Solution to the uncooked egg challenge

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Published online: 11 November 2010
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Solution

An educated guess regarding the thermal coagulation of the egg white is that hydrophobic forces or hydrogen bonds are not energetic enough; also the chemical nature of side groups of amino acid residues make covalent bond formation very unlikely. In this regard, the coagulated egg could be viewed as a hybrid between the “physical gels” (reversible with temperature) and “chemical gels” (permanent). Indeed, disulfide bonds could be a better candidate, as their bond energy is about 75% of that of the covalent bonds and they can form and disintegrate with simple oxidation/reduction processes. Moreover, cysteine residues are present in

many egg proteins. Are disulfide bonds responsible for the gelation of the egg white?

An easy test can be envisioned. If the disulfide bridges are indeed formed by oxidation, then reduction should lead to an *uncooked egg*. The experimental test is rather simple: first, cook an egg white, then add a small quantity of water (1 mL for an egg), and a few grams of a reducing agent, such as sodium borohydride (NaBH_4). Immediately, the solid egg white disintegrates as a foam is formed. After several hours a liquid *uncooked egg* is obtained. This *uncooked egg* is not a strict “proof” that disulfide bridges are responsible for the coagulation, because any bond obtained by oxidation could be credited for it, but other considerations lead us to assert that sulfur is the key!

This article is the solution to the Analytical Challenge to be found at doi:10.1007/s00216-010-3960-9.

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