

## BORAX, AND FOOD.

Dr. Wiley's elaborate investigations on the influence of boric acid and borax on digestion and health will shortly be published by the Department of Agriculture. We are enabled to present the following preliminary account of results obtained:

These investigations were commenced in the autumn of 1902. Prior to their beginning, a careful study of similar work done in this and other countries was undertaken and some of the laboratories where this work had been carried on, notably the laboratory of the Imperial Board of Health of Germany, at Charlottenburg, were visited and the method of experimenting investigated. The plan finally decided upon was to secure the voluntary services of a number of young men who would try the effect of the added substances upon their digestion and health, to make the necessary observations, and to submit themselves to the rigid analytical control which such a series of investigations required.

The number finally selected for experiment was 12, as this was found to be about the maximum number which could be cared for with the analytical and culinary facilities afforded by the Bureau of Chemistry. A kitchen and a dining room were fitted up in the basement of the Bureau and in December, 1902, the actual experimental work began, and it continued in the case of boric acid and borax until July 1, 1903. The work was so divided that no one of the young men under observation was required to submit himself to the rigid control necessary to the conduct of the work more than one-half of the time. The men selected were taken partly from the force of the Bureau of Chemistry and the rest from other Divisions and Bureaus of the Department of Agriculture. Each one was required to subscribe to a pledge to obey all the rules and regulations prescribed, and to abstain from all food and drink during the period of observation save that which was given him in the course of the experiment. Careful medical inspection of each of the members of the experimental class was secured, both directly and by collaboration with the Public Health and Marine Hospital Service. The details of the work, both analytical and medical, are found in full in the bulletin above mentioned, which is now in press.

A summary of the results of the investigations, omitting all technical and analytical detail, is as follows:

(1) Both boric acid and borax, when mixed with the food, are excreted from the body chiefly through the kidneys, about 80 per cent of the total amount exhibited being recovered in the urine. The rest of these bodies is excreted chiefly through the skin with the perspiration. Only traces of them are excreted in the feces. These facts show that these bodies are almost if not quite all absorbed into the circulation from the intestinal canal.

(2) When borax or boric acid is administered in the food it appears in traces in the urine in a very short time, but if equal quantities of this preservative be administered daily the maximum quantity excreted in the urine does not appear until about the third day. After that if the same quantities be continued equivalent quantities are excreted from day to day. These facts show that there is not any great tendency to the accumulation of these bodies in the system beyond what would be given over a period of about three days, and even the whole of this is not found in the body at once, as small portions of it, gradually increasing in quantity, begin almost immediately to be excreted after exhibition.

(3) The most convenient method of administering this preservative is by inclosing it in capsules. When mixed directly with the food it tends to give the person eating it a dislike for the food in which the borax is found, due largely to the mental attitude rather than to a bad taste or flavor.

(4) When boric acid or borax equivalent thereto, in small quantities not exceeding a half grain per day, is given in the food, no notable effects are immediately produced. If, however, these small doses be continued for a long while, as for instance in one case 50 days, there are occasional periods of loss of appetite, bad feeling, fullness in the head, and distress in the stomach. These symptoms, however, are not developed in every person within the time covered by the experiment, for some are far more sensitive to the action of these bodies in small quantities than others. There is no tendency in such cases to the establishment of diarrhoea or of diuresis, though there is a slight tendency to increase to a very small extent the amount of water in the feces. There is, however, no measurable tendency to increase the volume of the urine.

(5) When boric acid, or borax in equivalent quantities, is given in larger and increasing doses, there is a tendency to the somewhat rapid development in a more accentuated form of the symptoms above described. The most common symptom developed is a persistent headache, a sense of fullness in the head, with a clouding to a slight extent of the mental processes. When the doses are increased to 3 grammes a day these symptoms are established in a majority of

the cases but not in every case. They are also sometimes attended by a very distinct feeling of nausea and occasionally by vomiting, though the latter act is rarely established. There is a general feeling of discomfort, however, in almost every case, but the quantities required to establish these symptoms vary greatly with different individuals. In some cases very large quantities may be taken without the establishment of marked symptoms, while in other cases from 1 to 2 grammes per day serve to produce in a short time feelings of discomfort and distress.

(6) The specific action of the boric acid and the borax upon the digestive processes is not very well marked. There is but little apparent disturbance in the process of digestion or assimilation. But there is a slight tendency to decrease the proportions of the food which are digested and assimilated, and thus to cause the excretion of larger quantities of undigested materials in the feces. This action, though it may be traced definitely when large numbers are submitted to experiment, is not of a character to cause any very serious consequences. It is, moreover, not marked enough to warrant the statement that the administration of these bodies in small quantities causes a distinctly unfavorable effect upon the processes of digestion and assimilation, except when its use is long continued.

(7) The effect of the administration of borax upon the weight of the body is very well marked. As its continued exhibition decreases the desire for food, interferes somewhat with the digestion of the food in the alimentary canal, and produces, in certain cases, persistent headache, bad feeling, and discomfort in the region of the stomach, its final effect in diminishing the weight of the body is not doubtful. The compilation of the weights of the body obtained during the whole period of the observations shows a slight tendency to diminish the weight of the body during the administration of the preservative. This tendency becomes so well fixed that it is not entirely eliminated for several days after the administration of the preservative ceases. In the after periods extending in some cases for ten days, and during which time the subject was kept under observation after the administration of the preservative ceased, there was not a uniform nor even a general recovery of the original weight and of the original condition. Any effects produced by the administration of the borax do not extend to any considerable period of time, and apparently no permanent injury to any one of those experimented upon is produced.

(8) No conclusions were reached in regard to smaller quantities than half a gramme per day of the preservative, and therefore, any statements in regard to the administration of smaller quantities must be based largely upon the results obtained with the quantities actually employed. It is reasonable to infer that bodies of this kind not natural to nor necessary in foods which exert a marked injurious effect, when used in large quantities for short periods of time, would have a tendency to produce an injurious effect when used in small quantities for a long time. The general course of reasoning, therefore, would seem to indicate that it is not advisable to use borax in those articles of food intended for common and continuous use. When placed in food products which are used occasionally and in small quantities it seems only right, in view of the above summary of facts, to require that the quantity and character of the preservative, that is, whether borax or boric acid, be plainly marked so that the consumer may understand the nature of the food he is eating.

(9) The use of borax or boric acid as an external application to cured meats to preserve them in a proper condition during shipment to foreign countries when the use of such preservatives is not prohibited in such countries and when it is especially asked by the purchasers that they may be used, is a question which is not to be decided upon the data which have been obtained. Inasmuch as it is evident that in cured meats the processes of absorption and diffusion will be very much restricted, it is evident that unless the shipment of the product in question extends over a long period of time there could be no very great penetration of the preservatives to the interior of the package. The quantity of borax thus introduced into the food product would be minimal and the desirability or undesirability of its presence would be a question which should be left solely to the decision of the authorities in the countries to which the product is sent.

(10) The convincing justification of the use of boric acid and borax for domestic food products must lie in the possibility of proof on the part of those using them that the food products in question if not preserved in this manner would develop qualities far more injurious to health than the preservatives themselves.

(11) While many of the individual data obtained are contradictory, the general results of the investigation secured by combining into single expressions all the data relating to each particular problem studied show in a convincing way that even in doses not exceeding half a gramme ( $7\frac{1}{2}$  grains) a day boric acid

and borax equivalent thereto are prejudicial when consumed for a long time. It is undoubtedly true that no patent effects may be produced in persons of good health by the occasional use of preservatives of this kind in small quantities, but the young, the debilitated, and the sick must not be forgotten, and the safe rule to follow is to exclude these preservatives from foods for general consumption.

## SCIENCE NOTES.

An interesting discovery of old Roman and Anglo-Saxon relics has been made in the course of some excavations in a field at Mitcham, a southwestern suburb of London. Seven skeletons in a group accompanied by several spearheads were at first unearthed. A little later this discovery was followed by the finding of three more skeletons, all in an excellent state of preservation. In every case, the skeleton was lying on its back with the feet toward the east, and in separate graves made in the gravel. Remnants of old-fashioned armor, some spurs, and a two-edged broadsword were found near the remains. Several three-inch lengths of brass or bronze rod, with eyelets at the head, and portions of an old handsomely carved glazed vase were found on the chest of one of the skeletons. Another skeleton had a spearhead to the left of the skull, with a buckle and knife or dagger at the waist. The skeletons and relics of the implements have been carefully examined by archeologists, and their investigations incline to the theory that the bodies were buried about the year A. D. 400. As a matter of fact, there exists records of a battle having been fought near Mitcham about this period. The researches are to be continued carefully under the supervision of scientists and antiquarians, and it is anticipated that many more interesting links with the past will be discovered.

It has been observed that oysters grow much more slowly on some beds than on others—that in certain places they fail to fatten. These places were usually on overcrowded beds, and sometimes good results could be secured by transplanting or thinning out. Qualitative and quantitative study of the diatoms (which constitute the food of oysters) on beds where the oysters fatten well, and on other beds where they fatten poorly, showed that the number of diatoms per liter of water was very much greater in the former than in the latter. It was therefore believed that if the supply of diatoms could be increased on the unproductive beds the oysters on them would grow and fatten. Experiments along these lines were recently inaugurated at Lynnhaven, Va., under the immediate direction of Dr. H. F. Moore, of the Bureau of Fisheries. A small cove was selected where the bottom and the salinity of the water were favorable, but where diatoms were scarce. Commercial fertilizers of certain kinds were used to furnish food for the diatoms, and it was very soon found that the latter greatly increased in abundance, and lean oysters transferred to this cove fattened rapidly. Details of the process need not be given here, but it is believed that the experiments will demonstrate the entire practicability of the artificial feeding and fattening of oysters on a commercial basis.—National Geographic Magazine.

Some time before the ashes and lava of Vesuvius in 79 A. D. covered up Herculaneum and Pompeii, a municipal election was held in the latter city. Mr. Joseph Offord read a paper before the Society for the Encouragement of the Fine Arts concerning this election, about which nothing would have been known but for the terrible eruption, which from 79 to 1755 buried the municipium and its electors alike in a lava tomb. Mr. Offord showed that many of the inscriptions uncovered on the walls of the city relate to elections and claims of candidates, much in the same way as do the placards posted in our streets to-day. Some were rudely inscribed, others set forth with artistic embellishment, and one, at least, contained a topical verse written by some minor poet, and painted in red. Like our candidates, those in Pompeii were run by their supporters, who represented various trades and interests. The wood-cutters, fishers, perfumers, dyers, barbers, and the like had their men pledged to promote or protect their rights and privileges. There were fadists, too, in Pompeii, who were looked after by such societies as the Ball-players, Long Sleepers, Deep Drinkers, and Little Thieves, to adopt a free translation of some of their titles. At Pompeii's ultimate civic contest the Long Sleepers and Deep Drinkers appear most appropriately to have run a candidate in common—the main plank in their platform being the suppression of street noises. Even Pompeii had its religious difficulty. As every visitor to those wondrous unburied ruins knows, it was the home of a cosmopolitan and, for its age, cultured and tolerant people, and to this day stand altars erected to Egyptian gods side by side with those of the established worship of Venus. Naturally there arose some differences between them. It is suggested that further excavations may prove that at the 79 election there were Isis passive resisters. Thus near came imperial Rome to representative government.