

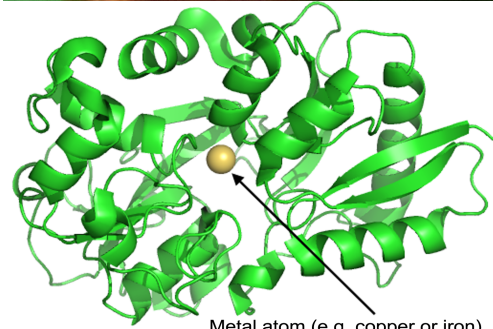


Perfecting egg white foams



Ovotransferrin can bind copper/ Cu^{2+} (copper bowl) or Iron (Fe^{3+})

- The binding of the metals gives the foam a golden (copper) or pink (iron) color
- The binding of the metal *increases the denaturation temperature of ovotransferrin.*
 - No Iron (pH 7.5) – 63°C/145°F
 - With Iron (pH 7.5) – 83.5°C/182°F



Metal atom (e.g. copper or iron) at center of protein.

Table 9-2 The Proteins in Egg White Albumen [1]

Protein	% of total	Natural Function
Ovalbumin	54	Nourishment for chick, <i>may</i> block digestive enzymes. Contains six cysteine residues. Two are engaged in a disulfide (-S-S-) bond.
Ovotransferrin	12	Binds iron



Perfecting egg white foams ...what have we learned

We want whipping to not take too long. We also don't want an "overwhipped" foam – it is grainy...this happens when the albumin denatures and sticks together /coagulates too tightly. We also want our foam to puff up in the oven before it sets.

Copper interacts with the outer -SH's of albumin and prevents them from forming disulfide bonds (limiting how much the albumin can "stick together")...the grainy problem

- ✓ Copper bowl
- ✓ Cream of tartar (tartaric acid)
- Aging egg whites

Acid helps prevent disulfide formation (grainy problem) and it also encourages protein denaturation (shortens whipping time)



Stiff peaks



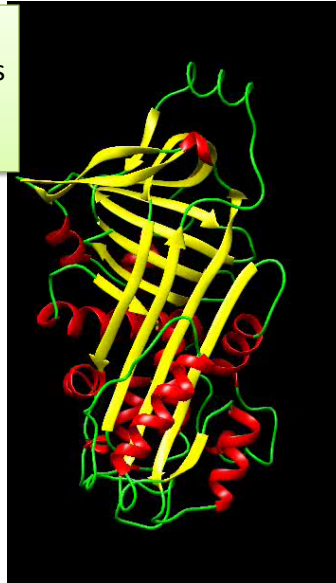
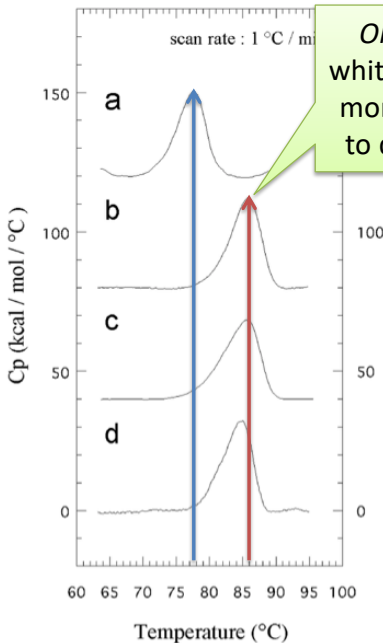
Overwhipped



Over time Ovalbumin becomes S-ovalbumin

Remember...Ovalbumin doesn't really denature with agitation

S-ovalbumin is *more stable to heat* and denatures at a higher temperature. That means the foam can expand more before it "sets".



Ovalbumin



S-ovalbumin



Cooking with eggs

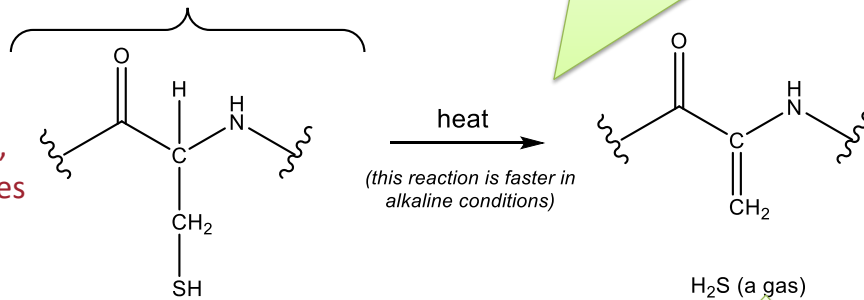
Heating causes chemistry



The cysteines within the egg white albumen protein react more readily to produce H₂S when the protein has unfolded (*denatured*). This exposes cysteines that were previously buried.

Heating proteins causes them to *denature* and *coagulate* into a solid, but heating also causes chemical reactions within the proteins.

a cysteine amino acid residue
(this cysteine is part of a protein)



The characteristic "eggy" odor of hard boiled eggs can be attributed to the degradation of cysteine amino acid residues within the albumen protein to produce H₂S (*hydrogen sulfide*).

The sulfurous odor of H₂S is what we associate with cooked eggs. In high concentrations, H₂S can be objectionable.

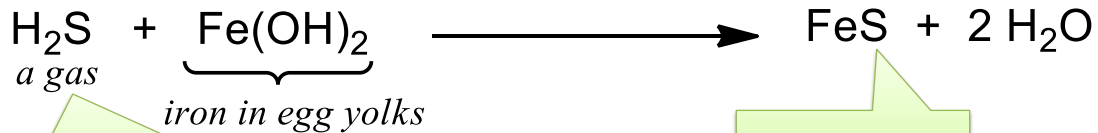


Green eggs?

Green-gray discoloration at interface of yolk and white



The green gray discoloration appears the longer the egg is cooked. It starts at the interface of yolk and white and then moves inward.



The H₂S is released by albumen cysteines

Greenish color

Sometimes when hardboiling eggs, a green gray discoloration can occur at the interface of the yolk and white, and can even (in some cases) discolor the entire yolk. This greenish color is caused by the compound *iron sulfide* (FeS).

Why (upon extended heating) does the egg yolk turn green and not the egg white?