

# INVESTIGATING EGGS

## Investigation 1

### Aim

Investigating the effect of heat on whole egg, egg white and egg yolk, and working out the temperature of coagulation for whole egg, egg white and egg yolk.

### Equipment

- Digital scales
- Digital timer / stopwatch / clock with a second hand
- 3 small mixing bowls
- Fork
- 3 small heatproof beakers (alternatively 3 bowls to use as a bain-marie)
- 3 small saucepans
- Measuring jug
- 3 small teaspoons
- Temperature probe and wipes
- Gas or electric hob
- 3 sticky labels and marker pen

### Ingredients

2 eggs (whole egg, egg white and egg yolk are needed)

### Method

Take 2 eggs:

- crack one egg into a bowl and beat with a fork until the white and yolk are fully mixed together
- take the remaining egg and separate the yolk and the white – place the yolk into one mixing bowl and the white into a separate mixing bowl.

Transfer 20g each of whole egg, egg yolk and egg white into the 3 separate small heatproof beakers.

Put the small heatproof beaker containing the whole egg into the saucepan, and use the measuring jug to pour cold water into the pan, until the surrounding water is higher than the egg. **Do not splash water into the beaker containing the egg, and do not allow the small heatproof beaker to touch the base of the pan.**

Apply heat and stir the egg continuously with the teaspoon.

Record the temperature at which the egg begins to thicken and finally set (coagulate).

Repeat the experiment for the egg yolk and the egg white.

## Results

You are now going to compare the temperature of coagulation for whole egg, egg white and egg yolks.

Create a table to record your results.

Temperature of coagulation	Whole egg	Egg white	Egg yolk
	73°C	60°C to 65°C	65°C to 70°C



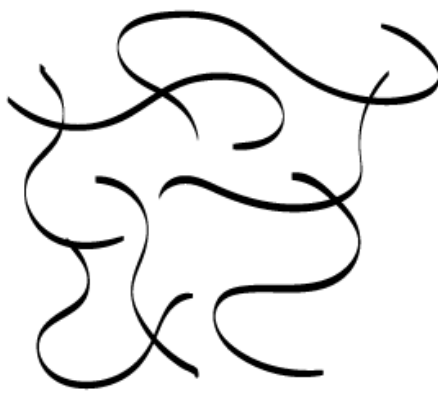
## Conclusions

Summarise your findings here. You should consider:

**What happens when you heat each of the egg samples?**

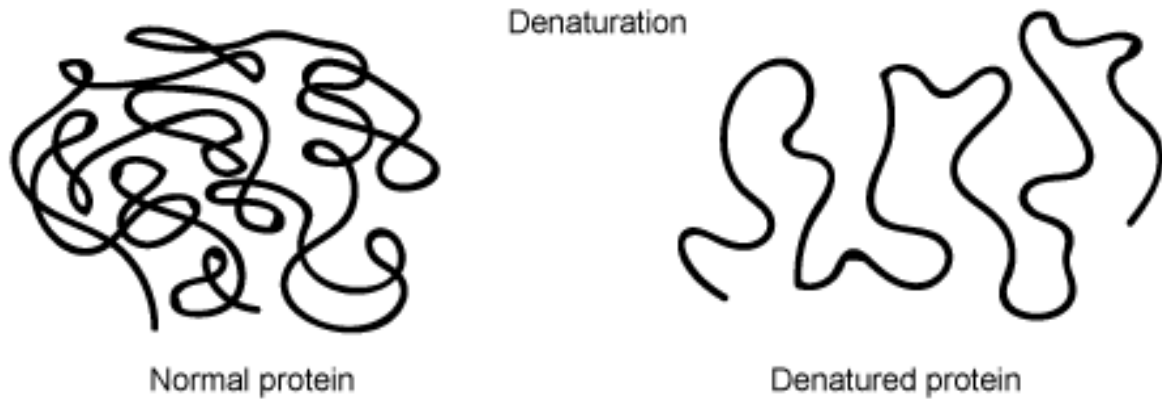
Eggs contain proteins. When these proteins are heated they undergo a process called coagulation, which basically means they begin to set.

**Explain the difference between denaturation and coagulation.**

Native egg proteins	Unfolded egg proteins	Coagulated egg proteins
		

### Denaturation

Denaturation refers to the physical changes that take place in a protein when exposed to conditions such as heat, acid, high salt concentrations, alcohol and mechanical agitation. When a protein denatures, its complicated folded structure unravels, and it becomes just a long strand of amino acids again. Denaturation is not a change in composition, only a change in structure.



If a protein structure undergoes the process of denaturation, **coagulation** is likely to occur. This is when the protein within the food sets – a good example of this is when egg whites are whisked. The mechanical agitation firstly starts to unravel the protein molecules, and the continuing whisking and application of heat (for instance, when cooking meringues or soufflés) will ensure that the protein molecules coagulate and set.

**Which egg sample coagulates at the lowest temperature?** Egg white – egg white (also known as albumen) mostly contains the protein ovalbumin. It also contains several other proteins including globulin and albumin. It will start to coagulate at around 60°C and should be set at around 65°C.

**Which egg sample coagulates at the highest temperature?** Egg yolk – egg yolk contains the protein vitellin. It will start to coagulate at around 65°C and will solidify at 70°C.

NOTE: As you would expect, the speed at which the egg coagulates will increase as the temperature increases.

**What happens if you continue to cook an egg after it has set?** If eggs are cooked for too long they get rubbery as proteins continue to coagulate, and water is pushed out from between protein molecules. This process is referred to as **syneresis**.

**Give examples of dishes that rely on the coagulation of whole egg.**

– quiche, egg custard tart



**Give examples of dishes that rely on the coagulation of egg white.**

– soufflé, meringues



**Give examples of dishes that rely on the coagulation of egg yolk.**

– hollandaise sauce, lemon curd



## Extension task

Repeat this experiment, with the addition of 10ml of milk to each of the 3 egg filled beakers. Note the new temperature of coagulation – how can this information impact on the cooking of dishes? Repeat again using vinegar, salt and sugar. Can you explain these differences in the temperatures of coagulation?

### **Answer**

When an acid, such as vinegar, is added to the cooking of eggs, it makes the pH lower. This enables the egg to set more firmly. The egg will also coagulate at a lower temperature.

The addition of salt will also have the same effect as above.

When a sugar is added to the cooking of eggs, the egg sets more loosely and will coagulate at a higher temperature.

**Can you suggest why vinegar is added to the poaching water for eggs?**