DEAD IN SHELL YOUNGSTERS AVIARY

By Dr. Colin Walker BSc, BVSc, MRCVS, MACVSc (Avian health)

I regularly receive calls from aviculturists that fertile eggs are failing to hatch i.e., that the embryos these eggs contain are dying in the incubation period. Many aviculturists immediately think of Salmonella when they see this, when in fact all infections together including Salmonella account for less than 5% of all dead in-shell youngsters. So just why do these youngsters die? Most young that die in the egg usually die either in the first few days of incubation, or alternatively the last few days of incubation.

In the first few days, embryo death is usually due to either inadequate incubation leading to too low a temperature to keep the chick alive, excessive jarring of the egg that either fatally damages the chick or yolk, or alternatively, a genetic problem affecting the chick which is incompatible with life.

Towards the end of incubation, chicks usually die as a result of problems associated with hatching. As incubation ends; the chick has to shift from getting its oxygen through the membranes that surround it, to breathing air. It also re-absorbs its yolk sac which supplies it with both food and immunity. If the temperature or humidity is incorrect at this time these processes fail to occur correctly and the chick can die.

Between the beginning and end of incubation, the chick is essentially just growing and it is here that nutrition and infection become more important. If the young chick is lacking a nutrient it needs for growth or becomes infected; it may die.

This past year has been a particularly good breeding season for me. Nearly every egg that was fertile has hatched and the resultant youngster has been successfully weaned. Although pleasing, this situation is not always the case despite the best of care. I did however, have one aviculturist mention to me last week that he had had 30% of all fertile eggs fail to hatch. He did not seen overly concerned and appeared to think that nothing could be done. This is far from the truth. An embryo fatality of 5% could be regarded as normal. Anything more than this should arouse suspicions of a problem.

For those of you having a problem with dead-in-the-shell youngsters, let's have a look at the potential problems that can arise with each of these periods of incubation in more detail, so that hopefully the problem can be solved.

Embryonic Death at the Start of Incubation

Deaths early in incubation can be detected by opening the egg and seeing that it is in fact fertile, but that the embryo is only poorly developed. As mentioned earlier, the usual cause is poor incubation leading to the egg becoming cold after development has started. Possible causes include improper nesting material, over interference by the aviculturist, inadequate control of nest

mites, overcrowding in the aviary, old arthritic birds, poor nest box design, and competition with other birds within the aviary, poor parenting, nest box too hot or too cold or poorly

ventilated, outside disturbances etc. Also as mentioned earlier, eggs are very vulnerable to vibration type injuries early in incubation. Shaking or jarring can kill the developing embryo either directly or by rupturing the yolk. This is of particular relevance when eggs are being transferred for fostering. Embryos that are unlucky enough to have genetic abnormalities usually also die early in incubation. Genetic problems are more likely to occur with in-breeding.

Deaths from Day 4 to Day 14 Of Incubation

This is the longest period of the incubation process and yet it is the time when least deaths occur. The embryo is simply growing. The growing chick receives its nutrition from the yolk and deaths here can reflect nutritional problems in the hen. Hens that are correctly fed are more likely to produce nutritious yolks that sup- port healthy embryos. The effect of breeding bird nutrition is very underrated. By simply feeding a blend of 2- 3 seeds and a calcium supplement such as grit, it is not possible to prepare the hens for breeding. Aviculturists who believe they can do this often accept as normal an elevated embryo death rate or several weak chicks in the nest.

Although embryos can die of infection at any time during incubation, it is at this time of growth that they are most vulnerable. Certainly, there are some infections that can be carried by the hen that can infect the ovary such as Chlamydia and Salmonella. These can be incorporated into the egg at the time of its formation, and subsequently infect and kill the embryo as it grows. Infection can also pass through the oviduct wall into the egg. However, these types of infections, that enter the egg prior to laying, are in the minority. Most infections that develop are caught in the nest after hatching. Nests that are dirty, poorly ventilated or excessively humid lead to egg- shell contamination and movement of infectious agents into the egg. Egg quality is also important. Cracked, thin, misshapen or rough eggs allow easier entry of infection and are more subject to trauma. Poor eggs can be due to oviduct disease, but are more often associated with a nutritional deficiency: in particular calcium. Some aviculturists will have noticed eggs with translucent clear lines running around the outside of the egg showing the eggs rotations, as it was passing down the oviduct. These thin areas can be an early sign of calcium deficiency.

Embryonic Deaths at the End of Incubation

Through incubation a membrane called the chorioallantois develops around the chick. The chorioallantois acts a bit like a human placenta, in that it delivers air to the embryo after it diffuses through the shell. At the end of incubation, the chick must swap from a chorioallantois respiration to breathing air. It does this in two stages. First it internally pips. This involves cutting a small hole into the air chamber at the end of the egg and starting to breathe the air it contains. At this stage vibrations can be felt in the egg and chick will sometimes vocalize.

After another 12-36 hours the second stage begins, with the chick cracking the shell and breathing ex- ternal air. While this is happening the last of the yolk sac which is the chick's nutrition during incubation, is drawn into the navel. This eventually ends

up as a tiny sac in the wall of the small intestine called Merkels diverticulum and lasts the whole life of the bird. Interestingly, during this time, the chick also drinks the clear fluid around

it called the amniotic fluid. This amniotic fluid, and also the yolk sac contain the antibodies that protect the chick from infection in the first few weeks of life.

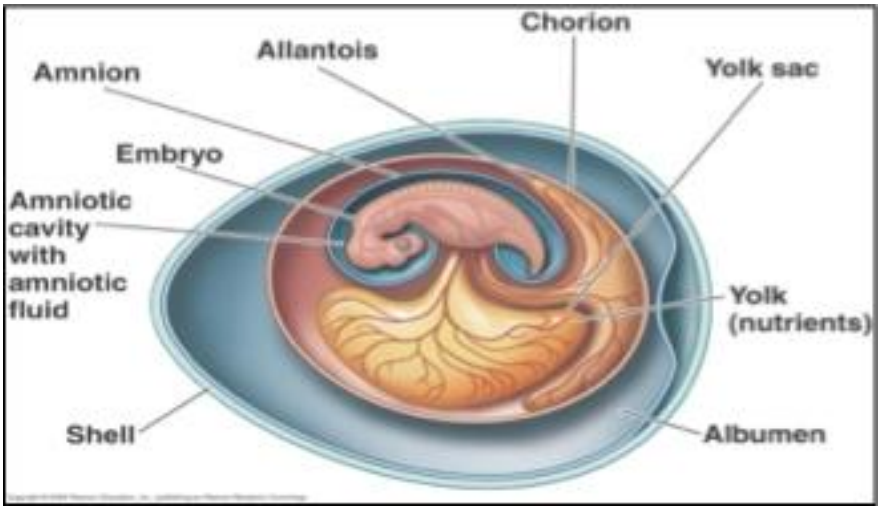
While all this complex physiology is going on the chick is vulnerable to problems. Too high or low temperature or humidity during this time will adversely affect the chick. The usual problem is too high a temperature, or too low a humidity. This combination causes the shell and shell membrane to become hard and dry. This can lead to a healthy chick becoming exhausted. In addition to this, the chick quickly becomes dehydrated. I am sure many of you, myself included, have helped these chicks hatch only to find them dead later. These chicks often die because they are dehydrated. Such chicks if given small drops of water will often suck them down greedily and survive. These dehydrated chicks are called "sticky chicks" because of the way they stick to the dry shell membranes. They are often found dead after hatching 1⁄4 to1/2 the way, emerging from the shell. If removed from the shell they often have unabsorbed yolk sacs and there is often dry, gluggy albumen still in the egg.

For consistently high hatch rates, it is vital the breeding birds have access to either rain or a bath around this time. If not possible the underside of the hen and also the eggs can be lightly misted with water from a spray bottle. In most species, ideally the nest box should have a humidity of 70% and the sitting bird needs to keep the eggs at between 36.5 to 37.0 degrees Celsius. If unsure, a thermometer and hygrometer can be placed in the nest box.

In summary, hatchability can be dramatically improved by three simple steps:

Improving nutrition in the months prior to breeding.
A clean nest for every round, and ongoing nest box hygiene. Access to rain or a bath around hatching.

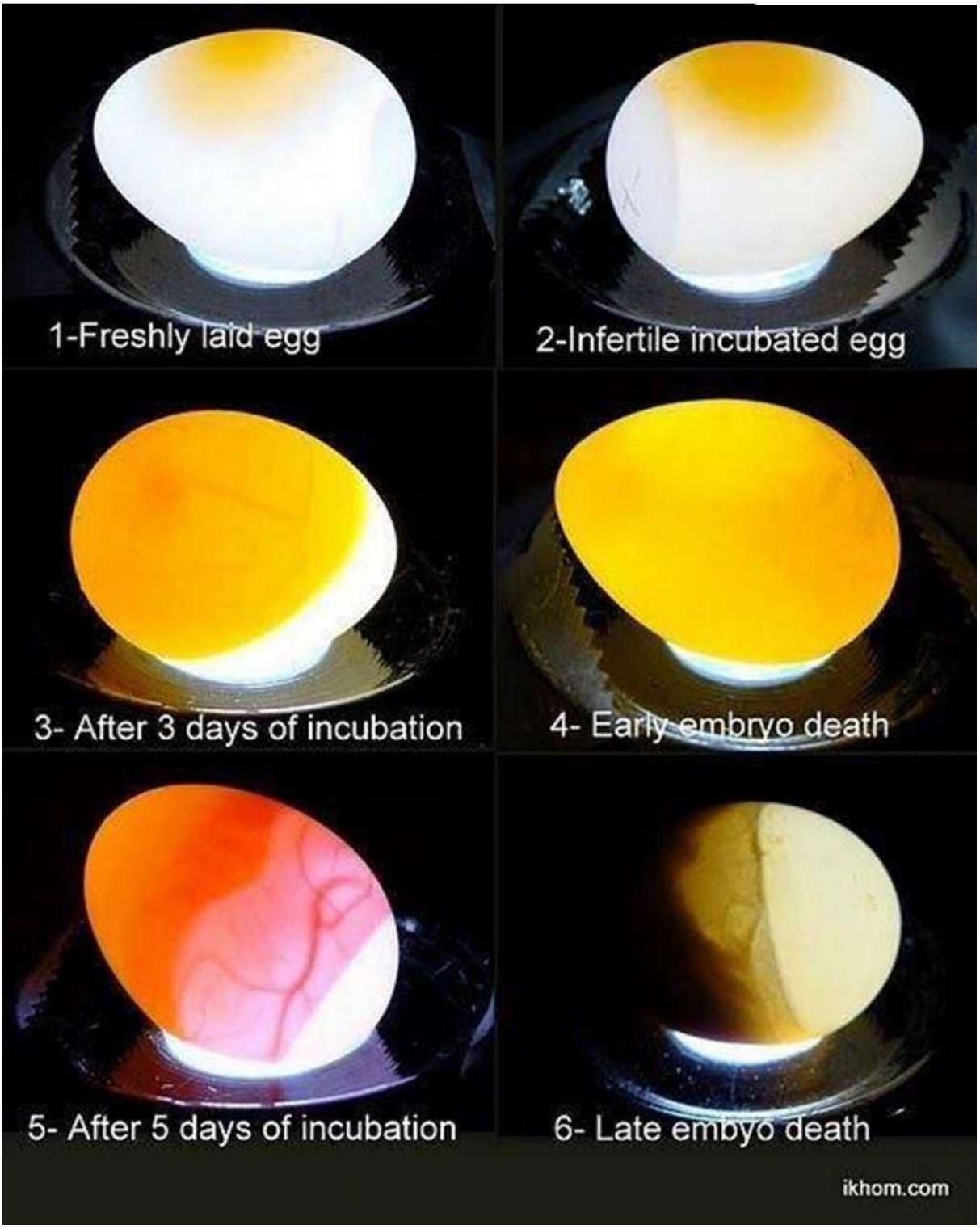
If attending to these matters does not help, your avian veterinarian will usually want to review the aviary environment and your management practices, test the hen for infection, or do an egg autopsy.



Life cycle of a chick in egg

Obviously, this is a chicken, but the same events/aspects occur in our beloved canaries. I added this to our newsletter because it was the best, real, live version of the process I had ever seen.

Multiple references of egg and bird development including problems, repairs and general information


1-Freshly laid egg
2-Infertile incubated egg
3- After 3 days of incubation
4- Early embryo death
5- After 5 days of incubation
6- Late embyo death
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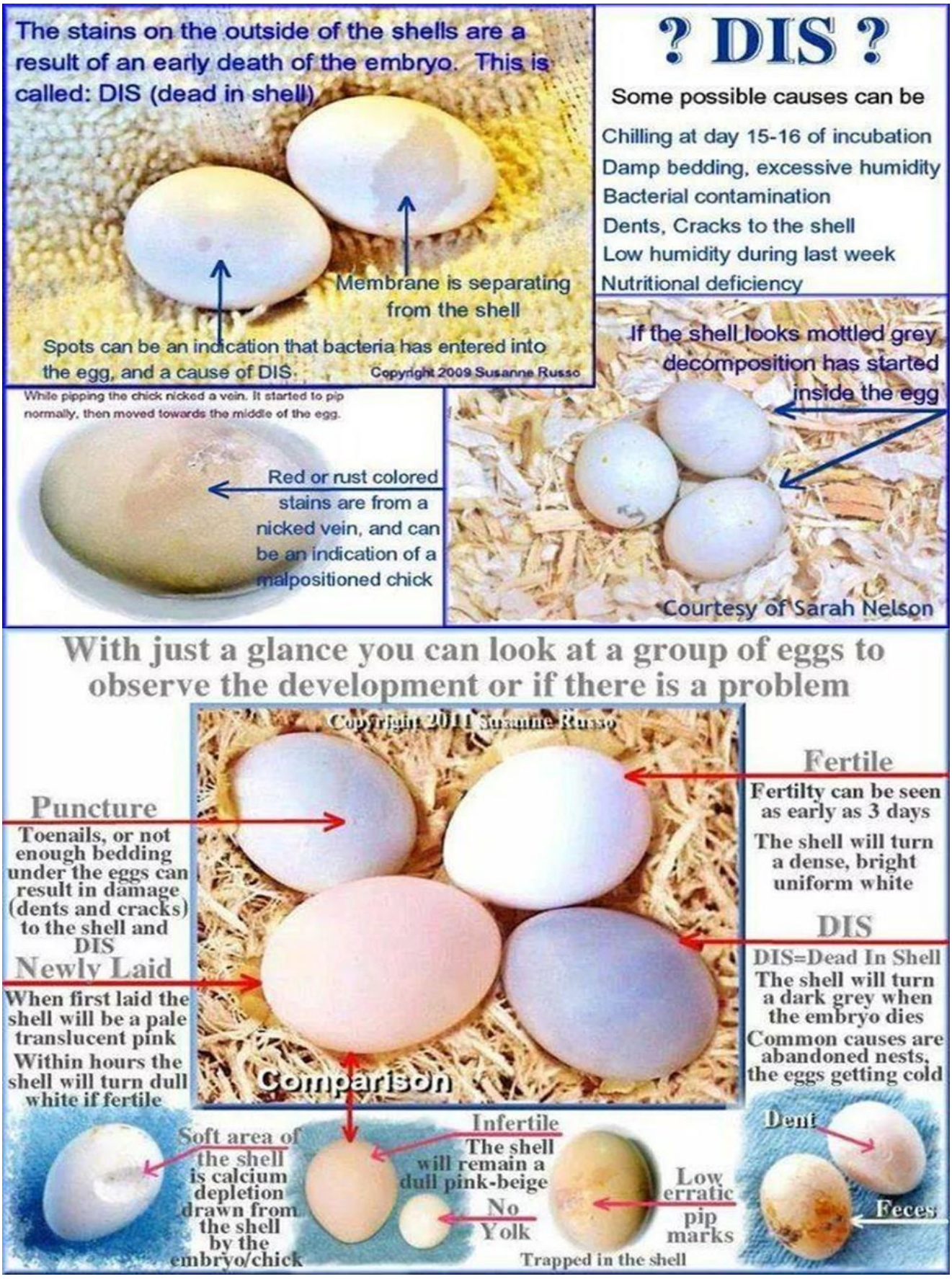
The stains on the outside of the shells are a result of an early death of the embryo. This is called: DIS (dead in shell)
Membrane is separating from the shell
Spots can be an indication that bacteria has entered into the egg, and a cause of DIS.
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? DIS ?
Some possible causes can be
Chilling at day 15-16 of incubation
Damp bedding, excessive humidity
Bacterial contamination
Dents, Cracks to the shell
Low humidity during last week
Nutritional deficiency
If the shell looks mottled grey decomposition has started inside the egg
Courtesy of Sarah Nelson
While pipping the chick nicked a vein. It started to pip normally, then moved towards the middle of the egg.
Red or rust colored stains are from a nicked vein, and can be an indication of a malpositioned chick
With just a glance you can look at a group of eggs to observe the development or if there is a problem
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Puncture
Toenails, or not enough bedding under the eggs can result in damage (dents and cracks) to the shell and DIS
Newly Laid
When first laid the shell will be a pale translucent pink
Within hours the shell will turn dull white if fertile
Fertile
Fertilty can be seen as early as 3 days
The shell will turn a dense, bright uniform white
DIS
DIS=Dead In Shell
The shell will turn a dark grey when the embryo dies
Common causes are abandoned nests, the eggs getting cold
Comparison
Soft area of the shell is calcium depletion drawn from the shell by the embryo/chick
Infertile
The shell will remain a dull pink-beige
No Yolk
Low erratic pip marks
Trapped in the shell
Dent
Feces

DEAD IN SHELL

WHEN THE TOP OF THE EGG WAS REMOVED
THE BODY WAS SWOLLEN AND FILLING THE AIR CELL

WING TUCKED UNDER THE NECK
PRIOR TO PIP

MEMBRANE HAD
SEPARATED FROM THE SHELL

BODY ENCASED IN THE MEMBRANE

Piping Egg

The first pip will look like a raised cracked area on the surface of the shell.

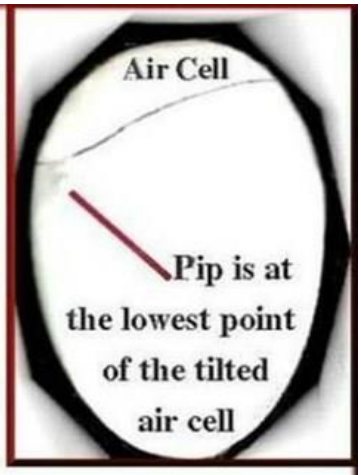
Pipping

Once the chick has started to pip it will use its egg tooth to cut around cut around the shell

Approx. time from pip to hatch is 24-36 hrs.

Egg Tooth

Cutting Out



Air Cell

Pip is at the lowest point of the tilted air cell

Pipping

Normal

After the egg is laid take note of the size of the air cell. This will be an IMPORTANT reference later on as the egg develops

Always candle the the air cell end of the egg

Monitoring the Air Cell Size

What to look For?

A change can be the the first alert to a problem

Pip

Approx. 24-36 hrs.

During this time the chick draws the blood and yolk into the body

Cutting Out

Approx. 10-30 min

Tilted

At 16-17 days the chick will turn in the egg towards the air cell. The egg-tooth is used to Pip the inner membrane and exterior shell at the edge of the air cell

Small

Excess Humidity

The shell is porous and when humidity is high the chick swells in the egg which decreases the air cell size. The chick is at risk of drowning or smothering in the egg

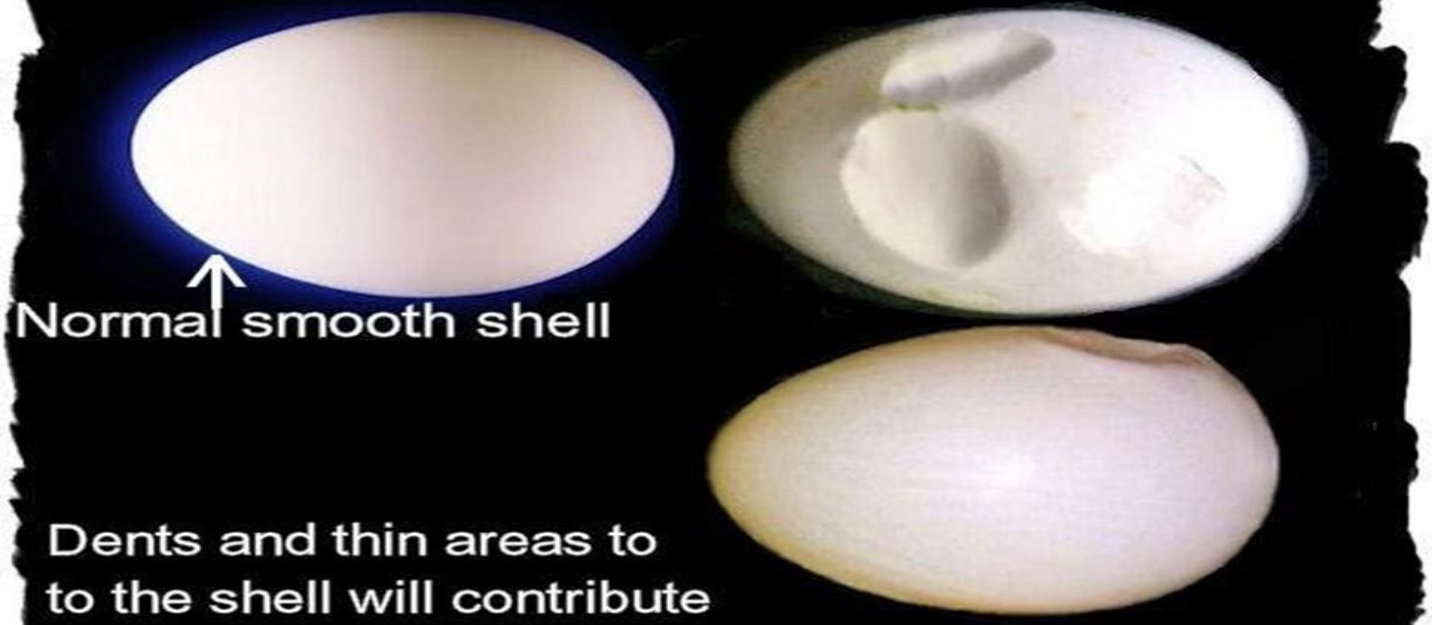
Low Humidity

Common cause of DIS

Large

As the egg loses moisture the inner membrane adheres to the chick preventing it from turning to pip the shell to hatch

Calcium Deficiency

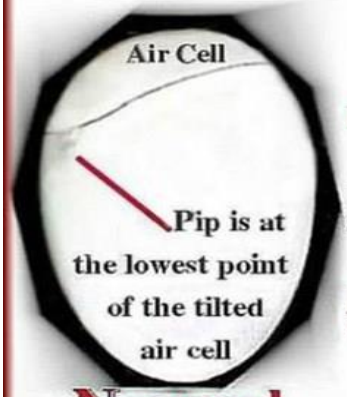


Dents and thin areas to to the shell will contribute to moisture loss within the egg. The membrane will stick to the chick and prevent it from hatching

Pipping

Normal and Malpositioned

What you want to see



Normal

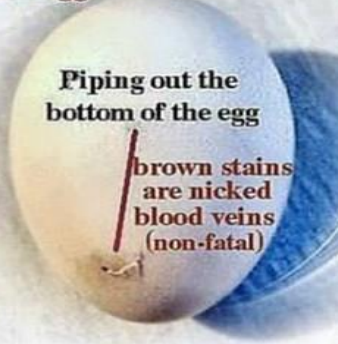
Problems What you don't want to see

I have noticed that weather and environmental temperatures can have an impact on eggs

If the environment is hot development is accelerated, and the chick can hatch a day early. Cool/cold temps. can delay the hatch by a day.

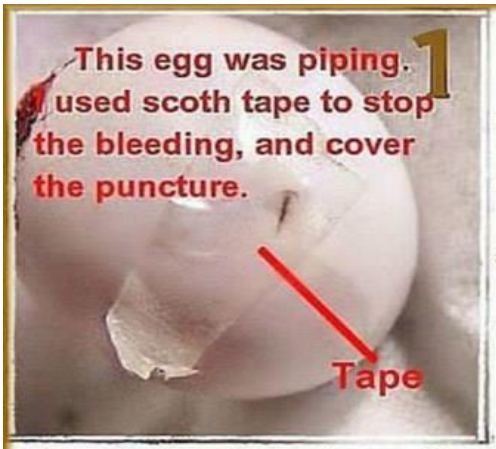
Erratic weather, such as storms one day followed by hot or cold weather the next, then storms again can have an impact on a piping egg. I have noticed when the weather was erratic so were the pips on the shell like the chick was lost and wandering in the egg.

Malposition



Can be a result of over supplementing of calcium, vitamins and minerals

Egg Repair



Punctures from toenails and/or sharp objects

The shell provides a safe and protective environment for the developing embryo. Damage to the shell can be repaired resulting in a successful hatch.

Various things can be used for repair such as nail polish for small repairs, to spackling and glue for large repairs.

If the damage occurs within the first week, AND fluid is leaking from the egg it will not survive. There should be NO fluid leaking from the egg. Damage during the last week of development, including eggs that bleed can be repaired and saved.

Oops! I dropped the egg (accidents happen)

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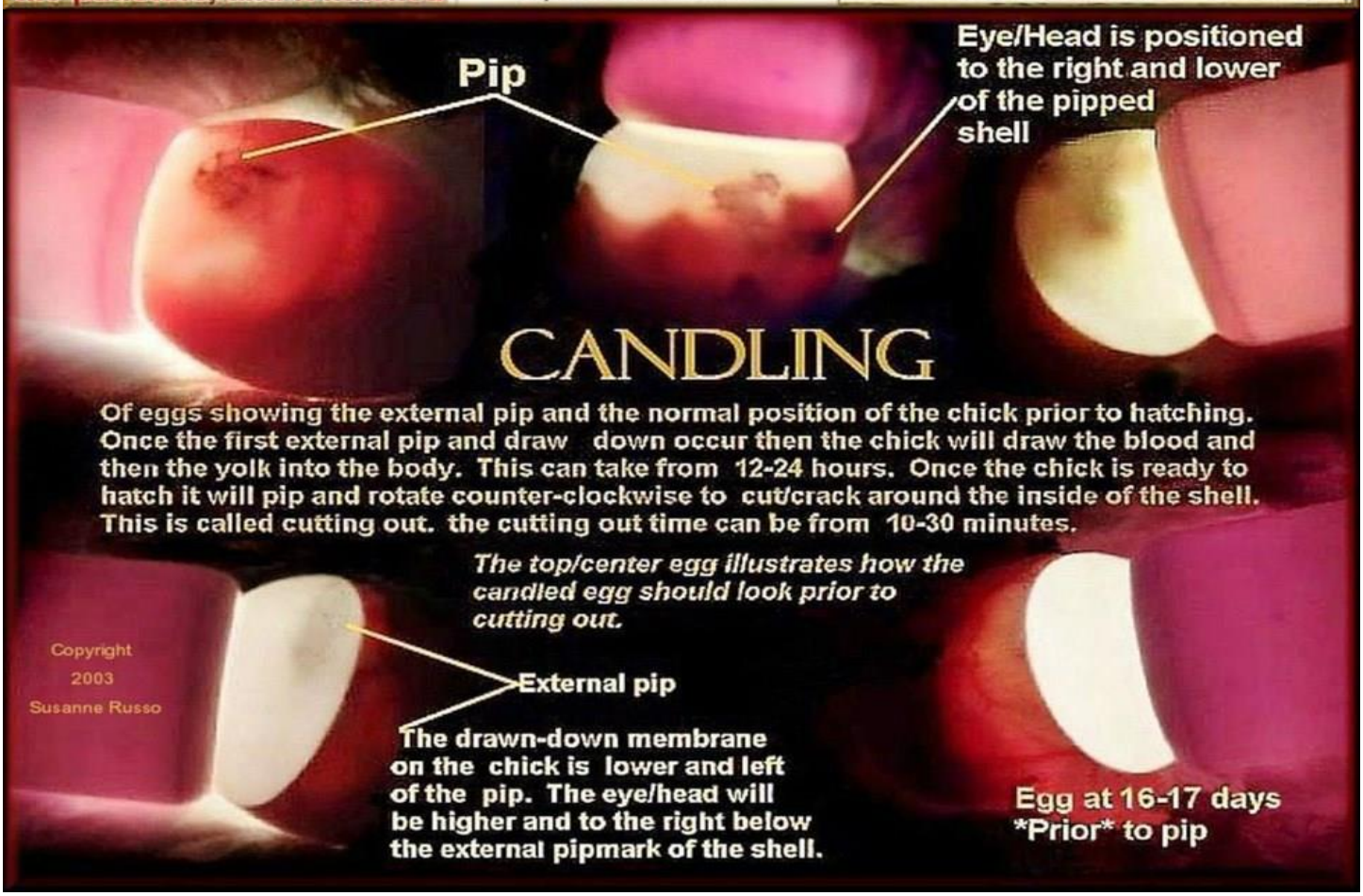

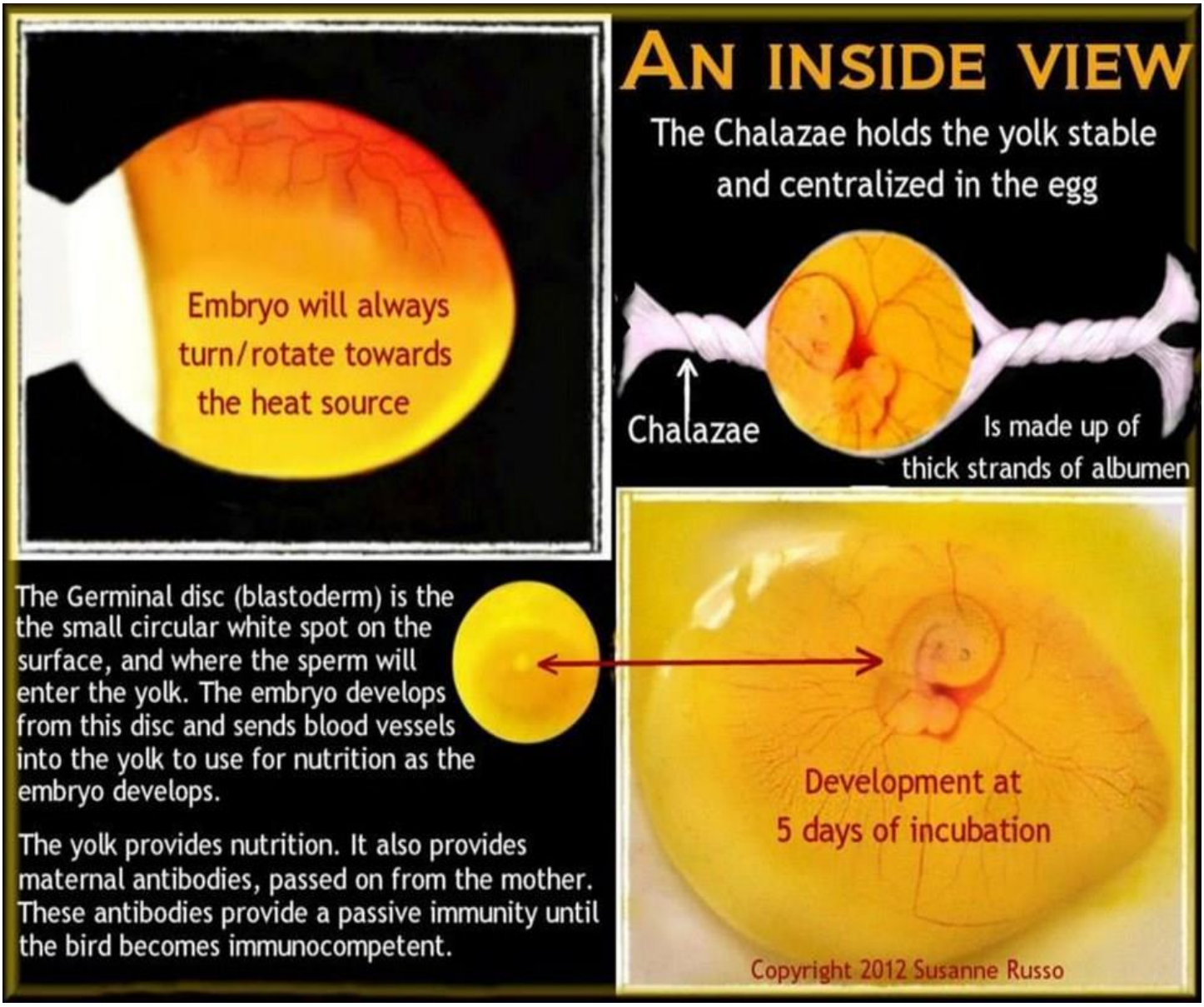
AN INSIDE VIEW
The Chalazae holds the yolk stable and centralized in the egg
Embryo will always turn/rotate towards the heat source
Chalazae
Is made up of thick strands of albumen
The Germinal disc (blastoderm) is the the small circular white spot on the surface, and where the sperm will enter the yolk. The embryo develops from this disc and sends blood vessels into the yolk to use for nutrition as the embryo develops.
The yolk provides nutrition. It also provides maternal antibodies, passed on from the mother. These antibodies provide a passive immunity until the bird becomes immunocompetent.
Development at 5 days of incubation
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