

twenty or thirty selected stations is desired to corroborate these facts and conclusions.

The amount of cirrus cloud is small during the rainy season in Upper India, and increases rapidly southwards, reaching a maximum in southern India.

The amount or frequency of cirro-stratus cloud is large in the dry season in northern India, and decreases rapidly southwards to southern India, where it is very small, as indicated by the Madras and Vizagapatam observations.

The amount of cirro-stratus is much smaller in the wet than in the dry season in Upper India. It is very small in the peninsula, almost as small as in the dry season. It is, on the other hand, of frequent occurrence over the area represented by Jaipur and Allahabad, and more especially in Allahabad.

Alto-cumulus cloud is a cloud of frequent occurrence in northern India throughout the whole year. It is of rare occurrence in the peninsula from November to May, and of occasional occurrence from June to October at Madras.

Cumulus and cumulo-nimbus are of frequent occurrence in the dry season at Simla, Jaipur, Vizagapatam and Madras, more especially at the two last-named coast stations, and are, in fact, the most characteristic clouds of the Indian area. They are of frequent occurrence in the wet season, more especially at the peninsular coast stations and at Jaipur and Allahabad.

It is noteworthy that cumulus and cumulo-nimbus are of much less frequent occurrence in the wet than in the dry season at Vizagapatam and Madras. The former type of cloud is also comparatively rare at Allahabad and the latter type of cloud at Jaipur in the dry season.

With regard to the directions of movements of the different types of clouds at the different seasons of the year, the maps in the volume illustrate the results most clearly. Reference may here, perhaps, be made only to the directions of the cirrus and cirro-stratus during the wet and dry seasons, and the following table sums up the information for the six stations.

Station	Mean direction of movement in			
	Dry Season		Wet Season	
	Cirrus	Cirro-stratus	Cirrus	Cirro-stratus
Simla	S. 80° W.	S. 82° W.	S. 85° W.	S. 69° W.
Lahore	S. 86° W.	S. 86° W.	S. 48° W.	N. 81° W.
Jaipur	N. 86° W.	N. 87° W.	N. 78° W.	N. 80° W.
Allahabad ...	S. 82° W.	S. 83° W.	N. 83° W.	S. 65° W.
Vizagapatam...	S. 4° W.	S. 27° W.	N. 72° E.	N. 65° E.
Madras	S. 13° W.	S. 86° W.	S. 82° E.	N. 87° E.

It will be seen that the movements of the two kinds of clouds in both seasons are practically the same in Upper or north-west India, but differ very considerably when the stations are more south.

It may further be noted that in the more northern stations the air movement as observed by the upper clouds is very steady in the direction from almost due west to east, and this is more especially so during the dry season from November to May.

During this small number of years of observation it was detected that the mean direction of the cirrus movement varied slightly in the same months or seasons of different years. This variation, as Sir John Eliot states, is almost certainly real, and represents a phase in the upper air movement over a considerable area.

Previous to these cloud observations it had been estimated on theoretical grounds that the south-west

monsoon currents reach up to an average elevation of 10,000 to 15,000 feet, no actual measurements having been made. Sir John Eliot here points out that the most remarkable feature of the present cloud observations is the great variability or unsteadiness of the cloud movement during this period up to the elevation of the highest cirrus at Allahabad, in the centre or axis of the trough of low pressure. From cloud measurements made by photogrameters at Allahabad during the wet seasons (June to September) of the years 1898 to 1900, it was deduced that the variable or unsteady movement in the monsoon trough extended "to a probable elevation of 30,000 feet at least, and perhaps even to 40,000 feet, and that the regular movement in the higher atmosphere from west to east is either suspended or occurs at a much greater elevation than in the dry season."

The important results obtained by determining the movements of the air currents at different heights by means of the observations of clouds indicate that the use of kites and unmanned balloons will perhaps prove a valuable auxiliary.

The appearance of these two important memoirs so recently after the one to which reference has already been made will give the reader some notion of the activity displayed by the Indian Meteorological Department under the distinguished direction of Sir John Eliot, and of the valuable researches which it contributes to meteorological science.

W. J. S. L.

THE FOOD AND DRUGS ACTS.¹

THE two Parliamentary papers mentioned below, although widely different in character, are, at bottom, intimately connected with a common question, namely, the effective administration of the enactments dealing with the adulteration of food and drink.

The Food and Drugs Acts are now upwards of a third of a century old. They have been considered and reconsidered by Parliament at various times even down to the year 1899, and in the consideration have had to run the gauntlet of much deliberate obstruction from faddists, federations, and that class of free-fooders which regards any legislative interference with the buying and selling of anything of the nature of food, however bad, as noxious economic heresy, and a restriction of the free play of competition. That the Acts contain compromises, inconsistencies, and anomalies is well known to those who have anything to do with their administration. Nor has the judge-made law by which these anomalies have been interpreted tended to their smoother working; indeed, it has caused them to be absolutely inoperative in certain directions. How imperfect the Acts are is strikingly exemplified in the two papers before us.

The first, and in a sense the most important, of these is the final report of the Royal Commission appointed to inquire into arsenical poisoning from the consumption of beer and other articles of food or drink. It will be remembered that in the latter part of 1900 there occurred a serious epidemic of poisoning which was traced to arsenical contamination of beer at numerous breweries through the use of brewing sugars manufactured by a single firm in the neighbourhood of Liverpool. The arsenic was introduced into these sugars by way of a highly arsenical sulphuric acid supplied by a firm of chemical manufacturers in

¹ Final Report of the Royal Commission appointed to inquire into Arsenical Poisoning from the Consumption of Beer and other Articles of Food or Drink. Parliamentary Paper. Cd. 1848. 1903.

Final Report of the Departmental Committee appointed by the Board of Agriculture and Department of Agriculture and other Industries and Technical Instruction for Ireland to inquire and report upon the desirability of Regulations under Section 4 of the Sale of Food and Drugs Act 1899 for Butter. Parliamentary Paper. Cd. 1749. 1903.

Leeds which had been used in their production. This occurrence was attended with serious consequences, and caused such widespread alarm that it was deemed expedient that a Royal Commission should issue to ascertain the amount of the sickness and death attributable to poisoning by arsenic, and to consider by what safeguards the introduction of arsenic into articles of food or drink can be prevented.

In their first report the Commissioners dealt with the immediate question which led to their appointments, and made certain recommendations with the view of strengthening the hands of the Inland Revenue Authorities in preventing a recurrence of such a catastrophe as that which occurred in the autumn of 1900.

In their second and final report the Commissioners state in the outset what action they took to ascertain what became of the large stock (more than 700 tons) of arsenicated glucose and "invert" remaining at the works of the firm who made it, and also what became of certain arsenicated table syrups (14 tons in amount) which they had placed on the market. It is satisfactory to know that all the contaminated glucose and "invert" sugar was got rid of for purposes unconnected with food, particulars regarding each sale and the undertakings entered into respecting the use of all sugars sold being communicated to the Commission and to the Local Government Board.

As regards the extent of the epidemic, it appears from the evidence of witnesses and from information obtained from medical officers of health that the total number of persons who suffered was certainly not fewer than 6000, and probably considerably more. It is impossible to determine the number of fatal cases with any approach to accuracy. From the returns of the medical officers of health it appears that these were at least seventy, that is to say, there were seventy cases in which arsenical poisoning was entered in the death certificate as the cause of death, or was found to be a cause as the result of a coroner's inquest. These, in the opinion of the Commissioners, do not represent the total number of cases. Deaths occurring before the discovery of the cause of the outbreak were frequently certified as due to "chronic alcoholism" and "cirrhosis of the liver," and in some cases were attributed to Addison's disease and to locomotor ataxy. Other deaths were recorded as due to "alcoholic," "peripheral," or "multiple" neuritis.

Not the least valuable result of the inquiry has been to bring together a series of detailed descriptions by competent medical observers of individual cases of poisoning, of different clinical types which they have distinguished, of particular symptoms met with at different stages of the malady, and of pathological changes observed *post mortem*. These descriptions form valuable material for reference and comparison, and merit careful attention.

The Commissioners are of opinion that a considerable proportion of beer brewed in some parts of the country before 1900 contained noteworthy quantities of arsenic, mainly derived from malt and from brewing sugars. It is also evident that before 1900 the degree to which beer had been liable to receive arsenic from malt must have varied greatly in different parts of England. Malt has been shown to have been subject to arsenical contamination in much greater degree when the fuel used on the kiln has been gas coke than when oven coke or anthracite has been employed. It would seem that the fact of greater prevalence of alcoholic neuritis among beer drinkers in Manchester and Liverpool before 1900, when compared with other places, is to be ascribed to the larger proportion of arsenic contained in much of the malt there used, due to the character of the fuel employed in kilning. That malt of this character will give rise

to arsenical poisoning was shown by the occurrence of an outbreak in Halifax in 1902, the circumstances of which were carefully inquired into by the Commission.

Incidentally, the Commission has accumulated interesting and valuable information on the question of individual susceptibility to arsenic, on the mode in which it accumulates in human tissues, and on the ways in which it is eliminated. Arsenic was detected in sweat, in the epidermic scales which are freely shed in the condition known as keratosis, in the nails and in hair. It appears that epidermic tissues, which consist principally of keratin, have a special affinity for arsenic, and that the effect of arsenic upon nerve tissue may be related to the fact that nerve sheaths consist largely of keratin.

With regard to the suggested relation between the disease known as "beri-beri"—a disease mainly characterised by peripheral neuritis—and arsenical poisoning, the Commissioners are of opinion that such clinical, etiological and chemical data as they have been able to collect lend no support to the idea of such relation.

Much of the evidence laid before the Commission related to the relative value of different methods of estimating small quantities of arsenic in brewing materials and in food and drink generally. Indeed, there has sprung up quite a plentiful crop of literature on the subject within the last three years, and one effect of the inquiry has unquestionably been greatly to improve our analytical methods of detecting and estimating minimal quantities of arsenic. On the whole the Commission is inclined to recommend the method of comparison of mirrors, obtained either by the so-called Marsh-Berzelius method or by the electrolytic method as worked out by a departmental committee appointed by the Board of Inland Revenue.

A considerable section of the report deals with the various ways in which foods are liable to become contaminated by arsenic, and the precautions which should be taken by manufacturers to exclude it. In the greater number of cases the introduction of arsenic would appear to be due to the use of mineral acids, more particularly sulphuric and hydrochloric acid, in the preparation of ingredients of food. Arsenic may also be introduced in the mineral or organic colouring matters which may be employed to "improve" the appearance of food preparations.

The subject of malt naturally receives much attention. Although the exclusion of small quantities of arsenic from it has proved to be a matter of considerable difficulty, it is satisfactory to know that all the evidence goes to show that it is now commercially practicable to produce malt which either may be considered free from arsenic or in which the amount of arsenic is certainly less than $1/250$ th grain per pound. Considerations of space preclude us from attempting to show how it has been proved that access of arsenic to malt may be obviated or diminished. No doubt this section of the report will receive from those commercially interested in the matter the attention which its exhaustive treatment merits.

In the concluding sections of their report the Commissioners deal with the present means of official control over purity of food, more especially in relation to arsenic, and discuss the general question as to what improvements are, in their opinion, needed in the official control over the purity of food.

As this is, perhaps, the most generally important outcome of their deliberations, and bears directly upon the question of the efficacy of the machinery which supervises the working of the Food and Drugs Acts, we propose to reserve the consideration of their recommendations to a subsequent article.