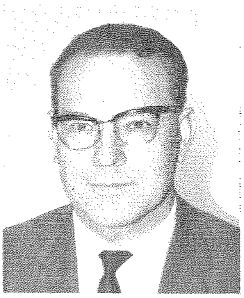
Mr. Boone

FOOD PRESERVATION QUARTERLY

Vol. 22 No. 4 CSIRO December 1962

REGISTERED IN AUSTRALIA FOR TRANSMISSION BY POST AS A PERIODICAL



Dr. S. E. Wright qualified as a pharmacist in New South Wales before taking a science degree with First Class Honours in Chemistry in Queensland. After lecturing for some time in Organic Chemistry at Queensland University he went to New Zealand as the head of its Pharmacy School. On returning to Australia Dr. Wright became Senior Lecturer, then Associate Professor, before being appointed to the first Chair of Pharmaceutical Chemistry at Sydney University. His researches have concerned mainly the chemistry of natural products and the metabolism of organic substances in animals, particularly cardiac glycosides and other drugs. Recently his laboratory has concentrated on some of the problems associated with the fate of food additives in animals.

Chemicals in Foods

By S. E. Wright

Pharmacy Department, University of Sydney

This paper was one of four introducing a Panel Discussion on Public Health Aspects of the Handling and Processing of Foods, at the Food Science Conference held at North Ryde, N.S.W., in September 1961. The Chairman, Dr. E. Forbes Mackenzie, of the Victorian Department of Health, on opening the discussion, said the housewife had shown a willingness to accept sophisticated foods which were taken on trust, perhaps on the score of convenience. This trust, he said, must not be abused.

To the scientist and manufacturer food standards posed problems which tended to become more and more complex. Standards, originally designed to cover comparatively few basic foods, must now be drawn up to cover many new foods. The work involved becomes increasingly complex, especially in the case of colouring materials used to improve attractiveness and as regards the residues of numerous chemicals used in primary food production, which may gain entrance to the food.

GENERAL PRINCIPLES

THE approach to the use of chemicals in foodstuffs is often made from two contrasting viewpoints. One is that of some chemical manufacturers, who want to have as much of their products used as possible, and who use as their thesis the dilution approach — since so little of the chemical gets into the diet danger is unlikely. The level of the chemical in the diet is emphasized more than the nature of the chemical itself and it is pointed out, often quite pertinently, that chemicals will have to be used increasingly in food production if world needs are to be met, and that wastage of good food, often urgently needed, could be minimized by the judicious use of chemicals.

On the other hand we have those who proclaim all synthetic substances added to food during production or processing to be harmful and demand that such practices should be stopped. This group does not think that there is a threshold for toxicity and wages a constant battle against the use of insecticides, antibiotics, hormones, dyes, emulsifying agents, flour improvers, food preservatives, and so on. This group of people is prone to blame synthetic substances for depredations in wildlife, human diseases such as disseminated sclerosis, Parkinsonism, renal and arterial degeneration, cancer and even congenital abnormalities. Sometimes this approach results in exaggerated official action such as that reported recently from West Berlin where menus in restaurants were required to state the chemicals likely to be present in the foodstuffs served.

The need to arrive at a compromise based on sound scientific evidence is obvious; but those responsible for food legislation frequently have a difficult task because data concerning the safety of chemicals likely to find their way into foods are often scant or not available. Food safety problems of modern times are concerned only rarely with substances that do immediate harm because of acute toxicity. It is the insidious hazard of chronic toxicity which is more likely to arise, and is, of course, more difficult to assess. It is generally agreed, however, that the addition of chemicals to foods introduces problems which must be met, as conservation of food and its transportation over long distances are factors of increasing importance in the world today.

A Joint FAO/WHO Expert Committee on Food Additives (1957) laid down the following principles justifying the use of acceptable food additives:

- To maintain the nutritional quality of a food.
- To enhance the keeping qualities or stability with resulting reduction in food wastage.
- To make foods attractive to the consumer.
- To provide essential aids to food processing.

It was agreed that, apart from any consideration of toxicity, chemicals should not be permitted:

- To disguise faulty processing and handling techniques.
- To deceive the consumer.
- When the result is a substantial reduction of the nutritive value of the food.
- When the desired effect could be obtained by good manufacturing practices which are economically feasible.

TYPES OF PROBLEM

Problems associated with chemicals in food may arise in the following ways:

(1) From naturally occurring substances of a toxic nature which inadvertently reach the consumer.

(2) From chemicals added during food production which are not desirable in the finished food, e.g. residues of agricultural poisons, antibiotics, plant hormones, fumigants.

(3) From substances added intentionally during processing and including permitted food additives such as certain dyes, antioxidants, preservatives, emulsifying agents, humectants, flavours, acidifiers.

(4) From chemicals added inadvertently during processing including contaminants from packaging, cleaning agents, lubricants, plasticisers, pigments, synthetic resins.

Naturally Occurring Substances Producing Toxicity Hazards

It is necessary in the interest of public health to maintain a constant watch for nutritional disorders which may be due to abnormal naturally-occurring substances reaching the consumer. Inorganic substances such as selenium, fluorine, iodine, and cobalt, which in minute quantity can be regarded as essential nutrients, become toxic if they are ingested in excessive quantities. The same applies to some vitamins, in particular D and A.

There are also many examples of pharmacological effects produced from the ingestion of excessive quantities of foods containing biologically active compounds. One need only mention phytate in cereals, alkaloids in improperly harvested potatoes, saponins found in many foods, toxic substances such as tutin in New Zealand honey, and oestrogenic compounds in clovers. The presence of goitrogens in some food is well known and local interest in this problem was aroused recently when Clements and Wishart (1956) found that physiologically significant quantities of goitrogens were present in the milk of cows grazed on a plant of the *Brassica* genus.

Chemicals Added during Food Production

The main problem here is to appraise the hazards associated with the continued use of agricultural products treated with normal amounts of pesticides. Many countries lay down tolerances for pesticide residues based on the effects produced by lifelong feeding studies in short-lived animals; these studies give informative, but not always fully conclusive, results. Metabolism and excretion data prove useful and the problem of the carcinogenicity of pesticides must also be watched. The Netherlands specify an interval between the application of pesticides and the time of marketing vegetables as well as maximum tolerances for their residues in foodstuffs. Such periods vary from 5 months in the case of tetrachloronitrobenzene, 8 weeks for organic mercury compounds, to 4 days for malathion. Such regulations are, of course, much easier to police in a small, than in a large, country.

It is interesting to note that recent analytical results, reported from the Department of Agriculture, New South Wales, show that the tolerances laid down for a representative group of insecticides in certain fruits are never reached. This indicates that our tolerances in Australia might well be lowered.

The magnitude of this problem can be seen from the fact that, in Canada, tolerances for 50 chemicals in about 1100 food items have been unofficially listed, in addition to a number of dangerous substances for which a "zero tolerance" is required. Examples of such substances are nitrophenols, alkyl phosphates, mercury and selenium compounds. In Australia tolerances are recommended for some 15 substances in addition to organic phosphate insecticides.

Antibiotic and hormone residues appearing in foods as a result of their use as feeding supplements are not as yet a problem in Australia. The presence of penicillin in milk resulting from the treatment of cows, might, however, become a real hazard. It has also been reported that the coccidiostat nicarbazin persists in the meat and liver of chickens for about 2 days after dosage. It is evident that the use of antibiotics and drugs for treating diseases in animals should be under constant watch.

Substances Added Intentionally during Processing

These are the substances referred to as "food additives" and include those previously mentioned extending from inorganic substances to complex organic dyes and emulsifiers. The decision whether the use of such substances should be allowed is based upon data derived from animal feeding tests, and on biochemical principles such as whether or not their addition is likely to fix calcium and prevent it becoming available in the diet. A frequently used criterion of toxicity is to determine if the substance is safe by long-term animal feeding studies in which it is fed in amounts at least one hundred times greater than are likely to occur in the human diet.

Recently the Commonwealth Food Additives Committee found it necessary to set out in some detail the information which should be submitted in order to have an additive approved. Such information should include an adequate chemical description, methods of analysis, the amount of additive to be used and comprehensive toxicity data. While the gathering of such information is often a difficult and lengthy process, requiring well-trained staff and properly equipped laboratories, it is necessary in the interest of public health. Results of critically designed studies of the physiological, pharmacological, and biochemical effects of a proposed additive in various species of animals can provide a basis for the evaluation of its safety at a specified level of intake by man. It is impossible, however, to establish absolute assurance that an additive at any level of intake will be completely safe for all humans under all conditions. In Australia our resources for providing comprehensive toxicity data are limited but we can contribute to the fund of information about the safety of additives by carrying out work of a more fundamental nature. Information about the metabolism of an additive, which may be decisive in determining its safety, may be obtained with more limited resources. For example, if it is found that a chemical is not absorbed from the alimentary canal then the chances of it being safe are raised. Or again if a dye can be shown to produce a metabolite which is a known carcinogen then this information can be used immediately. Again, if it can be shown that a food dye is excreted almost quantitatively unchanged, at dose levels much higher than are likely to be used in foods, then it is likely to be safer than a similar dye which is retained by the animal.

We are hoping, by work in the laboratory in the Pharmacy Department of Sydney University, to assist in untangling the somewhat chaotic position that exists in the matter of approved food dyes in different countries. For example, Great Britain has 30 approved dyes, the United States 15, and Australia about 21 of which only six are common to all three countries. As this disagreement about the safety of individual dyes implies, so little is known about food dyes that it is difficult to arrive at a satisfactory conclusion as to their safety. The safety of antioxidants is also a cause for controversy. While most countries approve butylated hydroxyanisole and butylated hydroxytoluene as antioxidants in certain foods, Australia has not, as yet, permitted the use of the latter chemical because of some uncertainty about its toxicity. When the excretion of these two substances was investigated in our laboratory no adequate data were found comparing their rate of excretion at dose levels comparable with those expected when they are used in human diets. This information had been difficult to obtain by chemical methods but the use of isotopically labelled molecules made it a comparatively simple investigation. We were able to label both BHA and BHT with tritium, administer them to rats at extremely low dose levels of about $0 \cdot 3$ μg/g and then follow the excretion by counting the radioactivity of the urine. It was found that whereas BHA was excreted by rats to the extent of over 85% in the first 24 hours, BHT was only excreted about 30–50% over the same period.

Although at first sight the information required about an additive appears to be quite formidable it is frequently possible to save much time and labour if routine testing is influenced by past experience, general knowledge of the metabolism of foreign substances, and in many instances common sense.

Chemicals Added Inadvertently during Processing

Contamination of foods with harmful substances by direct or indirect addition during processing, or from contamination with the material used in packaging, is difficult to deal with because of the wide variety of substances which may be present. The wise food manufacturer takes precautions to prevent such contamination for reasons of product purity. In particular the nature of packaging materials should be the subject of strict scrutiny both by the food technologist and food controller.

Although a number of the problems which have arisen in this category are now a matter of history the food technologist must remain on his guard to prevent repetition. Thus the limit prescribed for heavy metals and arsenic must be constantly watched. The increase in the number of materials used in packaging has introduced new problems. The British Plastics Federation (1958) listed some 120 substances which might be used in making plastic wrappers or containers for food, of which 30 were known to be toxic. The principal problem here, of course, is whether any component of the finished wrapper is transferred to the food with which it comes in contact. Extractability tests using the food to be packaged, or simpler food type solvents may be used. The United States Food and Drug Authorities have gone further than most other countries in appraising packaging materials and their lead could well be followed.

CONCLUSION

Finally it must be stressed that a decision to permit an additive must rest on sound evidence and should not be influenced by caprice. If the principles followed are sound, and adhered to strictly, the whole position becomes simpler. The imposition of tolerances is frequently necessary but these must be adequately policed and promptly revised should the need occur. It is the duty of industry to provide evidence of safety but government laboratories should be always available to resolve conflicting evidence, establish standards, devise analytical methods, and, of course, to police the decisions.

REFERENCES

British Plastics Federation (1958).—Report of the Toxicity Sub-Committee. Publ. No. 40.

Clements, F. W., and Wishart, J. W. (1956).—A thyroid blocking agent in the etiology of endemic goiter. *Metabolism Clin. Exp.* 5: 623–39.

Joint FAO/WHO Expert Committee on Food Additives (1957).—General principles governing the use of food additives. FAO Nutr. Mtg. Rep. Ser. No. 15. (Also published as World Health Org. Tech. Rep. Ser. No. 129.)

Cooling of Apples and Pears in Cartons

By E. G. Hall

Division of Food Preservation, C.S.I.R.O., North Ryde, N.S.W.

FOR optimum cool storage treatment and for export the rapid cooling of pears and apples, especially the Delicious variety, should commence as soon as possible after picking. A satisfactory initial cooling rate of 1°F/hr reduction in the temperature of the fruit in the middle of the container can be obtained in a normal cool store when loose fruit is open-stacked in wooden boxes or in bulk bins. Such a cooling rate is more difficult to achieve with wrapped fruit packed in boxes and with fruit in cartons.

Satisfactory cooling is not possible unless there is a good flow of air around each individual container to permit a quick transfer of heat from the fruit. In the refrigerated hold of a ship, air can pass freely through vertical gaps produced by top and bottom bulges when standard wooden boxes are stacked correctly on their sides. In cool stores on land, where the air movement is usually less than in ships, gaps between the ends of the boxes are also necessary. The stacking of boxes on end, as is practised sometimes, is not to be recommended since it restricts vertical air flow. Cartons, having flat surfaces, stack tightly together so it is necessary to provide adequate gaps for air passage. While satisfactory cooling of stows of undunnaged standard apple and pear boxes is possible in modern refrigerated ships, equipped for vertical air circulation, this is not possible with cartons of uniform size. It is difficult even with block stows of cell pack cartons of varying size. For proper cooling in refrigerated holds, stacks of cartons require vertical dunnage spacers between packages. Dunnaging of fruit cargoes takes up valuable shipping space and proves expensive both as regards material and labour.

Cooling of Cartons

The influence of stowage pattern on rate of cooling of fruit in cartons has been studied both in Australia and overseas and although much is known it is still an important subject for further investigation. In 1961 the cooling of cartons on pallets, both in a tight and open stow, was investigated by research workers of the Division of Food Preservation in a cool store at Orange, N.S.W. Temperature readings were taken in the centre of a package in the middle of a pallet load of 40 packages. The rate of cooling achieved was expressed as *half cooling time*, which, for practical purposes, is a measure of the time taken for the fruit temperature to reach half the difference between its initial temperature and the temperature of the cooling air. For example, with pears initially at a temperature 70°F and the

TABLE 1

Rate of Cooling Expressed in Half-Cooling Time (hr)

Container	Freely Exposed	Open Stow	Tight Stow
Wooden box; wrapped and packed apples	29	34	*c.* 40
Export pear carton; wrapped and packed pears	30	41	142
Tray pack carton; apples	21	41	89
Cell pack carton; apples	25	32	89
Loose unwrapped fruit in bushel box*	—	—	16

* From the data of Rostos (1960).

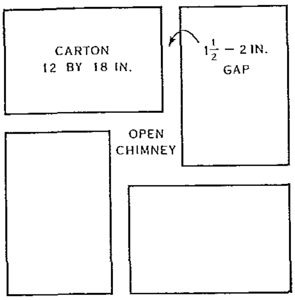


Fig. 1.—Open chimney stacking. Alternate layers are turned through 90° to give a criss-cross binding of the stack.

cooling air at 30°F the half cooling time would be the time taken for the fruit to reach 50°F. The same period of time would be required to cool the fruit a further ten degrees. Table 1 summarizes the results of the investigations.

The results indicate that, with suitable open stowage of cartons, the rates of cooling achieved would be similar to those obtained with wrapped and packed fruit in standard wooden boxes stacked normally to leave a $\frac{1}{2}$–1 in. air gap between rows of boxes. The fruit in the cell pack cartons with single thickness sides will be seen to have cooled rather more quickly than it did in the tray pack (telescopic) carton with double thickness walls.

Fisher (1960) found, in commercial storage trials, that tight stows of tray pack cartons on a pallet took twice as long (10 days) to cool to 32°F as did cartons in open stow. Similar results were obtained in the tests at Orange, N.S.W.

In a detailed study made by Sainsbury and Schomer (1957) of the influence of stacking pattern on the rate of cooling pears packed in cartons a close relationship was found to exist between equilibrium temperatures in the container after cooling, and the rates of cooling. Slower cooling resulted in higher equilibrium fruit temperatures. Rates of cooling were found to depend on air temperatures and stacking patterns.

Olsen, Patchen, and Schomer (1960) on investigating the influence of venting cartons on the cooling of apples concluded that the small vents normally used did not improve the cooling rate significantly and were therefore no substitute for proper spacing.

In Australia the pre-cooling of cartons of fruit intended for export has caused considerable concern. Taking a half-cooling time of 40 hr as reasonable, cartons of warm fruit at 70°F placed in air at a temperature of 30°F would take 120 hours to cool to a satisfactory temperature of 35°F or 80 hours to cool to 40°F. To achieve these temperatures, so as to ensure delivery of the fruit at the ship at a temperature of not more than 45°F, the cartons must be stacked with at least three of their faces exposed to air gaps (four-face exposure would be better).

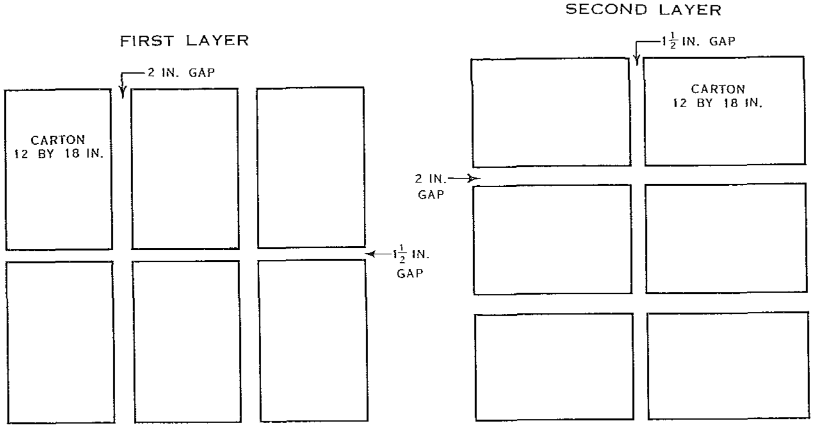


Fig. 2.—Parallel stacking.

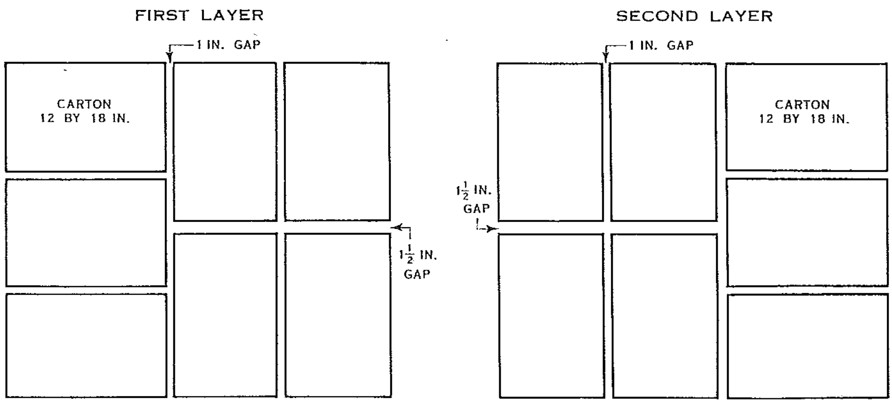


Fig. 3.— Cross stacking.

Stacking Patterns

For pre-cooling cartons of fruit the following stacking patterns can be recommended as allowing sufficient stack stability while permitting a good air flow around the ends and sides of the cartons.

(1) *Open Chimney Stacking.*— Each chimney stack should be built up with vertical gaps of $1\frac{1}{2}$–2 in. between cartons and there should be a 2-in. gap between each stack. Each chimney stack 35 by 35 in.

(2) *Parallel Stacking.*— A 3-by-2 stack with 2-in. gaps between the sides and $1\frac{1}{2}$-in. gaps between the ends of each carton. There should be vertical air gaps of 2 in. between each stack. Each stack 42 by 42 inches.

(3) *Cross Stacking.*— A 3-by-1 stack adjoining a 2-by-2 stack in each layer. Stacks spaced 2 in. apart. Each stack 42 by 48 in.

Floor space per group of four stacks with 2-in. gaps between stacks:

(1) 6 ft 2 in. by 6 ft 2 in. for 16 cartons per layer;
2 in. between cartons: 342 sq. in./carton
$1\frac{1}{2}$ in. between cartons: 333 sq. in./carton

(2) 7 ft 4 in. by 7 ft 4 in. for 24 cartons per layer;
323 sq. in./carton

(3) 7 ft 4 in. by 8 ft 4 in. for 28 cartons per layer;
314 sq. in./carton

Pallet Loading

The stacking patterns shown in (2) and (3) are recommended for spacing loads on pallets so as to obtain quick cooling of fruit. If they are adopted, however, it may prove necessary to restack the cartons before taking them to the ship. Closer pallet stows than those recommended for quick cooling are usually required for shipping so as to conserve space. The behaviour of pallet units of cartons during overseas transport is under investigation. Contrary to the experience with fruit in wooden boxes the cooling of cartons of warm fruit in refrigerated ship space, unless well dunnaged, is unlikely to prove satisfactory. Hence, on the basis of available evidence, the present compulsory pre-cooling of fruit in cartons, in land-based cool stores, could not be abandoned with safety.

For longer storage periods in cool stores permanent stacks of close chimneys (i.e. no gaps between cartons in the chimney) are recommended. A spacing of 2 in. between chimneys should give enough exposure of each carton — one end, one side, and a third of the other side extending into the chimney being exposed. Such a stow should be on a false floor which enables air to move freely through the chimney. The mean floor space per carton is 314 sq. in.

REFERENCES

FISHER, D. V. (1960).—Cooling rates of apples packed in different bushel containers and stacked at different spacings in cold storage. *Summ. Rep. Res. Sta. Summerland, B.C.* **1959**: 5.

OLSEN, K. L., PATCHEN, G. O., and SCHOMER, H. A. (1960).—Rates of cooling of apples packed in fibreboard boxes as influenced by vents, perforated trays and stacking pattern. *Proc. Wash. St. Hort. Ass.* **56**: 214–20.

ROSTOS, G. M. (1960).—Survey of fruit cool stores. C.S.I.R.O. Aust. Bull. No. 282.

SAINSBURY, G. F., and SCHOMER, H. A. (1957).—Influence of carton stacking patterns on pear cooling rates. U.S. Dep. Agric. Marketing Res. Rep. No. 171.

Preserving Berry Fruits by Freezing

By S. M. Sykes

Division of Food Preservation, C.S.I.R.O., Tasmanian Regional Laboratory, Hobart

FROZEN berry fruits, which are widely accepted table delicacies in many other countries, do not feature prominently in Australian food stores. There appears no serious reason why they should not become more popular.

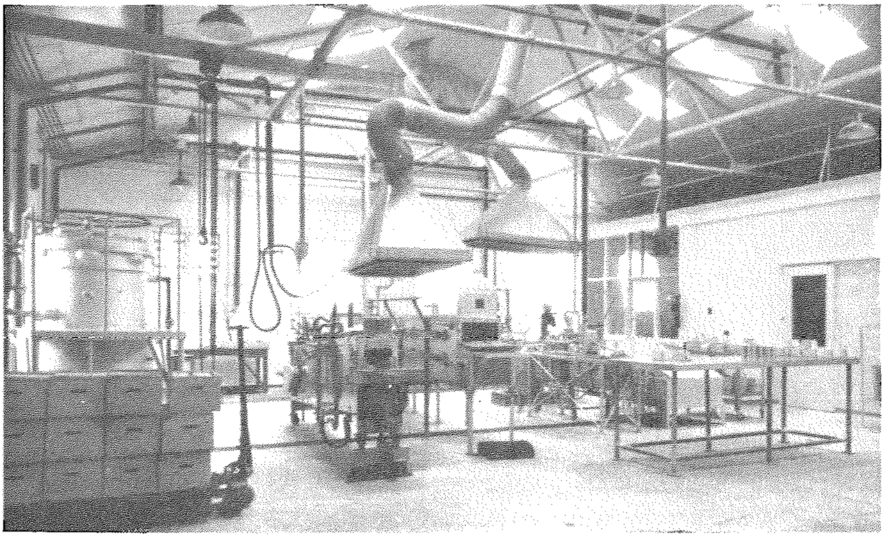
Much has been done in recent years, by the research worker and processor, to improve the quality of Australian frozen berry fruits. Continuing research is, however, essential if these fruits are to take the place on the Australian table they have taken on that of, say, the U.S.A.

The following notes on practical processing procedure are based on the results of investigations carried out by the C.S.I.R.O. Division of Food Preservation acting in collaboration with the State Departments of Agriculture of Tasmania and New South Wales, and on published works and accepted commercial practices in other countries.

The production of berry fruits in Australia is small in relation to the fruit industry as a whole. Agronomic and economic factors have restricted their cultivation, and as they spoil rapidly it is difficult to market them as fresh fruit.

Because of this handicap berry fruit production has become very dependent upon processing. Future production is thus likely to be influenced very greatly by the development of freezing. Alternative methods of preservation — canning and drying — alter the natural appearance and texture of the fruit and depreciate their fresh value. Fortunately the colour and flavour of berry fruits can be substantially preserved by freezing. Frozen berry fruit may be consumed, after thawing, as a fresh dessert or it can be used for manufacturing other products.

Raspberries, loganberries, and blackcurrants are grown in Tasmania and to a lesser extent in Victoria, while strawberries are grown mainly in the semitropical areas of southern Queensland. Tasmanian production



Experimental food processing laboratory at the Tasmanian Regional Laboratory, C.S.I.R.O., Hobart.

of strawberries, once relatively large, has been reduced substantially by disease.

Strawberries

Variety.— An ideal variety of strawberries for processing, apart from being able to withstand freezing, storage, and thawing without undue loss of quality, should have the following characteristics: a bright red colour extending over a large proportion of the surface and well into the flesh, a firm texture that will withstand handling and possibly slicing, and a characteristic strawberry flavour.

Since relatively few varieties of strawberries have been field-tested and propagated to the stage of commercial production in Australia, the opportunities for varietal studies have been limited. Satisfactory results, in small-scale experiments, have been obtained with the following varieties:

- Ettersburg Tree (grown in Southern Tasmania);
- Auchincruive Climax (grown in Southern Tasmania);
- Phenomenal (grown in Southern Queensland);
- Phenomenal (grown in N.S.W.).

Of these varieties, Ettersburg Tree, which is the main commercial variety in Southern Tasmania, has proved the best. Auchincruive Climax (usually known as Climax), although of fairly good freezing quality, has proved unreliable in the field because of a genetical weakness (Raphael 1956). Observations with the variety Phenomenal have been somewhat limited; whilst possessing a good appearance in its fresh state it has shown a tendency to soften after freezing. In one trial in Southern Tasmania the variety Royal Sovereign proved unsatisfactory for freezing. The result of this trial was supported by those reported at the Fruit and Vegetable Research Station, Campden, England (1951).

Condition of the Fruit.— Probably equally as important as choice of variety is the condition of the fruit at the time of processing.

Berries for processing should be "eating-ripe" but not over-mature. Over-mature berries, more subject to breakdown and damage before processing, often show defects of colour and flavour after freezing which were not obvious in their fresh state. There is evidence that, at least as far as Tasmania is concerned, fruit picked late in the season is inferior to that picked earlier. This quality deterioration may be a maturity effect or it might result from longer exposure to the hot weather conditions which often occur towards the end of the picking period. Another possibility is that it results from mechanical damage from previous pickings. Wet weather just prior to harvesting — which is often reflected in a reduced soluble solids value in the fruit — may affect adversely the quality after freezing.

The Ettersburg Tree strawberry variety has given very satisfactory results in freezing trials. (Photo Tasmanian Department of Agriculture.)

The greatest amount of deterioration prior to processing seems to occur after picking. The berries should be picked carefully so as to avoid bruising and other mechanical damage. If they are picked without their "caps" (calyces) a greater loss from breakdown and mould may be expected. The fruit should be transported promptly to the factory in suitable clean, well-ventilated, shallow containers, e.g. wooden punnets. If short periods of holding are necessary in the field a cool position should be selected. The same consideration applies to delays in the factory, when the use of a storage room at about 32°F is recommended.

Preparation for Processing.— The berries should be washed thoroughly and inspected for blemishes prior to processing. Size-grading may prove necessary to give uniformity in the pack.

In common with most other frozen fruits strawberries require the addition of sugar or of a syrup to retard undesirable changes in appearance and flavour, as well as for sweetening purposes. Syrup packs have given produce of superior quality to that obtained from the dry sugar method. Since, however, the presence of an appreciable quantity of syrup may be considered a disadvantage, a dry sugar pack may be often preferred. The latter method is applicable particularly where the retention of whole fruit shape is not of primary importance.

A strength of 45° Brix should prove satisfactory for syrup packs but higher levels may be also used. The proportion of syrup to fruit is usually varied according to the size of the container; in a 1-lb container it may be as high as 7 parts syrup to 9 parts fruit.

When dry sugar is used it is usually well mixed with the fruit prior to packing, by a slow-moving mechanical mixer. The fruit may be halved or crushed slightly to enable the sugar to dissolve more readily in the juice. Proportions of 4 or 3 parts fruit to 1 part sugar may be used for sliced or halved fruit and a ratio of 4 : 1 or 5 : 1 for the whole fruit.

The freezing of strawberries without sugar or syrup is not to be recommended because of the problems of off-flavour, tissue collapse, and change in colour which may occur.

Experiments with vacuum syruping and closing have shown some reduction in off-flavour development and have given a slightly better penetration of syrup. Addition of low-methoxyl pectin or other thickening agents to the syrup makes very little difference to general quality (Sykes and Scheltema, unpublished data).

Bulk Packs.— Most of the considerations mentioned already apply also to the larger packs. With bulk packs the dry sugar technique is to be preferred to the syrup pack, and the packing of berries without sugar or syrup should not be attempted.

Freezing.— From the point of view of quality the rate of freezing does not appear to be of great import provided that it is not so long as to allow deterioration in the early "cooling-down" stage. A slight improvement in texture is sometimes claimed for extremely rapid freezing, e.g. by liquid immersion or spray methods, but the reality of this effect is somewhat doubtful. Faster rates may, of course, be preferred because of the greater throughput achieved and the consequent saving in floor space.

Raspberries

Variety.— The investigation of varieties has been limited to the two generally grown commercially — Lloyd George and Red Antwerp — and to two other varieties, Taylor and Neika, at present grown on a very small scale. Apart from an indication of inferior retention of wholeness and shape with Red Antwerp, no consistent quality differences between the varieties have been found, all being regarded as suitable for freezing. The variety Neika has a flavour which, although quite attractive, differs somewhat from the desired raspberry flavour which is typified best by that of the variety Lloyd George.

The berries when harvested should be still quite firm but should show a good development of deep red colour. As recommended in the case of strawberries, the greatest care in picking and transport must be observed; the object in this case is to avoid breakage and collapse of the whole berries and of the small drupelets which make up the fruit. Adverse climatic conditions, e.g. hot dry weather, just before and during the harvesting period, prove detrimental to the quality of the frozen product.

The procedure adopted for transport and handling should be that recommended for strawberries.

Preparation.— The fruit should be washed properly before freezing although the time the fruit is in contact with the water should be kept to a minimum. Experimental work has shown no significant difference in the final quality of the frozen product between washed and unwashed fruit.

Packing whole berries in syrup seems to be the method preferred for the retail market.

Fresh raspberries of the varieties (left to right) Lloyd George, Red Antwerp, Neika, and Taylor, used in freezing experiments. (Tasmanian Government photo.)

It is, in fact, the only satisfactory method where a sweetened dessert fruit, with a high proportion of whole fruit, is required. When retention of whole fruit is not of importance, a dry sugar pack might prove acceptable.

With a syrup pack, a concentration of 50–60° Brix, according to preference, should be used. The level of 60° Brix used in several experiments has given a satisfactory sugar-acid balance in the finished product. The proportion of syrup to fruit will vary with the size of container but it should at least suffice to nearly cover the fruit.

With the dry sugar method, a proportion of 1 part sugar to 4 or 3 parts fruit may be used.

The freezing of whole raspberries without sugar or syrup is not to be recommended for small dessert packs intended for the retail market.

Freezing.—As for strawberries.

Bulk Packs.— At present bulk or "institutional" packing of raspberries is of more importance than the production of small packs for the retail market. Since much of the raspberry crop is packed in a pulp state, or as partially broken fruit, bulk freezing is applicable. In the case of such semi-liquid produce, usually intended for manufacturing into other foods, e.g. jams, syrups, icecream, etc., the addition of sugar is not necessary. When sugar is to be used in the secondary processing its addition initially gives the frozen pulp greater stability during long storage periods.

Fresh pulp intended for frozen storage should be of high quality and free from mouldy berries. It should not be held for long periods and the rate of freezing must be rapid enough to reduce overall temperature to a safe level before substantial microbial growth can occur. A "sharp-freezing" room, of adequate capacity, with ample forced air circulation, is desirable. The containers should be stacked in the store so as to give maximum contact with the cool air. Air-blast tunnels, which give fast rates of freezing, and therefore greater throughput, offer advantages where floor space is limited.

Other Berries

Several other types of berries have been frozen successfully both in experiments and, to a small extent, commercially. Bramble-fruits other than raspberries, e.g. loganberries, youngberries, boysenberries, phenomenal-berries, and mammoth berries, have proved well suited to freezing and should be handled, prepared, and frozen in the same way as raspberries.

Blackcurrants are normally used for manufacture into various products. Since the Vitamin C content is of special importance with this fruit, freezing offers the additional advantage of its better retention. Possibly because of its high acid content this fruit keeps well in the frozen state without the addition of sugar. The fruit may be packed dry, with or without stems, in suitable metal or plastic containers.

Gooseberries, of minor importance in the berry industry, may be frozen successfully with or without sugar for processing at a later date into other forms of preserve.

Containers

Containers for frozen berries should be liquid-tight, not only at the time of freezing but also during storage, or leakage of unfrozen viscous syrup or juice, concentrated by freezing, may occur.

For the large packs, cans lined with a suitable resistant lacquer, and fitted with a "press-in" or soldered closure, will give adequate protection. The 30-lb capacity rectangular cans used for egg pulp are frequently used for this purpose. Cylindrical containers of waxed board have been used also to a small extent. Flexible plastic bags are not suitable unless the seals can be made completely liquid-tight and there is no danger of "pin-holing" or breakage of the bags.

For small retail packs, the ordinary double-seam can is ideal but, for a number of reasons, a distinctive package, in keeping with other frozen foods, is usually preferred by processors. Metal-ended, fibreboard-bodied containers have been used commercially but to be successful the seams must be formed very carefully to ensure there is no leakage. When there is no objection to a two-piece package, properly sealed plastic bags protected by a carton are satisfactory.

When rigid containers are used a head space one-tenth the depth of container should be allowed for expansion of the contents on freezing.

Storage

Studies on storage life at different temperatures have shown, both in the U.S.A. (Guadagni, Nimmo, and Jansen 1957*a*, 1957*b*) and in Australia (Sykes and Scheltema, unpublished data), the desirability of maintaining the frozen berry fruit at 0°F or less. At this temperature the fruit should not change significantly in quality over a period of approximately one year.

REFERENCES

FRUIT AND VEGETABLE PRESERVATION RESEARCH STATION, CAMPDEN (1951).—Annual Report, 1951. p. 13.

GUADAGNI, D. G., NIMMO, C. C., and JANSEN, E. F. (1957*a*).—Time-temperature tolerance of frozen foods. VI. *Food Tech.* **11**: 389.

GUADAGNI, D. G., NIMMO, C. C., and JANSEN, E. F. (1957*b*).—Time-temperature tolerance of frozen foods. X. *Food Tech.* **11**: 633.

RAPHAEL, T. D. (1956).—Berry fruit culture. Bull. Tasm. Dep. Agric. No. 7 (new series).

Tests for Adequacy of Blanch for Frozen Vegetables

By G. C. Walker and J. Shipton

Division of Food Preservation, C.S.I.R.O., North Ryde, N.S.W.

CHEMICAL changes, including those brought about by microbial activity, may occur in all forms of stored foodstuffs and result in lowered quality or complete spoilage. The retention of quality of frozen vegetables is achieved in two ways: they are heat treated (blanched) prior to freezing, to destroy labile chemical systems believed to be primarily responsible for spoilage, and they are stored at low temperature, which minimizes chemical reactions. The advantages of blanching most vegetables have long been recognized and were incorporated in the patents filed by Haslacher (1928) and Birdseye (1934).

A great deal of evidence has accumulated over the past three decades to suggest that enzyme-catalysed reactions are primarily responsible for the spoilage of frozen foods (see review by Joslyn 1949). However, it is not possible to overlook other heat-labile chemical systems which may also cause off-flavour in stored produce.

Since the systems, either enzymic or chemical, causing deterioration are largely unknown the only real test for adequacy of blanch is the retention of quality over the whole storage life of the product. It is convenient, however, to have an indicator of adequacy of blanch which can be used at the time of processing. The heat destruction of the enzymes catalase and peroxidase has been used as such an indicator.

Catalase and Peroxidase

It was thought originally that catalase and peroxidase had different properties. Thus catalase was considered to catalyse only the breakdown of hydrogen peroxide to water and oxygen, while peroxidase was thought to catalyse the peroxidation (oxidation with hydrogen peroxide) of a range of compounds. These distinctions lost their significance with the findings that catalase could catalyse the peroxidation of ethyl alcohol (Keilin and Hartree 1945) and other compounds (Heppel and Porterfield 1947; Chance 1949; Keilin and Hartree 1955). Catalases and peroxidases are now regarded as members of a group of enzymes, the hydroperoxidases, which are very widely distributed in both animal and plant tissues.

While many tests for hydroperoxidase have been developed (Joslyn 1949) they are essentially modifications of the earlier catalase and peroxidase tests. Catalase is determined by adding hydrogen peroxide solution to the tissue to be tested and measuring either oxygen evolution or the destruction of hydrogen peroxide. The majority of tests for peroxidase are colorimetric, hydrogen peroxide being used with an indicator which changes colour on peroxidation. Alternatively the reduction of hydrogen peroxide in the presence of an indicator can be measured. Since each test differs in sensitivity and the degree to which it is affected by non-enzymatic side reactions, appropriate end points must be selected to indicate when blanching is adequate.

Hydroperoxidase Testing in the Factory

As there is need, in commercial processing, for a simple and rapid hydroperoxidase test, the present authors have sought to develop methods for testing the range of vegetables commonly frozen. Experiments have been conducted on brocolli, brussels sprouts, cauliflower, peas, runner beans, potatoes, carrots, swedes, and onions.

The vegetables were each subjected to a series of blanching treatments ranging in duration from $\frac{1}{2}$ to 5 min. They were then cooled and residual hydroperoxidase was determined. Initially the Association of Official Agricultural Chemists (1960) catalase method, which quantitatively measures the destruction of hydrogen peroxide, was used. While this method showed quite clearly the point of complete enzyme inactivation it proved relatively slow in use. In view of this drawback other tests were examined and evaluated in terms of the A.O.A.C. catalase assay. The following methods, which are recommended for trial by food processors, were found satisfactory with the produce tested. Peroxidase activity was determined by observing the formation of the red-brown polymer of peroxidized guaiacol following the addition of hydrogen peroxide and guaiacol (Reagent C) to the vegetable tissue. Reagent C was prepared daily by mixing equal volumes of the following:

Reagent A: 1·0 g guaiacol (*o*-methoxyphenol) dissolved in 50 ml ethanol and diluted to 100 ml with distilled water.

Reagent B: 5·0 ml 100-volume "Analar" hydrogen peroxide diluted to 100 ml with distilled water.

Preparation of Vegetables for Testing

Broccoli.—At least six spears were split longitudinally and placed on a well illuminated white surface. Reagent C was poured directly onto the tissue and the time taken for the appearance of a red-brown discolouration was recorded.

Brussels Sprouts.—These were prepared and tested as for broccoli. With part blanched samples the brown colouration was usually localized in the regions close to the butts. Marked variability was found between individual sprouts and it was necessary to use 6–7 sprouts for a representative sample.

Cauliflower.—Same procedure as for broccoli.

Carrots.—Sliced carrots were cut to approximately $\frac{1}{8}$-in. cubes. "Diced" carrots were halved to expose their centres. A 6 by $\frac{5}{8}$ in. test tube was filled to a depth of 1–2 in. with chopped tissue, which was covered with reagent C. The time taken to the first appearance of a brown colour in the vascular strands was recorded.

Onions.—Samples were prepared and tested as for carrot. Vein discolouration was ignored. The peroxidase reaction was slow, 3–5 min being required for tissue browning.

Peas.—These were split and tested as for carrot. The time taken to the appearance of a brown colour in the centres of the cotyledons was recorded. Any colour developing in the skins was ignored.

Potatoes.—These were prepared and tested as for carrot.

Runner Beans.—The bean tissue was chopped and transferred to 6 by $\frac{5}{8}$ in. test tubes to give a depth of 1–2 in. Reagent C was then added so as to cover the tissue by 1 in. The tube was shaken frequently and the time taken for the solution to brown was recorded.

Swedes.—These were treated as for runner beans

Results

The degree of development of a brown colour in exposed surfaces of partly blanched broccoli, brussels sprouts, carrots, cauliflower, and peas showed good agreement with the results of simultaneous catalase determinations. The point of inactivation of peroxidase, as judged by absence of colour after 5 min, closely paralleled catalase inactivation. Runner beans and swedes differed insofar as catalase inactivation did not appear to be related to the development of a brown colour in the tissues on adding Reagent C. Further work with beans indicated that much tissue browning arose from non-enzymatic reactions, the mechanisms of which were not elucidated. It was observed, however, that partly blanched beans and swedes caused a marked browning of solution C. Since catalase inactivation closely paralleled the degree of solution staining this was adopted as an indicator of peroxidase activity. Onions, while not normally blanched, have been included in this work. They show two forms of browning, one due to hydroperoxidase activity and the other probably non-enzymatic.

Interpretation of Results

It should be remembered that while the methods of determining the point of inactivation of hydroperoxidase, which have been described, may indicate blanch adequacy the use of greater or lesser heat than that necessary for enzyme inactivation may be desirable for the satisfactory maintenance, in storage, of produce quality. For example since it was found with some commercial samples of green beans that marked colour deterioration occurred when hydroperoxidase was inactivated completely the destruction point of the heat labile systems, responsible for the tissue discolouration during the hydroperoxidase test, is likely to provide the best indicator of blanch adequacy. It is intended to extend these investigations by examining the relationship between residual hydroperoxidase activity at the time of blanching and the retention of quality during subsequent storage. Only from such experiments will it be possible to obtain the degree of enzyme inactivation necessary to ensure that the produce will store satisfactorily.

REFERENCES

Association of Official Agricultural Chemists (1960).—"Official Methods of Analysis." 9th Ed. p.230, 17.003. (A.O.A.C.: Washington.)

Birdseye, C. (1934).—U.S. Pat. No. 1,955,484 (April 17).

Chance, B. (1949).—*J. Biol. Chem.* **179**: 1341.

Haslacher, A. B. (1928).—U.S. Pat. No. 1,668,903 (May 8).

Heppel, L. A., and Porterfield, J. T. (1947).—*J. Biol. Chem.* **178**: 549.

Joslyn, M. A. (1949).—*Advanc. Enzymol.* **9**: 613.

Keilin, D., and Hartree, E. F. (1945).—*Biochem. J.* **39**: 293.

Keilin, D., and Hartree, E. F. (1955).—*Biochem. J.* **60**: 310.

Notes

The British Industrial Biological Research Association

An association with the above name, a non-profit limited company whose directors represent various segments of the British food industry, has been formed with the object of undertaking research "to help manufacturers and the public satisfy themselves that the chemical substances used in foods, confectionery, beverages and cosmetics are not harmful to health."

In addition to undertaking basic research the Association is to make toxicity and other relevant tests of substances recommended for investigation by its Research Policy Committee. While emphasizing its primary intention of establishing itself as an authoritative body of recognized scientific standing, the Association also plans a maximum of direct aid to industry. It is already distributing a monthly bulletin aimed at keeping its members in touch with relevant scientific advances and legislative changes throughout the world. It is recruiting a strong scientific staff and pending the completion of its own laboratories, which are to be in the grounds of the Medical Research Council in Carshalton, Surrey, England, it will carry out basic research in other scientific laboratories. In due course members will receive full reports of the results of this research and of the tests carried out. Expert advice and other assistance will be available to members who possess their own laboratories and to those who normally obtain information from other sources.

To finance its activities the present 118 members of the Association have undertaken to subscribe £29,000 per annum for the next five years while the U.K. Department of Scientific and Industrial Research will aid by subscribing £1 for £1. To deal adequately with many pressing problems additional revenue is necessary. The Council of the Association decided recently to extend membership to all interested firms within the British Commonwealth. Enquiries should be addressed to the British Industrial Biological Research Association, 93–97 Regent Street, London, W.1.

Two International Meetings

FIRST INTERNATIONAL CONGRESS

More than 1200 delegates from 38 countries met in London on September 18–21 at the First International Congress of Food Science and Technology. Australia was represented by 11 delegates: Dr. J. R. Vickery, Mr. J. F. Kefford, Dr. J. H. B. Christian, and Dr. D. L. Ingles from the C.S.I.R.O. Division of Food Preservation; Mr. G. Loftus Hills and Miss L. Linton-Smith from the C.S.I.R.O. Division of Dairy Research; Dr. S. A. Trout from the Queensland Department of Agriculture and Stock; Mr. R. A. Edwards and Dr. B. Tarladgis from the University of New South Wales; Dr. R. A. Bottomley from M.B.&T. Research Laboratories; Mr. L. F. Gunnis from the Queensland Butter Board; and Mr. C. J. MacDermott.

Opening Session

Lord Rank, President of the Congress and Chairman of Ranks Hovis McDougall Ltd., opened the Congress at a plenary session held in the Odeon Cinema, Kensington. The opening session was then addressed by Dr. N. C. Wright, Deputy-Director of the Food and Agriculture Organization of the United Nations, and Dr. E. M. Mrak, Chancellor of the University of California, Davis, U.S.A., on the subject "Food Science and

Technology in Relation to Feeding the World". Their two complementary, authoritative addresses placed squarely upon food scientists and technologists major responsibilities in connection with world food problems.

Dr. Norman Wright considered it possible for the world to produce enough to feed its people, even if the present population is doubled by the year 2000. But production is not enough: the food must reach the consumer and be eaten. For food scientists and technologists the major task in the developing countries is to reduce post-harvest losses, mainly by improving traditional methods of food preservation; and in the developed countries to maintain consistent high quality, nutritive value, acceptability, stability, safety, and convenience in all foods marketed.

Dr. Emil Mrak discussed the contribution to world feeding problems that might be made by foods from new sources such as the microflora and microfauna of the sea, algae, plant proteins, and synthetic amino acids, carbohydrates, and fats. How to turn these products into economical and acceptable foods, he said, is a major challenge to food scientists and technologists.

Congress Programme

The remainder of the Congress programme was made up of a series of symposia and sessions for the reading of technical papers, and these meetings were held in lecture rooms in various departments of the Imperial College of Science and Technology at South Kensington. In addition, each afternoon visits and excursions were arranged to a number of laboratories, commercial plants, and educational institutions.

The first symposium on "National and International Aspects of Abstracting and Disseminating the Literature of Food Science and Technology" provided a valuable opportunity for delegates from many nations to present their views on problems and deficiencies in present food information and abstracting services. A resolution affirming the need for a comprehensive food abstract service was drafted and subsequently adopted by a plenary session of the Congress. Wide general interest was also shown in the other symposia on the subjects "The Education and Training of Food Scientists and Technologists", "The Changing Pattern of Consumption of Food—National and International", and "The Effects of Modern Agricultural Practices on Foods".

In the paper reading sessions, more than 300 papers were presented in the four general categories: chemical and physical aspects of foods; biological and microbiological aspects of foods; quality, analysis, and composition of foods; and manufacture and distribution of foods. Classification of papers on the basis of specific commodities was avoided since it was the desire of the organizers to demonstrate the unity of food science as a scientific discipline. Because of the large number of papers it was necessary to conduct as many as 11 concurrent sessions at certain times, and this inevitably proved frustrating to delegates who wished to hear papers that were being presented simultaneously in different sessions.

It is not easy to summarize the great variety of material presented to the Congress in terms of significant trends and advances. Topical interest in freeze-drying is reflected in the number of papers presented, while it is clear that less work is being done on the effects of ionizing radiations on foods. The chemistry of protein foods of animal and vegetable origin is still an active field of work, and tannins and other flavonoid constituents of foods are being studied in many laboratories. Gas chromatographic techniques are being applied very widely to problems in flavour chemistry that would have been impossible to attack by techniques previously available. Texture and consistency as quality attributes of foods are being studied more intensively, both from the points of view of fundamental chemistry and objective methods of measurement. The sessions on the training and use of taste panels attracted an interesting group of papers and large and enthusiastic audiences. In the field of canning technology a number of papers were concerned with the problem of post-processing infection through apparently sound seams. In addition to the many papers on foods that are universally familiar, there were papers on unusual foods such as gari, a Nigerian food made from cassava, and horchata, a Spanish beverage made from chufa tubers.

C.S.I.R.O. Contributions

Papers were contributed by members of the C.S.I.R.O. Division of Food Preservation on the following subjects: "Mechanism of Non-Enzymatic Browning Reactions, and of their Inhibition by Sulphur Dioxide" by T. M. Reynolds, E. F. L. J. Anet, and D. L. Ingles; "The Definition of Stages of Senescence in Stored Fruits" by F. E. Huelin; "Texture Studies on Pineapples for Canning" by D. J. Casimir, R. S. Mitchell, and L. J. Lynch; "Cooling of Fruit in Bulk Bins" by J. D. Mellor, E. G. Hall, and D. Martin; and "A Naturally Occurring Modification of Ovalbumin" by M. B. Smith.

Social Functions

Three social events during the course of the Congress provided additional opportunities for delegates to meet. On Tuesday evening, September 18, Lord and Lady Rank received members and their ladies in the Geological Museum. A reception at the invitation of Her Majesty's Government was held in Lancaster House on Wednesday, September 19, when a group of delegates, mainly foreign visitors, were received by Lord St. Oswald, Parliamentary Secretary to the Minister of Agriculture, Fisheries and Food, and Lady St. Oswald. Then on Friday, September 21, the Congress was concluded fittingly, at a banquet attended by the Lord Mayor and Lady Mayoress of London, in the magnificent traditional surroundings of the Guild Hall of the City of London.

Some General Comments

The Congress committees must be warmly commended for the smooth and efficient organization of this Congress in the face of unavoidable difficulties such as extensive building operations at Imperial College. There is no doubt that delegates found it to be a highly successful and worthwhile meeting, but there was general dissatisfaction with some aspects of the programme which are common to all large scientific meetings. It is generally admitted that such meetings are valuable chiefly for bringing scientific workers together, and not for the reading of specialist papers. Many delegates, however, cannot obtain permission to attend meetings unless they are presenting a paper, and therefore the first need is to amend official thinking in this respect. It is the writer's personal view that large scientific meetings should provide programmes made up chiefly of invited papers by acknowledged leaders giving critical and provocative surveys of specific fields of research activity and technological progress. These papers should be in the hands of the delegates before the conference and there should be ample time for discussion. In the London Congress, generally speaking, active and worthwhile discussions developed when there there was sufficient time available, for instance when a speaker failed to appear.

It was interesting to compare the London Congress with the Annual Meeting of the Institute of Food Technologists in Miami, which was attended by approximately twice as many delegates. As a location Miami had some inherent advantages over London. There were less distractions, the delegates were living close together in a group of adjoining hotels, and all of the sessions were held in the one hotel. As a result, there appeared to be more opportunities for delegates to meet.

In spite of some reservations about the value of large international meetings, there was a general feeling among delegates that further international congresses of food science and technology should be held. No decisions were made about the time or place for the next gathering, or about the formation of a permanent international organization in this field. These considerations were left in the hands of the international Steering Committee which was reappointed with power to add. Dr. J. R. Vickery is the Australian representative on this committee.

INTERNATIONAL SYMPOSIUM

On Monday, September 24, another international meeting was held in London, not connected with the International Congress of Food Science and Technology but attended by many of the same people. This was an International Symposium on Food Regulations in Relation to International Trade, organized by the Food Group of the Society of Chemical Industry. Approximately 400 participants met in Church House, Westminster, to exchange views on important topical problems concerned with food regulations.

Under the chairmanship of Mr. J. P. Van Den Bergh, Managing Director, Unilever Ltd., the meeting was addressed by Mr. T.

McLachlan, Public Analyst, London, on "The Present Chaotic Position"; by Dr. J. Mahoney Merck & Co. Inc., U.S.A., on "Food Additives"; by Dr. K. Dürrenmatt, Nestlé Alimentana, Switzerland, on "Food Labelling"; and by Mr. F. H. Townshend, Food and Agriculture Organization of the United Nations on "The Work of FAO in the Field of Food Regulations".

In the afternoon session, chaired by Dr. J. G. Davis, Chairman of the Food Group, a Brains Trust answering questions submitted by delegates and joined in general discussion. The members of the Brains Trust were the four speakers of the previous session together with Mr. Mogens Jul, Danish Meat Research Institute; Mr. W. M. Shortt, Ministry of Agriculture, Fisheries and Food, U.K.; Dr. H. Weiss, German Association of Food Law and Science; and Mr. J. F. Kefford, Division of Food Preservation, C.S.I.R.O., Australia.

This meeting provided a useful opportunity to bring to light common problems, and to assess differences in national viewpoints regarding ways of regulating the purity, composition, and quality of foods. One hopeful move towards order and standardization in the confused field of international food regulations is the joint FAO/WHO Codex Alimentarius Commission which is charged with the task of coordinating and simplifying all international activities on food standards, and which will meet for the first time in Geneva, October 1-6, 1962.

J.F.K.

C.S.I.R.O. Exhibit at Poultry Congress

This stand, shared by the C.S.I.R.O. Divisions of Food Preservation and Animal Genetics, in the Australian Scientific and Educational Exhibition at the World Poultry Science Congress, held in Sydney on August 10–18, 1962, attracted many visitors.

Five illustrated panels exhibited by the Division of Food Preservation depicted various aspects of its egg research programme. One panel defined egg quality, a second showed how it is assessed, while another dealt with a study of transport and marketing conditions which may cause the quality of eggs to deteriorate between the farm and the retail shop.

The remaining panels showed how a storage disorder, "pink whites", had been traced to chemical compounds in certain plants, including the marshmallow, which may be consumed by hens, and how investigations had led to a reduction in the bacterial rotting of eggs exported to Europe.

The exhibit of the Division of Animal Genetics was an electronic device, the "Eggatron", which registers and records automatically details of egg production.

Publications

1962 FISHERIES YEAR BOOK AND DIRECTORY

This well produced publication* of nearly 500 pages may well be, as the publishers suggest, one of the best bargains in the technical book world. Certainly it contains a wealth of information on many aspects of the fishing industry throughout the world, including the production, trade in, and consumption of, fish and fish products in some 40 countries.

In the reference section, which constitutes about half the book, there is a dictionary of fish names in eight languages, a record of recent fishery research and a list of specialized journals and trade organizations. Among the authoritative articles will be found several of general interest on "Progress in Fish Freezing", "Preservation of Fish", "Accelerated Freeze Drying", and "Fishing Vessel Design and Construction". Also of considerable interest are articles dealing with the fishing industry in the U.S.A., Britain, Iceland, Germany, and the U.S.S.R., the last giving an account of Soviet production and plans for its expansion.

There is an International Index of Fish Containers and a List of Advertisers which serves as a comprehensive buyers' guide to a wide range of products and fishery equipment. Mention must also be made of a 4-page "Subject Index" which conveniently refers to articles appearing in previous issues, as well as in the current edition of the Year Book.

CONFERENCE ON FRUIT AND VEGETABLE STORAGE RESEARCH

The third conference of technical officers engaged in Fruit and Vegetable Research was held at Sherbrook, Vic., in November 1960. The conference, organized by the C.S.I.R.O. Division of Food Preservation, in cooperation with the Victorian Department of Agriculture, which covered storage disorders of fruit packing and transport problems, design of cool stores, controlled atmosphere storage, local and export marketing, and training of research workers was attended by over 30 delegates from C.S.I.R.O., the State Departments of Agriculture, the Universities of Sydney and Adelaide, two members of the Fruit Research Division of D.S.I.R., New Zealand, and a number of other persons, including industry representatives. Mr. E. G. Hall of the C.S.I.R.O. Division of Food Preservation has been responsible for the editing of the 21 papers presented at the conference and for the summaries of the discussions and recommendations. It is of interest that a recommendation for similar conferences to be held at intervals of four years was endorsed recently by the Standing Committee on Agriculture.

A limited number of copies of the record of the conference, which is mimeographed, is available from the Librarian, Division of Food Preservation, Box 43, Ryde, N.S.W. The records of the proceedings of the two earlier conferences are now out of print.

* Publishers: British Continental Trade Press Ltd., 222 Strand, London, W.C.2. Price £1 stg. post free.

SOME NEW PUBLICATIONS OF THE DIVISION

Copies of the publications mentioned may be obtained from the Librarian, Division of Food Preservation, Box 43, P.O., Ryde, N.S.W. (Telephone 88-0233).

Cowell, N. D., and Scott, K. J.* (1962).—Variability of atmospheres produced by fruit stored in polyethylene box liners. *J. Hort. Sci.* **37**: 87–93.

Ingles, D. L. (1962).—Formation of sulphonic acids from the reactions of reducing sugars with sulphite. *Aust. J. Chem.* **15**: 342–9.

Kaess, G., and Weidemann, J. F. (1962).—Freezer burn as a limiting factor in the storage of animal tissue. III. Experiments with liver frozen without evaporative weight loss. *Food Tech.* **16**: 125–30.

Montgomery, W. A., and Prater, A. R. (1962).—Fish preservation inquiries. I. Preservation of fish bait. *Fish. News Lett. Aust.* **21**(7): 17; **21**(8): 17; **21**(9): 19.

Scott, W. J. (1961).—Available water and microbial growth. Campbell Soup Co. Low Temp. Microbiol. Symp. pp. 89–105.

Sykes, S. M., and Coote, G. G.† (1962).—Rapid estimation of moisture in dried apples. C.S.I.R.O. Aust. Div. Food Pres. Tech. Pap. No. 29.

* Department of Agriculture, New South Wales.

† Division of Mathematical Statistics, C.S.I.R.O.

NEWS FROM THE DIVISION OF FOOD PRESERVATION

STAFF CHANGES

Two senior members of the Division's Plant Physiology Unit at Sydney University have accepted professorial posts. Dr. D. D. Davies, who shared leadership of the Unit with Dr. F. V. Mercer, is to occupy a Chair in the Biology Department at the new University of East Anglia, Norwich, England, while Dr. J. F. Turner, Principal Research Officer, who has been engaged in researches in plant physiology and biochemistry in the Division since 1945, becomes the first Professor of Agricultural Chemistry in the School of Agriculture, Sydney University.

Dr. H. L. Evans, leader of the Physics Section at North Ryde, has been appointed to a lecture and research post in the Department of Mechanical Engineering at Imperial College, University of London, where he will continue his researches into the theory of heat and mass transfer.

Mr. B. J. Bloomfield, a Research Officer in the Microbiology Section, has accepted a position as Research Assistant at Rutgers University, U.S.A., where he will study microbial physiology.

Dr. Ole Myklestad, from the Department of Applied Physics, Christiaan Michelsens Institute, Bergen, Norway, has joined the research staff of the Physics Section at North Ryde to undertake the study of heat and moisture exchanges involved in the cooling and transport of foods. Dr. Myklestad took his primary degree in chemical engineering at the Georgia Institute of Technology, Atlanta, U.S.A., and his doctorate at the Federal Institute of Technology, Zurich, Switzerland.

Mr. D. F. Merz, who holds the degree of Master of Science from the University for Agricultural Science, Wageningen, Holland, has been appointed Experimental Officer at the Citrus Wastage Research Laboratory, Gosford, N.S.W., where he will participate in investigations on the fumigation of citrus fruits and the cold storage of pears. (The purpose of these treatments is to meet the plant quarantine requirements of countries wishing to import fruit from districts in Australia where there is Queensland fruit fly.)

An Experimental Officer, Mr. C. S. Rosenfeld, who has a Diploma in Chemical Engineering from the University of Technology, Timishoara, Rumania, has been appointed to the Canned Foods Section at North Ryde to assist with a programme of research on the packaging of foods.

OVERSEAS TRAVEL

Mr. F. S. Shenstone, Experimental Officer in the Animal Products Section at North Ryde, paid a visit to the U.S.A. during September and October. He took part in a symposium on fatty acids at the Autumn Meeting of the American Chemical Society at Atlantic City, New Jersey, spent some time at the Southern Regional Research Laboratory of the U.S. Department of Agriculture at New Orleans, held discussions with a number of research workers interested in cyclopropene fatty acids and their nutritional effects, and studied the storage, marketing, and packaging of shelled eggs, and the utilization of processed egg products. This tour was made possible through the generosity of the Australian Egg Board and a number of organizations in the U.S.A.

Dr. W. G. Murrell, Senior Research Officer in the Microbiology Section at North Ryde, was overseas for 3 weeks from the middle of August; he had accepted an invitation to attend the 8th International Congress for Microbiology in Montreal, where he served as chairman of a session on chemical and structural changes accompanying spore formation. Dr. Murrell also visited various research establishments in Canada and U.S.A.

Mr. J. B. Davenport, Senior Research Officer, returned to Sydney on October 24, 1962, after 3 years absence overseas. He was initially engaged in research on the chemistry of phospholipids at the Institute of Animal Physiology in Babraham, near Cambridge. At the end of 1960 he took up the Broodbank Fellowship within the University of Cambridge, and worked at the low Temperature Research Station on the lipids of liver and muscle. En route to Australia Mr. Davenport spent 3 weeks in Canada and U.S.A. visiting institutions doing research on phospholipids, lipoproteins, and their metabolism.