A Chicken Tender's Guide To...

Chick Development Throughout Incubation

Deer Run Farm
Heritage Breed Hatchery

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Did you know that chick development begins even before the egg is laid? It's true! Chick development starts as soon as the fertilization process occurs which is 24 hours before the egg is even laid. The first stage of chick development is the creation of a single cell (that's called the zygote) that's formed by the union of the egg and sperm cells of the parents. This cell will divide itself over and over again as the egg is being formed inside the hens 107 degree body. This group of cells is what makes up the blastoderm (or germinal disc) that can be seen on the surface of the yolk — you know, that white bullseye everyone tells you to look for to know if your eggs are fertilized or not?! Once the egg is laid and has a chance to cool the division of the cells stops. Although the chick is not developing at this time, as soon as the egg returns to the 99 degrees of an incubator or mother hen the cell division process will begin again.

Here is a description of what's happening inside the fertilized egg during incubation in terms of growth throughout the entire 21 day process:

Day 1 of 21: The chick's cells have begun to multiply again, but this time creating two new layers of cells called the ectoderm (uppermost) and the endoderm (underneath) layers.

Day 2 of 21: By day 2 of chick development a third layer of cells has already been formed between the ectoderm and the endoderm layers called the mesoderm. This is important to note because today the development of the heart, ear, eye and brain have already begun from the cells of these three layers.

→ *The ectoderm* produces the nervous system, parts of the eyes, the feathers, beak, claws and skin.

→ *The endoderm* produces the respiratory system, the digestive system and secretory organs.

→ *The mesoderm* produces the skeleton, muscles, circulatory system, reproductive organs and excretory system.

Although still not visible through candling, the blood vessels have formed and are connected to the heart which actually begins to beat today!

Day 3 of 21: The third day of incubation is the first day that, if candled, veins that have developed in the egg could very faintly be seen. These veins allow the embryo to access the nutrients in the egg from special membranes external to its body. The yolk sac, amnion, allantois and chorion are the four special membranes

in the egg during chick development. Each membrane has a specific function to help provide for the embryo.

→ The yolk sac produces and enzyme that changes the yolk material into a form that can be used for food by the embryo.

→ The amnion forms a sac that is filled with fluid in which the embryo floats. This allows the embryo to develop in a "shock absorbent" space.

→ The allantois develops the circulatory system that's connected to the embryo and is run by it's heart. When it is fully developed it completely surrounds the embryo and has a number of functions including respiratory, excretory and digestive.

→ The chorion helps the allantois membrane by fusing the inner shell membrane to it which allows it to carry out its functions.

Day 4 of 21: It's not likely that there would be any visible difference from day 3's development to day 4's if the incubated eggs were candled. However, by the end of today the chicks will have begun to develop all of their organs needed to sustain life after hatching!

→ The beak and limb buds for the wings and legs will have all begun to develop. The eyes will even start to take color today! The embryo will turn over, adjusting so that it's left side now rests over the yolk sac. This is so that while the heart is still developing on the outside of the chick's body, it will now have room to continue to grow without being suffocated by the body.

→ As the heart continues to enlarge, the head and tail will start to come together so that the embryo takes the shape of a "C". Parts of the digestive and respiratory systems such as the mouth, tongue and nasal pits will begin to develop today also.

Day 5 of 21: By the end of today the embryo will have become a male or female as the reproductive organs start to develop.
The chick's bones will also begin to form today and within the next 24 hours both it's legs and wings should be able to bend.

Day 6 of 21: Voluntary movements of the embryo can begin to take place today. This is caused by the force of the embryo's heartbeat that's now beating at the rate of 260 to 280 beats per minute!

The beak of the chick will begin to grow today also, however, the egg tooth that the chick uses to pip through the eggshell to hatch does not form just yet.

Two of the membranes we learned about on day three of chick development, the allantois and chorion, actually become one today. This "new" membrane is now known as the chorioallantoic membrane, but it's functions remain the same: supplying oxygen to the embryo from its blood vessels and removing the waste the embryo creates. This membrane surrounds the entirety of the embryo and is equivalent to the human embryo's placenta.

At a more technical level the chorion and the allantois come together today to form the chorioallantois or chorioallantoic membrane. It's full of blood vessels and surrounds the embryo - in human embryos this is the placenta.

Day 7 of 21: The embryo will look more like a bird by the end of day 7. All the main parts of the chicken will be present; digits will begin to appear on the feet and grow into toes, feather germs will begin to form on the tail and thighs, the comb will start to develop and the egg tooth will start to grow. The heart will finally be completely enclosed in the thoracic cavity, whereas previously it had been on the outside of the embryo resting on the yolk sac.

Of all of day 7 developments, the growth of the egg tooth may be the most critical part.

Without the development of the egg tooth (the small, pale tip of the beak of a newly hatched chick) the chick may never be able to hatch. The egg tooth acts as a tiny hammer to break through the first membrane and then the shell when it's time to hatch. Roughly 24 hours after the chick hatches the egg tooth will fall off as it's fulfilled it's only purpose for the chick.

Day 8 of 21: Day 8 marks the beginning of the second week of incubation for the embryo. If the embryo was examined closely it would appear to have an unusually large eye for the body that it is on. Unique to day 8 development is the forming of the nictating membrane which is actually the "third eyelid" of a chicken. This transparent membrane keeps the eye moist by moving across it. It's purpose is to allow the bird to always be able to see even when it blinks!

The pterylae also begin to develop on day 8 of incubation. These are also known as the feather tracts which the bird's feathers will eventually sprout from. Today, though, the embryo remains featherless, but the natal down does starts to grow.

Lastly, the development of the blood vessels is so far along that today they begin to provide calcium from the shell to the bones of its skeleton. Most notably the thigh bones will start to fill with marrow!

Day 9 of 21: As the embryo continues to grow larger today, the yolk takes a flatter form and the albumen separates into two layers that surround the top and bottom of the yolk. This helps to cushion the embryo while it becomes more and more active, moving around in the amniotic fluid.

The egg tooth discussed on day 7 has now grown larger and the beak is lengthening and hardening. By the end of today it will have started to split making the mouth opening present.

80% of the chorioallantoic membrane has formed at this stage in development. It's still functioning as the sole passage way for oxygen to get to the embryo through it's blood vessels and the only way for carbon dioxide and bodily waste to exit. (If you've ever hatched chicks before and have seen the slimy string left behind in the shell once the chick has hatched — that's the waste left behind in the cavity from this membrane!)

Day 10 of 21: The embryo continues to grow larger and the facial features become more prominent throughout day 10 of incubation. In particular, the beak begins to harden more and more while the nose openings

begin to grow and narrow. The chicks toes are now fully separated and have started to grow toenails as well.

Day 11 of 21: Today is officially the half way point of incubation! The chick's comb will develop a serrated edge, legs will develop scales, tail feathers will become apparent, toes will begin to curl and the aorta (the main blood vessel in the chick - just like us humans have) will be visible along the neck today.

One of the very last things (but one of the most critical!) a chick will do prior to hatching is absorb it's yolk sac. Today, the chick's intestine will push its way into the yolk sac in preparation to be able to absorb the yolk in just 10 more days!

Day 12 of 21: As the embryo continues to grow through day 12 of incubation, more sporadic movements can be seen if the egg were candled.

The embryo will have its first, wee-little down feathers along it's spine, upper eyelid and around it's ear today. The toes, claws and ribs will begin to harden from the calcium intake of the egg shell that the blood vessels are continuing to transport to the embryo.

Day 13 of 21: The embryo continues to enlarge today. The skeleton is almost completely formed at this point in development. If you've ever used the wish-bone of the chicken to make a wish — that bone is formed today. The left and the right collarbones merge together to form the wishbone.

The leg scales that started to grow early on are now growing more quickly and starting to overlap. The body is covered lightly all over with feathers and a few claws are completely formed by now.

Day 14 of 21: On the 14th day of incubation the embryo begins to position itself for hatching. It will turn its head towards the large end of the egg where the air cell is and its body will lay lengthways down the egg. The embryo will now have down everywhere and will soon completely cover the chick so that it will be ready for hatch.

Day 15 of 21: From day 15 on, the incubation process is all about finalizing the embryo's development. The bones, claws, skull and leg scales are all hardening today. The most important development of day 15 is the chick's gut (the small intestine) is drawn into the abdominal cavity. Thus far it's been outside of the body and on top of the yolk. This happens in preparation for the chick to be able to feed off the yolk when it hatches. Of course, there's still more to happen before the chick will get to that point.

Day 16 of 21: The albumen, or white of the egg, is just about gone by day 16 of incubation. Instead, the egg is mostly filled with the developed chick and it's yolk that it will eventually use solely for it's nutrients to survive the rest of incubation.

The chick's body is also now completely covered in down. It's scales, claws and beak are also further hardening.

The chick will lose moisture through the shell during the incubation process since the temperature is so high which is why one must strive to maintain the humidity in the incubator. The moister lost at this point in incubation is replaced by air in the air cell, ultimately allowing it to enlarge and form for hatch in the next 5 days.

Day 17 of 21: Hatch day is just around the corner. Today, the amniotic fluid is just about gone and the chick has started to shift into hatch position. It's head is between it's legs as it starts to turn it's beak towards the air cell.

The chick's kidneys will begin to make urine today and the chick will start to ingest the yolk for nourishment from now until hatch.

Day 18 of 21: Just one more day until "hatch lockdown" and 3 more days until hatch! There's not too much to report on day 18 other than the continued enlarging of the chick and it's yolk will begin to be retracted into it's body. The air cell at the large end of the egg will also continue to enlarge as we get closer to hatch.

If candled today, most of the egg would be dark showing just how large the chick is with the empty area being the aircell.

Day 19 of 21: Today is just a continuation of the yolk being ingested by the chick. The chick will continue to take up more space in the egg while also slowly turning into position for hatch. At this point the chick's head will be tucked under its right wing with it's legs curled into it's body.

Day 20 of 21: The chick is in full preparation to begin to hatch. The yolk is still being absorbed today and is now about halfway inside the chick's body. It needs to be completely inside the body before the chick can hatch safely.

The blood in the vessels of the chorioallantoic membrane begin to empty as the chick absorbs the blood within itself just as it does the yolk sac. This process makes the membrane become sticky and less important to the chick as it will soon pip through it and begin to breathe using it's lungs on its own for the first time.

It's extremely important that the humidity level in the incubator is kept higher than in incubation and is stable. If there's not enough moisture during humidity, the membrane is at risk of drying out and hardening making it impossible for the chick to pip through and ultimately causing the chick to die before making out of it's shell.

Day 21 of 21: Today the chick has fully absorbed it's yolk sac and blood supply. It now has a belly button where it's stomach closed after the absorption.

The chick will hatch by pushing its beak through the air cell and begin breathing on its own for the first time. The chick will use its egg tooth to pip the

shell and start to cut it in a circle around the egg. The chick will rest and rotate as needed to fully open the top of the shell so that it can then kick out of the bottom part of the shell.

After hatching the chick will be exhausted so it's important for it to rest. While it's resting it will be able to dry and allow its naval opening to heal. Eventually it will stand and begin to walk once it regains its strength.