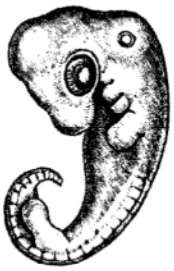
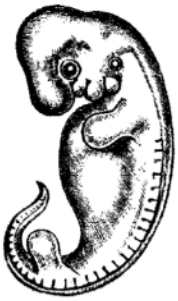
LT: I can use stages of embryonic development in order to defend which organisms are of common descent. 4.4.1

Timing Is Everything Can you tell a chicken from a fish? How about a human from a pig? Sure you can, you say. Chickens have wings, fish have fins, humans have arms, and pigs have hoofs. But what about when they are just starting to form? The drawings below represent three developmental stages of five different animals. They have been all mixed up— see if you can tell what's what.

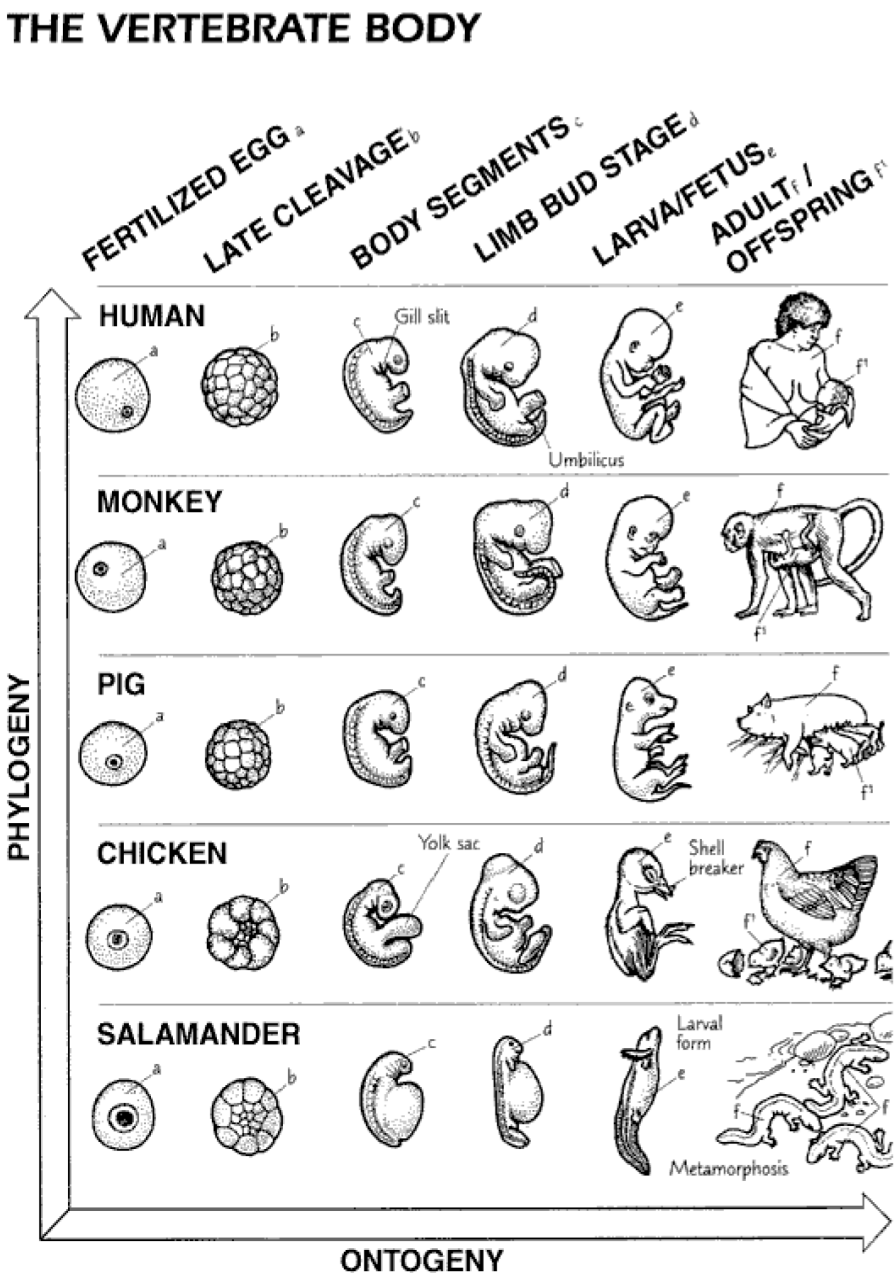
1. Cut out the squares with illustrations of embryos below and see if you can correctly match the embryos with the animals, placing them in order from earliest to latest stages of development.
2. When you are done, write an explanation of why you ordered the drawings the way you did.
3. Analyze and describe trends:
   a. At what stage do all of the embryos look very similar?
   b. What structures do all of the early embryos have? Why?
   c. Which organisms have similar embryos? Why might that be?

	fish	chick	pig	calf	human
stage 1	 9	 4	 7	 10	 13
stage 2	 2	 14	 8	 11	 5
stage 3	 3	 6	 1	 12	 15

COMPARATIVE EMBRYOLOGY: THE VERTEBRATE BODY

Even before Darwin proposed the theory of evolution through natural selection, Ernst von Baer claimed that the more closely related any two species are, the more similar their development. When Darwin brought together the diverse lines of evidence to demonstrate that new species arose from previous species, he included the findings from studies on embryos. Von Baer, who discovered the mammalian egg as part of his detailed studies on animal development, observed that vertebrate animals, during the early stages of their embryological development, seem to have a common design, whereas the adult forms show difference. Arm buds from different species, for example, are virtually indistinguishable when they first form on the embryo, yet they may develop into a wing, an arm, or a flipper. In the early stages of growth when vital organs originate, the developmental sequences, or ontogeny, of all vertebrates are very similar. As the fertilized egg transforms into an adult, the general vertebrate plan is modified during growth as each species acquires its adult species pattern

Note the similarities of body shapes among the five species in the early developmental stages on the image below:



The late fetal/newborn/adult stages reflect the emergence of species-specific body plans as a result of differential growth.

Directions: Use the diagram on the previous page and your understanding of science to complete the blanks below:

For example,
#s 1 – 3 are referring to the letter a on the previous page (page 2).
#1 is referring to letter a on the previous page (page 2), which shows a fertilized egg, also known as a zy___.
#2 is referring to the letter a on the previous page (page 2).
The sentence reads "they differ slightly in the size of the cell _____."
Look at the fertilized egg cell for each organism. What about each cell is different in size?

The fertilized eggs (a), or ____1____, are very similar, though they differ slightly in the size of the cell ____2____. The orderly division of the single-celled zygote into a multi-celled blastocyst is referred to as ____3____.

By the late cleavage stage (b), the embryos look very ____4____ and differ only in their cleavage patterns, which vary due to the presence of differing amounts of yolk in the egg.

As the body segments form (c), all three mammals remain almost ____5____. Notice the ancestral gill slits, which in the mammals will later develop into parts of the ____6____ and pharynx. The mammals possess an ____7____ that leads to the placenta. In contrast, the salamander and the chicken are nourished by ____8____.

The early forelimbs begin as buds (d).

By the late fetal stage (e), limbs take on their adult shapes.

The striking similarities in the late fetal stage between ____9____and human reflect their close phylogenetic relationship. The main difference lies in the absence of a ____10____in the human fetus. (If an ape fetus were substituted for this monkey, it too would lack a tail).

The chicken has developed its specialized ____11____.

The salamander has just hatched into its larval stage (e). It spends the first part of its life in the water, taking in life-giving oxygen through its feathery gill slits and using its limbs as paddles. Later, the salamander undergoes metamorphosis and acquires its adult form with terrestrial limbs and ____12____ for breathing air. Only then, as an adult, can it leave the water to live, but not reproduce, on dry land.

The newborn of each species receives quite different treatment.
The salamander ____13____.
The hen ____14____.
After gestation times of four (pig), six (monkey), and nine months (human), newborn mammals ____15____.

Early developmental sequences of all vertebrates are similar due to common ancestry. All vertebrate embryos follow a common developmental plan due to having a set of genes that gives the same instructions for development. As each organism grows, it diverges according to its species way of life. Human embryonic development is similar to that of other vertebrates, more like that of other mammals than nonmammals, and most similar to that of other primates. From the study of ontogeny, we discover clues about the transformation of species through evolutionary change.

Finding Patterns to Revise Cladogram

Comparative Embryology	
What did you learn about embryos and embryonic development across different species?	*How will this help you revise your cladogram?*