

A LITTLE CHICKEN BACKGROUND

Kingdom	Animalia
Phylum	Chordata
Class	Aves
Order	Galliformes (pheasant)
Family	Phasianidae
Genus	Phasianus
Species	colchicus

CHICKEN AND THE EGG

As early as 1000 BC domestic fowl were common in India. They were probably derived from the wild fowl of the Indian bamboo jungles. Artificial breeding (selection) has produced many breeds of chickens with different genetic traits.

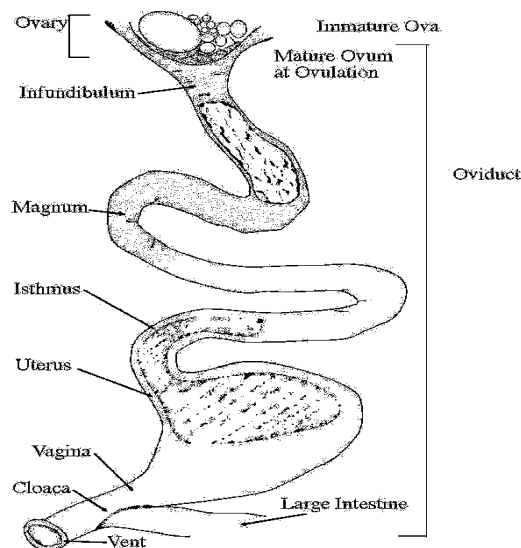
EGG FORMATION

Chickens mature quickly. Under good conditions a hen will begin to lay eggs soon after her 21st week.

How are chicken eggs as we know them produced? From the consumer's (eater's) standpoint, the egg is conveniently pre-packaged food but... **biologically, the egg is a method of reproducing the chicken.**

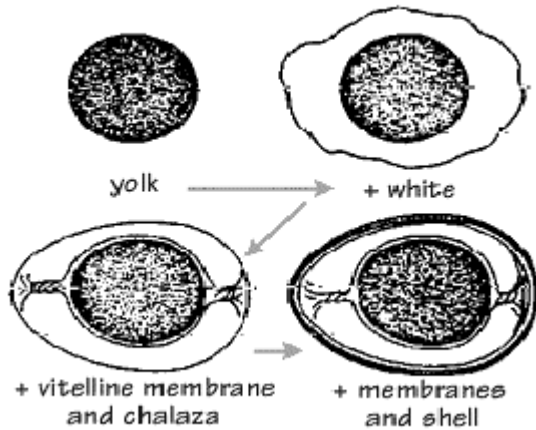
The egg passes through an assembly line beginning in the **OVARY** of the hen, where the **EGG** or **OVUM** with yolk matures. Upon maturation, the egg erupts from the ovary (ovulation) and is carried toward the funnel-like opening of the oviduct (Infundibulum) by lashing cilia. **OVULATION** is stimulated by the release of pituitary hormones.

Sometimes you will see abnormal eggs (double yolks) which occur when the ovary simultaneously forms two yolks at the same time – possibly hormone related.

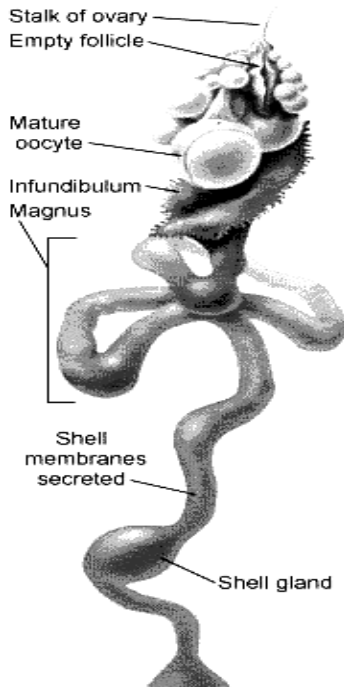
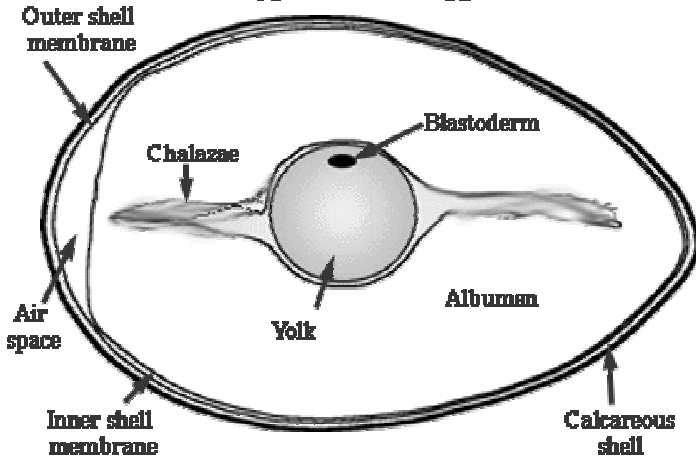


Upon release, the egg (oocyte) is usually grasped by the **INFUNDIBULUM** and moves into the left oviduct (right oviduct is vestigial) where the final stages of egg formation occurs. Fertilization of the hen's egg cell(s) occurs soon after the egg enters the funnel of the oviduct. The yolk and egg cell nucleus (blastoderm) is enclosed in a delicate membrane holding the yolk together, called the **VITELLINE MEMBRANE**. The upper part of the oviduct contains the **ALBUMEN GLANDS** (Magnum.) If fertilization of the cell has occurred, early embryo development begins actually before the egg is laid.

Formation of Egg in Hen's Oviduct



Typical Avian Egg



As the egg (yolk) travels through the oviduct's albumen glands (the **magnum**), it rotates, wrapping the dense thick stringy albumen and the thin liquid albumin around it. This rotation of the yolk gives rise to the **CHALAZA** in the spiral folds of the oviduct. The two chalaza are twisted in the opposite directions. Keep in mind that the albumen is composed chiefly of **proteins** and **water**, whereas the **YOLK** is composed chiefly of **HIGHLY NUTRITIOUS FOOD** for any developing embryo.

Next in the egg assembly line are the **MEMBRANE GLANDS (Isthmus)** where the **INNER EGG MEMBRANE (chorion)** encloses the yolk and albumen into a neat package.

The **OUTER SHELL MEMBRANE** is next to the shell. These two membranes are in close contact (cobweb-like fibers) with each other, except for an **AIR SPACE** at one end, which separates them. The chick's beak is thrust into this air space during later development. Often the chick can be heard to peep in this space before hatching.

The lower or posterior end of the **oviduct (Uterus)** contains the **LIME PRODUCING GLANDS** where the porous (perforated) **EGGSHELL** is produced. **WATER** and **SALTS** enter the porous shell membrane by diffusion, increasing its size. The eggshell completes the complete package of the egg. Under the power of the binocular microscope a person can see the small pores that open this shell to **RESPIRATION** (O₂ and CO₂ exchange) by the inner egg. If the egg's embryo is to survive, **OXYGEN** must pass in and **CARBON DIOXIDE** inside must pass out through the shell.

The **SHELL**, made of calcite is a crystalline form of **CALCIUM CARBONATE**. **GRIT** (small rock that the chicken swallows) is important to the bird for digestion (**gizzard**) and to provide calcium for skeleton and eggshell formation. Thin-shelled and cracking eggs are due to inadequate amounts of calcium.

The egg then passes through the **CLOACA** (urine and feces storage area) in the process of laying... the egg assembly line is complete. The egg developing process requires approximately 22 hours. Chickens will lay eggs only during the daytime hours – usually in the afternoon. Healthy genetically developed egg laying hens can lay one egg a day under excellent conditions.

A question often asked is:

Are some eggs that you eat fertilized and contain developing embryos?

The answer is yes!

Chicken eggs are incubated at the approximate temperature of 39°C or 103°F for 21 days to form a new baby chick.

DESIGNING YOUR OWN INVESTIGATION

You have been exposed to the written format in conducting previous investigations. These previous opportunities are important to use for many of life's problems. Now if you are presented with a specific biological problem or have one in mind, can you try to solve it? You are to design an investigation that will show a deeper understanding of chick development.

Remember, "Not to try is like not believing in yourself. I see a failure when you don't try. Success comes with efforts that help you find and develop yourself."

In this investigation, it is expected that you:

1. Design and carry out your own procedure for a specific experiment
2. Analyze your experimental data to draw meaningful conclusions

REQUIREMENTS FOR GRADE:

- I. Design an investigation to solve one of the following problems or a problem of your own design. Samples will be discussed in class.
 - A. Before actually performing your investigation, submit an outline of your experimental procedure. The outline should include:
 1. The problem to be studied with a hypothesis
 2. The materials needed
 3. The controls to be used
 - B. The time schedule will be the variable as we will continue to work on other topics at the same time, but you should have a daily observational chart or form for every day that we do work with the chicks
 1. Types of data charts or graphs to be used
 2. Your method of reporting your conclusion (speech, paper, video, etc.)
- II. Prepare an experiment that is simple, easy to observe and easy to record data.
 - A. The more complicated your experiment, the larger the number of possible unplanned variables!
 - B. Test one item at a time.
 - C. Repeat the trials or choices and limit the time the chick has for each trial. The time limit should be from 15 seconds to one minute.
 - D. Record positive and negative results for each trial.
 - E. These observations are easily graphed, but **remember** also make daily observational comments for your experiment.
- III. Prepare a lab report of your results and your conclusion after performing your investigation. Include all items listed in your outline.

PURPOSE:

I. An experiment is set up to gather data to test a guiding idea(s) or hypothesis(es). State your guiding hypothesis(es).

If _____
(variable factor that influences your chick)

then _____

expected results _____
(consequence of the variable)

Data collected might or might not support your results. It should be produced by your experimental variable. It is what you are looking for to test the variable factor.

II. **Controls** are set up in any experiment as an unchanging part or as a basis of comparison. If you are designing a behavior experiment, other chicks in your class not going through the same training regimen as you and your chick may be used as a comparison control

III. **Variables:** are the parts of the experiment that you actually test for or changes that occur in your experimental design. (i.e.: you may have picked too difficult a task for your chicken.) Some variables we expect, others develop due to technique or variation that can be critical. When we study our data, new variables can appear. These should be analyzed or set up for future testing. This is the beauty of experimentation – it's not a straight-line affair but also a method to unfold new questions of a more exact nature.

- IV. A few variables can appear in this experiment as we proceed:
- A. Weight changes due to food and water in crop and digestive tract of chick due to various times and amounts of eating. Crop can be full one day and nearly empty the next.
 - B. Weight change due to defecation with exercise and/or activities outside of cage.
 - C. Individual chick health and growth potential. Growth spurts can occur.
 - D. Variables in measurements taken by individual experimenters when using ruler, scale, and other tools give errors in technique.
 - E. Death of a chick.
 - F. Technique used to average out variations.

The method to overcome this hazard is taking as large a sample as possible and the _____ of every one's data into an all class average.

MATERIALS:

You can be as creative as you wish on your materials. Chick food will be provided. Excellent training incentives include mealworms that can be that obtained at your local pet store.

DATA COLLECTION:

- I. Growth will be measured not only by the comb index but also by weighing (massing) the chick and recording the data daily for just your chick.
 - A. Record also on a class record sheet so we can obtain all class averages.
 - B. The millimeter will be used for length. The 'mm' means you have a _____ part of _____ meter.
 - C. The comb index it obtained from L*W*H measurements by multiplying them to obtain a mm³, which means _____ mm a measurement of volume.
 - D. The mass will be in _____; the metric unit for mass.

- II. Tables and graphs
 - A. The data from your chick experiment requires an organization of your data.
 - B. Fully label each graph's axes with units and titles that describe **completely** the subject of your "picture" of the data.
 - C. Record your behavioral observations.

OBSERVATIONS:

DISCUSSION

Observations really grow with your knowledge and experiences. These can be of a planned nature or casual and unexpected. When we look for patterns previously observed or information from our reading we can organize and direct our sense to be on the alert for a "signal" or expected pattern. With these as a basis we are more alert to differences or deviations to our expected observations. In short, "knowing what to look for" summarizes observations.

We have been introduced to the value of taxonomy. It is useful to describe our organism. Let's take our chick as an example: It is found as a land bird with legs not unusually long nor with the webbed feet of a duck. Its bill is not curved or hooked as in birds or prey or parrots, but the bill is short and stout. The wings are not long either. Its habit of scratching is most revealing to its grouping among birds. Notice the hind toe is short and elevated above the other three toes. Therefore, the name of scratchers of Gallinaceous is give to this Order Galliformes.

The chick belongs in the Class Aves because it describes an organism with _____. It belongs in the Subphylum Vertebrata because it has a _____: In the Phylum Chordata because of its _____: and a part of the Kingdom _____ because _____

A little observation of you chick's feathers will reveal areas that are bare and sporting no feathers. Your young chick will be covered with downy feathers that give the chick its soft feel and its mellow yellow color. Look for pigmented feathers and

watch the development of feathers in coloration and complexity. Remove and mount a down feather for a drawing based on your observation with microscopic study of structure.

Your chick's behavior and your behavioral view of a chick's behavior may not be as interesting as the complex ways in which we communicate with each other. Consider how you react to stimuli such as laughing, weeping, the clenched fist, the open and extended hand, a raised eyebrow or scratched head. It is interesting to note during tests, how pencils are chewed, heads are scratched and "travelling eyeballs" search for answers. How odors become important in the nets laid for "gentle men" by "gentle women" or how that casual lock of his hair is placed; when a bell rings as we prepare for our escape into the "hall of life." For some reason unknown to civilized men, we often disguise our feelings with words, our skin with cosmetics, and our personal odor with perfume.

Charles Darwin understood this importance of nonverbal communication in man and realized that it comes from a very ancient heritage. You are surrounded daily in this sphere and base your opinions of others or teachers upon a shallow viewpoint of behavior. We build walls between ourselves and abuse each other with behavior. Sometimes we as teachers and you as students lack the patience nor do we allow time to evaluate our judgements. We choose our friends and goals on behavior of fellow students to oppose the "old guard." Then as we mature – not just grow up – we look back and wonder why we resented a behavioral connection.

Let's take one more example: Eibb-Eibasteldt has drawn attention to a small and very rapid up and down movement of the eyebrows – the eyebrow flash – that he has observed in many human cultures as well as monkeys. The eyebrow flashes seem to occur at the moment of friendly greetings and say "yes" to the social contact or "I recognize and attend to you," or may be a sign of flirtatious interest. Ah, you girls (and boys) are revealed again! If as, Eibb-Eibesfeldt says, the eyebrow flash is so universally used and "understood" in primate species. It is a most curious and significant fact that has escaped our conscious notice, even though we must make and receive the signal several times each day and are most let down if we are greeted by a deadpan stone or steadily raised eyebrows.

Now this exercise is designed to show behavioral actions of young chicks...

The following exercises are designed to show behavioral actions of young chicks. The first behavior observed could be vocalization. You will try to determine what outside influences cause different calls. Next, you could compare the behavioral development due to different chemical concentrations and applications.

I. VOCALIZATION BEHAVIOR

- A. Try to identify the different calls that the chicks produce.
- B. Two major classes – so called “pleasure calls” and “distress calls.” Crowing will be noted at a later date.
- C. Observe and record birds under these different conditions:
 - 1. Food – Chicken Dinners – test with and without, in the presence of other chicks and alone, and with and without tapping or “pecking” at the food.
 - 2. Cleanliness – chicken style – preening, act of trimming, dressing or cleaning feathers with beak.
 - 3. Chicken nerves – expose chicks to sounds of different types:
 - a. tapping glass rod on glass plate – rhythm of clucking hen
 - b. alarm sounds as might be formed in presence of a predator
 - c. associate the “pleasure calls” and “distress calls” with the sounds produced

III. Super Chicken – compare a hormone-treated with a control chick. Compare the following traits:

- A. Posture – do by sketches or drawings
- B. Facial appearances, especially around the eyes
- C. Manner of walking
- D. Crowing patterns
- E. Compare frequency and form in other patterns, such as parcking, lapping, stretching, yawning, etc.
- F. Temperature, respiration, or heartbeat
- G. Are any pre-existing behavioral patterns exaggerated, or have any been lost?

IV. Chick-on-the-go

- a. Count the frequency of the various types of posturing, pecking, etc.
- b. Try to distinguish pecking actions that are suggestive of giving from those that are clearly non-aggressive.

V. Pecking behavior for color. This type of situation that causes pecking will be based on color preferences.

- A. A short stick will be used to set up choices between bright colors of at least four or more different colors.
- B. We will present a pair of different colors to the chick to see which color is pecked first.

- C. Select chicks that are quick to peck and allow this chick around twenty chances to peck at the choices. Prepare a chart of color preferences.
- D. Try to record the time the chicks take to decide on a color choice.

VI. T-masses – Investigation 15.2 pages 554-555 Green Version BSCS

VII. Yerkes Alley

- A. A Yerkes Alley is a very simple apparatus to make.
- B. You will need a small cardboard box with no top.
 - 1. Divide the inside of the box in half with a partition.
 - 2. This partition can be inserted in place with masking tape.
- C. When using the Yerkes Alley, the chick is placed in the box at a point where he must choose to go either to the left or the right of this partition.
 - 1. Usually, some type of reward or penalty is placed at the ends of the two walk lanes.
 - 2. Your system of rewards or penalties will, of course, be determined by what you are trying to learn about chick behavior.
 - 3. Some students favored this device to test the learning abilities of chicks (and many other animals) in response to colors, food, light, temperatures, or sounds.

VIII. Imprinting – follow the leader pecking order.

In the past forty years, several biologists have experimented with a very interesting kind of animal behavior that they decided to call “imprinting.” These biologists observed that newly hatched chickens, ducks, and geese would become very closely attached to the first moving object that they saw in their surroundings. Because these animals normally hatched in a nest from eggs which the hen was incubating, the hen was the object to which they became attached (or imprinted) most often. Once the imprinting attachment occurred, the young ones would follow their mother wherever she went. From further observations and experiments, it has been learned that these sounds made by the hen are as important in forming this attachment as her appearance or movement. The clucks, quacks, honks, or squawks, which the hens make, seem to serve as reinforcement and assurance to the young ones. They also help the young to locate and focus attention on the hen.

Almost by accident, a man named Dr. Konrad Lorenz of Austria discovered that geese could become imprinted to human beings. He had hatched a batch of goose eggs in an incubator. After the goslings hatched, the first moving object they saw was Dr. Lorenz. From that time on they followed him wherever he went. He thought they would follow the mother goose if he put them near her. But, much to his surprise, they followed him when he walked away, even though they had the opportunity to follow their own mother.

If you are interested in trying to imprint a chick, here are some procedures other students and teachers have used with success.

- A. You must start with a chick that is able to stand and walk.
- B. A good time for imprinting is when the chick is 10-16 hours old.
- C. It will work best if your chick has been isolated since hatching and has not had any previous contact with other animals or moving objects.

- D. Put your chick on the floor (not a smooth or slippery one) and cuddle it in your hands to give it warmth and security.
1. With your hands still around it, start talking to it softly and gently. The actual words are not important; chicks associate with the sound of your voice.
 2. Use a rhythmic call such as “Come, chick, chick, chick,” or “here, chick, chick.” You can decide what you would like to use as a call.
 3. After a few minutes of cuddling and calling, move your cupped hands to a point about six to eight inches away from the chick.
 4. Coax the chick to walk toward your hands by calling to it and moving your hands back and forth in front of it.
 5. When it takes a step or two toward your hands, reward it by cuddling it.
 6. Then sit it down and repeat the same procedure.
 7. Keep moving your hands farther away and increase the distance the chick has to walk in order to be rewarded with cuddling.
 8. Be patient. This part of the training may take anywhere from 5 to 15 minutes.
- E. Once you have trained your chick to come to your hands whenever you move them away, you can go ahead with focusing the chick’s attention on your shoe or pant cuff.
1. Put your chick down by your heel and take one step while continuing to call to it.
 2. Wait until it catches up to you, then take another step.
 3. Gradually speed up your steps making sure your chick can keep up with you.
 4. Eventually your chick will be following you wherever you go as long as you walk at a slow, even pace.

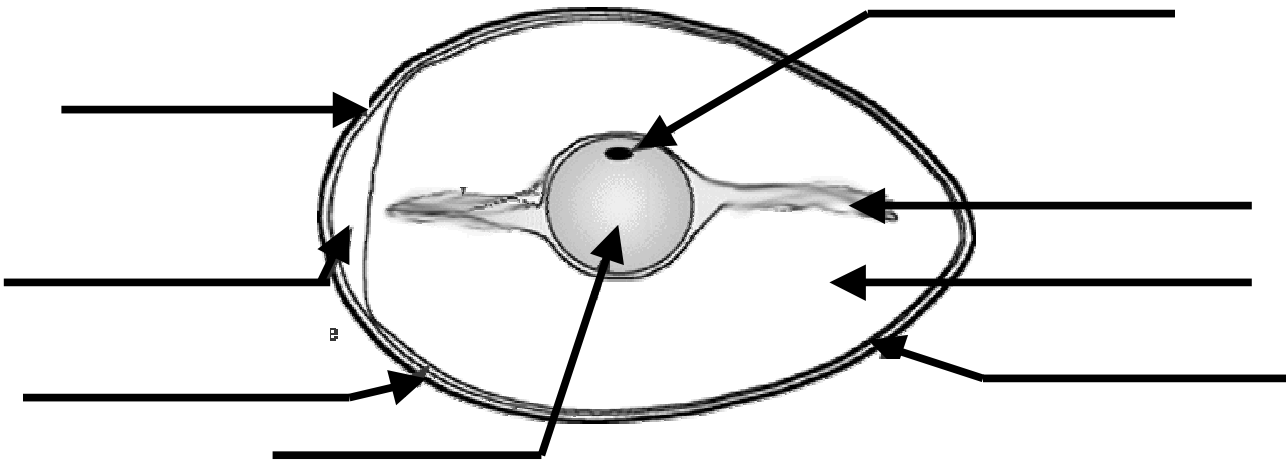
CONCLUSION: A Meaningful Analysis

If you have directed your observation, taken usable notes, and done some reading on your problem, you have obtained a vast store of information. Now your task is to reform it into a discussion that expresses this store of information. Actually you have in your data of numbers, graphs which are pictures of these numbers and short sentences to form a written conclusion.

Start by asking yourself questions like:

- a) Did you support your hypothesis; Remember this guides your observation. How and why; if not, why?
- b) Did the controls work and did the comparisons between variables show any patterns or differences?
- c) Did you find anything new?
- d) Do you have any new questions?
- e) Include a summary of your daily observations and data collected.
- f) Now write thoughts that reflect your learning experience.
- g) Do your best -- no more, no less!

LABEL PARTS INDICATED ON EGG



Some general egg questions brought up by students other than “which came first?”

Answer T (true) or F (false) according to your personal thoughts.

- _____ 1. Brown eggs are more nutritious than white eggs.
- _____ 2. The chicken’s egg is fertilized after the albumen is added.
- _____ 3. Fertilized eggs shouldn’t be eaten.
- _____ 4. Eggs with runny whites are old.
- _____ 5. Fertilized eggs are more nutritious and lower in cholesterol than unfertilized eggs.
- _____ 6. Discolored yolks in hard-boiled eggs are caused by sulfur & iron compounds in the eggs.
- _____ 7. Hatching eggs should not be handled with greasy hands to prevent pore blockage.
- _____ 8. Fresh eggs are difficult to peel when they are hard-boiled.
- _____ 9. Blood spots in eggs indicate spoilage and thus those eggs are unsafe to eat and should be thrown away.
- _____ 10. The sugar added to egg whites in commercial meringue toppings prevents bacteria from growing.
- _____ 11. You can distinguish hard-boiled eggs from uncooked ones by spinning them and watching their action.
- _____ 12. The stringy, white twisted pieces in raw egg whites indicate spoilage.
- _____ 13. Some people (Phillippines) eat developed young chick embryos as a nourishing appetizer.