Eggs

F+N 202

Eggs outline

- Functions of eggs
- Egg structure
- Egg defects
- Egg grades
- Egg storage and preservation

Eggs outline

- Sizing
- Properties and food uses
- Foams
- Heat coagulation

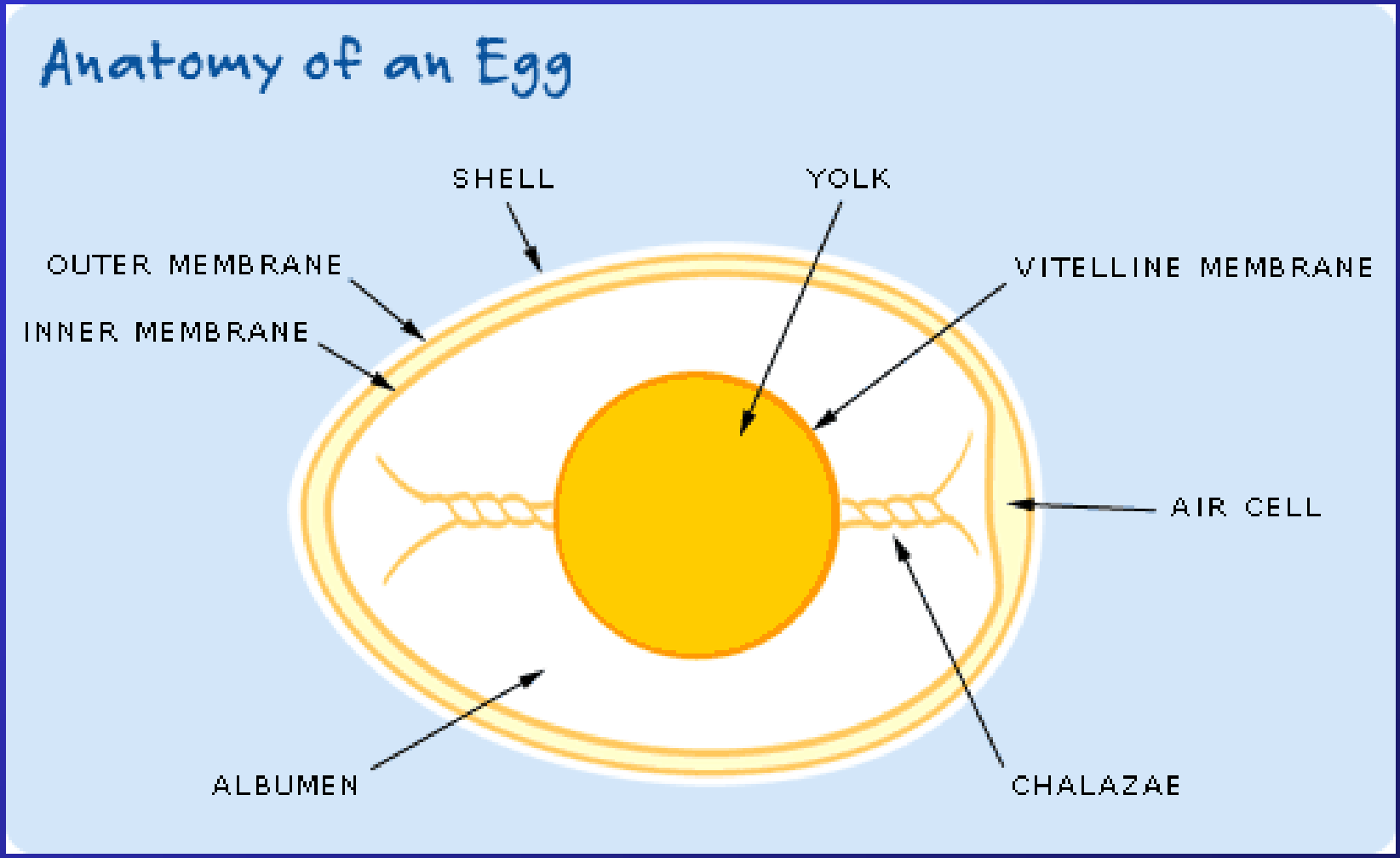
Egg functions

- Binding
  - Meatloaf
- Coating
  - Breading for deep fat frying
- Thickening
  - Custards
- Leavening
  - Soufflés, meringues

Egg structure

Image courtesy of www2.hawaii.edu/lynn/chapter11.html

Egg Structure



Egg structure

- Shell
  - Porous
  - Gas and water exchange with the atmosphere
- Air cell
  - The older the egg, the larger the air cell
- White
  - 7/8 water and about 1/8 protein (albumin)
  - Also, contains sulfur, potassium, sodium, and chloride

Egg structure

- Yolk
  - 1/2 water
  - 1/6 protein
  - 1/3 fat
  - emulsifiers (lecithin)
  - Phosphorus, iron, and carotenoid pigments (Xanthophylls, primarily lutein. These are Vitamin A precursors.)

Egg defects

- Very susceptible to bacterial spoilage, especially Salmonella
- Blood spots in yolk - remove manually
- Most physical egg defects are detected by the candling process

Egg grades

- AA
- A
- B
- AA is the highest grade, B is the lowest
- Grade is not related to safety for consumption

Egg grade depends on

- Shell color and uniformity
- Air cell size
- White and yolk quality

Profiles of fresh and stale eggs

Fresh

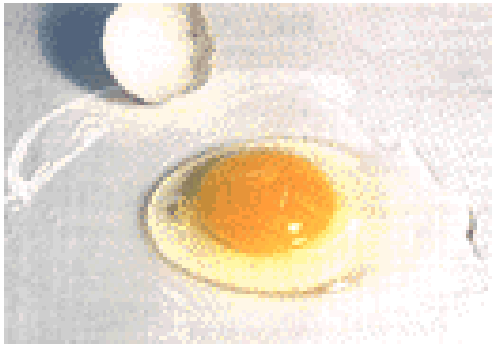
Stale

A fresh egg

Note high-standing white, both thin and thick type

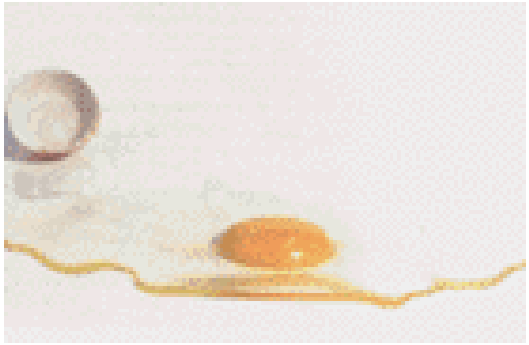
Image courtesy of www2.hawaii.edu/lynn/chapter11.html

Fresh vs. stale



Above - FRESH EGG

Below - STALE EGG



Changes in eggs during aging

- The amount of thin white increases
- The yolk absorbs water from the white
- The chalaza disintegrate
- There is a loss of water through the shell
- There is an increase in the air cell size
- Both the white and the yolk increase in pH

Egg storage and preservation

- Refrigeration
  - Primary concern - Salmonella infection
  - Under controlled refrigeration, eggs may be stored up to 6 months
  - Under normal home refrigeration, storage time is only 1-2 weeks
  - Don't store at room temperature!

Egg storage and preservation

- Pasteurization
  - Aim - to destroy pathogenic bacteria but not alter the functional properties of the egg proteins
  - Whole egg - 60-61.5^{o}C for 3.5 minutes
  - White - same time but add aluminum sulfate and lactic acid to prevent denaturation and process at 52-55^{o}C
  - Alternatively, may add sodium polyphosphate instead of the Al salt and lactic acid

Egg storage and preservation

- Freezing
  - White -- OK, no change in quality
  - Whole -- OK without additives, but better if salt or corn syrup is added to stabilize egg proteins
  - Yolk -- alone, becomes gummy and non-functional. OK if you add sugar, salt, or corn syrup to protect proteins

Egg storage and preservation

- Drying
  - Whole -- store at low temperature and low relative humidity
  - White -- to maintain good color, remove small amounts of naturally occurring D-glucose by treatment with glucose oxidase
  - This treatment prevents Maillard browning
  - Usage -- reconstitute with water or sift with other dry ingredients before adding liquid

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Nutritive value and functional properties of preserved eggs

- Nutritive value
  - Nearly the same as fresh
- Functional properties
  - Almost as good as fresh, except for frozen yolks
- Lightning Quiz

Egg sizing

- Pee wee - 15 ounces/dozen
- Small - 18 ounces/dozen
- Medium - 21 ounces/dozen
- Large - 24 ounces/dozen
- Extra large - 27 ounces/dozen
- Jumbo - 30 ounces/dozen
- For most recipes, when it calls for an egg, it means a large egg

Egg values

- To determines the best buy in eggs, calculate the cost per ounce
  - Medium: $1.09/dz = 5.19 cents/ounce
  - Large: $1.19/dz = 4.96 cents/ounce
  - Extra large: $1.25/dz = 4.63 cents/ounce

Egg properties and uses

- Emulsifiers
  - Yolk phospholipids (lecithin)
  - In mayonnaise, baked products, cream puffs
- Egg foams
  - Whip ----------> incorporate air to make a foam
  - Whites, yolks, and whole eggs will all whip but whites will incorporate the most air
  - Examples: soufflés, meringues

Chocolate souffle

Image courtesy of www.foodwine.com/food/eggs/eggo298/souffle.html

Meringues

- Soft
  - 2T of sugar/egg white
- Aim: To make a stable and safe product
- To accomplish
  - Beat to stiff peak
  - Add acid (cream of tartar)
  - Bake to destroy bacteria (350-375°F, 15 minutes)

Egg white foam stages

Foamy

Soft peak

Stiff peak

Image courtesy of www2.hawaii.edu/lynn/chapter11.html

Whipping egg whites

Soft meringues

Image courtesy of www.onwis.com/news/sunday/food/0216meringue.html

Meringues

- Hard
  - 4T of sugar/egg white +acid
- Beat until very stiff, almost dry
  - Bake dry -- low temperature (200°F) for a long time (45 minutes to 1 hour)

Heat coagulation of eggs

- Poached, soft-cooked, hard-cooked, scrambled, fried, omelets, soufflés, custards
- Coagulation temperature
  - White = 65°C
  - Yolk = 70°C

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Egg protein denaturation and coagulation

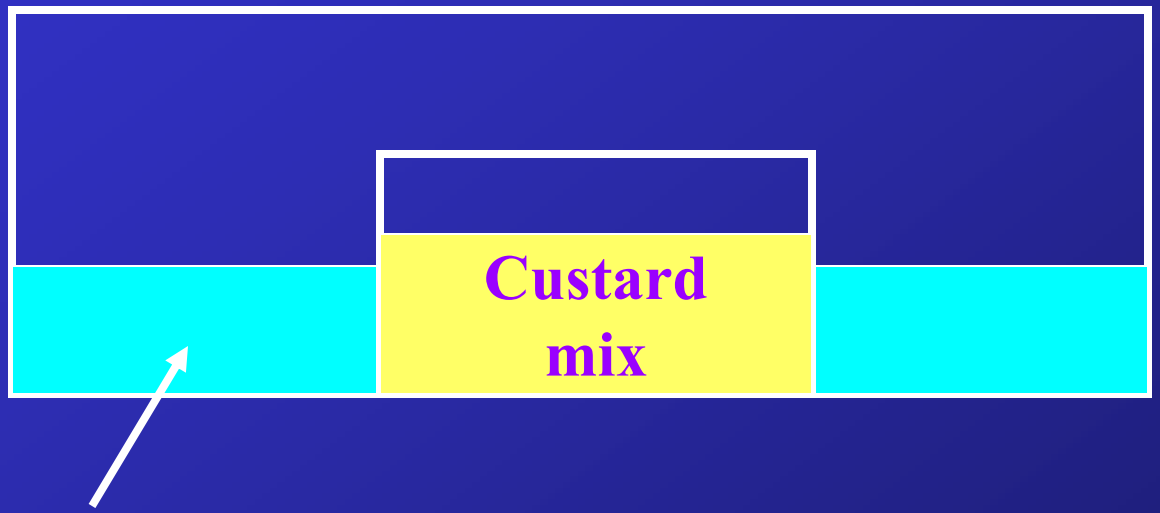
Hard cooked egg principles

- Don’t need to boil
- Ideal cooking temperature is about 85°C
- Cool quickly after cooking to avoid overcooking (e.g., greenish ring around the yolk [iron sulfide] and a rubbery white)

Greenish FeS ring around yolk

Image courtesy of www2.hawaii.edu/lynn/chapter11.html

Custard cookery



Cooking custards in a pan of water ensures even heat penetration into the custard and a temperature of no more than 212°F (except on the surface). Custards are normally baked at 350°F.

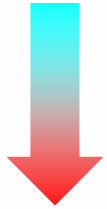
Custard types

- Stirred
  - Gel formation is interrupted by stirring before the gel is totally set
- Baked
  - Gel is not stirred during the baking process

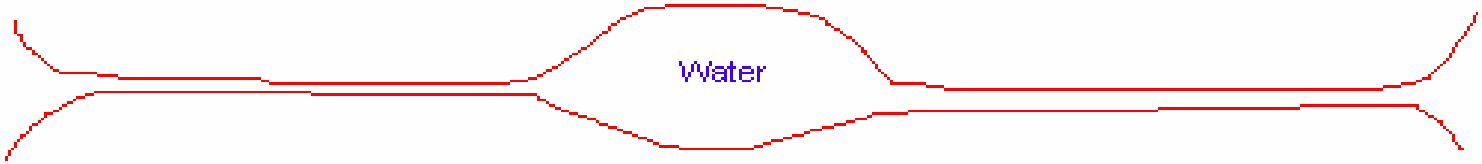
Syneresis

- If custards (or almost any other primarily egg dish) are overcooked the proteins are overdenatured and overcoagulated
- Tunnels appear in the gel and the gel loses water
- This is syneresis

Syneresis



→ loss of water



Effect of other ingredients on egg cooking time

- Sugar
  - Increases coagulation temperature and cooking time
- Acid
  - Decreases coagulation temperature and cooking time
- Less egg
  - Increases coagulation temperature and cooking time
- Lightning Quiz