CHICKENS 101

- Biology (Anatomy, Breeds, Development, & Reproduction)

- Eggs (Production, Quality, & Food Safety)
Chicken Anatomy
THE BASICS: TERMS

Chicken Wing & Feather Anatomy
**THE BASICS - TERMS**

**Chick** – a new hatch or very young chicken

**Pullet** - a young female chicken

**Hen** – a mature female chicken

**Cockerel** – a male chicken less than 1 year old

**Cock** – a male chicken more than 1 year old

**Rooster** - a male chicken
**Broiler** - used mainly for meat. A broiler is a chicken is 6 to 7 weeks of age and weighs 4 pounds when it is sent to market.

**Layer** - a mature female chicken that produces eggs. Most can lay 300 eggs/year.
THE BASICS: BREEDS
How Did Chickens Originate?

– All breeds are descendents of an original Red Jungle Fowl of East Asia. Domestication impacts are great.

Figure 1. Graph illustrating the results of generations of genetic selection of the Jungle Fowl chicken to create specific purpose breeds

* Mature body weight (at 20 weeks of age) = 2 lb
* Eggs/yr = 10-12

**MEAT PRODUCTION**

Broiler chickens can reach 6.6 lbs in eight weeks

**EGG PRODUCTION**

Some hens can lay over 300 eggs a year

**PUREBRED**

Chickens now come in all shapes, colors and sizes
There are many things to consider before selecting a chicken breed for your flock - whether you are planning to start a new flock or to add to an existing one.

For instance, what are you looking for?

- a broiler breed
- a layer breed
- a dual-purpose breed
- a pet
- chickens to show at exhibitions
- a heritage breed
Before selecting your chickens also review your zoning restrictions

For instance . . .
+ is slaughtering allowed?
+ how many chickens can you have?
+ are roosters allowed?
THE BASICS: BREEDS

Many Websites Available on Breed Traits Info
e.g., the Handy Dandy Chicken Chart

http://www.ithaca.edu/staff/jhenderson/chooks/chooks.html
**Meat Breed Factors**

- A fast growing ‘broiler’ breed
  - A Cornish cross can reach 4-5 lbs in six weeks and 6-10 lbs in twelve weeks
- A slower growing breed (for ‘ethnic markets’)
  - Australorp and Silkie breeds
Egg Breed Factors

- Hybrids (Production): Not a specific breed but a cross of known breeds.
- Layers grow slower
- Flock uniformity
- More production types
  - Red Sex links
  - Production Reds
  - White Leghorns
Selecting a breed based on egg color

White Eggs
- Brown Eggs
- Leghorns
- Buttercup
- Ancona
- Andalusian
- Hamburgs
- Rhode Island Red
- Rhode Island White
- Buff Orpington
- Plymouth Rocks
- Delaware
- Dominique
- Wyandottes
- Red Sex Links
Egg Breed Examples

THE BASICS: BREEDS

WHITE LEGHORN

RHODE ISLAND RED

ARAUCANAS
**Heritage Breeds**

- Allow you to participate in conservation of genetic and breed diversity
- Use breeds that are adapted to area’s environmental conditions
- Opportunities to provide specialty products
Heritage Meat Breed Examples

NEW HAMPSHIRE

BARRED ROCKS

BUFF ORPINGTONS
THE BASICS: DEVELOPMENT

Steps in Natural Development
THE BASICS: REPRODUCTION

Chicken reproductive system
(photo of poster in Norfolk zoo, VA)

- albumen added
- fertilization
- ovary
- mature ovum enters oviduct
- shell added
- sperm
- cloaca

GeoChemBio.com
THE BASICS: REPRODUCTION

FEMALE POULTRY REPRODUCTIVE SYSTEM

- The ova produced in the ovary develop into egg yolks.
- The oviduct of the chicken has five parts.
- It takes approximately three hours for the thick white to be placed around the yolk in the magnum.
- It takes approx. 1 ¼ hrs for two shell membranes to be placed around the yolk and thick white.
- It takes about 25 to 27 hours for a chicken to produce one egg.
THE BASICS: REPRODUCTION

REPRODUCTIVE ORGANS OF A MALE CHICKEN

- Testicles
- Vas Deferens
- Cloaca
- Rectum
- Kidneys
- Ureters
- Intestine

ROOSTER
1. The vas deferens carries the seminal fluid and sperm cells to the cloaca.

2. The cloaca is the enlarged part where the large intestine joins the end of the alimentary canal.

3. The alimentary canal is the food-carrying passage that begins at the mouth and ends at the vent.

4. The papilla is the organ in the wall of the cloaca that puts the sperm cells into the hen’s reproductive tract.

5. Roosters are necessary only for fertile eggs.
THE BASICS: PRODUCTION DEVELOPMENT

- Incubator
- Brooder
- Housing & Feeding

Eggs for Consumption and/or Incubation

Laying Hens

Housing & Feeding
An **Incubator** provides and maintains a favorable environment for hatching fertile eggs. The incubator replaces the hen.
4 Important Factors to Successful Incubation Are:

1. Temperature – 98 – 102 degrees F
2. Ventilation – air must flow through the incubator
3. Turning the eggs- at least 3 times daily. Incubators can have automatic turners
4. Humidity (water)– there must be moisture to keep the egg shell healthy
THE BASICS: DEVELOPMENT

Chicken Egg Anatomy and Embryo Development

See video of chicken egg development at
http://www.youtube.com/watch?v=LKvez9duEHQ
Candling is the process of using a bright light to look inside of the egg without cracking it to see if the chick is developing properly.

Notice the embryo has begun to develop.

Notice the veins, this is the embryo forming.
THE BASICS: DEVELOPMENT

INTERNAL DEFECTS
Focuses on albumen cleanliness and viscosity, size of air cell, yolk shape and strength.

OLD CRACK
FRESH CRACK
SOFT SHELL
BEAK OR TOE PUNCHED

BLOODSPOT IN WHITE EGG
BLOODSPOT IN BROWN EGG
BLOOD EGG
**Hatching Time**

- Hatching Begins on Day 21 give or take 3 days
- Impacted by Light and Temperature
- May take Several Hours for Chick to Exit Shell
- Don’t help Chicks Hatch -- Struggle Necessary for Survival
Chicks hatching and drying in incubator.

And Then?

- Chicks remain in incubator until dry and fluffy
- May take several hours to dry
- Once dry and fluffy place in brooder
What’s a brooder?

- Pen for chicks
- Absorbent bedding i.e. saw dust, newspaper, etc
- Shop light hung low to warm chicks
Why Is Proper Brooder Management So Critical?

- All of the chicken’s body systems are developing
  - Immune system
  - Thermoregulatory system
  - Digestive system
  - Feathering
  - Eating and drinking behavior
BROODER EXAMPLES

Lamp Type
BROODER EXAMPLES

Battery

Box

Ring
**THE BASICS: DEVELOPMENT**

**Brooder Requirements**

- **Space**
  - Draft shield 12-18” high
  - ½ square foot of space per bird

- **Heat Sources**
  - light bulb
  - 95°C for week 1 – then decrease 5°C per week.

- **Litter**
  - 3 inches of clean dry litter (*No VERY fine sawdust or cedar*)
  - Keep litter around water and feed **dry and clean**
Keep Brooder Clean!

- Change out daily
  - Bedding
  - Water
  - Food
Brooder Success Rules of Thumb

- **Water**
  - 1 quart for every 25 birds (clean and fill daily)
  - For large number automatic watering systems work best

- **Feeders**
  - Place near heat, but not directly underneath source
  - Fresh food in front of chicks at all times

- **Delivery Day**
  - Brooder up and running 24 hr before chicks arrive
  - Have them sent overnight
  - Show each bird water source
THE CHICKS WILL TELL YOU IF THEY ARE COMFORTABLE

Ideal Brooding Temperature and Equipment Arrangement

Brooding Units

Waterers
Feeders
Chick Guard
Chicks

Comfortable
Too Cold
Drafty
Too Hot
THE BASICS: SEXING YOUNG POULTRY

- Best way to tell is to wait till they grow up

Rooster
- Tail feathers
- Comb size
- Wattle size
- Spur size

Hen

Images of a rooster and a hen illustrating the differences in their features.
THE BASICS: EGG LAYING

Why have my hens stopped laying?

FACTORS:

- **Nutrition**
  - Completely balanced diet
  - Out of feed or water
- **Disease**
  - Vaccinate (esp. in confinement systems)
- **Biology: age**
- **Management**
  - Heat
  - Overcrowding
  - Light
Why have my hens stopped laying?

250 eggs per year = 1st year of production
Why have my hens stopped laying?

- A layer will produce an egg every 1-2 days
- Pullets start laying when they reach 20-24 weeks
- First eggs will be small and on the floor
- Light hours (have a program)
  - Decrease light hours for growing pullets
  - Increase hours after they start laying with artificial lights (orange/red lights are best) to maintain 14-16 hr day
Chicken Egg Anatomy
Exterior quality refers to a shell’s appearance, cleanliness and strength. Appearance is important because the shell is the first thing you notice about an egg. Cleanliness is important because the shell is the egg’s first defense against bacterial contamination; the cleaner the shell, the easier it can do its job. Strength influences the egg’s ability to remain intact until you’re ready to use it. The shell accounts for about 12 percent of the weight of a large egg. It is made up of three layers:

1) The inner, or *mammillary*, layer encloses the inner and outer membranes surrounding the egg.

The spongy, or *calcareous*, layer is made up of tiny calcite crystals consisting of 94 percent calcium carbonate with small amounts of other minerals. Viewed through a microscope, these crystals look like thousands of thin pencils standing on end. The spaces between them form pores connecting the surfaces of the inner shell and outer shell so moisture and carbon dioxide can get out of the egg and air can get in to create the air space.

2) The bloom, or *cuticle*, is a light coating that seals the pores to preserve the egg’s freshness by reducing evaporation and preventing bacteria from entering through the shell. Sometimes you’ll find a freshly laid egg before the bloom has dried. Most of the pigment that gives the shell its color is in this layer.
### The Basics: Egg Quality

**What Are The Causes of Egg Shell Problems?**

<table>
<thead>
<tr>
<th>Condition of Shell</th>
<th>Possible Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Odd shaped</td>
<td>1. Inherited &lt;br&gt; 2. Disease: Newcastle disease, infectious bronchitis, laryngotracheitis, Egg Drop Syndrome 76 &lt;br&gt; 3. Age of hens: incidence is higher in older hens</td>
</tr>
<tr>
<td>B. Thin, porous or shell-less</td>
<td>1. Inheritance influences porosity and ability to produce strong shells &lt;br&gt; 2. Lack of sufficient calcium, phosphorus, manganese or vitamin D$_3$ &lt;br&gt; 3. Vitamin D$_2$ mistakenly substituted for D$_3$ &lt;br&gt; 4. Excess phosphorus consumption, especially by older hens &lt;br&gt; 5. Ingestion of sulfanilamide (sulfa drugs) &lt;br&gt; 6. Disease: Newcastle disease, infectious bronchitis, avian influenza, Egg Drop Syndrome 76 &lt;br&gt; 7. Hens exposed to temperature over 85-90°F &lt;br&gt; 8. Age of hens: incidence higher with older hens &lt;br&gt; 9. Premature laying of the egg</td>
</tr>
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[http://edis.ifas.ufl.edu/ps020](http://edis.ifas.ufl.edu/ps020)
# The Basics: Egg Quality

## What Are The Causes of Egg Shell Problems?

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<th>Condition of Shell</th>
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| C. Rough or abnormal shell texture                      | 1. Inherited  
2. Newcastle disease or infectious bronchitis  
3. Excessive use of antibiotics  
4. Excess calcium consumption by the hens  
5. Copper deficiency                                      |
| D. Mottled shells                                       | 1. Primarily caused by high or low extremes in humidity  
2. Inherited  
3. Manganese deficiency  
4. Artificially induced                                   |
| E. White strain layers producing tinted eggs            | 1. Primarily inherited.                                                         |
| F. Yellow shells                                        | 1. Extended use of high levels of certain antibiotics                           |
| G. Tremulous or loose air cells                         | 1. Newcastle disease  
2. Infectious bronchitis  
3. Rough handling of eggs  
4. Eggs stored large end down                              |
| H. Depigmented brown shell                              | 1. Infectious bronchitis  
2. High stress in the flock  
3. Egg Drop Syndrome 76                                     |
# The Basics: Egg Quality

What Are The Causes of Egg White Problems?

<table>
<thead>
<tr>
<th>Condition of Albumen</th>
<th>Possible Causes</th>
</tr>
</thead>
</table>
| A. Increased thin white              | 1. Inherited  
2. Diseases: Newcastle disease, infectious bronchitis, laryngotracheitis or Egg Drop Syndrome 76  
3. High egg storage temperature  
4. Age of hens: incidence higher with older hens  
5. High level of ammonia from droppings  
6. Loss of CO₂ from egg  
7. High vanadium levels in the feed |
| B. Greenish albumen in fresh eggs    | 1. Riboflavin (vitamin B₂) in feed: this is natural and is not undesirable                                                                 |
| C. Cloudy white                      | 1. High CO₂ inside egg: may result from oiling egg too soon after lay  
2. Refrigeration of fresh eggs at low temperatures (32 to 39°F)                                                                 |
| D. Pink white                        | 1. Cottonseed oil (contains the fatty acids malvalic and sterculic acid)                                                                        |
| E. Blood spots                        | 1. Inherited  
2. Increased blood spots occur with sudden environmental temperature changes  
3. Age of hens: incidence higher with older hens  
4. Deficiencies of vitamin K (probably rare) or vitamin A  
5. Sulfaquinoxaline may increase incidence if vitamin K is marginal |
| F. Meat spots                         | 1. Inherited  
2. Bits of ovary, oviduct or cuticle  
3. Blood spots dissolved from blood pigment                                                                                             |
| G. Spoilage by bacteria and molds    | 1. Green whites (under UV light) *Pseudomonas* bacteria  
2. Black rots caused by *Proteus* bacteria  
3. Molds can cause either green or black appearance when candied                                                                 |
## What Are The Causes of Egg Yolk Problems?

### The Basics: Egg Quality

#### What Are The Causes of Egg Yolk Problems?

<table>
<thead>
<tr>
<th>Condition of Yolk</th>
<th>Possible Causes</th>
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</table>
| A. Blood spots    | 1. Inherited  
|                   | 2. Increased blood spots occur with sudden environmental temperature changes  
|                   | 3. Age of hens: incidence higher with older hens  
|                   | 4. Deficiencies of vitamin K (probably rare) or vitamin A  
|                   | 5. Sulfaquinoxaline may increase incidence if vitamin K is marginal |
| B. Yolk color variation | 1. Pigment level in diet  
|                   | 2. White yolks:  
|                   | a. Unknown disease condition  
|                   | b. Capillary worms  
|                   | c. White corn, grain sorghum, wheat or barley in ration, without pigment supplement  
|                   | 3. Olive or salmon colored yolks: caused by 5 percent or more cottonseed meal containing gossypol or cyclopropene fatty acids in the diet |

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**THE BASICS: EGG QUALITY**

What Are The Causes of Egg Yolk Problems?

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<thead>
<tr>
<th>CONDITION OF YOLK</th>
<th>POSSIBLE CAUSES</th>
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</thead>
<tbody>
<tr>
<td>C. Mottled yolks</td>
<td>1. Nicarbazin (anticoccidial drug)</td>
</tr>
<tr>
<td></td>
<td>2. Gossypol (cottonseed meal)</td>
</tr>
<tr>
<td></td>
<td>3. Worming compounds: piperazine, citrate, phenothiazine, dibutylin dilaurate</td>
</tr>
<tr>
<td></td>
<td>4. Tannic acid</td>
</tr>
<tr>
<td></td>
<td>5. Calcium deficiency</td>
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<tr>
<td></td>
<td>6. Age of hens: incidence is lower in older hens</td>
</tr>
<tr>
<td></td>
<td>7. Inherited</td>
</tr>
<tr>
<td></td>
<td>8. Storage time, increases with time</td>
</tr>
<tr>
<td>D. Thick, pasty, rubbery or cheese-like yolks</td>
<td>1. Crude cottonseed oil</td>
</tr>
<tr>
<td></td>
<td>2. Severe chilling or freezing of Intact egg</td>
</tr>
<tr>
<td></td>
<td>3. Seeds of velvetweed and other related species</td>
</tr>
<tr>
<td>E. Off-odors</td>
<td>1. Chemicals for treating parasites</td>
</tr>
<tr>
<td></td>
<td>2. Fruits, vegetables, and flowers: never store in egg cooler</td>
</tr>
<tr>
<td></td>
<td>3. Household detergents: use only special egg washing detergent/sanitizer materials</td>
</tr>
<tr>
<td></td>
<td>4. Moldy flats, cases or egg room</td>
</tr>
<tr>
<td>F. Flat yolks</td>
<td>1. Weak vitelline membrane: age of eggs, improper storage temperature, age of hens</td>
</tr>
<tr>
<td></td>
<td>2. Indirect effect of poor egg shell quality</td>
</tr>
<tr>
<td></td>
<td>3. Nicarbazin (anticoccidial drug)</td>
</tr>
</tbody>
</table>

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# THE BASICS: EGG QUALITY

<table>
<thead>
<tr>
<th>Quality factor</th>
<th>AA Quality</th>
<th>A Quality</th>
<th>B Quality</th>
<th>Inedible/loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of Air Cell</td>
<td>1/8&quot; of less in depth</td>
<td>3/16&quot; or less in depth</td>
<td>more than 3/16&quot; in depth</td>
<td>doesn't apply</td>
</tr>
<tr>
<td>Egg white</td>
<td>clear, firm</td>
<td>clear, may be reasonably firm</td>
<td>clear, may be weak &amp; watery</td>
<td>doesn't apply</td>
</tr>
<tr>
<td>Yolk</td>
<td>outline slightly defined</td>
<td>outline may be fairly well defined</td>
<td>outline clearly visible</td>
<td>doesn't apply</td>
</tr>
<tr>
<td>Blood/Meat Spots</td>
<td>none</td>
<td>none</td>
<td>blood or meat spots aggregating less than 1/8&quot; in diameter</td>
<td>blood or meat spots aggregating more than 1/8&quot; in diameter</td>
</tr>
</tbody>
</table>
Eggs are a very nutritious food for a healthy diet.

However, they are perishable just like raw meat, poultry and fish.

Chickens may carry bacteria, e.g., *Campylobacter* and *Salmonella*, that can cause illness to consumers.

Infected birds do not usually appear sick and even unbroken, clean, fresh shell eggs may contain harmful bacteria.

http://www.foodsafety.wisc.edu/assets/pdf_Files/Egg_Safety_and_the_Backyard_Flock.pdf
**Steps to Be Safe With Backyard Eggs**

- Eggs will stay cleaner if the coop area is kept clean and dry. Thoroughly clean and disinfect the coop at least twice a year.

- Allow one nest for every three to four chickens and large enough for your hens. To protect eggs, pad nests with straw or wood chips. Clean out nest boxes once a week to remove dirty litter and manure and replace with clean nesting material.

- Provide a perch above the floor over a dropping box away from the nests. Chickens will roost on the perch to sleep and defecate into the wire-mesh covered dropping box.

http://www.ext.colostate.edu/pubs/foodnut/09377.html
Steps to Be Safe With Backyard Eggs

- Collect eggs at least twice daily, preferably before noon, to reduce soiling of eggs by hens.
- Discard eggs with broken or cracked shells.
- If eggs need to be washed, the temperature of the water should be at least 20°F warmer than the egg. This will prevent the egg contents from contracting and producing a vacuum. It will also prevent microscopic bacteria from being pulled by vacuum through the pores of the egg.
- A mild, non-foaming, unscented detergent (e.g., a dishwashing liquid) can be used to wash eggs.

http://www.ext.colostate.edu/pubs/foodnut/09377.html
- UF/IFAS Extension Pinellas County Office
  [http://pinellas.ifas.ufl.edu/](http://pinellas.ifas.ufl.edu/)

- UF/IFAS Solutions for Your Life - Poultry
  [http://solutionsforyourlife.ufl.edu/agriculture/livestock/poultry.html](http://solutionsforyourlife.ufl.edu/agriculture/livestock/poultry.html)
• American Livestock Breeds Conservancy - http://albc-usa.org/
• Backyard Chickens - http://www.backyardchickens.com/
• Build A Chicken Coop Easy: How to Build a Chicken Coop - http://www.buildachickencoopeasy.com/
• 4 H Virtual Farm – Poultry - http://www.sites.ext.vt.edu/virtualfarm/poultry/poultry.html
• Heritage Poultry Conservancy - http://www.heritagepoultry.org/
• The City Chicken.com – http://home.centurytel.net/thecitychicken/index.html