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California 4-H Project Sheet Series

Embryology

4-H embryology projects provide youth the opportunity to learn about life sciences in a hands-on, experiential way by incubating and hatching poultry (usually chicken) eggs. Participants learn about the environmental factors that are needed to support healthy embryo development and how an embryo develops within its shell over time. In addition to 4-H community club project settings, embryology projects are extremely successful in classroom and afterschool program settings.

By the end of the project, members will

- be able to set up, operate, and maintain an incubator
- learn to care for eggs successfully during the incubation period
- identify and describe the stages of embryo development

Project levels

Starting out: Beginner

- Identify and draw the parts of an egg.
- Set up a basic incubator and identify its components.
- Learn how many days it takes to hatch chicken eggs.
- Successfully hatch a brood of chicks.

Learning more: Intermediate

- Learn the pros and cons of incubating eggs under a hen or using a forced-draft or still-air incubator.
- Candle eggs daily during the incubation period.
- Know the ideal ranges for temperature, humidity, and other environmental factors in the incubator.
- Learn how long it takes to incubate other types of poultry, such as ducks and quail.

Exploring depth: Advanced

- Explain the function of each part of the egg.
- Explain the order of development of the embryo (for example, the heart forms before the eyes).
- Dissect chicken embryos at various stages of development and describe developed organs and their function.

Note: The activities above are ideas to help inspire further project development. This is not a complete list.

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Expand your experiences!

Science, technology, engineering, and mathematics

- Design and build a mock incubator that supports the needs of an egg, such as temperature and humidity levels.
- Participate in California's Avian Science Bowl, avian.ucdavis.edu/news, to learn about advanced embryology and poultry science.
- Compare how a bird embryo develops to how a mammal develops within its mother by creating posters illustrating the two life cycles.

Healthy living

- Learn about the nutritional qualities of the "incredible, edible egg" by visiting the American Egg Board's website, incredibleegg.org/nutrition/nutrition-education-materials/.
- Cook some healthy snacks at your project meeting using recipes developed by the American Egg Board, incredibleegg.org/recipes/.
- Learn how to safely buy, store, and cook eggs at the Food and Drug Administration's website, fda.gov/food/buy-store-serve-safe-food/what-you-need-know-about-egg-safety.

Civic engagement

- Create an informational poster about egg biosecurity and display it at your local fair, farmer's market, grocery store, or other location to teach the public about egg biosecurity (Biosecurity—United Egg Producers, unitedegg.com/issues-advocacy/biosecurity/).
- Learn about recent legislation regarding "factory farming" and hold a debate within your project about the pros and cons of current egg-production practices.
- Volunteer at a poultry show to learn more about bird breeders in your area (California Poultry Shows, poultryshowcentral.com).

Leadership

- Plan, prepare, and present a presentation about egg incubation at a 4-H presentation day.
- Offer to mentor new 4-H members once you have completed this project .
- Become a junior or teen leader for the group!
- Help teach an embryology project at an afterschool program as a teen teacher.

College and career readiness

- Visit a local egg hatchery and observe how they breed and produce poultry on a large scale, and what job opportunities are offered at such a facility.
- Take a tour of a college campus that offers poultry science programs, such as Modesto Junior College and UC Davis.
- Take high school classes that focus on biology, zoology, and vertebrate physiology.

Enhancing participation

Connections and events

- **Presentation days:** Share what you have learned with others through a presentation.
- **Field days:** At these events, 4-H members may participate in a variety of contests related to their project area. Contact your county 4-H office to determine additional opportunities, such as a county match or resource fair.

4-H record book

- 4-H record books, 4h.ucanr.edu/Resources/Member_Resources/RecordBook/, give members an opportunity to record events and reflect on their experiences. For each project, members document their experiences, learning, and development.
- 4-H record books also teach members record-management skills and encourage them to set goals and develop a plan to meet those goals.

Materials for delivery

Curricula

- ChickQuest*
- Experiments in Poultry Science*
- Embryology Helper's Guide*
- Getting Started in the 4-H Embryology Project, edis.ifas.ufl.edu/pdf/4H/4H36700.pdf
- The Incredible Egg, catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/4-h1500.pdf

Available at shop4-h.org

Resources

- Embryology and Egg Cam 4-H school enrichment, lancaster.unl.edu/4h/embryology—Nebraska Extension
- Chicken embryo development photo series, aces.edu/blog/topics/poultry/chicken-embryo-development/—Alabama Extension
- Chicken embryo development video, youtube.com/watch?v=PedajVADLGw—Poultry Cooperative Research Center in Australia
- 4-H candling resources, lancaster.unl.edu/4h/embryology/candling—Nebraska Extension
- 4-H incubation resources, lancaster.unl.edu/4h/embryology/incubation—Nebraska Extension
- Virtual chicken project, youtube.com/@virtualchicken891—Auburn University research
- American Egg Board website, incredibleegg.org/

Note: The UC 4-H Youth Development Program does not endorse, warrant, or otherwise take responsibility for the contents of unofficial sites.

What did my 4-H members learn?

Sometimes what our youth members actually learn is different from what we intend for them to learn. Do some of these activities to check on how your project is going!

1. Clover diagrams: Print out blank 4-H clovers and have the members label them with the 4 "H's." Ask them to write how they will apply what they learned in the project to each "H". For example, they could write "I learned to care for the hungry through our food-bank service project" under Heart.
2. Muddiest point: At the end of the meeting ask each member to write down one thing you covered that they do not fully understand yet.
3. Plus/delta sheets: You can do this on your own as a leader reflection or with your whole group after a meeting or activity. Make two columns on a sheet of paper and label one with a "+" and one with a "Δ". Write down everything that went well under "+" and what should be changed for next time under "Δ."
4. Quiz games: Check content knowledge with a round of Jeopardy or another fun quiz!

4-H thriving model of positive youth development

Youth thrive when 4-H programs are done well. It is important to ensure, no matter what project or activities are offered, that the program context matters. Ensuring a foundation for youth engagement starts with a focus on the three categories outlined below.

Facilitating youth sparks

A spark is something youth are passionate about; it really fires them up and gives them joy and energy. Youth use their sparks to make the world a better place.

- Sparks create action and provide fuel for growth in knowledge and skills.
- Sparks grow a young person's networks.

Help youth find how this project may bring them joy, purpose, and direction.

To learn more, visit tinyurl.com/y2lwct7u.

Program quality

Research shows that youth programs must be done well if they are to make a positive difference in the lives of youth.

Quality programs ensure

- physical and psychological safety
- appropriate structure
- supportive relationships
- opportunities to belong
- positive social norms
- support for mattering
- opportunities for skill-building
- integration of family, school, and community

To learn more, visit tinyurl.com/yxg27m3j.

Fostering developmental relationships

Caring, supportive adults are clearly connected to positive youth development.

Across the childhood years, youth need different things from adults as they learn, grow, and self-regulate. What should remain constant from all adult volunteers and staff includes

- expressing care through listening, warmth, and dependability
- challenging growth by expecting youth to do their best
- providing support
- sharing power
- expanding possibilities

To learn more, visit tinyurl.com/y6434ntw.

Experiential learning/Learn-by-doing

Well-executed 4-H programs provide learning opportunities that are direct and hands-on; invite discussion; involve active reflection; and make connections between activities and the real world.

Experiential learning

Facilitate learning experiences through a three-part cycle:

1. Experience: Hands-on experience offer youth opportunities to move around and handle materials, which engage them in investigations, observations, experiments, or scenarios.
2. Reflection: Seamless movement through three distinct phases whereby the facilitator guides the learners to share thoughts and feelings with others in order to process and generalize their experiences, using broad questions that invite interaction.
3. Application: An opportunity for learners to apply new knowledge to authentic situations in order to help deepen and extend their understanding.

Active learning

In 4-H projects, youth need to be involved in active learning where they plan, explore, build, and work with minimal instruction from the volunteer. Youth need to seek their own answers to questions rather than being given answers. When using active learning, youth will be engaged in the following activities:

- asking questions and defining problems
- developing and using models
- planning and carrying out investigations
- using simple equipment or tools to gather data
- analyzing and interpreting data
- using math and computational thinking
- constructing explanations and designing solutions
- engaging in argumentation from evidence
- obtaining, evaluating, and communicating information

Extend the learning

Extend learning through a variety of leadership, field-day, presentation, and record-keeping activities.

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