Parrot Eggs

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Introduction

Just as parrots form a unique order of birds – psittaciformes – with only the most conjectural relationship to other avian groups, so have their eggs proved exceptional. The most striking difference is in the resistance the shell has against injury.

Other birds' eggs are more brittle. A strong tap will chip them and the sharp edges of the pieces, as they are depressed with the blow, too readily cut through the egg membranes. When the albumen leaks out, or if air gets to lie under the inner-shell membrane, the embryo dies. The unique "spongy" structure of the proportionately thinner parrot egg shell gives it a greater pliability. A similar slight blow merely caves in a mild dent at whose edges the shell membranes hold firm. In practical terms this means that the psittaculturist can give first-aid repairs applying, say, a wipe of nail varnish, to a dented parrot egg with some likely success of it hatching.

General

Most information available on the incubation of eggs has come from investigations on poultry. Obviously much of what has been found will apply to other eggs. This will be particularly so for game birds. On the other hand, when it comes to parrots, some findings may mislead. For example, the fresh-hatched poultry chick obtains most of its body calcium by absorbing away the inner layer of the shell during the last third of the egg's incubation. But as parrot chicks have no need for a strong, supportive skeleton until much later in their life, their egg shell remains quite undigested.

Neither do parrot eggs have a cuticle: that water repelling "varnish" to the outermost layer of the shell. However, the parrot egg similarly cannot absorb water by direct capillary action. If you moisten a parrot egg by submerging it for hours in water at its temperature, not a particle of moisture will enter. The high-gloss and submicroscopic openings to the shell pores keep it out. Or, put another way, spraying eggs (something commonly advocated in the cage-bird press) merely serves to lower their temperature. It chills them by evaporative cooling. Wetting eggs does not, unless the nest is practically inundated, make any difference to the rate at which they lose water.

As anyone who has regularly monitored eggs throughout natural or artificial incubation gets to know, they are exceptionally resistant to infection. The unincubated egg, unless it is cracked, does not go bad for weeks and weeks. Much of this "natural" protection comes from the excellence of the three-layered "packaging" preventing bacteria from getting in. The smooth, waterproof shell overlies the two bacterially near-impermeable shell membranes. Should the shell be cracked, this inevitably will let bacteria in. Despite which, if the shell membranes remain intact, the contents can still remain sterile, for even the inner-shell membrane alone can prove to be remarkably efficient. If the broader end of the shell, above the air-sac, is perforated to increase the transpiratory rate, infection does not necessarily happen. (I have yet to experience this in more than 50 examples.)

Once incubation begins, the innermost shell membrane becomes closly underlined by the "placental" tissues of the growing embryo. At this stage, however, even though the shell remains intact, when the embryo dies the egg will now get infected. This conversion of a good to a bad egg can be amazingly prompt in the heat of an incubator. Postmortem changes cause the contents of the egg to break down. This releases substances that damage shell membranes. The net result is that the shell membranes and, not infrequently, adjacent portions of the inside of the shell will become soft with moisture. Through this soggy lining, bacteria wander in. Therefore, non-hatching eggs, irrespective of why the embroyo has died, when sent to an investigatory laboratory, are found to be infected. Sadly, an inevitable, rapid infection and subsequent post-mortem decay is well-known in all corpses that are not preserved. A pathologist may not be aware that this equally applies to incubated eggs. When this is the case, the egg autopsy report is irrelevant if it assumes that the infection has spread into the egg from the incubator or nest box and killed the chick.

This is a cart-before-the-horse example. Our wish is to know why the egg has died. Not what, inevitably, happens after death. True, a pipped egg, when the still incarcerated embryo is moist and with an unabsorbed yolk-sac, may get infected. This is uncommon.

To put this innate resistance to infection in another light, the owl's nest and eggs always stink because of the build-up of rotting carrion. Yet, amidst these fetid surroundings, they hatch. Likewise so do parrot eggs soiled with feces as they are.

This is not to say that a primary infection of eggs never happens. We know how notorious, politically, Salmonellosis became. However, even in this instance, it is still true to say that this bacterium, in most instances, is on the shell, not inside with the contents. Salmonellosis involves us when the egg is broken and the yolk and albumen are seeded with bacteria from the shell. It is then kept for a while at temperatures at which the organism can grow. The mayonnaise, or whatever foodstuff, that gives Salmonella to a person generally grew from this egg-shell seeding.

Nor can we deny that "vertical" transmission, that is, infection of the chick through the egg itself, cannot happen. It can occur when Salmonella affects the peritoneal cavity, ovaries, or oviduct as might, equally infrequently, take place with Ornithosis (Psittacosis). The contents of an egg have some ability to defy infection, for the albumen is rich in lysozymes (general anti-bacterial agents). It also contains specific antibodies against those infections to which the hen has developed resistance.

There are, however, at least three serious parrot diseases which are known to be transmitted vertically. The first is mycoplasmosis. This is characterized by a rhino-conjunctivo-sinusitis (inflamed eyes, discharging nares, and swellings about the front of the head). This insidious, debilitating, chronic, and oh so difficult to treat condition, although mostly quiescent, will evince itself when the bird is stressed. In the commercial poultry world, mycoplasmosis has had to be expensively eliminated. In parrots it is particularly harmful in *Polytelis, Neophema,* and *Amazona.* The method of injecting antibiotics into the egg as a method of getting parrots free of mycoplasmosis cannot be used as with turkeys and poultry. However, in a trial run of ours in which incubator-hatched, hand-reared chicks with which we had good reason to assume were likely to be affected, they were medicated with lincomycin/spectomycin at hatching and for a further week onwards, the resulting prophylaxis appeared wholly successful.

Our continuing experiments prove that the virus that gives rise to French Moult (FM – the tendentiously named Psittacine Beak and Feather Syndrome [PBFS]), is transmissible through the egg. To those who hand-rear from artificially-incubated eggs and who maintain good hygiene, FM

As of January 1, 1990, AFA's policy was reaffirmed to no longer allow hybrid birds to be offered for sale in its official publication, the *AFA Watchbird*.

rarely proves a nuisance. On the other hand, when FM appears in the wild, cage, or aviary, in nests of parent-raised chicks, it becomes pandemic: spreading rapidly by the ingestion and inhalation of dander.

Unlike FM, the third egg-transmitted virus of "neonatal hepatitis" can spread with amazing virulence through hand-rearing units. Yet, in outside aviaries, if it does occur, it seems to be limited to the odd nest.

For an egg to hatch successfully, it must be kept warm, have air, be turned, and evaporate off a certain quantity of water. Until 1989, our eggs have been incubated at a constant temperature of 100°F (37.7°C). Success has been variable. For some parrots (including the Indian Ringneck, Pyrrhura Conures, African Greys and Caiques) it has been over 85 percent. This is at least as good, if not better, than what the parents can achieve. For others, and this lamentably included the Palm Cockatoo, it has been lower.

Consistently, the major reason for failure has been from DIS (Dead In Shell) i.e. the chick dying within hours of its expected hatching time. On examination, the greater majority of DIS chicks have either become orientated so that they came to drown either by abnormally facing the pointed end of the egg, or, and this applies for practically all (including those disorientated), by not having evaporated off enough water. The embryo that is the "wrong way round" is common (greater than 1:10) in parrot eggs. Unfortunately the prenate chick will have a far greater chance of drowning if there is any surplus of fluid. The chick that does not point towards and lie against the air-sac has to take respiratory air directly from the hole it pips in the shell.

In an attempt to find out whether DIS would be affected by the temperature of incubation, we are now trying to maintain them at 35°C for the first week, 36 the second, and for the final days, 37°C, the principle being that, under the hen, a gradual increase in incubation temperature is normal. Results so far are equivocal.

Ventilation we will gloss over. The relatively small size of the parrot egg, compared to the air-changing capacity of the standard incubator and the small number of a clutch, will put far less strain on this function of the machine than if it were filled with, say, duck or game bird eggs.

We prefer to have the eggs turned artificially at hourly intervals. It does seem logical that once an egg has pipped, it would require no further turning. (Actually, in the nest, from about half-way through incubation, the lopsided growth of the embryo causes jiffled, freely moving eggs to lie with the same side uppermost. Or, in nature, true turning is minimal from now onwards).

We take the pipped egg from the tray and lay it, stabilized on its long-axis, with the egg-tooth perforation facing almost uppermost. Although this is now our general practice, it must be admitted that eggs seem to hatch as well kept in the hourly-moving trays. Our reason for moving them down to the bottom of the incubator is that when left in the trays they hatch and plummet downwards. By so doing, one has drowned and another got crushed.

In some ways, a parrot egg is the perfect vehicle for undertaking a study of natural and artificial incubation. It is translucent. By the fourth day, the early embryo can always be seen as an open, red circle. The contained chick may have sufficient value to make it penny-foolish not to put the eggs in the best of mechanical incubators. A weighing machine – capable of recording to two, or even three, places of decimals, in grams – is also required and, perhaps, a pair of high quality calipers. Above all, such a study has to have an unhurried, daily period in which to monitor and record developments.

Although many incubator manufacturers place high stress on how their machines can maintain a high humidity, in practice it will be found that frequently the most difficult thing is to get the contained air dry enough to evaporate off sufficient water. Not that such an innate "resistance" of the egg to desiccation is peculiar to parrots. The curiosity is how well parent birds manage to get such "water retaining" eggs to evaporate away enough in the nest. For various reasons, we much prefer to take our eggs immediately when they are laid. Against this, many know from the literature or experience, better results can often be had with mechanical incubation if the parents or foster-parents have been given charge for the first week or so.

Various interpretations are given

Photo by George D. Dodge/Dale R. Thompson

There are many reasons for poor hatchability in a parrot egg. They can range from poor water loss rate or temperature to drowning by being in a reverse-in-shell position. This can be seen with the Blue and Gold Macaw egg on the left where the head is positioned in the small or narrow end of the egg.

for this "parent start." Mine is that the benefit comes because the incubating parent can increase the potential water-loss rate of "reluctant" eggs. They get their eggs to lose "extra" water by two means. The first is by delaying incubation. Our study has shown that the first eggs of a clutch tend to have the thicker shells. If incubation is held back (and the majority of birds do not commence with the first few), the cool eggs still lose water. The contained, very early embryo is not affected by this pre-incubation cooling. By the time the delayed eggs are given heat, they can have reduced the "surplus" water.

The second method the parents have is to alter the porosity of the shell by subtly cracking it. "Egg turning" in the nest is not always a gentle shuffling and repositioning. The incubating bird lifts the egg's end with the bill and drops it back. This causes it to clink against adjacent eggs. Dense eggs cause extra fidgeting: they get more bashed together. In large clutches of waterfowl eggs, I have found that those with the higher density invariably get to lie in the center of the nest, whereas the least dense lie at the edges. Under ultraviolet light, using special techniques of staining, we have seen microscopic cracks in the shell. Even if these very minute cracks could not be demonstrated, they would have to be the only rational explanation for how the incubating parents can get some eggs to lose water at a greater rate than can be managed in even the driest of mechanical incubators.

For a maximum hatch, parrot eggs have to be individually monitored. For the first few days at least, we have to accurately weigh the egg at approximately the same time. We generally work with densities which involves measuring length and breadth, but it is loss of weight that concerns us here. When held at the same temperature and humidity, egg weight diminishes at a precise daily rate until it pips.

As its density is greater, the fresh-laid egg, when placed in water, sinks. The shell, the yolk, and the albumen are heavy and pull it down. The lightness of the air sac cannot, yet, buoy it up. While hot inside the hen, the egg has no air-sac. It is formed by a peeling apart of the broad end's shell membranes when, like a glass thermometer, the liquids within contract more than does the solid shell as it cools down.

Despite being so relatively thin, the shell is impermeable except where the submicroscopic pores are distributed all over it. These extremely evenly spaced pores communicate, via the "spongy" thickness of the shell, with the shell-membranes and these are in contact with the egg white. The egg ever becomes lighter: for the water in the egg, through these pores, then continually escapes as water vapor into the atmosphere.

Given sufficient heat and ventilation, the embryo chick grows. It obtains its oxygen and loses its carbon-dioxide by them freely passing through the shell pores. Like a tadpole, it is fully aquatic and has to change into an air breather. The chick "tadpole"is incarcerated in its ever-diminishing and very small pond. As it grows, less room is available so it contorts into a tight curve, finishing up with its head under a wing.

During the development of the chick, the air-sac has steadily fallen back on the shrinking contents. The first sign of imminent hatching is seen by candling. The straight edge of the air-sac's inner shell-membrane then begins to bulge and pulsate from the movements of the chick's head. Until now, the volume enclosed by the inner shell membrane has become ever less. This now alters. The chick, slashing and bumping its bill forward, slices into the air-sac. As it evolves its respiratory ability, the breathing passages start to fill with air. A little, repetitive, clicking noise is made by all chicks as the moist surfaces of the respiratory "tubes" alternately stick and pull apart. As the ever inflating chick puffs up with air, it extends more and more into its air sacs.

As the chick approaches its anticipated hatching time, it is absolutely imperative that it loses a certain quantity of water. We know, or if we don't we can calculate, the laying weight of an egg (length x maximum width x maximum width x 0.548). We should also find out how long they take to hatch. This is remarkably constant for any species. Now we must take a few measurements of the daily weight loss. We then do a little calculation to work out 85 percent of its laying weight (multiply the laying weight by 85, and divide this by 100). This will give us the extrapolated weight of the egg immediately before it hatches.

We now draw a simple graph with the number of days of expected incubation (it is never more than 30 and never less than 18) along the bottom. (The weight goes "uppermost" on the graph.) Take a rule and join the two points on the graph and now superimpose the extrapolated curve for the few weights already taken. If these two curves are approximately the same, then it will be strong odds that the chick will hatch. This applies if the loss is somewhat greater. Should, however, the egg be anticipated not to lose so much of its weight before the incubation time is up, then it is probable that the chick will die of DIS. This is because the pre-hatching chick can be shown to be far better able to withstand comparative "desiccation" than it can "saturation."

We can regulate the egg's expected water loss to some large degree. To reduce it, we can increase the humidity of the incubator's air. To diminish it, we get water out of the atmosphere. In practice it will be found that extra humidity is seldom needed.

As most of us will want to use the same incubator for all sorts of eggs, other ways will have to be tried to get some uniformity of weight loss. For "reluctant" eggs, we are able to thin the shell. Over the air-sac we can rasp some of this away with fine sandpaper. (If done carefully this should not damage the outer shell membrane). Or, this end to the egg can be pierced by a fine hypodermic needle.

The eggs that lose excessive weight can have the pores on parts of their shell sealed off. Although nail-varnish is most often used, liquid paraffin can be better. (As this spreads, a little goes a very long way. Apply it with the very tip of a child's paintbrush and dab surplus off). Do all such treatments in stages, taking several measurements of changing patterns of weight loss over a few days to give more exactly what is needed.

I have had eggs hatch that finally lost almost exactly half their original weight, but never have had one that hatched after it had lost but 13 percent in the *extrapolated* time. It is highly important to remember that 15% weight loss, or thereabouts, will not be the final weight of the egg immediately before it hatches, for once the shell is pipped the rate of evaporation jumps up. So greatly increased is this post-pipping evaporation that the egg usually loses as much weight in one day as it will have done in the previous three weeks.

The chick "wants" to hatch. The near-hatching chick does take full charge of its own hatching program even though it is constrained by the incubation time being very precise and having a feeble amount of strength. It cannot hatch in less than a certain number of days and hours. It cannot pip unless the chick is positioned correctly and has strength to strike at the shell. It can be shown that when parrot eggs are taken as laid, and subjected to exactly the same conditions, they take an equal amount of time to hatch.

Chicks can never escape from the

shell if the contents are going to finish up too damp or, and this is far less likely, too dry. Before it can become an air-breather, the chick has to evaporate off the excess water inside its respiratory system. The stronger poultry chick can drink surplus fluid away. The parrot chick is unable to do this. It has to lose all of its fluid by direct evaporation into the atmosphere.

Pipping is said to occur when the chick prizes up its first chip from the egg shell. In eggs which have lost an insufficiency of water, pipping takes place abnormally early or not at all. Once a shell's surface is chipped, water vapour escapes rapidly. The "over-damp" chick becomes frantic. If it is not to drown, it "has to" behave in this "panicky" way. Not only does a "damp" chick smash a hole earlier than usual, but it proceeds to repeat it several times over to make the opening still bigger.

Put another way, pipping time (the interval between making the pip and hatching) is highly variable in parrot eggs, even within the same clutch. The longest period I have recorded is 82 hours and the minimum but eight. (Both were for Eclectus). It can be destructive to increase humidity (as is so often advocated) for parrot eggs once they have pipped. The chick is perfectly well able to chip for itself an appropriately sized hole to satisfy its own evaporative needs. If humidity is now increased, the chick, instead of being able to rest awhile, now has to pip further other openings to get back to the evaporative position it originally had. This poor, interfered-with chick now has had to work longer than it originally needed to. It has to work overtime, as it has precisely the same time left in which to dry out and hatch.

A tired chick builds up lactic acid in its muscles. All needless work will shorten its energy span. It may become impossible for it to recuperate sufficiently for it to undertake the heavy task of rapidly having to slice itself free of the shell. Then, like a rotating tin-opener, it surprisingly rapidly comes to spin full circle before the rapidly drying membranes can hold it fast.

There are always long pauses, often of days, with parrot eggs after they pip during which time nothing much seems to be taking place. However, on lifting the egg to the ear, regular clicks will be heard from the chick. Inactivity is normal because it is absolutely necessary.

As water gets to be evaporated off from the respiratory tract, the chick breathes ever more easily. It soon can push some of the air it has inhaled back to make a cheep. Only a drying chick can cheep. A chick can breathe perfectly adequately through the unpipped shell. When it is the right way around, the bill gets to be in the capacious air-sac chamber. As breathing through the lungs becomes ever more efficient, the respiration by the embryonic membranes proportionately diminishes and they contract away.

Sensibly, the yolk sac remains outside the body cavity of the chick until almost the last minute. It is moist and unharmed deep inside the shell so that, when it does get withdrawn inside the bird's abdomen, it is slippery and uninfected. The air-sacs have to be expanded before the yolk sac can be withdrawn into the body.

Regretfully there are those who become impatient over the slow progress in hatching. They believe that things ought to move faster. Therfore these gratuitous midwives get to impose, what turns out to be hindrances, help. The mildest form of such uncalled for impertinence is to put the hatching parrot egg into a more humid atmosphere. Despite the poor little thing having managed so excellently on its own for this part of its journey, they now must interfere. The shell gets to be chipped away from around the pip. Then, becoming somewhat alarmed at what even they inwardly must feel they definitely should not have done, they balm the now excessivly drying inner shell membrance with water.

Why do they handicap the poor creature at such a critical time? Certainly although such unwanted interference is wrong, it is a common enough phenomenon. It is found in boy scouts, too eager to get an old woman across the road she doesn't want to cross, and in those who attend whelping bitches or women in childbirth. It is a good maxim in obstetrics to assume that nature "knows" what she is doing far better than the onlooker.

In point of fact, very, very, very few chicks want assistance. The odd one might get as far as to incise its shell cap almost off and then tire, but this is about all the help they ever want.

When it hatches, the chick soon dries and needs to be fed, but that is yet another story. ●