Lesson Three

Embryology

Subject Area

Science/Language Arts/Math

Objective

- Be able to identify the two ways in which eggs are hatched (incubator and hen)
- Be able to describe incubator conditions needed for a healthy chick to hatch

4-H Life Skills

Learning to Learn, Leading Self and Others, Relating to Self and Others, Communicating with Others

Suggested Grade Level

4–5

Background

Incubators

There are two types of incubators, still-air and forced-draft. The still incubator can incubate eggs in only one layer. It has no fan, and must maintain a temperature of 102°F at the top of the eggs. The forced-draft incubator has a fan, is multi-layer, and the temperature must be maintained at 99.5°F.

Hatching

Eggs are hatched in two different ways—by a broody hen or by an incubator. Today, however, very few chicks for commercial use are hatched by hens. It would be impossible to raise the millions and millions of new chicks needed every year by hatching a few eggs at a time under hens. Instead, professional hatchery-persons and poultry breeders use huge electric incubators that can hatch thousands of eggs at a time.

Egg Tooth

The hard white spot on the tip of the chick's beak. It is used to pip (break or chip) and crack the shell during hatching.

Embryology

A science that deals with the growth and development of an embryo to a chick inside an egg.

Step By Step

Day 3

The body is shaped like a backwards question mark surrounded by blood vessels in the yolk sac. The head and heart begin to form.

Day 4

All the organs (digestive tract, nervous system, etc.) are present.

Day 5

The face and nasal parts begin to take shape.

Day 6

The beak begins to form. The brain is present but without a skull. The eyes have formed, but without eyelids. Leg and wing buds are present. All parts of the chick have now begun to develop.

Day 9

The chick is complete except for feathers and growth.

Day 12

Eyelids now cover the eyes. Hair-like feathers cover the skin. Chicks begin to swallow the albumen as a protein source.

Day 14

The embryo moves itself in the shell so its head is by the air cell at the large end of the egg.

Day l5

The body is covered with down feathers. The egg tooth is formed. The feet now have toenails.

Day 16

The albumen is almost gone—the yolk continues as a food source for the chick.

Day 17

The head is under the right wing and the beak is turned toward the air cell at the large end of the shell. At the end of this day, humidity is increased. The incubator should now be kept closed until the hatched chicks are dried off and ready to be moved.

Day 18

The embryo is almost full-grown and ready to begin the hatching process.

Day 20

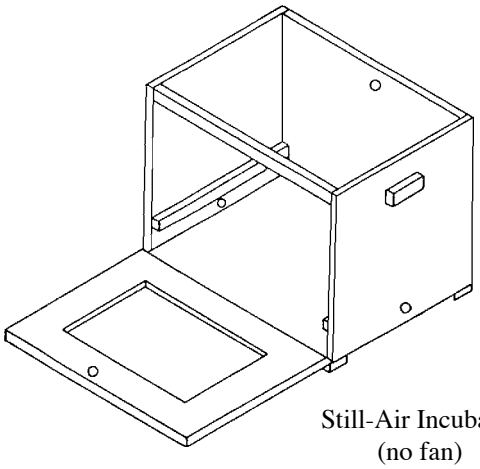
The yolk sac is drawn into the embryo's body; it will need this food for energy during the hatching process and its frst few days of life. The embryo now takes up all the space except the air cell. It will pip the shell membrane with its egg tooth, and fll its lungs with oxygen from the air cell.

Day 21

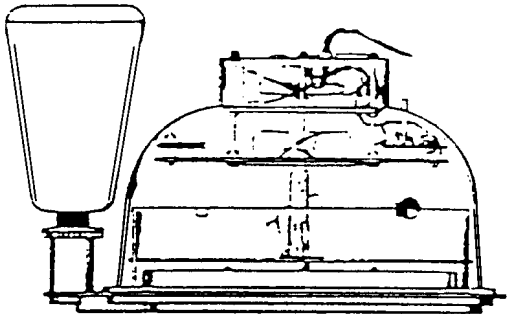
Hatching time! The embryo's normal position before hatching is to have its head under its right wing at the large end of the egg, with its beak pointing at the air cell. The embryo uses its egg tooth to pip (break or chip) almost all the way around the inside of the shell. Then, by kicking, it emerges out of the shell all wet and tired. For a few hours it will need to rest and dry off into a fuffy chick. It needs to be kept in the warm incubator until completely dry.

Temperature

Still-air incubators (no fan) need to be maintained at about 102°F at the top of the eggs. In this type of situation the top of the eggs will be warmer than the bottom of the eggs. Forced-draft incubators (with fan) must be maintained at a temperature of about 99.5°F. The temperature in these incubators is the same throughout. Over-heating will speed up the rate of development, causing abnormal embryos, lower hatchability, or early death.



Still-Air Incubator
(no fan)
Temp: 102°F (top of egg)



Forced-Draft Incubator
(with fan)
Temp: 99–100°F

Humidity

Humidity is important to control the amount of water lost from an incubating egg, and thus for normal embryo development. The relative humidity of air within the incubator for the first 18 days should be about 60 percent. A variation of 5 to 10 percent probably will not hurt. Low humidity causes too much loss of water from the egg, while high humidity does not allow enough water loss. In both cases, hatchability is reduced. A pan of water in the incubator will ensure moisture in the air. The eggs, however, should not come into direct contact with the water.

Turning the Eggs

Turning prevents the embryo from sticking to the shell. Good results can be obtained by turning the eggs the first thing in the morning, again at noon, and the last thing at night. Turn them at least three times a day (preferably five to seven times a day). Always turn the eggs an odd number of times each day so at night the chick will be lying differently than the night before. Also, turn them a different direction each turn. They only need to be turned until the end of the 17th day. After that the embryo can move enough on its own without sticking to the shell.

Ventilation

As the embryo grows, it uses oxygen and gives off carbon dioxide. Thus, efficient ventilation within the incubator is required to assure an adequate supply of oxygen in the air, and to keep the carbon dioxide low.

Resources

PNW 478, *Hatching Small Numbers of Eggs*, Oregon State University Extension Service, reprinted 1995.

Materials

1. Worksheets K, L, and M
2. Transparency C
3. Certificate—"The Egg-ceptional Award"

Procedure

1. Discuss the conditions necessary for proper incubation (found in the background section of the lesson)
   a. temperature
   b. humidity
   c. turning the eggs
   d. ventilation
2. Have students complete worksheet K, then review them together.
3. Discuss the development of the embryo using Transparency C and the background information.
4. Have students make a booklet from Worksheets L.
5. Duplicate and complete certificate "The Egg-ceptional Award" for each student who completes this unit.

Eggstra Activities

- Have students use the information from this list to make a graph. Use the least number of days when an approximation is given.

Bird	Days
Chicken	21
Turkey	28
Duck	28
Muscovy Duck	33–35
Goose	28–35
Guinea	26–28
Pigeon	16–18
Ring-Necked Pheasant	23–25
Bobwhite Quail	24
Japanese Quail	17–18
Chukar Partridge	24
Peafowl	28

• Have students copy and illustrate this poem.

Baby Chick

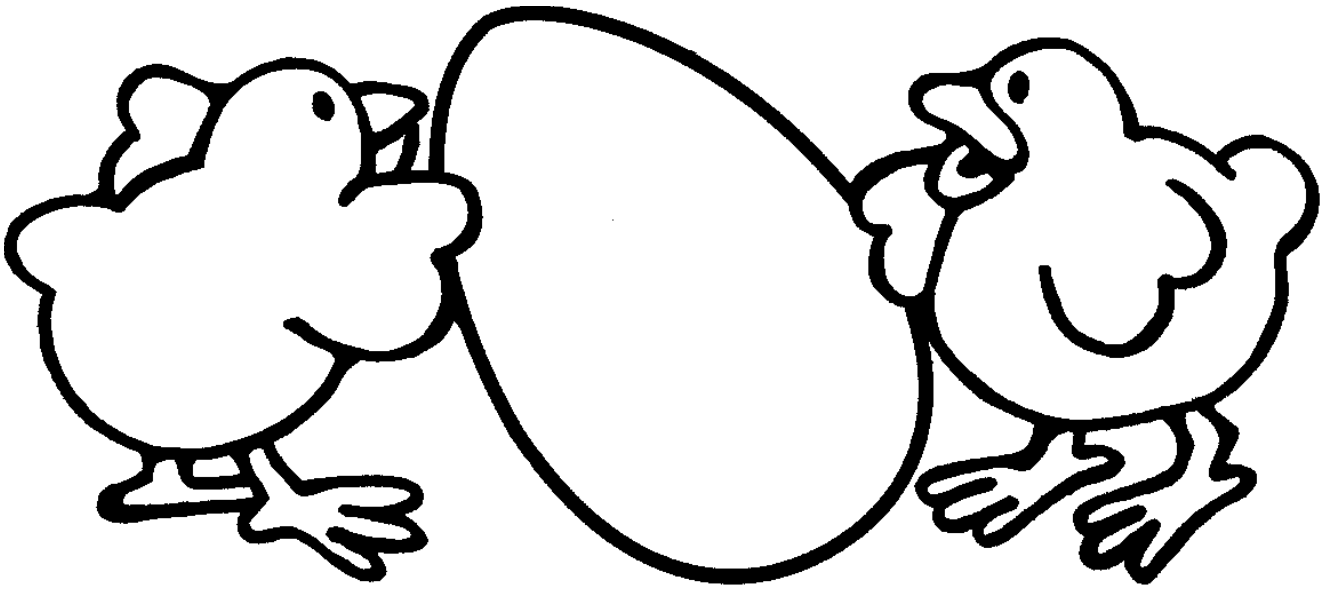
Peck
peck
peck
on the warm brown egg.
OUT comes a neck.
OUT comes a leg.

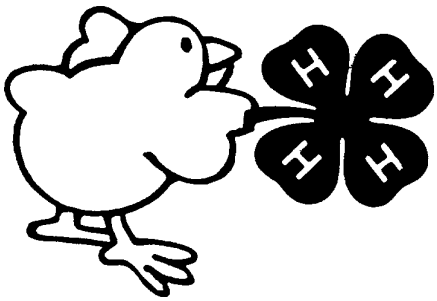
How
does
a chick,
Who's not been about,
discover the trick
of how to get out?

by Aileen Fisher

Taken from: *Widening Circles: Level 8*
Teachers Edition,
Harcourt Brace Jovanovich

• Assign Worksheet M to be completed at home or in groups during class.





Incubation

Name _____

Complete each sentence below by circling the correct answer.

1. A human-made container for hatching eggs is _____ .
   an aquarium an incubator a thermometer

2. Embryology is the study of the development of _____.
   an embryo an insect a reptile

3. It takes _____ days to hatch chicken eggs.
   12 31 21

4. The temperature in the incubator is measured with a _____ .
   ruler thermometer scale

5. Water is kept in the incubator because the eggs need _____ .
   ventilation moisture warmth

6. As the embryo grows is uses _____ and gives off carbon dioxide.
   oxygen humidity moisture

7. Good _____ is important because the embryo needs oxygen.
   ventilation carbon dioxide humidity

8. The eggs should _____ be put directly into the water pan.
   always sometimes never

9. The eggs in the incubator should be turned _____ times a day.
   one two three

10. Turning the eggs prevents the embryo from _____ .

getting too big sticking to the shell sleeping

11. The eggs in the incubator should always be handled _____.

gently roughly with gloves

12. The embryo pips (breaks) open the shell with its _____ .

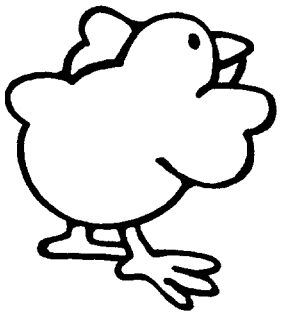
egg tooth feet wings

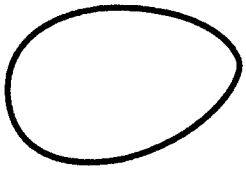
13. After the chick hatches, it will be _____.

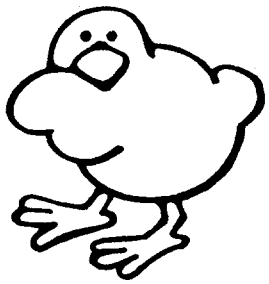
ready to play learning to fy wet and tired

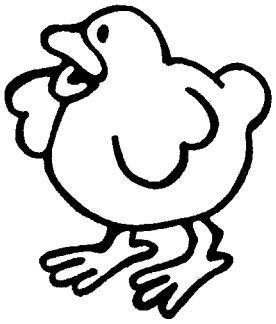
14. The _____is the main source of food for the growing embryo.

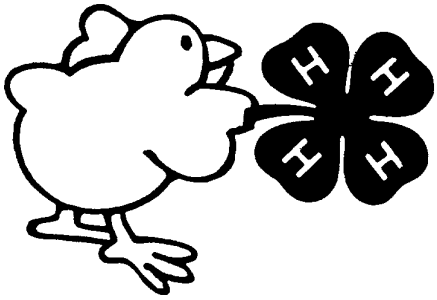
chalazae yolk albumen











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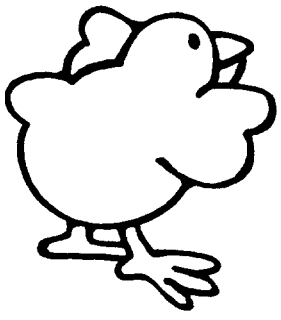
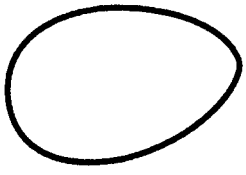
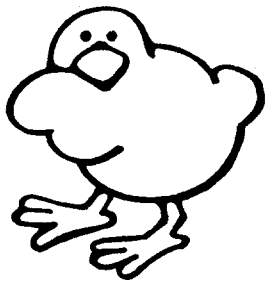
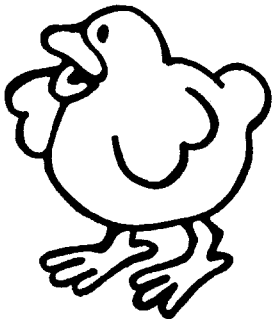




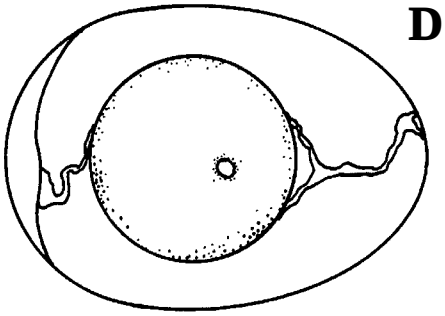




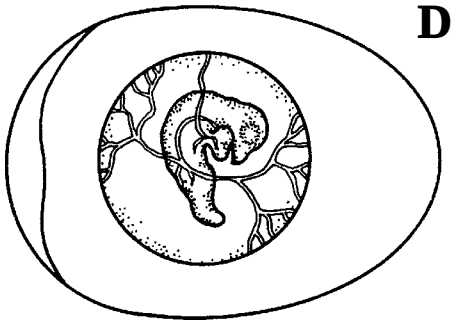
K

The Developing Embryo

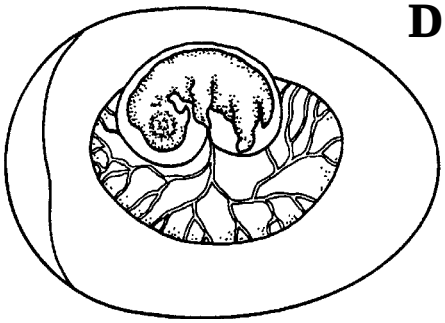
Day 1



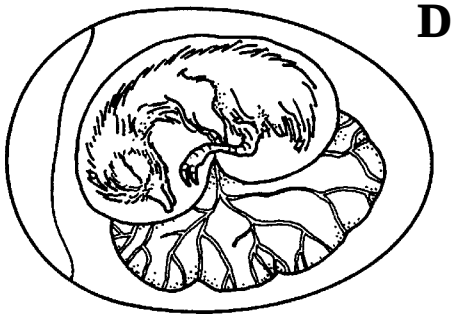
Day 3



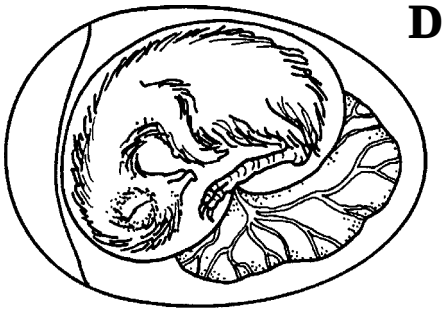
Day 6



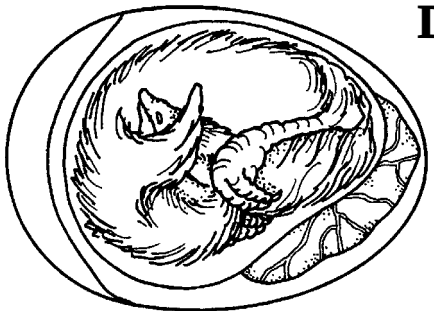
Day 13



Day 16



Day 19

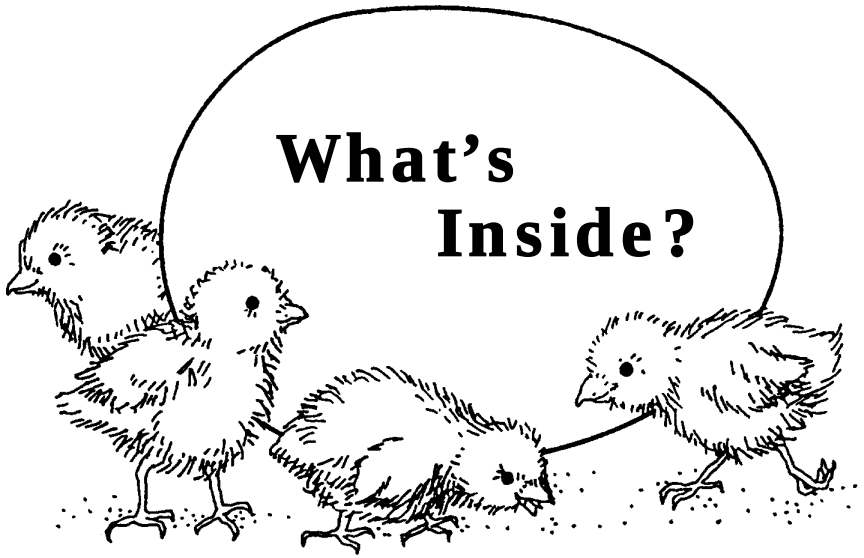


Day 21

Adapted from *Copycat*

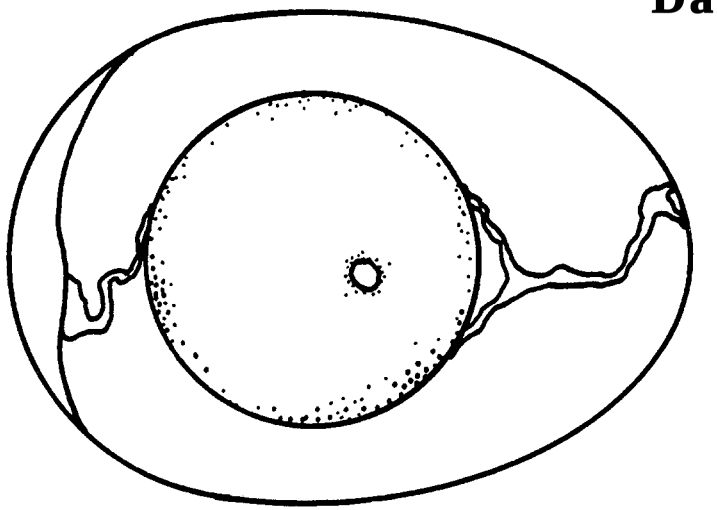
Transparency C

What's Inside?



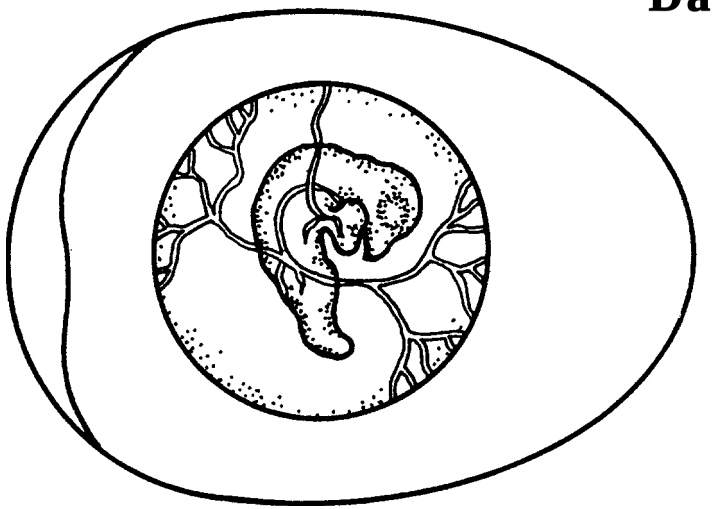
What is inside of this little eggshell?
A new baby chick! This story will tell.

Day 1



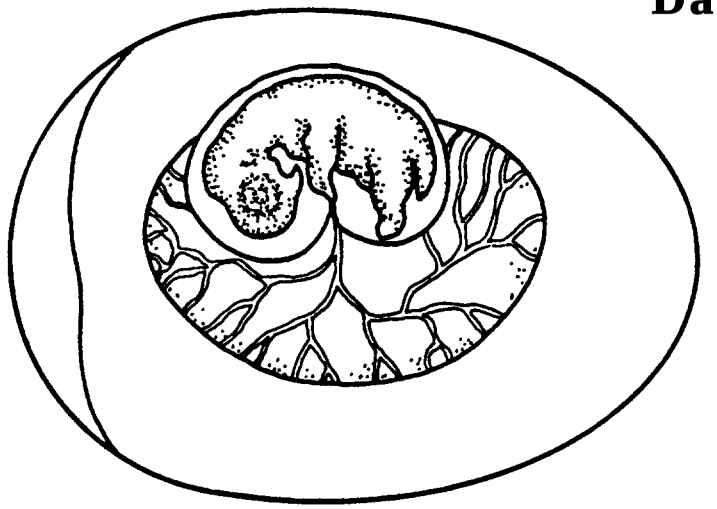
Baby chick, baby chick, when will you hatch?
Did you begin with this little white patch?

Day 3



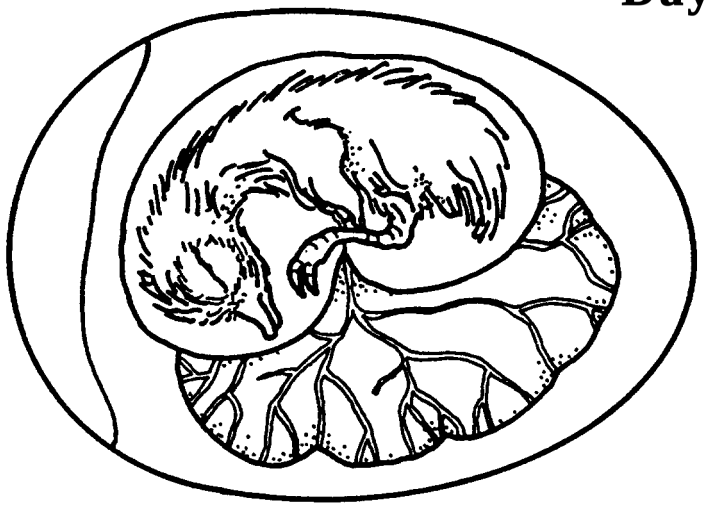
You're very tiny but warm as can be.
Your heart and your head we begin to see.

Day 6



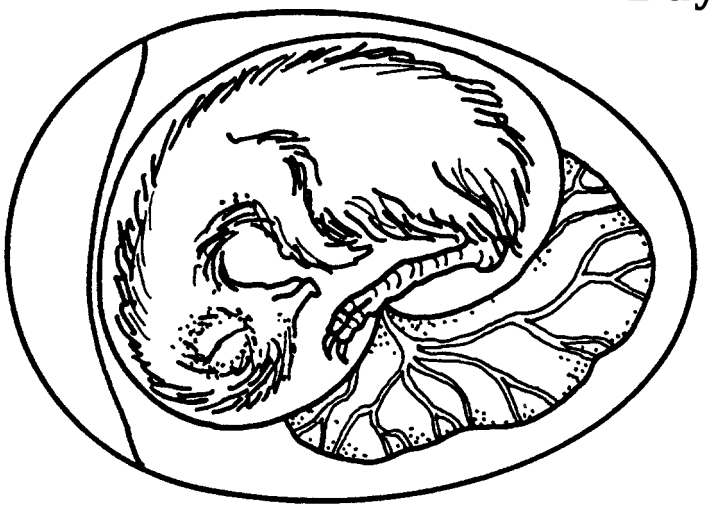
More days for growing, almost a week.
You now have two wings, two legs, and a beak.

Day 13



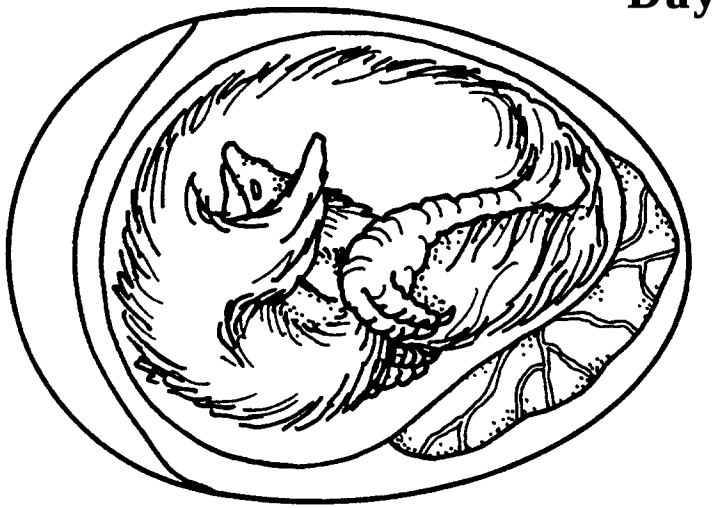
Soon you have feathers, and claws on your toes.
Oh, my, how fast a new baby chick grows!

Day 16



Bigger and bigger you grow every day.
Your food's almost gone. Not long can you stay.

Day 19



This shell is too small. You're too big to fit.
You're just about ready to hatch out of it.

Day 21

Peck for awhile, then take a short sleep.
You work very hard and you're out. Peep! Peep!

The Egg-ceptional Award

Presented To

_____

On This Day

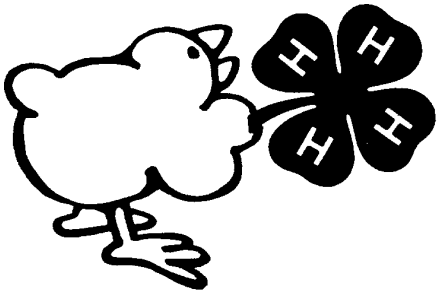
_____

For

_____

Teacher

_____



Egg-U-Bation

Name _____

The incubator allows us to hatch millions and millions of chicks each year. Can you find what makes an incubator work?

(words can be spelled vertically, horizontally, diagonally, backward, and forward)

B G Q E C R T D X V E Y S F W Z
G R W R O T A T I O N H K I A M
J O K U L A B U M J B N V L T O
F U P T H E R M O M E T E R C Y
E P H S R G P C Q I D O N N H T
S W T I U X W D V E C F T Y F I
Z O B O G J P E L U K Z I Y U C
Q R R M V B M G D I E T L A L I
S K W Z A I Z G O W A D A W N R
X V G C T C W S M B N J T X E T
W H U I W M K N T J E S I R S C
A J C D B Q C N E G Y X O X S E
R E T A B X K G X K O J N H B L
M L Q S R Y F J R P Z W F D G E
T N K P R E Q S T U D E N T S J
H A O M Y T I D I M U H C I E Z

Check List

Eggs	Time	Ventilation	Moisture
Thermometer	Rotation	Groupwork	Care
Watchfulness	Electricity	Humidity	Warmth
	Students	Oxygen	

Egg-U-Bation

Name __ANSWER KEY_____

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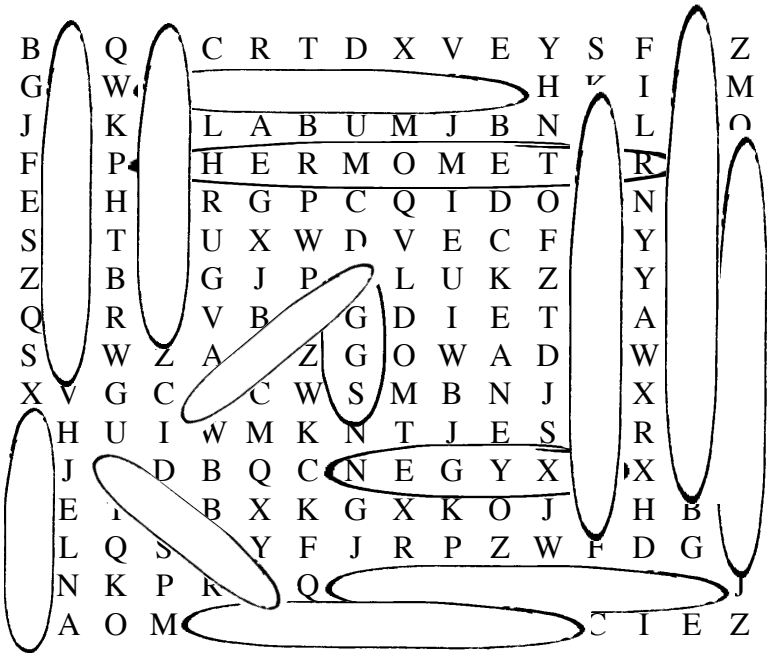

Check List

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