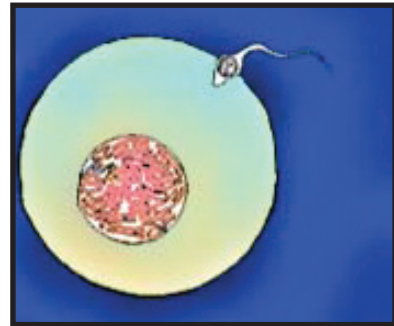


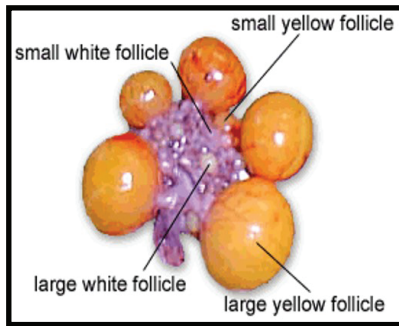
Development of the Chicken Embryo



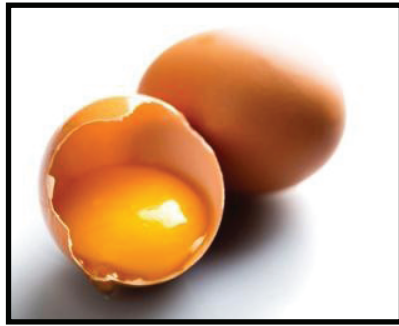
Fertilization is the process which enables development of the gamete and begins with contact between a sperm cell and ovum. Embryology is the study of the development of the fertilized single cell egg into a complex multi-cellular individual. It covers development from fertilization to hatching.



In most avian species, only the left ovary and oviduct develop and are active. The left oviduct contains numerous follicles, which will develop into a mature ovum (yolk). The zygote is formed following syngamy of the male and female pronuclei (Sperm and ovum).



The hens' ovary contains a cluster of yolks that form a hierarchy as they develop. Each mature ovum is a single cell, containing yolk material which will be food for the developing embryo, with the female nuclear material contained in the germinal disc. All are held together by the very thin vitelline membrane.



The mature ovum are released from the ovary, usually one at a time, about 24 hours apart. The ovum is fertilized while in the infundibulum of the oviduct. During egg formation, embryonic development continues by cell division and will result in 40 - 60,000 cells at the time of lay.



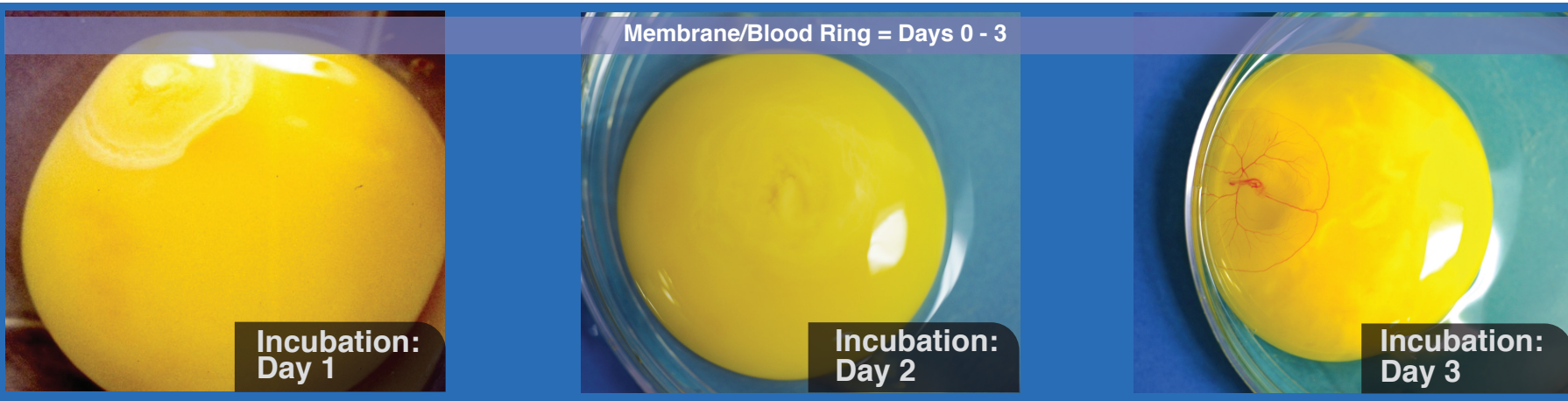
The germinal disc on the infertile egg appears as shown in this photo. Note the solid concentration of white in the central area of the germinal disc, with a lacy white appearance around the outer edge giving it an irregular appearance.



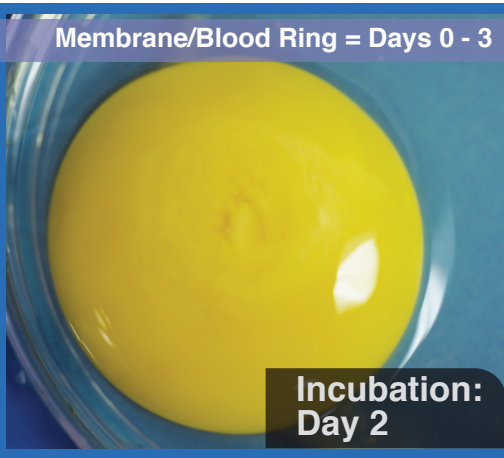
The germinal disc appears as in this photo. After fertilization, the formation of a blastocoel (fluid filled cavity) is visible as a donut, or ring, and accommodates cell movement in the developing embryo. This creates a less dense central area which causes the appearance of a white ring over the germinal disc.

**** This wall chart is supplied with the compliments of your Jamesway distributor, to assist hatchery personnel in having a better understanding of egg handling, incubation and hatching, and achieving a Platinum Chicks TM hatch. Jamesway provides a range of hatchery solutions to suit your hatchery needs, and products are distributed and serviced worldwide.****

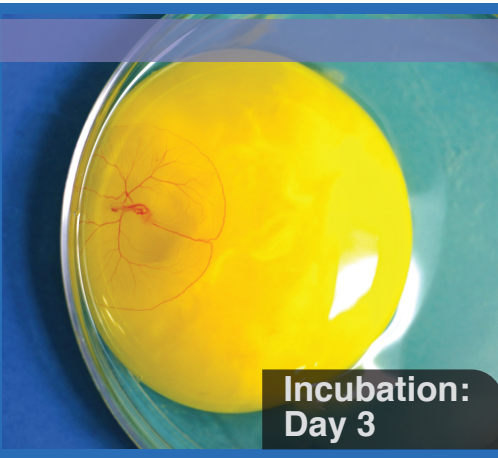
Endothermic Stage



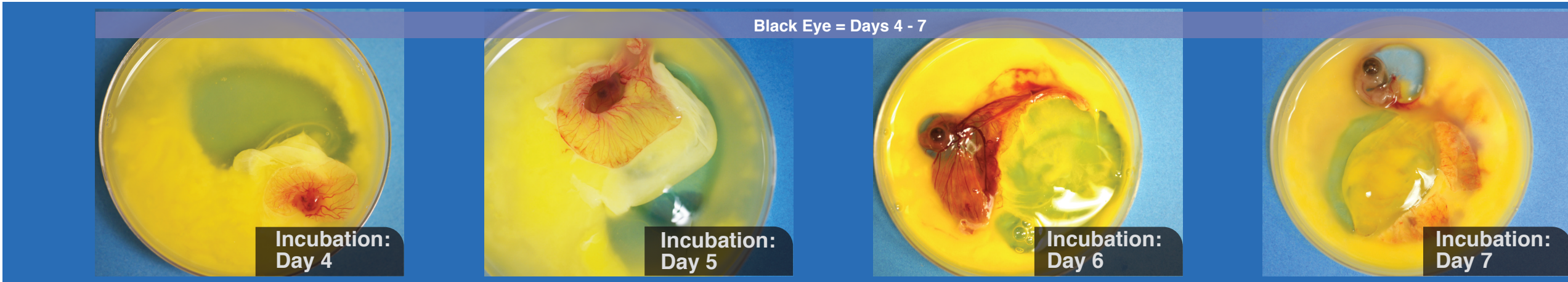
Cell growth and development is restarted at the beginning of incubation, preferably within five to seven days after lay. The germinal disc at this stage is now referred to as the blastoderm and is saucer-shaped in appearance. The outer area opaca, and the center area pellicula, which is raised from the yolk by the segmentation cavity, can be seen as a darker ring.



The primitive streak is visible as the elongated dark line in the center of the blastoderm from which the chick will develop. Early development of the circulatory system is visible as spider web like red lines. The yolk sac plays a key role in nutrition for the developing embryo. The amniotic sac and the associated allantois are called extra embryonic membranes.



The heart is visible along with further development of circulatory system. The embryo flips to its left side and appears as a question mark in the lower part of yolk. The tailbud is forming and primary division of the brain is evident as a transparent bubble on left side of embryo. The amniotic fluid protects the embryo from shock and gives it freedom to move during incubation.



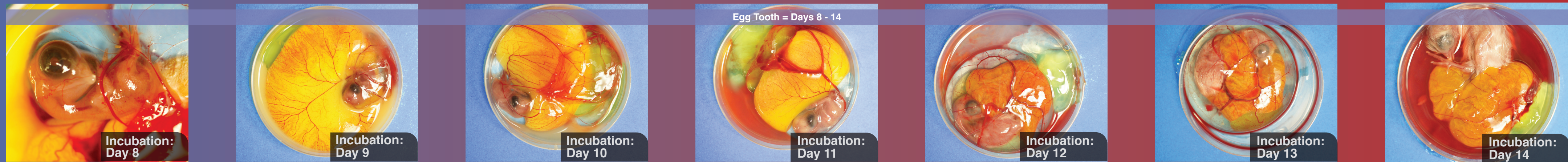
The brain is divided into three parts, (the fore-brain, mid-brain and hind-brain) and can be seen at the top of embryo. The heart and the vascular system of the yolk sac membrane is visible. The chorioallantoic membrane (CAM) is formed and functions to assist in nutrient exchange throughout embryo development. Pigmentation of the eye is visible and prominent.

The embryo size has increased considerably. The tail is distinct and limb buds are forming and visible. The tail and heart come closer together, so the embryo appears as the letter C. The allantois (CAM) is large and increases functioning as respiratory system, calcium absorption and container for excretory waste.

The embryo shape is becoming characteristic of a bird. The thoracic cavity is beginning to envelop the enlarged heart and the brain and eye are quite prominent. The amnion and allantois (CAM) are clearly defined and the yolk sac covers well over half the yolk.

The embryo growth is accelerated. The neck appears as a pinched area separating head and thorax. Beak is forming with the brain becoming smaller as it is absorbed into the cephalic or head region. Feather tracts begin to appear. The heart is completely enclosed and the yolk sac almost completely surrounds yolk area.

Neutral Stage



The embryo brain is completely enclosed with both eyes visible. The upper and lower beak are of equal length with the neck becoming longer with wings and legs well defined. Seven rows of feather tracts are present along the back. Sex of the embryo can be determined through gonadal inspection. The egg tooth is visible and very prominent.

The yolk sac completely envelops the yolk area and becomes increasingly folded and vascularized. The transparent allantois is also enlarging and migrating along the inner shell membrane with the position of the CAM fixed in relation to the shell. Toe digits are now forming.

The yolk dimension has reached its maximum. Toe nail, comb and wattles are present and wing and feet digits are completely separated. Complete loss of webbing between phalanges and toes). Primary wing feather follicle development is noticeable.

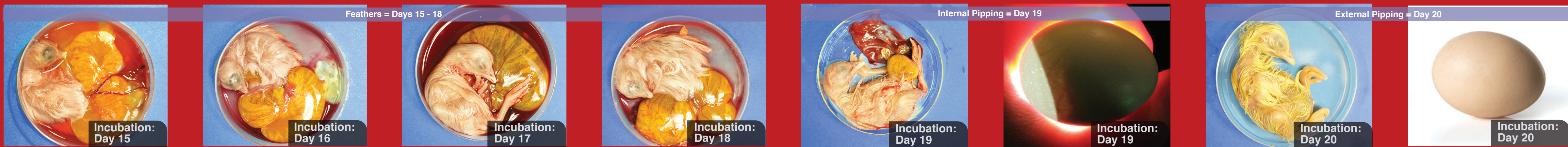
The embryo looks like a chick. As it becomes heavier, the body sinks into the yolk material which is beginning to shrink. Tail feathers present and distinct, eyelid flattened oval, claws flattened laterally and curved ventrally with opaque tips, embryo moves independent of amnion, CAM fuses to shell membrane.

The weight of the embryo causes it to sink deeply into the yolk material. To the left of the eye the small opening of the ear can be seen. Toes are well formed and down feathers are also beginning to appear. Margin of eyelids form a narrow elliptical slit, primordial scales present on legs. Sero-amniotic connection open - embryo drinks albumen.

The only real change in external appearance is growth and the production of feathers. Eye lids closed, toenails are formed and there are overlapping scales on the legs. A light down covering is evident, and white uric acid precipitates are beginning to be present within allantoic sac as its pH increases.

The back curves from the top down the left side with head curving back up toward the body. The embryo is oriented along the axis of the egg, embryo is well covered with down, beak hatching position determined, beak clapping movements observed in live embryos.

Exothermic Stage



Little change in appearance other than size and growth, with chick down prominent throughout. The head is moving more toward its shell-pipping position under the right wing which is the normal embryonic position for pipping when hatching, the yolk sac has become thick and is decreasing in size.

The embryo occupies most of the space in the shell with the beak tucked under the right wing. The yolk is now the most important source of nutrients since the albumen has been almost completely absorbed. Yolk sac positioned ventrally in front of embryo, hatching position well fixed, and white uric waste accumulation prominent.

More growth of the embryo, white urate waste material can be seen in the allantois and the chick is well positioned within the egg. The air cell increases in size, and with the egg in proper incubating position, will be above the chick in the blunt end of the egg. The beak under the wing points toward the air cell with the head directed between thighs. There is a decrease in amniotic fluid, yolk sac contraction is observed.

The chick is preparing to hatch. Amniotic fluid continues to decrease as well as the yolk material being greatly reduced with the only remaining visible yolk being absorbed through the navel. The embryos toes, wings and feathers are well developed. Chicken eggs may be transferred to hatching baskets. Head/beak oriented under right wing.

The beak is positioned close to the inner shell membrane near the enlarged air cell. When properly positioned, the wing is over the beak, and the chick uses the wing as a guide when pipping a ring around the shell. Yolk sac mostly withdrawn into body cavity, with allantoic fluid completely absorbed.

Once the air cell is pierced (internal pipping), pulmonary respiration is initiated. As the contents of the egg have been utilized by the developing embryo, the air cell has grown larger. The developing chick occupies most of the shell space, with the rest of the contents being the air cell. The majority of the yolk has been absorbed into the body cavity.

The inner shell membrane is broken and the beak is in the air cell. The navel opening has not yet healed, so if the hatching process is accelerated it could result in hemorrhaging or infection. The beak then pierces the eggshell (external pipping), yolk sac withdrawn, CAM loses vascularization and dries up, pulmonary respiration is occurring.

Pulmonary respiration is initiated as oxygen and other gases are transferred through the pores in the shell. Just prior to pipping the shell, the chick has absorbed the last of the yolk, which will be the chicks nourishment for up to 72 hours after hatching.

Hatching



Using its pipping beak as a hammer, the chick breaks the shell and enlarges the opening. It can now breathe free atmospheric air. Humidity is very important at this stage to prevent drying out of shell membranes and to prevent the shell from sticking to the down.

By pushing with its legs and feet the hatching chick turns its body, and still using the wing as its guide, breaks a ring around the shell. If the down sticks to the shell the chick can't turn and will not hatch.

Eggs will hatch during the 20th day of incubation and will often take 12-18 hours of continuous muscular exertion on the part of the chick to get completely free of the shell.

With one final heave the shell lid is opened and with a little more effort the chick is free to join the other newly hatched chicks. While wet it will look a little scrappy, but it should soon dry and become fluffy and active.

When incubation and hatching conditions are ideal, the chicks will hatch within a 20-24 hatch window. When the baskets are pulled from the hatcher, most of the chicks should be dry and active. The chicks must then rest for a few hours after they are pulled before their gut is ready for the consumption of feed and water.

If incubating and hatching conditions have been ideal, most of the hatch will resemble these fluffy, sturdy chicks, when the baskets are pulled from the hatcher.

Original photographs and commentary by
Jamesway Chick Master's Embryologist and
Director of Hatchery Consultants
Dr. Keith Bramwell, PhD.

www.jamesway.com
sales@jamesway.com
service@jamesway.com

Jamesway Chick Master Incubator Inc.
30 High Ridge Court - Cambridge - Ontario - Canada N1R 7L3
Tel +1 519 624 4646 - PRT 24/7 Service: +1 (226) 765-0210