

MODULE #16: Reptiles, Birds, and Mammals

EXPERIMENT 16.1 - Bird Embryology

INSTRUCTIONS

Supplies:

- Micro slide: The Chick Embryo
- Magnifying glass
- Microscope (optional)
- Desk lamp
- Lab notebook
- Colored pencils

Object: To observe bird embryology by studying the chick embryo

Procedure:

1. Pull the micro slide of the chick embryo out of its cardboard booklet. Hold the slide in your right hand so that the copyright section is closest to your hand and you can read the words in the copyright section.
2. Hold the micro slide up so that the light from the desk lamp shines through the images on the slide. With this illumination, you should be able to see the image in this section fairly well with your naked eye. To get a closer look, use your magnifying glass.
3. There are eight frames on the slide. Observe each section and read the information about that section in the cardboard booklet which came with the micro slide. Observe with both your naked eye and the magnifying glass. Be careful not to stare at the image for too long, as your eyes will tire from the light of the lamp.
4. Draw and label the image in each frame. Remember, each frame represents a certain stage in the embryo's development. The total time it takes for all of this development is only 96 hours!
5. Important things to note:
 - a. The brain is forming in the 18th hour.
 - b. By the 21st hour, the mouth and digestive system have started forming.
 - c. In the 28th hour the circulatory system is beginning.
 - d. By the 38th hour, the heart is forming and beating. The brain now has five regions.
 - e. By the 56th hour, the four chambers of the heart are forming, along with the ears and eyes. Additionally, many organs like the lungs and kidneys are developing.
 - f. By the 96th hour, the chick has every part, including the beginning of the wings.
6. (Optional) Observe each frame under the lowest power of your microscope. This slide was not really meant for a microscope, so you will have to hold it in your hands and move it up and down to find a good focus. Even though this method is a bit annoying, it will allow you to see some really nice detail.
7. Clean up your mess and put all of the equipment away, leaving it in good condition.

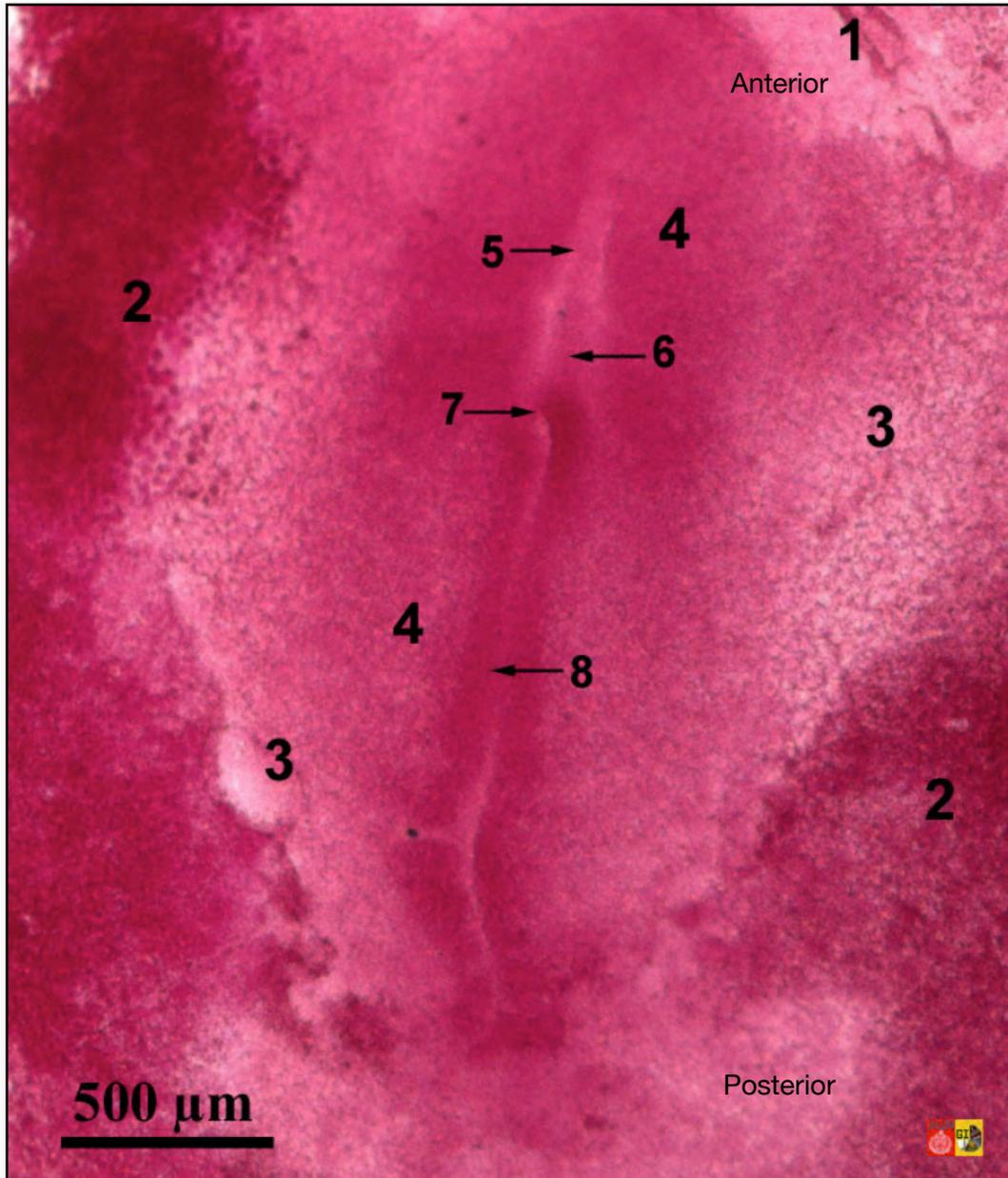
Student Notes

Procedures 1-3 you will skip because you do not have the micro slide. I will be providing snapshots of wholemount¹ images for the labeled stages of embryo development for steps 4-5.

Stage 18 hours

Note: The scale measurement is in microns (500 microns = 0.5 mm). Legend:

4 = Embryonal region, 5 = Neural plate, 6 = Chorda, 7 = Hensen's node, 8 = Primitive streak

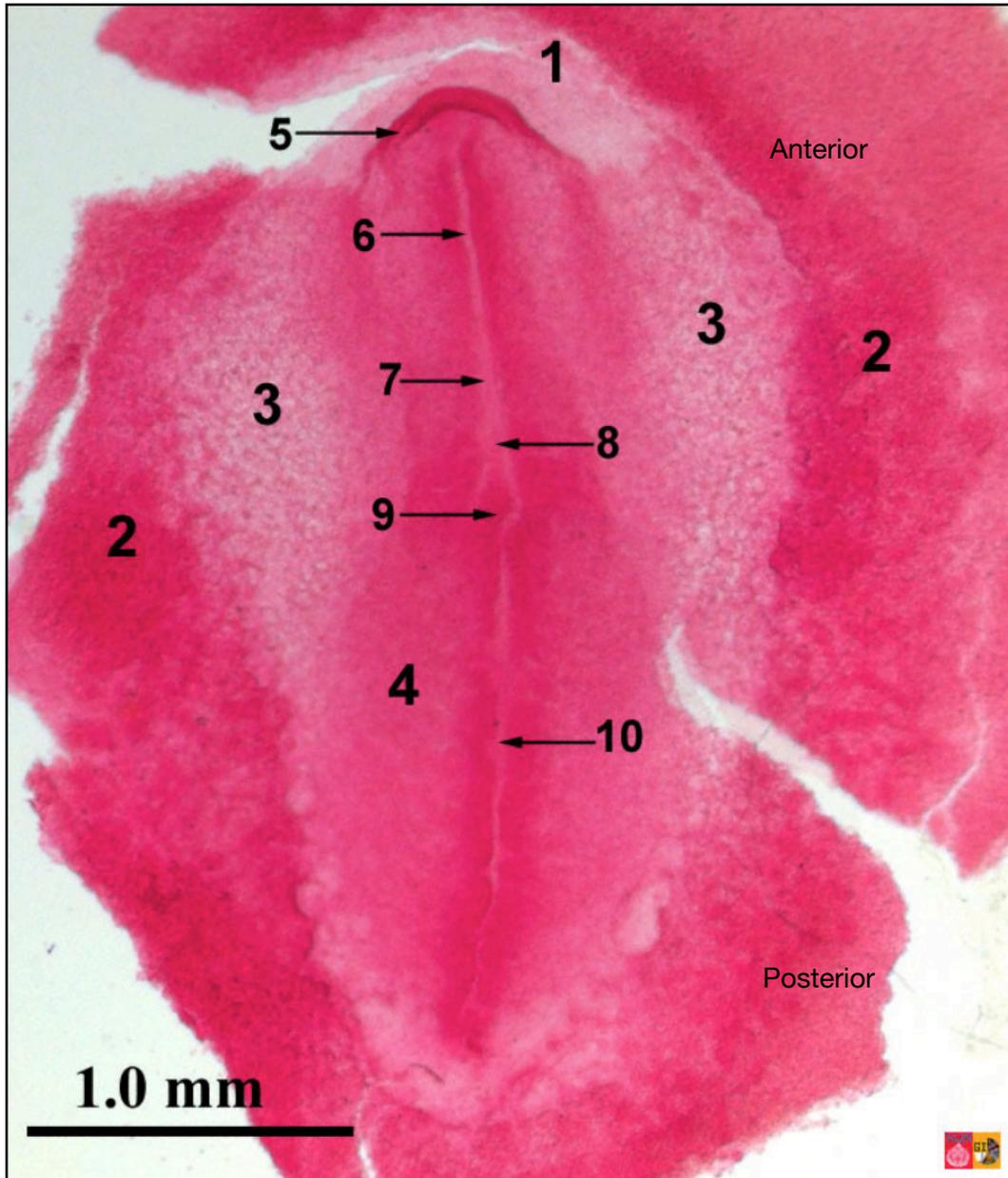


¹ wholemount - The practice of placing an entire organism on a microscope slide for examination

Stage 20 hours

Legend:

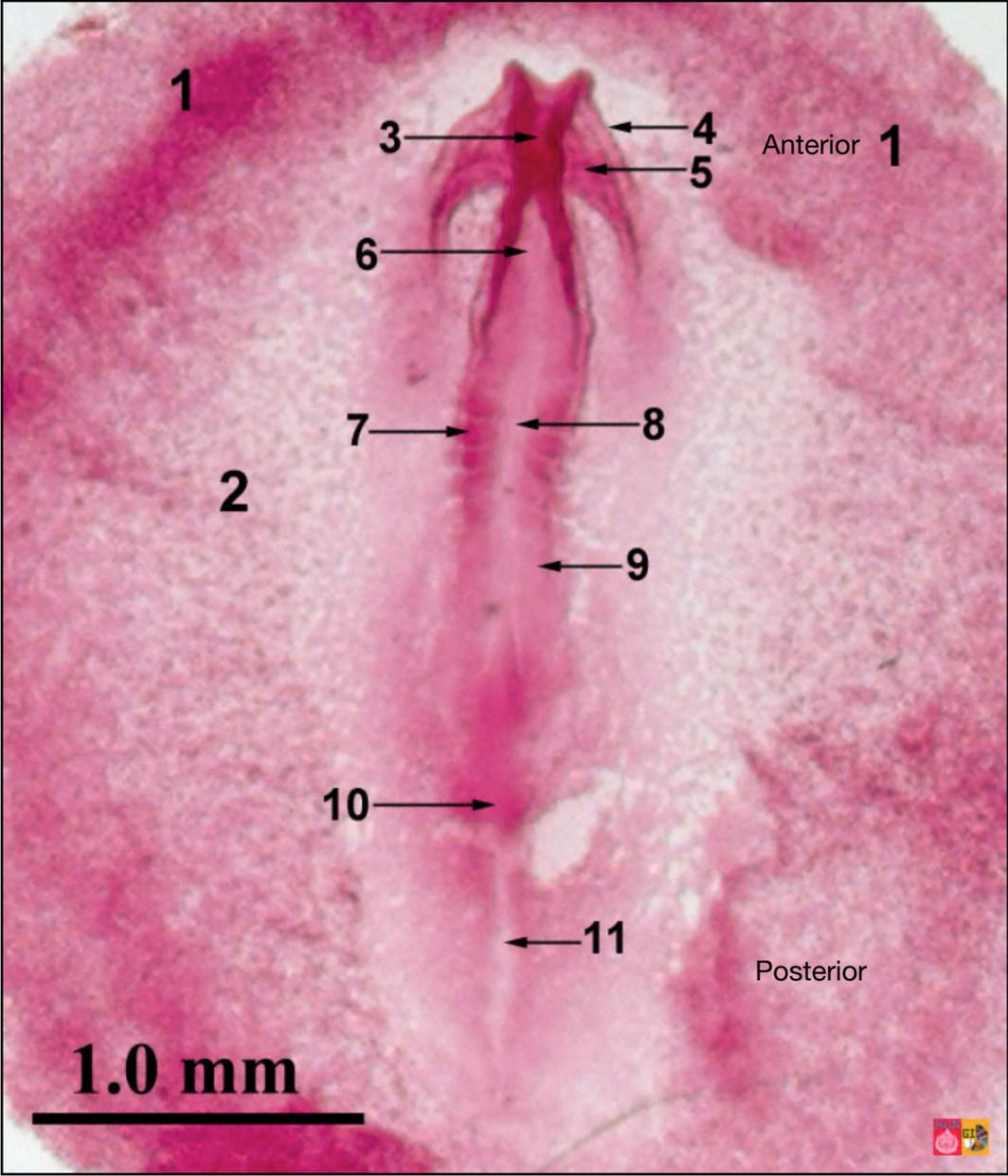
4 = Embryonal region, 5 = Head fold, 6 = Neural groove, 7 = Neural plate, 8 = Chorda, 9 = Hensen's node, 10 = Primitive streak



Stage 24 hours

Legend:

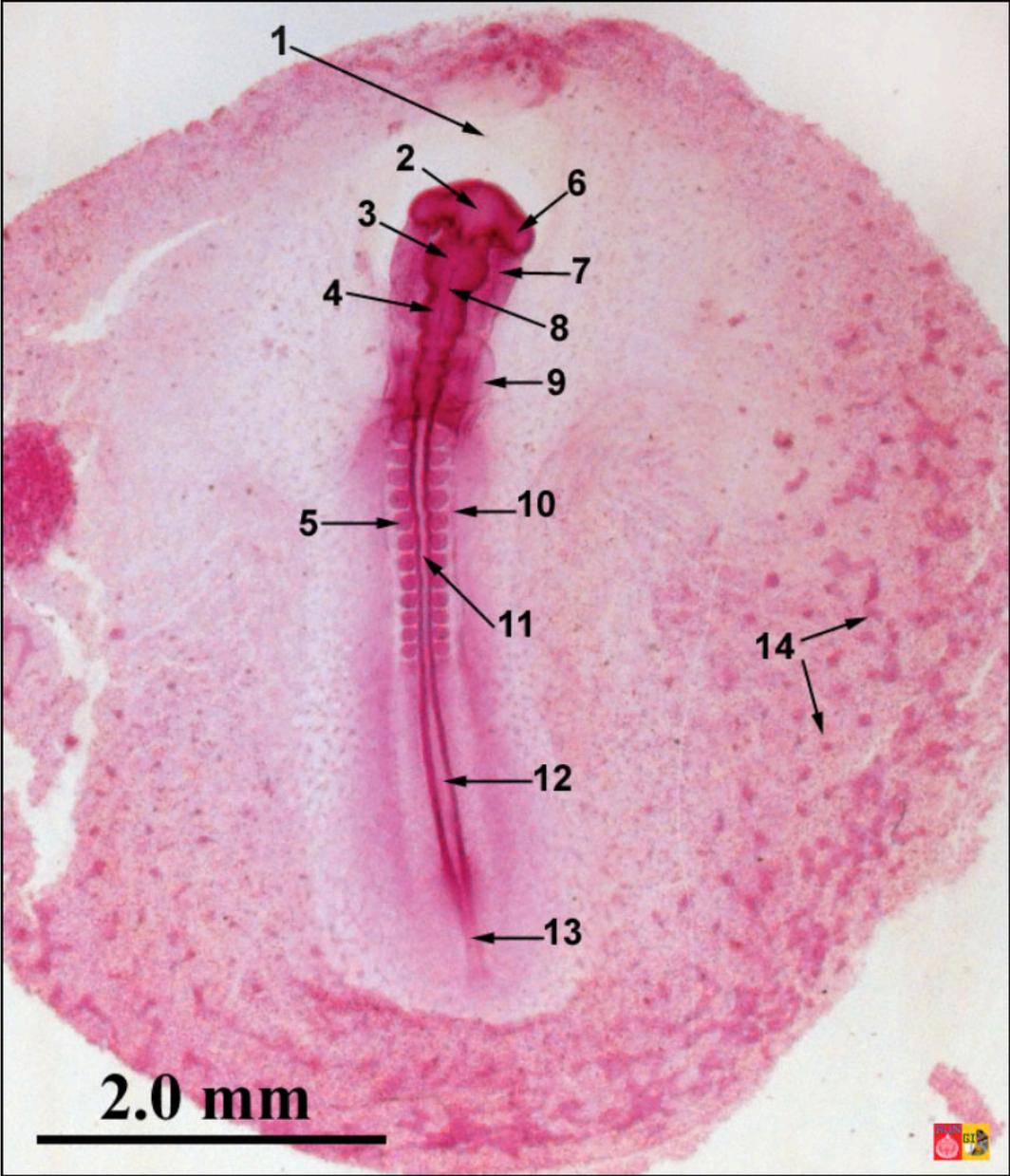
3 Neural fold, 4 head folding, 5 Foregut, 6 en ng Neural groove, 7 Somite, 8 Chorda, 9 unsegmented mesoderm, 10 Hensen's node, 11 Primitive streak



Stage 33 hours

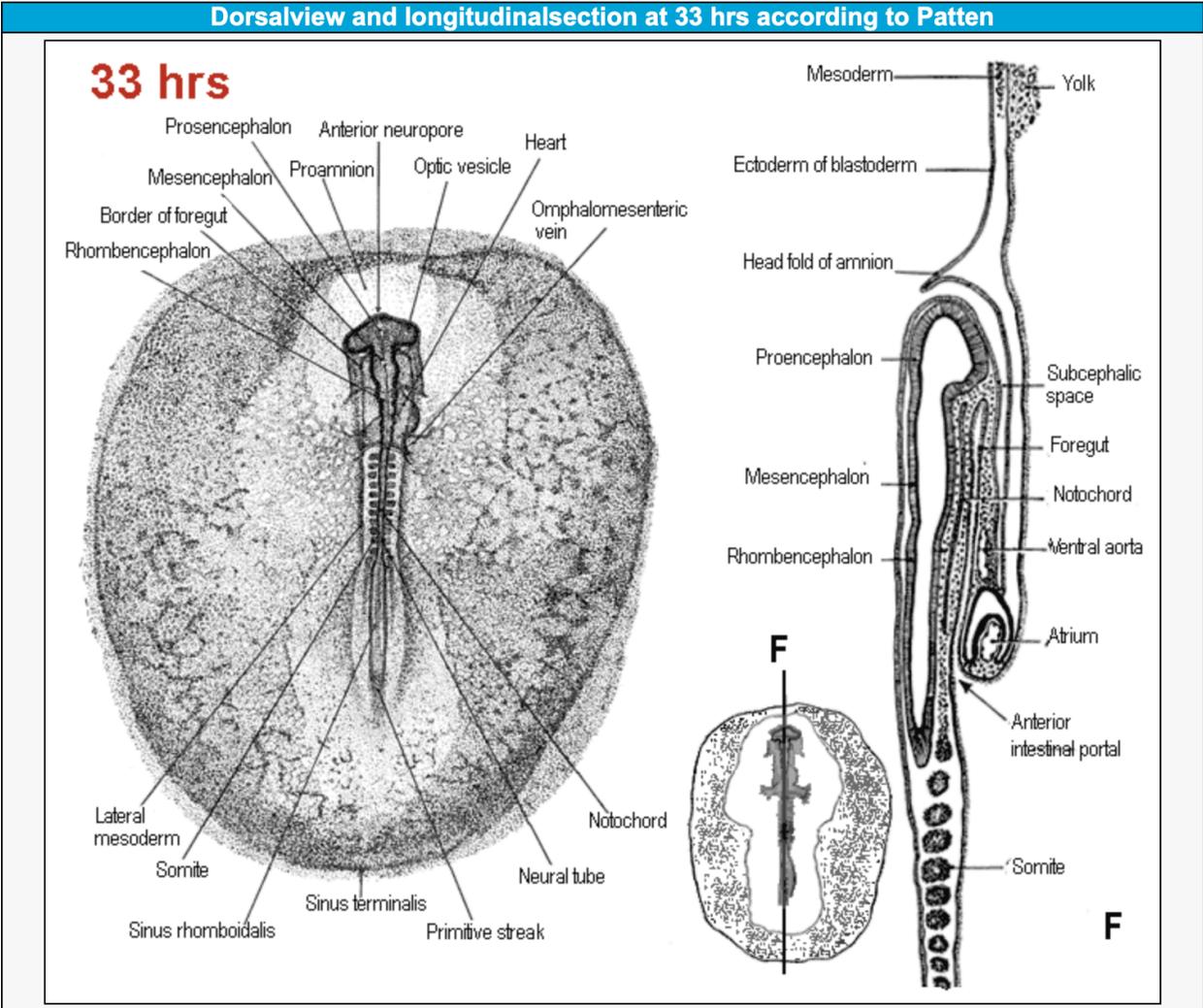
Legend:

1 = Proamnion, 2 = Prosencephalon, 3 = Mesencephalon, 4 = Rhombencephalon,
5 = Somite, 6 = Eye vesicle, 7 = Foregut, 8 = Chorda (translucent), 9 = Heart, 10 = Lateral
mesoderm, 11 = Spine, 12 = Sinus rhomboidalis, 13 = Primitive streak, 14 = Blood islands



Stage 33 hours

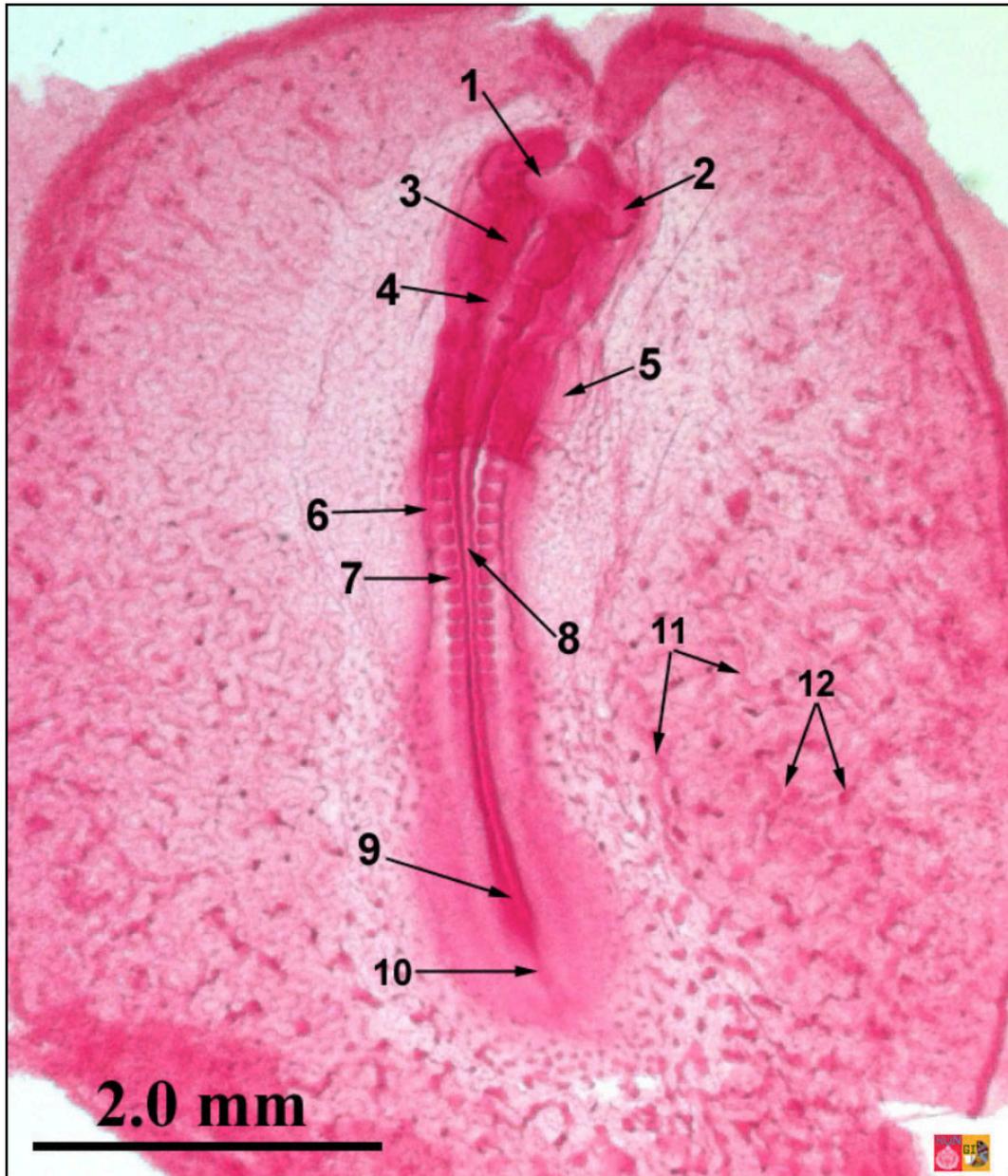
This drawing is included for further understanding of the different components of the chick embryo.



Stage 36 hours

Legend:

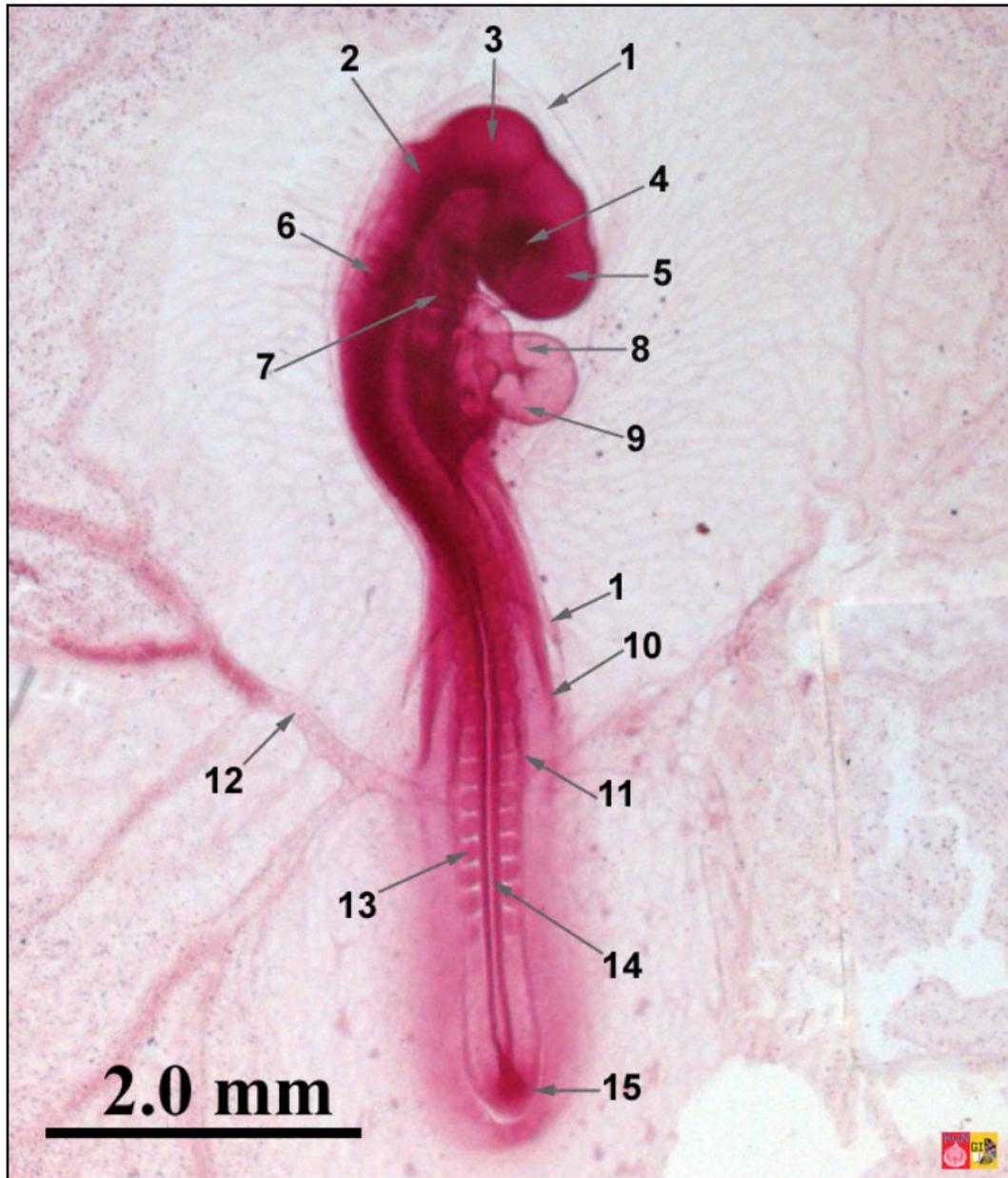
1 = Prosencephalon, 2 = Eye vesicle, 3 = Mesencephalon, 4 = Rhombencephalon, 5 = Heart, 6 = Lateral mesoderm, 7 = Somite, 8 = Spine, 9 = Sinus rhomboidalis, 10 = Primitive streak, 11 = Small blood vessel, 12 = Blood islands



Stage 48 hours

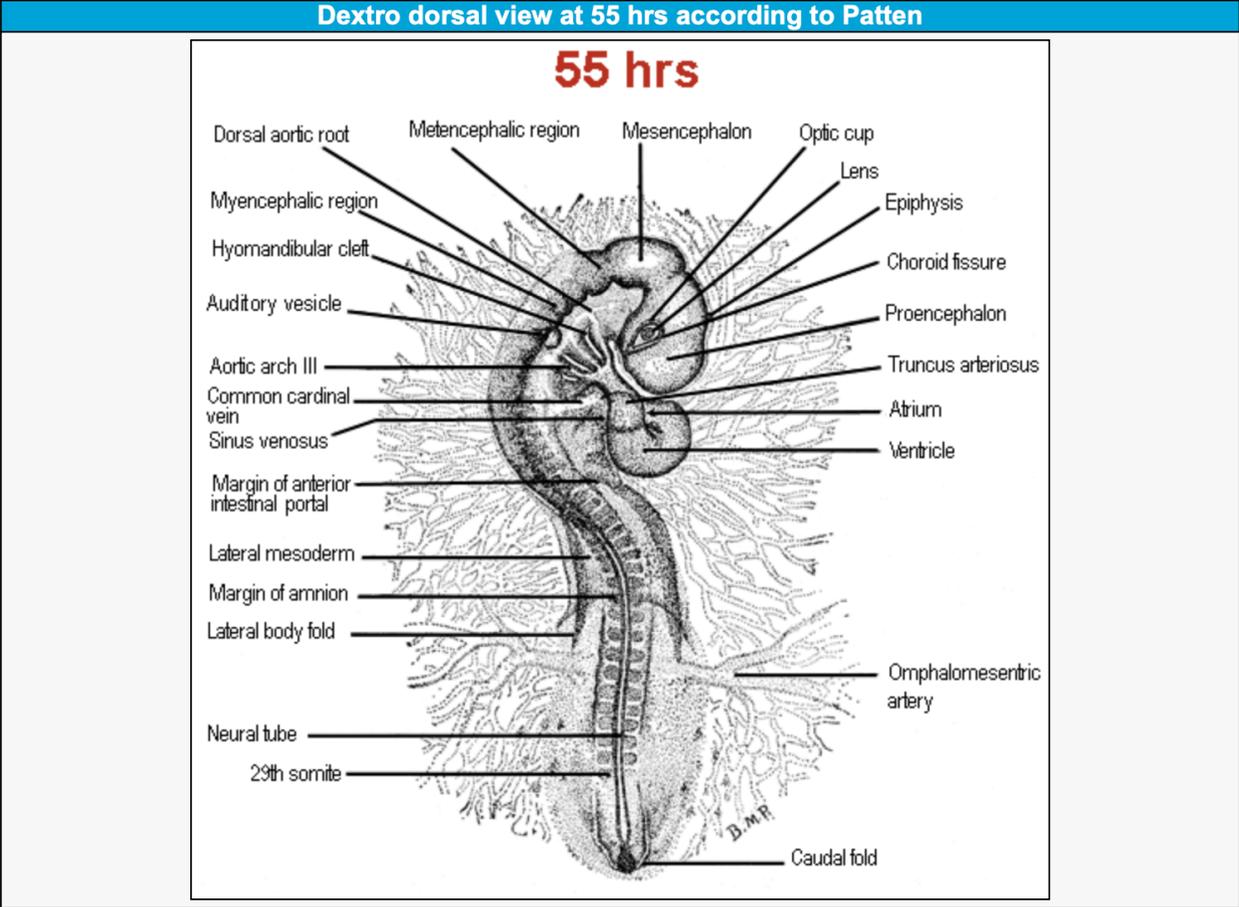
Legend:

- 1 = Amnion, 2 = Metencephalon, 3 = Mesencephalon, 4 = Optic cup + lens,
5 = Prosencephalon, 6 = Otic vesicle, 7 = Branchial arches, 8 = Atrium, 9 = Ventricle,
10 = Lateral fold, 11 = Lateral mesoderm, 12 = Vitelline arteria/vein, 13 = Somite, 14 = Spine,
15 = Tail fold



Stage 55 hours

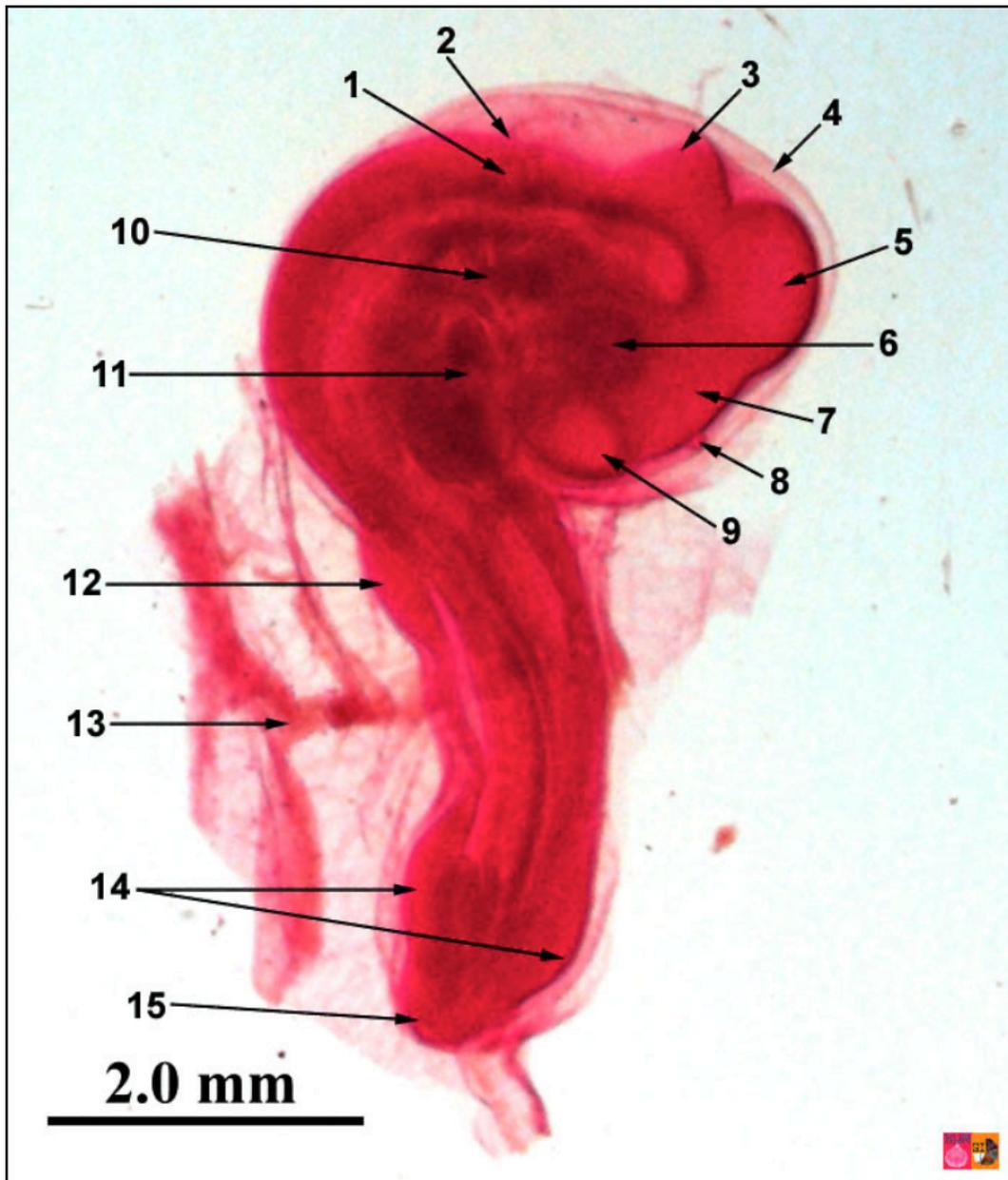
This drawing is included for further understanding of the different components of the chick embryo.



Stage 72 hours

Legend:

1 = Auditive (otic) vesicle, 2 = Myelencephalon, 3 = Metencephalon, 4 = Amnion,
5 = Mesencephalon, 6 = Optic vesicle + lens, 7 = Diencephalon, 8 = Epiphyse,
9 = Telencephalon, 10 = Branchial arches, 11 = Heart, 12 = Forelimb (wing) bud, 13 = Vitelline



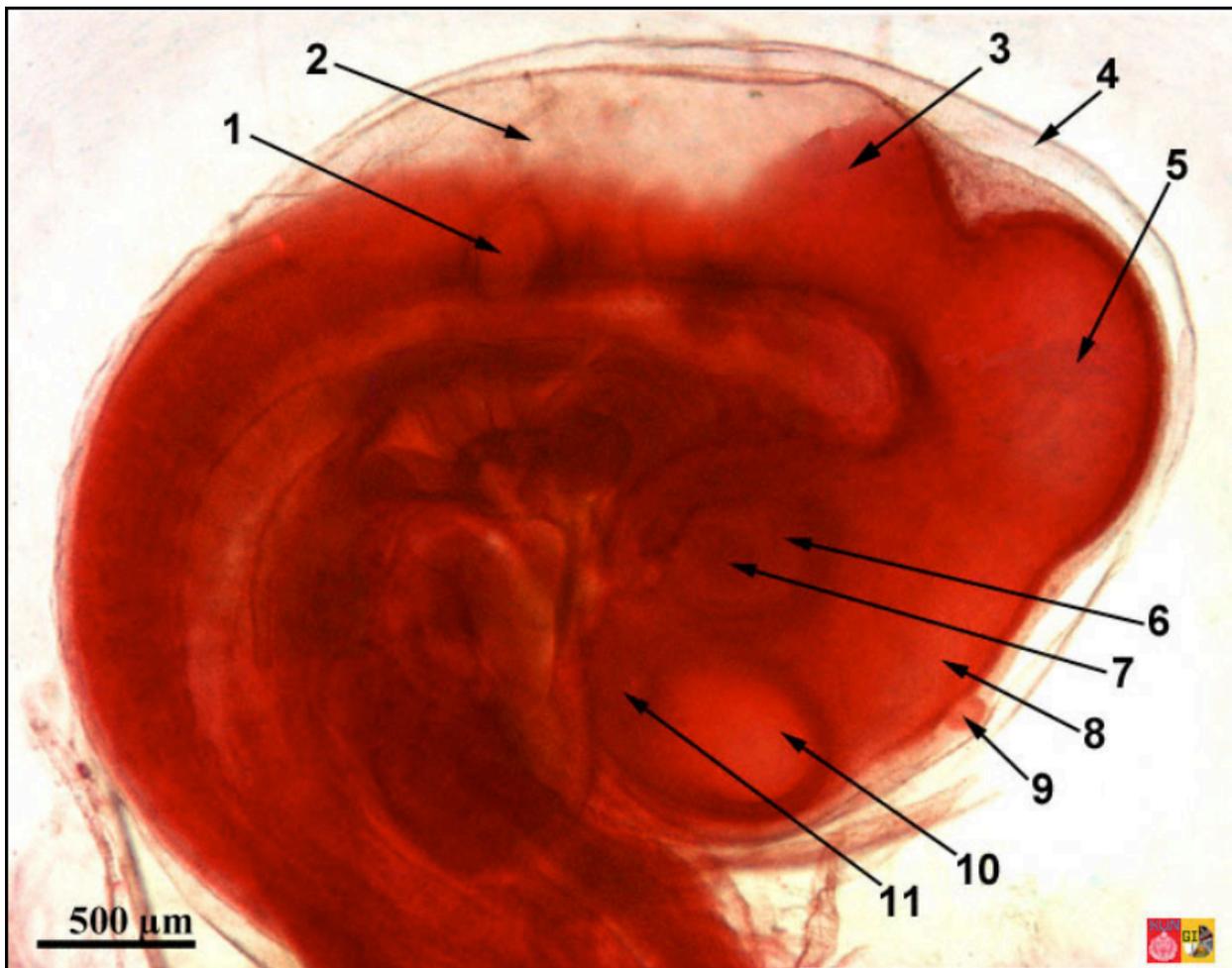
Stage 72 hours

Note: The scale measurement is in microns (500 microns = 0.5 mm).

This is a magnified view of the chick embryo head

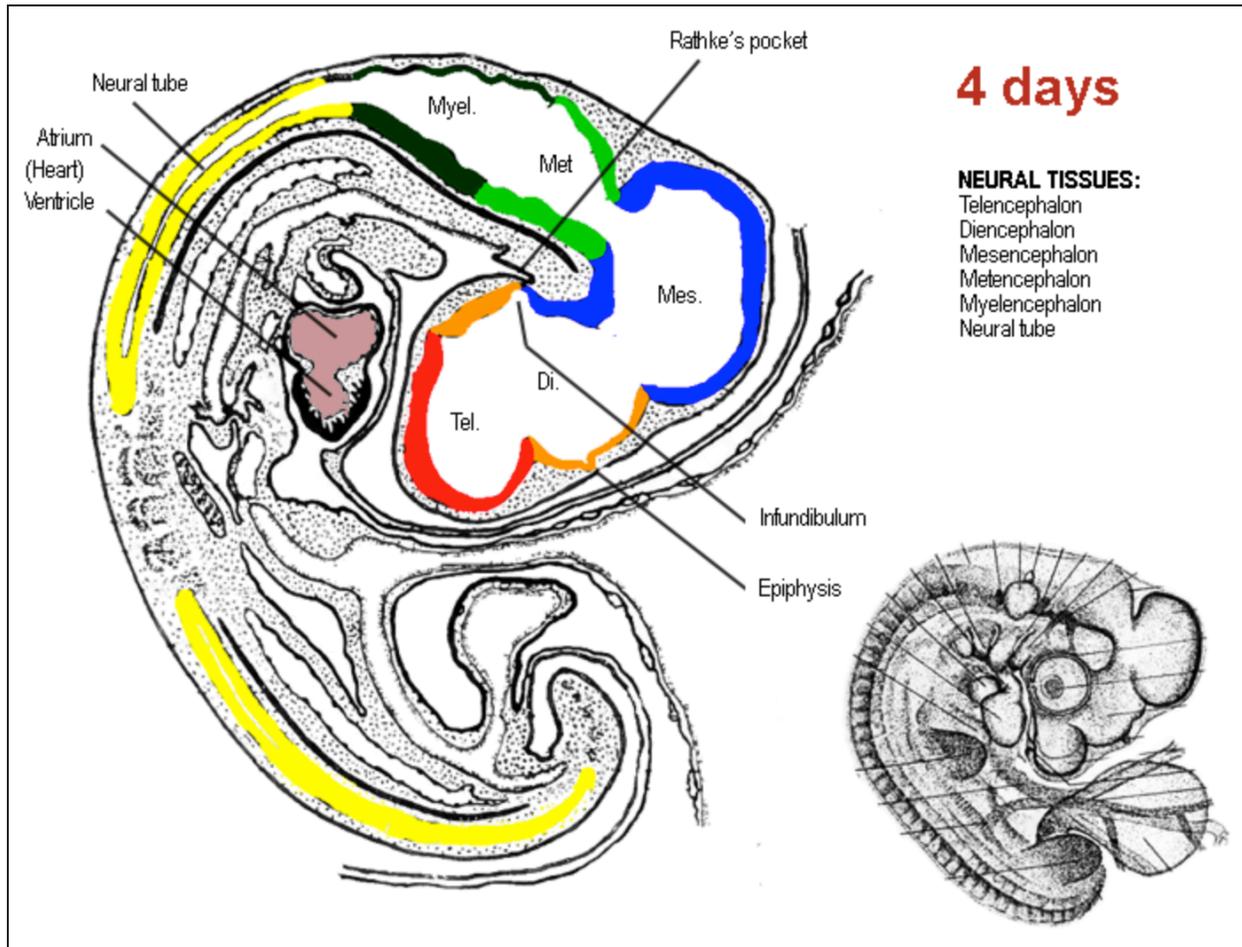
Legend:

1 = Auditive (otic) vesicle, 2 = Myelencephalon, 3 = Metencephalon, 4 = Amnion, 5 = Mesencephalon, 6 = Optic bulb, 7 = Lens, 8 = Diencephalon, 9 = Epiphyse, 10 = Telencephalon, 11 = Olfactory groove

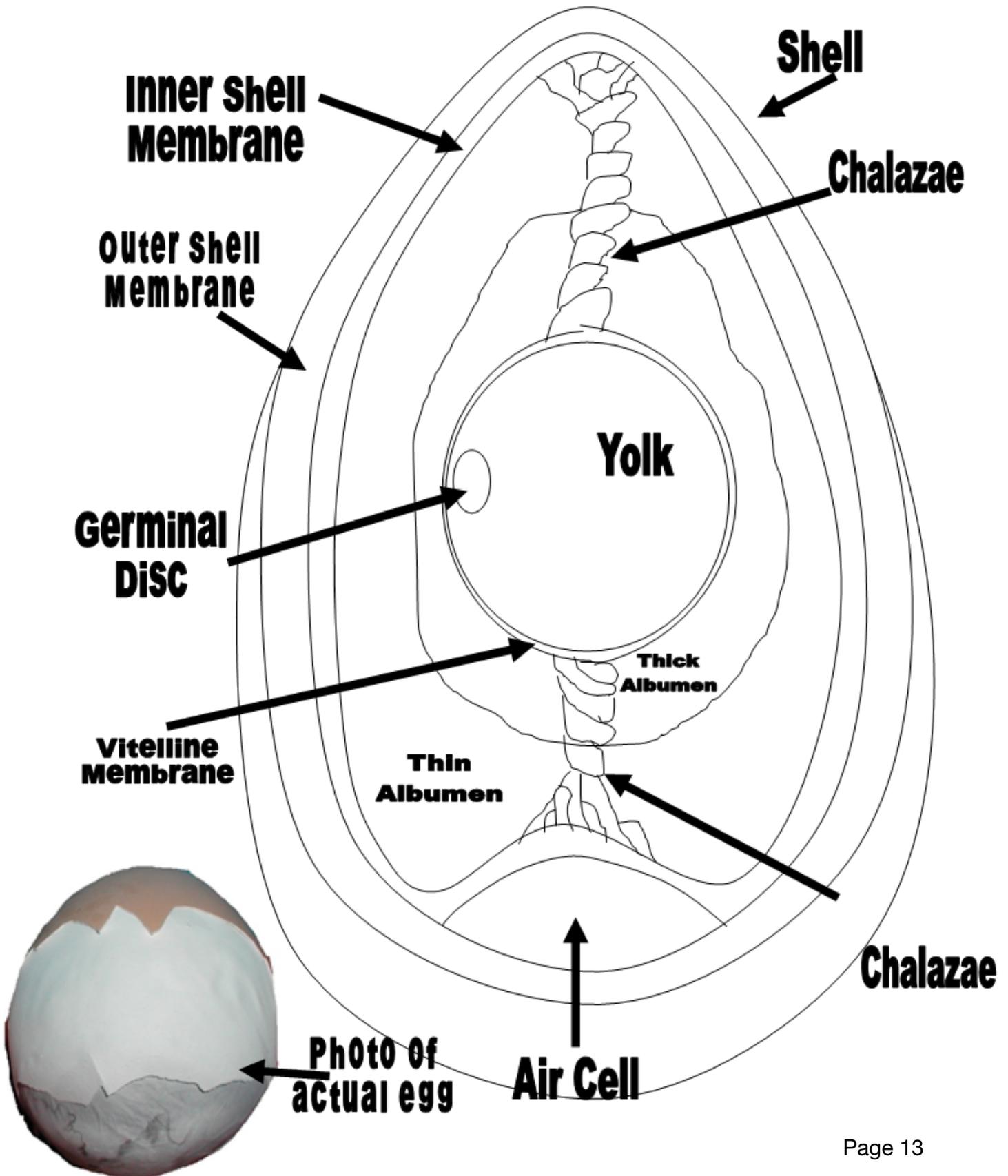


Stage 72 hours

This is a drawing of the previous page wholemout picture showing the brain & nerve tissues (neural tissues). It also shows the heart with an atrium & ventricle (the chicken heart has two atriums & two ventricles).



Basic Egg Anatomy



IMPORTANT EVENTS IN EMBRYONIC DEVELOPMENT

(From A. L. Romanoff - Cornell Rural School Leaflet, September 1939.)

BEFORE EGG LAYING

Fertilization

Division and growth of living cells

Segregation of cells into groups of special function

BETWEEN LAYING AND INCUBATION

No growth; stage of inactive embryonic life

DURING INCUBATION

FIRST DAY:

16 hours - First sign of resemblance to a chick embryo

18 hours - Appearance of alimentary tract

20 hours - Appearance of vertebral column

21 hours - Beginning of formation of nervous system

22 hours - Beginning of formation of head

23 hours - Appearance of blood islands - vitelline circulation

24 hours - Beginning of formation of eye

SECOND DAY:

23 hours - Beginning of formation of heart

35 hours - Beginning of formation of ear

42 hours - Heart begins to beat

THIRD DAY:

50 hours - Beginning of formation of amnion

60 hours - Beginning of formation of nose

62 hours - Beginning of formation of legs

64 hours - Beginning of formation of wings

70 hours - Beginning of formation of allantois

FOURTH DAY:

Beginning of formation of tongue

FIFTH DAY:

Beginning of formation of reproductive organs and differentiation of sex

SIXTH DAY:

Beginning of formation of beak and eggtooth

EIGHTH DAY:

Beginning of formation of feathers

TENTH DAY:

Beginning of hardening of beak

THIRTEENTH DAY:

Appearance of scales and claws

FOURTEENTH DAY:

Embryo turns its head toward the blunt end of egg

SIXTEENTH DAY:

Scales, claws, and beak becoming firm and horny

SEVENTEENTH DAY:

Beak turns toward air cell

NINETEENTH DAY:

Yolk sac begins to enter body cavity

TWENTIETH DAY:

Yolk sac completely drawn into body cavity; embryo occupies practically all the space within the egg except the air cell

TWENTY-FIRST DAY:

Hatching of chick

A great video for viewing the development of a chick embryo

<https://www.youtube.com/watch?v=PedajVADLGw>

Chick Embryo Development

						
<p>INFERTILE</p> <ul style="list-style-type: none"> No development. 	<p>DAY 1</p> <ul style="list-style-type: none"> Appearance of tissue development. 	<p>DAY 2</p> <ul style="list-style-type: none"> Tissue development very visible. Appearance of blood vessels. 	<p>DAY 3</p> <ul style="list-style-type: none"> Heart beats. Blood vessels very visible. 	<p>DAY 4</p> <ul style="list-style-type: none"> Eye pigmented. 	<p>DAY 5</p> <ul style="list-style-type: none"> Appearance of elbows and knees. 	<p>DAY 6</p> <ul style="list-style-type: none"> Appearance of beak. Voluntary movements begin.
						
<p>DAY 7</p> <ul style="list-style-type: none"> Comb growth begins. Egg tooth begins to appear. 	<p>DAY 8</p> <ul style="list-style-type: none"> Feather tracts seen. Upper and lower beak equal in length. 	<p>DAY 9</p> <ul style="list-style-type: none"> Embryo starts to look bird-like. Mouth opening appears. 	<p>DAY 10</p> <ul style="list-style-type: none"> Egg tooth prominent. Toe nails. 	<p>DAY 11</p> <ul style="list-style-type: none"> Comb serrated. Tail feathers apparent. 	<p>DAY 12</p> <ul style="list-style-type: none"> Toes fully formed. First few visible feathers. 	<p>DAY 13</p> <ul style="list-style-type: none"> Appearance of scales. Body covered lightly with feathers.
						
<p>DAY 14</p> <ul style="list-style-type: none"> Embryo turns head towards large end of egg. 	<p>DAY 15</p> <ul style="list-style-type: none"> Gut is drawn into abdominal cavity. 	<p>DAY 16</p> <ul style="list-style-type: none"> Feathers cover complete body. Albumen nearly gone. 	<p>DAY 17</p> <ul style="list-style-type: none"> Amniotic fluid decreases. Head is between legs. 	<p>DAY 18</p> <ul style="list-style-type: none"> Growth of embryo nearly complete. Yolk sac is still on outside of embryo. Head is under the right wing 	<p>DAY 19</p> <ul style="list-style-type: none"> Yolk sac draws into body cavity. Amniotic fluid gone. Embryo occupies most of space within egg (not in the air cell). 	<p>DAY 20</p> <ul style="list-style-type: none"> Yolk sac drawn completely into body. Embryo becomes a chick (breathing in air cell). Internal and external pip.