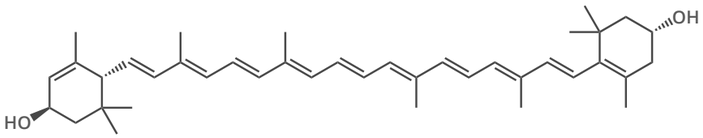
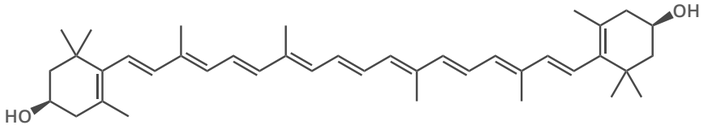
THE CHEMISTRY OF EGGS & EGG SHELLS

Eggs are one of the most versatile kitchen ingredients; there are numerous ways of cooking them on their own, and they can also be used to help create a range of other foods. Here, we take a look at what they're made of, and how they change during cooking.

EGG COLOUR & COMPOSITION



LUTEIN



ZEAXANTHIN

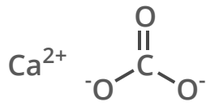
The yellow colour of egg yolks is due to the presence of the carotenoid pigments lutein and zeaxanthin. Artificial additives aren't permitted, but additives such as beta-carotene and marigold petals can be added to chicken feed to influence the yolk's colour.

EGG WHITE PROTEINS

OVALBUMIN	CONALBUMIN	OVOMUCIN	OTHERS
54%	12%	2%	32%

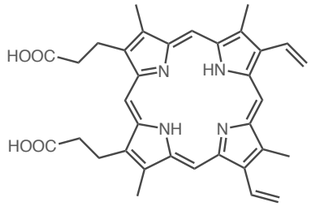
About 90% of the egg white is water; the rest of its mass is mostly protein. Ovalbumin's purpose is thought to be nutrition for the developing chick; Ovomucin helps thicken the egg white; and conalbumin binds iron & guards against infection.

EGG SHELL COMPOSITION



CALCIUM CARBONATE

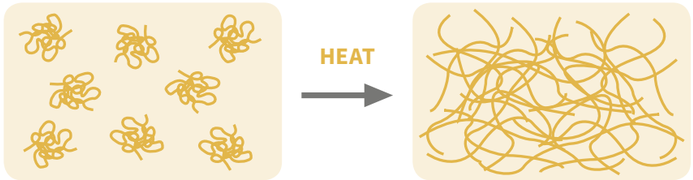
Calcium carbonate is the main component of eggshells. Nanoparticles of calcium carbonate are arranged into ordered crystals by proteins, forming a calcite shell. The colour of the eggshell comes from porphyrin pigments on the shell's surface.



PROTOPORPHYRIN IX

Brown pigment; the presence of the pigment oocyanin causes eggs to have a blue or green colouration.

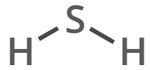
COOKING EGGS



BEFORE COOKING

AFTER COOKING

Egg proteins begin in the raw egg as folded chains, but as they are heated they begin to denature and unfold. Interactions between the unfolded proteins create a three-dimensional network, trapping the water and causing the egg to solidify.



HYDROGEN SULFIDE

FeS

IRON (II) SULFIDE

Hydrogen sulfide, formed by the reaction of sulfur-containing proteins in the albumen, is the compound that gives cooked eggs their characteristic smell. When eggs are cooked for a long time it can react with iron in the yolk, forming iron sulfide, and giving a green hue to the yolk surface.

7.6 — ALBUMEN pH OF FRESHLY LAID EGG

9.2 — pH AFTER SEVERAL DAYS OF STORAGE

Albumen pH increases as CO_2 diffuses out through the shell. Albumen adheres more strongly to the shell at lower pH, making it harder to peel boiled eggs.

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