarely influenza type A, certain subtypes). Take care when doing a necropsy on a native bird:

Safety

Where will the necropsy occur? Safety precautions are more easily implemented in a designated necropsy room, then in the field. If in the field, ensure that you can adopt a comfortable standing position and have a rigid surface on which to place the bird.

Do not contaminate the environment with infectious material, or contaminated equipment.

Formalin

- Formaldehyde is used to preserve tissues for histopathology and is a potential carcinogen that may cause illness in later life from excessive uncontrolled exposure
- Avoid unnecessary exposure to formalin. Good ventilation is vital. Avoid inhaling the vapour.
- Be aware of the carcinogenicity of this chemical, and to exercise care when placing samples in it.
- Never pour formaldehyde down a sink. Take precautions to prevent contaminating the environment with formaldehyde.
- Return unused formaldehyde to a central location for disposal.

History

Record

- The location
- Species involved:
  - adult, sub-adult, juvenile, neonate, egg
  - male, female, sex undetermined
- Number of animals involved
- Clinical signs.
- Take images, preferably with a digital camera, being very careful not to contaminate the camera.

Euthanasia

The intravenous administration of sodium pentobarbitone (100 mg/kg) is preferred. Dilute 1:1 for small birds and 1:3 for very small birds to avoid artefactual changes in the vessels and heart due to pentobarbitone toxicity.

Cervical dislocation is an acceptable method for birds weighing less than 1 kg. The operator must be able to perform this procedure quickly and effectively, so that consciousness in the bird is immediately lost.

Note

Birds lack a diaphragm and the cavity housing the viscera is referred to as the coelom. However, the terms “thorax” and “abdomen” will be used in this document to refer to the areas that are separated by the diaphragm in mammals. In some cases the term thoracoabdomen may be used, meaning the coelom, or both the thorax and abdomen.

Procedure

If you are unsure of what has killed the bird, or if it has been presented as "sick", then it is important that a complete range of tissue and blood samples be obtained from the carcase. If only a selection of samples is obtained (eg, because a particular disease is suspected), then other diseases (which require other samples to exclude their presence) cannot be excluded. If you know the bird was sick, or died from a particular disease, then you may take appropriate samples for that disease. However, always be guided by the laboratory to which you will be submitting samples.

The necropsy must be performed as soon as possible after death to avoid decomposition of internal organs. Always indicate if samples are sterile or non-sterile

External examination

After donning protective clothing (see Equipment Lists) note the species, sex and weigh the bird
Note leg band numbers, if present, or other identification

If you need to take morphometric measurements, ensure that the measuring equipment is metallic or plastic, so that it can be disinfected after the necropsy.

- A bird in good body condition has rounded, firm pectoral muscles and minimal subcutaneous fat.
- A prominent keel and wasted pectorals indicates weight loss.
- Fat birds often have large fat pads over the pectorals and protruding abdomens
- Palpate the legs and wings, feeling for fractures, dislocations, lumps or deformities.
- Palpate the joints for swelling
- Examine the skin, plumage, beak and nails
- In psittacine birds, look for presence or absence of powder down.
- Feathers should sit tightly, be clean, and not damaged or misshapen
- Is the bird moulting?
- Missing or mis-shapen feathers may indicate PBFD, APV infection or feather picking
- Signs of trauma
- Examine body orifices - eyes, nares, oral cavity, ear, vent for discharges, foreign bodies.
- Look for external parasites
- Examine the uropygeal gland (if present in the species)
- Examine the beak and nails for deformities, fractures or delaminations
- Are the nails normal, overgrown or distorted?

Wet the bird's feathers with a warm 1% detergent solution. This allows the water to penetrate the feathers and prevent powder down/dander floating and being inhaled or contaminating the viscera. Ensure that the head does not get wet (may compromise microbiology of eyes, ears, nares and mouth due to contamination). Alternatively, collect smears and microbiology samples from ears, eyes, nares, mouth and cloaca before wetting the carcase. If a bird cannot be necropsied immediately, soak it in 1% detergent solution, ensuring that any trapped air is squeezed from the plumage, wrap the bird in a sealed plastic bag, chill it in the freezer for 5 minutes and then place it in a refrigerator at 4-6°C until a necropsy can be performed.

Remove the feathers on the ventral surface. Waterfowl are very heavily feathered and so are difficult to pluck. You may need to soak the bird for a few minutes to allow the feathers to be parted without adhering to your gloves..

Head and Neck

- Place the bird on its back with its feet away from you.
- Examine the head and neck, looking for abnormalities in the eyes, ears, beak and oral cavity. Apparent haemorrhages in the skull can be a post mortem artefact.
- Examine the external auditory meatuses (ear openings and canal).
- Turn the head to the left of the bird, presenting the right side of the head and neck. Cut through the right lateral commissure of the mouth, continue the subcutaneous incision down to the thoracic inlet and over the sternum to the cloaca. Reflect the skin, exposing the oesophagus, crop, pectoral muscles and abdominal wall. Observe the thymic lobes which lie on each side of the neck, along each jugular vein. These may or may not involute as the bird ages. In the domestic fowl, thymic lobes are found at two and more years of age.
- Note that pigeons have a vascular plexus in the neck and that this can be mistaken for haemorrhage, if accidentally incised.
- Examine the oral cavity, tongue and choanal slit. Samples may be collected from the conjunctiva and choanal slit at this time.
- Make a longitudinal incision in the larynx and trachea. You may need to hold the tongue with forceps to start your incision. Describe any lesions.
- The tracheas of some birds (some waterfowl) are arranged in loops. This is normal. For example, in the magpie goose, the trachea travels subcutaneously down to the cloacal area, then returns to the thoracic inlet, crosses to the other side, goes back to the cloaca, then returns to the thoracic inlet and then branches into bronchi and enters the lungs.
- The syrinx of male ducks has an expansion on the left hand side called the tympanic bulla. The shellduck has one on both sides of the syrinx, the right being slightly larger. The whistling duck (*Dendrocygna* spp) has symmetrical bullae. These are normal.
- Make a longitudinal incision through the oesophagus and crop and examine any content, as well as the surfaces.
- Remove the upper beak with a transverse cut near the eyes (bone shears may be needed for this, depending on the size of the bird). Examine the nasal cavity and opening to the infraorbital sinus (under the eyes) for abnormalities. If pathology of the sinuses is seen, obtain a swab from inside the sinus.
- Examine the eyes. Swellings beneath the eyes (infraorbital sinus), indicate vitamin A deficiency.

- The eyes and brain will be looked at later.

Body

- Turn the bird around with its feet towards you
- Disarticulate the hips (coxofemoral joints) by forcing the knees outward. This helps to stabilise the carcase.
- If the bird is very small, the wings and legs may be pinned to a dissecting board to keep the carcase steady.
- The pectoral muscles should be turgid and brownish-red. Examine for decreased muscle mass or bruising. Look for pallor or streaking, which may be an indicate exertional myopathy or selenium/vitamin E deficiency. Whitish stripes in the musculature may indicate sarcosporidiosis. Serially incise the pectoral muscles, looking for lesions.
- If you are not performing the necropsy in a biohazard cabinet, cover the carcase with plastic or glad-wrap, place your hands underneath and incise the abdominal muscle from just in front of the cloaca to the sternal edge (this is to avoid inhaling the plume of aerosols that sometimes occurs when you open the abdomen). Ensure that you have penetrated the abdominal airsac before removing the covering.
- Remove the covering and extend your incision along the last ribs on each side up to the spine. Reflect the abdominal muscle backward to expose the abdomen.
- In most cases, the ribs may be cut along the line where they meet the spine. At this point, the ribs

are cartilage and are easily cut. Cut from the abdomen to the thoracic inlet, and remove the sternal plate, taking care not to tear the pericardial sac. If you wish to cut the ribs from the spine, you will need bone shears.

- The pericardium should be transparent. There should be no fluid within the pericardial sac. Examine the heart for discolouration, paleness, pale area, or "spangles"(visceral gout). Remove the heart and open it to examine the valves for lesions (like mammals, the avian heart has four chambers). The right atrioventricular valve is muscular, not membranous. The heart may be fixed without cutting in small birds.
- There should be fat around the top of the heart. If this fat is jelly-like, it indicates the bird may be mobilising its fat stores because it is not eating
- Locate the thyroid glands located at the thoracic inlet lateral and slightly behind the syrinx and adjacent to the carotid arteries. The right thyroid contacts the oesophagus. Examine for enlargement and locate the parathyroid glands, lying at the caudal pole of each thyroid gland.
- Proceed down to the sides of the liver.
- Examine the caudal thoracic airsacs, located behind each lung. A normal airsac should be clear, like glad-wrap in most species (it is often at least partially opaque in ratite birds and penguins) . If you can imagine you can read a page of print through the airsac, then it is normal. If abnormal, obtain a swab and sample. Place the airsac sample in a container immediately, since it may be difficult to find if left on the bench surface.
- There is often a large amount of fat around the cloaca, especially in waterfowl.
- The thoracabdominal cavity should not contain any fluid. The presence of fluid or fibrin should be noted and a swab taken.
- Examine the liver for changes in size, colour, white or yellow spots, abscesses, tumours. The liver should be a mahogany brown. The shape and size varies between species - the lobes appear approximately the same size in raptorial birds and domestic fowl. The right lobe is larger in psittacine birds. In birds that eat fish the right lobe is larger and may extend to the cloaca. The gall bladder should be examined (it is absent in some species). Many mistake the liver for the lungs.
- A swollen yellow fragile liver is normal in neonates - the liver is infiltrated by fat absorbed from the yolk sac. The liver attains a normal colour during the second week of life, although this depends on the size and species of bird. A fatty liver is also normal in a laying bird, and the liver returns to a normal colour 7-14 days after laying the last egg.
- In young birds (usually less than 5-7 days old), the yolk sac will be seen when the abdominal cavity is opened. This is attached to the umbilicus at one end, and the mid-point of the small intestine at the other (Meckel's diverticulum). It is enclosed by the abdominal wall just prior to hatching and is a store of food for the neonate during the first few days of life.
- Observe the abdominal viscera before you disturb it. There will be minimal fluid in a healthy bird. Excessive amounts of fat are abnormal, except in an indeterminate laying bird. Note any excessive exudate or fibrin. Yolk maybe present if a follicle and yolk has not been engulfed by the infundibulum and has entered the abdominal cavity. (Determinate layers are birds which lay a specific number of eggs per nesting. Indeterminate layers are birds which will lay extra eggs if some are removed from the nest during incubation. A domestic fowl is an indeterminate layer).
- Grasp the proventriculus and rotate it to your left side (i.e., the bird's right side). This exposes the spleen, caudal to the proventriculus. The spleen is oval in psittacine and galliform birds, comma-shaped in passerine birds, and sausage-shaped in columbiform birds. Note any abnormality.
- Remove the liver, proventriculus, ventriculus (gizzard), small intestines, large intestine, caeca (if present), and bend the viscera caudally, leaving the cloaca attached to the body. The cloacal bursa (in a young bird) lies dorsal on the cloaca..
- The pancreas can be seen as pinkish organ cradled within the loop of duodenum the first part of the small intestine.
- A green discoloration of the liver near the gall bladder is a normal finding.

- The adrenal glands are located on both sides of the abdominal aorta close to the medial border of the cranial pole of each kidney. They may be covered by the testicles in the male, while the left one is covered by the ovary in the female.
- Male birds have two testes, located just beneath the vertebral column near the cranial pole of each kidney. The testes vary considerably in size from small during the moult to large at the height of the reproductive cycle. They also vary in colour between species, from pearly white to dark green or black.
- In the female, the ovary lies against the cranial pole of the left kidney. Quiescent ovaries are finely granular, while during egg production the ovary is very large, covering the cranial and middle lobes of the left kidney and containing many developing and mature follicles.
- The paired kidneys lie in the synsacral fossa on each side of the vertebral column. Each kidney is elongated and consists of three successive lobes joined together by bridges of kidney tissue. The colour of the kidney varies from pink to brownish red, depending on the blood supply. In very small birds it may be impossible to remove the kidneys without fragmenting them, so it may be necessary to cut them out attached to the spine.
- The lungs may now be seen, two bright pink and small (compared with mammalian lungs) organs located under the vertebral column and extending from the first to the last rib. These may be gently teased from the rib cage. The lungs should be removed because many lesions occur on the hidden dorsal and lateral surfaces.
- Look for enlargement of the sciatic nerves located on the interior upper thigh and near the medial side of the femur
- Incise the hip, knee and hock joints, looking for abnormal exudate - the joints should be smooth with only a small amount of clear fluid. Incise the tibia and tibiotarsus looking at the bone marrow.
- The cloacal bursa (bursa of Fabricius) lies on the dorsal aspect of the cloaca. This organ disappears when the bird reaches sexual maturity.
- Now look at the gastrointestinal tract, starting with the proventriculus. Incise it lengthwise. The normal surface should have pore-like nodular thickening - these are the openings of the submucosal glands. Collect a smear for Avian Gastric Yeast.
- Incise the gizzard, intestines and caeca (if present). The gizzard of seed-eating and omnivorous birds is thicker than that of carnivorous and piscivorous birds. The latter is thin and blends with the wall of the proventriculus. Examine the gizzard contents for foreign bodies or heavy metal fragments. Note the appearance of the inside walls (mucosa) and the presence of parasites, or thickening of the surface. Tease the gizzard lining from the underlying muscle - parasites commonly occur there. The caeca may contain blood, pus or necrotic material. Smears should be made of the small and large intestine and caeca (if present) and examined for parasites and coccidia. Deep scrapings should be made to look for *Capillaria* spp.
- Return to the head. Secure the head and peel the skin of the scalp forward to expose the skull. Small areas of bluish blood are sometimes seen here, and usually do not indicate trauma. The brain may be removed by gently incising the bone at the front, and tipping the head upside-down so that the brain drops away as its attachments to the cranial nerves are cut. This is more difficult in psittacine birds, because of the strong bone plate that covers their optic lobes.
- Remove and inspect both eyes. The eyes are much larger than they appear, and must be removed by dissection of the soft tissues and section of the lateral wall of the orbit. The optic nerve is cut and the eye removed.
- The brain is more easily removed in small species. If a swab is required, the sterile swab may be inserted through the foramen magnum. The skin over the dorsum of the head is removed, exposing the bone beneath. The cranial bone is very thin and can be incised to expose the brain below. Inspect it for haemorrhages or congestion. For smaller birds, hold the skull upside-down and allow the brain to exit the cranium without forcing, while severing the cranial nerve attachments. The skull of small birds may be placed in fixative and the bone decalcified later. Alternatively, the head and brain may be placed in fixative after the calvarium (bony covering

on the top of the brain) is removed. The head may also be transected longitudinally and both halves placed in fixative. Large brains should be partly sliced to enable the fixative to penetrate more easily, and the fixative should be renewed every day for 2-3 days. The spinal cord may be removed by blunt dissection and placed on a piece of card for fixation.

- Dispose of the carcase and disposable gear properly and disinfect all surfaces and instruments.
- Record all necropsy findings thoroughly.

Further Reading:

1. Dein FJ (1984) Laboratory Manual for Clinical Hematology

2. Dorresteinj GM. 1997. Diagnostic Necropsy and Pathology, in *Avian Medicine and Surgery*, eds Altman RB, Clubb, SL, Dorrestien, GM and Quesenberry K. WB Saunders Company Philadelphia. pp 158-169

3. Latimer KS and Rakish PM. 1994. Necropsy Examination, in Avian Medicine: Principles and Application. BW Ritchie, GJ Harrison and LR Harrison. Wingers Publishing, Inc. Lake Worth, Florida. Pp 355-379

4. Nickel, R, Schummer, A and Seiferle, E. 1977. Anatomy of the Domestic Birds, Translated by WG Siller and PAL Wright. Verlag, Paul Parey, Berlin

5. Samour J. 2000. Post-mortem examination with anatomical notes, in Avian Medicine Ed. J Samour. Harcourt Publishers Limited. London. Pp. 292-308.

6. Schmidt, RE and Reavill, DR. 2003. Avian Necropsy, CD-ROM. Zoological Education Network, Lake Worth, Florida.

.

7. Schmidt RE, Reavill DR and Phalen DN. 2003. Pathology of Pet And Aviary Birds. Iowa State University Press, Ames, Iowa.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Equipment Lists

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document contains lists of equipment necessary for collection of bird samples for testing. It has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Equipment Lists

Introduction

Equipment listed in this document may be obtained from hardware suppliers and veterinary equipment suppliers. Australian veterinary laboratories supply some materials such as sterile plastic specimen bottles, formalin, glass slides, zip-lock bags and specimen advice forms. A computer search will locate local suppliers of specific equipment.

Basic Personal Equipment

- Overalls - 2 pairs
- Rubber boots
- Plastic overshoes x 10
- Disposable powderless nitrile gloves (e.g.,)
- Plastic safety glasses x 2
- Surgical masks
- 5 litre plastic bucket, nail brush, larger firm brush for cleaning rubber boots
- Virkon S powder 50g to make 25L 2% solution (also available in 2kg and 5kg) 50 gm sachet $13.00 5 kg $470.00
- Insect repellent
- Sunscreen, hat, sunglasses
- Paper towels
- Mobile phone
- Tape recorder with spare batteries
- Digital camera
- First aid kit
- Bird catching cloth net (made of strong black cloth, not netting).

Necropsy Equipment

- For very small birds: Microdissection scissors
  Microdissection forceps
  Small pane of glass for examining gastrointestinal tract
- Apron PVC - only required for necropsy of large birds (>4 kg body weight).
- Tape recorder
- Digital camera
- 10% buffered formalin in leak-proof 60 mL plastic containers.
- Necropsy forms, necropsy checklist sheets
- Lead pencils and two sharpener sharpeners
- Clipboard with record sheets
- Scales for weighing birds
- Cooler - esky or plastic esky and ice packs
- Sharps disposal box
- Metal or strong plastic ruler
- Face masks
- Knives - 2 with 6 inch blades; steel to sharpen knives

Necropsy Equipment (continued)

- Disposable plastic forceps, toothed and plain
- Scalpel blades No 22, Scalpel Handle 4
- Scalpel blades No 15, Scalpel Handle 3 or 7
- Glass microscope slides 1 box
- Cover slips 22 x 50 mm 1 box
- Plastic glass slide transporters 10
- Leak-proof zip-lock bags
- Small and large scissors, round and sharp-pointed
- Poultry shears or large bandage scissors
- Portable Bunsen burner
- Neoprene cutting board
- Swabs
- Disposable gloves
- Whatman No 3 Filter paper for PBFD HI test

Sample Collection Equipment

- Portable Bunsen burner
- Neoprene cutting board
- Permanent marking pen
- Microscope (may require mirror as light source if no access to power)
- Sterile plastic Zip lock® bags
- Esky and ice bricks or liquid-nitrogen dry shipper
- 10% buffered formalin in 60 mL plastic containers. (These should be filled under adequate conditions, and should never be filled in the field).
- Torch
- Matches

Blood:

- Tuberculin syringes - 1.0 mL
- 25, 26 or 27g hypodermic needles
- Swabs (alcohol)
- 100 ml 70% ethyl alcohol
- Absolute methanol for fixing blood smears (if there is to be a delay in getting to lab)
- 10 µL x 32 mm capillary tubes
- Paediatric blood tubes EDTA and Heparin -
- Syringes - 5,10, 20 mL
- Hypodermic needles - 21g, 25g
- Serum collection tubes
- Microscope slides with frosted ends
- Glass microscope slides, cover slips, and plastic glass slide transporters.
- 22mm x 22mm cover slips

Faeces:

- Sterile plastic specimen bottles - 60 mL, 100 mL
- Plastic spatulas
- Sterile saline
- Faecal flotation vials and solution
- Microscope slides with frosted ends
- Bacterial culture swabs
- Disposable gloves

Sample Collection Equipment (continued)

Crop samples:

- Crop needles- selection of sizes.
- Sterile saline
- Dry sterile swabs

Ectoparasites:

- Preservative for parasites (absolute alcohol 70 mL, glycerin 5 mL, water 25 mL)
- Sterile plastic specimen bottles - 60 mL, 100 mL

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Field Necropsy Protocol for Psittacine Beak and Feather Disease in Wild Australian Psittacine Birds

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes a *Field Necropsy Protocol for Psittacine Beak and Feather Disease in Wild Australian Psittacine Birds*, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Field Necropsy Protocol for Psittacine Beak and Feather Disease in Wild Australian Psittacine Birds

---

This document sets out how to collect specimens for confirmation of PBFD, or identification of BFD virus, in the field.

Read the documents Clinical Evaluation of Captive Birds and Full Necropsy Protocol before undertaking a field necropsy. Follow the Post Mortem Checklist closely. The Necropsy Protocol document also fully details precautions to be taken when conducting an avian necropsy. The Murdoch University PBFD Submission Form (last page of this document) must be completed and forwarded with specimens.

External examination

Put your findings in the "history" section of the submission form.

- Where was bird sourced?
- Is the bird in good or poor body condition?
- Are there any fractures etc of the limbs?
- Plumage
  - Normal - powder down
  - Moulting
  - Abnormal feathers ± powder down
  - Damaged misshapen feathers
- Beak
  - Normal - powder
  - Abnormal - misshapen, fractures, delaminations
- Claws
  - normal
  - overgrown
- Examine body orifices - eyes, nares, oral cavity, ear, vent for discharges, foreign bodies.
- Look for external parasites

If the bird is alive and being euthanased

- Aseptically obtain a blood sample in heparin (PCR/HI)
- Aseptically collect 1-2 suspect feathers, including the quill and place them in a labeled container (PCR and HA).

  OR

  Place a drop of the blood on to filter paper (Whatman No 3) and allow it to dry at room temperature overnight, or 37°C for 2 hours. Apply enough blood to spread over the area equivalent to a 5-cent piece (PCR, HI).

Internal Examination

Put your findings in the "history" section of the submission form.

Open the carcase as per the Full Necropsy Protocol and proceed with your necropsy. Note any lesions.

If the bird was received dead, ensure that the liver is not contaminated from your necropsy efforts.

- Heat a scalpel blade (attached to a handle) with a gas flame.
- Sear the surface of the liver with the flat side of the blade against the liver capsule.
- Using a new sterile scalpel blade, cut through the seared liver surface.
- Insert a sterile swab into the cut liver parenchyma and roll it a few times.
- Withdraw the swab and place it into its container, with the swab beneath the surface of the transport medium.

Note: *Due to the sensitivity of PCR, false positives due to cross-contamination of samples is common. Samples should be collected aseptically and each sample placed in a sterile labeled container. If you are collecting feather samples for PCR from more than one bird, ensure that you do not transfer contamination from one bird to the next. Gloves should be changed for each bird and sterile instruments replaced between samples.*

Equipment List

PBFD submission form (next page)
Plastic safety glasses x 2
Cling wrap
Disposable plastic forceps
Scissors - small, medium, large
Sterile swabs with transport medium
Paediatric heparin blood collection tubes
Permanent marking pen
Disposable powderless nitrile gloves
Scalpel blades No 22, Scalpel Handle 4
Sterile plastic containers 60 mL
Glass microscope slides 1 box
Cover slips 24mm x 50mm1 box
Plastic Glass slide transporters 10
Virkon S powder 50g to make 25L 2% solution (also available in 2 and 5kg)
Overalls 2 pr
Rubber Boots 1 pr
5 litre plastic bucket, nail brush, larger form brush for cleaning rubber boots
Insect repellent
Hat
Mobile phone
Plastic overshoes x 10
Portable bunsen
Matches or lighter
Tape recorder, spare batteries
Digital camera with 512k-1Gb memory card for recording images.
Filter paper, Whatman No 3

Division of Health Biomedical Sciences
School of Veterinary & Biomedical Sciences

Veterinary Diagnostic Pathology Service

PBFD SUBMISSION FORM

MURDOCH UNIVERSITY
PERTH, WESTERN AUSTRALIA

South St, Murdoch
Western Australia 6150
Telephone: (08) 9360 2356
Facsimile: (08) 9310 4144
Email: raidal@murdoch.edu.au

Date: | **Submission:** ☐ Whole blood ☐ Filter paper blood ☐ Feather ☐ Liver swab

Submitter Details

Name: _____
Department _____
Address _____
Suburb _____
City, State, Pcode: _____
Phone No: _____
Mobile No: _____
Fax No: _____
Email: _____

Specimen Information

Species: _____
Identification: _____
Sex : ☐ Male ☐ Female ☐ Not determined
Age: ☐ Adult ☐ Subadult ☐ Juvenile ☐ Neonate
Origin: ☐ Captive bred ☐ Wild
Clinical information: ☐ Normal bird ☐ Suspect PBFD
☐ Found Dead ☐ Euthanased

History

_____
_____
_____
_____
_____
_____
_____

Interim Pathology Report (lab use only)

Pathology No: _____ **Date out:** _____

Results: **Feather HA:** _____
Feather PCR: _____
Blood HI: _____
Other: _____

HYGIENE PROTOCOLS FOR THE PREVENTION AND CONTROL OF DISEASES (PARTICULARLY BEAK AND FEATHER DISEASE) IN AUSTRALIAN BIRDS

8 – Avian post mortem checklist 1

This form has active fields that cannot be incorporated into this document. Please refer to the document checklist-1-pm.pdf

9 – Avian post mortem checklist 2

This form has active fields that cannot be incorporated into this document. Please refer to the document checklist-2-pm.pdf

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Transportation Protocol for Bodies and Tissues

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes the *Transportation Protocol for Bodies and Tissues*. It has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Transportation Protocol for Bodies and Tissues

The World Health Organization has published the document "*Guidance on regulations for the Transport of Infectious Substances 2005*", available from here.

The International Air Transport Association (IATA) and the Civil Aviation Safety Authority (CASA) have adopted this document, and all air carriers are required to comply from January 2007. Many have already adopted the recommendations. You are advised to read this document. Shipments sent by air must adhere to the guidelines specified in the document, but in general the majority shipped by land in Australia must also comply.

Packaging

IATA packing instructions are available in the document:

Dangerous Goods Regulations 2006 - 47th Edition:

Any person who packs, or supervises an individual who packs, dangerous goods for transportation by air, is first required to undertake a dangerous goods training course approved by CASA. The training courses are offered by classroom tutorial or correspondence. The course is called: *Safe Transport of Infectious Substances and Diagnostic Specimens Training Course* and those who complete it satisfactorily receive a *Certificate of Currency* which is valid for two years.

http://www.caaa.com.au/ISdetails.htm

You may request the courier to pack the consignment for you. This course only applies to samples consigned by air.

The following advice for safe shipment and delivery of samples should always be followed:

- Always contact the laboratory before you send samples;
- The quality of results depends on the care and attention given to the collection of specimens;
- Ensure that you can get samples that need to be refrigerated to a laboratory within 12-24 hours of collection - do not collect samples on a Friday or Saturday;
- Keep the outside of sample AND shipping containers clean and uncontaminated. If the outside of a sample container is contaminated, clean and disinfect the outside with 2% Virkon S solution, allow contact for 10 minutes, and rinse thoroughly with water and allow to dry;
- IATA regulations do not allow handling of foam eskies, unless they are placed inside a cardboard box. If the esky is made of impact-resistant plastic, it does not have to be placed inside a cardboard box; and
- Ensure that sample containers will not leak by screwing the lid down firmly on the inner bottle. For formalin- or alcohol-fixed tissues, drain the fluid from the samples once they are fixed. You can use formalin- or alcohol-soaked gauze to keep fixed samples moist. Place them into a screw top container to ensure samples do not dry out, and then seal the container in a zip-lock® bag.

Fresh or frozen tissues

Fresh or frozen tissues, such as avian bodies, blood, serum, swabs and tissues may contain infectious agents and should be shipped within a three-layered package system as supplied by the CSIRO Animal Health Laboratory and laboratories such as IDEXX and Gribbles.

A biological product or diagnostic specimen with a low probability of containing pathogens in Risk Groups 2 or 3 (see Australian/New Zealand Standard, Safety in laboratories, Part 3, Microbiology AS/NZS 2243.3) may be transported in such containers. The sender, not the transport company, is responsible for the shipment until the package reaches the consignee

The containers ("lab mailers") from Gribbles and IDEXX Laboratories are made up as follows:

A. An inner plastic cylinder containing absorbent material (and the specimen into a zip- lock® biohazard bag).
B. A screw lid to seal A.
C. An inner thick cardboard cylinder in which to place A.
D. This then fits into E.
E. An inner lab mailer 80mm cylinder with two red plastic lids to fit F.
F. An outer lab mailer 100mm cylinder with two red lids, with both lids taped down.

Ensure that all lids are on straight and tight. Release residual vacuum or air pressure in the vacutainers by sticking a needle through the bung.

Additionally, Gribbles and IDEXX provide plastic 60 mL jars, laboratory mailers and consignment notes free of charge. Larger plastic jars (250 and 500mL 1L) may be purchased from them. Consignment notes are pre-printed on Diagnostic Specimen labels and cover all consignments up to 3 kg (for toll priority). Specimens that do not fit into the lab mailer, but do not exceed 3 kg and $0.018m^3$, should be packed into a ziplock bag, placed into a secondary leak-proof container surrounded by absorbent material (eg. 6-pack esky), and placed into a cardboard box, that should be securely taped and the consignment note affixed to the outside. Consignments exceeding 3 kg and $0.018m^3$ attract an extra charge by the laboratory.

Fresh tissues must be shipped as soon as possible, however note that overnight courier is significantly cheaper than same day.

The shipping container (which includes the specimen advice form) should contain the following information:

- Bird species, age, sex, whether captive or wild bird, and if wild, location found.
- Short history and clinical signs.
- Necropsy findings (if necropsy performed).
- Disease suspected with tests requested.
- If a disease has not been diagnosed, contact the laboratory and ask what specimens should be submitted. If this is not possible, then submit a broad range of tissues and specimens,

Whirl-pack® bags are not leak-proof

Packaging Histopathology Tissues

Small pieces of fixed tissues are all that is usually required.

- Collect the sample into 10% neutral buffered formalin in a screw top plastic jar. Do not use glass jars as these may break and spill formalin.
- The recommended size is 10mm in thickness. Formalin will penetrate and fix tissue of this size in 24 hours.
- Liquid formalin is regarded as dangerous goods/biological products (IATA regulations).
- Once the tissue is fixed, decant the formalin and add tissues or cotton wool to mop up any liquid formalin. This reduces the chance of formalin spill completely.
- Place the plastic jar containing the fixed tissue with gauze wadding into a zip-lock biohazard bag with the gross necropsy report inserted into the side panel of the bag.
- Once the formalin is drained from the samples, they are not regarded as dangerous goods/biological products with respect to IATA regulations.
- If 50 mL or more of either formalin or 70% alcohol is being shipped, then the consignment is regarded as dangerous goods.
- Samples consigned with alcohol greater than 70% concentration are regarded as dangerous goods.
- Do not use containers with metal lids as these react with formalin and may affect the quality of specimens.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Transportation protocol for Live Birds

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes a *Transportation Protocol for Live Birds* and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Transportation Protocol for Live Birds

The protocols outlined in this document have been adapted from the IATA (2005).

General standards for transportation of birds

- Birds must be healthy and independent
- Birds should be transported in a secure, darkened and well-ventilated container. Most birds will settle into a dark carrying container.
- Have the bird checked and certified healthy by a qualified avian veterinarian
- Ensure that the transportation cage is sturdy and provides enough room for the bird to stand, turn around, and flex its wings without damaging its tail.
- If the cage is to be re-used, it should be constructed of a material that is light, impervious, and which can be easily cleaned and disinfected.
- Encourage water intake before the flight, if possible.
- Transportation containers should be sturdy enough to survive dropping and minor impacts.
- They should be closed on all sides, except for an open front for ventilation.
- On long trips water should be provided by wetting cotton wool in fixed containers.
- For short trips fruit and seeds will suffice.
- Transportation causes stress and should be kept to an absolute minimum time
- Containers should be sufficiently robust for the species they contain and should be securely closed during transportation to prevent injury or escape
- If there is more than one transportation cage, they should not be packed together in such a manner as to obstruct efficient air circulation between them.
- Food should always be available during transportation, especially for small or young birds, and water should be provided at intervals of at least every eight hours.
- In hot weather this should be reduced to every six hours.
- Birds should not be exposed to temperature extremes - they should not be shipped in very hot weather, unless in an air-conditioned environment.
- A bird should not be transported in a container with a bird of an incompatible species.
- As far as is practical, birds should be transported one bird per compartment to avoid birds injuring each other due to stress (this may occur even with bonded pairs).
- Aggressive species must be shipped singly.
- The floor of a carry cage should allow birds to obtain a secure footing.
- The floor should be sealed and covered with a non-toxic absorbent material to stop the escape of urine or faeces.
- Cages should be thoroughly cleaned and disinfected between consignments. Cages of wooden construction cannot be cleaned and disinfected effectively. Wooden perches should be discarded between shipments.

Shipper´s Responsibilities (within Australia)

Before a bird is handed to the carrier, the shipper must:

- Verify that the species to be transported are not protected or restricted, whether nationally or internationally.
- Have all the necessary supporting documentation in hand
- Pack the birds in containers that match the basic construction principles found in the IATA Live Animals Regulations, regarding safety, protection and comfort.
- Attach to the transportation documentation a copy of feeding and watering instructions to be followed in case of delays or other emergencies. The shipper must record on the container instructions the date and time that food and water had been given to the animals, prior to carrier's acceptance.
- Plan, together with the carrier, the most direct route possible.
- Birds in lay must not be transported
- Verify that the animals of a shipment are in good health and conditions to be transported by air. This must be confirmed by the Shipper's Certification for Live Animals.
- Verify that wild-caught birds are accustomed to confinement and the provided diet.
- Ensure that the container is free of sharp edges or projections that might cause injury
- The carrier will not accept an animal container when:

    - The container is not sufficiently sturdy or is in disrepair and the animal is likely to escape
    - The container is unclean
    - The bird appears diseased
    - The container could cause injury or suffering to the bird
    - The container fails to meet the RSPCA regulations that the bird must be able to stretch its wings, allow the bird to stand in a natural position and turn around without traumatising its tail.

Carrier's Responsibilities

- Provide a suitable vehicle or aircraft for transportation.
- Provide the required space within the cargo compartment
- Ensure adequate environmental conditions in the cargo compartment in relation to ventilation range, air flow and temperature control.
- Ensure adequate environmental conditions apply during intermediate stopovers and during loading or unloading
- Ensure that other cargos do not affect the birds.
- Determine whether attendance is required during transportation.
- Ensure that required documentation is present eg shipper's Certification for Live Animals, health and welfare certificates for the animals, export, import and transit permits (when required).

Attendant's Responsibilities

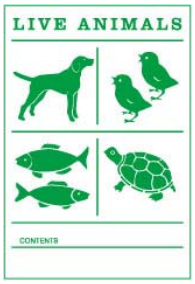
- The attendant must be provided by the shipper and must be deemed competent by the carrier. They must show competent skills in handling the birds
- The attendant must bear all the documentation necessary to enter the country of destination as well as the country of transhipment when required [i.e. passport, visa, vaccination certificates (if required), etc.].

Container Marking and Labelling

Full name and address and a 24 hour telephone number of the shipper, consignee or a person responsible for the shipment if other than the shipper or consignee.
The scientific and common names of the animals in the container and quantity of each animal as shown on the shippers declaration.
Labels

The following labels (minimum dimensions of label 10 x 15 cm must be used on an animal container:

"Live Animals" label (green)



"Package Orientation" label on four sides of the container

Reference

1. IATA 2005. IATA Live Animals Regulations. 2005. 32nd Edition ISBN 92-9295-560-4. IATA, PO Box 113, Montreal, Quebec, Canada H4Z 1M1

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Avian Gastric Yeast: Response to Test Results

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document describes Avian Gastric Yeast: response to Test Results. It has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Avian Gastric Yeast - Response to Test Results

- Infection with AGY may be common, but disease is rare.
- All diagnosed birds in a module should be treated
- Amphotericin B 5g/L ml of drinking water, administered for 30 days (or orally 100 mg/kg by gavage BID 30 days). Treatment for 30 days is recommended because there is evidence of resistance to this agent, and that eradication of the organism is not achieved unless a long treatment is given to infected birds.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Avian Polyomavirus Infection: Response to test Results

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document, *Avian Polyomavirus: Response to Test Results*, has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Avian Polyomavirus Infection: Response to Test Results

- At present, this is regarded as an exotic disease - an affected property will be quarantined.
- Once APV enters an aviary it spreads rapidly, so it is likely that many birds in the complex will be infected.
- Avoid all direct and indirect contact with budgerigars, African lovebirds, cockatiels and SCC.
- Full quarantine and hygiene protocols
- A vaccine is not available in Australia
- The epidemiology of APV infection in OBP's is not known, and so the length of shedding of the virus after infection is not known. Testing of all adult birds is recommended.
- Parent-raised chicks (except budgerigars and African lovebirds) seem not to develop disease but shed the virus for up to 10–12 weeks.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Chlamydophilosis: Response to Test Results

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document *Chlamydophilosis: Response to Test Results*, has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Chlamydophilosis: Response to Test Results

- Persons at risk who have been in contact with infected birds or contaminated materials should be informed about the nature of the disease. They should be advised to see a medical practitioner, irrespective of whether they have respiratory signs, who should be told they may have been exposed to *C. psittaci*. Treatment should be initiated if clinical signs fit psittacosis..
- All personnel should be instructed on the pathogenesis of the disease. Personnel who will be cleaning cages and equipment or handling birds should wear protective clothing, powderless nitrile gloves, a disposable surgical cap, and a P2 face mask.
- Any dead birds should be thoroughly sprayed with 2% Virkon S solution to which has been added 10 mL of detergent per litre, to facilitate penetration of feathers. This is to prevent aerosolization of infectious particles.
- Any necropsies should be performed under a biological safety cabinet or equivalent.
- Examine records to determine bird movements as far back as possible to aid in identifying sources and exposed persons.
- Forward all sick birds to the hospital in a safety cage for treatment.
- All in-contact (exposed) birds should be isolated and treated.
- Test all in-contact birds
- Cage management:
  - Avoid the transfer of droppings, feather dander and oculonasal secretions from one area to another.
  - Dispose of all nest boxes and porous equipment (including wooden perches)
  - Never stack cages.
  - Individual water supply - do not allow water to travel from one cage to another.
  - Use litter that does not produce dust (newspaper)
  - Wash all cages and receptacles daily. Disinfect all receptacles with 2% Virkon S solution and allow 10 minutes' contact time. Rinse residual disinfectant from receptacles.
  - Exhaust ventilation should be sufficient to prevent accumulation of aerosols and prevent contamination of other areas and the environment.
  - Minimise contamination from dust by spraying the floor with 2% Virkon S solution before sweeping it.
  - Frequently remove waste (after moistening with 2% Virkon S) and dispose of it in accordance with Section 11.
- Thoroughly clean and disinfect aviaries with 2% Virkon S solution and allow 10 minutes' contact time. Rinse residual disinfectant from surfaces and allow to dry in the sun. Discard all porous material and nestboxes.
- Treatment
  - Treated sick birds and treated healthy birds can be reinfected and should not be exposed to potential sources of infection.
  - Birds should not be stressed (eg, chilling, heating, transportation)
  - Ensure that birds that are to be treated are housed in clean and uncrowded cages
  - Doxycycline therapy. Data are not available for the treatment of Neophema sp. Therapy for cockatiels has been reported by Powers *et al.* (2001), and in-water treatment by Flammer *et al.* (2001). In-water medication failed to produce adequate blood levels of doxycycline in budgerigars (Flammer *et al.* (2003). In-water medication at 400 mg/L doxycycline has been commonly recommended for 21-40 days, depending on the size of the bird. Doxycycline doses of 50 mg/kg may cause regurgitation in some psittacine

birds (Carpenter, 2001).

- High dietary concentrations of calcium and other divalent cations should be avoided since they chelate with tetracyclines and so inhibit their absorption. Sources of calcium such as cuttlebone and mineral blocks should been removed.
- Therapy should be continued for the full recommended period to try to avoid relapses. Ill birds may appear clinically normal after a few days' treatment, but can shed chlamydial organisms within days.
- Oral doxycycline 25-50 mg/kg
- Injectable tetracyclines are to be avoided in threatened neophemas since they may damage pectoral muscles
- Medicated feed may be used as the sole source of food for at least 30 days for neophemas, and recipes are available.

References

1. Carpenter JW, Mashima TY and Rupiper DJ (2001). *Exotic Animal Formulary*, 2nd Ed. WB Saunders Company. Pp 118-119.

2. Flammer K, Trogdon MM, Papich M. 2003. Assessment of plasma concentrations of doxycycline in budgerigars fed medicated seed and water. *J Am Vet Med Assoc* **223**:993-998.

3.

4. Flammer K, Whitt-Smith D and Papich M. 2001. . Plasma concentrations of doxycycline in selected psittacine birds when administered in water for potential treatment of *Chlamydophila psittaci* infection. J Avian Med Surg **15:**276-282.

5. Powers LV, Flammer K, Papich M. 2000. Preliminary investigation of doxycycline plasma concentration in cockatiels (*Nymphicus hollandicus*) after administration by injection or in water or feed. *J Avian Med Surg*. **14**:23-30.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

External and Internal Parasitism: Response to Test Results

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document, *External and Internal parasitism: Response to Test Results*, has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

External and Internal Parasitism: Response to Test Results

External Parasitism

- Some parasites can survive for up to 4 weeks off the host
- Regular monitoring of the aviary, nest boxes and birds for evidence of mites
- Replace wooden perches
- Wooden walls of aviaries need to be treated with .....
- Apply a pyrethrum spray to the birds, nest box and the walls of the aviary.
- Apply weekly for 5 times (ie over 4 weeks).
- Treatment of adult birds prior to breeding
- Full quarantine procedures.
- New nest boxes each year, treated with pyrethrum spray and allowed to dry before being used for breeding.
- Moxidectin administered to each bird at 200 μg/kg will kill blood sucking mites reside.

Internal Parasitism

- An impervious concrete floor should be provided.
- Sand or other relatively fine and inert material should be spread over the concrete. The sand should be sourced from a supply which has no possibility of being contaminated by birds.
- Remove sand every 7 days, clean the concrete, disinfect the concrete and remove residual disinfectant
- Spread new clean material spread over the concrete
- Treat birds with moxidectin 200 micrograms/kg and again 3 weeks later

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Newcastle Disease and Avian Influenza: Response to Test Results

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document, *Newcastle Disease and Avian Influenza: Response to Test Results*, has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Newcastle Disease and Avian Influenza: Response to test Results

Both of these diseases are OIE listed disease agents and are notifiable in all Australian states and territories.

The nearest Regional Veterinary Officer (RVO) is to be immediately contacted by telephone from the outbreak property. If the RVO is not contactable, then telephone the Emergency Animal Disease Watch Hotline on 1800 675 888 (24 hours).

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Psittacid Herpesvirus Infections: Response to Test Results

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document, *Psittacid Herpesvirus Infections: Response to Test Results*, has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Psittacid Herpesvirus Infections: Response to Test Results

- At present, this is regarded as an exotic disease, and an affected property may be quarantined.
- It may be necessary to kill all birds shedding the virus and those in contact with virus-shedding birds
- Much easier to prevent than to treat
- Transmission typically through close contact - carrier status
- Confirm that the disease is caused by PHV
- Minimise human exposure and transmission
- Any bird that survives the outbreak must be considered a carrier.
- Do not use acyclovir - treated birds may subsequently carry and excrete live virus
- Stop all breeding
- PCR DNA test:
  - Whole blood (0.2 ml) sample in EDTA tube.
  - Dry cloacal swab
  - Tissue (liver, spleen or kidney) in sterile container.
- Keep track of all movements of tissues and other samples and ensure that they are destroyed to prevent other birds being directly or indirectly exposed.
- Re-evaluate quarantine effectiveness
- Prevent contact with wild birds - direct and indirect
- Cease all new additions to flock
- Destroy nest boxes.
- Discard all wood or porous objects and do not replace them until treatment is complete
- Disinfect all thoroughly cleaned surfaces with 2% Virkon S. Ensure that fan blades and air filters are effectively disinfected.
- Reduce intensification
- Isolate in pairs
- May be possible to rear herpesvirus-free progeny from positive adults, sterilising egg surfaces and artificially incubating eggs.

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Contact Details for Government Departments, Animal Welfare Organisations and Animal Health Web Sites

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document lists the contact details for Government departments, animal welfare organisations and animal health web sites, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge. Links are valid as at July 2006.

Contact Details, Web Sites

Government Addresses

Canberra

- Emergency Animal Disease Watch Hotline
  Phone: 1800 675 888

- National Office of Animal and Plant Health
  Department of Agriculture, Fisheries and Forestry
  GPO Box 858
  CANBERRA ACT 2601
  Phone 02 6272 4509
  Fax 02 6272 3372
  Email chris.bunn@daff.gov.au

Australian Capital Territory

- ACT Veterinary Services
  PO Box 144
  Lyneham ACT 2602
  Phone: (02) 6207 2357
  Fax: (02) 6207 2361

New South Wales

- Technical Specialist, Animal Regulation,
  Division of Animal Industries
  NSW Agriculture
  Locked Bag 21
  ORANGE NSW 2800
  Phone 02 6391 3719
  Fax 02 6361 9976

Northern Territory

- Veterinary Officer
  NT Department of Business Industry and Resource Development - Primary Industries
  GPO Box 990
  DARWIN NT 0801
  Phone 08 8999 2035
  Fax 08 8999 2146

Queensland

- Information Centre
  Department of Primary Industries and Fisheries
  GPO Box 46
  BRISBANE QLD 4001
  Phone 13 25 23

South Australia

- Veterinary Officer
  Department of Primary Industries and Resources
  GPO Box 1671
  ADELAIDE SA 5001
  Phone 08 8207 7908
  Fax 08 8207 7852
  Email Critchley.Kim@saugov.sa.gov.au

Tasmania

- Veterinary Officer
  Emergency Animal Disease Program
  DPIWE
  St Johns Avenue
  NEW TOWN TAS 7008
  Phone 03 6233 6875
  Fax 03 6278 1875

Victoria

- Assistant Principal Veterinary Officer, Counter Disaster/ Exotic Disease
  Department of Primary Industries
  Animal Health Operations Branch
  475 Mickleham Road,
  ATTWOOD VIC 3049
  Phone 03 9217 4174
  Fax 03 9217 4322

Western Australia

- Principal Veterinary Officer
  Division of Animal Industries
  Department of Agriculture Western Australia
  GPO Box 1400
  SOUTH PERTH WA 6983
  Phone 08 9368 3620
  Fax 08 9367 6248

- ***The National Consultative Committee on Animal Welfare (NCCAW)***
  This is a non-statutory body established by the then Minister for Primary Industries and Energy in 1989. Its position statements are listed here.

- ***Code of Practice for the Welfare of Captive Birds in the A.C.T.***
  This Code of Practice for the Australian Capital Territory has been prepared from a consideration of the welfare of birds held in captivity. Its purpose is to provide general guidelines on the minimum standards of accommodation, management and care that are appropriate to the various species of captive birds.

- ***National Guidelines for the Housing of Caged Birds***
  This code has been prepared by NCCAW from a consideration of the welfare of cage birds held in captivity. Its purpose is to provide general guidelines on the minimum standards of accommodation, management and care that are appropriate to the various species of cage birds. These guidelines will be considered for adoption at their April 2006 meeting.

- ***Animal Welfare Documents***
  Under the Australian Constitution, state and territory governments have primary responsibility for animal welfare within Australia. Each state and territory government has laws to prevent cruelty and to promote the welfare of animals by legislating standards for their care and treatment. Most states and territories have incorporated the Australian model codes of practice for the welfare of animals under their jurisdiction's 'Prevention of Cruelty to Animals' legislation. The Australian Government has responsibility for trade and international agreements.

- ***Pest Bird Control***
  Prepared by the National Consultative Committee on Animal Welfare, this is a position statement that recognises there are some species or groups of birds that may cause agricultural damage and/or other problems.

- ***Royal Society for the Prevention of Cruelty to Animals***

- ***RSPCA Policy on Companion Animals***. This document describes the Housing of Pet Birds.

- ***Victorian Code of Practice for the Housing of Caged Birds***

- Australian Government Department of the Environment and Heritage
  John Gorton Building
  King Edward Terrace
  Parkes ACT 2600
  Postal Address: GPO Box 787, Canberra ACT 2601
  Phone: (02) 6274 1111
  Fax: (02) 6274 1666

- Environment ACT
  Department of Urban Services
  Level 2, Macarthur House
  12 Wattle St
  Lyneham ACT 2602
  (PO Box 144 Lyndeham ACT 2602)
  Phone: (02) 6207 2333
  Fax: (02) 6207 2316

- ACT Parks and Conservation Service
  Environment ACT
  PO Box 1065
  Tuggeranong ACT 2901
  Phone: (02) 6207 9777
  Fax: (02) 6207 2197

New South Wales

- NSW Environment Protection Authority
  59-61 Goulburn Street
  Sydney NSW 2000
  Post: PO Box A290 Sydney South NSW 1232
  Phone: (02) 9995 5000
  Fax: (02) 9995 5999

- NSW Department of Environment and Conservation
  Level 1
  43 Bridge St
  Hurstville NSW 2220
  PO BOX 1967 Hurstville NSW 2220
  Phone: (02) 9585 6444
  Information: 1300 36 1967
  Fax: (02) 9585 6455

Northern Territory

- Northern Territory Office of Environment and Protection
  Level 2
  Darwin Plaza Building
  41 Smith St
  Darwin NT 0800
  Post: GPO Box 1680 Darwin NT 0801
  Phone: (08) 8924 4139
  Fax: (08) 8924 4053

- Parks and Wildlife Commission of the Northern Territory
  Goyder Centre
  25 Chung Wah Terrace
  Palmerston NT 0830
  Post: PO Box 496 Palmerston NT 0831
  Phone: (08) 8999 5511
  Fax: (08) 8932 3849

Queensland

- Queensland Environmental Protection Agency
  160 Ann Street
  Brisbane OLD 4000
  Post: PO Box 15155 City East OLD 4002
  Phone: (07) 3227 7111

- Queensland Parks and Wildlife Service
  PO Box 155
  Brisbane Albert St
  Brisbane OLD 4001
  Phone: (07) 3227 7082
  Fax: (07) 3227 7676

South Australia

- South Australia Department for Environment and Heritage
  Chesser House
  91-97 Grenfell Street
  Adelaide SA 5000
  Post: GPO Box 1047 Adelaide SA 5001
  Phone: (08) 8204 9000
  Fax: (08) 8204 1919

- South Australia Environment Protection Authority (EPA)
  77 Grenfell Street
  Adelaide SA 5000
  Post: GPO Box 2607 Adelaide SA 5001
  Phone: (08) 8204 2000
  Fax: (08) 8204 9393

Tasmania

- Tasmania Department of Infrastructure, Energy and Resources
  10 Murray Street
  Hobart TAS 7000
  Post: GPO Box 936 Hobart TAS 7001
  Phone: 1300 135 513

- Tasmania Department of Primary Industries, Water and Environment
  Marine Board Building 1
  Franklin Wharf
  Hobart TAS 7000
  Post: GPO Box 44 Hobart TAS 7001
  Phone: (3) 6233 8011
  Fax: (03) 6234 1335

- Tasmania Parks and Wildlife Service
  Lands Building
  134 Macquarie Street
  Hobart TAS 7000
  Post: GPO Box 44 Hobart TAS 7001
  Phone: (03) 6233 5732
  Fax: (03) 6224 0884

Victoria

- Department of Sustainability and Environment
  8 Nicholson Street
  East Melbourne VIC 3002
  Post: PO Box 500 East Melbourne VIC 3002
  Phone: (03) 9637 8000
  Fax: (03) 9637 8100

- Victoria Environment Protection Authority
  Herald and Weekly Times Tower
  40 City Road Southbank VIC 3006
  PO Box 4395QQ Melbourne VIC 3001
  Phone: (03) 9695 2700
  Fax: (03) 9695 2780

- Parks Victoria
  Level 10/535 Bourke Street
  Melbourne VIC 3000
  Phone: (03) 8627 4878
  Information Line: 131963
  Fax: (03) 9629 5108

Western Australia

- Western Australia Department of Conservation and Land Management
  Hackett Drive
  Crawley WA 6009
  Post: Locked Bag 104 Bentley Delivery Centre Bentley WA 6983
  Phone: (08) 9442 0300
  Fax: (08) 9386 1578

Other Addresses

- Australian Government
  Department of Agriculture, Fisheries and Forestry
  Edmund Barton Building
  Broughton St,
  Barton
  GPO Box 858 Canberra ACT 2601

- Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease
  National Office Building 76
  Molecular Biosciences
  The University of Queensland
  St. Lucia QLD 4072
  Phone: (07) 3346 8866
  Fax: (07) 3346 8863

- Australasian Invasive Animal Cooperative Research Centre
  GPO Box 284
  Canberra ACT 2601
  Phone: (02) 6242 1768
  Fax: (02) 6242 1511

- Royal Society for the Prevention of Cruelty to Animals Australia Inc
  PO Box 265
  Deakin West ACT 2600
  Phone: (02) 6282 8300
  Fax: (02) 6282 8311

- Wildlife Disease Association - Australasian Section
  Dr Tim Portas
  C/o Western Plains Zoo
  PO Box 831
  Dubbo NSW 2830
  Phone: (02) 6882 5888
  Fax: (02) 6884 1722

- Association of Avian Veterinarians, Australian Committee
  PO Box 63
  West Ryde NSW 1685

- Animal Health Australia
  National Animal Health Information System
- Australian Government Department of the Environment and Heritage
- Australasian Regional Association of Zoological Parks and Aquaria (ARAZPA)
  Membership of ARAZPA includes zoos and aquariums in Australia, New Zealand, Papua New Guinea and the Pacific Islands
- Australian Registry of Wildlife Health
- Australian Wildlife Health Network
- Australian Government Department of Agriculture, Fisheries and Forestry
- Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease
- CSIRO Australian Animal Health Laboratory
- The Sub-committee on Animal Health Laboratory Standards (SCAHLS)
  This site contains lists of standard laboratory test procedures and reference laboratories.
- Australian Quarantine and Inspection Service (AQIS)
  Division of Australian Government Department of Agriculture, Fisheries and Forestry
- Wildlife Disease Association Australasian Section

Australian Capital Territory

- Environment ACT

New South Wales

- NSW Department of Primary Industries
- NSW Department of Environment and Conservation
- NSW Environment Protection Authority
- NSW Wildlife Information and Rescue Service (WIRES)
- Zoological Parks Board of NSW

Northern Territory

- Northern Territory Government Environment

Queensland

- Queensland Dept of Primary Industries
- Environmental Protection Agency and Queensland Parks and Wildlife Service

South Australia

- SA Department for Environment and Heritage
- Primary Industries and Resources South Australia
- Environment Protection Authority (SA)

Tasmania

- Tasmania Parks and Wildlife Service

Victoria

- Victorian Dept of Primary Industries
- Department of Sustainability and Environment
- Parks Victoria

Western Australia

- Department of Agriculture Western Australia
- Western Australia Department of Conservation and Land Management

Other Websites of Interest

- **Smithsonian National Museum of Natural History**
  Guidelines on the use of wild birds in research. Acrobat file
- **IATA Live animal regulations**
- **IATA Live animals transport by air**
- **Air Transport of Animals (AFFA)**
- **Animal Ethics Infolink - Wildlife Research**
- **Licenses to Transport Animals into and out of NSW**
- **World Organisation for Animal Health**
- **CITES** (the Convention on International Trade in Endangered Species of Wild Fauna and Flora)

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Glossary

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This Glossary has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Glossary

AAVAC	Association of Avian Veterinarians, Australian Committee
Abdomen	The portion of the body that lies between the thorax and the pelvis.
Abdominal cavity	The space that contains the abdominal viscera
ACT	Australian Capital Territory
Acute	Refers to an illness with a sudden onset and a relatively short course.
Aerobic	Requiring oxygen (compare with anaerobic).
Aetiology	The study of causation, generally the study of why things occur, or even the reasons behind the way that things act. The study of the agents that cause disease processes
AGY	Avian Gastric Yeast (megabacterium, *Macrorhabdus ornithogaster*)
Air sacs	Thin-walled sacs that communicate with the lungs and some bones and are part of the avian respiratory system.
Airsacculitis	Inflammation of the air sacs in birds.
Anaemia	A reduction in the normal number of red blood cells, or erythrocytes, in the body
Anaerobic	Absence of oxygen; often refers to an organ-ism that grows, lives, or is found in an environment devoid of oxygen, such as the cellular form of Clostridium botulinum, which causes avian botulism.
Antibody	A specific protein used by the immune system to identify and neutralize foreign antigens like bacteria, fungi and viruses. Each antibody recognizes a specific antigen unique to its target.
Antigen	Any foreign substance (generally proteins) to which the body reacts by producing antibodies. Antigens maybe soluble substances such as toxins, particulate matter such as pollen, or microorganisms such as bacteria and viruses.
APV	Avian polyomavirus
Aseptic	Free from infection; sterile.
Asymptomatic	Without visible signs of illness; an asymptomatic carrier is an organism that harbors a disease agent, but that shows no outward signs.
Avirulent	Not virulent, does not cause disease.
AWHN	Australian Wildlife Health Network
Bacterium	Singular for bacteria. Any of a group of microscopic, unicellular organisms that have distinct cell membranes and that lack a distinct nucleus surrounded by a nuclear membrane.
Benign	Noninvasive, that is, tumors that do not spread to other parts of the body; not malignant.
BFDV	Beak and feather disease virus
Biosecurity	Security from transmission of infectious diseases, parasites and pests. An assurance that the ecology (either natural or intensive) sustaining animals is maintained**.**
Bumblefoot	An inflammation and, often, swelling of the foot of birds as the result of a bacterial infection.

Bursa (of Fabricius)	Part of the immune system of birds, located in the dorsal cloaca, where young lymphocytes released from the bone marrow mature into B-type lymphocytes (a type of white blood cell which produces antibodies)
CAC	Closed Aviary Concept
Carrier	An infected bird or flock that does not show obvious signs of clinical disease. They may or may not show clinical signs after infection, and although appearing healthy, shed the aetiologic agent either continually or intermittently. Examples are Pacheco's disease and chlamydophilosis.
CAV:	Chicken anaemia virus
Commissure	The point or surface where two parts, such as the beaks or eyelids join or form a connection
Contagious:	Transmissible by direct or indirect contact - spread of disease from bird to bird. All contagious diseases are infectious; all infectious diseases are not contagious
Caecum	(Plural caeca) a large, blind pouch or sac (often a pair) at the junction of the ilium and rectum. They are absent or rudimentary in some species.
Choana	One of the paired openings on the inner side of the maxilla (upper beak), near the back of the oral cavity, that opens into the nasal cavity.
Chronic	Persisting for a relatively long time.
Chronic losses	Mortality of attrition; small numbers of continual losses over extended periods of time.
Clinical sign	An abnormal physiological change or behaviour pattern that is indicative of illness. Signs are externally observable, as contrasted with symptoms, which are subjective.
Cloaca	A common pathway in birds, reptiles and amphibians for the excretory, reproductive and digestive wastes. It consists of three (potential) chambers from front to rear: coprodeum, urodeum, proctodeum ("CUP").
Congestion	The abnormal accumulation of blood in a tis-sue or organ; often causes a reddening of the affected area.
Contagious	Capable of being transmitted from animal to animal.
Crop	A dilation of the cervical oesophagus at the base of the neck of some birds (not present in gulls, penguins, ostrich).
Cull	To remove from the flock, birds that are not performing well, eg, because of illness or infertility.
DEH	Department of the Environment and Health
Depopulation	The destruction of an exposed or infected group of animals.
Direct life cycle	A parasitic life cycle that requires only a single host for its completion.
Ectoparasite	A parasite that lives on the external surface, or in the integument, of its host.
EDTA	Ethylenediamine tetra-acetic acid; an anticoagulant and a chelating agent that binds with lead and that is used in the treatment of lead poisoning.
ELISA	A molecular-based enzyme-linked immonosorbentassay; a type of test used to detect either antigen or antibody.
Emaciation	A wasted condition of the body; excessive leanness.
Endangered species	As defined in and listed under the EPBC Act, a native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered *and* (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Endemic	In a broad sense, means belonging or native to, characteristic of, or prevalent in a particular geography, race, field, area, or environment. In epidemiology, an infection is "endemic" in a population in a specific geographic area when that infection is maintained in the population without the need for external inputs.

Endemic	A disease that commonly is present within a population or a geographical area.
Endoparasite	A parasite that lives within the body of its host.
Enteritis	inflammation of the intestine.
Enzootic	An animal disease that commonly is present within a population or geographical area.
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Australian Government legislation)
Epidemic	In epidemiology, an epidemic is a disease that appears as new cases in a given human population, during a given period, at a rate that substantially exceeds what is "expected," based on recent experience (the number of new cases in the population during a specified period of time is called the "incidence rate"). (An epizootic is the same thing but for a nonhuman population.)
Epizootic	A disease affecting a greater number of animals than normal; typically, occurrences involving many animals in the same region at the same time.
Erythrocyte	Red blood cell
Exotic Disease	A disease that normally does not occur within a particular area.
Exotoxin	A toxin formed and excreted by bacterial cells.
Fauna	The animals of an area.
Fomite	An inanimate object (pencil, doorknob, handkerchief) that can harbour and transmit an infectious agent to a living organism; fomites such as food or water are called vehicles
Formalin	A liquid solution of formaldehyde that is used asa tissue fixative, usually to prepare tissues for microscopic examination.
Gizzard	The enlarged muscular ventriculus (stomach) of many birds.
Haemagglutination	The clumping of red blood cells. Used to titrate agents that agglutinate some avian erythrocytes under specific conditions.
Haemagglutination inhibition:	Used to detect and titrate specific antibodies to some viruses In HI assays, an antigen sample (e.g., BFDV) is incubated with serum and then RBCs sensitive to the virus are added and the incubation continued. If agglutination occurs, the serum does not contain BFDV-specific antibody.
Herpesvirus	One of the major groups of related viruses that have DNA nucleic acids and that are further characterized by similar size, shape, and physiochemical reactions.
HI	Haemagglutination-inhibition
History	Refers to information about the past life of a bird, especially medical, social, nutritional and environmental. It can also be a record pf a bird's medical background.
Hygiene	The science or practice that deals with the promotion and preservation of health.
IATA	International Air Transport Association
Iatrogenic infection:	An infection caused as a result of medical procedures (vaccination, blood collection, surgery) which easily introduce pathogens into bird tissues
Incidence	The number of new cases of diseased birds in a flock at one time
Incubation period	The interval between exposure to an infectious agent and the first appearance of clinical signs
Infectious:	Relative ability of an organism to invade a bird.
Infection	The invasion and multiplication of an infectious agent in host body tissues.
Infectious agent	A living organism capable of invading another.
Insecticide	a pesticide used to kill insects.
Intracellular parasite	A parasitic organism, usually microscopic, that lives within the cells of the host animal

Isolate	A collection of a sub-population before the conduct of tests of biological characterisation
Keel	The narrow middle portion of a bird's sternum.
LA	Latex Agglutination
Latent	Dormant or concealed; a latent infection refers to the situation in which a disease condition is not apparent.
Lesion	An abnormal change in tissue or an organ due to disease or injury.
Megabacterium	AGY, Avian Gastric Yeast (*Macrorhabdus ornithogaster*)
Microbiology	Examination of diagnostic samples for bacteria or viruses
Morbidity	Disease; sickness; clinical illness
Mortality	Death
Nares	The external openings on the top of the bill of birds; the external orifices of the nose; the nostril
Nasal cavity	The forward (proximal) portion of the passages of the respiratory system, extending from the nares to the pharynx and separated from the oral cavity by the roof of the mouth.
Necropsy	The methodical examination of the internal organs and tissues of an animal after death to determine the cause of death or to observe and record pathological changes.
Necrosis	The death of cells in an organ or tissue.
Necrotic	Dead; exhibiting morphological changes indicative of cell death; areas of dead tissue.
Nematodes	Unsegmented, cylindrical parasitic worms; eg, ascarids.
NSW	New South Wales
NT	Northern territory
OBP	Orange-bellied parrot
Oesophagus	The passage extending from the mouth to the proventriculus
Pacheco's disease	Caused by Psittacine Herpesviruses 1 (PsHV1) and characterised by acute death in susceptible psittacine birds, enlarged liver with liver necrosis, and latency. The virus also causes mucosal papillomas .
Panzootic	A disease involving animals within a wide geo-graphic area such as a region, continent, or globally.
Parasitism	An association between two species in which one (the parasite) benefits from the other (the host), often by obtaining nutrients.
Pathogenesis	The origination and development of a disease process
Pathognomonic	A change that is characteristic or peculiar to a specific disease
Pathology	Study of the changes in structure and function associated with disease
PBFD	Psittacine beak and feather disease
PCR	Polymerase Chain Reaction, not "Positively Correct Result"!
PCV	Porcine circovirus, also packed cell volume (acronym, not used for latter in this document)
Plasma	The liquid component of blood before the cells have clotted
Prevalence	The ratio of the number of new cases in a flock at a specified time and the number of individuals in that flock at that specified time.
Protozoan	A one-celled animal with a recognisable nucleus, cytoplasm, and cytoplasmic structures.
PsHV	Psittacine herpesvirus, the cuase of Pacheco's disease and mucosal papillomas
Psittacine bird	A birds in the order *Psittaciformes* that includes the families *Cacatuidae* (cockatoos and cockatiel) and *Psittacidae* (parrots).
QLD	Queensland
Reservoir	A site, bird or flock in which infectious agents remain viable and from which infection of individuals may occur

RVO	Regional Veterinary Officer
SA	South Australia
Septicaemia	The presence of pathogenic microorganisms or toxins in the blood.
Serology	The measurement of antibody concentrations in serum
Serum	The fluid component of the blood after the cells have been removed.
Signs	Observable evidence of disease in animals ("symptoms" is used in humans).
Strain	A sub-population with previously defined biological characteristics
Seroconvert	The development of antibodies in response to an antigen, natural or by vaccination.
Seroprevalence	The number of birds in a study population that have antibodies to a particular organism. The number of birds in a population who test positive for a specific antigen based on serology specimens; often presented as a percent of the total specimens tested.
Subcutaneous	Under the skin.
Systemic	Affecting the entire body.
TAS	Tasmania
Thorax	Te part of the body between the neck and the liver, containing the heart a lungs, encased by the ribs.
Threatened species	Refers to the Australian Government list of threatened native species divided into the following categories as per the EPBC Act: critically endangered; endangered; vulnerable; conservation dependent
Thymus	Several lymph-gland-like organs located in the neck along the jugular veins.
Vector	A living animal agent which is capable of transmitting an infectious agent (ticks, fleas, flies mosquitoes)
Ventriculus	The gizzard
VIC	Victoria
Viraemia	The presence of virus in the blood.
Viraemic period	Period when a virus can be detected circulating in the blood.
Virulence	The disease-producing ability of a microorganism, generally indicated by the severity of the infection in the host and the ability of the agent to invade or cause damage or both to the host's tissues.
Virulent	The degree to which an infectious agent produces adverse effects on the host; a highly virulent organism may produce severe disease, including death.
Viscera	The internal organs, particularly of the thoracic and abdominal cavities.
WA	Western Australia

Hygiene Protocols for the Prevention and Control of Diseases (Particularly Beak and Feather Disease) in Australian Birds

Australian Veterinary Laboratories

Australian Government

Department of the Environment and Heritage

Copyright

This publication is available online at:
http://www.deh.gov.au/about/publications/index.html

For additional hard copies, please contact the Department of the Environment and Heritage, Community Information Unit at ciu@deh.gov.au or 1800 803 772.

Disclaimer

Note

This document lists Australian veterinary laboratories, and has been developed with the involvement and cooperation of a broad range of stakeholders, but the making of this document does not necessarily indicate the commitment of individual stakeholders to undertaking any specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the document due to changes in knowledge.

Australian Veterinary Laboratories

Reference Laboratories

- **Avian Influenza and Newcastle Disease Reference Laboratory**
  CSIRO's Australian Animal Health Laboratory
  Private Bag 24, Geelong VIC 3220
  Deliveries to:
  5 Port Arlington Rd
  Geelong VIC 3220
  Phone: (03) 5227 5414

- **Salmonella Reference Laboratory**
  IMVS
  PO Box 14
  Rundle Mall Post Office
  Rundle Mall
  Adelaide SA 5000
  Phone: (08) 8222 3365

Australian Laboratories

- CSIRO Australian Animal Health Laboratories
  5 Portarlington Rd
  Private Bag 24
  Geelong VIC 3220
  Phone: (03) 5227 5000
  Fax: (03) 5227 5555

Australian Capital Territory

- ACT Veterinary Services
  PO Box 144
  Lyneham ACT 2602
  Phone: (02) 6207 2357
  Fax: (02) 6207 2361

New South Wales

Government

- A comprehensive test list for NSW Government laboratories can be downloaded from:
  http://www.agric.nsw.gov.au/reader/das-vettesting

- NSW Department of Primary Industries
  Elizabeth Macarthur Agricultural Institute Deliveries:
  Woodbridge Road
  Menangle NSW 2568
  PMB 8, Camden NSW 2570
  Phone: (02) 4640 6333
  Fax: (02) 4640 6300

- Wollongbar Agricultural Institute
  1243 Bruxner Highway
  Wollongbar NSW 2477
  Phone: (02) 6626 1200
  Fax: (02) 6628 1744

- Orange Agricultural Institute
  Forest Road
  Orange NSW 2800 Phone:
  Phone: (02) 6391 3943
  Fax: (02) 6391 3899

* Taronga Zoo
  PO Box 20
  Mosman NSW 2088

Private

- IDEXX Laboratories
  Laboratory Enquiries: Phone: 1300 799 722 Fax: 1300 799 744
  Webpage: http://www.idexx.com.au/index.jsp

- IDEXX Laboratories NSW
  The Metro Centre
  Unit 20, 38-46 South Street
  Rydalmere NSW 2116
  PO Box 227
  Rydalmere NSW 2116
  Email: lab-sydney@idexx.com

Northern Territory

Government

- Northern Territory Department of Business, Industry and Resource Development - Primary Industries
  Berrimah Veterinary Laboratories
  GPO Box 990
  Darwin NT 0801
  Phone: (08) 8999 2249
  Fax: (08) 8999 2024

Queensland

Government

- Queensland Department of Primary Industries and Fisheries Primary Industries Building
  Yeerongpilly Veterinary Laboratory
  665 Fairfield Road
  Yeerongpilly QLD 4105
  Phone: (07) 3362 9471
  Fax: (07) 3362 9440

- Toowoomba Veterinary Laboratory
  203 Tor Street
  Toowoomba QLD 4350
  Phone: (07) 4688 1351
  Fax: (07) 4688 1195

- Oonoonba Veterinary Laboratory
  80 Abbott Street
  Oonoonba Townsville QLD 4810
  Phone: (07) 4722 2624
  Fax: (07) 4778 4307

Private

- IDEXX Laboratories QLD
  3 Overend Street
  East Brisbane QLD 4169
  PO Box 1119
  Coorparoo DC QLD 4151
  Email: lab-brisbane@idexx.com

South Australia

Government

- Department of Primary Industries and Resources, South Australia
  Gribbles Pathology
  1 Goodwood Road
  Wayville SA 5034
  Phone: (08) 8205 5655
  Fax: (08) 8271 9320

Private

- IDEXX Laboratories SA
  33 Flemington Street
  Glendale SA 5065
  PO Box 445
  Glenside SA 5065
  Email: lab-adelaide@idexx.com

- Gribbles VETLAB SA
  33 Flemington St
  Glenside SA 5065
  Phone: (08) 8202 3300
  Fax: (08) 8338 3800

- Gribbles Pathology SA
  1 Goodwood Rd
  Wayville SA 5034
  Phone: (08) 8372 5000
  Fax: (08) 8272 0768

Tasmania

Government

- Department of Primary Industries, Water and Environment - Tasmania
  Mt Pleasant Laboratory
  PO Box 46
  Kings Meadows TAS 7249
  Phone: (03) 6336 5216
  Fax: (03) 6336 5374

Victoria

Government

- Victorian Department of Primary Industries
  Attwood Centre
  475 Mickleham Rd
  Attwood VIC 3049
  Phone: (03) 9217 4200
  Fax: (03) 9217 4299

Private

- IDEXX Laboratories VIC
  Unit 124,
  45 Gilby Road
  Mt Waverley VIC 3149
  Locked Bag 15
  Mt Waverley VIC 3149
  Email: lab-melbourne@idexx.com

- Gribbles Veterinary Pathology Victoria
  1868 DandenongRd
  Clayton VIC 3168
  Phone: (03) 9538 6777
  Fax: (03) 9538 6778

Western Australia

Government

- Department of Agriculture - WA
  Animal Health Laboratories
  South Perth Laboratory
  3 Baron-Hay Court
  South Perth WA 6151
  (Locked Bag 4, Bentley Delivery Centre, Bentley WA 6983)
  Phone: (08) 9368 3333
  Fax: (08) 9368 1205

- Animal Health Laboratories
  Albany Laboratory
  444 Albany Highway
  Albany WA 6330
  Phone: (08) 9892 8444
  Fax: (08) 9892 8564

University

- School of Veterinary and Biomedical Sciences
  Murdoch University
  South Street
  Murdoch WA 6150
  Contact: Professor Shane Raidal
  Email: shraidal@csu.edu.au

  Tests offered: BFDV: HA, HI, PCR
  Psittacid herpesviruses: PCR
  APV (by arrangement)
  Full blood count
  Faecal and crop sample testing

- The Director
  Wildlife Health and Conservation Centre
  Faculty of Veterinary Science
  The University of Sydney
  Private Gab 3
  Camden NSW 2570
  Contact: Professor David Phalen
  Email: dphalen@camden.usyd.edu.au

  Tests offered: Psittacid herpesviruses: PCR
  APV (by arrangement)
  Full blood count
  Faecal and crop sample testing

Specialist Laboratories

Avian Genetic Sex Determination

- Genetic Science Services
  Animal Division of Genetic Technologies Limited
  PO Pox 115
  Fitzroy VIC 3065
  Phone: (03) 8412 7077
  Fax: (03) 9416 4076
  Webpage:
  http://www.geneticscienceservices.com/index_general.asp?menuid=120&imageid=

- Wildlife genetics Lab (WGL)
  School of Veterinary and Biomedical Sciences
  Murdoch University
  South Street
  Murdoch WA 6150
  Contact: Dr Peter Spencer
  08 9360 2489
  Email: P.Spencer@murdoch.edu.au

Parasite Identification

- School of Veterinary and Biomedical Sciences
  Murdoch University
  South Street
  Murdoch WA 6150
  Contact: Parasitology: Mr Russell Hobbs
  Telephone:08 9360 2499
  Email: russ.hobbs@murdoch.edu.au

Internal Parasite Identification

- Dr lan Beveridge
  Veterinary Clinical Centre
  School of Veterinary Science
  University of Melbourne
  Princess Highway
  Werribee VIC 3030
  Phone: (03) 9742 8285

Insect Identification

- Ms Merydyn Davison
  Entomology Enquiry Officer
  NSW Department of Primary Industries
  Orange Agricultural Institute
  Forest Road
  Orange NSW 2800
  Phone: (02) 6391 3980
  Fax: (02) 6391 3899
  Webpage: http://www.agric.nsw.gov.au/Hort/ascu/staff/merydyn.htm

Insect identification and advice

- Identification and Advice Officer
  Australian National Insect Collection
  CSIRO Entomology
  GPO Box 1700
  Canberra ACT 2601
  Street Address
  Clunies Ross St
  ACTON ACT 2601
  Phone: (02) 6246 4263
  Fax: (02) 6246 4364
  ento-ident@csiro.au
  Webpage: http://www.ento.csiro.au/insect_id/about.html