five minutes after the onset of the first symptoms. He was picked up by the other workmen and rushed to the hospital, where oxygen was administered as well as heart stimulants but apparently with little effect. The cyanosis persisted, the heart action was very feeble and remained so for over sixteen hours, and he did not regain consciousness till the morning of July 25, a period of about twenty-two hours.

A catheterized specimen of urine obtained on admission showed nothing of note, but a second examination was made eighteen hours later, when it was found to be smoky, specific gravity 1.022, there was a trace of albumin, no sugar, and the presence of hemoglobin was detected by the Heller test and by the Schönbein-Almén turpentine-guaiac test, which is even more delicate than the spectroscopic. This hemoglobi-nuria persisted for five days.

A blood examination made on entrance gave normal findings in all respects except for a slight eosinophilia, but four days later there were stippled red cells and some irregularity in the size and shape of the reds. The hemoglobin then was 75 per cent. (Sahli).

The patient suffered from severe headache for five days and complained of weakness and exhaustion for at least two weeks longer, after which he improved slowly. He was warned not to expose himself to this danger again.

The second case is cited because it is representative of the slower and much less typical forms of anilin poisoning: H. M., a chemist employed in the research laboratories of one of the large rubber companies of Akron, was seen Nov. 1, 1915. He complained of palpitation of the heart, dizziness, marked muscular weakness and occasional nausea and violent headaches. On close questioning it became evident that the palpitation of the heart was worse and headache was more apt to come on during active work, and that this work often consisted in the handling of a compound containing anilin. Most of the work was carried on under a hood, but he admitted that the odor of anilin was at times quite noticeable. He had been doing this sort of work for months, and said that he had never been cyanosed and never had had to lose a day from the laboratory.

An examination of the urine showed nothing abnormal: The red cell count was 5,400,000, but the hemoglobin only 68 per cent., and a stained smear showed pale, unevenly staining reds. Physical examination revealed nothing of note except a rapid heart action; the pulse was 94.

On this scanty evidence the patient was advised to give up his work and find some outdoor occupation, which he did, and as a result the symptoms disappeared entirely in six weeks.

The third patient, a lad of 18 years, was also employed in the research laboratories of one of the rubber companies. He was given a special problem to work on, which involved the grinding and mixing of certain compounds together with anilin. He did it in a corner of the room where the fumes could not spread and expose the other workmen. After working in this way for a few weeks he began to suffer from a dull headache which persisted all day. Then one day he became conscious of a severe throbbing in his head, and his face became cyanotic. He stopped work for the day and came back the next morning feeling fairly well, but it so happened that the ventilation was unusually poor that morning and the fumes very noticeable. After just one hour's work he lost consciousness and remained in a deep coma for over twenty-four hours. He was very cyanotic and his heart action was weak; at times he was almost pulseless. Camphorated oil administered hypodermically seemed to exert a better effect than did the oxygen which was given continuously for twelve hours. In this case no blood examination was made; the urine was at first bright red, later a smoky black.

Examination of the histories of a large number of cases of anilin poisoning reveals interesting facts as to the varying susceptibility of men to this poison. We have already noted the increased sensitiveness of heavy drinkers. It seems also that men of dark hair and complexion are less susceptible than blonds, as

has been observed in one of the large rubber works where records have been kept of over fifty cases of poisoning. Furthermore, it is found that young men are more susceptible than are the middle-aged, especially to the acute, violent form of anilism.

CONCLUSIONS

Commercial anilin is a well known industrial poison in Germany and in Great Britain. It is just beginning to be known in the United States, where it has already been the cause of numerous cases of poisoning among men engaged in the manufacture of rubber goods, in reclaiming rubber from scrap, in making anilin from benzene, and in using certain washes for press rollers.

It is a blood poison, causing the formation of methemoglobin with the consequent "internal suffocation."

Poisoning may take place through the skin or the lungs. Usually in industrial cases both portals of entry play a part.

Exposure to the fumes need not be excessive or long-continued to bring about serious symptoms in the susceptible.

Young men are more susceptible than the old or middle-aged, blonds than dark-haired men, heavy drinkers than the temperate.

Hot, humid weather, heated rooms and poor ventilation are important factors in the production of acute anilin poisoning.

Early recognition of anilin poisoning is of prime importance so that the sufferer may be withdrawn from the danger of further exposure to the poison.

Men working in anilin constantly seem to acquire a certain amount of tolerance to it; nevertheless, if the exposure is increased beyond the point of tolerance, there is apparently a cumulative effect, and symptoms of chronic poisoning result. After symptoms of poisoning have once manifested themselves, the patient is usually hypersensitive to the fumes.

The treatment consists in fresh air, oxygen and heart stimulants, especially camphorated oil. Prevention of subsequent exposure is imperative.

AN OUTBREAK OF TYPHOID ATTRIBUTED TO INFECTED OYSTERS

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An outbreak of typhoid fever, comprising fifty cases, which presented itself during November and December, 1916, in the city of Binghamton and in certain nearby municipalities in Broome and Chenango counties, offered an unusual opportunity for epidemiologic study, and proved particularly interesting since it was demonstrated with reasonable certainty that it was due to infected oysters.

Typhoid fever had prevailed to some extent in Binghamton and vicinity prior to the recent outbreak. Table 1 indicates the municipalities involved in this outbreak, the population of each, and the number of cases which had occurred during 1915, prior to November 1.

During the recent outbreak, cases appeared in each of these municipalities as follows: Binghamton, 25; Johnson City, 10; Windsor, 6; Norwich, 5; Oxford, 3; Greene, 1.

During December it was noted that an unusual number of cases were being reported at practically the same time from these various municipalities, in some of which, as will be noted (Table 1), there had previously been no cases for at least ten months. This naturally excited a suspicion that there might be a common origin.

Johnson City is a village practically continuous with the city of Binghamton; Windsor is situated about 15 miles from Binghamton; Greene, Oxford and Norwich are located on a division of the D. L. & W.

Municipality	Population	Cases prior to Nov. 1
Binghamton	53,668	24
Johnson City	5,400	6
Windsor	2,384	None
Norwich	8,342	2 (April and May)
Oxford	3,073	None
Greene	2,959	None

Railroad, 20, 33 and 42 miles distant, respectively, from Binghamton.

December 15, through conference with the health officer of Johnson City, it was learned that three of the four patients then reported as having typhoid fever were known to have had raw oysters at a time consistent with the period of incubation, while nothing else in common had been discovered. It was learned on inquiry from one of the local retailers, who had supplied two of the patients, that much of the oyster trade in Binghamton and nearby towns was supplied by two Binghamton wholesale houses, from one of which he had received his supply.

The following day at Windsor it was found that in the cases then reported, occurring in two families situated at a distance from each other, one family living in the village and the other in the country, oysters from the same source had also been eaten raw at the proper time.

In the city of Binghamton, the records of the health officer showed that attending physicians in a few cases had reported "oysters" as a possible source of infection.

These incidents, together with the reports received later from health officers of other municipalities, led to a strong suspicion that oysters were among the possible sources of infection. Owing, however, to the relative rarity of authentic oyster outbreaks, it was still assumed that some other source of infection would be discovered.

About January 1, because of the number of cases reported and the difficulties encountered, it was deemed advisable for the sanitary supervisor temporarily to lay aside all other work and give his entire time to a detailed investigation. Mr. C. A. Ferrin, an inspector of the Division of Cold Storage Inspection, was assigned to assist in tracing shipments of oysters from their source, through the wholesalers, to the large number of retailers involved; while Dr. F. M. Meader, director of the Division of Communicable Diseases, gave advice and assistance throughout the investigation. This included a house-to-house study of the cases, the thorough investigation of all "clues" to other possible sources of infection, such as water, milk and its products, celery and other raw vegetables and fruits, association with other cases, carriers, etc. As already indicated, it also included a detailed study with reference to oysters as a possible agent in the transmission of infection.

It was found that the dates of onset ranged between November 15 and December 18, with the greatest incidence of onsets at about November 21 and December 2, the dates of onset in all the municipalities being practically coincident.

Of the various agents investigated, it was evident that water could not be a common source of infection, since each municipality had its own supply. Reports of bacteriologic examinations of the water supply of the city of Binghamton, made almost daily during November, did not indicate infection. In Binghamton the cases were scattered over the routes of nineteen different milk dealers. A clue which might have cast suspicion on the milk of one dealer came to naught when it was found that he was among the few who had no cases on their routes, and that he sold no milk except at retail. Naturally, at Thanksgiving time and at Christmas, a considerable number of persons had eaten celery. It was found, however, that there was no common source of supply, and investigation of a number of truck farms supplying celery led to its elimination.

The study to determine the possible relation of oysters to the outbreak proved most interesting and instructive. Incidentally, it was noted that there were no cases occurring among the very poor, of which class Binghamton naturally has its share. If water or milk had been the responsible agent, it might reasonably have been expected that the very poor, as well as those in comfortable circumstances, would have been affected.

It was found that thirty-eight patients, or 76 per cent. of the total number, fifty, were definitely known to have had oysters—a few having eaten them to excess—on a date consistent with the period of incubation. This period was determined by going back one week, and assuming that infection may have occurred at some time in the preceding two weeks. Most of the patients had eaten the oysters raw. In one instance they had been fried, and in others stewed.

It was found that the common practice, in preparing oyster "stew," was first to "bring the water to a boil," after which the oysters were added. They were not boiled, as this process is said to make them "tough." It is apparent, therefore, that the process of cooking, as ordinarily practiced, is not likely to sterilize infected oysters effectively.

The results of investigation in the remaining twelve cases, or 24 per cent. of the total number, not included in the foregoing are summarized in Table 2.

	Number of Cases
Oysters, raw, at about the date given as that of onset	4
Oysters, raw, at the right time but apparently not from the common source	1
Diagnosis apparently incorrect	1
Outside infection probable	1
Secondary	2
Not determined	3
Total	12

In regard to the source of supply of the oysters consumed, it was found that they had been purchased from a large number of retailers. There were in Binghamton six wholesale distributors; much of the retail trade, however, both in Binghamton and in the other municipalities, had received its supply from one or the other of two of the larger distributors, whom we will designate as A and B. It was found that twenty-seven of the thirty-eight definite oyster cases

had in all probability had oysters supplied by A, while those eaten by ten came from B. In one case the source of supply was not determined. In other words, practically all of these cases, located in six different municipalities, had oysters believed to have been supplied by only two out of six wholesale dealers. These oysters were received by the wholesalers in sealed gallon cans, and were said to have been sold to the retailers without the cans having been opened.

Wholesaler A, in turn, received his supply from two Maryland firms of packers, one in Baltimore and the other in Cambridge, while B was supplied wholly by one packing house in Baltimore. It was stated that none of these Maryland packing concerns owned any oyster beds, but that each in turn received its supply from nine or more "shucking" houses, scattered through Maryland. At the time of writing, the matter of determining, if possible, the ultimate source of the oyster used, and whether a single "shucking" house may have supplied some of the oysters which reached both A and B, is in the hands of organizations outside of New York State. At the time of the receipt of the last report, it had been impossible to determine the source of those shipped to this section of New York State.

It is interesting to note that, at the time of our investigation, oysters from one of the Maryland packers mentioned above were under suspicion in connection with outbreaks of typhoid fever in three cities in Illinois.

Since a large number of persons other than those who developed typhoid ate oysters from the common source mentioned, while practically all of those who have been included as "oyster cases" had oysters from the same source, the inference is that, mixed with the oysters received by the two Binghamton wholesalers, were small quantities of infected oysters. From the incidence of the dates of onset, it may perhaps be assumed that the infected oysters were included in two shipments, one about November 1, the other shortly before Thanksgiving day.

SUMMARY

In November and December, fifty cases of typhoid fever occurred in six municipalities, in three of which there had been no cases in over ten months, and in one none in five months. There was apparently no possible common source of infection other than oysters purchased from various retailers, these retailers having been supplied by two of six wholesalers. In the thirty-eighth case the source of the oysters consumed was not determined, but presumably it was the common one. The two wholesalers received their supply from three Maryland packing houses, each of which drew for supply on a large number of small "shuckers" scattered throughout Maryland. Whether oysters from one "shucker" reached both of the Binghamton wholesale houses remains to be determined if possible. Apparently the infected oysters were received in two shipments, one in November, the other in December. It may be added, in conclusion, that there have been no cases in these municipalities, other than secondary, since that time.

NOTE.—Under date of April 5, I have been advised that it has been impossible to locate with certainty the source of the infected oysters responsible for this outbreak; that there are two small areas regarded as especially dangerous, one near the outfall of a sewer on which is a hospital, and that oysters from these areas have been sold during the past season.

VITAMIN SOLUTION OF THE PELLAGRA PROBLEM

A PRELIMINARY NOTE *

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A number of writers¹ have suggested the possibility of the solution of the pellagra problem in a vitamin removed in the process of milling, but there has been no experimental or clinical evidence worthy of serious consideration.

There is no doubt in the minds of a large number of the students of pellagra that the deficiency theory of Dr. Joseph Goldberger² is correct. This report is based on the correctness of his theory. The present work had its inception in an idea suggested by Dr. Goldberger pointing out the analogy between pellagra and beriberi. Reviewing the beriberi situation as it stands at this time, one is impressed with the fact that it is not essential to eat rice in order to suffer the disease, but that it is highly improbable that beriberi will ever become a great economic problem except in rice eating countries, though sporadic cases are occurring even in this country. With this idea in mind, one naturally turns back to the old theories that pellagra was caused by defective corn. An effort was made to determine if corn suffered in the milling process. The work was planned entirely from the standpoint of a deficiency, and developments soon justified the strong suspicion that the protective vitamin was removed by milling, just as the vitamin is removed in the milling of rice when the product is polished rice.

Until recent years,³ in the South especially, corn was simply crushed between two stones, and the power was that of the stream nearby. Each neighborhood had its own mill. The only thing removed was the coarse particles of outer skin or husk. This method of milling has been largely replaced by steam or electric milling. By this process the corn is subjected to heat in order to loosen the outer coarse husk. Our attention at this time is directed to this portion of the industry to determine how much heat is employed. In the modern mill, in which these observations were made, the heat is a negligible quantity; but it must be remembered that 120 C. is sufficient to destroy any vitamin that may be contained. This part of the work, therefore, cannot be too strongly emphasized. After the heating process the grain is passed into a "degerminator," which removes the germ. This is done because the germ contains such a large amount of fat that rancidity would soon occur if it were left in the meal. Besides this, the germ would give to the meal a yellow color which by modern standards is counted undesirable. The offal, which contains the germ, husks and bran, some flour and flinty portions of the grain, constitutes about 30 per cent. of the entire weight of the grain. It is known as "corn chops," and is fed to the cattle. The remaining endosperm, after the removal of the offal, is finely ground, and the product is known as granulated corn meal; but in this article it will be referred to as milled meal.

* From the Public Health Laboratory of the City of Wilmington and County of New Hanover, North Carolina.

1. Castellani and Chalmers: *Manual of Tropical Diseases*, Ed. 2, 1913. Stitt: *Diagnostics and Treatment of Tropical Diseases*, 1914.

2. Goldberger, Joseph: *Pellagra: Causation and a Method of Prevention*, *THE JOURNAL A. M. A.*, Feb. 12, 1916, p. 471.

3. *Farmers' Bull.* 298, U. S. Dept. Agric.