

## Introduction to Animal Science

ANS 3006C

4 credits

### Course prerequisites:

one year of general biology and one year of general chemistry

This course has been approved by the University of Florida College of Veterinary Medicine as satisfying their requirements of an animal science course for incoming veterinary students.

### Course description:

Overview of nutrition, physiology, genetics, growth, and development related to the equine, beef, swine, dairy, aquatic, and poultry industries. Overview of the farm animal, poultry, and aquatic industries. Lab consists on relevant field experiences in these industries.

### Course objectives:

- To help students understand the broad scope of disciplines and opportunities that exist in the animal industry and their contribution to man.
- To help students understand the purpose, proper usage, and impact of various management techniques used in various animal industries.
- To help students develop an insight into the problems and status of animal production.
- To help students realize the affiliation that exists between animal production and other animal agricultural enterprises.
- To develop an appreciation of the meat animal, dairy, poultry, horse and aquatic industries.
- To explore the career of veterinary medicine and to objectively discuss the application procedures.

### Required texts:

*Introduction to Animal Science* by W. Stephen Damron

### Course Evaluation Method:

Exams (4), worth 150 points each =	600 points total
Quizzes (4) worth 25 points each =	100 points
Attendance/Participation =	200 points
A = 90% and above	
B = 80-89% (+ for 88 and 89)	
C = 70-79% (+ for 78 and 79)	
D = 60-69% (+ for 68 and 69)	
F = below 60%	

## Topics:

Introduction/ overview

Nutrition ( 1 session)

Reproduction (2 sessions)

Growth and Development (2 sessions)

Genetics (2 sessions)

Meat animal production (2 sessions)

Sheep and Goats (2 sessions)

Aquaculture (2 sessions) – see attached sample outline of topic

Poultry (2 sessions) – see attached sample outline of topic

Swine (2 sessions)

Equine (3 sessions)

Beef (2 sessions)

Dairy (3 sessions)

## Tentative Lab Schedule

Laboratories are scheduled on select Saturdays, all day (4-5 times during the semester) – announced on first day of class.

### Cattle

Conformation

Judging

Lecture on beef industry / dairy industry

### Equine

Hyperbaric chamber lecture

Discussion with Dr. Reed / operators/surgeries/emergency coverage/intern program

Observe surgery

### Aquaculture – HBOI

Fish research

Turtle research

Dolphin research

### Zoo Animals

Lion Country Safari

### Wild Life Center

**"I" Policy:** A grade of Incomplete will not be awarded except in exceptional circumstances. Consistent with university policy, "Incomplete" will not be awarded to a student whose completed work in the course is of unsatisfactory (D or lower) caliber. If a grade of Incomplete is given, the student will be asked to sign a statement acknowledging terms and time frame under which the incomplete must be removed. A grade of "I" cannot be awarded without such a signed agreement. If the work is not completed in the time frame agreed upon, the "I" grade will be changed to a letter grade, with grades of F awarded to incomplete work.

**Disability Policy Statement:** In compliance with the Americans with Disabilities Act (ADA), students who require special accommodation due to a disability to properly execute course work must register with the Office for Students with Disabilities (OSD) -- in Boca Raton, SU 133 (561-297-3880); in Davie, MOD 1 (954-236-1222); in Jupiter, SR 117 (561-799-8585); or at the Treasure Coast, CO 128 (772-873-3305) – and follow all OSD procedures.

**Code of academic Integrity Policy Statement:** Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the University mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the University community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. Students caught cheating on an examination or plagiarizing on a paper or otherwise violating academic integrity will receive an F in the class and will be reported for academic irregularity. For more information, see the Code of Academic Integrity in the University Regulations at [http://www.fau.edu/regulations/chapter4/4.001\\_Code\\_of\\_Academic\\_Integrity.pdf](http://www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf).



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## MEMORANDUM

**TO:** Ingrid Johanson, PhD  
Associate Dean

**FROM:** David Binninger, PhD  
Associate Professor and Associate Chair  
Department of Biological Sciences

**DATE:** March 22, 2012

**SUBJECT:** *Introduction to Animal Science (ANS 3006C)*

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I am writing as a follow-up to our conversation about the *Introduction of Animal Science (ANS 3006C)* course. While some sections of course will have some overlap with topics taught in different biology courses, none of that overlap would be significant enough to warrant a concern about duplication of a course already offered in biological sciences. We have a fairly large number of pre-veterinary students so I am sure the course will have strong enrollments

Please feel free to contact me if you have questions.

Regards,

A handwritten signature in cursive script, appearing to read 'David Binninger', written in black ink.

Phone: (561) 297-3323

E-mail: [binninge@fau.edu](mailto:binninge@fau.edu)

## Aquaculture

### **The propagation, cultivation, and marketing of fish, shellfish, and plants in the fresh, brackish, and salt water.**

1. Aquaculture is agriculture
  - Farming in the water
  - Hunting = fishing
  - Agriculture is about domestication, where breeding is controlled and organisms are selected for particular traits or qualities
  - Achieved by human intervention involving physical control of the organism at some point in its life cycle other than at harvest
  - Fastest growing segment of agriculture today: growing at about 10% per year
  - Farming implies individual or corporate ownership of the stock being cultivated
  - 1986 USDA recognized aquaculture as agriculture
  - Allows for cheap food production
  - Until recently, aquaculture was really only done for subsistence purposes
  - Mostly done in fresh water, but can be done in salt, brackish
  - Salt water aquaculture occurs in inlets where it is protected
  - Norway has one of the greatest aquaculture industries because of its fjords
  - Chile has a successful aquaculture industry for the same reason
    - has boomed over the past 15 years
    - greatest producer of salmon (salmon is not normally found in the southern hemisphere)
2. All of the seafoods we eat were hunted. Now they are farmed.
3. Chilean seabass, swordfish, tuna are not sustainable- major scarcities
4. Problems in the future may include battles over how to use aquatic resources
5. Where do we draw the line between hunting and farming?
  - Putting an enclosure around and allowing whatever it is inside to grow
  - Anything beyond point-blank harvest is considered agriculture
  - Tuna: Collect juveniles, put them in cage, let them grow, sell and harvest
    - problem is that you are depleting the natural stock
    - Major goal is to close the cycle (go from egg to juvenile, turns into adult, get gametes from adult, grow animals)
    - NOT dependent on wild stock
    - This is considered DOMESTICATION
6. Most organisms worked with today in aquaculture are not domesticated
7. In aquaculture, we don't know of many heritable traits
  - We do know that egg size is a heritable trait
8. We are in infancy with aquaculture as agriculture
  - Most people working in aquaculture are reproductive biologists
  - Have produced literature on how to induce spawning

- Biggest problem: How do we raise the larvae?
    - Bottleneck effect
9. If you catch it, you don't own it.
    - Ownership of a particular animal
      - Who owns what?
      - Major point of contention
  10. Aquaculture is the most efficient way to produce protein
  11. FAO (Food and Agricultural Organization) monitors and assists in agriculture around the world
    - Inducted aquaculture as a form of agriculture to feed the world
  12. Species for aquaculture
    - Finfish: fishes which have fins and usually scales, include all freshwater and marine fish
    - Shellfish: crustaceans and mollusks
    - Crustaceans: invertebrates that molt (shrimp, lobster, crab, crayfish)
    - Mollusks: invertebrates usually with hard shells and a "foot"
    - Seaweeds: aquatic plants of brown, red, and green algae type (protista)
    - Other: aquatic species that are used for aquaculture but their numbers are not significant at this time (sponges, frogs, turtles, alligators)
  13. Why is aquaculture important?
    - FOOD FOR HUMAN CONSUMPTION
    - Food for other aquaculture species (bigger money-wise than human consumption)
    - Recreational fishing (fee fishing, pond stocking, etc)
    - Bait for sportfishing
    - Restoration of natural stock
    - Experimental use (zebra danios)
    - Biological control (aquatic weeds- grass carp)
    - Production of biofuels (algae)
    - Waste water treatment
    - Miscellaneous use (chemicals, skins, sponges, pearls)
    - Ornamental or aquarium species
      - FL is one of the biggest producers in the world
  14. Benefits of aquaculture
    - Supply of seafood is no longer appearing inexhaustible (80-100 metric tons carrying capacity)
    - Species excellent attributes to culture (numbers, growth rates, reproduction, etc)
    - Fish culture can utilize resources that are unsuitable for other forms of agriculture (e.g. salinized farmlands)
    - Fish convert food to body tissues more efficiently than land animals so they will require less energy for protein synthesis
      - Feed is most expensive aspect of farming
      - Feed conversion ratios (lb of feed/lb of meat)
      - Cattle 7-8:1
      - Swine 3-4:1
      - Poultry 2:1

- Catfish 1.5-2:1
  - Salmon 1.1-1.2:1  
(salmon and catfish are the only two aquatic animals that have had an energy budget done)
  - Biggest difference in energy partition between fish and land animals is in maintenance: endotherms vs. ectotherms (heat production and metabolism)
15. Ecological footprint
- All life is dependent upon water
  - Agriculture depends on water (depends on how much we need to produce a particular crop)
  - How much water do we use to provide one pound of meat?
    - Beef 100,000 (grain fed)
    - Beef cattle 43,000
    - Pigs 6,000
    - Broilers 3,500
    - Grains 900-2,000
    - Catfish 6,737
    - Striped bass/trout/salmon 131,538
    - Sturgeon/tillapia 1,419
    - Why does it take so much water to grow fish? Flow through system, non-consumptive water, sometimes too much nutrient output causes pollution
    - In FL you can no longer dump water back into environmental systems
16. China, Japan, India, Korea represent 69% of all aquaculture practices
17. All other countries make up the remaining 31%
18. China's environment is totally destroyed due to poor aquaculture practices
- Production of materials at expense of environment
  - Large scale contamination of resources
  - Expecting a collapse in the Chinese aquaculture system within the next 5-10 years
19. Aquaculture needs interest from people, government support, and geographic support (water)
20. Aquaculture will shift to Latin America
21. Chile and Norway are top producers of salmon in the world. Chile actually produces more than Norway because they bought the technology (salmon is not native to the southern hemisphere)
22. Chicken is cheap and efficient to produce and is the #1 meat consumed in the USA, but aquaculture is expected to surpass this because of its cheapness and efficiency
23. Dependent on canned tuna in the past
- Has shifted
  - Shrimp #1 seafood consumed in America
  - Most of the shrimp in the past was wild caught, now 30% of it is farmed
24. We are beginning to see a static or declining wild fishery and an increase in aquaculture
25. Catfish is the #1 species cultured in this country
- Farmed in marginal lands around the Mississippi
26. Crawfish should be produced instead of marine shrimp
27. Mollusks are produced in Cedar Key, FL



28. Shrimp around the Gulf of Mexico, warm waters, not efficiently produced in this country
29. Tilapia is produced in many US regions
30. Ornamental fish are produced primarily in FL
  - Top aquaculture product
  - Can include plants
  - 70%
31. Florida produces
  - Tropical fish
  - Aquatic plants
  - Clams, oysters
  - Alligators
  - Other food fish
  - Catfish
  - Tilapia
  - Live rock
  - All sportfish
  - 7% is all other aquaculture
32. 7 Billion dollars = cash receipt for sturgeon
33. There are about 200 producers of ornamental fish in FL
  - Carp is #1
  - Hundreds of species of ornamental fish
  - Polyculture: more than one species grown in the same area
34. Mussels and scallops are also popular because they are low on the food chain
35. Life stages
  - Domestication: closing the cycle
  - Fish: egg → larvae → fry → marketable fish → spawners → back to egg
  - Mollusk: D veliger → later veliger → young spat → adult → back to egg
  - Crustacean: egg → nauplius → protozoa → mysis → postlarvae → juvenile → reproductive adult
  - Brood stock = domestication → egg = hatchery → larvae = nursery → subadult = grow out
36. Most important part of aquaculture is the water
  - Inputs and outputs are both going into the water
    - need to worry about maintaining the water
    - limiting factor in water is toxic waste (metabolic products)
    - most toxic output is ammonia in the form of urea (byproduct of protein-Nitrogen metabolism)
    - fish produce and release NH<sub>3</sub> down the concentration gradient
37. Management factors
  - Physical: temperature, flow, level, clarity, and light in the water
  - Chemical: salinity, pH, hardness, conductivity, alkalinity, oxygen, CO<sub>2</sub>, dissolved gases, supersaturation, H<sub>2</sub>S, chlorine, NH<sub>3</sub>, nitrite, nitrate, N, P
  - Biological: crowding, transportation, therapy, bacteria, plankton, algae

- Objective of the farming system is to get what you want, production systems help you do this

38. Extensive versus intensive systems

- Cheaper to produce on an extensive system
- More expensive to produce on an intensive (indoor) system
- Both are dependent on how much you can sell the fish for
- As the environment deteriorates, we move closer to intensive systems

39. Most valuable fishery commodities worldwide (in descending order)

- Caviar sturgeon, ornamental fish, abalones, shark fins, lobsters (live), lobsters (frozen), salmon (smoked), eels (live), crab meat, livers and roes
- Abalone is the most valuable meat
- Sturgeon typifies the aquaculture process
  - Cartilaginous, bony plate, have been around for 150 million years, have no teeth as adults, barbels help it to taste and savor prey, found in the northern hemisphere, anadromous like salmon (catadromous like the eel is the opposite), average size was 1,000 lbs, sturgeon populations have seen a decline and have been brought back artificially

### Poultry

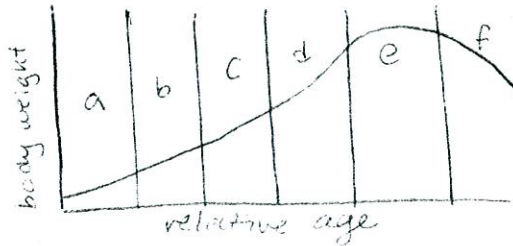
1. Structure of the US poultry industry
  - Same type of birds found all over the world
  - BIG business
2. Genetically speaking, from what bird did all of our domestic chickens of today originate?
  - Red Jungle Fowl
    - congregate
    - establish social orders ( alpha and omega animals)
    - wild, scavenging bird
    - India (3200 BC), were not used for meat
    - China (1400 BC) were not used for meat
    - Brought to Europe for cock fighting and religious rituals (still used in Miami for voodoo, bad because they are bred underground and imported- can bring exotic diseases, viruses)
3. Cockfighting
  - Take off the spur and replace it with an acrylic or a tortoise shell spur
4. Archaeopteryx
  - Origin of ALL birds
  - Means “ancient wind”
  - Feathers (modified scales)
  - How many have been discovered? First was found in 1861 in Bavaria, Germany. 2 feet tall, one pound.
  - Think it glided instead of flying
  - So far about 9 in total have been discovered
5. Everything about the egg is functional in regards to the development of the chick
  - Egg is the largest single cell on the planet
  - Ostrich has the biggest egg
  - Egg develops outside of the body
6. Eggtooth
  - Made of keratin, hard structure- protein
  - Allows baby birds to break through the shell
  - Shell is 98% Ca Carbonate, 2% phosphoric membranes, proteins, and other minerals
7. Insulin
  - Released from the beta cells of the pancreas
  - Decreases blood glucose
  - Has disulfide bridges
  - Promotes deposition of fat, carbs, in the body
  - Increases protein synthesis, associate it with building and storing so that synthesis can occur

- Polypeptide, made up of 51 amino acids in 2 (A & B) chains
8. The hen reproductive tract
    - Ovary, infundibulum, magnum, isthmus, uterus, vagina, cloaca
    - Cloaca = common junction for the digestive, reproductive, urinary tracts; means “common junction” or “sewer”
  9. Salmonella
    - Strain of bacteria that can live in the ovary
    - Any blood spot is removed (blood spots are caused by hemorrhaging when yolk ruptures from the follicle)
    - Fragile with regards to temperature and pH, will die at 140 degrees C for 3 seconds
  10. Leutenizing Hormone
    - Fizzure line
    - Egg will rupture
    - Yolk falls into the infundibulum
    - Fertilization occurs within 30 minutes
    - Uterus = shell gland
    - Magnum = albumen “white” is added
    - Isthmus = where membrane and chalazae are added
      - chalazae is tightly wound protein strand that holds the yolk in the center of the egg for 21 days, large chalazae is an indicator that the egg is fresh
  11. There is no better protein on the planet than meat, milk, and eggs
  12. Over time, water leaves the egg and increases size of the air cell. If egg sinks in water, it is fresh.
  13. Shell of the egg will weigh 5-6 grams
    - 98% mineral
    - 38% calcium (2-2.2 grams of Ca)
  14. Sperm glands = “sperm nests”
    - Invaginations in the wall of the reproductive tract
    - Sperm get into invaginations, can live for up to 2 weeks in the “nests”
  15. Egg is made up of mostly lipid
  16. As a chick uses nutrients, egg cell gets bigger
  17. Germinal disk
    - Where sperm unites with the germ from the female and fertilization occurs
    - Called the germ spot
  18. Egg incubation times
    - We can control to the hour when we want the animals to hatch
    - Chicken (chick) ~21 days
    - Turkey (polt) ~28 days
    - Duck (ducking) ~28 days
    - Quail ~24 days
  19. Fertilization occurs at the germ spot
    - The egg is a closed environment
  20. Population growth is 100 million/year
    - Protein consumption per capita per day

- developed countries ~65 grams
- developing countries ~15 grams
- as population increases, need more protein; as per capita increases protein consumption increases

## 21. Animal growth curve

- A = neonate
- B = juvenile
- C = adolescent
- D = young adult
- E = adult
- F = old



\* there are differences in the growth of bone, fat, and muscle all along this curve

22. During the neonate period, following hatch, the chick is adapting metabolically

## 23. Poultry industry structure

- Birds used for meat are processed during the juvenile stage
- Two major sectors: meat, eggs
- Meat sector
  - broiler
  - turkey
- Egg sector
  - White eggs = white leghorn (not a broiler)
  - Brown eggs = brown egg layer

24. If you look at a chicken, and it has red/brown earlobes, 90% of the time, these birds lay brown eggs

- Why do some birds lay brown eggs?
  - shell glands secrete pigments (a break down product of red blood cells)
  - pigment is put on the surface of the shell in the uterus
  - gives it a brown coloration
  - put on the egg during the last 4 hours of shell formation
  - nutritionally, there is no difference between a white and brown egg

25. A chicken egg requires 21 days to incubate and hatch

- After 7 days of storage the hatchability goes down by 0.5% per day

## 26. Physiological zero

- Germ development does not occur until all eggs reach the same temperature
- Eggs can be different ages and still hatch at the same time
- Tapping on the inside of the shell speeds up the development of the other eggs (eggs communicate)

## 27. On growth curve

- Juvenile stage
  - 1) 4 week old bird (Cornish game hen- niche market)
  - 2) fast food, cut-up, portion tray pack (36-42 days old)
  - 3) further processing, 63 days old (breast meat)

28. Balute = to kill an embryo after 26 days by boiling it

29. Switch chicks from a high lipid to a high carb diet immediately

30. We know more about the nutrient and energy requirements for poultry than for any other animal
  - Know amino acid requirements to the 3<sup>rd</sup> decimal point
31. Parents are the only birds allowed to grow past the juvenile stage on the growth curve
32. Broilers = meat chickens
  - Broiler breeders = parents of the broilers; lay eggs
    - don't lay as many eggs as egg layers
    - about 160 eggs/year
33. Males are selected for growth
  - Males grow faster than females
34. Females are especially selected for eggs
  - But not too many because the shell will lose body mass
35. Size of "keel" has increased in muscle content since 1957
36. A kilo is 2.2 lbs, the average weight for market is about 3 lbs
37. We have about 60 breeds of chickens in the world
  - Meat, eggs, pets (ornamental)
  - 3 main types of chickens
  - Today who does all the breeding to produce the genetic stock of meat and egg-type birds?
    - primary breeders
    - the heart of today's poultry industry
38. No other food animal industry has the degree of centralization of breeding provided by the poultry industry's "primary breeders"
  - Elite when it comes to genetic selection
39. Goal of primary producers is to make a profit on improving genetic performance capabilities of different strains and maintaining sufficient numbers of these improved strains to sell worldwide
40. Will begin selected for feed efficiency
  - 80% of the cost of meat goes into buying feed for the animals
41. The USA will produce 9.5 million broilers this year
42. Breeding pyramid (from top to bottom)
  - Elite → GGP's → GP's → Parent stock → commercial broilers and layers
  - Major genetic selection for desired traits happens in the elite and GGP sections
  - US and the UK provide breeding stock in the GP's and parent stock
  - The further up you go on the pyramid, the cleaner it gets (more biosecurity)
  - Best disease control is at the top of the pyramid
43. In poultry houses, water and feed lines drop down from the ceiling
44. There is a proper floor space that houses have to abide by
45. Chicks are hatched and shipped to the House (100 chicks/box)
  - Do not want corners in the chicken house (#1 rule)
  - Can cause chicks to crowd in and suffocate
  - Rounded edges instead
46. Litter is what you have once bedding is soiled
  - Best bedding is wood shavings
  - Also called "broiler litter"

- laying hens are kept in cages
  - broilers are kept on the floor
  - good fertilizer (lots of N, P)
  - good fertilizer for pine trees
  - can burn it for energy
  - can compost it, changes it to broiler litter compost, different material, no longer has animal feces (140-160 degrees F, encourages thermophilic bacteria)
  - composted broiler litter is biologically stable organic matter, can use it for cattle feed
47. What is a food item today that is cheaper than it was in the 60s?
- Accounting for inflation, on a per pound basis at the retail level broiler prices are half the price that they were in 1966
  - Why?
    - breeding (intense genetic selection)
    - bird health (biosecurity)
    - equipment
    - management
    - processing
    - marketing technology
    - nutrition
48. Today on an average, people eat 90 lbs of chicken per capita
49. In 1955 100% of broilers were sold whole (intact), today less than 5% of birds are sold whole
50. If you buy it cut up, you add about 40 cents per pound because of the cost for the added processing
- Value added products
  - Do something else to add value
51. There are over 300 different products
52. Breast meat
- Pectoralis major and pectoralis minor
    - in all birds the pectoralis major has one function: to flap downward quickly
    - pectoralis minor causes upward motion of wings, less strong, marketed as chicken tenders
53. Poultry industry trends
- \$2 per pound in 1955
  - <\$1 per pound in 2008
  - 3 As when we talk about chicken: Affordable, Available, Appealing
  - There are no religious barriers to chicken
54. World poultry consumption represents 1/3 of all meat consumed per year
- Most versatile meat
55. Demand for poultry increases each year
- Problem in the future is going to be supplying enough grain to feed poultry
56. Poultry bypassed beef and pork in the 1980s because of marketing methods
- In 1965 most marketed birds were whole birds
  - Today cut up parts are marketed most

- Convenience products, mainly why poultry bypassed beef
57. 9.5 billion broilers produced in 2008
  58. 6.5 billion dozen table eggs produced this year
  59. 17 million metric tons of processed meat produced this year
  60. White meat stays in the USA while dark meat is exported to other countries
    - 16% of total US production
    - considered a waste product
    - Russia buys the most legs and thighs from us
      - “Bush Legs” which Russia boycotted
  61. White meat is leaner and has less fat and less blood than dark meat
  62. Leg quarters in the US broiler industry are considered a waste product and 95% is exported
    - Research is being done to take the dark meat and convert it to white meat
  63. Money in the industry is in the breast meat, feet are shipped to China
  64. TREND
    - Genetic selection
    - Money is in efficiency
      - Companies are selecting for birds with high feed efficiency
    - Young birds put down muscle and bone
      - Muscle is about 75% water and water is cheap
    - When animals put down fat, production becomes inefficient
  65. Larger birds means more meat for the deboning market
  66. The broiler belt
    - Texas, Oklahoma, Arkansas, Mississippi, Alabama, Georgia, Florida, Tennessee, South Carolina, North Carolina, Kentucky, Virginia, Maryland, Pennsylvania
    - The farther north you go, the more energy you need to keep the birds warm
  67. Three major companies
    - 1) Pilgrims Pride
    - 2) Tyson Foods
    - 3) Perdue Farms
    - Major companies buy by the pound and sell by the piece
    - Pilgrims Pride processes 280 lbs of broiler per second 24/7/365 in order to keep up with US demands
  68. 60% of the cost of raising a broiler is in the chicken house
    - Integrated industry
    - Contract farming (industry today)
  69. Corn = major energy source
  70. Soybean meal is the major protein source
    - What the US poultry industry is based on
    - Well balanced diet = rapid growth
  71. What 2 words represent the structure of the US broiler industry?
    - VERTICAL INTEGRATION
    - Companies and farmers are responsible for certain things
    - Not going to get rich off of the poultry industry
  72. The grower



- Contract farmer
  - owns chicken house
  - owns land and lives on land
  - has to furnish labor to take care of the birds
  - responsible for getting money to build the chicken house, put equipment in the chicken house
  - responsible for finding bedding, getting rid of litter
  - 60% of the cost of poultry is on the side of the grower

#### 73. Poultry company

- Doesn't want to be associated with the land
  - owns hatchery
  - owns birds
  - owns feed and feed mills
  - hire service persons
  - processing plant
  - marketing
  - final product distribution
  - responsible for genetics

#### 74. Pullets and layers

- Goal is the largest amount of eggs with the best quality
- Pullet is a young bird that has not reached sexual maturity (reach sexual maturity at 18 weeks)
- Can control sexual maturity by lighting but don't want to give light before they reach enough body weight because once it is mature, the bird will not gain any more weight
  - All nutrients go towards making eggs at that point

#### 75. Birds have both estrogen and testosterone

- Combs
  - testosterone

#### 76. Layers

- First 2 weeks
  - small eggs (small amount)
  - go to breaker plant
- Medium and large to follow

77. Today the white leghorn hen is capable of laying an average of 330 eggs per year

78. Egg consumption peaked in 1955 and slowly declined due to concerns about cholesterol. (300 per capita in 1955, 200 per capita in 1968 consumed) Now egg consumption is rising again with 265 eggs consumed per capita in 2008.

79. Vitamin D and steroid hormones are made from cholesterol

#### 80. Pullet growing houses

- All automated
- Humans never touch the eggs or the birds
- Lots of biosecurity

#### 81. Rule about lighting in the chicken house

- If you can hold something at arms length and still read it, there is enough light

#### 82. Layer complex

- “In line”
  - everything is in a line, carries eggs from where they are laid to the processing plant
    - Egg stays on conveyor belt the whole time
  - do not have in-line in broiler plants, only layers
  - The US will produce about 6.5 million eggs in a year
83. Eggs are weight individually and stored by law at 45 degrees F until they reach the consumer because they want to keep down microbial growth
84. Egg breakout
- 3 components: shell, albumen, yolk
  - albumen is in egg
  - albumen is a protein in blood
  - yolk and albumen is separated, collected, stored, pasteurized
  - The consumer can buy whites, dried albumen, dried yolks, etc.
85. What are the eggs greatest enemies?
- Gravity
  - Temperature
  - Age
86. Egg processing plant
- Weighing and packaging
  - Machines put eggs into carriers
87. Egg quality deficiencies
- “yolk shadow”
  - grade
  - as eggs age, the yolk migrates from the center of the egg towards the shell
    - yolk is filled with lipids and most of the egg is water and protein
    - as egg ages, chalazae break down and the egg yolk floats to the top
88. An egg ages, water leaves and is replaced by air. Creates the air cell
- 10,000 pores at the end of the egg shell
89. Sometimes a capillary near the egg will break and fall into the infandibulum
- Shell is built around the yolk and the blood
  - Causes blood spot in the egg
90. Shell factors
- Cleanliness and shape
91. Not many contract egg farmers (“designer” eggs)
92. Hy-line and Dekalb are two of the largest egg companies
93. USDA grades
- AA>A>B
94. Raymond Haugh (1937)
- Micrometer
  - Internal egg quality for albumen
    - The higher the albumen stands when the egg is cracked open on a surface, the better quality of the egg (because of pH)
  - Haugh units
95. Egg sizes (oz per dozen)

- Jumbo (30), XL (27), L (24), M (21), S (18), peewee (15)
  - Peewee eggs are the first eggs that are laid (about the size of a marble)
96. The turkey industry
- 271 million turkeys produced this year
  - we debone the majority of our turkey
  - injected birds (inject marinade into meat)
97. Why would per capita consumption increase from 5 lbs in 1990 to 20 lbs in 2008?
- Turkey industry learned from broiler industry
  - Value added products
  - Deboned turkey meat
    - further processing (ground, bologna, sausage, etc)
98. Bronze turkey versus broad breasted white
- Difference is the feather color
  - Desirable to have white feathers
    - isolated mutant gene in the bronze turkey
    - dark pin feathers leave a black speck in meat sometimes (not as appealing)
99. Male turkeys are called "toms"
- Tom is much larger than a female
100. 100% of the turkey industry uses AI
- males are too heavy to mate naturally
  - do not freeze turkey semen
101. Young turkey is called a "Polt"
- Today's modern turkey will grow at a rate of about 1 kilogram per week on average (very fast)
  - Marketed between 15 and 25 weeks of age
  - White turkeys grow much bigger than wild turkeys because of genetic selection
102. The skin hanging from the top of a turkeys beak is called a "snood"
- Sexual attraction (colorful)
  - Heat dissipation
103. Per capita consumption in the United States
- Broilers: 90 lbs
  - Eggs: 260 lbs
  - Turkey: 20 lbs
104. The poultry industry is very dynamic
- Genetics for rapid growth is changing every year
105. Major poultry states
- Broilers
    - 1) Georgia
    - 2) Arkansas
    - 3) Alabama
  - Turkeys
    - 1) Minnesota
    - 2) North Carolina
    - 3) Missouri
  - Eggs

- 1) Iowa
- 2) Ohio
- 3) Pennsylvania

\*States may flip-flop from one year to the next but generally stay the same