CHAPTER

2

THE AVIAN FLOCK

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Changing attitudes and regulatory pressures are transforming the companion bird industry. Birds for pets and aviculture are being increasingly supplied by domestic breeding programs, and the importation of wild-caught birds is no longer necessary or acceptable for most species. As aviculture advances, veterinarians must play a major role in maintaining the health and increasing the productivity of individual pairs and flocks. The quality of avian medicine available for individual birds has advanced tremendously in recent years. The successful growth of aviculture will require simultaneous advances in the knowledge and application of preventive medicine from the veterinary community.

Avicultural medicine differs from clinical care of individual companion birds in several very important ways. In general, the health of the flock is of primary concern, and establishing a diagnosis or preventing exposure of the flock to an infectious agent is usually more important than providing supportive care for the individual ill bird.

The economics of the companion bird industry are also changing. As production increases, sale prices for individual captive-bred birds decline. The commercial producer, as is the case with any livestock producer, often operates on a slim margin of profit, which can be profoundly affected by disease or management problems. Understanding the economics of the companion bird industry is vital for a successful avicultural practice.

Flock Preventive Medicine

The Veterinarian / Aviculturist Relationship

To be of service to the aviculturist, a veterinarian must understand some of the principles of aviculture as well as the principles of medicine and disease. A knowledgeable avian veterinarian will serve as part of a well coordinated aviary team. Table 2.1 lists routine veterinary services that are beneficial to aviculturists.

Veterinary/client confidentiality is of utmost importance for the avicultural client. Inappropriate discussions concerning disease problems in an avicultural facility can permanently and irreparably damage a facility's reputation. The clinical staff must be counseled in strict professional behavior to ensure that they also maintain client/doctor confidentiality.

TABLE 2.1 Veterinary Services of Benefit to Aviculture

- Perform new bird examinations
- Perform resident bird examinations
- Assist in establishing and maintaining records
- Establish a preventive medicine program
- Offer husbandry advice
- Provide emergency care for aviary birds
- Take appropriate action in the face of disease outbreaks
- Evaluate reproductive failure
- Assist with incubation and pediatric problems

Commercial Breeder vs. Hobbyist

The primary goal for the commercial breeder is to produce young companion birds at a profit. Rare or endangered species, species that inherently make poor pets, species that reproduce poorly in captivity or species that have extraordinary housing requirements are not advisable for the commercial breeder. The true economic advantages and disadvantages of a particular-sized facility should be carefully evaluated. Increases in housing density may be economical but can also contribute to the incidence and severity of disease outbreaks, necessitating a detailed monitoring system to prevent health hazards. The commercial breeder should select species that are easy to produce in captivity, that adapt well to the environment in which they will be kept and are popular, acceptable companion birds.

Hobbyists may specialize in a species, or group of species, in order to produce birds for exhibition, for the pure pleasure of aviculture or for the more altruistic goal of establishing or preserving a species in captivity. Hobbyists typically sell offspring to recover the costs of maintaining their collection or to allow them the freedom of devoting more time to aviculture. Profit is not typically the primary motive of a hobbyist breeder. Many aviculturists may start as hobbyists and turn that hobby into a profitable business as they gain expertise and appropriate species of birds.

Flock Monitoring Team

The veterinarian should work closely with the aviculturist to establish an effective preventive medicine program. Quarantine procedures, parasite control techniques, pest control, identification systems, first aid procedures and subclinical disease testing (chlamydia, PBFD virus, polyomavirus) should be discussed. A healthy, pre-existing aviculturist/veterinarian relationship ensures fast action if a disease outbreak occurs.

Aviculturists must be viewed as the veterinarian's eyes and ears. They see and evaluate their birds daily and must be willing to discuss even the slightest changes in behavior, appetite, stance or excrement output with the attending veterinarian. The aviculturist must respect the veterinarian's medical judgement and strictly implement any and all suggestions. If the advice of the veterinarian is not sought after and respected, a new veterinarian should be engaged.

Aviary Visits

Veterinarians and their staff should be aware of potential biosecurity hazards to avoid being mechanical vectors for disease transmission between individual patients or avicultural facilities. The veterinarian should visit only one avicultural facility a day, preferably in the morning prior to entering the hospital. If this is not feasible, it is best to have each facility maintain coveralls, scrubs and shoes that can be worn while evaluating that facility. These clothes then remain at the facility for laundering.

When it is necessary to handle a bird in the aviary, it is important to remove the bird from its enclosure with a minimal amount of disturbance. This can be achieved by having all necessary equipment and supplies readily available, with the least number of people involved and minimal noise. The number of assis-

tants and visitors that a veterinarian uses while making any aviary call should be minimized.

Selling Birds

Offering a liberal warranty may be used as a method to sell birds. However, long-term guarantees given on the health or life of birds, especially unweaned neonates, can be complicated. Pre-sale testing for selected infectious diseases such as polyomavirus, PBFD virus or chlamydiosis, may help assure the buyer of good health. The best guarantee of good health would logically stem from a stable flock of known health history and good husbandry practices. Pet retailers and breeders often require a veterinary examination within a certain period of time in order to activate a guarantee.

A suggested guarantee may last for 14 to 30 days post-purchase as long as the buyer has the bird examined within seven days. An immediate refund should be considered if the buyer's veterinarian determines that a bird has a health problem. The veterinarian must practice good judgement in recommending return, and not reject birds for frivolous or unsubstantiated reasons.

The New Bird

Acquisition

Initially, most aviculturists have little concept of which species they will ultimately be breeding. They often acquire, and later sell, many pairs or individual birds before determining which species are best for their aviary. Proper selection of a species for breeding will increase reproductive success, be personally satisfying and will provide better financial return. Choosing species that can easily adapt to the climatic conditions of a region will usually increase breeding success. For example, species that inhabit dry, high altitude environments may be unduly stressed and more susceptible to disease when housed in outdoor aviaries in a warm humid climate; likewise, species from lowland tropical forests may not thrive in dry desert areas.

Ideally, the aviculturist should attempt to envision what he or she would ultimately like to accomplish before establishing an aviary collection.

Sources of birds for captive breeding include imported wild-caught birds, captive-bred juvenile birds and surplus birds, either wild-caught or captive-bred, from other aviculturists or pet owners.

In the past, aviculturists have relied principally upon wild-caught birds for the majority of their breeding stock. A program was established in 1992 for phasing out the importation of wild-caught birds; the availability of these birds is limited to aviculturists who are willing to participate in cooperative breeding programs. As importation ceases, so too does the exposure of immunologically naive birds to previously unencountered pathogens. This provides the veterinary preventive research community with the time necessary to control some of the diseases that have already been introduced to the aviary through previous importation programs.

The purchase of captive-bred birds for breeding stock is a logical alternative for many species. Many psittacine and passerine species have adapted well to captivity and breed prolifically in properly designed aviaries. The psittacine species that have proven to be difficult to breed in captivity will require further work. In some cases, hand-fed neonates are not thought to produce well in captivity, while in other cases these birds reach sexual maturity at a much younger age than expected and readily reproduce.

Although the purchase of culled breeders from another aviculturist should be viewed with suspicion, moving a pair of healthy, unproductive birds to a new environment frequently initiates breeding activity.

Care must be taken to avoid the purchase of smuggled birds. Bargain-priced birds should always be viewed suspiciously. The addition of illegally imported (smuggled) birds to a collection has both unacceptable disease and legal risk.

The buyer should attempt to obtain as much information as possible about the seller and the bird before

CLINICAL APPLICATIONS

- Veterinary/client confidentiality is of utmost importance for the avicultural client.
- A healthy, pre-existing aviculturist/veterinarian relationship ensures fast action if a disease outbreak occurs.
- The level of husbandry advice provided by the veterinarian must be adjusted to compensate for the experience of the aviculturist.
- If a bird leaves a facility for any reason and is exposed to any other birds, it should be considered contaminated and must be placed in quarantine before return to the aviary.
- An aviary must meet the physical and psychological needs of the birds. Healthy, happy birds breed. Healthy, unhappy birds may not breed.

purchase. The first question to ask the potential seller would be, "Why is this bird or pair being sold?"

The aviculturist should determine the original source of the bird. If the bird was wild-caught, it is wise to determine the country of origin and the importer. If the bird has changed owners several times, it is best to determine why. For captive-bred birds, it is advisable to determine where the bird was produced, when it was hatched and if the bird was parent-raised or hand-fed. If the bird is represented as captive-bred but is not closed banded, it is useful to know why. Determining the genealogical history of the bird, determining if any previous health problems have occurred and evaluating as much information as possible about the flock of origin can guide the aviculturist in making a wise choice in adding birds. A copy of all medical and reproductive records should be requested. If a proven pair is being sold, are the birds identified and are breeder's records available? Knowing when and how the gender was determined in a bird may help identify reasons for reproductive failure. Male cockatoos are frequently available for sale after they have killed their mate. If a seller is unwilling to freely provide any requested information, the buyer should be concerned about the validity of any claims that are made concerning a pair of birds.

Evaluating a Prospective Purchase

The addition of new birds to an established aviary increases the potential for introducing an infectious disease. Additionally, new birds that are misrepresented (inaccurately sexed or sold, due to previous reproductive failure) represent a loss to the aviculturist by occupying space and requiring care that could be used for productive pairs. Examination of a breeding bird being considered for addition to the aviary should be more than a health exam. The bird's gender and the visual health of the reproductive tract should be confirmed by laparoscopy. Diagnostic testing should be based on the client's needs, species of birds, source of the birds and any questionable abnormalities detected on physical examination.

Quarantine

A routine quarantine program for new birds is vital to protect an established avicultural collection from the introduction of infectious diseases. The type of examinations performed, length of the quarantine period and preventive techniques vary according to the resources of the aviculturist, the species and source of the birds being added and the type of collection. If a bird leaves a facility for any reason and is exposed to any other birds, it should be considered contaminated and must be placed in quarantine before being returned to its normal enclosure. Neonates that leave the nursery and come into contact with other birds should not re-enter the nursery.

Quarantine Facilities

Facilities used for quarantine will vary among aviculturists. In many instances there is no opportunity for strict segregation of new arrivals, and in these cases it is prudent not to add new birds to a facility. Ideally, birds in quarantine should be housed separately from the remainder of the collection for a minimum of sixty days. Birds in quarantine should be attended by an individual who has no contact with the established collection, who takes care of established birds prior to servicing the quarantine facility or who showers and changes clothes after servicing the birds in quarantine. Quarantining birds off the aviary property (eg, a neighbor's home) is a practical means of providing an effective quarantine period.

Birds placed in separate rooms within a home provide a minimum amount of separation between new and established residents. Birds that are maintained in any enclosure (home or building) with the same air space should not be considered to be in quarantine. The bowls and all handling equipment used for birds in quarantine should not come in contact with the remainder of the birds in a collection.

New Bird Examination

Birds should be examined at the beginning of quarantine to establish any pre-existing problems and again at the end of quarantine to detect any clinical changes that may have occurred (see Chapter 8).

It is critical for the aviculturist to understand that quarantine is only a "safety valve" in the prevention of infectious disease and does not ensure that a new bird is not an asymptomatic carrier of parasitic, bacterial or viral pathogens.

The new bird exam and quarantine testing program should be tailored to the needs and resources of the aviculturist and the species of bird. Suggested screening techniques would include a thorough physical examination, Gram's stain of feces and evaluation of a blood smear. Complete blood count, blood chemistry profile and cultures are useful to detect birds that require more extensive evaluation. By performing a complete CBC, biochemical profile and radiographs on each new bird in a facility, the veterinarian is able to establish a "normal value" for

a particular test in a particular bird. In essence, this testing allows the veterinarian to establish a "point-in-time" medical fingerprint for the individual bird. Specific diagnostic screening tests that should be considered include ELISA tests for chlamydia and DNA probes for polyomavirus and psittacine beak and feather disease virus (see Chapter 32). Direct and flotation examination of feces for internal parasites should also be considered in birds that were recently imported or that are in flights with access to the ground (see Chapter 36). Any thin birds, especially species susceptible to neuropathic gastric dilatation (formerly proventricular dilatation syndrome) should be examined radiographically. Some diseases that are characterized by an asymptomatic carrier state (Pacheco's disease virus, giardiasis) are easily missed with routine testing.

Identification

Each new bird should be permanently identified during its initial physical examination. Implantable transponders provide the least alterable identification with minimal risk to the bird.[a-c] The transponder number should be included in the medical, genealogical and breeding records to provide positive identification of the bird throughout its lifetime (Figure 2.1). Closed bands can be used as an adjunct to or replacement for transponders but are not ideal. Properly fitting closed bands are an indication (not proof) that a bird was bred in captivity.

Closed bands are currently required for export of captive-bred birds of CITES-listed species. Unfortunately, the numbers often wear off closed bands and large birds may collapse them, resulting in leg or foot injuries. In addition, bands can catch on loose enclosure wires. These disadvantages should not dissuade the serious aviculturist from closed banding nor should they encourage the veterinarian to remove those bands.

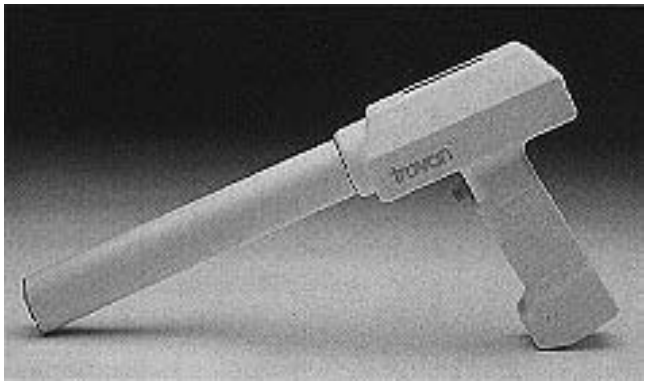


FIG 2.1 Electronic transponders provide the most permanent, least alterable and safest method for identifying a breeding bird.

FIG 2.2 A closed band on a bird may or may not indicate that the bird was domestically bred. Slightly oversized closed bands can be placed on the leg of most birds. Alternatively, a bird that was captive produced in another country and imported into the United States could have a closed band and an open import band. Such was the case in this macaw.

Open bands are the least desirable but are none the less an effective means of identification. The rolled steel bands used for identifying birds in USDA quarantine stations have sufficient tensile strength to preclude complete closure, increasing the risk of entanglement when compared to closed bands (Figure 2.2). An alternative to removal of these bands is to close them as tightly as possible, thereby reducing the risk of the gap slipping over enclosure wire. The numbers are typically more durable on steel open bands than on breeders' closed bands, which are usually made of aluminum. Metal bands must be removed from the legs of birds exposed to sub-freezing temperatures, as they contribute to frostbite. The importance of individual identification was graphically demonstrated in the aftermath of Hurricane Andrew's assault on South Florida in August 1992. Many birds escaped when their enclosures were damaged and could not be identified by the aviculturist to facilitate recovery.

The veterinarian can help the aviculturist establish a record system that is best for a particular facility, assist in developing and implementing effective identification systems and evaluate production records. Records that include all available medical information should be established at the time the bird enters the aviary.

Trends indicate an increasing interest in the establishment of stud books and cooperative breeding programs involving private aviculturists. The more information that is available for a particular bird, the

more valuable that bird is to captive reproductive programs.

Acclimation

Birds should be acclimated to their new surroundings as soon as they arrive. Birds may refuse food for several days (small birds) or up to a week (larger species), especially if the bird was a previous pet. New birds should be weighed upon arrival and observed closely for weight loss. Gavage feeding should be used only if the weight loss is dramatic (15% of initial weight) in order to avoid unnecessary stress. A bird that is reluctant to eat can be maintained on the diet to which it is accustomed and slowly changed to the diet used by the aviculturist. Changes in the quality of water may cause temporary intestinal upset. A species that will be housed outdoors must be slowly acclimated to its new climatic conditions. Tropical birds can tolerate northern temperate climates if acclimated for several months before being exposed to winter temperatures. Exposure to direct sunlight can cause burns on the unfeathered portions of the face. Eye rings, facial patches in macaws and exposed skin in feather-plucked birds will eventually "tan" and show color changes indicative of melanization or deposition of other protective pigmentation. Biting insects may cause dermatologic reactions that can become quite severe in a new arrival (see Color 24). Housing of affected birds indoors until the severity of such reactions subsides may be helpful. The possibility of birds becoming sensitized (allergic) to pollens or resins of plants has been suggested.

Preventive Husbandry Practices

The level of husbandry advice provided by the veterinarian must be adjusted to compensate for the experience of the aviculturist. Successful aviculturists frequently have vast experience in animal husbandry and carefully evaluate the behavior and condition of their birds on a daily basis. They often understand intuitively when problems are occurring that require veterinary assistance to identify, correct and prevent. If a veterinarian expects client compliance, recommended therapeutic programs must be designed to address the daily problems faced by the breeder and require minimum input of time, labor and resources. Minimal disruption of the collection may be the most important factor in maintaining a stable, healthy collection of breeding birds.

A routine preventive medicine program should be designed around a detailed health history for the collection. Fecal samples should be evaluated on an annual basis and can be grouped (no more than three to five pairs/sample) to facilitate testing for paraites in a large aviary. Infected groups can then be screened on an individual basis and treated as needed.

Annual prophylactic treatment for chlamydiosis is often advocated even in the absence of a diagnosis of chlamydiosis. This may be beneficial in birds housed outdoors and exposed to free-ranging birds, especially pigeons. In most cases, the indiscriminate use of antibiotics is not recommended. Exposing birds in a flock to unnecessary or sub-therapeutic levels of antibiotics will create "super" strains of bacteria that are resistant to a particular antimicrobial agent. If birds are medicated, treatment should be delayed until the non-breeding season (the fall for most species). Egg production will typically decrease during treatment, and chicks that hatch from eggs laid during treatment may have developmental abnormalities.

Commercially available oil emulsion adjuvant vaccines for Pacheco's virus disease, pox and salmonella can be beneficial in populations at risk. These vaccines were developed for use in wild-caught imported birds to prevent catastrophic disease outbreaks. In an avicultural collection, the benefits of vaccination must be weighed against the potential for granulomatous reactions to oil emulsion adjuvants.

Feeding Aviary Birds

Proper nutrition is vital to avicultural success. Diets should be complete and balanced for optimal health and reproduction. The goals in formulating diets for captive breeding birds include meeting the known or perceived nutritional requirements, maintaining good food hygiene, providing psychological enrichment by offering variety, and having a diet that is easy to prepare and minimizes labor, waste and expense. In general, breeding birds should receive a formulated diet, a variety of fresh fruits and vegetables and some seeds and nuts. In-the-shell peanuts should be avoided because of their potential for exposing a bird to aflatoxins. Establishing a species in captivity requires an understanding of the feeding habits of free-ranging conspecifics. Knowing what free-ranging birds consume will define dietary preferences, may suggest nutritional requirements and will help provide psychological stimulation that could enhance breeding success.

In captivity, birds are usually offered the same diet year-round. In contrast, free-ranging Psittaciformes must forage for food. In their quest for food, birds

typically ingest a varied diet that might include fruits, flowers, buds, pollen, seeds, grains, roots and some insects. Many of these foods will be seasonally available as dictated by the wet and dry seasons, which often control the reproductive cycles. The seasonal provision of extra soft foods prior to the onset of the breeding season may stimulate reproduction.

Birds that are housed outdoors are exposed to natural sunlight and should not require supplemental Vitamin D_3. Macaws are especially susceptible to Vitamin D toxicity, which could be potentiated by unnecessary supplementation.

Facility Design

An aviary should be designed to be easy to maintain while providing safety, security and sanitary conditions for its inhabitants. It must also meet the psychological needs of the birds. Healthy, happy birds breed. Healthy, unhappy birds may not breed. A part of making a bird feel secure is to provide it with a defendable space (its enclosure), which is rarely, if ever, violated. Additional factors in providing a secure environment include having visual barriers to separate the nesting areas of secretive birds, and keeping louder, more boisterous birds (eg, macaws) widely separated from quieter, more timid birds (eg, African Grey Parrots). Indoor/outdoor facilities provide the most natural conditions for the birds, but may be unsatisfactory in urban areas. In these situations, properly designed indoor facilities can be used to successfully raise birds.

- ***Indoor Facilities:*** Indoor housing has several advantages over outdoor facilities including improved pest control, the ability to manipulate lighting, temperature and humidity, and protection from inclement weather and theft. Routine care is not affected by seasonal changes, rainfall and weather conditions. Disturbance by nocturnal predators or other wildlife and the exposure to infectious agents through contact with free-ranging birds is eliminated.

Indoor aviaries also have disadvantages. They are generally more crowded than outdoor aviaries, the increased proximity of birds to each other potentiates the spread of infectious agents, and the lack of seasonal cycling of light and other unknown climatic factors may alter or prevent normal breeding behavior. The per-unit cost of building and maintaining indoor units is generally higher than an all-outdoor facility. Indoor areas require more frequent cleaning to prevent the accumulation of feces, food wastes and dust, all of which reduce the air quality and increase the likelihood of a disease outbreak. The potential hazard that dust poses for human health should also be considered. Full spectrum light must be used to facilitate Vitamin D synthesis, which is necessary to maintain the general health of a bird. The concept of full spectrum light is confusing. In general, if a light source is not sufficient to induce "tanning," then it should not be considered full spectrum from a biologic perspective.

The most important considerations when planning an indoor aviary are to avoid overcrowding and to ensure ease of cleaning and frequent air exchange. Walls and floors should be designed to allow pressure

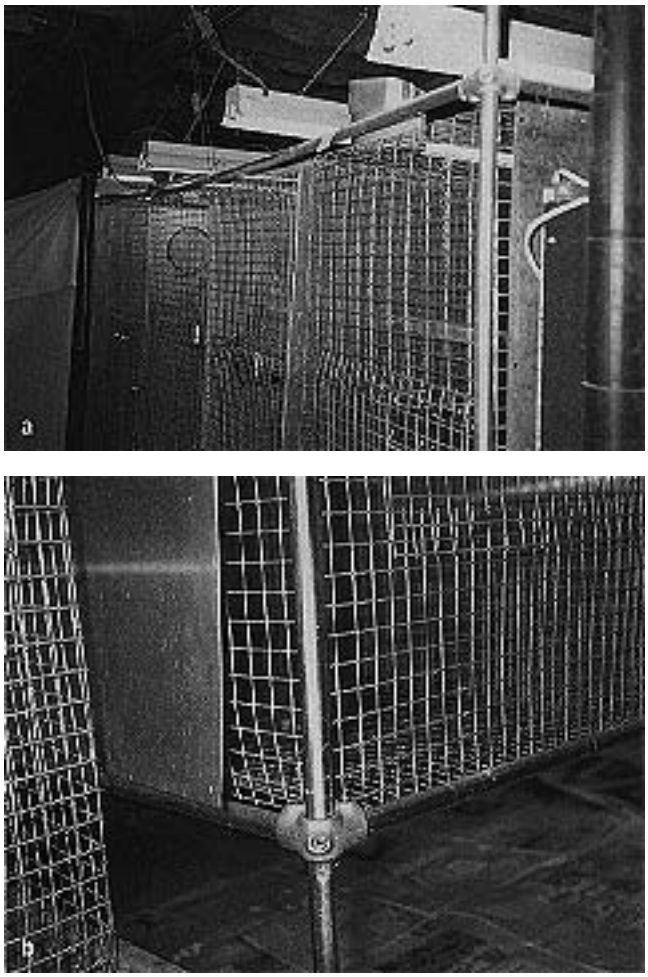


FIG 2.3 Birds can be successfully bred in indoor aviaries. However, these facilities are more labor-intensive and increase the likelihood of disease outbreaks. Indoor facilities should be easy to clean, provide adequate fresh air and must have a source of full spectrum light. This facility provides adequate light for each pair of birds but is impossible to clean with the exposed beam ceilings and open light fixtures. Newspaper is used to remove the bulk of droppings followed by rinsing of the concrete floors. The three-way hex-nut connectors are an easy way of putting conduits together to make the frame for enclosures.

cleaning, and floor drains should be of sufficient size to prevent blockage by debris or feed (especially seed that sprouts in drains). Floor drains should be covered to prevent pests, especially rats, from entering the facility. The facility should be designed to minimize any disturbance of the birds during cleaning activities (Figures 2.3).

The use of ventilation fans and air filters is necessary to ensure adequate air quality, to reduce stress and minimize the spread of infectious agents. The air in an indoor facility should be completely changed or filtered every two minutes. Tropical species may need additional humidity during dry winters.

- ***Outdoor Facilities:*** Site selection and preparation is the first step in outdoor aviary planning and construction. Considerations include location of aviaries in relation to support buildings, flow of traffic through the aviaries, source of water and electric power, the effects of noise on neighbors and potential disturbances from people, free-ranging animals and traffic. Drainage may be critical if aviaries are built in low-lying areas. The degree of protection from inclement weather should be evaluated. Natural or artificial windbreaks may be necessary in some parts of the country. The primary direction of wind and rain should be considered in the design of roofs in order to maximize protection of nest boxes and food bowls from rain (Figure 2.4). Privacy may be provided by the use of vegetation or fences or by placement of birds as far as possible from roads or houses. The need for shade will vary among species. Desert species may prefer a more sunny, open aviary while forest species may feel more secure in wooded or secluded aviaries.

FIG 2.4 Outdoor facilities with a covered area to keep the food bowls and nest box dry can be used to breed birds in appropriate climates. The enclosure can be constructed over concrete pads with a drainage ditch to one side for ease of cleaning.

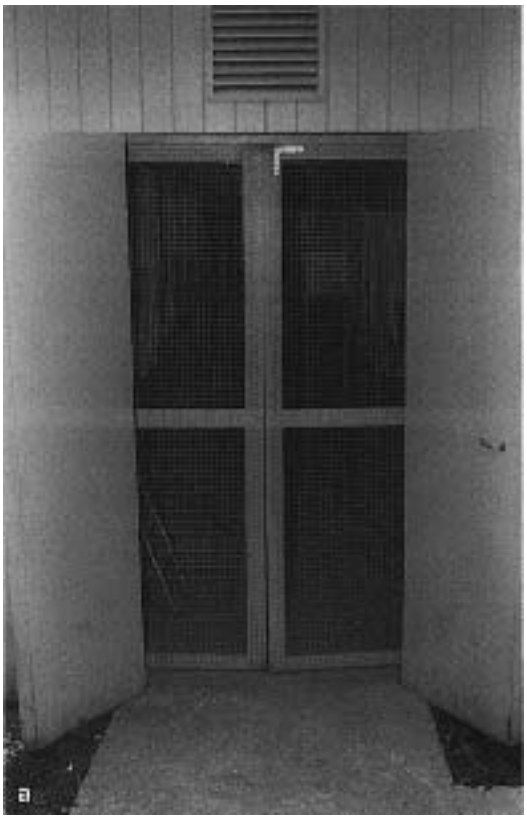
Outdoor aviaries should be designed to reduce the entrance of predators. Raccoons, opossums, foxes, rats and free-ranging cats and dogs may directly injure birds, frighten them into causing self-inflicted injuries or introduce infectious agents. Electric fences are helpful in excluding free-ranging predators from aviaries. Well behaved, properly trained dogs can be used in an attempt to exclude predators. Poorly trained, noisy or excitable dogs may affect production by disturbing or frightening the birds. A fenced "kill zone" that is patrolled by dogs should reduce the entrance of pests and predators into the aviary grounds.

Outdoor aviaries are common in the southern United States, and offer natural conditions and constant exposure to fresh air and sunlight. The per-unit cost of this type of facility is usually lower than an indoor facility. Exposure to natural, seasonal variations in weather may stimulate reproduction.

Disadvantages to an outdoor breeding facility include the inability to control inclement weather, increased difficulty in pest control, the potential of noise irritation to neighbors and increased risk of theft. Some birds may be bothered by biting insects or aerosolized allergens.

- ***Combination Indoor and Outdoor Facilities:*** Heated indoor facilities that are attached to outdoor flights are ideal for breeding birds in areas where the birds cannot remain outdoors year round. One facility that might be used as a model was designed to hold up to 24 pairs of birds and was completely constructed for less than $25,000 (Figure 2.5). A concrete slab was poured for the base of the indoor building. The concrete floor was sealed with a waterproofing agent to make cleaning easier and more effective. The slab was constructed with a 15-20% slope to one end. Two, covered four- to six-inch drainage pipes that drain water outside the perimeter fence were placed in each end of the building, and an easily removable sink was installed in one end. The sides of the building were made of concrete block with holes to the outside placed at the desired height (bottom of the bird's cage floor) and at numerous horizontal intervals (the number would depend on the width of the interior and exterior enclosures).

The ceiling was made of exterior grade plywood, and the walls and ceiling were sealed with an industrial-grade epoxy paint that can withstand pressure cleaning. A strip of florescent lighting was positioned down the center of the building. A central heating unit was installed in the attic of the building with four evenly



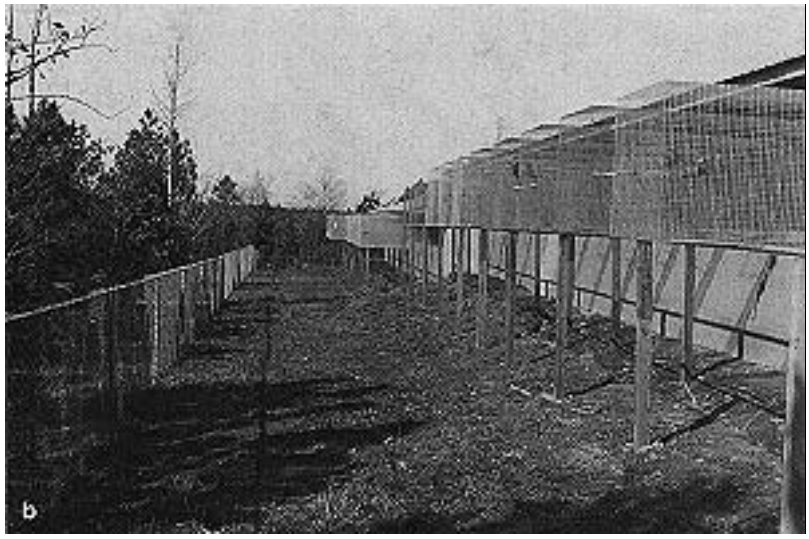


FIG 2.5 Indoor/outdoor facilities are ideal for breeding birds in climates where supplemental heat is needed in the winter. The lighted indoor facility is made of concrete blocks on a concrete slab for ease of cleaning. Wire doors on either end allow flow-through ventilation when opened. The outdoor flights are connected to the indoor flights through a hole in the concrete block. Note the height of the enclosures, which provides extra physiological security for the birds, and the perimeter fence with a "kill zone" to discourage unwanted intruders (eg, raccoon, opossums, rats, snakes) (courtesy of Apalachee River Aviary).

spaced registers and a centrally located return. Insulation was placed in the attic to reduce heat loss in the winter and keep the buildings cooler in the summer. The lights were placed on a timer and are adjusted seasonally to correlate with the natural changes in photoperiod.

The interior enclosures are suspended from beams in the attic. Alternatively, individual enclosures may be placed on pipe racks attached to the concrete floor; however, these are more difficult to clean. The thermostat for the heating system is placed at a level even with the enclosure perches and maintained at 50°F in the winter. By placing the thermostat at this position, a bird's living space is heated to the desired temperature while the area below the outdoor entrance hole (bottom of the enclosure floor) remains unheated.

Enclosures

The two primary styles of enclosures used in breeding aviaries are suspended wire enclosures and flights. A suspended enclosure is separated from the ground and is not entered by aviary personnel. Suspended enclosures are easy to construct, clean, modify or move, and are relatively inexpensive and secure. Birds have reduced exposure to their feces and accumulated food, simplifying disease and parasite control. These enclosures should be placed so that the perches are above eye level of aviary personnel to contribute to the security and contentment of the birds housed within (Figure 2.6).

Enclosures should be spaced far enough apart to prevent any physical contact between birds in adjacent housing. In general, the larger the size of the enclosure, the better (Table 2.2). Obese birds rarely breed, and larger enclosures provide for improved exercise. Suspended wire enclosures may not be advisable for toucans or some aggressive species that need ample room to escape from attacking mates.

Most enclosures for Psittaciformes are constructed from appropriate gauge welded wire (10 ga for larger macaws, 14 to 16 ga for cockatoos and Amazon parrots). Wire that is galvanized after welding is superior in strength to wire that is galvanized before welding. The galvanized coating that is used on welded wire does contain heavy metals. This wire should be thoroughly scrubbed with acetic acid using a wire brush and rinsed immediately to remove loose galvanizing material. "Weathering" the wire (ie, the practice of leaving rolls of wire in the open for six months to a year before use) does not reliably remove heavy metals (see Chapter 37).

FIG 2.6 Suspended enclosures provide an advantage over walk-in flights in being easier to clean and less expensive to construct and in reducing the birds' access to contaminated food or droppings. Enclosures should be placed as high as possible to increase the inhabitants' feeling of security. Note that the African Grey Parrots in this picture are completely unconcerned about the photographer. The perches in this bird's enclosure are about seven feet above ground level (courtesy of Apalachee River Aviary).

Flight enclosures extend to the floor or ground. Large flights are aesthetically pleasing to people and provide more space for exercise and normal behavior. However, these enclosures are difficult to clean and to maintain pest- or parasite-free. Additionally, aviary personnel walking from one enclosure to the next can serve as mechanical vectors for the transmission of infectious agents.

Enclosures should be designed with access locations that allow the capture of birds with minimal chasing. Escape proofing is suggested and may be accomplished by safety aisles or suspended safety netting. In outdoor facilities without safety aisles or netting, a portable safety cage or drape can be suspended over the door, surrounding the handler in order to reduce the chance of escape.

Containers to hold the food bowls should be designed to reduce dumping, to prevent or reduce perching on the bowls and to keep the food dry. Food bowls should be positioned away from perches to reduce excrement contamination of the food and water containers (Figure 2.7) Alcove-type feeding troughs are ideal for preventing food and water bowls from being turned over. Alcove servicing also prevents escapes because an enclosure door is not opened to gain access to the food and water containers. These alcoves can be designed to slide onto the floor or to fit under the floor of the enclosure. In either case, the access to the food bowls should be covered by a hinged, locking flap that provides two to three inches of coverage on each side of the alcove opening (Figure 2.8). Some aviculturists are finding that the use of bottles serves as an effective method of maintaining a constant supply of clean, fresh water at all times (Figure 2.9). However, birds in a dry climate that are incubating eggs must have access to a bowl of water in which to bathe to help control egg humidity.

TABLE 2.2 Suggested Minimum Sizes for Suspended Enclosures and for Nest Boxes

	Enclosure	Nest Box
Large macaws	6'x6'x12'	48"x16"x16"
Large cockatoos, medium macaws, obese Amazons	4'x4'x8'	36"x12"x12"
Amazons, African Grey Parrots	2'x2'x6'	24"x12"x12"
Pionus, mini-macaws	2'x3'x8'	24"x12"x12"
Conures, caiques	2'x2'x6'	18"x12"x12"
Small conures, cockatiels	2'x2'x3'	16"x10"x10"
Lovebirds, parrotlets, budgerigars	2'x2'x2'	8"x8"x24"

* Enclosure and box dimensions are height x width x depth

Perches must be secure and non-movable in order to provide an optimal site for successful copulation.

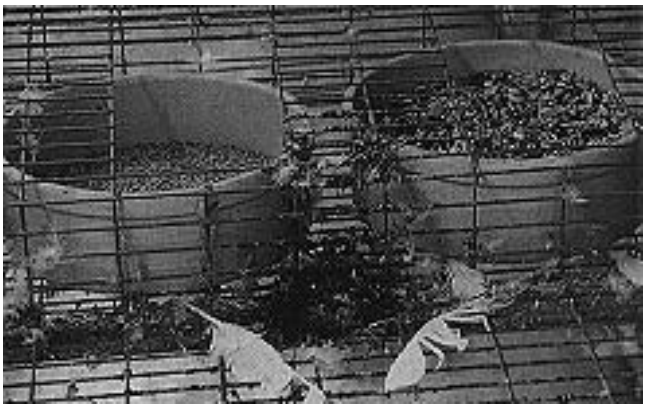


FIG 2.7 Food and water containers should be positioned away from perches or nest box openings to reduce excrement contamination. In this case, the feeding alcove was placed directly under the nest box, resulting in continuous excrement contamination of the food and water. Note also that these unproductive breeding birds were on an all-seed diet. The incidence of recurrent enteritis in the breeding adults and gram-negative bacterial septicemia in the neonates was high in this breeding facility.

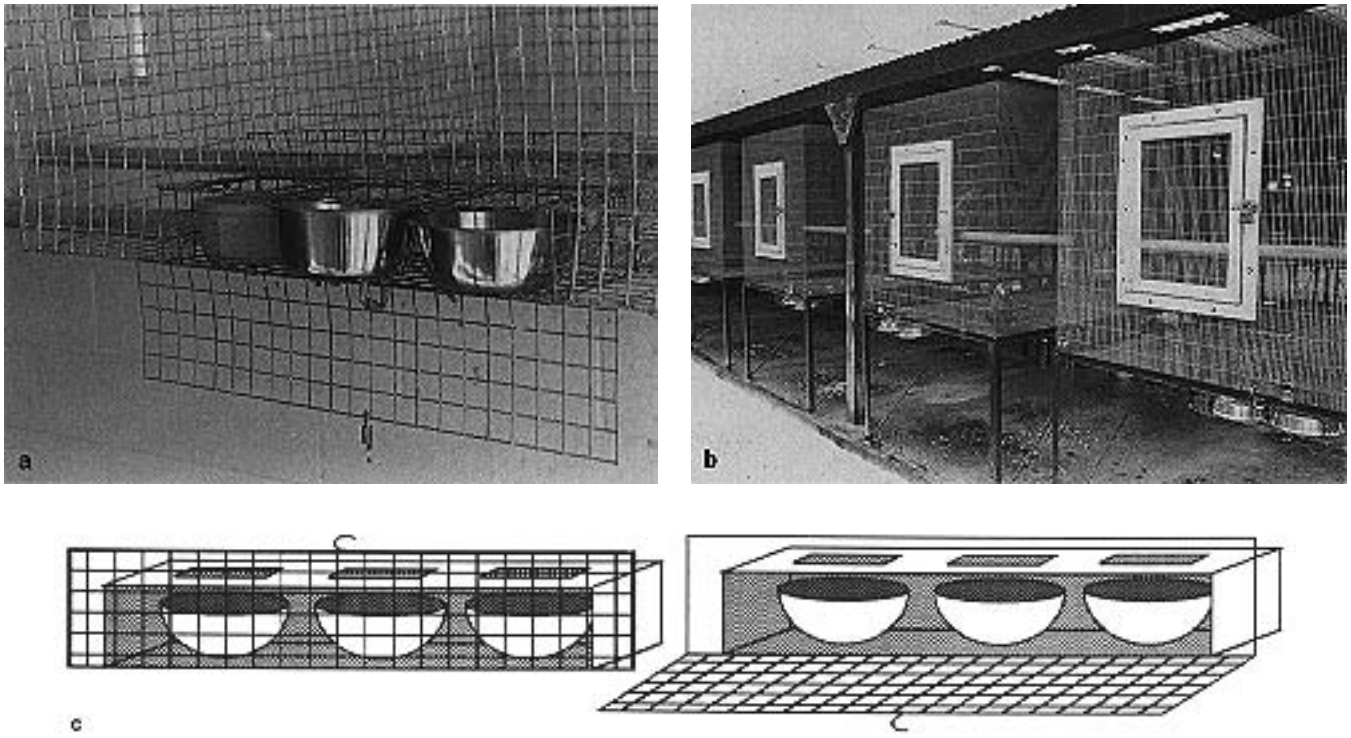


FIG 2.8 Alcove-type feeding trays can be placed **a)** on the bottom of the enclosure (courtesy of Apalachee River Aviary) or **b)** under the enclosure. This type of feeding tray allows easy access to the food and water containers without opening a door to the enclosure that could allow an inhabitant to escape. Note that both of these alcove designs are lockable and have a flap that sufficiently covers the opening to the alcove. Note also the use of stainless steel or hard plastic food and water containers. **c)** Diagrammatic illustration of an alcove-type feeder.

Wood perches that vary in diameter and surface texture provide the most natural standing surface. For larger psittacine birds, these perches should be made of manzanita, Australian pine or oak to prevent their rapid destruction. Excessively large or flat perches may cause pressure lesions on the ventral surfaces of the hocks. More permanent perches can be constructed of PVC, steel pipe or some synthetic materials. These should be used only in combination with some type of natural wood perch. Having wooden perches in an enclosure provides psychological stimulation (chewing) and will help maintain beak health. Some foot and leg problems may be associated with continuous perching on hard surfaces, especially in cold climates where chilling of the feet or frostbite may occur.

Nest Boxes

Nest boxes should be placed in or on the enclosure in such a way as to allow easy and frequent examination. Placing nest boxes on the same end as the feeding and watering station allows simultaneous feeding and nest box examination (Figure 2.10). Shy birds are more likely to use a nest box that is secluded from high traffic areas. Nest boxes must be waterproofed or placed so they do not get wet during heavy rains. The nest boxes should also be shielded from direct sunlight, which may cause overheating of the occupants. Some aviculturists believe that certain species such as Amazon parrots require visual isolation around the nest box, while other species such as cockatoos are less affected by visual contact with conspecifics. These differences may arise from flock-

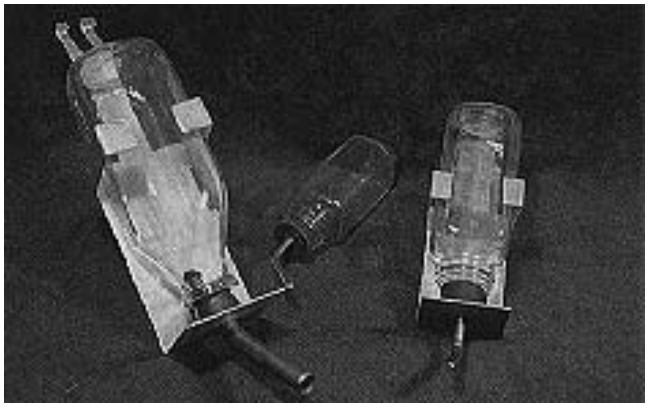


FIG 2.9 Many aviculturists are finding that bottles are an effective way to ensure a clean, fresh supply of water. Both a bowl and a bottle should be used during the transition phase to bottles. Changes in feeding or watering techniques are best performed after, not before or during the breeding season.

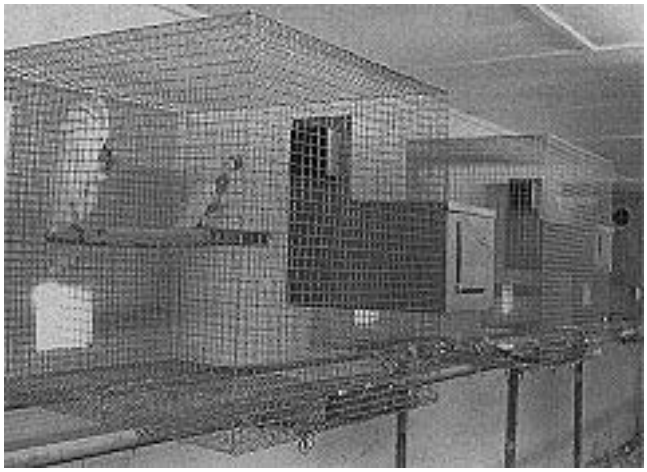


FIG 2.10 Nest boxes can be made of wood or metal depending on the degree of destructive behavior exhibited by a particular pair. Nest boxes should be positioned so that they are easy to inspect and stay dry and cool (courtesy of Apalachee River Aviary).

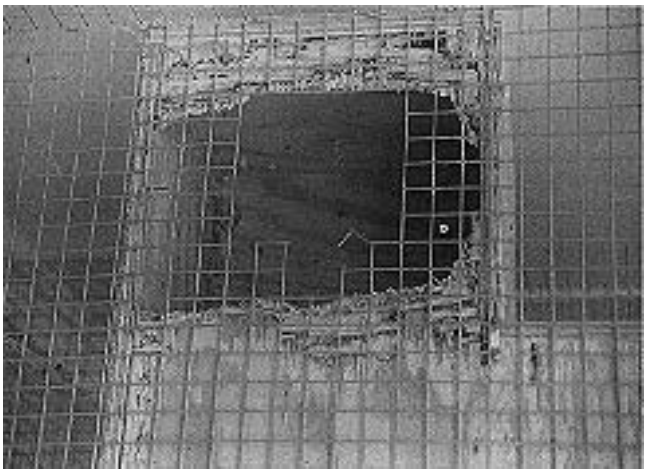


FIG 2.11 Attempts to protect wooden nest boxes by covering them with wire can result in ragged metal edges that can cause severe lacerations, broken bones or death. In extremely destructive birds, metal nest boxes that are protected from extremes in temperature are superior to wooden or plastic boxes. This wooden nest box from a pair of prolific Umbrella Cockatoos was replaced with a metal box with no change in productivity (courtesy of Apalachee River Aviary).

ing behavior and the existence or lack of communal nesting behavior in a particular species.

Nest boxes may be constructed of many materials, with plywood being the most common. Pressure-treated plywood contains numerous toxins and should not be used to construct nest boxes. Lining the nest box with wire will decrease chewing damage; however, chewed wires can produce dangerous projections that can cause injuries to the chicks or adults (Figure 2.11). Plastic or metal barrels are more permanent than wooden boxes and can be disinfected; however, they are more susceptible to extreme temperature fluctuations. Nesting materials can contribute to disease problems. The use of potting soil, corn cob bedding, eucalyptus leaves or hay may contribute to fungal growth. There is a high incidence of cancer in laboratory rodents that are maintained on pine or cedar shavings. Assuming that long-term exposure to these nesting materials could have adverse effects on companion birds, it is best to use large hardwood or aspen chips in the nest box (Figure 2.12).

FIG 2.12 Large hardwood or aspen chips are best for use in Psittaciforme nest boxes (courtesy of Apalachee River Aviary).

Health Maintenance Program

The health maintenance program should be designed to address problems common in a species as well as endemic problems for a particular aviary. For example, Old World Psittaciformes housed in outdoor aviaries in southern coastal states must be protected from opossums to prevent an inevitable outbreak of sarcocystosis (see Chapter 36). Mosquito populations are high in the same geographic regions, and susceptible species of birds should be protected from poxvirus by vaccination.

Physical examinations and aviary repairs should be planned for the non-breeding season, typically in the fall.

Good hygiene is vital to good health; however, the level of hygiene must be balanced with the level of disturbance that it creates. Enclosure designs should be easy to clean with minimal labor, cost and disturbances (which, in the aviary, can reduce the chances of successful reproduction in shy birds). Frequent disinfection of enclosures is not necessary if birds are healthy, organic debris is not allowed to build up in the enclosure and the food and water bowls are changed daily.

FIG 2.13 Food hygiene is critical to prevent the spread of food-borne pathogens. All open food containers should be stored in sealable containers to prevent infestation by flies, roaches or rodents. Unopened food containers should be stored in a dry, cool environment (courtesy of Apalachee River Aviary).

FIG 2.14 Fresh frozen vegetables should be stored in the freezer until opened for use. In addition, the dry, powdered formula used for neonates should also be stored in the freezer in a sealed container (courtesy of Apalachee River Aviary).

Exceptional food hygiene is vital to prevent the spread of food-borne pathogens or the spoilage of moist foods within an enclosure. Opened food cartons should be stored in sealable containers to prevent infestation by insects or rodents (Figure 2.13). Food stuffs have been frequently blamed for flock outbreaks of bacterial enteritis. In reality, formulated foods designed for companion birds are usually of excellent quality, and bacterial contamination is more likely to occur from improper food handling (allowing food to get wet or be infested by rats or insects) than from milling-related contamination. By comparison, foods designed for gallinaceous birds (eg, chick starter, chicken scratch) frequently have large numbers of gram-negative pathogens and should not be used in association with companion birds. Hygiene is especially important when dealing with soft or fresh foods in which spoilage is rapid (Figure 2.14). Bean sprouts are considered highly nutritious and are thought to stimulate breeding by many aviculturists. However, sprouts can be a source of bacterial or fungal pathogens, and they should be avoided or rinsed thoroughly with dilute hypochlorite, chlorhexidine or peroxide solutions prior to feeding. Fruits or vegetables that remain on the floor of an enclosure can be a source of bacterial and fungal pathogens and should be removed daily, especially in warm climates. The use of a commercial coleslaw machine to grind and blend vegetables allows for easy removal of uneaten food by simply washing the remaining food bits out of the enclosure.

Birds should have potable, fresh water provided in a clean bowl daily. Vitamins should not be added to the drinking water; they oxidize rapidly and provide a growth media for bacteria and fungus. Water should be collected directly from a tap that is run for 30-45 seconds before filling a container. *Pseudomonas* sp. can frequently be cultured from garden hoses and from PVC pipe systems. Automatic watering systems reduce labor, ensure that birds have a clean fresh supply of water at all times and prevent food or fecal contamination of the water supply. Water should be flushed through the lines daily as part of the maintenance routine. Weekly flushing of water lines with hypochlorite or iodophores is necessary to keep the lines free of bacteria and algae. Automatic watering systems should be checked daily to ensure that they are working properly. Mortality levels could be high if a watering system fails and it is not detected immediately.

The use of foot baths is frequently discussed as vital in the management of infectious diseases. Realistically, they are probably of minimal value as long as aviary personnel are not entering flight enclosures.

More attention should be focused on the cleanliness of objects that come in direct contact with the birds, such as clothing, nets and hands. The veterinarian must take precautions when going from one premise to another to avoid transmission of pathogens on contaminated foot wear. Having a pair of rubber boots that remain on each premise is the best way to prevent disease transmission. Any equipment that comes in contact with a bird should be disinfected, rinsed and thoroughly dried before it is used again. Nets and equipment that are not disinfected between birds can serve as fomites.

Air conditioners and ventilation systems may serve as foci for bacterial or fungal growth in an indoor facility. They can also harbor aerosolized viral particles. In a finch breeding facility, recurrent bacterial infections were traced to an air conditioner filter that supported the growth of *Aeromonas* sp. In another facility, *Aspergillus* sp. was believed to have been harbored and disseminated through an air conditioner filter that was not changed frequently.

Food and water bowls should be made of stainless steel, hard plastic or crockery and should be washed daily. Bowls can be washed in soap and water and returned to the same enclosure. If cleaned as a group, the bowls should be disinfected (with Clorox) before reuse (Table 2.3). For ease of washing, a series of tubs can be set up as follows: detergent and hot water, rinse, immersion for at least 30 minutes in a properly diluted disinfectant solution (Clorox), a second rinse and air drying on a rack. A commercial dishwasher is a viable alternative to hand-washing techniques as long as organic debris can be adequately removed (Figure 2.15).

FIG 2.15 Food and water bowls used in the aviary should be cleaned and allowed to dry daily. Use of a commercial dish-washer is an excellent way to maintain bowl hygiene in larger facilities.

The dark, damp interior of a nest box can provide an ideal environment for the proliferation of or dissemination of pathogens. Nest boxes should, at a minimum, be thoroughly cleaned on an annual basis, and nest material should be changed after each clutch if chicks were allowed to hatch in the nest. Nest boxes constructed of wood or other porous material should be destroyed if the inhabitants develop a viral or bacterial infection. Embryos may die in the shell or septicemic chicks may occur if an egg becomes moist in the nest box, allowing bacterial agents to pass through the shell pores.

- ***Disinfectants:*** All aviary facilities should be clean and sanitary. Organic debris must be removed from a surface before disinfecting. Disinfectants should

TABLE 2.3 Commonly Used Disinfectants in an Aviary

	Sodium Hypochlorite (Clorox bleach)	Quaternary Ammonium (Roccal)	Phenol (One-Stroke)	Chlorhexidine (Nolvasan)
Bacteria	Most	Most	Most	Not *Pseudomonas* sp.
Mycobacterium	Ineffective	Ineffective	Effective	Ineffective
Chlamydia	–	Recommended	–	–
Candida	–	–	Effective	Less effective
If organic debris present	Ineffective	Ineffective	Less effective	Less effective

All disinfectants are toxic and should be used in a conservative fashion for the specific purpose of preventing exposure to infectious agents. There is no such thing as a safe disinfectant. If it is safe, it does not kill any microbial agents. The least toxic agent that will effectively meet the disinfecting needs should be chosen. In most cases, a 5% dilution of sodium hypochlorite is the safest and most efficacious with the least potential for leaving toxic residues. Materials should always be cleaned before they are disinfected, because few disinfectants are effective in the presence of organic debris. Only household chlorine bleach should be used. Granulated chlorine products release toxic levels of chlorine gas. Birds should not come in direct contact with disinfectants, and it is best if they are not exposed to disinfectant fumes as well. Either decreasing the pH or increasing the temperature will increase the efficacy of Clorox. As a general disinfectant, bleach is mixed at a rate of 200 mls/4 liters of water.

always be used according to the manufacturer's recommendations. Stronger solutions are not more effective and may be toxic. The constant use of powerful disinfectants in the absence of a disease threat is not beneficial, and continuous contact with these chemicals can be detrimental to the birds and aviary personnel. Chlorine bleach should be used only in well ventilated areas, and a 5% solution is effective for most uses.

Pest Control

- ***Insects:*** Insects and rodents are potential vectors for disease and parasites. They also may irritate and disturb the breeding birds. Cockroaches that eat contaminated opossum feces can transmit *Sarcocystis falcatula* by defecating in a bird's food or by being eaten by a bird. Control of roaches, especially in outdoor facilities in southern coastal climates, is challenging, if not impossible. Insecticides alone are usually not effective and are potentially dangerous to the birds. Biological control of roaches is preferable to insecticides. Clean, sealed facilities reduce hiding places for roaches. Insectivorous animals (gecko lizards or chickens) can be used to consume the insects. The use of flightless silky chickens is recommended to prevent the chickens from roosting on the aviary enclosures.

  Ants can transmit some parasites such as the proventricular worm *Dispharynx*. Ants may reduce food consumption by swarming food bowls or may build nests in the nest boxes. Control procedures should include baiting of nests and trails, keeping facilities clean and avoiding foods with high sugar and fat content, which attract ants. The incidence of mites and lice is low in captive psittacine birds but they may be introduced into an aviary by free-ranging birds. The red mite (*Dermanysis gallinae*) can be troublesome in some avicultural situations. This mite is nocturnal and hides in crevices in the aviary and nest boxes during the day. These mites are blood feeders and can kill chicks by exsanguination. For the control of mites inhabiting nest boxes, five percent carbaryl powder has been used successfully without apparent harm to chicks or adults. Mosquitos can also be a problem for chicks in the nest box.

- ***Rodents:*** Rats may enter an aviary at night and spread infectious agents, disturb nesting birds or actually kill some smaller species. In a survey on one breeding farm in South Florida, 50% of resident rats were found to be carrying *Salmonella* sp. In Southern coastal areas, rat populations seem to rise in the fall. Biological control methods start with constructing a facility that discourages nesting in or around the aviary. For example, in outdoor aviaries, concrete slabs are frequently used to provide additional cleanliness under suspended cages; however, rats almost invariably tunnel and nest under these slabs. Enclosures suspended on poles can be fitted with rat guards, or the poles can be greased to prevent climbing. Sheet metal guards can be wrapped around trees to prevent nesting. Bait boxes should be used as needed and with caution. Snap traps baited with small quantities of ground meat are particularly effective.

- ***Snakes:*** Snakes will occasionally enter enclosures and consume small birds, but will rarely attack larger Psittaciformes. If an aviculturist is breeding small birds (canaries, finches, budgerigars, lovebirds) outdoors, the enclosure should be constructed with small wire or screen to prevent entry of snakes.

Evaluating and Treating Flock Problems

Emergency Care

An experienced aviculturist is usually the first individual involved in providing emergency care to a sick or injured bird. The client should be well schooled in providing first aid and recognizing signs of illness that require veterinary intervention. The veterinarian should assist the aviculturist in preparing a first aid kit, in being prepared to provide post-examination nursing care and in having the necessary supplies to safely and effectively transport a sick bird (Table 2.4) (Figure 2.16). The experienced aviculturist should know how to administer stabilizing therapy (SQ fluids, tube-feeding, hemostasis) that can be used if the veterinarian cannot immediately attend to an ill bird. Helping the aviculturist handle emergency problems will encourage the involvement of a veterinarian in the management of the collection (Figure 2.17).

The aviculturist should visually evaluate each bird every day during routine feeding procedures. In addition to the health, behavior and attitude of the bird,

TABLE 2.4 Avicultural First Aid Considerations

- Quiet, isolated area with appropriate enclosure
- Enclosure that will provide heat, humidity and preferably oxygen
- Balanced electrolyte solutions
- Feeding tubes and syringes
- Syringes and needles
- Emergency medications (to be prescribed by the veterinarian)
- Bandage materials - non-stick elastic bandage material, adhesive tape, non-stick wound pads, antibiotic ointment, hydrogen peroxide or iodine solutions
- Scissors and forceps
- Coagulants for bleeding nails
- Disinfected container for transporting sick or injured birds

the aviculturist should also evaluate the enclosure for signs of bleeding and feather loss that may indicate a traumatic episode. Fresh excrement should be evaluated for color, consistency and amount of feces, urine and urates (see Chapter 8).

Managing Disease Outbreaks

Rapid action early in a disease outbreak can prevent catastrophic losses. Isolation and appropriate therapy is warranted with an individual sick bird. In an avicultural setting, maintaining flock health must be the priority, and containing an infectious agent, determining its source and implementing control procedures are mandatory. The more complete the medical examination (blood work, cultures, radiographs, endoscopy), the more likely the veterinarian is to be able to identify the problem and to make specific recommendations to prevent further illness in the flock. Sick birds should be immediately removed from the collection and a thorough diagnostic evaluation performed. If the bird dies, a complete necropsy

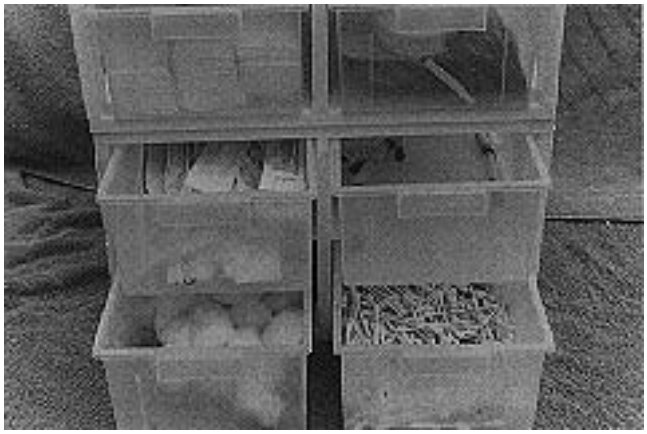


FIG 2.16 The advanced avicultural client should have a readily available supply of routinely used culturing, blood collection and selected medical supplies (courtesy of Apalachee River Aviary).

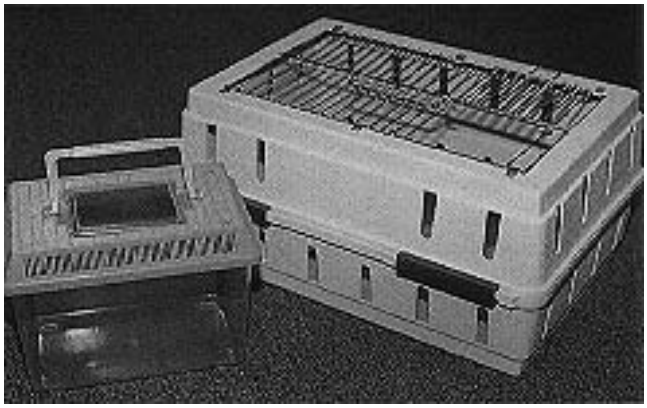


FIG 2.17 An attending veterinarian should help the avicultural client maintain first aid supplies including clean, disinfected containers for safe transport of sick or injured birds to the hospital (courtesy of Cathy Johnson-Delaney).

with collection of representative tissues from all organ systems is critical. The speed with which histopathology results can be obtained is also critical. Many state diagnostic laboratories have free or relatively inexpensive fees for histopathology services. However, the period of time that elapses before these results can be obtained may allow an infectious agent to spread through a collection. When histopathology results are needed quickly, it is best to advise the aviculturist to spend the extra money and send samples to a private laboratory. Following an infectious disease outbreak, all materials that cannot be properly cleaned (eg, perches, wooden nest boxes) should be removed and destroyed. The remainder of the facility should be steam-cleaned several times. In any given medical situation, repairing management flaws and using biological control measures are superior to drug therapy.

An easily and completely cleanable isolation area for new and sick birds should be available, and protocols should be established for managing this area. Storage for medical supplies and equipment should be discussed.

Evaluating Reproductive Failures

Resident Bird Examination

Annual examinations of all birds in a collection can be used to detect flock problems, establish and confirm the accuracy of identification systems and collect data that may lead to the removal of unproductive individuals. The efficacy of husbandry practices and the plane of nutrition can be determined by assessing the physical condition of the birds.

The causes of reproductive failure may be multifactorial and illusive (Table 2.5). The veterinarian working in unison with the aviculturist may be able to determine correctable physical, hormonal, nutritional, behavioral and psychological causes of reproductive failure.

A review of the potential health problems identified during the previous breeding season and appropriate testing of nonproductive birds can provide information that is critical to identifying the source of a problem (see Chapter 29). Estimating the age of a bird may be helpful in understanding reproductive failure.

TABLE 2.5 Evaluation of Reproduction Failure

- Obtain detailed histories
- Review health and production records
- Perform complete physical examination including cloacal mucosa
- Perform diagnostic tests as dictated by the findings
- Use laparoscopy to verify gender and visually evaluate the reproductive system and other organ systems
- Evaluate husbandry practices
  - Is diet appropriate, balanced and accepted?
  - Are enclosures appropriate in design and size?
  - Are nest boxes secure, dry, clean, free of pests and placed properly in the enclosure?
  - Are secure perches available for copulation?
  - Is the pair protected from environmental extremes?
  - Are aviary disturbances (visitors, pests) minimized?
- Evaluate behavior
  - Is one bird in a pair or in a colony exhibiting excessive aggression?
  - Does the pair exhibit a strong pair bond?
  - Has the pair been observed copulating?
  - Does the pair show any interest in or inspect the nest box?
  - Do the birds exhibit signs of stress, fear or unrest in the present location?
  - Do birds quarrel with, or display to, birds in adjacent enclosures?

Culling

Culling is a vital technique to improve the quality of captive breeding stock. Decisions to remove a bird from a breeding program can be emotionally difficult, especially when dealing with tame birds that are considered pets and with species that are endangered. In reality, maintaining breeding birds that are not vigorous, that fail to adapt to captivity or that are of poor genetic lineage is a detriment to the future of aviculture and to the species. While no birds should be considered disposable, in the breeding situation the aviculturist must be aware of the necessity of selective breeding to the overall success of an aviary.

The purchase of culled breeding stock, especially birds represented as proven breeders, carries with it a degree of risk. Birds are often culled because they failed to breed, and the novice aviculturist frequently adds someone else's problems to his collection. Birds purchased as part of an entire collection that is being dissolved may be less risky.

Dealing with birds that are to be removed from a collection can challenge the ethics of the veterinarian. Euthanasia of valuable birds due to poor reproductive success or due to poorly understood medical problems (such as cloacal papillomatosis) is unacceptable to many people. Resale of these birds without full disclosure of their problems is equally unacceptable and can strain the client/veterinarian relationship. It is never advisable for the same veterinarian to represent both the buyer and the seller in a bird transaction.

Incubation and Pediatrics

Veterinarians should be involved in evaluation of incubation failures and management of the psittacine nursery. Successful incubation entails extensive experience, and subtle problems in egg handling, especially prior to or in early incubation, can result in developmental abnormalities that may not be expressed until hatching (Figure 2.18). A definitive cause of embryonic mortality is often illusive. Ideally, all fertile eggs that fail to hatch should be examined in an attempt to detect patterns of mortality, which

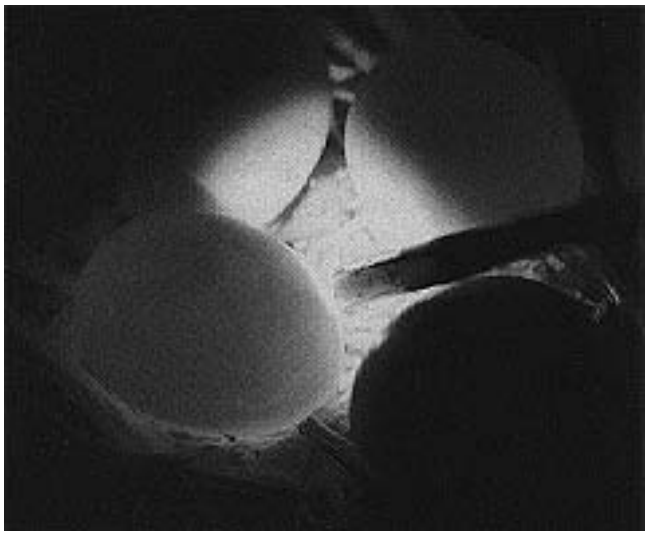


FIG 2.18 The avicultural veterinarian should have a thorough understanding of the incubation process and how to determine the cause of embryonic or early chick mortality. Every embryo that fails to hatch should be necropsied and submitted for histopathology to help identify management or disease problems in the flock. A fertile six-day-old Red-bellied Parrot egg is being candled in the nest (courtesy of Isabel Taylor).

may be helpful in identifying problems associated with incubation (see Chapter 29).

A veterinarian who is experienced in nursery management can provide advice and management recommendations that could prevent the occurrence of clinical disease related to husbandry or nutritional problems of neonates (see Chapter 30).

Products Mentioned in the Text

a. Infopet Identification Systems, Inc., Burnsville, MN
b. American Veterinary Identification Systems (AVID), Norco, CA
c. Destron IDI, Boulder, CO

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