Food-borne Infections and Intoxications in Europe*

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Any attempt to evaluate the prevalence of food-borne diseases in Europe is fraught with difficulty, partly because in some countries such diseases, if reported, are not clearly designated as food-borne, and partly because of the variety in terminology and methods of classification.

Nevertheless, it is apparent that, although certain food-borne infections have decreased in prevalence, others have increased during the past decade. This increase has been shown to be related in some countries to the import of certain foodstuffs and fodder from tropical and subtropical regions and has resulted in a general spread of Salmonella infections by a wide variety of serotypes. Food-borne intoxications are predominantly caused by the ingestion of the toxins elaborated by the growth of Staphylococcus aureus in food and by spore-forming bacilli. Botulism is now rare in Europe.

While the recent increase in the prevalence of these diseases calls for strict supervision of food products and improved measures of ensuring food hygiene, the efficacy of such steps as may be taken will depend on close co-operation between public health and veterinary public health authorities.

HISTORY AND GENERAL REMARKS

The knowledge of food-borne infections and intoxications in Europe dates back to the early days of medical bacteriology when it became apparent that such dread diseases as typhoid fever, paratyphoid fever and dysentery could frequently be traced to the consumption of food contaminated with enteropathogenic bacteria.

Besides direct-contact and water-borne infections, various foodstuffs—either contaminated directly (by carriers, etc.) or indirectly (by flies, etc.) with the primary human pathogens, Salmonella typhi, Salm. paratyphi A and B and those of the Shigella group—were incriminated as vehicles of infection of these classical anthroponoses. The microbes causing scarlet fever and diphtheria were also occasionally found to be spread by contaminated food.

In addition to such micro-organisms of strictly human origin, several animal pathogens known to cause zoonoses in a variety of wild and domestic animals were recognized as important agents of human food-borne infections. This, for instance, is true of all salmonelloses with the exception of the septicaemic and enteric fevers due to the above-mentioned organisms whose natural host is the human being. Other dangerous diseases like Malta fever, Bang’s disease and tuberculosis are also quite often food-borne. The same occasionally applies to tularaemia, listeriosis and other zoonoses.

A third group of bacterial food-borne illness in man is represented by several more or less dangerous intoxications. Such toxicooses are provoked by the ingestion, often of minute amounts, of powerful exotoxins elaborated by saprophytic soil bacteria and by parasitic human microbes in certain types of food under favourable conditions. A well-known example of the saprophytic toxicooses is botulism, with its high fatality rate. Food-poisoning due to staphylococcal enterotoxins, Clostridium welchii and other toxogenic bacteria has only been shown to be a major problem during the past two decades following the elucidation of the etiology of “non-specific” food-poisoning.

CLASSIFICATION AND TERMINOLOGY

Before discussing the subject in detail, the terminology of bacterial food-borne diseases requires comment, for it is a rather complex problem. In various languages the term “bacterial food poison-
The general designation "food-borne infection" seems to be most useful when it is restricted to clinically apparent or inapparent infections caused predominantly by micro-organisms, or almost exclusively transmitted by directly or indirectly contaminated food.

Only if the food-borne nature of the illness is diagnosed or suspected by the attending physician can further steps be taken by the public health authorities to prove or disprove the presumptive diagnosis of bacterial food-poisoning and to replace this general term by the etiological designation.

In practice this would mean that wherever clinical and circumstantial evidence points to food as the cause of an infection or intoxication, the disease will be classified by the clinician as food-borne. Where the onset, symptoms, clinical course etc. are typical, he may at least have grounds for suspecting a particular etiological agent.

In many acute infections, particularly in those caused by salmonellae, signs of intoxication prevail at the beginning of the illness and symptoms of true infection—fever, etc.—follow later.

Other medical designations, such as vomiting, vomiting and diarrhoea, enteritis, colitis, gastro-enteritis, etc., are merely descriptive and are irrelevant to the mode of transmission.

In short, the general trend is to use etiological terms in the classification of bacterial food-borne diseases instead of merely descriptive clinical designations.

From the standpoint of the epidemiologist and of the public health officer it is imperative that the physician use a classification (quite apart from his clinical diagnosis) which points to the possible source. Doctors should therefore be encouraged to include important epidemiological features in the classification of diseases.

It should be mentioned that this method of classification was not used in the 1955 revision of the International Classification of Diseases (World Health Organization, 1957). For instance, some bacterial food-borne diseases with predominant intestinal involvement may be found classified under infectious diseases commonly arising in the intestinal tract (040-049). These, which exclude enteritis (571, 764) and diarrhoea (571, 764, 785.6), are as follows:

040 Typhoid fever
041 Paratyphoid fever
042 Other Salmonella infections
043 Cholera
Some descriptively classified diseases can be found under:

543 Gastritis and duodenitis
571 Gastro-enteritis and colitis, except ulcerative, age 4 weeks and over
785.6 Diarrhoea, age 2 years and over.

Both for epidemiological reasons and for the application of preventive measures, it is essential to subdivide bacterial food-borne diseases according to their etiology. When food-borne infections and food-borne intoxications are classified separately, several etiological terms would have their place under each heading.

The use of the general term "bacterial food-poisoning" may be accepted if applied in a general manner, as in the United Kingdom, Switzerland, the Federal Republic of Germany and other countries.

Cases and outbreaks the etiology of which cannot be identified are usually classified as "non-specific" in the sense that their true nature remains obscure. Some workers have suggested a more detailed system of classification.

However, where the etiology can be established, the proper etiological designation should be applied.

The advantages of such a procedure are obvious. In England and Wales, where this system of classification has been used for several years, it is easy to estimate not only prevalence but also the proportion of the various pathogenic agents, their relative frequency and their epidemiological importance. This is illustrated in Table 1, taken from a technical working paper and from reports issued by the Central Public Health Laboratory at Colindale, London.

In most other countries this subdivision has not yet come into general use though it is employed by certain health departments and municipal and State bacteriological laboratories.

In the following, the term bacterial food-poisoning will, unless otherwise stated, be restricted to the recognized intoxications, i.e., to bacterial food-borne diseases which are not transmitted directly from man to man or from man to animal, and which are characterized by toxic symptoms. The remaining bacterial food-borne diseases will be discussed under the term food-borne infections even when they are reported under bacterial food-poisoning in many official statistics.

**NOTIFICATION**

Compulsory notification of bacterial food-poisoning is not yet generally practised in European countries. Official reporting was introduced many years ago in Germany, and in England and Wales before the Second World War. In Switzerland official reporting started in 1952, while in many other countries no official system of notification exists, e.g., in Norway. This, however, does not mean that the public health authorities in those countries are not interested in the problem. In fact, in some countries, Norway, for instance, the State laboratories collect sufficient information on bacterial food-poisoning and from this are able to estimate its prevalence very well (S. Hauge, personal communication, 1959). In other countries, the more severe contagious and infectious diseases are still of such importance as to arouse the main interest of the public health services.

In recent years experience in some countries, particularly during and since the Second World War, has shown that the older methods of notifying and reporting bacterial food-poisoning are insufficient and need improvement. For instance, in England and Wales, new regulations came into force in 1949 (Cockburn, 1955), greatly improving the
previous notification system. As this procedure has now proved its value over a period of ten years it may be summarized briefly.

Private physicians must notify all cases of suspected food-poisoning to Medical Officers of Health who, in turn, not only carry out the necessary investigations in collaboration with authorized laboratories, but also submit these reports for central registration. This applies to all those diseases which are apparently due to the ingestion of infected or contaminated food.

Furthermore, the Medical Officer of Health reports all sporadic and epidemic outbreaks of food-poisoning to the Ministry of Health, while the public health laboratories and the majority of the hospital laboratories forward their findings to the Central Public Health Laboratory Service.

Wherever possible, the physician should report the kind of food believed to be responsible for the incident of suspected food-poisoning.

In some countries, such as France, there is an obligatory system for group outbreaks or epidemics only, but not for sporadic cases.

It should, however, be borne in mind that compulsory notification does not mean that all cases or outbreaks are reported. Generally, only the severe cases come to the attention of the public health service. The less severe are usually not reported. Therefore, the available data—even in those countries where official reporting is practised—must be evaluated with caution.

Whether incidents of bacterial food-poisoning are reported depends not only on the existence of an official reporting procedure but mainly on the willingness of doctors to co-operate in notifying the public health authorities. It should be realized that official notification may have numerous consequences, both personal and economic, greatly influencing the patient’s future attitude towards his physician. Mild symptoms and rapid recovery further explain (at least in many cases) why official reports probably represent only a fraction of the true incidents. This subject will be further discussed below under the heading “Validity of Data” (see page 475).

**FACTORS INFLUENCING BACTERIAL FOOD-BORNE DISEASE**

Human illness due to consumption of food containing pathogenic bacteria or toxins—partly the result of bacterial contamination, partly the result of the primary presence of pathogens in the food and partly the effect of poisonous products—is not restricted to those European countries where hygiene and sanitation are still undeveloped. It is quite common in those countries, too, which are known to have a high standard of living, good sanitation and personal hygiene.

Food-borne diseases have always been present in under-developed countries but, owing to the high prevalence of other severe diseases, they were usually considered of minor importance. The more the fatal diseases are brought under control, the greater is the interest focussed on other forms of illness. This certainly also applies to the food-borne infections and intoxications.

Bacterial food-borne disease has likewise been a typical concomitant and sequel of wars, devastations, natural catastrophes and periods of famine and starvation all over Europe, very few areas excepted. One only has to recall the innumerable cases of dysentery, typhoid and paratyphoid fever which occurred in Europe during and following the First and Second World Wars, as well as the occurrence of botulism and gangrene of the bowel, the last two being mostly due to the unsatisfactory preparation and canning of food which thereby becomes contaminated. It has almost been forgotten that at the beginning of the First World War cholera was still a menace to the soldiers fighting in the east and south-east of the European continent.

The enormous movements of people, sometimes actual migrations involving millions of soldiers, prisoners, and refugees, widely dispersed the existing pre-war endemo-epidemic foci of enteric fevers and dysentery (e.g., Shiga dysentery). This resulted in the spread of countless carriers of these dangerous human pathogens all over Europe. Poor hygiene, crowded quarters, low standards of living, the increased chance of contamination of perishable food, insufficient supervision and control by the public health services, lack of remedies and of hospital facilities affected the epidemiological picture and led to post-war epidemics of typhoid and paratyphoid fevers and of bacterial dysentery in many parts of Europe. The number of cases can only be estimated, as no valid statistics exist for a number of years. It has been calculated that several millions of Europeans were stricken by food-borne enteric infections during the period between 1940 and 1950.

The tremendous importance of the endemo-epidemic, highly contagious food-borne infections and of other types of bacterial food-poisoning
stimulated extensive control measures by the public health and veterinary public health authorities. Their joint efforts have been rewarded by considerable success with regard to the suppression and prevention of some of the most dangerous food-borne diseases and in a general improvement in food hygiene. This is well illustrated by the steady decrease of the severe forms of shigellosis (Shiga dysentery) as well as of typhoid and paratyphoid fever in most European countries since 1946-47.

However, the promising results obtained so far by the conquest or suppression of some food-borne enteric fevers and of tuberculosis due to bovine tubercle bacilli do not justify the conclusion that the problem has been solved. Typhoid and paratyphoid fevers have by no means disappeared, and 2860 fresh infections due to Salmonella paratyphi B were reported from the Federal Republic of Germany in 1956, many of them food-borne. The danger to public health that still exists has been exemplified by two large-scale food-borne outbreaks of typhoid fever in the Federal Republic.

Although the improvement in general living conditions and in food hygiene in most European countries has led to a diminution in the incidence of dangerous food-borne diseases, it is interesting to note that the incidence of gastro-enteritis and related diseases, including bacterial food-poisoning in a general sense, has not just remained stationary during the past decade, but has shown a definite tendency to increase. Such observations are not confined to countries that suffered directly during the war. They extend beyond their frontiers to countries where food and culinary hygiene are highly developed and in which the incidence of malignant food-borne enteric fevers has dropped to a low figure. This has been illustrated by several large outbreaks of food-borne infections caused by salmonellae in Sweden and Switzerland during recent years.

INCREASED INCIDENCE OF FOOD-POISONING AND FOOD-BORNE INFECTIONS AND FACTORS RESPONSIBLE

A steadily increasing number of published reports from most European countries record numerous sporadic or epidemic occurrences of disease obviously connected with the ingestion of pathogenic organisms or their toxic products.

The high incidence of bacterial food-borne diseases was first recognized by American workers in the USA. Besides the well-known Salmonella infections, intoxications caused by staphylococcal and other bacterial poisons were found to be very frequent. For 1944 alone the number of cases of staphylococcal gastro-enteritis was estimated to run between half a million and one million (Feig, 1950).

During the period immediately prior to the arrival of the Allied Forces in the Second World War, and thereafter, mass infections and intoxications occurred in Western Europe among soldiers and civilians to a hitherto unknown extent. Many outbreaks were caused by the ingestion of food-stuffs containing different species of Salmonella known to have their natural habitat in animals. Only a few of these species, such as \textit{Salm. typhi-murium}, had played an important role during the pre-war years; others had been reported rarely or not at all. It soon became apparent that various egg products, dried and otherwise preserved, harboured live \textit{Salmonella} species, thereby creating a new health hazard of great importance (see the accompanying figure).

Furthermore, increasing evidence was obtained that common human parasites, \textit{Staphylococcus aureus} in particular, played a great a role in Europe as in the USA, as the causes of bacterial food-poisoning. In addition, new agents in bacterial food intoxications were identified. Among these \textit{Clostridium welchii} and \textit{Bacillus cereus} deserve special mention.

![Outbreaks of Salmonella Food-Poisoning in England and Wales, 1923-44](image-url)
There is no doubt that an increase in the number of food infections and of cases of so-called food-poisoning have occurred in many areas of Europe. The increase is real, and not merely an apparent rise brought about by better diagnostic facilities. Of course, improved and refined diagnostic techniques (see, for instance, International Association of Food Sanitarians, 1957; Dack, 1956; Hobbs, 1953; Hobbs et al., 1953; Mossel, 1958) have facilitated the investigation of etiological factors and led with growing frequency to their elucidation.

It is noteworthy that in some cases the high incidence of food-borne diseases in hygienically progressive countries has recently been shown to be directly related to the volume of certain foodstuffs and fodder imported from tropical or subtropical regions. The significance of such materials destined for human and animal consumption without further treatment as a reservoir for pathogenic organisms has been appreciated for a long time, but the potential dangers have not been fully recognized. Incidentally, the presence of Salmonella species in Chinese dried egg yolk was established as early as 1931. The small volume of importation prior to 1942, however, created no serious concern or hazard. The real danger was detected only when mass imports increased the chances of contamination and infection. The correctness of these conclusions is proved not only by the outbreaks mentioned above during the war and post-war years, but also by identical observations in the Federal Republic of Germany following the restoration of trade communications in 1948.

Even more important than the imports of contaminated egg products were the quantities of imported fish-, blood- and bone-meal from tropical countries. This type of animal food was found to contain a tremendous number of Salmonella species. A glance at German import statistics shows, however, that the origin of these products was the decisive factor, and not the quantity alone. For instance, between 75 000 and 132 000 tons of fodder of animal origin were imported into Germany annually during the period from 1926 to 1936 with no serious consequences, except a few sporadic cases or small epidemics which might have been caused by contaminated foodstuffs. The reason for this low rate of infection apparently was that usually not more than 3% of this type of animal food was imported from tropical countries. The remainder came from Scandinavia, Great Britain, Canada, etc. Between 1949 and 1958 the import of fish-, blood- and bone-meal in the German Federal Republic alone rose from 13 000 tons to more than 100 000 tons annually. During this period more than 30% originated from tropical areas, Angola in particular. These 30% contained enough enteropathogens, Salmonella especially, to create a public health hazard of the utmost importance. There is sufficient evidence that these observations and conclusions are valid for many European countries, and not for Germany alone.

It must be realized that neither the food and fodder import dealers and industries nor those responsible for the preparation of food within the family circle or on a wider scale have had any awareness of this change in the epidemiological situation.

Great changes are taking place in the living and eating habits of large parts of the European population. One such change has been the increased consumption of perishable foods, such as cream-containing cakes and ice-cream. Another is that, contrary to pre-war customs, almost a third of the population of western and northern Europe now eat at least one meal per day, often more, away from home in canteens, cafeterias and restaurants. Yet another example is the meals service for school-children which it is compulsory to provide in several countries. As early as 1942 the public health hazard involved in the war-conditioned trend to mass-feeding was under careful review (Trüb & Wundram, 1942).

Lack of knowledge of the potential dangers, increased consumption of perishable food, inadequate preparation and preservation processes, insufficient storage, large-scale catering, and continued importation of infected or contaminated basic or raw materials must be regarded as among the most important factors responsible for the present high incidence of human illness due to infected foodstuffs.

Food-borne infections due to salmonellae and intoxications have occurred in the past, too. But they were usually restricted to single persons or to small groups such as families. Major outbreaks were confined to persons living in barracks, camps, prisons, hospitals or mental institutions, where they obtained their food from a central kitchen. With the changes that have since occurred in living and eating conditions the risk of acquiring a bacterial food-borne disease has increased considerably.

Added to the factors favouring food-borne diseases are the problems of latent infection of cattle and poultry stock due to ingestion of infected
fodder without clinical symptoms. The large-scale infestation of domestic animals with enteropathogens results in the transmission of infectious agents to the meat-processing plants and abattoirs, to butcher's shops and kitchens. Moreover, rivers and lakes may become contaminated through infectious waste and excreta. Pastures may be infected by floods, aquatic animals may ingest the pathogens and then aquatic animals may, in turn, be eaten by gulls etc. Thus the vicious circle of infection is completed.

Infected raw materials and food are responsible also for active infections and the development of carriers among food-handlers. Pathogenic organisms may thus be transmitted to food-handlers and then from the excreta of the food-handlers to food products, utensils, towels and so forth. The sources and possibilities of food contamination with pathogens are therefore numerous and the epidemiological consequences obvious.

The increase of food-borne diseases in Europe is also closely connected with international travel. Tens of thousands of travellers from tropical and subtropical countries arrive in Europe every month, some harbouring and excreting human pathogens transmissible by food. During the greater part of the year millions of European tourists, particularly from the north, west and central parts, move to the south and adjacent areas where—despite all efforts—hygienic conditions do not always correspond to modern requirements.

Relatively high carrier rates, especially among the poor; bad latrine facilities; polluted water supplies; the large numbers of flies, predominant vectors of enteric disease; unsafe methods of handling, preparing and storing food in combination with the climatic conditions and high average temperatures which favour the survival of pathogens and their multiplication are regarded as the main reasons for the intestinal disorders of varying severity and duration from which many visitors to southern Europe suffer. Not infrequently they return sick or become sick shortly after their return, especially from enteric fevers with a prolonged incubation period.

What is often attributed to intolerance of certain foods, olive oil in particular, is in fact often the consequence of a bacterial food-borne infection or intoxication. Of course, various other factors, intolerance of food included, do have their part in such disturbances.

Small eating places often advertise (not only in the south) that their food is prepared with a maximum of hygiene. Unfortunately, however, many of these advertisements are in marked contrast to reality. There may be plenty of goodwill, but this is made ineffective by insufficient knowledge of hygienic requirements. Moreover, culinary hygiene in warm countries is not inexpensive, and therefore frequently not compatible with cheap food.

In large restaurants and hotels, sometimes famous for their good cuisine, the risk of acquiring food-borne diseases is also high. There may be adequate facilities for the preparation of safe food, but they are often not used. Moreover, the type of food served in these places—pies, hors-d'œuvres, creams, etc.—are more susceptible to infection by micro-organisms and their subsequent multiplication than the simple food prepared in the small places. Such perishable foodstuffs are also used for the decoration of other food which involves increased handling and risks. The experienced observer—usually following his own experience of the sequels of eating hors-d'œuvres, sweets etc.—can study at such places how practically every newly arrived guest is stricken by some intestinal disorder within a few days.

The native population of the southern European countries is by no means spared from food-borne diseases. The official statistics usually give no indication of the incidence of enteric fevers and dysentery in these areas. The figures for bacterial dysentery, particularly, are often incredibly low. Apparently the indigenous population in many areas acquires immunity against dangerous enteric fevers and locally prevalent types of bacterial dysentery during the first two decades of life, often in early childhood. But these people suffer from other intestinal disturbances and food-poisoning, too. In fact, such attacks are regarded as normal during the warm season.

Although the occurrence of Salmonella in endemic areas is often a local problem, the spread becomes epidemiologically important as soon as human and animal food products from such places are exported to other areas, where they may be encountered by a non-immune population.

Any reduction of food-borne diseases in these countries would benefit not only the tourists, but also the inhabitants themselves.

VALIDITY OF DATA

Although a general increase of food-borne infections and intoxications is evident from publications
and reports, only data of limited accuracy regarding the real prevalence are available.

As stated above, this is largely due to the confusion created by the poor diagnostic terminology in which, according to Feig (1950), unrelated syndromes appear as synonymous, and related syndromes are often classified independently. Another important reason is that modern knowledge of the various kinds of bacterial food-poisoning is still restricted to a small number of physicians, public health officers and veterinary public health officers and their auxiliary personnel.

Sporadic cases of food-poisoning and food-borne infections frequently do not come to the attention of the public health authorities. Even larger outbreaks with classical symptoms are often erroneously diagnosed as “non-specific”, or regarded as infections of unknown nature caused by viruses, etc. One such outbreak involving a great number of persons at a large factory in a western German city was thus reported in the newspapers as a possible new virus disease, before careful investigations performed by the local public health authorities established that the epidemic was due to a Salmonella reading food-borne infection.

As a rule, only major outbreaks are thoroughly investigated. Owing to the severity of the clinical course and the improved diagnostic facilities, food-borne infections caused by Salmonella species are more frequently recognized and reported in Europe than bacterial food-poisoning of staphylococcal or Clostridium welchii origin. Therefore, figures and estimates of the latter two are far lower than in the USA, for example. Whether the differences are real or only apparent remains to be ascertained.

There is sufficient evidence that the overwhelming majority of food-borne infections and intoxications are not reflected in official statistics. At the present time, even a rough estimation or approximation of the actual figures is hardly possible, except in a few instances. Figures concerning botulism may be considered reliable, as the disease is easily recognized owing to the severe clinical picture. But unfortunately botulism usually is not reported separately from other forms of bacterial food-poisoning.

Lastly, it should not be forgotten that even in countries with good reporting and sufficient laboratory facilities—for instance, England and Wales—more than 40% of incidents of reported foodborne disease remain obscure etiologically (Cockburn & Vernon, 1957), though this may be due in part to lack of special investigation of incidents. Of the outbreaks which could be investigated by laboratories at the right time, only 12% could not be identified. In the Land of North-Rhine-Westphalia out of 26 epidemic incidents which were reported, 19 were cleared up during 1946 and 1950 (Trüb & Reploh, 1954). There is no doubt that these 26 reported incidents represented but a minute fraction of the real figures.

All these points must be kept in mind when the prevalence of bacterial food-borne disease is discussed.

FOOD-BORNE INFECTIONS IN EUROPE

Enterobacteriaceae

Typhoid and paratyphoid fever. Official figures demonstrate that both diseases have gradually reached pre-war levels. Occasional epidemics, mostly food-borne, have disturbed this tendency. The prevalence of these epidemiologically related true anthroponoses is different for different countries, and may even differ within the same country. In West Germany and West Berlin, for example, there is a higher rate of paratyphoid B infection than in Central Germany and East Berlin, where—in contrast to the rest of the country—typhoid fever is still predominant. Available statistics give no evidence of the percentage of these diseases due to food-borne infections.

One remarkable example of paratyphoid B fever needs some comment: proved infections due to a phage type of Salmonella paratyphi B hitherto not known to occur in Europe, could be traced to the importation of Chinese frozen whole egg, from which that particular phage type was isolated repeatedly in England and Germany. As frozen whole eggs are used extensively in baking (those responsible being unaware of the possible dangers involved) it is obvious that enteric fevers might easily be spread, before efficient control measures could be applied.

Other Salmonella infections. During the past ten years members of the Salmonella group have been responsible for the majority of sporadic and epidemic incidents of food-borne infections in the northern, central and western areas of Europe.

In contrast to the causative organisms of typhoid and paratyphoid fevers, which are often directly transmitted by man, the main reservoir of other Salmonella species is in animals, with only occasional human carriers. Poultry, poultry products and
cattle are the most significant for human infections. Apart from endemic infection in herds—usually due to *Salm. typhimurium*, *Salm. dublin* and *Salm. enteritidis* in cattle, *Salm. gallinarum-pullorum* in poultry, and a variety of other types in ducks—the importation of infected animals or their products from eastern and south-eastern Europe into the central and western part was formerly one of the sources of human salmonellosis. In recent years such imports have again caused several outbreaks of *Salmonella* infections due to *Salm. newport*, *Salm. cholerae-suis*, and other species which are frequent in swine.

It is certain that the importation of infected fodder materials such as fish-, bone-, blood- or whale-meal has become largely responsible for the latent *Salmonella* infections of European livestock. In Denmark, where the danger apparently was appreciated first (Müller, 1952), it proved largely possible to take appropriate and successful preventive measures. In the Netherlands and the United Kingdom valuable contributions were made with regard to the control and prevention of fodder- and food-borne salmonelloses (Hobbs, 1957; Mossel, 1958). In the Federal Republic of Germany, during 1957 and 1958, legislative measures had to be taken in order to diminish at least the continuous importation of certain fodder and food products.

Even if urgent measures, such as the pasteurization of all products containing salmonellae, were adopted generally, it would still take some time to alter the situation in view of the enormous quantities of material in stock, and the difficulties of finding and eradicating carriers amongst cattle, swine and poultry. Apart from the fact that animal carriers mostly appear to be quite healthy and that their meat passes the usual inspections without being suspected or condemned, the clinically inapparent infections are difficult to trace. Consumption of bacon, ham and sausage meats contaminated directly or indirectly with *Salmonella* species of obviously non-European origin has resulted in large-scale outbreaks with thousands of infections. One epidemic with more than 6000 cases due to a *Salm. bareilly* infection was caused by camembert cheese (Bonitz, 1953). This cheese was apparently contaminated by a healthy human carrier of *Salm. bareilly* who lived on a farm where swine were fed with batches of fish-meal known to contain *Salm. bareilly*. The chain of infection is often so complex that reconstruction of the path of transmission is impossible.

Another important epidemiological factor is the infection of egg products by *Salmonella*. The role played by ducks' eggs in food-borne infections is well known. Hens' eggs may also be incriminated in a number of incidents. The significance of dried egg powder was first appreciated during the Second World War (Great Britain, Medical Research Council, 1947). This was confirmed after 1950 by English, Dutch and German investigators. In the Federal Republic of Germany and in Great Britain several outbreaks were traced to this source of infection. It has already been mentioned that Chinese egg powder was found to contain *Salmonella* as early as in 1931 (Knorr, 1931). Frozen whole egg and crystalline egg albumen may be even more important epidemiologically.

The pasteurization of egg products, during or immediately after production, or perhaps on arrival in the importing country, would be most desirable. But it appears to be impracticable owing to the substantial deterioration in quality that it causes, especially to frozen whole egg and dried egg yolk. Crystalline egg albumen is one of the few egg products which can be pasteurized without any major loss of quality. The subject has been carefully reviewed in an extensive monograph by Brooks & Taylor (1955).

Routine examination of imported egg products, unfortunately, does not ensure the safety of the consumer, as was noticed during some outbreaks in 1957 in the Federal Republic of Germany, for no laboratory service can hope to examine a high enough proportion of the total imports to be able to say with assurance that only negative shipments pass for human consumption.

Fortunately, not all salmonellae pathogenic to animals or transmitted by animal products are of the same order of pathogenicity to man. Several species, such as *Salm. abortus-ovis*, *Salm. typhi-suis* and *Salm. gallinarum-pullorum*, very rarely, if at all, cause human illness. However, infections due to *Salm. gallinarum-pullorum* have been reported in a few instances.

Not all *Salmonella* species found so far in imported fodder have been re-isolated from human or latent animal infections. In the Federal Republic of Germany from 1955 until 1957 only about 75% of such species had been found in human excreta. The same holds true for isolation from European animals. This may indicate that some strains of tropical *Salmonella* will not easily adapt themselves to hosts in non-tropical areas. It has been suspected.
that the animal may serve as some kind of a screen for these enteropathogens. Other species, however, have obviously settled down successfully and have become endemic for more than three years. *Salm. blockley* is a typical example. Whether such events are merely accidental or the expression of a variable host specificity remains to be seen (Seeliger, 1957, 1958).

A few figures may be cited to illustrate the incidence of food-borne *Salmonella* infections. In England and France during 1956 out of 7710 reported outbreaks of bacterial food-borne disease salmonellae were found to be the cause in 4323 instances. In these countries the total figure of *Salmonella* isolations from human beings rose from 1997 in 1949-50 to 2347 in 1951-52, 4432 in 1953-54 and 6505 in 1955-56.

No less impressive are the figures reported from the Federal German Republic, including West Berlin, where fairly complete data are available for the years 1956 and 1957. This may be seen from Table 2, based on data in Seeliger (1958b, 1959).

The corresponding figures for reported cases of bacterial food-poisoning (which include most *Salmonella* infections) are, according to the German Federal Office of Statistics: for 1955, 7.6 per 100 000; for 1956, 8.9 per 100 000; and for 1957, 5.3 per 100 000.

During the same period, the following reports were received on paratyphoid fever (which also includes some severe infections due to other *Salmonella* species): for 1955, 7.1 per 100 000; for 1956, 5.7 per 100 000; for 1957, 4.9 per 100 000 (which is only 0.1 per 100 000 higher than the pre-war figure for Germany with the 1938 boundaries). From this one may conclude with due caution that, after the continued increase since 1950, a slight decline in *Salmonella* infections was observed for the first time in the Federal Republic as a whole during 1957. This, however, does not apply to all localities. At several places the figures were definitely higher than during the preceding years.

Altogether, more than 150 different species of *Salmonella* have been identified in Federal Germany and West Berlin since 1950—the first year of increased prevalence—from human, animal, food, fodder, sewage, river water and other sources. This represents more than 25% of all *Salmonella* species recognized by the Kauffmann-White Schema. There was a conspicuous concordance of the species of human, animal, food, fodder and other origin, with the limitations stated above.

### Table 2

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<td><strong>Total</strong></td>
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<tr>
<td><strong>Number of species isolated</strong> (except <em>Salm. typhi</em>)</td>
<td>86</td>
<td>88</td>
</tr>
<tr>
<td><em>Salm. paratyphi</em> B, total</td>
<td>3,099</td>
<td>2,649</td>
</tr>
<tr>
<td><em>Salm. typhimurium</em>, total</td>
<td>2,610</td>
<td>1,919</td>
</tr>
<tr>
<td>Other species, total</td>
<td>4,217</td>
<td>3,618</td>
</tr>
</tbody>
</table>

Among the great diversity of *Salmonella* species isolated in the central, western and northern parts of Europe, *Salm. typhimurium* is predominant. It causes more than 30% of all incidents. In Sweden and England bacterial phage-typing has been employed with very gratifying results to elucidate extremely complex problems of epidemiology and epizootiology (Lilleengen, 1948; Anderson & Stone, 1955).

Comparable data from the German Democratic Republic are available through the public health authorities and from various reports (e.g., Meyer-Oschatz, 1957) up to 1957. They likewise show a trend of increasing prevalence of human salmonelloses as regards both actual incidents and the serological species isolated.

The sharp rise in the incidence of salmonellosis can easily be gauged by comparing the above data with a summary report covering findings in pre-war Germany from 1933 to 1939: then only 18 different species, most of them single isolations, were identified.

Unfortunately, detailed data are not available from various European countries, particularly in the south. According to some unpublished reports, the total figures and numbers of *Salmonella* species isolated seem to be rather low compared with the findings cited before. Certainly more accurate information is needed before any conclusions can be drawn.

From the foregoing it is obvious that successful control and prevention require close co-operation, nationally and internationally, on the part of both public health and veterinary public health services. They need the support and the understanding of import merchants and experts in the national
economy as the complex epidemiology and epizootiology of the food-borne Salmonella infections has far-reaching consequences for international trade, national economy and agriculture.

**Shigellosis.** Shigellosis is still prevalent throughout Europe. For the most part, Shigella infections are caused by members of the *Sh. flexneri* subgroup and by *Sh. sonnei*. Many infections are food-borne in the sense that the organisms are transmitted by foodstuffs infected directly or indirectly. While *Salmonella* and *Shigella* strains seem to be spread by food in a haphazard manner, *Sh. sonnei* apparently is not. Out of the large number of infections due to this organism, practically none of them was found to be food-borne in England and Wales. Again it must be stressed that neither the official statistics nor the bacteriological reports allow any conclusion as to the number of incidents caused or the part played by food-borne infections. As the causative organisms are strictly parasites of man and the primates, control and prevention are chiefly restricted to the normal public health authorities. It may be assumed that shigellosis occurs more frequently in the southern, south-eastern and eastern areas of Europe. This however, is not always supported by official statistics (Rodенwaldt & Jusatz, 1950-57).

**Other enterobacterioses.** The role played by other enterobacteriaceae and related organisms such as *Alkaligenes, Aeromonas, Pseudomonas*, etc., in food-borne infections is uncertain. As they constitute part of the normal faecal bacteria it is extremely difficult to evaluate their part in intestinal infections. Moreover, many of these organisms live as saprophytes outside the body and are found as commensals and contaminants of various kinds of food. Under favourable conditions they easily multiply and cause spoilage. The presence of *Escherichia coli* in water and foodstuffs has long been regarded as definite proof of recent faecal contamination. Only during the past ten years has it been discovered that several serotypes are pathogenic to man. Clinical infections of the small intestine are quite frequent among the newborn, particularly in children’s hospitals and similar institutions where they have become more important than the *Shigella* infections so frequently observed in the past. Clinical infections among the older age-groups seem to be rarer, although this has not yet been fully investigated. The proportion of food-borne *E. coli* infections is probably variable, as in the case of shigellosis and other enterobacterioses. Some reports indicate that enteropathogenic *E. coli* types may be transmitted from animal hosts to the human being. Neither the importance of this nor the route of infection is known.

It is possible that certain serotypes of other groups such as *Hafnia, Providencia, Klebsiella* and *Proteus* may also be enteropathogenic for man, while others are not. The situation may be similar to that arising with the pathogenicity of the various *Salmonella* and *Arizona* species (Taylor, 1958).

Among these organisms of doubtful pathogenicity, *Proteus* has been incriminated as a cause of food-borne infections (Dack, 1956; Moser, 1953).

The obscurity of the causal relationship of many enterobacteriaceae and related species with food-borne infections renders well-planned and careful investigations imperative in order to approach the problem successfully.

Another point should also be stressed. Even if a few salmonellae or other enterobacteriaceae may be harmless from the clinical point of view, they nevertheless indicate faecal contamination of human food. Apart from the epidemiological and clinical implications, any type of food can be rejected for aesthetic reasons where gross faecal contamination is found.

**Food-borne infections due to other bacteria**

It is generally acknowledged that *bovine tuberculosis* is responsible for human infections. These are chiefly conveyed by infected milk and milk products. The proportion of bovine infections among the human tuberculosis cases is still under study. It obviously is more prevalent among young children in rural areas than in urban areas where only pasteurized milk is available. Bovine infections in man have become very rare in those countries where eradication of bovine tuberculosis in cattle is near to completion or in rapid progress (WHO/FAO Seminar on Zoonoses, 1953). In the Federal Republic of Germany it has been reported that almost 75% of the cattle are now free from tuberculosis.

Certain forms of human *pasteurellosis*, especially due to *Pasteurella pseudotuberculosis*, may likewise be food-borne. This is borne out by the fact that the primary localization is usually found in the digestive tract, particularly in the mesenteric glands. So far its epidemiology and prevalence are still obscure.

Another important zoonosis causing food-borne infections is *brucellosis*. In the Mediterranean area it is estimated that approximately 50% of the human cases of brucellosis are caused solely or
partially by the consumption of infected food, chiefly milk and milk products (WHO/FAO Seminar on Zoonoses, 1953). Whether these estimates apply to other parts of Europe remains to be investigated. Apart from Bang's disease, which has been endemic and zoonotic in all European cattle-raising countries, Malta fever has found its way from the south and south-western parts of the continent to central Europe, where an increasing number of animal and human infections have been reported since 1948. As infections due to Brucella abortus are still prevalent in many herds all over Europe, the potential danger on the one hand to the consumer of non-pasteurized milk, cheese and other products and on the other of animal losses to the farmer makes the eradication of brucellosis in cattle an urgent problem.

Tularemia has become enzootic over extensive areas of Europe (Rodenwaldt & Jusatz, 1950-57). This has resulted in several sporadic and epidemic human infections. So far, no food-borne case due to ingestion of infected meat has come to the author's attention. It has been proved, however, that the causative organisms can be transmitted to man by infected hare's meat. In the incidents in question infection was apparently induced through small wounds during handling of the infected food.

Among the "newer" diseases that may be transmitted by originally infected food, chiefly by non-pasteurized milk, is listeriosis. Relatively little is known of the epidemiology, epizootiology and natural reservoir of its causative organism, Listeria monocytogenes. In several instances human infections have been traced to the consumption of raw milk from infected cattle and goats. Eggs and meat may also have some importance in the transmission of the disease. With more than 500 human cases observed during the past decade in Europe, listeriosis requires special attention (Seeliger, 1958a).

Although infections due to Erysipelothrix rhusiopathiae transmitted by animal products occur occasionally in human beings, the danger seems to be small.

In conclusion it should once more be emphasized that close collaboration of the public health and veterinary public health authorities is indispensable for the control and prevention of the food-borne zoonoses. It has become clear that these diseases represent not only a professional hazard for those who handle and take care of animals or their products, but in some instances an even greater danger for the majority of people who come into indirect contact with animals via infected or contaminated food. There is plenty of work to be done to diminish existing dangers to public health caused by food-borne infections of human and animal origin.

FOOD-BORNE INTOXICATIONS
(BACTERIAL FOOD-POISONING) IN EUROPE

Botulism
This malignant form of bacterial food-poisoning has been discussed extensively by competent authors (Meyers, 1928; Dack, 1956). Its distribution is world-wide, but fatality rates differ. In Europe, for instance, fatality has been reported to be much lower than in the USA, apparently owing to the prevalence of less toxogenic Clostridium botulinum types in the soil. In Europe type B is prevalent. Several outbreaks were reported during the post-war period up to 1948. They were exclusively due to poor methods of home-canning and preservation of susceptible food. Typical instances have been the small outbreaks in the Federal Republic of Germany due to sour-fried-herring, a northern dish; to homemade liver-sausage; and to several kinds of home-preserved "sterilized" vegetables.

In Norway some recent outbreaks of type B botulism were caused by cured meat and ham (Skulberg, 1957, 1958), while in Denmark outbreaks of type E botulism could be traced to marinated herring (Pedersen, 1953).

Owing to lack of proteolytic properties, intoxicated food may not show any obvious sign of spoilage.

In official medical statistics and in the lists of causes of death, botulism is not separated from other food-borne infections in most European countries. It is not possible, therefore, to give any reliable information on its prevalence. From the reports and literature available, it seems that botulism is almost non-existent in the western and central parts of Europe at the present time.

Staphylococcal food-intoxication
Following the detection of staphylococcal enterotoxin as a cause of human food-poisoning (Dack, 1947, 1956; Jordan & Burrows, 1934a), numerous reports have presented evidence that staphylococcal food-intoxication is one of the relatively prevalent forms of bacterial food-borne disease.

The extent of food-poisoning due to the pyogenic staphylococci is still underestimated. It was not appreciated in Europe until the end of the Second
World War that this food-intoxication played such an important role. In the USA, between 1945 and 1947, 926 outbreaks were reported, involving approximately 50,000 individuals. Of these outbreaks 80% were caused by enterotoxins of haemolytic staphylococci. This amounts to four times the number of food-borne infections due to salmonellae during the same period. As already pointed out, it has been estimated that in 1944 from half a million to a million persons were affected by staphylococcal food-poisoning in the USA. This should in no way be interpreted as due to any particular sensitivity in the American population to staphylococcal enterotoxin, as was at first thought by some. The ingestion of foodstuffs containing staphylococcal poison by American soldiers and European employees during 1947-48 produced severe outbreaks with identical results in both groups.

Whether the figures reported in the USA apply to European conditions is uncertain. In England and France, for example, the percentage of staphylococcal food-poisoning was far lower, amounting to about a hundredth of the cases of food-borne infections due to salmonellae in 1956 (Cockburn; Cockburn & Vernon, 1957). Meat and meat products, milk, cheese and certain types of sweets and pastry were found to be mostly involved in these incidents (Cockburn; Cockburn & Vernon, 1957; Hobbs, 1953; Ritchie et al., 1947).

For several years now an increasing number of reports has been received of similar incidents in the Federal German Republic, in southern countries like Italy (Sicily) and Portugal (Da Fonte, 1950; Moser & Mumme, 1954; Spano, 1956), and in Czechoslovakia (Sedlak, 1950). It is quite probable that many other outbreaks have occurred but have not been reported or even recognized as due to staphylococci.

The causal organisms, certain types of Staphylococcus aureus, are transmitted directly from infected individuals to food or by means of contaminated food utensils. They produce, under favourable conditions, a specific toxin, particularly in substrates rich in albumen, with or without the presence of sugar (cream, bread pudding, ice-cream, glaze, ham, meat dishes, sandwiches, sausage, cheese and milk). Keeping these products for a few hours at room or body temperature encourages the rapid multiplication of the organisms and the development of the enterotoxin. Batches of dried milk with high staphylococcal content were responsible for repeated severe outbreaks among schoolchildren in England. At first the outbreaks were unexplained, but they stopped when dried milk free of staphylococci was employed in the preparation of school meals (Anderson & Stone, 1955).

Bacteriophage-typing is essential in the investigation of staphylococcal food-poisoning because some 50% of the human population carry Staph. aureus.

It should be noted that the presence of Staph. aureus in raw milk destined for human consumption (Grade A milk) has been observed quite frequently by the author. But the hazard to public health is usually not considered very high.

Prevention of staphylococcal food-poisoning is largely a technical kitchen problem and will not be discussed in detail in this connexion. There is general agreement that rapid refrigeration of those foodstuffs that can be frozen is the best means of preventing possible outbreaks of this type of food-poisoning. The measures to be taken, however, will be understood by the people involved only when the medical profession collects enough material to convince the public of the health hazard involved. At the present time, many doctors are not even aware of the fact that "staphylococcal food-poisoning" exists as a disease.

**Streptococcal food-poisoning**

Apart from the occasional food-borne transmission of pyogenic streptococci resulting in human infections, such as scarlet fever, sore throat, and so forth, streptococci have been incriminated as a cause of true food-poisoning (Jordan & Burrows, 1934b). As only very few reports are available on this subject, it is not yet possible to evaluate its incidence or importance.

**Food-poisoning due to spore-forming bacilli (except Clostridium botulinum)**

Food-borne intoxications due to a particular heat-resistant anaerobic bacillus, belonging to the gas-gangrene-producing Clostridium welchii, are being reported with increasing frequency. One of the first reported incidents was recognized in Germany before the Second World War (Zeuner, 1938) and possibly even earlier. Later on, several outbreaks were observed in England, France, Norway, Germany and elsewhere.

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1 Cockburn, C. W., Epidemiology of food-borne diseases with special reference to England and Wales (unpublished working document of the WHO Regional Office for Europe, EURO/88.2/6)
Poisoning is mostly caused by meat and sauces prepared in canteens and kept in large containers at temperatures which allow the multiplication of the organisms, and then eaten the next day without further thorough heating. Milk likewise has been incriminated in several instances (Buttiaux & Beerens, 1953). In fact, enumeration of heat-resistant C. welchii has been suggested as a valuable criterion for the initial contamination of milk samples (Buttiaux & Beerens, 1953). The enterotoxic effect seems to be associated with the bacterial cells and is not present in filtrates without organisms. Pressure-cooking with rapid cooling and so forth are simple and effective measures. The rapid cooling of large containers, however, may present technical problems. This entity seems to be etiologically related to a disease called intestinal gangrene (Darmbrand), which was observed in northern Germany after the last war.

The actual incidence of C. welchii food-poisoning is not known. According to reports available from England and France, proved incidents have represented quite a variable proportion of all food-poisoning incidents. Sometimes they have amounted to only a tenth of the reported cases of staphylococcal food poisoning and sometimes the proportion has been higher (Cockburn; Cockburn & Vernon, 1957, 1958; Dack, 1956). In Norway, C. welchii food-poisoning is definitely more prevalent than staphylococcal food-intoxication. In Germany this type of disease has been diagnosed at a few places where its symptomatology and bacteriology were known. In the light of findings in Hamburg and Bonn, one would be inclined to believe that this type of food-poisoning is much more frequent than would appear from official reports and the relevant literature (Linzenmeier, 1956; Moser, 1953; Seeliger, 1956).

Another type of food-poisoning is ascribed to Bacillus cereus, an aerobic spore-forming soil organism. Several large outbreaks were studied in Norway and Denmark with some 800 cases reported (Christiansen et al., 1951; Hauge, 1955). Other incidents were observed in Sweden (Hauge, 1955) and the Netherlands (Clarenburg & Kampschimer, 1957). Starch-containing foodstuffs such as vanilla sauce, yellow pudding and sour potato mash have been incriminated. This type of food is compatible with the frequent occurrence of B. cereus in starch, flour and potatoes. Experience shows that intoxication will not occur unless the number of organisms is at least in the order 10⁷ per gram. More studies are necessary in order to estimate the prevalence and importance of B. cereus food-poisoning.

From the foregoing it must be concluded that the increasing incidence of bacterial food-borne infections and intoxications demands closer supervision of food products and better food hygiene, the careful instruction of producers and consumers in the dangers involved, improved culinary hygiene and, most urgent of all, legal measures to forestall the continuous spreading of pathogenic organisms in food products. All this requires better cooperation and collaboration between the public health and veterinary public health authorities.

RÉSUMÉ

Des rapports de plus en plus nombreux signalent en Europe des infections, épidémiques ou sporadiques, en relation avec la consommation d’aliments contenant des germes pathogènes ou leurs toxines. L’accroissement de la fréquence de ces infections est réel. Il n’est pas dû seulement à de meilleurs diagnostics ou à des déclarations plus fidèles. Diverses circonstances l’expliquent: la guerre et ses séquelles, la consommation grandissante de produits pour l’alimentation humaine ou animale, importés de régions où les prescriptions d’hygiène sont peu rigoureuses ou inappliquées, le nombre croissant de produits tropicaux consommés en Europe, l’habitude qui se généralise dans tous les secteurs de la population, en particulier chez les travailleurs manuels et les écoliers, de prendre au moins un repas hors du foyer, au restaurant, en cantine, etc., le développement du tourisme qui fait affluer les habitants de pays où l’hygiène est la plus développée vers les pays du sud, où elle l’est moins. Du reste, les pays où l’hygiène alimentaire et culinaire est d’un niveau élevé ne sont pas à l’abri de ces infections, les diverses épidémies qui s’y sont déclarées ces dernières années en témoignent.

L’auteur analyse la situation telle qu’elle se présente en Europe. Il passe en revue les divers facteurs qui empêchent que l’on s’en fasse une idée exacte: différences dans le système de notification d’un pays à l’autre, impré-

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1 Cockburn, W. C., Epidemiology of food-borne diseases with special reference to England and Wales (unpublished working document of the WHO Regional Office for Europe, EURO/88.2/6)
cison de la terminologie et variétés des méthodes de classification. On peut cependant faire quelques consta-
tations générales:

D'après les statistiques dont on peut faire état, la
grande majorité des infections d'origine alimentaire sont
attribuables aux Salmonella.

Outre les espèces endémiques connues, on en a isolé
des centaines d'autres dont beaucoup étaient pour ainsi
dire inconnues en Europe jusqu'à maintenant. L'atten-
tion a donc été appelée sur de nouvelles sources d'in-
fection, décelées principalement dans les produits impor-
tés en provenance de différents pays tropicaux ou sub-
tropicaux. Les examens bactériologiques ont révélé par
exemple que certains produits à base d'œufs déshydratés
ou surgelés, et les tourteaux de farine de poisson, d'os,
et de sang, renfermaient parfois un nombre impression-
nant d'espèces de Salmonella, souvent identiques à celles
qui avaient été isolées dans des prélèvements pathol-
ogiques pris sur l'homme. En outre, les mêmes types ont
été isolés chez les animaux domestiques, en particulier
chez les animaux de boucherie.

Outre les salmonelles, les shigelloses dues en particu-
lier à Shigella sonnei sévissent toujours en Europe.
Toutes cependant ne semblent pas avoir une origine
alimentaire.

Contrairement aux infections, les intoxications d'ori-
gine alimentaire sont produites surtout par l'ingestion
de toxines élaborées par la croissance de Staphylococcus
aureus dans les aliments. La prophylaxie des intoxications
alimentaires dues aux staphylocoques est surtout une
question de technique culinaire. On s'accorde en général
de reconnaître que la réfrigération rapide de ceux des
comestibles qui peuvent être congelés est le meilleur
moyen préventif. Le phago-typage est une mesure indis-

pensable dans l'analyse des intoxications alimentaires
dues aux staphylocoques; en effet, cette technique est
souvent la seule qui permette de remonter à la source de
l'infection.

Un autre type d'intoxication alimentaire est provoqué
par les bacilles sporogènes. Le botulisme est pour ainsi
dire inexistant en Europe, où l'on ne rencontre plus des
cas sporadiques. Les maladies dues à l'ingestion de
bacilles anaérobies particulièrement résistants à la cha-
leur et appartenant au groupe de Clostridium welchii
semblent présenter une plus grande importance, comme
on l'a observé en Angleterre, en France, en Norvège
et en Allemagne. Les intoxications de ce type sont liées le
plus souvent à la consommation de viandes et de sauces
prerobées dans des cantines et conservées dans de grands
récipients à des températures qui favorisent la multipli-
cation du germe. Il semble que le nombre des accidents
qui lui sont imputables soit bien inférieur à celui des
intoxications staphylocoques.

Parmi les bacilles aérobies sporogènes, Bacillus cereus
a été incriminé en Norvège, au Danemark, en Suède,
aux Pays-Bas et récemment en Hongrie. Il ressort des
données disponibles que l'intoxication se produit seule-
ment si le nombre des micro-organismes intéressés est en
moyenne de l'ordre de 10⁷ par g. Le rôle étiologique de
ce bacille est encore discuté.

La recrudescence des toxi-infections d'origine alimenta-
taire impose un contrôle plus étroit et une amélioration de
l'hygiène des denrées alimentaires. Toujours, l'effi-
cacité des mesures prises, quelle qu'en soit la nature,
dépendra de la collaboration étroite des autorités de
santé publique et de santé publique vétérinaire, qui
devront être armées de tous les moyens réglementaires
nécessaires.

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