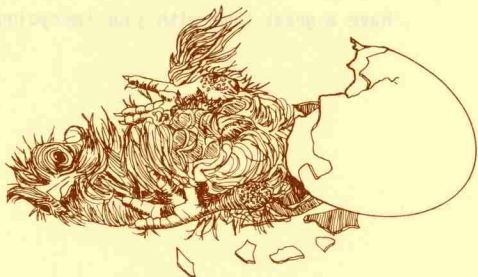
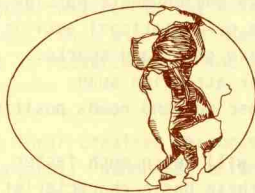
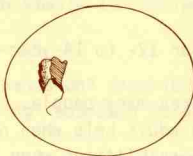
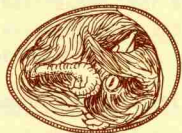
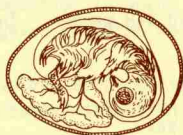


Embryology

4-H Leader's Guide



Dear 4-H Leader:

You are about to begin an exciting adventure with 4-H boys and girls. As a leader of the Embryology Project, you will guide 4-H members in learning experiences found in Embryology I and II.

Embryology I is written for the 9- to 11-year-old 4-H member. This age child:

- is active, has lots of energy.
- enjoys activities with members of his/her own sex.
- has a short attention span and moves from one activity to another quickly.
- needs guidance to accomplish tasks.
- needs clear instructions.
- needs recognition for even the smallest accomplishment.
- is eager to try something new.
- admires older youth.

Embryology II is written for 12- to 14-year-olds. This age child:

- values friendships; admires many people.
- is independent but seeks adult help when needed.
- questions and explores possibilities when learning.
- explores new environments outside the community.
- enjoys some co-educational activities.
- enjoys active games and sports.
- has a longer attention span.
- is self-conscious and needs positive reinforcement.

Your 4-H'ers will learn much faster if you will provide opportunities to learn which meet these basic characteristics. The material in this leader's guide and in the 4-H project manuals will help you.

Have a great time with your Embryology Project members!

INTRODUCTION

Embryology is more than watching chicks hatch. It can expose young people to diverse topics. This project introduces many concepts necessary for the psychological growth and development of the child. Here are some ways embryology can fit into a complete educational experience:

- Embryology can be a means of introducing and explaining the topic of reproduction to young people. If handled correctly, this project will enlighten children more than any lecture on the "birds and the bees."
- Embryology helps children grasp developmental processes and understand progressive stages in growth.
- Embryology teaches respect for and the value of living things. It focuses on processes of life and death. It is a gentle introduction to the cessation of life.
- Embryology teaches responsibility. It stresses caring for another creature. Careful observation and management skills are stressed. It gives children skills with simple lab equipment; reading thermometers and adjusting thermostats.
- Embryology emphasizes a "hands-on" experience with living things. It utilizes the "learn by doing" approach so popular in 4-H projects.
- This project can be used as an introduction to other areas of life sciences. Embryology will introduce children to the life sciences in a way that will spark their interests. This will help them explore careers, not only in poultry, but in research, medicine and other biological pursuits.
- Leaders and members alike can use their creative resources to make their own (unique) supplements to the project: handouts, artwork, games and group activities.

LEADER'S RESPONSIBILITIES

1. Inform eligible boys and girls. Tell about possibilities in embryology to interested 4-H'ers.
2. Obtain an incubator or supervise in the planning and construction of one. Incubators can be borrowed from some county Extension 4-H agents, purchased from a farm supply company or constructed out of a variety of materials. Building instructions are included in the Embryology 4-H Member's Manual, Level II.
3. Procure fertile eggs. Fertile eggs can be obtained through some county Extension 4-H agents, local hatcheries and producers. Be a friend to the poultry industry. Be sure the eggs purchased are Mycoplasma Gallisepticum (MG) and Pullorum clean.
4. Help young people understand the principles of incubation and embryology presented in the Member's Manuals, Levels I and II.
5. Discuss developmental stages. Show visuals such as slides, posters and pictures depicting different stages of the embryo.
6. Dispose of chicks properly.
7. Provide creative materials for children to use. These materials are found in the 4-H Embryology Notebook and include vocabulary lists, word puzzles, word problems and other handouts related to the study of embryology. Use your imagination and create your own materials!
8. Introduce other related projects that emphasize "hands-on" experiences. Let older 4-H'ers teach the younger ones. Allow them to create additional materials for the Embryology Notebook.

INCUBATION INSTRUCTIONS

PREPARE INCUBATOR:

1. One day before eggs arrive, get the incubator ready. This allows adequate time to adjust the thermostat and stabilize the temperature inside the incubator.
2. Clean out the incubator thoroughly with mild soap and water. Dirty eggs may become contaminated and explode.
3. Locate the incubator in a room with a moderate temperature: between 70 and 75 degrees F. Avoid rooms with excessive temperature variations. Keep incubator away from windows. The sun's rays can overheat the incubator and damage the embryos.
4. Adjust thermostat so incubator temperature is held at 101 degrees F (38.3 degrees C). Still-air incubator temperature can range from 99 to 101 degrees F for a successful hatch.
5. Keep a pan of water in the incubator to maintain humidity. Low humidity causes the eggs to dry out and the embryo to stick to the shell. Thus, the chick is not able to hatch. You can use a hygrometer to determine relative humidity inside the incubator. Relative humidity should be between 50 and 60 percent. During the last 3 days of incubation, raise the humidity by lightly sprinkling the eggs with water or adding several wet paper towels.

EGG CARE:

1. Developing embryos, like other living things, require oxygen to live. Be sure the incubator is adequately ventilated. Ventilation holes are normally built into the incubator to provide proper air circulation. Leave these holes open to allow adequate air exchange. It is a good idea to open the incubator each day to let in fresh air. This is normally accomplished during egg turning.
2. Eggs should be turned at least three times a day. Eggs should not be turned in a circle as this ruptures the embryo's protective membranes and causes embryo death. Mark an "X" on one side of the egg and an "O" on the other. Turn the eggs back and forth. Eggs do not need to be turned on Day 1 nor from Day 19 of incubation until hatch.

3. Embryonic death will result if the incubator temperature and/or humidity fluctuates. Be sure to watch these two factors closely. To keep the thermostat properly adjusted, avoid exposing incubator to cold drafts.
REMEMBER: 101 degrees F and 50 to 60 percent relative humidity.
4. Chicks require 10 to 20 hours to hatch after they have pipped the shell. Be patient. Don't try to peel the shell off the chick. You might injure an otherwise healthy creature.

AFTER HATCH:

1. After they dry, remove chicks from the incubator and place in a suitable brooding environment.
2. Remove and discard old shells after chicks hatch. Clean out the incubator with a damp cloth. Use a disinfectant, household bleach or ammonia to clean the incubator. Follow the manufacturer's recommendations or ask your county agent which product to use.

Brooding Instructions for Baby Birds

1. After hatch, allow chicks to dry their down in the incubator for several hours. Keep a few hatched chicks in the incubator because their movement and sounds encourage chicks inside the other eggs to hatch.
2. Chicks should be housed in a warm environment, about 95 degrees F for the first week. As a rule of thumb, you can decrease their brooding temperature by 5 degrees F each following week. You can use a 75-watt (or larger) lightbulb as a heating device. Since baby birds cannot maintain their body temperature alone, it is vital that these temperature requirements be met.
3. Chicks should be housed away from other pets, such as dogs, cats, and small children. Unfortunately, other pets prefer to eat baby birds and small children often harm chicks because they don't understand their delicacy. A large cardboard box is a good temporary brooder.
4. Chicks should be put on straw, litter (i.e. cat litter) or some form of textured paper. Do not use newsprint or shiny magazine paper. Birds slip on these types of paper and permanently damage their legs (spraddle legs). Newspaper can be used if cut into strips. However, litter or straw is preferable.

5. Chicks should have plenty of cool, fresh water available. Water can be provided in a pint-sized waterer or jar lids. Never place water in a deep, open pan. Birds can fall into the pan and drown or become severely chilled.
6. Feed should be available at all times. Small lids or egg flats (not cartons) make good feeders. Chicks should be given a commercial starter diet or, if one is not available locally, you can grind dry dog food in a blender until fine and feed. Newly hatched chicks should receive feed and water 24 hours after hatch.
7. Observe the chicks. If they seem to be shivering and huddling together they are too cold. If they pant and lie around, they are too hot. Success requires constant observation and good management skills.
8. Provide chicks with ample space so they don't overcrowd and trample each other. As a rule of thumb, figure one outstretched hand width per bird as a space requirement for the first week. Of course, as the birds grow they will require more space.

Disposing of Chicks

One consideration before starting the embryology project is the welfare of the chicks after they hatch. A proper means of disposal should be worked out before the project is initiated. Baby chicks, although cute, grow up to be adults who crow, defecate and smell funny. Poultry are not pets like dogs or cats. Therefore, in order to avoid grief and hard feelings, they should not be treated as pets. In fact, there is a North Carolina state law which prohibits selling chicks or rabbits as pets. Make this point clear to the 4-H'ers before the project begins.

Chicks can be disposed of in one of three ways:

1. They can be given to someone who has proper brooding facilities.
2. They can be given to the S.P.C.A. who will dispose of them for a small fee.
3. They can be euthanatized by a number of methods, including oxygen deprivation by ether, carbon tetrachloride, CO₂, or cervical dislocation.

Cervical dislocation is probably the simplest and most inexpensive method. Merely grasp the head in one hand and the body in the other. Pull quickly, thus separating the head from the spine. If done properly, there is no blood and the chick dies instantly.

Some people feel that disposing of birds in this manner is cruel and inhumane. However, a quick and painless death is preferable to suffering caused by starvation, dehydration, exposure or other common mistakes made by inexperienced persons when brooding chicks. Euthanasia means death with dignity. No abuse occurs when birds are disposed of properly.

People who produce poultry as a livelihood, worry about "backyard" flocks. You've probably heard about Avian Influenza (AI), an infectious disease of poultry. Recently, AI caused an epidemic among poultry in Pennsylvania, Virginia, New Jersey and Maryland. Poultry producers are concerned with infectious diseases such as AI. One serious outbreak of AI in North Carolina could wipe out the broiler, layer and turkey industries. Once AI is contracted, all poultry must be destroyed or the disease will spread. Therefore, commercial poultry producers sanitize equipment and houses, vaccinate birds and isolate their farms from visitors to prevent the spread of disease. If you are going to be a "mini" poultry producer, you must take the same precautions.

Many commercial hatcheries have agreed to work with 4-H'ers and make fertile eggs available. However, if a disease is spread because of a 4-H project, the hatcheries would discontinue their support. The 4-H Embryology Project would then be considered hazardous to the poultry industry. Therefore, if proper facilities and sanitation measures cannot be practiced, it is best that the chicks be euthanatized.

If a child shows a desire to raise poultry as a project, refer to the Small Poultry Flock, Farmer's Bulletin No. 2262, for further assistance. However, be aware that there are space and equipment requirements in brooding and rearing poultry. Also, proper sanitation and vaccination measures are necessary to stop the spread of infectious diseases.

TROUBLESHOOTING: SOME REASONS WHY THINGS GO WRONG.

If your hatch was not a successful one, or you have deformed chicks, here are some possible causes. Browse through this list before beginning the embryology project to gain an insight on the importance of proper incubator management.

HATCHABILITY PROBLEMS

Observation

May be caused by:

Hatch late

Temperature too low
Humidity too low
Incorrect thermometer
Large eggs
Old eggs
Variable room temperature

Hatch early

Temperature too high
Humidity too high
Incorrect thermometer
Small eggs
Leghorn eggs vs meat-type eggs

Blood rings, embryos dead the first 5 days

Improper temperature
Bacterial contamination
Failure to turn eggs
Lack of ventilation

Dead embryos, second week of incubation

Temperature too high
Temperature too low
Eggs not turned
Inadequate ventilation

Eggs pipped but chicks dead in shell

Improper temperature
Improper humidity
Inadequate ventilation at 20-21 days
Bacterial penetration
Diseased flock
Thin-shelled eggs

HATCHABILITY PROBLEMS

Observation	May be caused by:
Sticky chicks (shell and down sticking to chicks)	Humidity too low and/or temperature too high (20-21 days) Improper turning Old eggs
Crippled chicks	Variation in temperature (1-21 days) Humidity too high
Chicks dehydrated	Humidity too low (20-21 days) Chicks left in incubator too long after hatch
Mushy chicks, unhealed navel	Unsanitary incubator or handling conditions
Exploders	Bacterial contamination of egg and contents Dirty eggs Dirty flats or equipment Washing of eggs Sweating of eggs Incubator contamination

From: Hatchery Manager's Manual, DeKalb AgResearch, Inc., DeKalb, IL 60115,
pages 22-25.

ONCE PIPPED, LET YOUR CREATIVITY HATCH!

Help members with "hands-on" activities. Involve yourself with incubator and candler construction. Younger members might need some technical assistance, especially with electrical wiring. A list of supply sources for small incubator and candler construction follows. Supervise making of the embryo sets. Stress care when using chemicals like Formalin.

A notebook containing masters and worksheets for younger members is available. Let your imagination soar! See how many different activities you can create from the concept of the egg. Brainstorm. Let members make suggestions and express their ideas. Share your creations with other leaders and educators involved with embryology. Have your members make a notebook of their own.

Play Egg Tag! Have fun and increase your cardiovascular capacity. Invent new games which combine knowledge and exercise. Make learning a work-out!

Discuss related projects and demonstrations with your group. Promote cumulative records and individual and group demonstrations.

Most of all, help your 4-H'ers to learn and grow through this project. Who knows? You might learn something yourself.

SUPPLY SOURCES

Carolina Biological Supply
2700 York Street
Burlington, NC 27215
(919) 584-0381
Free phone order service:
1-800-632-1231

Incubators, Formalin

G.Q.F. Manufacturing Co., Inc.
P. O. Box 1552
Savannah, GA 31498
(912) 236-0652

Complete incubator setup

Lyon Electric Co., Inc.
3425 Hancock St.
P. O. Box 81303
San Diego, CA 92138
(714) 297-9000

Incubation, brooding and
candling equipment

Marsh Farms
P. O. Box 7
Garden Grove, CA 92642
(714) 891-4412

Incubation, brooding and
candling equipment; books and
specialty items

Nasco
901 Janesville Avenue
Fort Atkinson, WI 53538
(414) 563-2446
Free phone order service:
1-800-558-9595

Incubation, brooding and
candling equipment; other
poultry supplies

Sears, Roebuck and Co.
Farm and Ranch Catalog
Philadelphia, PA 19132
(Call catalog department
at retail store)

Fertile chicks; day-old
birds; incubation, brooding
and candling equipment

Some counties have incubators which can be loaned out by county extension agents. Contact your local agents to see if incubators are available and learn the check-out procedure. For the handyman, incubators can be built from a variety of common and inexpensive materials. Consult the chapter on Incubator Construction in the Member's Manual, Level II for specific details.

AUDIO-VISUAL MATERIALS

Hatchery System Co.
P. O. Box 1232
Matthews, NC 28105
(704) 847-2219

Poster: "Development of the Chicken Embryo"

Nicholas Turkey Breeding Farms
19449 Riverside Drive
Sonoma, CA 95476

Poster: "Embryonic Mortality of Turkey"

E. S. Shano
205 Rice Hall
Cornell University
Ithaca, NY 14853

Slide set and pictures: "The Growing Embryo"

Films, filmstrips and slides dealing with embryology, brooding and poultry production are available from the Visual Aids Film Library, Box 7603, N. C. State University, Raleigh, NC 27695-7603 and can be borrowed by your county extension agent for local viewing.

NORTH CAROLINA HATCHERIES PARTICIPATING IN THE
NATIONAL POULTRY IMPROVEMENT PLAN
AND 4-H EMBRYOLOGY PROJECTS

ALAMANCE COUNTY

Jim Wright 622-4251
Mid-State Farms, P. O. Box 8, Staley 27355

BURKE COUNTY

Tom Hester 437-2535
Mountain Ice Hatchery, Box 308, Morganton 28655

C. A. Schoenen, Jr. 437-2611

Western Hatcheries, Inc., P. O. Box 911, Flemming Dr., Morganton 28655

CHATHAM COUNTY

Jim Shepard 663-3277
Carolina Farms, Inc., P. O. Box 350, Siler City 27344

Pete Ray 742-4747

Gold Kist Hatchery, Siler City 27344

CLAY COUNTY

James Walker 389-6060
B & H Chicks, Box 466, Hayesville 28904

CLEVELAND COUNTY

Valencia Green 482-2480
Cleveland Hatchery, RR 2, Lawndale 28090

IREDELL COUNTY

J. B. Barnes 872-2751
Hubbard Farms, Inc., P. O. Box 1302, Statesville 28677

JOHNSTON COUNTY

Ray Auckerman 934-5576
DeKalb Hatchery, 301 North, Smithfield 27577

LEE COUNTY

Charles Martin 775-2348
Perdue Farms, Inc., P. O. Box 610, Sanford 27330

MCDOWELL COUNTY

Howard Lawing 738-3613
Howard Lawing & Son Hatchery, RR 5, Box 181, Marion 28752

MONTGOMERY COUNTY

Bill Kerr 974-4135
Perdue (Peachland) Hatchery, Candor 27229

NEW HANOVER COUNTY

Claude McAllister 763-5431 or 791-5352
7 Oaks Game Farm, 837 Masonboro Sound Road, Wilmington 28403

RANDOLPH COUNTY

John (Dee) Clark 622-2213
Paramount Poultry, P. O. Box 937, Liberty 27298

RICHMOND COUNTY

Ronald McFayden 652-4661
Hilltop Hatchery, Inc., RR 1, Ellerbe 28338

UNION COUNTY

Pruitt Garmon
Holly Farms, 224 Garmon Dr., Matthews 28105

WAYNE COUNTY

Chris Newman 566-4672
Newman's Hatchery, P. O. Box 6, LaGrange 28551
(eggs available between February and October only)

Pat Patrick 778-0060
Webber's Hatchery, RR 9, Box 143, Goldsboro 27530

WILKES COUNTY

Bob Sebastian 838-2171
Holly Farms, P. O. Box 88, Wilkesboro 28697

WILSON COUNTY

Charles Amick 284-2034
Perdue Farms, Inc., RR 3, Box 325, Kenly 27542

Hatcheries involved in the National Poultry Improvement Plan produce fertile eggs and chicks which are certified to be MG and Pullorum clean. MG and Pullorum are infectious diseases of poultry. This certification is one way to stop the spread of these infectious diseases. It improves poultry stock for commercial producers and hobby flock owners alike. Always deal with quality stock to protect yourself and others who work with and appreciate poultry.

North Carolina State University poultry farm, Raleigh, N. C., also has a limited supply of fertile eggs. Contact your county agent if local supplies of fertile eggs are unavailable. Your agent can make the necessary arrangements to procure fertile eggs from the NCSU poultry farm.

REFERENCES

- Bodemer, Charles W., 1968. Modern Embryology. Holt, Rinehart & Winston, Inc., New York. pages 193-231.
- North, Mack O., 1978. Commercial Chicken Production Manual, Second Ed. AVI Publishing Co., Westport, Conn. pages 40-41.
- Northeast Cooperative Publications/NEI. From Egg to Chick, A 4-H Manual of Embryology and Incubation.
- Patten, B. M., 1971. Early Embryology of the Chick. McGraw-Hill, Inc., New York.
- Romanoff, A. J., 1960. The Avian Embryo. Macmillan, New York.
- Saunders, John W., 1970. Patterns and Principles of Animal Development. Macmillan, New York.

BOOKS ON EGG ART

- Arnold, Susan, 1979. Eggshells to Objects: A New Approach to Egg Craft. Holt, Rinehart & Winston, New York.
- Coskey, Evelyn, 1973. Easter Eggs for Everyone. Abingdon Press, Nashville.
- Dunne, Robert L., 1978. Egg Carton Critters. Walker, New York.
- Newsome, Arden J., 1973. Egg Craft. Lothrop, Lee & Shepard Co., New York.
- Pflug, Betsy, 1973. Egg-speriment, Easy Crafts With Eggs and Egg Cartons. Lippincott, Philadelphia, PA.
- Riotte, Louise, 1973. Egg Decorating. Drake, New York.
- Szilvasy, Linda M., 1976. The Jeweled Egg; A Comprehensive Guide to Design and Creation of Decorated Eggs. Association Press, New York.

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