

general paresis, there is no morphologic difference demonstrable. In the rabbit testis, numerous short thick forms with few spirals were found. In the cultures from this material, however, the predominating form was the typical fine spirochete with many convolutions, identical, in fact, with those seen in early cutaneous syphilids.

It is worthy of note, however, that although we had rich material to begin with, the cultures grew much more slowly and much less luxuriantly than do those cultivated from the early cutaneous or mucous membrane syphilids. On the other hand, it is to be noted that they are extremely viable. Examination at present of the original cultures, which have been disturbed by frequent examination and transplantation, still shows moderate numbers of organisms, actively motile and apparently as viable as when first seen.

SANITATION AND THE CONTROL OF PELLAGRA

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That the incidence of pellagra is not decreased by improved sanitation and general disease prevention methods, and that it is materially increased by business depression and increased prices of food, is the conclusion that must be drawn from the experience obtained in this city during the past five years.

The following tables show the improvement in health conditions which have been secured since 1911 through improved water supply, excreta disposal by means of sanitary sewers, the general sanitation of the city, incineration of all waste and refuse, strict laboratory control of milk and water supply and the infections that are subject to laboratory control, market and food inspection, improved drainage, medical school inspection, and the various other methods used for human conservation in modern public health work.

TABLE 1.—COMPARISON OF GENERAL DEATH RATES PER THOUSAND

Year	White	Black	Total
1911.....	19.94	34.78	29.43
1912.....	14.99	28.55	21.46
1913.....	13.30	24.94	19
1914.....	12.27	25.80	18.62
1915.....	11.1	22.8	16.4

TABLE 2.—COMPARISON OF DEATH RATES UNDER FIVE YEARS PER HUNDRED THOUSAND; COMPUTED ON ENTIRE POPULATION

Year	Rate
1911.....	1,123.03
1912.....	655.94
1913.....	651.24
1914.....	644.11
1915.....	474.2

TABLE 3.—COMPARISON OF DEATH RATES FROM ENTEROCOLITIS PER HUNDRED THOUSAND

Year	Rate
1911.....	411.64
1912.....	320.84
1913.....	206.72
1914.....	220.02
1915.....	80

TABLE 4.—COMPARISON OF DEATH RATES FROM TYPHOID PER HUNDRED THOUSAND

Year	Rate
1911.....	100.98
1912.....	35.64
1913.....	50.09
1914.....	25.5
1915.....	9.2

TABLE 5.—COMPARISON OF PERCENTAGE OF DEATHS FROM COMMUNICABLE DISEASES

Year	White Per Cent.	Black Per Cent.	Total Per Cent.
1911.....	50.34	54.42	54.16
1912.....	40.27	61.05	53.57
1913.....	34.76	45.40	41.47
1914.....	31.86	44.21	39.74
1915.....	22.39	32.59	30.20

The percentages in Table 5 are computed to show the relation between the total number of deaths and the number of deaths from all known communicable diseases, including pellagra.

While this improvement was continuous, as shown in these tables, the death rate from pellagra shows a marked increase in 1915 over 1912, 1913 and 1914. In Table 6 is given a comparison of the death rates from this disease for the past five years.

TABLE 6.—COMPARISON OF DEATH RATES FROM PELLAGRA PER HUNDRED THOUSAND

Year	Rate
1911.....	38.83
1912.....	21.38
1913.....	16.69
1914.....	38.26
1915.....	64.6

The years 1912 and 1913 were marked in this section by exceptional prosperity. The trucking industry and other industries of the county were very prosperous. The cotton market was active, and there was a marked increase in manufacturing and building activities. There was plenty of work for all, wages were good, and the prices of food were from 15 to 20 per cent. lower than they are now. With the outbreak of the war in the middle of 1914, there was an immediate depression, which has been more or less continuous though less marked at this time than up to June, 1915. The increase in the incidence of pellagra and the increase in the death rate of this disease follow this business depression very closely.

In the rural sections of New Hanover County a special intensive effort at sanitation began in July, 1914. The effort was concentrated on excreta disposal and water supply in order to control intestinal infections, which were especially prevalent. By the beginning of 1915 every rural home, black and white, in the county had been supplied with a privy at the owner's expense. At that time there were but twelve privies in the rural district which were not provided with receptacles and in which there was not a more or less successful effort at fly proofing. These conditions were maintained throughout 1915. Indeed, there was a marked improvement in this respect during 1915. In December, 1914, Prof. C. W. Stiles and Dr. L. L. Lumsden of the United States Public Health Service made a survey of the rural sections of this county with special reference to the methods of excreta disposal in use. A second survey was made in December, 1915, by Prof. C. W. Stiles of the United States Public Health Service and Dr. George M. Cooper, director of the Bureau of Rural Sanitation of the North Carolina State Board of Health. The last survey disclosed the fact that on the system of scoring used by the United States Public Health Service, the rural sanitary index in New Hanover County has been increased in a single year by 45 per cent. The rural population has been instructed in all disease prevention methods with the exception of pellagra, the means of preventing pellagra being only recently established. The incidence of this disease in the rural section as in the city has increased

during the past year. This incidence among the rural population from the cases reported shows three cases per thousand inhabitants, while in the city the incidence is a little more than one case per thousand. Our experience here teaches us that there are a great number of mild cases of this disease which are not reported and of which we have no knowledge, only those being reported in which the patients present themselves to physicians and hospitals for treatment. The numerical relation existing between the rural and city cases is, we believe, about that stated above.

In our local experience these conclusions seem to be justified:

1. There is no existing relation between soil pollution and the incidence of pellagra.

2. Close supervision of all cases, disinfection, fumigation, isolation and the other usual means of controlling infection have no influence on pellagra incidence.

3. Business depression, lack of employment, a limited market for products, and increased price of food, with consequent increase of indigence, increase the incidence of pellagra very definitely.

SYSTEMIC POISONING WITH BISMUTH *

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Bismuth salts have been used for many years for diagnostic and therapeutic purposes, but their effects after absorption on the human system have received only scant attention. This is all the more remarkable in view of the fact that the other heavy metals have been the object of careful study in systemic poisoning, and are known to produce well recognized symptoms. Edsall has a very exhaustive article on metallic poisonings in Osler's "System of Medicine," but makes no reference to the toxicity of bismuth. The subject, however, has not been neglected so far as experimental work is concerned, as shown by the literature. As long ago as 1786, there were reports of vomiting, twitchings, dizziness and somnolence due to the ingestion of these salts. It was thought that these symptoms were due to impurities, particularly arsenic and lead, and it is possible that such was the case at that time.

In 1882 Kocher used bismuth subnitrate as a dusting powder on granulating surfaces. Although these wounds healed, rather severe constitutional symptoms followed the continued application in several cases. He observed a stomatitis progressing in some instances to ulcerations, diphtheritic gingivitis, dysphagia, nephritis, nausea and diarrhea. One of his patients died, and at necropsy large purplish spots were found scattered over the lining of the colon. Following his observations, others reported cases of similar type in which bismuth had been used for one cause or another.

Impressed by these reports, Steinfeld and Meyer, in 1884, undertook certain experiments in order to determine the toxicity of bismuth in animals. Their results showed that two forms of intoxication could be produced. The manifestations in the first or acute class were convulsions, dyspnea and bradycardia, with

a fatal termination. In the second or chronic type, the animals showed marked lassitude, ulcerative stomatitis, anorexia, diarrhea, loss of weight and body heat, albuminuria, and sometimes tetanic contractions. The postmortem examinations in the latter class revealed ulceration and necrosis of the mucous membrane of the colon. Their explanation of this condition was that the bismuth circulating in the blood in a soluble form was precipitated by the hydrogen sulphid in the colon, and that the newly formed bismuth sulphid produced a necrosis by blocking the capillaries and lymph channels.

Other observers confirmed these experiments and showed that while bismuth subnitrate could be administered by mouth to dogs without untoward effects, very definite evidences of poisoning appeared after subcutaneous injections, producing the symptoms described by Steinfeld and Meyer. For example, one of Dalché's dogs received subcutaneous injections for twelve successive days. It died on the thirteenth day. Five days before death a brownish glistening line appeared on the gums of the anterior molars and on the mucous membrane of the inferior maxilla, and dark violet spots were seen on the mucosa of the left cheek. During the remaining days, similar lesions developed throughout the mouth, and at necropsy necrotic plaques were found on the lining membrane of the cheek.

Dalché's conclusions¹ were that the most striking feature of bismuth poisoning is the stomatitis. It is characterized by lesions of a brownish purplish color appearing on the tongue, buccal membrane and throat. It may remain stationary, but in the advanced cases the teeth are loosened, the gums become spongy, and there is a mild salivation. The breath has a fetid odor, and there is difficulty in swallowing. The lesion usually begins at the level of the molars and is most severe where the teeth come in contact with the mucous membrane. Generally these spots are covered by a whitish diphtheritic membrane surrounded by a blackish areola. Dalché believes that the stomatitis results from the elimination of the salt through the salivary glands, and may follow within a few days after the bismuth injection. Attention is called to the similarity of the stomatitis caused by lead, mercury and bismuth, lead being the least severe because it is not easily absorbed, except under certain conditions of peculiar susceptibility. Mercury stands midway between lead and bismuth. In view of the high atomic weights of these metals, Dalché suggested the possibility of all heavy metals producing similar lesions provided they are absorbed in sufficient quantity. Normally bismuth subnitrate is insoluble, but when it comes in contact with juices rich in albumin, changes occur, converting it into a soluble salt.

Dalché's experiments were repeated by other observers with *other* salts of bismuth, and similar results were obtained. Thus it was shown by the constancy of symptoms and lesions experimentally produced, despite the *variations* in salts, that the toxic effects are due to *metallic* bismuth. Up to the present year there have been forty-three reported cases of intoxication, thirteen of these fatal, following the local application of bismuth to granulating surfaces.

Quite distinct in symptomatology as well as in cause are those types of so-called acute intoxication follow-

* Read before Richmond Academy of Medicine and Surgery, Dec. 1, 1915.

1. Dalché, quoted by Mayer and Baehr: Surg., Gynec. and Obst., 1912, xv.