Dr. Ron Riis, veterinary ophthalmologist at the College of Veterinary Medicine, recently fitted a blue and gold macaw with a soft contact lens that won't correct vision but will protect the bird's cornea. Boris, a parrot owned by Fred Allen of Syracuse, suffered from a non-healing corneal ulcer of his right eye; in this case, the lens would act like a bandage while the ulcer had time to heal. It took Boris two weeks to take out the stitches holding the lids closed but by then the 5 mm ulcer had been reduced to 1 mm. The referring veterinarian, Dr. Ed Spindel, left the lens off for two weeks, but after healing failed to progress, he replaced the "bandage" with a lens supplied by the Small Animal Clinic. This lens is due to be taken off in two weeks and, based on the previous healing success, Dr. Spindel is very optimistic about Boris's recovery.

The lens, in this enlarged photo, is nearly the size of a half-dollar, but in reality it was slightly smaller than a dime. Once the lens was in position, Boris's eyelid was sutured partially shut to hold the lens in place.
MAKING THE DIAGNOSIS

By Michael Bonda '88

In the Avian Clinic of the New York State College of Veterinary Medicine, finding the correct diagnosis is often due to the combined efforts of many people and their specialized disciplines. Such a case was the immature -and flightless - red-tailed hawk admitted to the Avian Clinic.

The raptor had been found beneath a tree in the Buffalo, NY, area, in July, 1986. Ronald M. Kondrich, DVM and a New York State licensed rehabilitator, with Michael Bonda a third year student at the College of Veterinary Medicine, examined the hawk, palpating long bones, checking wing feather structure, vision, and joint mobility. They found a lack of normal pectoral muscle mass and a generalized muscle weakness that may have been due to an inadequate diet. Such young raptors rely on parental feeding while in the nest, and after leaving the nest may take some time to develop hunting skills. In the interim "learning period" the immature hawks may lose condition.

Throughout July, the hawk was housed in a small outdoor flight cage and fed a diet of whole live and dead mice and rats. Human contact was kept to a minimum. By early August, the bird had gained weight and normal pectoral muscle mass had returned but it was still unable to fly. The main problem seemed to be its inability to fully extend and abduct the wings when flapping, yet manual extension and abduction were possible. In mid-August, the hawk was taken to the Laboratory of Ornithology where it was housed in a large flight cage with another red-tailed hawk. No improvement was seen and by the end of October, it was decided to bring the flightless hawk to the Avian Clinic for testing.

At the clinic, a complete blood chemistry profile was run with results that showed serum enzymes and electrolytes were within normal ranges for a red-tailed hawk. Elevated levels of creatinine phosphokinase, a muscle enzyme, were found, indicating possible muscle damage. In a neurological examination performed by Dr. Alexander deLahunta probable musculoskeletal disease was diagnosed. Radiographs were taken and, according to Dr. Amy Dietze, these showed erosions in the bone of both humeral heads, indicating arthritis of both shoulder joints. Since this was a young bird, osteochondrosis was suspected.

It was believed an electrodiagnostic examination might help to detect the nature and location of motor unit lesions. The EMG or electromyography is not routinely used in avian medicine because the instrumentation and the experience necessary to interpret the results are not widely available. Veterinary pathologists, Dr. Beth Valentine and Dr. Barry Cooper conducted the hawk's electromyography. When a fine needle electrode is inserted into the muscle, the action potentials spontaneously present in an abnormal muscle can be seen on the cathode-ray oscilloscope and heard on a loud speaker. Almost no sound is generated by the normal electrical properties of skeletal muscles but abnormal muscle activity can be heard as loud static and seen by extreme peaks and troughs on the oscilloscope screen.
In an EMG of the left pectoral muscles, left tricep muscle and left tibial muscle, abundant spontaneous activity particularly in the pectoral and deep pectoral muscles was seen and increased insectional activity in the tricep muscle was noted. By contrast, the cranial tibial muscle was essentially electrically silent. This suggested neuromuscular disease but it was difficult to define exactly what type.

Based on these findings, a biopsy of the pectoral and tricep muscles was suggested and minute sections were taken surgically by Dr. Jay Harvey for staining and microscopic examination. Further diagnostic work-up will include a humeral joint tap and an air-arthrogram to evaluate any damage to the joints.

Not every patient requires specialists in neurology, surgery, medicine, radiology, and pathology but it is the strength of a major veterinary teaching hospital that such services and specialists are available. As this issue goes to press, the results from the complete battery of tests are incomplete and so the diagnosis is not definite. However, this case demonstrates how multi-disciplinary efforts and new applications of technology combine to make a difficult diagnosis.

In the photo on page 2, Dr. Barry Cooper, fourth year student Laura Smiley, and Dr. Beth Valentine monitor the oscilloscope screen for unusual electrical activity. The sedated hawk is connected to the machine by needle electrodes inserted in muscle. The needles cause minimal discomfort and similar needles are routinely used in acupuncture procedures.

The oscilloscope screen can be seen in the top left corner of the photo above, where Dr. Valentine is carefully positioning the needle electrodes.
CHLAMYDIOSIS IN PET BIRDS
(Psittacosis - Ornithosis)

By Priscilla A. Lightcap, DVM '82

Chlamydiosis in birds caused by Chlamydia psittaci is of special interest because it is a disease that can be transmitted to humans. In fact, the human ailment was documented in the 1800's, years before the avian disease was recognized, although it was known that contact with birds did play a role in the etiology of the disease. Several names have been used for diseases caused by the organism, such as ornithosis, pneumo-typhus, psittacosis, parrot fever and Bedsonial disease.

Symptoms and Signs
The infection in humans is usually mild, however it may appear as an acute generalized infection with fever and headache. There may be an associated atypical pneumonia. The patient is lethargic and anorexic and may present with constipation or diarrhea. A more chronic manifestation of the disease might be associated with endocarditis and obstructive heart disease. Two cases were reported in England where the patients both presented with generalized toxemia, acute renal failure and evidence of pancreatitis. It was thought that these patients had been ill for some time before they sought medical help. There are occasional deaths associated with psittacosis.

Chlamydial infection in birds may be latent or may present clinically as an acute or subacute disease. The signs of chlamydiosis vary with species of bird affected, virulence of the strain of chlamydia, stresses on the bird and route of exposure. A bird may be an asymptomatic carrier or (rarely) the first sign of illness may be sudden death.

A typical bird with generalized chlamydiosis looks like a bird with any systemic febrile illness. It is lethargic, the feathers are ruffled, and it is anorexic and sleepy. There may be a serous or purulent ocular and/or nasal discharge. There may be diarrhea, and the urates are stained green to yellow-green. As the disease progresses the stool will become more firm, but it is dark green and sticky. If the bird survives with the disease beyond the twentieth day, stools usually become more copious - watery and whitish - and the bird becomes extremely emaciated and dehydrated. Death may occur - or the signs may subside after prolonged periods of weakness and debilitation.

The mortality rate in birds can approach 100% among nonresistant species (e.g., budgerigars, conures and Amazon parrots) if no treatment is given. Cockatoos, pigeons and chickens tend to be more resistant hosts and the mortality rate is lower, from 10 to 50%, depending on the virulence of the infecting strain of chlamydia.

Diagnosis
None of the clinical signs associated with chlamydiosis are specific (pathognomonic). Psittacosis should be suspected if a patient has been recently purchased, recently boarded or introduced to a new bird. The owner of a bird that has been healthy for the last several years and presents with signs possibly suggestive of chlamydiosis, should be questioned carefully to determine if there has been any contact between this sick bird and any new bird. A bird that was purchased within the last few months and that has been ill with nonspecific signs for a few weeks, despite treatment with antibiotics, would be a possible chlamydiosis suspect. Treatment with tetracycline or chlortetracycline should begin immediately. A positive diagnosis can be made only by isolation of the organism or by serologic evidence of infection.

Specialized laboratory facilities and training are necessary for reliable identification of chlamydial isolates. A cloacal swab is frozen and sent to the laboratory where it is used to inoculate a cell culture. Within four-to-five days a fluorescent antibody test is run. The advantage of this procedure is that it takes much less time. A veterinarian can have an answer within a week of sending a sample.
Serological tests available are a complement fixation test, hemaggutination inhibition, conglutinating complement absorption, latex agglutination test, and a capillary tube agglutination test. The complement fixation test does not work very well with smaller birds and there are marked variations.

There is also an agar gel precipitin test; a single drop of serum is put into a well of a petrie dish containing agar, with antigen put into another well. A readily recognizable line of precipitation develops if the test is positive.

The major problem with serologic testing is the interpretation of results. A positive with a serologic test simply means that the bird has been exposed to the disease, not that the bird currently has the disease. Many birds are too small to yield sufficient blood for serological testing, but in the larger birds acute and convalescent blood samples can be tested for complement fixing antibody to determine if there has been a significant rise in titer. Fecal samples are not reliable samples for smears or for isolation because some birds are intermittent shedders. Smears made from exudates are discussed later.

In summary, a bird suspected of having chlamydiosis should be put on treatment immediately, because of the potential health hazard and the delay in getting test results. Although postmortem examination may be highly suggestive - splenomegaly, a swollen friable liver (occasionally with focal necrosis), air sacs covered with a thick yellow exudate, pericarditis, fibrinous air saculitis and serositis - the only sure diagnosis is isolation of the organism.

In fatal cases, the typical gross lesions and the demonstration of chlamydial elementary bodies in impression smears provide good evidence that the cause of death was systemic chlamydiosis. The smears can be obtained from exudate or from air sac membranes, liver or lungs. The infective form of the chlamydial organism, the elementary body, stains purple with Giemsa's stain and red with Gimenez' or Macchiavello's stain. The vegetative form stains blue with Giemsa's. Under oil immersion magnification (1000x) the Chlamydiae are seen as characteristic clusters of spherules approximately 0.2 to 0.4 μ in diameter.

Finding elementary bodies on impression smears or smears from exudates from apparently healthy birds is uncommon. Definitive post-mortem diagnosis is based upon identification of chlamydiae by immunofluorescence (fluorescent antibody test) or by isolation of the organism in embryonated eggs or cell culture.

Epidemiology
In wild parrots there are probably few (less than 5%) adult birds infected with chlamydiae and not all of these birds are actively shedding. Most of them appear healthy. When these birds are stressed by egg laying or feeding a nestling, latent infections may be activated. Chlamydiosis is essentially a disease of the nestling which is living in an environment of dried, readily aerosolized excreta and nasal discharges. It is likely it is also being fed food contaminated by the adults.

Some nestlings will escape infection, some will succumb and die, while others will survive. As the survivors mature some will lose their chlamydial infections (but they will not be immune to future challenges). Others will recover but harbor the organism, thus becoming the carriers for sequential infection of the young that they will raise.

Capturing and exporting these wild birds interferes with this cyclical relationship of the birds and the disease because hundreds are brought together into holding areas. They are subjected to many strange changes; handling, confinement, crowding, different sounds and a new diet. The healthy carriers begin shedding organisms as a result of these stresses. A 5% infection can go to a 90-100% infection simply by stressing and crowding so that all are exposed.
It is important to remember that a bird may harbor the chlamydial organism after quarantine and remain susceptible to chlamydiosis even after full recovery or previous treatment. For example, a healthy pet may be exposed to the organism through contact with a contaminated environment, or through contact with a wild or pet bird that is shedding the organism.

It is possible for the infection to go from mammal to mammal, but that is considered rare. Chlamydiae have been isolated from lice, mites and ticks. It is conceivable that these arthropods may serve as vectors but that has not been proven.

The primary source of infection for humans is infected birds. In the U.S., parrots are the most common reservoir. Turkeys are the next most common source. Chickens, pigeons and ducks are less commonly blamed. Wild birds may be a significant factor in spreading the disease in native bird populations.

In at least one case, the evidence for human to human transmission was convincing though circumstantial. The primary infected human had been in contact with an infected cockatiel recently released from quarantine.

Treatment and Prophylaxis
Most strains of chlamydia are resistant to the sulfonamides. Streptomycin has no antimicrobial effect on chlamydiae and is therefore useful in controlling contaminating bacteria in chlamydial isolation and propagation attempts. Chlamydiae are susceptible to penicillin in varying degrees. Some feel that chlamydiae are sensitive to chloramphenicol, but there are unacceptable toxic side effects associated with the necessary drug levels.

The drugs of choice for both treatment of chlamydiosis and prophylaxis against chlamydial infection are the tetracyclines. The tetracyclines inhibit protein synthesis. They do not inactivate the organism, therefore extended therapeutic regimens, as long as 45 days are necessary. Chlortetracycline is readily absorbed from the avian gastrointestinal tract and is therefore used for oral administration. It is estimated that on a 30 day regimen about 15% of those infected remain infected. On a 45-day schedule that percent drops to 1%. After treatment a bird can be reinfected, therefore a treated bird should be kept isolated from untreated birds. Previous illness does not confer immunity and therefore it is unlikely that a vaccine would be reliable.

Therapeutic blood levels of tetracycline or chlortetracycline can be achieved rapidly by intramuscular injection. However, administration of the antibiotic in feed requires less manipulation of the bird. Because the risk to an already stressed bird is less, and there is less contact between therapist and bird, giving medicated feed is the method usually chosen. Treatment by injection might be employed in a single, acutely ill, anorexic patient. It could be switched to the medicated feed when it begins to improve and will eat on its own. The aim of treatment is to rapidly produce and maintain adequate blood levels of drug, considered to be 1 to 2 µg per ml of blood.

All persons who come in contact with suspected cases of chlamydiosis should be informed about the nature of the agent and disease. When working with large groups of birds the USDA recommends protective masks and special clothing. This is probably not necessary when dealing with a single patient, if good hygiene, general cleanliness and common sense are observed. Humans are generally infected by inhaling contaminated aerosols, thus precautions should be taken to keep cages clean and the dust down to a minimum. It is recommended that gloves and masks be worn at necropsy.

Treatment of:
Parakeets and other small, seed-eating birds:
Keet-Life by Hartz Mountain is millet seed impregnated with 0.5 mg. chlortetracycline (CTC) per gram of seed. The easiest regimen is to feed Keet Life exclusively for 45 days. A
parakeet that is too sick to eat can be given 5-10 mg. CTC intramuscularly for up to 5 days. By this time, the bird should be feeling better and have a nearly normal appetite and can then be switched to the medicated millet.

**Parrots**

A parrot will not eat enough of the Keet Life to achieve satisfactory blood levels of CTC. The concentration of the CTC in the feed has to be approximately 4-10 mg/gm. SF66 is a formulation of CTC in soybean meal which can be mixed with a mash. SF66 is not water soluble and is not easily mixed into feed. It has the advantage of being accepted by most birds, while the more easily handled water-soluble formulations of CTC are often rejected.

A cooked mash to mix with the SF66 can be prepared from rice, hen scratch feed and water in a weight ratio of 2:2:3. This mixture should be cooked until soft, but not mushy. Because CTC is inactivated by heat, the mixture should be allowed to cool before the SF66 is added. Weighing of the mash and the drug should be done carefully with as much accuracy as possible. The amount of drug should be two percent by weight of the mash.

The SF66 should be sprinkled over the mash in a large container and continually stirred and agitated until the antibiotic is evenly distributed and there should be no visible lumps of soybean meal. An amount of brown sugar equal in weight to the SF66 can be added to improve palatability but it should be added after the antibiotic is thoroughly mixed, otherwise it becomes very sticky.

The bird should be offered as much of the medicated feed as can be consumed in 24 hours. A rough guide is that the bird will eat about one-fourth its weight per day once it has become used to the feed. No other food should be offered. Sand or gravel should not be given to a sick bird because of the danger of gorging and compaction. A vitamin and mineral supplement can be added to the drinking water which should be fresh and available at all times.

On this diet, treated birds have built up, within a few days, blood levels of 2-10 ug of chlortetracycline per ml of blood. Intramuscular injections can be given at a level of 40 to 50 mg. daily depending on the size of the bird. This is recommended only if the bird is not eating.

**Pigeons**

Uncooked hen scratch mixed with SF66 will be accepted by pigeons. The hen scratch should be moistened with just enough water to make the medication stick, and then mixed thoroughly. The mixture should contain SF66 amounting to 4% of the weight of the hen scratch. The final concentration of chlortetracycline is 0.89 percent. Pigeons usually won't eat very much for the first few days, but as they become accustomed to it their intake increases. The level of chlortetracycline in the blood will reach 2-4 ug/ml which is adequate if maintained for 45 days.

**Loridae - Lories and Lorikeets**

These nectar feeding parrots can be treated with a medicated liquid diet. This liquid diet is made from a human dietary canned food (e.g., Nutrament or Metracal), honey and water in a ratio of 1:1:4. Chlortetracycline should be added fresh daily in a quantity of 500mg/liter. Boiled rice or kibbled dog food can be added in small amounts to the basic liquid formulation to increase palatability and as a source of additional nutrients. During the recommended 45-day treatment, no other food is offered. After several days' treatment a bird will not be shedding organisms and it can be sent home to be treated with oral medications. To avoid overgrowth by gram positive bacteria, Lactobacillus acidophilus can be added to the food. Mycostatin, 1 ml. per day (100,000 units) should be administered to prevent candidiasis.

**Import Regulations**

In 1972 the importation of all birds into the United States was placed under the jurisdiction of the Animal and Plant Inspection Service of
the USDA. The regulations are designed to protect the commercial poultry industries from exotic communicable diseases. The quarantine was implemented primarily to prevent the introduction of Viscerotropic Velogenic Newcastle Disease (VVND) virus.

Regulations regarding commercially imported birds require:
1) an import permit in advance of shipping,
2) a certification of health from a full-time government-salaried veterinarian from the country of export,
3) a minimum quarantine of 30 days for each lot of birds. The facility has to be provided by the importer, USDA approved and in the immediate vicinity of the port of entry. The 30-day holding time is in response to the exotic Newcastle threat. For treatment of inapparent chlamydiosis in the larger birds, 45 days would be better.
4) that during the quarantine all psittacines must receive treatment with chlortetracycline as a chlamydiosis prophylaxis in accordance with the guidelines set up by the United State Public Health Service.

Veterinarians should be aware that chlamydiosis is not uncommon in pet birds. They should seriously consider chlamydiosis in a lethargic bird which presents with no specific signs, particularly if the bird has had recent contact with other birds, or is a new purchase. If chlamydiosis is suspected, treatment should begin at once, even as confirmatory tests are being run.

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