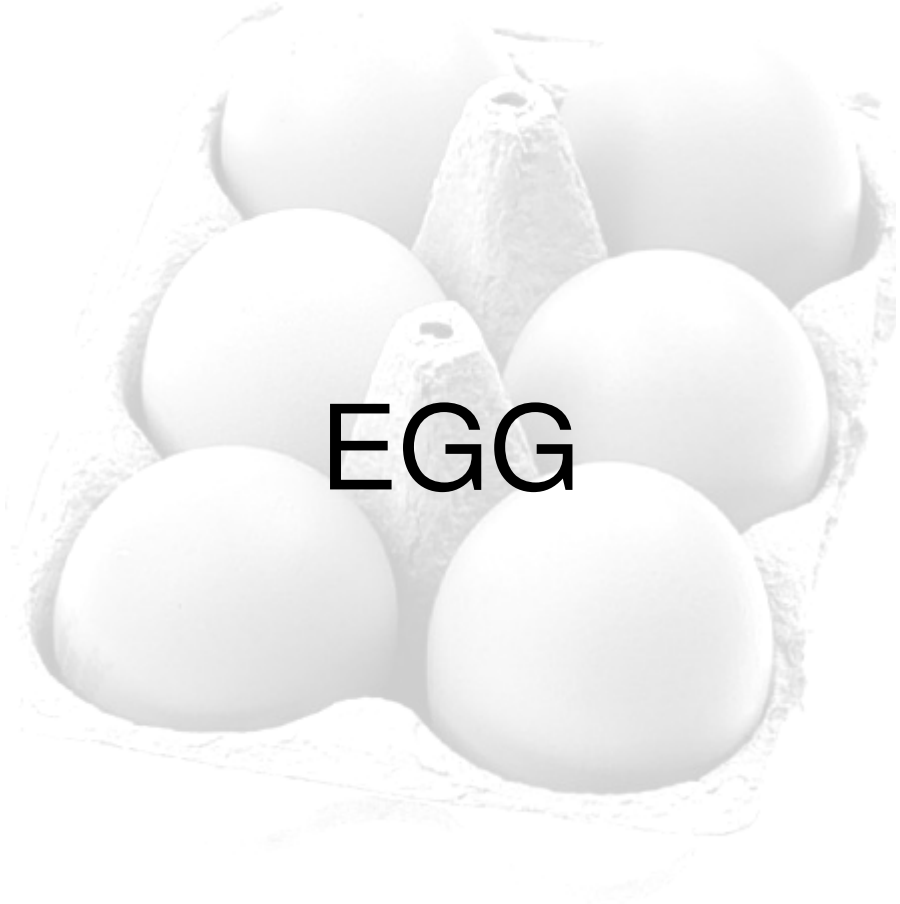
**Food Material Science 2012/2013**
**Inneke Hantoro**



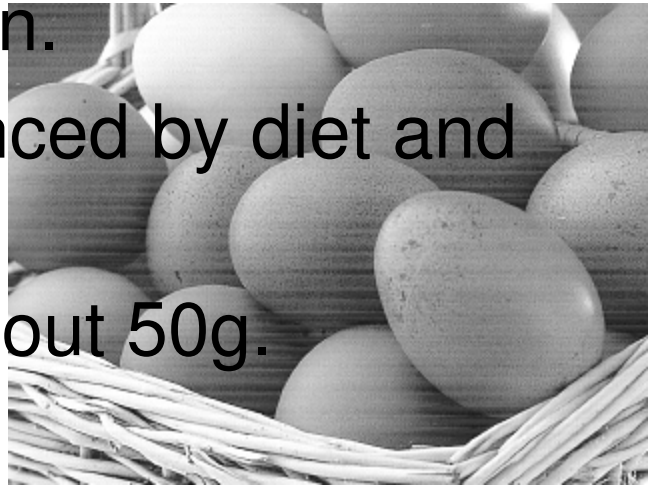
# EGG

# Introduction

- Special strains of chicken are breed for large-scale egg production.
- The moment egg is laid, physical and chemical changes begin to reduce freshness.
- Eggs are usually kept in refrigerator (between 5$^{o}$C and 7$^{o}$C). Egg (in shell) can be kept in refrigerator for 4-5 weeks.

# Type of Eggs

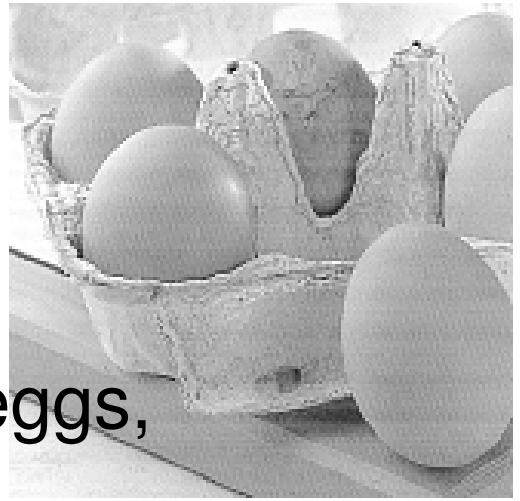
- Hen's eggs
  - There are brown eggs and white eggs --- is there any difference between these kinds of eggs?
  - No difference in the nutritional value of white or brown eggs. The color of the shell is determined by the breed of hen.
  - The color of egg yolk is influenced by diet and feed.
  - A medium hen's egg weigh about 50g.



# Type of Eggs 2

- Quail's eggs
  - The size is about 1/3 of the size of hen's eggs.
  - They are the smallest of all commercial eggs.
  - They have dark[illegible]d pale shells.

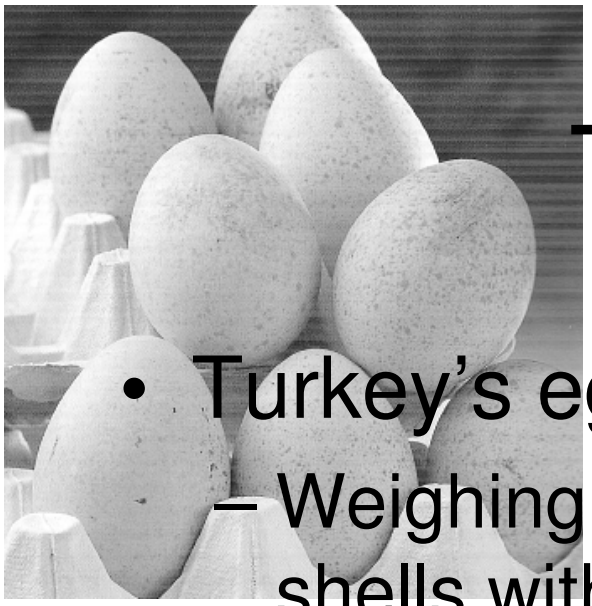
# Type of Eggs 3



- Duck Eggs
  - The eggs are bigger than hen's eggs, weighing about 90 g.
  - The shell color can vary from shades of very pale green-blue to white.
  - They have a slight higher fat content and oilier texture than hen's eggs, and also are richer in flavor.
  - The whites are firmer and slightly rubbery in texture when set, so they aren't to everyone taste when plainly cooked.

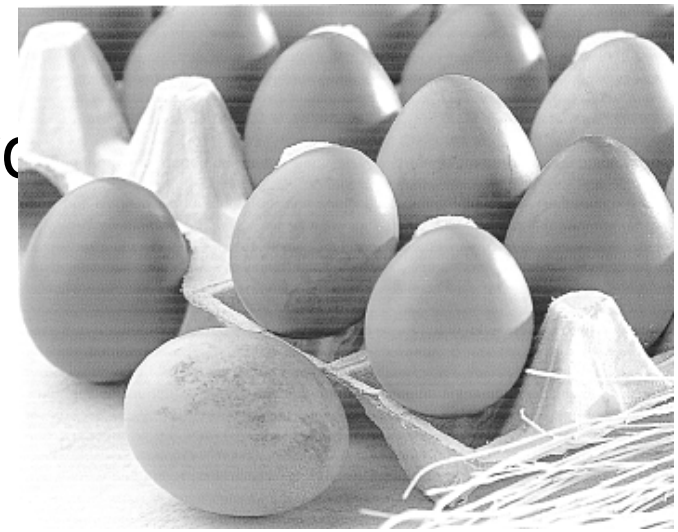
# Type of Eggs 4

- Goose eggs
  - Their eggs are at least twice the size of hen's eggs, weighing about 200 g each, and a pure, chalky white.
  - The shells are usually very hard.
  - Although they are stronger in flavor than hen's eggs, goose eggs are slightly milder than duck eggs.



# Type of Eggs 5

- Turkey's eggs
  - Weighing about 75 g and have creamy white shells with light brown speckles.
- Pheasant eggs
  - They vary in color, from buff to green-blue or olive and can be speckled.
  - They have quite a strong flavo

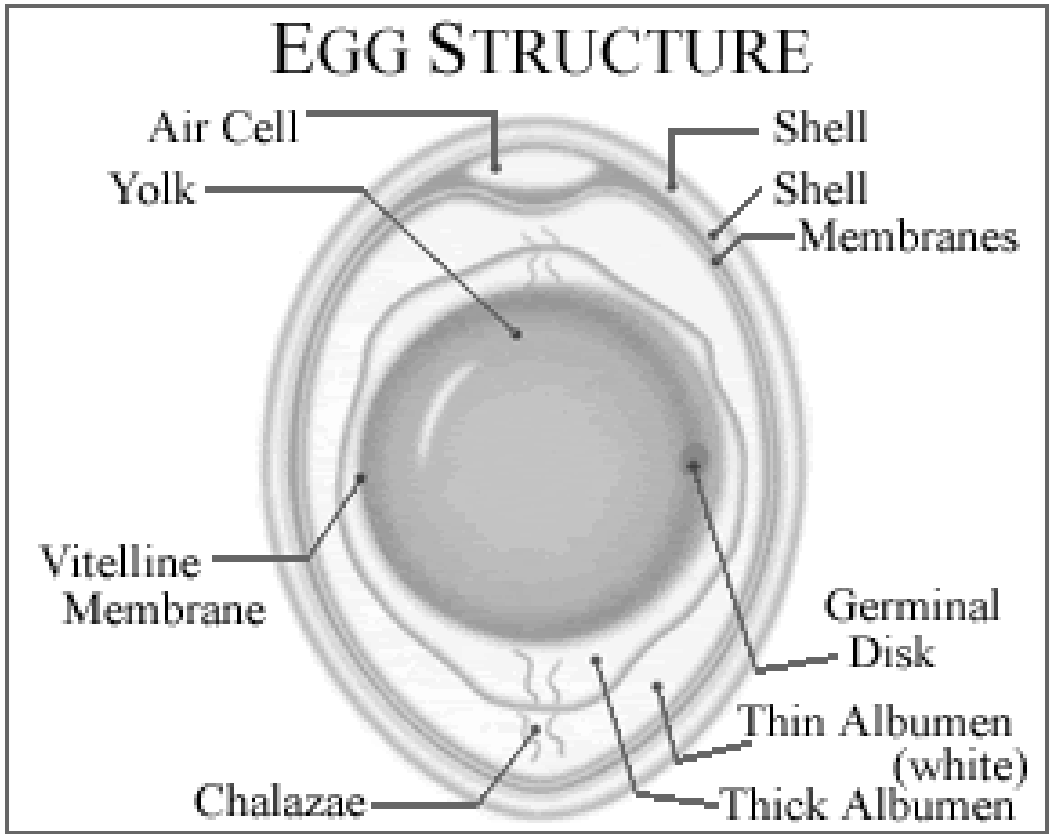


# Type of Eggs 6

- Ostrich Eggs
  - An ostrich eggs weigh 450g or more.
  - It has a comparatively strong flavor.
  - The pale shells are very thick and hard to crack.
- Emu Eggs
  - Emus are occasionally farmed for their meat and eggs.
  - The shell's color is dark blue green and very hard.

# Formation and Structure

- The structure and characteristics of an egg include its color, shell, white, yolk, air cell, chalazae, germinal disc, and membrane.



- Shell
  - The color comes from pigments in the outer layer of the shell and may range in various breeds from white to deep brown.
  - Composed of calcium carbonate (94%) and small amounts of magnesium carbonate, calcium phosphate, and other organic matters.
  - It can prevent egg from bacterial contamination.
- Albumen
  - Egg albumen in raw eggs is opalescent and does not appear white until it is beaten or cooked.
  - A yellow or greenish cast in raw white may indicate the presence of riboflavin.
  - The cloudiness of the raw white is due to the presence of $CO_2$ that has not had time to escape through the shell --- indicates a very fresh egg.

- Yolk
  - The color depends on the diet of the hen.
  - Some customers prefer gold or lemon colored.
  - Yolk pigments are relatively stable and are not changed during cooking.
- Air cell
  - The empty space between white and shell at the large end of the egg.
  - When an egg is first laid, it is warm. As it cools, the contents contract and the inner shell membrane separates from the outer shell membrane to form the air cell.

- Chalazae
  - Ropey strands of egg white that anchor the yolk in place in the center of the thick white.
  - They are neither imperfections nor beginning embryos.
  - The more prominent the chalazae, the fresher the egg.
- Germinal Disc
  - The germinal disc is the channel leading to the center of yolk.

- Membranes
  - There two membranes inside the cell, inner and outer.
  - After the egg is laid and it begins to cool, an air cell forms between these two layers at the large end of the egg.
  - The vitaline membrane is the covering  of the yolk. Its strength protects the yolk from breaking.
  - The vitaline tends to become more fragile as the egg ages.

# Egg Composition

- The whole mixed egg contains about 65% of water, 12% protein, and 11% fat
- The yolk make up about 33% of the liquid weight of the egg. It contains all the fat in the egg and a little less than half of the protein.
- The yolk contains a higher proportion of the egg's vitamins than the white.
- The yolk also contains more P, Mn, Fe, I, Cu, Ca than albumen. And it also contains Zn.

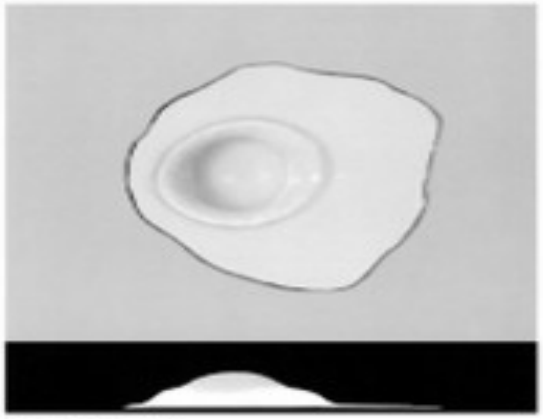
# Egg Composition

- Albumen contains more protein, niacin, riboflavin, Cl, Mg, K, Na and S.
- Protein from albumen and yolk provides a high quality protein containing all the essential amino acids.
- Albumen is more opalescent than truly white. The cloudy appearance comes from $CO_2$. As the egg ages, $CO_2$ escapes, so the albumen of older eggs is more transparent than that of fresher eggs.

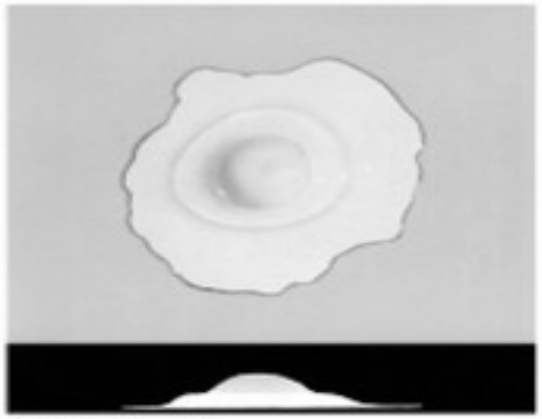
# Grading

- Eggs are examined for both interior and exterior quality and are sorted according to weight (size).
- No different nutritive value exists between the different grades.
- Based on USDA, eggs are graded into:
  - Grade AA
    - When cracked on the surface, egg will stand up tall.
    - The yolk is firm
    - The area covered by the white is small.
    - A large proportion of thick white to thin white exists.
    - The shell is clean and unbroken.

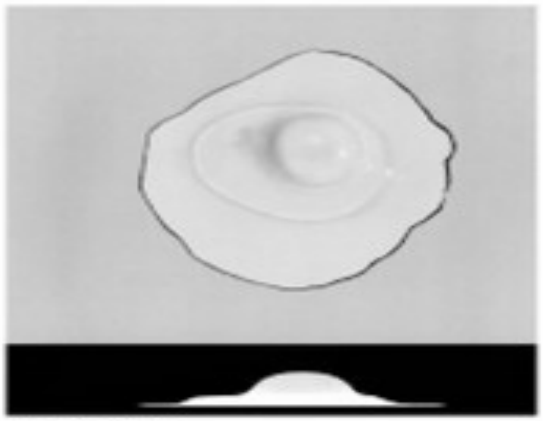
- Grade A
  - When cracked onto a surface, a grade A egg covers a relatively small area.
  - The yolk is round and upstanding.
  - The thick white is large in proportion to the thin white and stands fairly well around the yolk.
  - The shell is clean and unbroken.
- Grade B
  - When cracked onto a surface, a grade B egg spreads out more.
  - The yolk is flattened and there is about as much (or more) thin white as thick white.
  - The shell has an abnormal shape and unbroken.



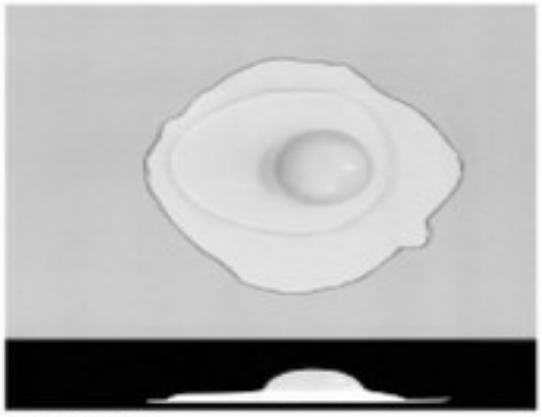
1. High "AA"



2. Average "AA"

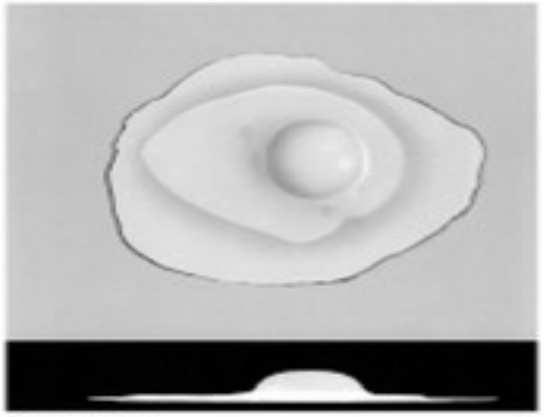


3. Low "AA"

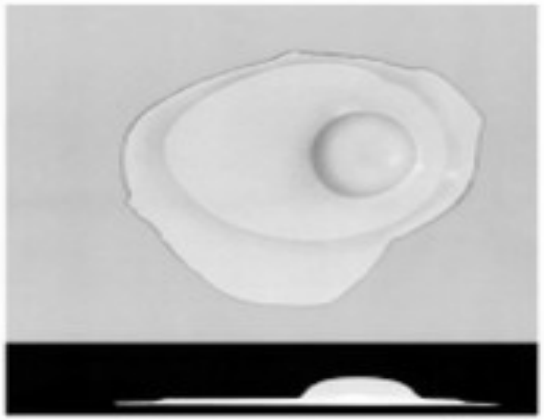


4. High "A"

5. Average "A"

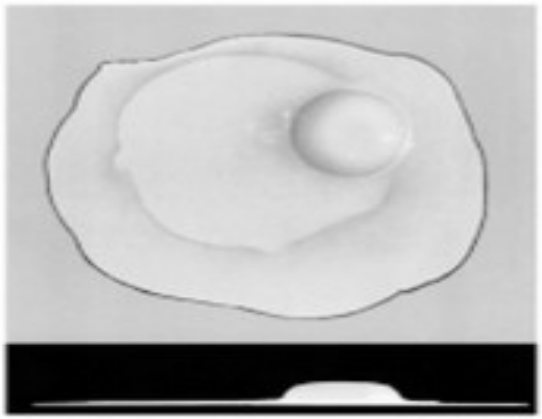


6. Low "A"



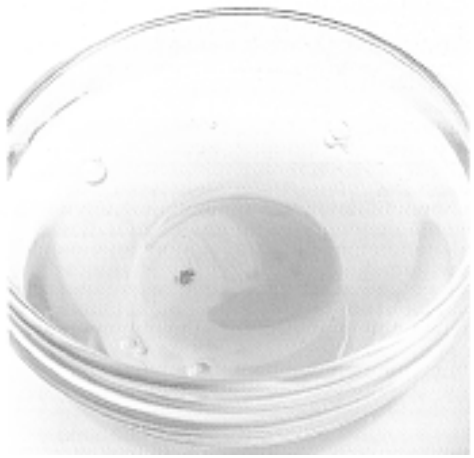
7. High "B"

8. Average "B"



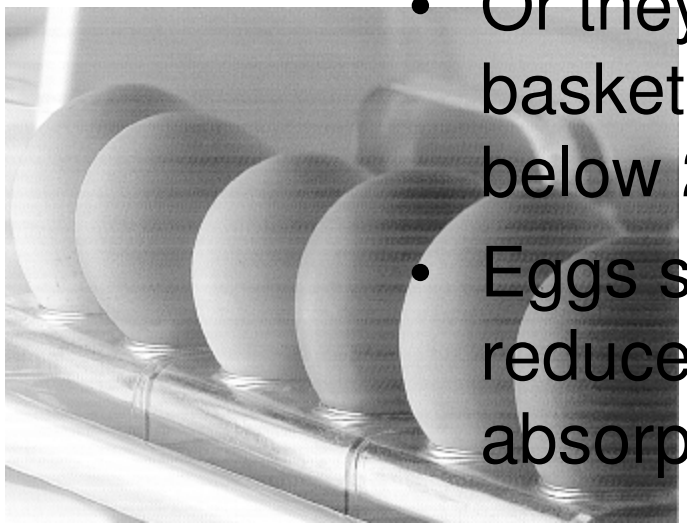
9. Low "B"

- Blood spots
  - These are occasionally found on an egg yolk.
  - These spots do not indicate a fertilized egg, but the rupture of blood vessel on the yolk surface during formation of the egg.
  - Less than 1% of all eggs produced have blood spots.



# Storing Fresh Eggs

- Egg shells are porous, making eggs vulnerable to bacteria and odors, which can be absorbed by the egg.
- They should be stored in their box or in a special egg compartment in the fridge, at or below 4°C (for 3-4 weeks).
- Or they can be stored for about a week in a basket, as long as the temperature is at or below 20°C.
- Eggs should be stored pointed end to down to reduce evaporation and help to stop the absorption of odors.



# Testing For Freshness

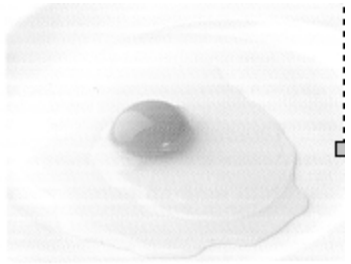
- As soon as the egg is laid, moisture begins to evaporate through the porous shell.
- Air enters the egg and starts the natural process of deterioration. The warmer the egg, the faster the rate of deterioration.
- As the egg ages, the membranes that separate the various elements of the egg begin to soften, causing the egg to become flabby.

# Testing For Freshness 2

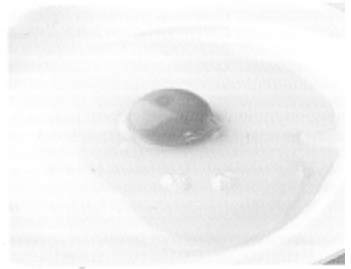
- Although freshness doesn't influence the nutritional value of eggs, it does affect their cooking quality.
- Older egg spread, looking flatter and flabbier when fried, but they are easier to peel when hard-boiled (the air sac will have grown larger pushing the egg further from the shell).
- A fresh one will have a plump rounded yolk, sitting up well within two distinct layers of white.

# Testing For Freshness 3

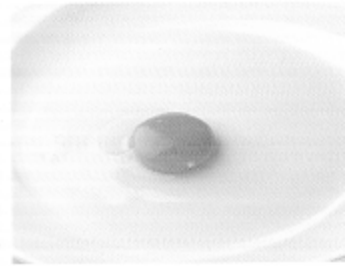
- A 10-12 day old egg will have a far flatter yolk and less definition between two layers of white.
- A 21-28 day old egg will have lost definition between separate layers of white, which will have relaxed and blended into each other.



*Above: A very fresh egg has a plump yolk and two distinct layers of white.*



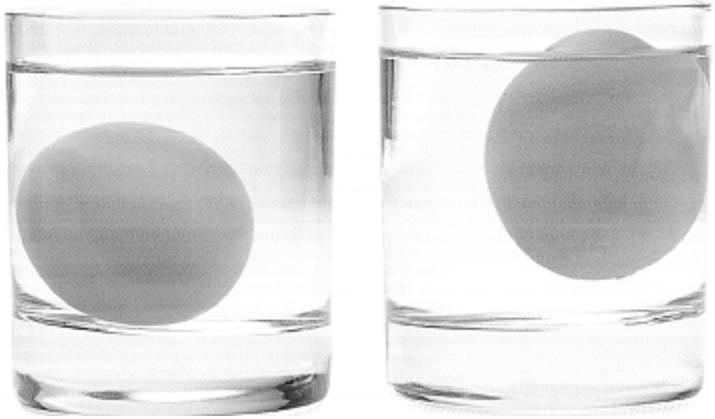
*Above: A 12-day old egg will have a flatter yolk.*



*Above: A 21-day old egg will lose the definition between the layers of white.*

# Testing For Freshness 3

- Candling
- Placing the egg in its shell in a glass of cold water. A very fresh egg will contain only a small air sac, so it will be heavier and should be lie flat at the bottom of the glass. If the egg floats it has probably gone bad an ed.



# Thousand years old egg

Thank You