- Senses and sensation / Foods



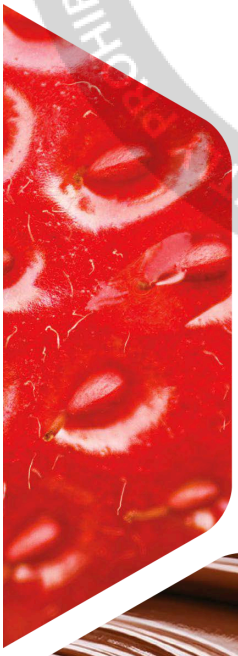
PRINTED FROM PRESSREADER
NOT FOR SALE

DID YOU KNOW? Participants of an experiment rated the same crisp 15 per cent crunchier when the sound of its crunch was amplified

WHAT GIVES FOOD ITS TEXTURE?

From crisp, crunchy fruit to satisfyingly stretchy cheese, explore the chemistry behind each bite

WORDS AILSA HARVEY



Flavour alone doesn't determine how highly you rate a food. The feeling of food in the mouth plays a huge part in your enjoyment of a meal. While taste receptors process the flavours in foods, nerve cells help the brain perceive the tactile feeling of the contents of your mouth. In the brain's somatosensory cortex – part of the parietal lobe at the top of the brain – signals from your mouth's interaction with food are incorporated into your perception of the experience.

Aside from the sense of touch, which is the primary texture-detecting response, kinesthetics also play a part in sensing texture. This is the movement and position of food in the mouth, and it's your teeth's role to test this. As they chew on different foods, the mouth senses how they break apart, bend or stick to the teeth. The sight of food before it even touches the mouth also plays a part in our perception of its texture. You judge a food by how it sits on a plate at rest before you eat it. For example, the thickness of a sauce can be observed by how much it spreads on the plate, as well as its speed of movement. Finally, the sound of food or feel of it moving against your touch prepares your brain for how the food will feel in the mouth.

Did you know?
Crunchy, smooth and chewy are the most favoured textures

A food's texture is a product of its physical and chemical structure, as well as the environmental conditions it's presented in. The chemical structure of foods can be dependent on qualities like temperature. The cocoa butter content of chocolate is made up of molecules of fatty acids and glycerol called triglycerides. The different structures of these molecules alter how easily it forms crystalline structures in the chocolate. There are six different ways cocoa butter can crystallise, and each one has a different melting point. As a result, some chocolate changes texture when placed on a warm tongue, causing it to melt in your mouth almost instantaneously.



HOW TEXTURE IS MEASURED

At food-manufacturing sites, the texture of foods is assessed using food texture analysers. Food texture analysers are machines used when carrying out quality checks on different products, as the texture can often reveal the freshness and overall quality. The machines apply controlled force to foods to compress, stretch or cut them. Unlike a human tester, these machines can then provide quantitative data based on the input force. This ensures that all the items of a certain product a company sells are consistent in texture. The machine has a range of attachments, such as extendable arms that are used to attach foods to the texture analyser. A food sample can also be attached to the base of the machine, and when the arm extends away from the base, exerting a controlled force, its stretchiness is analysed. For each force applied to the food, an attached load cell converts the tension, compression and pressure into a standardised measurement.



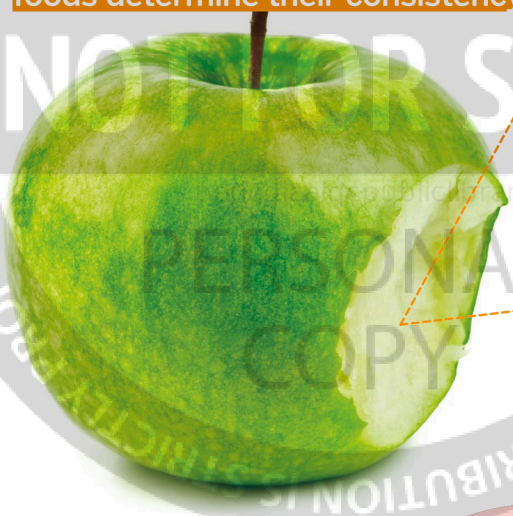
A texture analyser shows a marshmallow before and after compression

© Shutterstock

SCIENCE

MEAL MAKE-UP

How does the structure of different foods determine their consistency?





- CELL WALL
- CELL MEMBRANE
- CYTOPLASM
- MIDDLE LAMELLA
- VACUOLE
- NUCLEUS

1 VACUOLE
This cell component is filled with sugar and water. When full, the cell's surrounding water presses against the cell wall, and pressure builds.

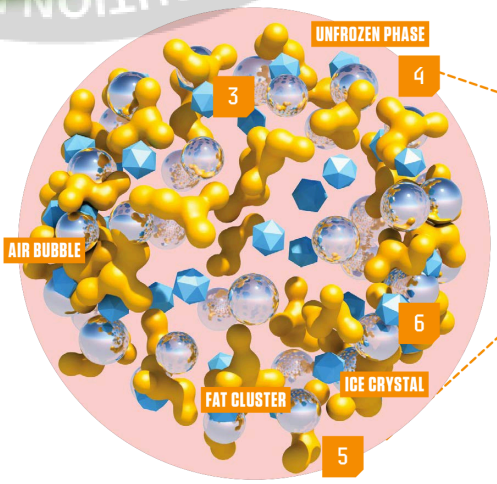
2 CELL WALL
The apple's cell walls have rigid coverings. When your teeth cut into a liquid-filled apple, the cells easily rupture and make the apple crunch.

3 AIR
Air bubbles make ice cream light and voluminous.

4 UNFROZEN PHASE
This solution includes stabilisers, such as gums extracted from plants or animals, which stop ice cream melting too quickly or becoming too hard.

5 FAT
Fat clusters are smooth and creamy and prevent ice crystals growing too large.

6 ICE CRYSTAL
Water in the ice cream mixture freezes into crystals. Smaller crystals are made when it's frozen suddenly, causing a smoother texture.





COOKING TRANSFORMATIONS

Applying heat to foods can make them more palatable for many different reasons. For example, cooking foods at 70 degrees Celsius for two minutes kills any bacteria that may cause harm to the body, the caramelisation of sugar creates unique tastes and a warm meal can aid digestion. But cooking also changes the chemical and physical properties of foods to alter their texture and change the consumer's experience. When heated in water, pasta swells up as the starch granules absorb water. This changes pasta to a soft and slightly chewy consistency – a stark contrast to the hard, brittle and dry uncooked version. The heat from cooking food also causes proteins to break apart and clump together. This can make liquid foods, like raw egg, transform into a firmer, solid hard-boiled one. With meat, the cooking process needs to be controlled to produce the desired texture. Heat makes the solid fats melt and the proteins soften, adding tenderness to the finished product. But if cooking continues for too long, the meat will become tough and difficult to chew.



Each of these eggs has been cooked for a progressively longer period, showing the change in texture and colour due to heat

COMMERCIAL DISTRIBUTION IS STRICTLY PROHIBITED · PRINTED FROM PRESSREADER · NOT FOR SALE · PERSONAL COPY

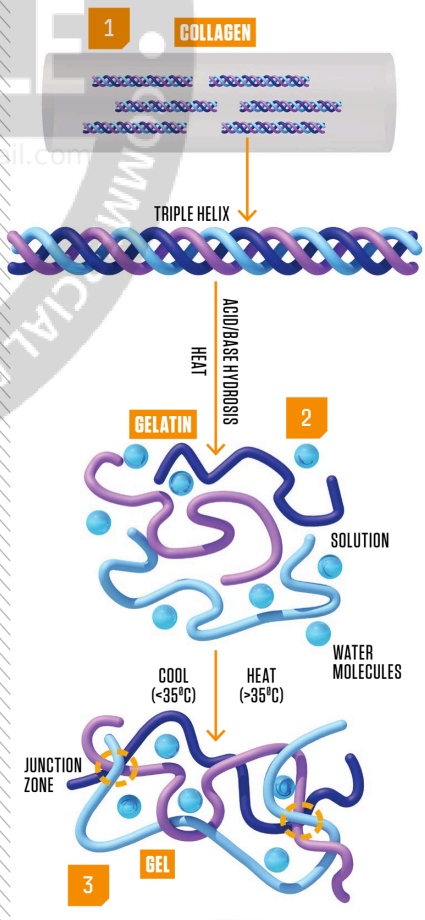
DID YOU KNOW? People with avoidant-restrictive food intake disorder are very selective or fearful of certain food textures



Did you know?
Jelly was invented in 1897

HOW DOES JELLY FORM A GEL?

Animal protein is manipulated by temperature in the making of this popular dessert



1 COLLAGEN STRUCTURE

Collagen is a protein found in the connective tissues of animals like cattle. It has a triple-helix structure that makes the protein strong, yet flexible.

2 DENATURED SOLUTION

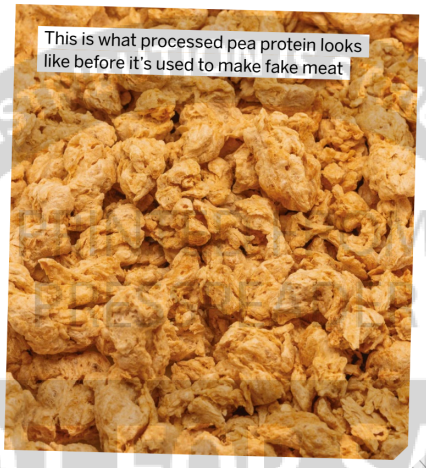
When the collagen solution is heated, the triple helix unravels. This process is called denaturation and makes the collagen more soluble in water. This is the liquid stage of jelly-making.

3 COOLED TO GEL

Upon cooling, the jelly solution reorganises itself and forms new bonds. The gelatin molecules link together at junctions along the chains. The result is a 3D network of tangled gelatin chains. Water becomes trapped in this structure, making a semi-rigid and squidgy jelly.

REPLICATING FIBROSITY

Texture is so integral to our experience of eating a meal that food manufacturers try to replicate the same textures meat has when producing meat-free versions of popular foods, like meat-free burgers. Peas are one ingredient that can be processed to recreate the consistency of animal proteins for those who want a similar meal experience without eating animal products. Pea protein is extracted from peas and undergoes a process called extrusion. This involves separating the protein from the peas and reshaping it in a mechanical machine under high temperatures and pressures. The resulting fibrous product makes a food that, of all meats, most resembles chicken. The meat industry also uses peas to improve the texture of real meat. Because pea fibre can hold onto moisture well, it's added to some meat products to keep the consistency soft. When cooking, pea fibre doesn't shrink as much as meat, so it's added to processed meat products to reduce volume loss, too.


This is what processed pea protein looks like before it's used to make fake meat

© Shutterstock / Alamy / Illustrations by Adrian Mann