Beginning of Life
4-H School Enrichment Project
About the Project

- Science Based, Hands-on
- Extension provides educational resources for the project
  - Leaders Manual
  - Suggested Activities
  - Youth Activity sheets
Project Expectations

- Teach responsibility and caring for a living thing
- Emphasize a “hands-on” experience with living things
- Introduce and explain the topic of reproduction to youth
- Help youth grasp developmental processes and stages of growth
Which came first?
The chicken or
The egg?

http://www.youtube.com/watch?v=1a8pl65emDE
Five to six months
Why can’t I incubate eggs from the Grocery Store?

- Most eggs from a grocery store come from hens that have never seen a rooster - they are unfertilized.
The Fertilization Process

- A rooster is placed in an enclosed area with about 10 hens.
- Rooster will deposit sperm on the vent of the hen.
- The sperm then travels through the oviduct.
Hen Reproductive Anatomy

1. Follicle
2. Immature ovum
3. Egg yolk
4. Magnum
5. Isthmus
6. Albumin protein
7. Two shell membranes are secreted loosely around the ovum and albumin
8. Shell gland
9. Genital tract
10. Vagina
11. Cloaca
Egg Anatomy

Diagram of the egg anatomy, showing:
- Germinal Disc
- Air Cell
- Albumen or White
- Chalaza
- Vitelline membrane
- Inner Membrane
- Outer Membrane
- Shell
Function of Embryonic Membranes

- Yolk Sac
  - Food

- Amnion
  - Protection

- Chorion / Allantois
  - Respiration
  - Waste
  - Minerals from shell
  - Absorption of albumen
How do Chickens hatch eggs on their own?

- Hens will lay about one egg every other day until they have enough in their clutch to start brooding.
- The hen’s body temperature is 106 degrees and when she sits on the clutch, she brings the temperature of the eggs up to 100 degrees.
Fertile vs. Not fertile

Fertile

Non-Fertile
What’s the Difference between White and Brown Eggs?

- Eggs come in all different sizes and colors
- Different colored eggs come from different breeds of chickens - the earlobe color will tell you the color of the egg
- Older chickens lay bigger eggs
What breed do we use?

- White Leghorns
External Chicken Anatomy
Embryonic Development
Embryonic Development

Day 1
- Beginning of formation of brain and nervous system, head and eyes
- Appearance of vertebral column and blood island

Day 2
- Blood vessels appear in yolk sac
- Heart begins to beat
- First sign of amnion
- Formation of throat
Embryonic Development

- **Day 3**
  - Beginning of formation of nose, wings, legs, allantois
  - Amnion completely surrounds embryo

- **Day 4**
  - Beginning of formation of tongue
  - Embryo separate from yolk sac
Embryonic Development

- **Day 5**
  - Proventriculus and gizzard formed
  - Reproductive organs formed

- **Day 6**
  - Beak and egg-tooth begin formation
  - Main division of legs and wings
  - Voluntary movement begins

- **Day 7**
  - Digits in legs and wings
  - Viscera development

- **Day 8**
  - Feather formation

- **Day 9**
  - Embryo begins to look like bird
  - Mouth opening appears
Embryonic Development

- **Day 10**
  - Beak starts to harden
  - Skin pores visible to naked eye
  - Digits completely separated

- **Day 12**
  - Toes fully formed
  - First visible feathers

- **Day 13**
  - Appearance of scales and claws
  - Body covered in feathers

- **Day 15**
  - Intestines taken into body
Embryonic Development

- **Day 16**
  - Scales, claws and beak become firm
  - Albumen gone and yolk increasingly important as nutrient

- **Day 17**
  - Beak turns toward air cell
  - Amniotic fluid decreases
  - Embryo begins preparation for hatching
Embryonic Development

- **Day 19**
  - Yolk sac draws into body cavity through umbilicus
  - Embryo occupies most of space in egg except air cell

- **Day 20**
  - Embryo breaks amnion and starts breathing air in air cell (becomes chick)

- **Day 21**
  - CHICK HATCHES!
Beginning of Life: Hatching
How do I Successfully Hatch Eggs?

- Proper Preparation and Planning
Preparation and Planning

- Equipment Needs
  - Calendar/record sheets
  - Incubator
  - Thermometers
  - Candler
  - Pencils
  - Cheesecloth
  - Brooder Box
  - Jar lid, tuna can, etc.
<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
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<th>Saturday</th>
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<tbody>
<tr>
<td>March 12</td>
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<td>March 14</td>
<td>March 15</td>
<td>March 16</td>
<td>March 17</td>
<td>March 18</td>
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<tr>
<td>Lesson 1</td>
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<td>temperature drops for a while after you put the lid back on.</td>
<td>an &quot;X&quot; and &quot;O&quot; if you are turning by hand.</td>
<td>Heart begins to beat. Turn 3 times per day.</td>
<td>Turn at least 1 time per day.</td>
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<td>Day 1</td>
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<td>Lessons 2 and 3</td>
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<td>development and fertility. Turn 3 times per day.</td>
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<td>Day 6</td>
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<td>Lesson 4</td>
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<td>Keep humidity extra high by misting eggs several times per day. Use warm water. Do NOT turn eggs.</td>
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<td>April 2</td>
<td>April 3</td>
<td>April 4</td>
<td>April 5</td>
<td>April 6</td>
<td>April 7</td>
<td>Welcome Peeps!</td>
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<td>Lessons 5 and 6</td>
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4-H Embryology Record

Reminders:
1. Keep the temperature between 99.5-100.5°F for forced air incubators and 100.5-101.5 for still air incubators.
2. Candle the eggs on Days 7, 14, and 18.
3. Keep the water tray full. Only add warm water.

<table>
<thead>
<tr>
<th>Day of Incubation</th>
<th>Temperature</th>
<th>Initial each time that eggs are turned</th>
<th>Check if candled</th>
<th>Relative Humidity</th>
<th>Concerns and Observations</th>
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<tbody>
<tr>
<td></td>
<td>Morning</td>
<td>Afternoon</td>
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<td>Incubator Room</td>
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Total Eggs Set ______
Total Hatched ______

Revised March 4, 2010
Preparation and Planning

- Inform co-workers and custodial staff
  - Power outages?
  - Will you be notified?
  - Who will take care of eggs/incubator in the case of power outages or school cancellations?

- Lower school temps on weekends?

- Tampering
Preparation and Planning

- What happens to the chicks after the project?
  - Chick pick up will be on April 22 or you can find your own home for the chicks.
  - This means you should have three days with the chicks to discuss the brooding process.
Equipment: Incubator

Types

- Forced Air - air is circulated by a fan or fans
- Still Air - air is not circulated manually
**Equipment: Incubator**

- Make sure has stabilized for at least 24 hours at the desired temperature before setting eggs.

**Placement**

- Avoid drafts, direct sunlight, heat & AC outlets.
- Set in room that stays above 65°F (70-80°F).
- Make sure electrical outlet will be “on” 24 hours/day.
- On sturdy, level surface.
- 6 inches away from edge of surface.
Equipment: Candler

- See Teacher’s Packet for information on constructing your own candler.
How do I Successfully Hatch Eggs?

- Proper Preparation and Planning
- Start Up Day
When Will Eggs Arrive?

- Delivery to Fauquier County Public Schools between 9 AM and 1 PM on March 29th
- Non-Fauquier County school participants can pickup from the Extension Office from 4:30 – 5:30 on March 28th or 2 – 5 on March 29th

Route for March 29th
- Grace Miller
- Pearson
- Brumfield
- PB Smith
- Ritchie
- Greenville
Start Up Day

- Have the incubator ready to go
- Prepare eggs for incubating
  - Allow a couple of hours for eggs to come to room temperature - approx. 2 hrs
  - Candle eggs and discard any:
    - Cracked eggs
    - Double-yolked eggs
Candling eggs prior to incubation

Good quality hatching egg

Cracked

Two Yolks

Poor quality large air cell dark yolk
Start Up Day

- Prepare eggs for incubating (cont.)
  - Identify eggs
    - Put a number on large end of each egg
    - Mark eggs with “X” and “O” on opposite sides
    - Use a pencil or wax crayon
  - Set eggs in incubator with “X” sides up
    - Best to set fertile eggs in heated incubator within 24 hours of arrival
How do I Successfully Hatch Eggs?

- Proper Preparation and Planning
- Start Up Day
- Good Incubation Management
Incubation Management

- **4 Important Factors**
  - Temperature
  - Humidity
  - Ventilation
  - Turning

- **Pay Attention to Temperature and Humidity!**
Temperature

- Thermometer
  - Same height as top of eggs
  - Keep away from the heat source
  - Two makes for a more accurate reading

- Varies by incubator type and turning technique
  - Forced Air
    - Manual: 99.5 - 100.5°F
  - Still Air
    - Manual: 100.5 - 101.5°F
Temperatures BELOW 96°F or ABOVE 103°F result in high mortality

DO NOT adjust incubator temp during first 48 hours

Half way through incubation process may see an increase in temp
Humidity

- Proper humidity is important for chick health
  - Prevents sticking to shell
  - Maintains amnion fluid
  - Provides for free embryo exercise
  - Prevents crippled chicks

- Determine humidity using a wet-bulb thermometer
  - Wet-bulb and dry-bulb thermometers at same temp = 100% humidity
## Relative Humidity

<table>
<thead>
<tr>
<th>Incubator Temperature (°F)</th>
<th>Wet Bulb Readings (°F)</th>
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</thead>
<tbody>
<tr>
<td>100</td>
<td>81.3</td>
</tr>
<tr>
<td>101</td>
<td>82.2</td>
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<tr>
<td>102</td>
<td>83.0</td>
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<tr>
<td>Percent Relative Humidity</td>
<td>45%</td>
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</tbody>
</table>
Maintaining Humidity

- **First 18 days**
  - 60%

- **19th - 21st days (hatching period)**
  - 65-70%
  - Condensation indicates adequate moisture

- **Adding water**
  - Should be about the same temperature as incubator
  - Add when opening incubator to turn eggs (wet sponges may help)
  - Make sure water is clean
Ventilation

- Normal atmospheric air
  - Oxygen Concentration - 21%
  - Carbon Dioxide Concentration - 0.5%

- Air movement past eggs
  - Make sure ventilation holes are open

- Vent plugs
  - Front plug is for regulating humidity (removed one week prior to hatch)
  - Back vent for excessive humidity (should be removed the day chicks start to hatch)
Turning

Why is turning necessary?

How often should eggs be turned?
- 3-5x daily for 2nd-18th day of incubation
- DO NOT turn during last 3 days!

What about weekends?
- Turn once daily on weekends
- It is okay to move incubator and eggs prior to 19th day of incubation
Candling

- Candle eggs as often as every three days to check progress

Day 7
Hatching Out

- Remove automatic turner (if used) and place eggs on cheese cloth over wire bottom on day 18.

- Never help the chicks from the shell.

- Remove the chicks from the incubator and place them in a warm brooder within 2 to 6 hours after they hatch.
  - 6-12 hours will be okay if they hatch when nobody is around.

- Remove and discard all remaining un-hatched eggs 60 hours after the first chick hatches.
Clean Up

- Remove loose shells and dry matter
- Egg trays and water pans
  - Soak in warm water and scrub off adhering dirt
- Wipe plastic clean with soft cloth and glass cleaner
- Bottom of incubator
  - No chemical cleaners
  - Soak in 25% bleach/water solution and wipe with cloth
- Heating elements and other electric units
  - DO NOT touch or get element wet
  - Brush gently with soft brush to remove dust
Brooding

- Make sure the brooder box is working 2-4 days prior to hatch
- Maintain 92 to 95°F for the first week
  - Take temperature at one inch above the floor level
- Supply a textured, absorbent litter to provide traction and prevent leg damage
  - Textured paper towels work well
- Chicken starter feed
  - 18 to 22 % protein
  - Will be provided with one pound
  - Use a jar lid, egg carton, small tuna can, etc. as a feeder
- Water should be available at all times
- Clean waterer and brooder daily
Avoiding Disease

Emphasize the importance of sanitation and good hygiene before and after handling any animal reduces risk associated with project to almost zero.
Troubles Arise ...

- The most common problems are associated with improper incubator management...
Low Humidity can cause:

- Chicks fully formed, but dead without pipping.
- Eggs pipped, but chicks dead in shell.
- Dry sticks – shell sticking to chicks.
- Short down on chicks or eyelids stuck closed with down.
- Chicks with splayed legs or curled toes.
High Humidity can cause:

- Sticky chicks – chicks smeared with egg contents
- Large, soft-bodied chicks with bad odor.
Low Temperature can cause:

- Eggs pipped, but chicks dead in shell.
- Sticky chicks – chicks smeared with egg contents
- Large, soft-bodied chicks with bad odor.
- Delayed hatch – eggs not starting to pip until 21st day or later.
High Temperature can cause:

- Embryos that stop developing after a certain point.
- Chicks fully formed, but dead without pipping.
- Chicks hatching too early with bloody navels.
- Short down on chicks or eyelids stuck closed with down.
Trouble Shooting

**Problem:** Chicks with splayed legs or curled toes.

- **Causes**
  - Insufficient moisture
Other Problems that may Occur

- **Sudden losses at any time**
  - **Causes:**
    - Power or equipment failure or overheating
  - **Corrections:**
    - Check incubator temperature at least 2x daily
Even in the best of conditions . . .

- A hatch rate above 50% is considered a success.
- Separate unhealthy chicks from the healthy ones.
- In cases of chick death VA DEQ has approved the following methods of poultry carcass disposal:
  - Landfill off-site (this means that you could throw the carcass in a school dumpster)
  - Follow school dissection projects policies for biohazard waste
Please don’t forget to consult these resources...

- Chick Calendar
- Embryology Record
- Tip Sheet
- Teacher’s Packet
- Beginning of Life Curriculum
- Embryology Record Book
Questions?