

FREEZING

Clarence 'Bob' **Birdseye** was largely responsible for every major early breakthrough in the development of the methods and technology that made freezing a viable way of preserving food, without sacrificing too much taste or quality.

Birds Eye's time-honoured range of frozen products - vegetables, potato and chip products, fish, chicken and snacks - are universally known to offer wholesome taste and nutrition the whole family love and enjoy.

Birds Eye products are high quality, fresh and nutritious, with all the goodness locked in.

1. [The History of Freezing](#)
2. [Frozen Foods in Australia](#)
3. [What is Freezing?](#)
4. [Freezing Rate](#)
5. [Ice Crystal Formation](#)

THE HISTORY OF FREEZING

The ancient Egyptians, Greeks and Romans understood that evaporation of water could be used as a cooling method. Porous clay vessels were used to keep water cool by this method. Natural caves, that were dry and cool, were later used to store food for limited periods.

Storage was extended into the warmer months by lowering the temperature with natural ice and snow brought from the mountains.

It was not until early in the 19th century that the principles involving mechanical methods of producing intense cold were understood. In 1823, Michael Faraday demonstrated that a gas could be changed to a liquid by the application of pressure. A machine patented 11 years later was essentially the compressor used today.

A succession of scientists, including Carnot, Joule Thomson and Carre, added pieces to the puzzle. The invention of an ammonia absorption system by Dr Carl Linde in 1875 completed the picture. By 1890 cold storage by mechanical refrigeration was established. Meat and fish could be stored successfully, although considerable 'drip-loss' occurred on thawing.

Fruits and vegetables were stored but the slow freezing methods produced large ice crystals within the plant cells. This caused tissues to collapse, and the loss of nutrients during thawing. Another generation was to pass, before a process that would maintain the quality of frozen food was developed.

It was in Alaska in 1916 that an American, **Clarence Birdseye**, discovered that food frozen quickly in the Arctic cold remained fresh and wholesome. When Clarence Birdseye returned from the Canadian Arctic in 1917, he began experimenting with ways to quick freeze food mechanically. He speculated that it was the speed of freezing which made the techniques he had observed superior to conventional cold storage, which robbed food of much of its flavour. He tested a method that involved immersing meat, fish and vegetables in brine which circulated around the food at -45 °. Birdseye was granted a patent for his quick freezing process in 1921. Initially progress was slow, but in 1925 thousands of pounds of frozen meat and fish were prepared and sold to test public reaction. The acceptance was most encouraging.

The next few years were devoted to developing the most suitable packaging and the multiplate contact freezer. This culminated in the first commercial manufacturing plant in 1929. The initial production appeared in March, 1930 in several stores in Springfield, Massachusetts, under the Birds Eye brand, when two vegetables, peas and spinach, and three fruits, raspberries, loganberries and cherries, were offered with a selection of meats and fish. It was a brave venture since the USA and the world was passing through the worst economic depression every known.

It was not until 1935 that frozen foods were again brought before the public, but the new industry was finally on its way. By 1937 there were a number of rival processors in the USA: quick frozen foods had crossed the Atlantic Ocean and were beginning to appear in Britain and Europe. Technology continued to develop and in 1939 Birdseye introduced the 'gravity froster', designed to quick-freeze products individually. The period of World War 11 slowed progress to some degree, but tinplate shortage in the late forties encouraged the public to try foods not sold in cans.

Freezing principles were now well established to provide the essential characteristic of rapid freezing – a very small ice crystal that would not damage the cell structure. Research confirmed the need to store these foods at -18°C to retain quality and ensure adequate storage life. When thawed, the fresh flavour, texture and colour of the food is maintained.

Prior to 1930, Birds Eye had achieved great success with fish, but found that vegetables acquired an off flavour when frozen. The problem was solved by an employee, Donald Tessen, who discovered that 'blanching' overcame the problem. This led to an explosion of new products.

Frozen Foods in Australia

Quick frozen foods – vegetables only at first – became available in Australia in 1940. But it was 1949 before the first vegetables were specially grown and processed in New South Wales for sale under the Birds Eye brand.

Today the Birds Eye range of frozen foods are manufactured in plants across Australia including Bathurst and Kelso in New South Wales and Ulverstone and Devonport in Tasmania. The range includes:

What is Freezing?

- Frozen Fish products
- Frozen Potato products
- Frozen Vegetable products

Freezing is a method of food preservation where the water in the food is converted to ice. The food temperature is lowered to below 0°C and the food is stored at -18°C or below.

The purpose of freezing is two-fold:

1. Chemical reactions and microbial growth are reduced at low temperatures.
2. The formation of ice removes water from food tissues thus, lowering the water activity. This prevents microbial growth and reduces chemical reactions.

Freezing Rate

The freezing rate affects the quality of frozen food. The Zone of Maximum Crystal Formation refers to the region between 0°C and -5°C where the removal of the heat of fusion takes place.

Quick freezing occurs when a food takes less than 30 minutes to pass through the zone of maximum crystal formation.

Factors Affecting Freezing Rate

The time a food takes to freeze depends on the following:

1. Shape and size of the food.
2. Thermal characteristics of the food (specific heat, thermal conductivity, initial freezing point, food density and moisture content).
3. Initial temperature of the food.
4. Heat transfer coefficient of the freezing medium (air velocity, degree of contact).
5. Characteristics of the packaging.

Ice Crystal Formation

Rapid freezing produces many small ice crystals which cause minimum water movement out of the cell, drip and chemical damage to the cell.

Slow freezing produces a few large ice crystals which can lead to mechanical and chemical damage due to partial dehydration of the cells. The food becomes flabby and soft and exuded a lot of drip.

Very fast freezing is usually only an advantage in foods consumed raw and some other foods such as frozen vegetables, seafood and poultry.

