7  Fresh and chilled foods:  
meat, poultry, fish, dairy products and eggs

Meat

The quality of meat is affected by the growth of microorganisms, by enzyme activity and by oxidation. The three kinds of microorganisms involved during meat storage are bacteria, yeasts and moulds, and those normally present on meat cause spoilage which can be smelt and seen. Not all bacteria are harmful but some can cause food poisoning directly (e.g. Salmonella) or indirectly through the toxins they produce (e.g. Staphylococcus). Uncooked meat is an ideal medium for rapid bacterial growth, because it supplies the three necessary factors: moisture, nutrients and an environment which is only slightly acidic (where food is highly acidic, only specialized microorganisms can grow). Enzymes present in the meat bring about chemical changes, only some of which are beneficial. Finally, oxidation of the fat by atmospheric oxygen produces rancidity, which gives the fat an unpleasant flavour.

Enzymes are destroyed and microorganisms killed by high temperatures such as those used in cooking. However, warm temperatures encourage rapid microbial growth. At low temperatures, enzymic activity and the growth of microorganisms are retarded, and at very low temperatures, they virtually stop. Oxidation is retarded at low temperatures and can be prevented by packaging meat in materials which have low oxygen permeability, although materials used for short-term retailing for fresh prepacked cuts are often selected for their high oxygen transmission rate, which helps preserve the bright red colour of the meat.

Preparation of meat

Bacteria are present in very large numbers in the gut and on the fleece or hide of live animals. Good slaughter practice is essential, from the personal cleanliness of the operators to the regular cleaning and sterilizing of knives and other tools to minimize the transfer of bacteria from the hide and gut to the meat. The carcass may also be cleaned by spraying with hot water. Hygiene at the abattoir and in handling and storing carcass meat is essential for a good storage life.
Chilling and chilled storage

Immediately after the animal has been slaughtered, the carcass is at body temperature (38°C) at which all bacteria, including any food poisoning organisms, can grow rapidly. Below 10°C, bacteria grow only slowly, and hence the meat is quickly cooled to that temperature. Reducing the temperature still further to 1°C prevents the growth of spoilage organisms. Nevertheless, chilling of beef and lamb must not be carried out too quickly and the temperature within the meat must not fall to 10°C in less than 1 h or rigor mortis sets in, the muscles contract (cold shortening) and the meat becomes tough. However, rapid chilling has very little effect on pork [1].

Unchilled carcasses lose weight by evaporation of moisture from their surfaces. The extent of the loss can be reduced by lowering the surface temperature, and, therefore, the faster the chilling, the smaller the loss of weight. Quick chilling also reduces the quantity of juices lost when meat is cut. There are obvious economic advantages in this, and modern abattoir practice combines rapid chilling with careful temperature control to avoid cold shortening.

After chilling, fresh meat is stored until transported to the retailer’s refrigerator. Ideal storage conditions for fresh meat carcasses are a temperature of about 0°C, a relative humidity of 85–90%, adequate spacing for hanging and good air circulation at low air speeds of 15–30 cm/s. This allows the meat to age which makes it more tender.

The expected maximum storage lives for carcasses under such conditions are:

- Beef: up to 21 days
- Veal: up to 21 days
- Lamb: up to 15 days
- Pork: up to 14 days
- Offal: up to 7 days

Cutting and boning

In the cutting room, at both the abattoir and the retail shop, the temperature of the meat should be kept as low as possible. Air-conditioning keeps cutting room temperatures low, and the carcasses are boned, cut, packaged and returned to the chiller in as little as 30 min. Precautions are necessary to ensure the cleanliness of the cutting room and the personal hygiene of the operators.

Deterioration of fresh and chilled meat

Fresh meat is a complex material in which many biological processes associated with living tissues are still active. The period of storage is obviously important, but the best means of packaging meat depends upon a number of