



myself knowing that eggs broken by parents don't hatch. More information on incubation of parrot eggs came with the Stoodleys' book, "Parrot Production Incorporating Incubation." Advice from a peregrin falcon breeder was gratefully received, as were many more nuggets of information garnered here and there. All of this resulted in more chicks, as failures gave way to success.

The basic tools needed for incubation are the incubator with an automatic turner and a scale accurate to 0.1 gram. Choosing an incubator can be difficult. Having used nothing but the Turn-X, we may not know what we are missing. However, we have several good reasons for staying with them. When fitted with a 10-turn temperature control, it is fairly easy to set and holds the temperature to .1 degree. Used with a 12 inch thermometer accurate to .1 degree and the automatic turner, it produces 90% hatch of fertile eggs for us.

Without discussing diet in detail, let it be said that many hatching fail-

ures of fertile eggs, as well as deaths in the first week of life, can be attributed to the inadequate diet of the parents. Once the egg is laid, nothing can be added to make up for the lack. Parrots can and do breed and lay eggs on inadequate diets. The adequacy of a diet should be judged by the percentage of chicks raised to independence or, better yet, by the production of second generation young. All claims concerning diet should be considered in this light.

The egg, then, is a self-contained nutrient capsule for the growing chick. The yolk is the innermost part. It is upon the upper surface of the yolk that the germinal disk is located. It must be fertilized before the white (i.e., albumen) is added. The yolk is lighter in weight than the albumen, and tends to float to the top of the egg, whichever way it is turned. The side of yolk containing the germinal disk is the lightest side, and also turns to the top however the egg is turned. The egg requires regular turning at least five times each day to achieve

good hatching results. The turning of the egg puts the growing embryo in contact with fresh nutrients and prevents the chick from adhering to the shell. Turning should be done alternately back and forth, and an automatic turner is an effective way to accomplish this. If the egg is turned continually in one direction, the chalazae (i.e., the white, stringy party) which suspends the yolk correctly, will wind up on one side and wind down the other. This will result in a poor hatch.

The outermost part of the egg is the shell directly laid down upon the outer shell membrane. There is a second membrane just inside the first called the "inner membrane." As soon as the egg is laid, it begins to cool. As it cools, the contents of the egg contract, and the inner membrane will begin to separate from the outer membrane at the large end of the egg, thus forming the air cell. Under high magnification, the membranes are found to be a mat of elastic fibers. Occasionally, a floating air cell is



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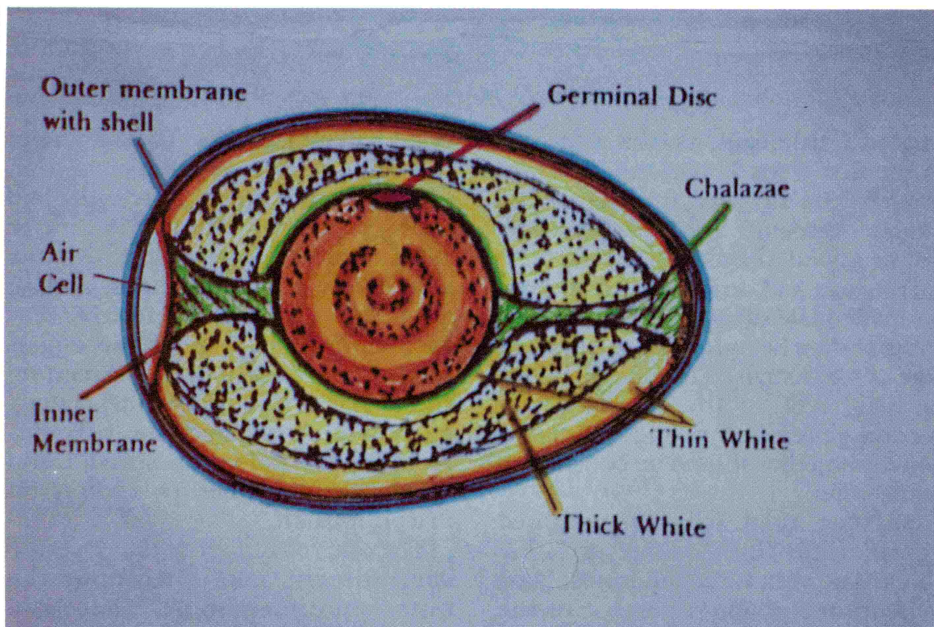
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found as a result of the two membranes not adhering to each other properly. These eggs have never hatched for me.

The shell consists mainly of calcium carbonate, and is the source of calcium for bone growth in the chick. As incubation progresses, the shell becomes more porous as calcium is mobilized. The entire shell is permeated with microscopic pores permitting the exchange of gases and the evaporation of water.

An infertile egg can be determined

by observing the germinal disk. It will have a solid white dot in the center, and will be surrounded by a lighter white ring. The fertile egg will have a dark center surrounded by a white ring, having the appearance of a doughnut with a small hole. The following is an overview of the growth process of an egg requiring a 28 day incubation:

- After one day of incubation, the disk will triple in size.
- By the second day of incubation, the disk will have tripled again.



*These tools should be kept handy in the event a problem arises during incubation or hatching. L to R: nail polish, cutical instrument from manicure set, syringe and small needle, sterile distilled water, extra egg shells to use as capping pieces, pin, felt tip marker and pen light.*

• On the third day, a deep ridge known as the "primitive streak" may be plainly seen.

• On day four, the huge white disk becomes clear, with blood vessels and the embryo appearing before the eye. This is the day, with the use of a good candle, that the eggs determined to be fertile. (Note: previous days of development cannot be detected by candling.)

• Day five, the heart can be seen beating with careful candling.

• By the sixth day, the blood vessels and embryo with beating heart may be easily seen.

• The seventh day, the embryo has eyes and limb buds.

• Day eight, the beak is apparent.

• At day nine, the embryo is clearly a bird.

• Day fourteen, the down has started developing.

• On the twenty-first day, it is plain what type of chick it is, whether parrot or turkey.

• Finally, on the twenty-eighth day, it is ready to hatch.

Candling eggs is an excellent tool to use in assessing the progression of development in incubation. The egg can be determined to be infertile or fertile, addled or near hatching. Penlights have excellent advantages for candling eggs. They emit very strong light, run cool, are portable and, best of all, they're inexpensive.

The air cell increases rapidly in size over a period of 24 to 36 hours as the chick nears hatching. The phenomenon is called the "draw down" and is the result of the chick pressing up against the inner membrane, causing it to pull away from the outer membrane. This occurs when 90% of incubation time has elapsed. In eggs with a 26 to 30 day incubation, this should happen three to four days before hatch. (It will not occur if the chick has died.) It is at this point that egg turning is discontinued. The chick continues to press and struggle, eventually tearing a small hole in the inner membrane, thereby entering into the air cell for its first breath. The chick can be heard breathing and peeping occasionally. This is proof that the chick has achieved "internal pipping," and is beginning the transition from obtaining oxygen through the network of blood vessels to breathing with its lungs. The egg should be provided with as high a humidity level as possible from now until hatch.

The "external pip," which is a small

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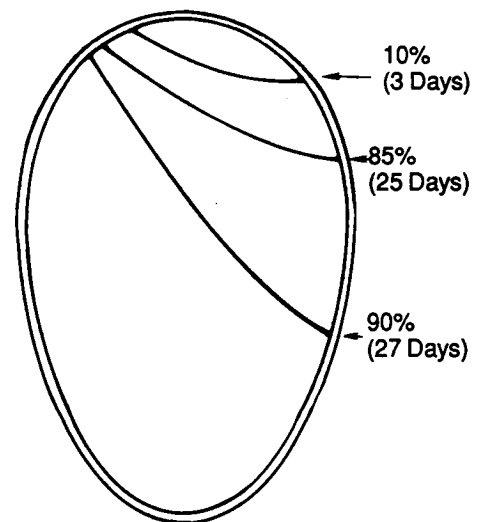
chip made in the shell by the chick, usually occurs soon after the internal pip. As oxygen is depleted quickly in the air cell, the external pip provides more ventilation. If the pip is sealed, or the first pip did not provide sufficient ventilation, the chick will make a second external pip next to the first. Occasionally, the external pip is in the wrong place. With the drawn down side fully facing us, and the large end of the egg up, the pip should be just above the air cell line and to the right of center. If the pip does not occur on time, we should be looking for it elsewhere on the shell. A pip at the small end means an inverted chick. This malposition does not necessarily spell disaster, but a prayer would be in order after elevating the small end of the egg with the pip mark uppermost.

Another malpositioned pip commonly found is just below the correct position, but below the air cell line. This indicates internal pipping has not taken place, but the chick is looking for more oxygen. A small hole at the pip site may be in order. A small tear into the inner membrane separating the chick from the air cell can be made, taking care not to tear obvious blood vessels. A small amount of bleeding is sure to occur, but it is normally not crucial. The hole is then covered with a snug fitting piece of shell from infertile or previously hatched eggs. The piece of shell is soaked in hot water for a few moments, excess water is shaken off, and then it is placed over the repair site. This will adhere as it dries if a proper fit is found. Using shells from eggs of approximately the same shape and weight provide the best results. This technique is referred to as "capping."

Capping is extremely useful for a variety of needs. An egg that has not hatched on time and shows no movement or signs of life upon candling, can be investigated without killing the possibly still living chick. Most of us have heard of someone opening an egg presumed to be dead, only to find to their horror a living chick which subsequently died as a consequence. This does not have to be so. An egg presumed dead should be opened through the air cell. Normally, the inner membrane will be white and papery in appearance. Often the chick will begin to move as a reaction to a gentle prodding at this point. A few dabs of warm, distilled water applied with a small brush will cause

the membrane to become transparent, and the blood vessels of the inner membrane in a living egg will become plainly visible. These blood vessels are a good indicator of nearness to hatch. They are bright red until just before the hatch commences, when they lose their blood supply and become pale pink. As the blood flow to the membranes slows, the remaining yolk is drawn up into the body cavity and the heart undergoes changes in blood flow. It is truly a miracle that it happens with such precision as often as it does. Most deaths occur in the first and last week of incubation. The first week is sensitive as the cells differentiate into the various organs, while the last week is critical because of the major transition from life in the egg to life after hatching.

### AIR CELL DEVELOPMENT (30 Day Incubation)



The egg should be capped once the chick is found to be alive. Further checks can be made by wetting the cap with warm water to loosen the seal, determining all is well, and recapping. If the egg is well past internal pip time, the chick may appear lethargic but alive. It may be well to achieve the internal pip with a small tool (manicure sets are handy for this purpose) if the chick has not already done so. Care is taken not to tear a blood vessel. The beak should be found near the expected pip site to make sure air is actually reaching the facial area. Occasionally the beak is not found, but rather a foot. The chick is inverted in the shell. Cap the egg and look for a pip elsewhere. If none is found, careful determination will help you select a spot 1/3 to 1/2

of the way down from the small end of the egg where you may start looking for the beak. Once it is found, and air has been supplied, a loose cap should be made.

Just before hatching, the chick becomes very excited and vocal. Expect the hatch to be complete within four to six hours. The chick will start at the external pip site and continue making pips in a line to the right, often pushing off the top of the egg before completing the circle. If the egg is capped, the double shell may hamper hatching somewhat. Monitoring the progress of the egg will alleviate possible hatching complications. Many chicks are capable of breaking through two shells and do so.

When encountering the occasional hatch where the chick pips continually in the same area, calling loudly, the problem may be that the chick is entangled or stuck and cannot make the turn around the egg. After three to six hours have elapsed and the situation continues, it is time to intervene by opening the top of the egg. Once this is accomplished, use a wet brush to moisten and disentangle the chick as needed. Do allow the chick to push out on his own if possible.

Small cracks in damaged eggs may be repaired by using nail polish to seal them. Dents must be repaired with nail polish and a cap of shell to strengthen the area and prevent further caving in of the surrounding shell, and to prevent eventual air leakage. Once air leakage has occurred beneath the damaged shell, there is little hope of saving the egg. Sealing large portions of an egg often results in inverted chicks, so close monitoring at hatch is essential.

Candling can only go so far toward helping hatch the problem egg. The other indispensable tool is the triple beam scale. All eggs are weighed to the 0.1 gram when freshly laid, whether they are to be left with the parents or incubated from day one. An egg loses weight during incubation in the form of evaporated water. An ideal weight loss from fresh weight to hatch is 15% to 16%. The loss is divided by the number of days' incubation to arrive at the daily weight loss. Subtracting the daily weight loss from the fresh weight will give target weights for each day of incubation. This is a simple system with the use of a calculator with paper tape. Each egg has its own tape with the dates written next to the weight.

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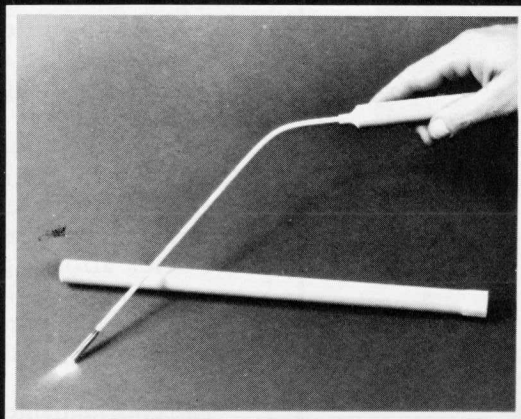
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As incubation progresses, the egg is weighed and actual weight is written next to the target weight. With the use of two incubators, one wet and one dry (both set to 98.5 to 98.8 degrees Fahrenheit), the eggs can be moved back and forth to control weight loss. When an egg is too light, it is placed in the wet incubator to slow water evaporation. If too heavy, it is moved to the dry incubator to hasten evaporation. Most eggs stay in one incubator, tending to run heavy or light throughout the incubation period. Although all of our large parrots are on the same diet, our cockatoos and greys tend to run light and require a wet incubator, while the Amazons run heavy and require a dry incubator. After the internal pip has taken place, all eggs are placed in the wet incubator regardless of their weight status.

The wet and dry incubators work for us the majority of the time. There are eggs, however, that resist losing weight even in the driest of incubators. An egg that is more than 3% off target is in deep trouble. Some of our Amazon chicks owe their lives to the technique known as "ventilation." Ventilating an egg is accomplished by using a candler to locate the air cell, and then piercing the shell with a sterile needle guided into the air cell. The outer membrane must be pierced to provide air flow, using three to four holes initially, and up to as many as ten holes after monitoring weight loss. Large losses can be obtained in as little as six hours, so care must be taken not to overshoot. Neither will an egg tolerate huge losses in short time spans. Therefore, it is best to act before the egg is critically (3%) overweight. Once the weight is corrected, the holes are sealed with nail polish. Candle the egg after allowing it to dry, as a second coat of polish may be necessary. These holes are easily reopened as required, and subsequently resealed.

The chorioallantoic membrane is a good indicator of the length of incubation completed. This membrane is the placenta of the growing chick. It adheres to the shell, mobilizing calcium for the embryo. At 1/3 of incubation, it has covered half of the shell. This would be day 10 in an egg with a 30 day incubation period. Halfway through incubation (day 15), the membrane has covered the entire outer circumference of the egg with the exception of the small end. The

albumen is now located at the small end of the egg, extending up into the interior, with the embryo and yolk being nearest the large end or center. Knowing these stages can be helpful when removing eggs from parents part way through incubation, and onset of incubation is unknown. This is also helpful when incubating a new species and the incubation period is unknown.

A technique I developed in a moment of desperation over another wayward egg is "injection." All of the red throated conure chicks we have raised are due to this method. These eggs lost far too much weight under the parents, and were near hatch weight when only halfway through incubation. Sterile distilled water is drawn up in a 1.0 cc syringe, and warmed in the incubator. 1 cc equals 1 gram, so the calculations are simple. An egg that is 0.5 grams too light needs 0.5 cc water. The egg is injected at the small end, inserting the needle just inside the egg and slowly injecting the water while being careful not to inject any air. The injection site is sealed with nail polish. This method is extremely successful after the first half of the incubation period is completed. It is not recommended during the first half of incubation as the chorioallantoic membrane is not complete until then. Injection at this stage has often proved to be too much of a jolt to the delicate membranes, resulting in an addled egg within 24 hours.

Important as weight loss control is, egg storage is critical. Comparing fertile eggs hatched with subsequent chicks living to ten days old, it was found that eggs stored one to two days at room temperature did slightly better than eggs set to incubate immediately. Falcon breeders have found resting the egg one day to be beneficial. Resting eggs one to two days has resulted in 90% hatch and livability to ten days old. Eggs stored three to four days, however, have produced a severe drop with only 40% living to ten days. Needless to say, we have discontinued storing eggs beyond two days until viable techniques are developed.

My hope is that you will find these simple tools and techniques useful in increasing your problem eggs' chances of survival, that you will improve and expand upon them, sharing your discoveries with your fellow breeders to the advancement of aviculture. ●

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