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Sex Determination of Birds

Linda R. Elliott, DVM

Summary

The techniques available for sex determination of birds are the museum technique of measurements and weights, cloaca examination, laparotomy, fiber optic endoscopy, fecal and plasma steroid hormone analysis, and karyotyping. The procedure found most practical for the average veterinarian is the laparotomy. In this article the laparotomy procedure will be described, and its advantages and disadvantages discussed.

Interest in captive breeding of non-domestic birds has greatly increased during the last few years. This interest is due not only to stricter and more expensive regulations on importation and quarantine measures of exotic birds, but also to the endangered status of some birds of prey in North America. Survival of these birds of prey, primarily those in the Order Falconiformes (diurnal birds of prey) and the Order of Strigiformes (largely nocturnal owls), may become dependent upon captive breeding and rehabilitation. It is also noted that substantial numbers of falconiform birds of prey are used for pesticide research.1

Determination of the sex of a bird becomes necessary when the species shows no sexual dimorphism or when there is such an overlap of the dimorphic characteristics as to make the determination somewhat ambiguous.2

Except for the American kestrel (Falco sparverius) and the marsh harrier (Circus cyaneus), North American birds of prey show little to no sex-related plumage variation. There is, however, a sex-related distribution in body size: in wing chord, body weight, and tarsal diameter. These measurements can be up to 100% accurate with birds which show significant variation of body size such as the sharpshinned hawk (Accipiter striatus), in that the female is approximately twice the size of the male. With the red-tailed hawk (Buteo jamaicensis) or the goshawk (Accipiter gentilis), size difference is less pronounced and body measurements become ambiguous.3

In the past, sex determination has been based on sexual behavior patterns and pelvic examination. It is not uncommon to place birds (such as conures, macaws, and African greys) together as breeding pairs based on the observation of mating activity only to have unfertile eggs produced. Upon further examination, it was discovered that both birds were either male or both female. Regurgitation, a courting behavior pattern, and copulation have been observed between two males.3 It has also been found that females of some species go through the same behavior pattern as the males.2 It would seem necessary then to have further evidence before selling a "breeding pair" of psittacines.

Laparotomy is a technique used by several practitioners, with many variations for its use. It was first used for castration (caponizing) in domestic fowl to improve flesh quality and

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decrease aggressiveness. Since then it has been used not only for sex determination but also for sequential data on gonadal changes and for peritoneal implantation of electronic sensory devices for migratory information. The technique used is very simple, and the results are accurate, rapidly obtained, and cosmetically acceptable. The equipment necessary varies with the technique, but consists primarily of a gram scale, an anesthetic (general or local), a restraint board (optional), a scalpel blade (No. 15), an otoscope with a sterile speculum, a sharp instrument for puncturing the air sac (a long syringe needle may be used), and suture material (optional). It has the main disadvantage of being a surgical procedure and there is risk of some mortality.

The first step of the laparotomy is to weigh the bird to the nearest tenth of a gram. Ketamine hydrochloride is administered in the pectoral muscle via a tuberculin syringe at a dose of 0.05-0.05 mg/g body weight. Other general anesthetics which may be used are: Halothane; Equithesin at a dosage rate of 0.20-0.25 ml/100g. body weight; and Metomidate at the initial dosage of 10 mg./kg. If the bird is small and restraint is no problem, only a topical anesthetic such as ethyl chloride may be used.

When the bird is properly anesthetized, it is placed in right lateral recumbency. The bird is placed in this position because in most females only the left ovary develops. The bird may be held in this position by an assistant or by use of a restraining board with the left wing in an anterodorsal position and the left leg in posterior extension. Feathers are plucked from a small area in front of the left femoral region and the area is prepared with isopropyl alcohol, benzalkonium chloride, or providone-iodine. A dorsoventral skin incision is made over the last intercostal space. The sartorius muscle is bluntly dissected free from the rib cage and is retracted posteriorly to expose the last intercostal space. The intercostal muscles are penetrated and the opening enlarged to expose the abdominal cavity. The otoscope speculum is then placed in the opening and directed in a dorso-posterior position to detect the gonad. It has been found that in large birds and in some smaller species the abdominal air sac must be punctured to facilitate examination of the gonads. This is done by puncturing a small hole in the air sac with a sharp instrument followed by blunt dissection.

Figure 1 shows the general appearance of the male and female reproductive systems. The gonads lie on the roof of the body cavity posterior to the lungs and adrenals and ventral to the anterior pole of the kidneys. The species, age and breeding season will determine the appearance of the gonads.

Fig. 1: Excised urogenital system of typical breeding birds. Left: Male has paired testes (the left is generally the larger) whereas the female, (Right) has a single irregular shaped ovary and convoluted swollen oviduct on the left side (from Godin, 1960).
In most species, the testes are off-white in color. However in some birds such as cockatoos, the testes are very dark or black (melanis gonads). The testes are always smooth and elongated. In general, the left testis is larger than the right testis. Both are functional. They become quite pendulous and large with maturity and breeding season, but are fairly small and more closely adhered to the kidney and adrenal gland during seasonal gonadal regression. See Fig. 2.

In the female, the ovaries are paired in early life, but the right ovary fails to develop, so that only the left ovary is functional. In some of the Falconiformes, the right ovary persists but is nonfunctional. This also occurs in some ducks and perhaps 5% of the common birds. Usually the right oviduct, like the right ovary, is nonfunctional. During the nonbreeding season, the ovary is light yellow to white, finely granular and appears as a cluster of small grapes (See Fig. 3). The ovary grows larger and more orange as the breeding season approaches due to follicular development. The immature ovary is flat and adipose-looking.

After examination of the gonad, the incision may be sutured with 4-0 or 5-0 gut in the musculature and 4-0 or 5-0 gut in the subcutis to bury the knot. It has been found that no suturing is necessary, since the skin and musculature become apposed when the bird assumes its normal upright position.

The wound heals rapidly and healing is complete in about two weeks. This technique has been used with great success on wild birds. With the use of a topical anesthetic, the birds can be released within one hour of capture. Normal behavioral activity to mates and neighbors resumes immediately upon release. No effect on normal behavioral events in the reproductive cycle have been noted.

The technique in exotic birds and birds of prey has had varied results, with mortality rates ranging from 2-20%. The death rate decreases as the size of the bird increases. Necropsies were performed on a few birds which died of other causes weeks to months following surgery. No adhesions or scars were found. Most of the cockatiels and budgerigars were producing young during the breeding season following surgery.

The laparotomy is a simple technique with the only difficulty initially being in distinction of the gonads through the otoscope speculum. This difficulty can be solved quickly with minimal practice. The technique causes little stress to the bird and is cosmetically acceptable. The results are rapidly determined and accurate.

References
3. Harrison, G. J.: Endoscopic Examination of Avian Gonadal Tissue To be published in VM/SAC.


The ISU Veterinarian would like to thank the Wildlife Society, Inc. of Washington, D.C. for the use of their diagram on page 101 taken from Wildlife Investigational Techniques, 1963. 3rd Ed. Henry S. Mosby, Editor, p. 125.

Running Dean Update

D. Nick Jensen, D.V.M.*

As reported last winter in this journal, Dr. Phillip Pearson, Dean of the ISU College of Veterinary Medicine, is an avid long distance runner. (See "A Dean on the Run," The ISU Veterinarian Vol. 40, No. 1, 1978.)

At that time Dr. Pearson mentioned that he was hoping to break 3 hours at the 26.2 mile Drake Relays Marathon in the spring of 1978. A three hour marathon is widely regarded as the amateur distance runner's equivalent of a four minute mile. The physical and psychological demands this goal imposes make it both greatly respected and deeply cherished once accomplished.

This year's Drake Relays Marathon was held on April 29 in Des Moines, Iowa. The temperature was in the 50's and it was cloudy that day, close to ideal weather because of the enormous amount of heat generated while running a marathon. One thousand one runners started the race, including 126 in the Master's division (over forty years old). Eight hundred five runners finished with times ranging from the winner's 2 hours, 15 minutes, 19 seconds to over 5 hours.

Dr. Pearson accomplished his goal, finishing in 2 hours, 57 minutes, 37 seconds and placing twelfth in the Master's division. Congratulations, Dr. Pearson!

*Dr. Jensen is a 1978 graduate, ISU.

Cover Story—

"Veterinary Medicine—Small Animal"

Michael L. Westfall*

The cover photo is of a painting by Fritz Buttgen. The painting, "Veterinary Medicine—Small Animal," was recently presented to the College of Veterinary Medicine by Dr. and Mrs. A. K. Takayama (ISU '58) of Honolulu, Hawaii.

Dr. Takayama commissioned Buttgen to paint something for his hospital. The painting was completed in 1967. Buttgen was a well known artist in Hawaii until his death in an auto accident in his native Germany about 3 years ago.

The oil has the eyes and hand of a veterinarian with the veterinary caduceus. The animals represent veterinary medicine while the concentric circles show depth or infinity. In describing the symbolism of the painting Dr. Takayama said, "Being abstract—it's all in the eyes of the beholder."

Dr. Takayama practiced in California for one year after graduation. He then moved to Hawaii where he has been since. He currently owns a small animal hospital in Honolulu.

The painting is currently on display in the Veterinary Medicine Library and can be viewed during regular library hours. Future plans call for it to be moved to the student entrance after remodeling work has been completed in that area.

On behalf of the students and faculty of the College of Veterinary Medicine the staff of the ISU Veterinarian would like to thank Dr. and Mrs. Takayama for their very beautiful and gracious contribution to our College.

*Mr. Westfall is a fourth year veterinary student at ISU.