important. Yet much of the fish arriving in our ports has deteriorated a good deal even before it is set on shore. On a winter's day I once watched the catch laid out for auction in a great fishing port. Stormy weather had kept some of the boats for as long as nineteen days at sea. The fish, of course, was ice-packed, but, even at that, much had deteriorated palpably. It was to me a pathetic sight to consider the expenditure of effort, of money, of hard-ship, perhaps even of life, that lay behind that catch of now indifferent fish. That, however, can be improved upon and all our principal food fishes can be brought into the season class. All important species can be kept in good condition for six months—the fatty fishes perhaps for no more, but the white fishes for longer.

The kipper, again, has normally a life of about a week; but arrangements could be made for herrings landed in Aberdeen to be sold as perfectly good kippers in Australia; and if they can be sold as good kippers in Australia, so they could be here after the same interval.

Another interesting fact which attaches to the preservation of fish is that among foodstuffs at present it stands out as one of which the deterioration can be assayed by chemical methods of the utmost delicacy.

Half of our meat supply comes from over-seas. This fact is so familiar that I need say very little about it, except this: in theory meat can be kept for a very long time. A Siberian physiologist claims to have made the heart of a dog beat thirty-one days after the death of the dog, the body being kept cold. Believe that or not as you please, there is no doubt that American workers have stored meat under sterile conditions—chilled but not frozen—for a year; the flavour had deteriorated, but the chemical changes that had taken place were only very trifling. The storage of meat, therefore, whether mutton or beef, is really a problem in cleanliness. Two factors should be realized: (1) that the meat should throughout its history come in contact with the fewest organisms; (2) that it should be kept under conditions as unfavourable as possible to the growth of such organisms as come its way. Both conditions are very much the business of the Food Investigation Board and of its associates in the Dominions: the second has been met by the gas storage of chilled meat.

Preservation over Shorter Periods

The subject of preservation over shorter times and shorter journeys, the insurance that lettuces or strawberries should reach the customer as fresh as when they were picked, is one of which I will only treat very lightly. First let me say that I have been taken to task for putting strawberries and lettuces in the same category. From the point of view of transport they are similar, but in importance they differ greatly: strawberries are a luxury; lettuces are the very type of green vegetable so important for its vitamin value. The storage of hundreds of tons of lettuces merely to provide a given number of grammes of vitamin seems the wrong policy. Surely the ultimate aim must be the manufacture and storage of the vitamins or vitamin concentrates. Meanwhile the provision of green vegetables out of season seems to leave a good deal to be desired in times of emergency.

The word "emergency" brings me to one final sentence. Although the statement I have just made is definitely a review of the position in the light of a possible emergency, the review has much wider implications. The possible implications have been put forward with all the authority of Maynard Keynes at the Cambridge meeting of the

British Association; it would be an impertinence for me to do more than allude to them. They are, however, in brief, that much work could be saved, prices could be stabilized, and speculation discouraged by a policy of storing foodstuffs which could be released in the correct quantities at the appropriate moments.

Summary

This paper deals with the contribution which food investigation has made to the facilities for the supply of commodities to this country, especially in time of emergency.

Foodstuffs are discussed under three main headings, according to the length of time they can be kept.

It is considered that the ultimate goal would be the manufacture and storage of the vitamins.

THE COMMONER TYPES OF SUPERSENSITIVENESS AND THEIR MANAGEMENT

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Supersensitiveness has been defined as the liability of an individual to suffer severe effects of a special nature on exposure to certain agents which are harmless to others, at least in the doses used (Browning, 1934). The terms "allergy," "idiosyncrasy," and "hypersensitiveness" have been employed as equivalent terms. This condition may show itself in connexion with many of the body tissues—for example, the respiratory tract, the gastrointestinal tract, and the cutaneous structures, depending on the susceptibility of the individual. Thus one patient may display catarrhal manifestations of supersensitiveness affecting the mucous membranes of the nasopharyngeal region (hay fever), while in another, bronchial spasm occurs with resultant asthma. In others, varieties of cutaneous manifestations may be seen—for example, angioneurotic oedema, urticaria, dermatitis, etc.; also nausea and colic may be due to gastro-intestinal supersensitiveness.

Manifestations of Supersensitiveness

Asthma.—Owing to its wide and somewhat indiscriminate use "asthma" should be defined. Asthma, as distinct from the dyspnoea of simple bronchospasm, is a type of paroxysmal dyspnoea occurring in individuals in whom certain primary essentials are present. Bray (1937) has pointed out that these are, firstly, a family tendency to supersensitiveness, and, secondly, tissue damage following on a severe illness often pneumonic in nature, coupled in either case with a superimposed specific sensitization. In these individuals a paroxysm may be initiated by such secondary factors as reflex nasal irritation, psychic and endocrine disturbances, and non-specific factors often alimentary in origin. In the asthmatic attack there is a spasmodic constriction of the bronchial muscles

with swelling of the lining membranes of the bronchi and a thick viscid exudation, leading to dyspnoea from inadequate aeration. Asthma should be distinguished from the dyspnoea of bronchospasm, which may occur in any individual by the influence of irritants acting either locally or through the vagus nerve. Moreover, asthma should be clearly differentiated from the dyspnoea of cardiac or renal insufficiency.

Hay Fever.—In specifically sensitive individuals contact with certain pollens gives rise to a train of oculo-naso-pharyngeal symptoms: (a) conjunctival congestion, lacrimation, and photophobia; (b) nasal fullness, sneezing, and a profuse watery discharge; and (c) pharyngeal congestion leading to coughing. More rarely the lower parts of the respiratory tract may be involved, with the production of bronchial spasm and paroxysmal dyspnoea (hay asthma). The pollen capable of producing these effects is wind-borne and is copiously disseminated from plants widely distributed in Nature. The seasonal incidence of hay fever in the British Isles is related to the times of pollination of some grasses in June and July, and less commonly to that of certain trees somewhat earlier. Meteorological factors such as rain, wind, and temperature determine the concentration of pollen in the atmosphere. Vasomotor rhinitis, which has many points of similarity with hay fever, has no seasonal incidence, since the specific factor may be some inhalant such as dust which is encountered all the year round. Brown Kelly (1925) has emphasized the importance of emotional disturbances in precipitating paroxysms of vasomotor rhinitis.

Cutaneous Supersensitiveness.—This may be displayed after contact with, ingestion of, or inhalation of, the specific irritant. Many of the phenomena of cutaneous supersensitiveness are analogous to the changes which follow an intradermal injection of histamine. These are, first, capillary dilatation, by direct action on the capillary wall; secondly, wheal formation, from increased capillary permeability; and, thirdly, a flush from reflex dilatation of the immediate arterioles. Urticaria and angioneurotic oedema are among the best-known members of a large and ill-understood group of cutaneous manifestations of supersensitiveness.

Miscellaneous Manifestations.—Migraine in many instances is a manifestation of supersensitiveness and, for the purposes of this paper, is the most important member of a large miscellaneous group which includes gastro-intestinal supersensitiveness and serum reactions. The mechanism of such migraine attacks has been described as a vasomotor spasm followed by secondary vascular dilatation, the first producing the symptoms of the aura and the second causing the attack itself. Pickering (1939) has pointed out that there are certain resemblances between migraine and the headache which follows an intravenous injection of histamine. The manifestations of both cutaneous supersensitiveness and migraine may be brought on by secondary factors such as have been described above, operating in an individual in whom the primary essential conditions are present. It is thus seen that supersensitiveness is protean in its manifestations, and Bray (1937) has stated that it runs in families who may compose up to 10 per cent. of the population of some countries. Bearing these facts in mind, a careful watch for supersensitiveness has been kept in hospital and private practice during recent years. Where the case history was suggestive the previous history and family history were carefully reviewed. A thorough search was made for abnormalities in nose, sinuses, throat, and chest. Group protein skin tests, with solutions prepared by Messrs C. L. Bencard

(1934) Ltd., were carried out, since the specific sensitizing substances will also produce an urticarial wheal when brought into contact with the deeper layers of the epidermis.

Management of Supersensitiveness

This is discussed under five headings—general, palliative, specific, dietetic, and the treatment of complications. The management of asthma is stressed throughout, since this is the most important type of supersensitiveness and the commonest in our series of cases. In hay fever the treatment resolves itself into palliative and specific measures, while in the other forms discussed specific and dietetic measures are the most important.

General.—We have been impressed by the large number of patients with asthma who are greatly relieved immediately after admission to a hospital ward, without any specific treatment being begun. This demonstrates the importance of certain cardinal points in the general management of supersensitiveness. The patient has his own bed, in a large, airy, warm room which contains a minimum of dust-collecting furnishings, and he is relieved from anxiety and fussing, which tend to precipitate attacks. The bedding is of a simple nature, there are no eiderdowns, and loose cotton undergarments are worn.

Palliative.—During an acute attack relief can be obtained by the early injection of 2 to 5 minims of adrenaline hydrochloride solution (1 in 1,000), which may have to be repeated. This never failed during the period under observation, no case of "status asthmaticus" being encountered. As an additional measure ephedrine hydrochloride, half a grain night and morning, has been found helpful at the beginning of treatment. When bronchitis was present an antispasmodic expectorant mixture was employed, such as:

R.	Pseudo-ephedrin.	...	...	...	gr. j
	Pot. iodid.	...	...	...	gr. v
	Tinct. stramon.	...	...	...	℥ x
	Tinct. lobel.	...	...	...	℥ x
	Syr. prun. serot.	...	...	...	℥ x
	Infus. seneg.	...	...	ad	3 ij

Sig.—3 ij eight-hourly.

In hay fever dark glasses and eye drops containing decicaine and adrenaline will ease the conjunctival irritation. Endrine nasal compound (mild) relieves the nasal symptoms.

Specific.—The ideal to be aimed at in treatment is the removal of the specific sensitizing factor when possible. Thus one of our patients who gave a positive reaction to the mixed inhalants solution (Group I) obtained complete and permanent relief from his asthma when his cat was disposed of, following instructions to get rid of household pets. Unfortunately the nature of the specific factor is often such that it cannot be eliminated by simple means, and desensitization has to be employed. While this may not be uniformly successful in its results, in a majority of cases it is eventually curative, provided an adequate dosage is attained. This treatment may have to be repeated at a later date if relapse occurs. Desensitization may be specific or non-specific, but only the former method has been employed in this series. As Browning (1934) puts it, this consists in administering the agent in increasing doses, those at the start being very minute. This aims at the production of abundance of circulating antibodies, so that on reaching the subject the specific factor is fixed and neutralized before it can come into contact with the tissues which are still

vulnerable. It must be remembered, however, that another explanation of the rationale of desensitization has been offered which may apply in a number of cases—namely, that the substances injected lead to exhaustion of the reactive mechanism. In this series the desensitizing solutions employed were prepared by Messrs. C. L. Bencard.

Dietetic.—It is well known that large heavy meals, especially of a high carbohydrate content, and taken in the evening, are apt to evoke some evidence of supersensitiveness. The patient quickly learns that gastric distension or a loaded colon may precipitate the onset of symptoms by reflex irritation. Purgatives which act by increasing peristalsis reflexly through the autonomic system should be avoided. Liquid paraffin or mild salines are to be preferred. As suggested by Kennedy (1936), whose diet we give below, many of our cases, especially where supersensitiveness to foods was suspected, were given a special trial diet, unlikely to contain specific sensitizing proteins. This excludes certain common articles such as eggs, raw milk, wheat, and potatoes, since these are the most frequent causes of food supersensitiveness. On this diet it was found that the responsive patient became free of symptoms in a period of about ten days, unless he happened to be one of the occasional examples of supersensitiveness to articles included in the diet, when his intake would have to be further revised. Thereafter individual foodstuffs are added at four-day intervals, and the return of symptoms looked for. The offending article or articles having been determined, these may either be excluded in every shape and form, or an attempt may be made to desensitize the patient, as described above.

Kennedy's Diet: Egg, Raw Milk, Wheat, and Potato Excluded.—Breakfast: Rye bread, thinly buttered and covered with treacle or golden syrup, grape-fruit or oranges; tea with a little condensed or well-boiled milk. 11 a.m.: Oxo or bovril, with rye bread if required. Dinner: Soup (only clear soup, Scotch broth, or chicken broth); chicken (no stuffing) or boiled fish; swedes, turnips, carrots, cabbage; fruit jellies, steamed rice, or any preserved fruit; rye bread and butter, if required; tea with a little condensed or well-boiled milk. Tea: Rye bread, thinly buttered and covered with treacle or golden syrup; any preserved fruit, tomato, lettuce; tea with a little condensed or well-boiled milk. Supper: Oxo, bovril, or tea, with rye bread if required.

Complications.—The results of treatment will be disappointing unless concomitant disease, especially in the nose and throat, has been adequately dealt with. Bray (1937) has called attention to the importance of a free airway in the nasal passages. Thus every case must be thoroughly examined for evidence of disease in sinuses, nasal mucosa, middle ear, tonsils, and adenoids. In respiratory supersensitiveness exercises may be employed to train the patient in correct methods of breathing.

Personally Observed Cases

Definite evidence of supersensitiveness was obtained in forty-three cases, which form the basis of this paper. Twenty-three of these were hospital patients, and the remainder were seen in private by one of us (J. G. G.). Twenty-seven were suffering from asthma, four had hay fever, seven urticaria, two angioneurotic oedema, and three migraine. Several patients, especially in the asthma group, showed more than one manifestation. A family history of supersensitiveness was obtained in 55 per cent., although, as has been generally noted, the type of supersensitiveness, and the causal agent, were not the same in all members of any one family. The number of cases in

this series is too small to show the manner of inheritance, but it appears to be established that it is more commonly from the maternal side. The average age at onset of symptoms was eighteen years, and in 45 per cent. the onset had occurred in the first decade. No significant variations in sex incidence were observed: twenty-one of the forty-three patients were males.

It was noted that the incidence of diseases of the nose and throat was very high, especially in respiratory supersensitiveness. Tonsillectomy had been performed in sixteen cases, and there were eight examples of otorhinological sepsis apart from tonsillitis, while in eight additional instances thickening of the mucous membrane of the sinuses was noted. A search was always made for permanent changes in the lungs, in view of the fact that a previous history of pneumonic illness was obtained in twenty-two instances, nineteen of these being patients with respiratory supersensitiveness. While bronchitis was a frequent finding, relatively few of our cases had definite evidence of emphysema, and in only one instance was tuberculous disease of the chest found. We have been impressed by the rarity of permanent cardiac damage, although during an acute attack of asthma there must be a greatly increased load on the right heart. In this connexion Parkinson and Hoyle (1937) have stated that cardiac symptoms and signs in emphysema are more likely to be due to hypertension (systemic) than to the direct effect of emphysema on the heart. Three of our cases showed cardiac enlargement, one of them having hyperpiesis.

In all the forty-three patients the supersensitiveness was of severe degree, the average period of liability to symptoms when first seen being twelve years. The accompanying table shows that in the asthma group by far the greatest number of positive skin reactions followed testing by mixed inhalants solution, Group I (which includes feathers, horse dander and hair, cat fur, dog hair, mixed house dust, and orris). In some cases, mainly those of patients developing symptoms in the first decade, the reaction was to foodstuffs, chiefly cereals, eggs, and milk. In hay fever the predominant reaction was to pollens. In the other forms of supersensitiveness the incriminating reaction was found in the foodstuffs, although incidental reaction to inhalants was often seen.

Table showing Numbers of Strongly Positive Skin Reactions

Group Protein Skin Tests	Asthma (26 cases)	Hay Fever (4 cases)	Urticaria (7 cases)	Angio- neurotic Oedema (2 cases)	Migraine (3 cases)
Mixed inhalants { I II	19 5	1 —	4 —	1 —	— —
Pollens	6	3	2	1	—
Cereals	6	—	1	—	1
Egg; milk .. IV	4	—	3	—	1
Vegetables .. V	1	—	2	1	—
Meats VI	2	1	1	1	—
Fruits VII	2	—	—	2	—
Fish VIII	1	—	1	1	—
Shellfish .. IX	2	—	1	—	1
Fabrics X	2	—	—	—	—
Unclassified .. XI	1	—	—	—	—

It is seen that many of the patients reacted to more than one group. Three cases of asthma showed no reaction to the skin tests, and in one case skin tests were not performed.

The patients were followed up over an average period of two and a half years. Of the twenty private cases nineteen were cured and one (an asthmatic) was not improved.

Among the hospital patients there were three cases of asthma in which treatment failed (two having heart disease and one having pulmonary tuberculosis), four were definitely improved, two could not be traced, and the remaining fourteen were cured.

Illustrative Cases

Case 1.—Asthma. A schoolboy aged 13. Family history negative. Pneumonia at 4 years of age, followed by frequent attacks of severe asthma, necessitating admission to hospital. Protein skin tests: marked reaction to mixed inhalants solution (Group I). Specific desensitization and removal of septic tonsils and adenoids. Breathing exercises employed. Patient reports two years later, without further attacks.

Case 2.—Asthma. A schoolboy aged 6. Family history positive on maternal side. Onset of asthma at 2 years of age. Attacks were frequent and complicated by bronchitis. Protein skin tests gave a marked reaction to egg-milk group. Tonsils and adenoids removed. Treatment by Kennedy's diet only, with cure after elimination of eggs. He was free from symptoms three years later.

Case 3.—Asthma. A baker aged 32. Family history negative. Severe asthma for ten years. On admission to hospital a strong reaction was obtained to mixed inhalants solutions (Groups I and II) and also cereals. Desensitization to inhalants only. He reported two years later without improvement. On reinvestigation the positive reaction to cereals was noted, and improvement followed renewed desensitization, including wheat.

Case 4.—Asthma. A single woman, at home, aged 38. Family history positive on paternal side. Frequent attacks of asthma since 2 years old. Protein skin tests: positive to rice, barley, and potatoes. Cessation of attacks on elimination of these articles from her diet. Ten years later an attack of asthma returned on taking as a tonic a vitamin B preparation obtained from rice polishings.

Case 5.—Asthma. A housewife aged 34. Family history negative. Asthmatic attacks for four years following pneumonia and pleurisy. Slight reaction to mixed inhalants solution (Group I). Sinus infection was present and antral lavage was performed. Desensitization to inhalants, without any improvement. X-ray examination of lungs pointed to old pulmonary tubercle, but on three examinations tubercle bacilli were not found in the sputum.

Case 6.—Hay fever. A hairdresser aged 23. Family history positive on paternal side. Severe hay fever annually since 9 years old. Skin tests: strong reaction to pollens. Pre-seasonal desensitization in three successive years, resulting in complete freedom from symptoms.

Case 7.—Angioneurotic oedema. A boy aged 8. Family history strongly positive on maternal side. Severe reactions since 5 years old following the ingestion of fish. Owing to the family history his mother rapidly noted the offending article, which was eliminated from his diet, with complete cessation of symptoms. Two severe attacks occurred at 8 years of age following the accidental ingestion of seccotine (fish glue) by finger contamination. Skin tests gave a grossly positive reaction (with lymphatic involvement) to the fish group.

Case 8.—Migraine. A housewife aged 50. Family history positive on maternal side. Bi-weekly attacks for thirty years. Skin tests strongly positive to egg-milk group. Absolute relief followed elimination of eggs from the diet.

Conclusions and Summary

Supersensitiveness is briefly described in its commoner manifestations—namely, asthma, hay fever, cutaneous and miscellaneous supersensitiveness. It is stressed that certain primary essentials are present in supersensitiveness. These are an inherited predisposition and tissue damage, coupled in either case with a superimposed specific sensitization. Authorities explain the basic reaction to the specific sensi-

tizing substance as a liberation of a histamine-like compound, leading to smooth muscle spasm or increased capillary permeability. A reaction may be initiated in certain individuals by secondary factors—for example, psychic and endocrine disturbances.

The importance of diminishing the presence of sensitizing substances—for example, dust—is noted in the general management of supersensitiveness. Palliative measures are detailed. Group protein skin tests which may point the way to specific desensitization are advocated and the rationale of the latter is briefly discussed. Dietetic measures are of great importance in the management of supersensitiveness, and the use of a special trial diet is described. It is suggested that complications of supersensitiveness, especially in the nose and throat, be sought for and adequately treated.

Forty-three patients with supersensitiveness are analysed. Twenty-seven had asthma, four hay fever, seven urticaria, two angioneurotic oedema, and three migraine, several of the cases showing more than one manifestation. In 55 per cent. there was a family history of supersensitiveness, and in 45 per cent. the onset occurred in the first decade. There was a very high incidence of diseases of the nose and throat, especially in respiratory supersensitiveness. Bronchitis was a frequent finding, but permanent cardiac damage was rare. The results of group protein skin tests in these patients are tabulated, bringing out the great importance of inhalants as sensitizing agents. A few typical cases are briefly summarized.

On following up the results of treatment by desensitization or dieting, or both, over an average period of two and a half years, it was found that of the forty-three patients thirty-three were cured, four were improved, in four there was no success, and two were not traced. The failures were all in asthmatics who showed supersensitiveness to inhalants, whereas asthmatics who were supersensitive to foodstuffs gave a good therapeutic response.

Supersensitiveness presents a vast and fascinating problem. Great numbers of patients are subject to some of its numerous manifestations and many are in danger of drifting into chronic invalidism. This paper is an attempt to show that a large proportion of persons who have suffered severely from some of the manifestations of supersensitiveness over a long period of years may be rendered free from symptoms by adequate investigation and treatment.

Grateful thanks are due to Dr. George A. Allan, who generously provided facilities for the investigation and treatment of cases in his wards in the Western Infirmary of Glasgow; also to Professor C. H. Browning and Professor T. K. Monro for helpful advice and criticism.

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The Ministry of Health has published a pamphlet entitled "Abstract of Reports of Public Analysts for the Year 1938," which is a summary of the reports of all public analysts in England and Wales on samples submitted to them by authorities enforcing the food and drugs law. This is an annual publication, but this year it is issued a few months earlier than usual. The pamphlet, in addition to tables showing the number of samples taken in various districts and the types and number of samples of foods and drugs found to be adulterated, contains a detailed summary of the actual findings of public analysts. It may be obtained from H.M. Stationery Office at 4d., or through any bookseller.